California Environmental Protection Agency
Department of Pesticide Regulation

GUIDANCE MANUAL

METHYL BROMIDE
(In Combination With Chloropicrin)

FIELD SOIL FUMIGATION

DECEMBER 8, 2004

Changes since the January 14, 2001 version
are shown in red and vertical lines

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INTRODUCTION

The *Guidance Manual: Methyl Bromide (In Combination With Chloropicrin) - Field Soil Fumigation* is designed to aid county agricultural commissioners' staff in the issuance of a restricted materials permit for methyl bromide pursuant to Title 3, Division 6, Subchapter 4 of the California Code of Regulations. This manual contains information the county agricultural commissioner will use to review and evaluate an application for a restricted materials permit for methyl bromide (singly or in combination with chloropicrin or any other pesticide or warning agent) intended for field soil fumigation. It contains information on the fumigation methods, procedures, charts, tables, and other information necessary to calculate appropriate buffer zone sizes and duration at intended fumigation sites.

The information in this manual does not apply to golf courses, tree holes, potting soil, raised-tarpaulin nursery fumigation of less than one acre, and greenhouses or other similar structures. Commissioners should follow DPR's suggested permit conditions for potting soil and greenhouses (raised-tarpaulin fumigations). All other soil fumigations should follow label requirements.

Restricted Materials Permit Review

The restricted materials permit process provides an abbreviated environmental review procedure that serves as functional equivalent to a full-scale environmental impact report, which would normally be required by the California Environmental Quality Act (also known as CEQA). This process requires commissioners to issue time- and site-specific permits for the agricultural use of restricted materials.

Title 3CCR section 6428(c) requires permit applicants to identify all known areas that could be adversely affected by the use of restricted materials. In addition, grower/applicants are required to plan their needs in advance, consider reduced use of restricted materials, and promote open dialogue with the people who live near application sites before applying for their permits. Commissioner involvement ensures that the public receives accurate and complete information.

Any interested person may ask the commissioner to review his/her decision in issuing, refusing, revoking, suspending, or conditioning a permit to use or possess a restricted material. The commissioner may affirm, modify, or cancel the permit decision. A review pursuant to FAC section 14009(a) is typically requested by persons who have had a permit refused, revoked, or suspended with the purpose of having the commissioner reissue or reinstate the permit. Occasionally, the request comes from other interested persons seeking to have commissioner refuse, revoke, suspend, or further condition a permit. Each request for review shall be in writing to the commissioner.

The commissioner will review the request and provide a written response within 10 days, or as soon as it is practicable. The commissioner shall conduct each review in an expeditious manner so the needed pest control measures are not adversely affected.

A person directly affected by the commissioner's decision may thereafter appeal to the Director for review. The commissioner's review of a permit is a process, which must precede an appeal to the Director regarding the commissioner's review. In an appeal of the commissioner's decision to the Director, the issues are limited to: whether the proposed permit's use is consistent with the applicable pesticide label restrictions and applicable regulations; commissioner properly considered the provisions of FAC 14006.5; or commissioner abused his/her discretion in issuing, refusing, revoking, or conditioning the permit.

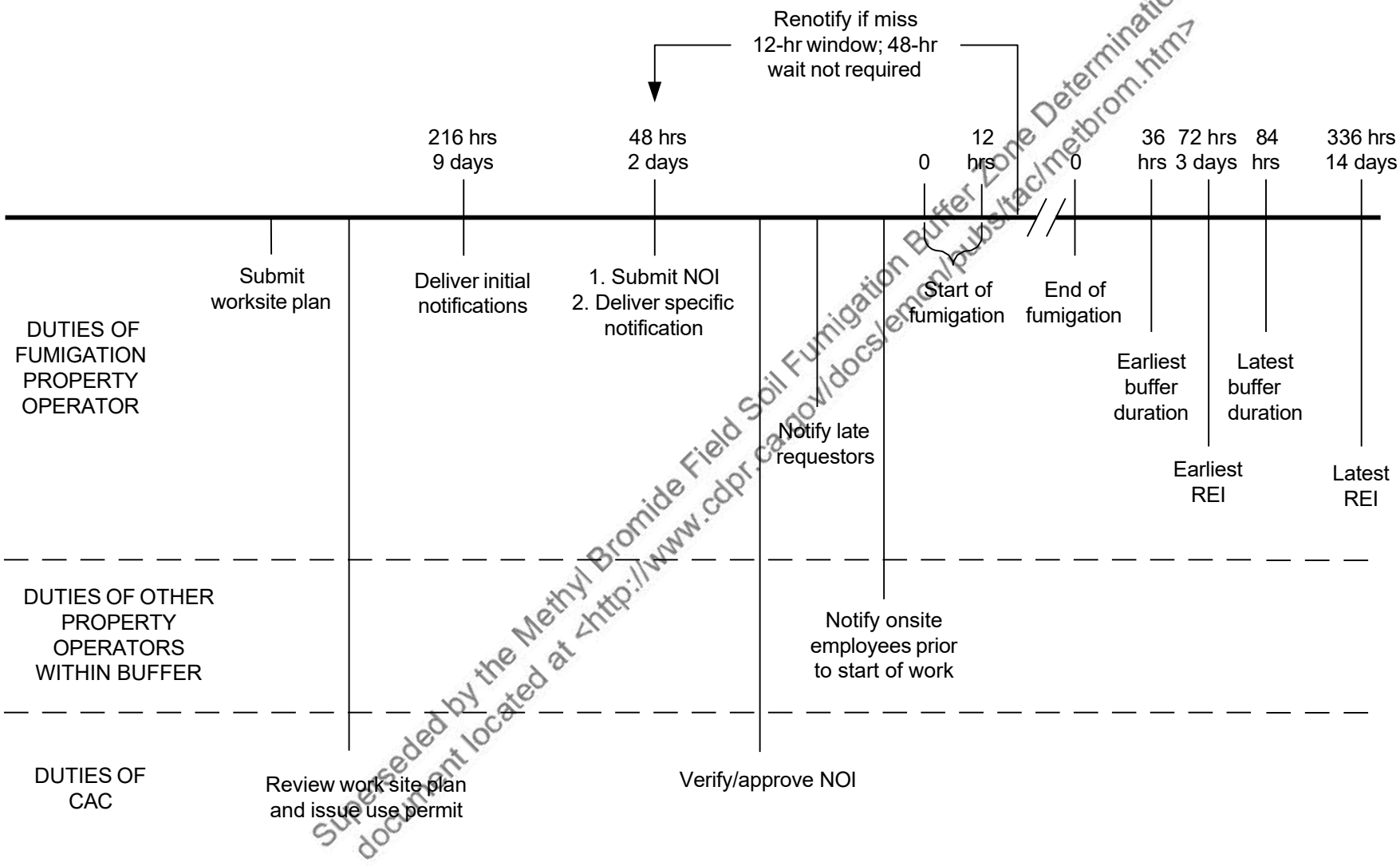
Permit Application and Evaluation

The commissioner will evaluate the permit applicant's request for a restricted materials permit (3CCR section 6432). The commissioner shall determine whether a substantial adverse environmental impact may result from the use of a pesticide before issuing any permit to use a pesticide and when evaluating the Notice of Intent (NOI). If the commissioner determines the pesticide's use would likely cause a substantial adverse environmental impact, the commissioner shall determine if there is a mitigation measure to substantially reduce the adverse environmental impact or a feasible alternative. If the commissioner determines mitigation measures or a feasible alternative exists, the permit or intended pesticide application shall be conditioned on utilization of the mitigation measure or the permit shall be denied.

The commissioner is responsible for knowing local conditions and using his or her knowledge to make these determinations. The permit shall contain any appropriate conditions and limitations on the pesticide(s), including: appropriate conditions or limitations on the use of the pesticide(s), requirements, if any, for notice (to the commissioner) to apply before an agricultural use pesticide application and appropriate conditions.

The purpose of the NOI is to provide specific and critical information that was not available at the time the preliminary permit was issued. The permit evaluation process continues with the commissioner's review of each NOI and possible pre-application site inspection. The commissioner's NOI review and acceptance or denial signals the completion of the evaluation process for that use of the restricted material at the proposed site and time. The commissioner is required to review all NOIs submitted to determine whether the: location(s) of the proposed application matches the permit locations, and environmental conditions have changed since the permit was issued (this is the "local knowledge" or, permittee specifies on the NOI).

FIGURE 1. SOIL FUMIGATION REQUIREMENTS TIMELINE



WORKSITE PLAN

The operator of the property to be treated is responsible for completing and submitting a proposed Worksite Plan to the commissioner. The Worksite Plan contains the detailed specific information about the local conditions at the intended fumigation site. This detailed information will be used to determine the appropriate mitigation measures (conditions) to be utilized at the specific fumigation site before a restricted material permit is issued for the proposed use. The county agricultural commissioner will evaluate the Worksite Plan and local conditions, then condition and issue the use permit.

DPR does not prescribe a particular form for the Worksite Plan. Commissioners should custom-tailor their own Worksite Plan forms in a manner that addresses local issues and in a format that works best for their county. It should contain as much detailed information as necessary to determine the appropriate mitigation measures (conditions) to place on the applicant's restricted materials permit.

The Worksite Plan should contain the following information:

- **Property Operator (to be treated)**
  - Name, Business Address, Business Telephone Number
  - Contact Person
  - Fumigation Site Location

- **Pest Control Business**
  - Name, Business Address, Business Telephone Number
  - Contact Person

- **Methyl Bromide Product (Singly, or in combination with Chloropicrin)**
  - Brand Name, Registration Number, Registrant
  - Application Rate
  - Number of Acres
  - Fumigation Method
  - Type of Tarpaulin
  - Earliest Date of Fumigation
  - Latest Date of Fumigation
  - Posting of Inner Buffer Zone Perimeter On Other Properties
  - Description of Activities Within Buffer Zones
  - Anticipated Expiration Date and Time of Buffer Zones
  - Detailed Map Showing Field Location, Field Dimensions, On-Site and Off-Site Housing, Other Sensitive Areas

- **Notification To Neighboring Property Operators**
  - Method of Notification
  - Copy of Written Notification (if applicable)
  - Date(s) of Notification
  - Map(s) Showing Neighboring Properties Notified

- **Workday and Work Hour Limitations**
  - List of employees performing fumigation handling activities
  - Proposed number of workdays during the month for each handler
  - Proposed number of work hours for each handler
  - If needed, description of respiratory protection for each handler

- **Tarpaulin Repair and Response Plans**
  - Person(s) Responsible
  - Person(s) Certified To Test Ambient Air Concentrations of Methyl Bromide
  - Schedule For Checking Tarpaulins
  - Maximum time following notification of damage that the pest control business or permittee will respond
  - Minimum Time Following Injection That Tarpaulin Will Be Repaired
  - Minimum Size of Damage That Will Be Repaired
  - Other Factors Used To Determine When Tarpaulin Repair Will Be Conducted
  - Type of Testing Device Used To Measure Air Concentrations
  - Type and Number of Respiratory Protection Devices Available At Site

- **Tarpaulin Removal Plan**
  - Person(s) Responsible
  - Equipment Used To Cut Tarpaulins
  - Method Used To Cut Tarpaulins
  - Schedule For Cutting Tarpaulins
  - Schedule For Removing Tarpaulins

GENERAL REQUIREMENTS

Maximum Application Block Size

In general, the maximum acreage that can be treated as a single application is 40 acres in a 48-hour period. Application blocks larger than 40 acres may be treated, but this likely requires increasing the buffer zone distances, increasing the buffer zone duration, revising the isolated block criteria, and increasing the restricted entry interval. On a case-by-case basis, DPR can provide information to the commissioner to establish permit conditions for treating blocks larger than 40 acres. The commissioner should provide a copy of the worksite plan to DPR's Enforcement Branch Liaison (EBL) for application blocks larger than 40 acres.

Applications larger than 40 acres may impact small growers due to changes in the isolated block criteria. Currently, application blocks separated by 1300 feet or 36 hours are considered isolated, and the buffer zones are calculated independently. Application blocks larger than 40 acres may require increased distance or time separation to be considered independent. Small applications that are currently considered isolated from other applications may become non-isolated if an application larger than 40 acres occurs nearby.

Approved Tarpaulins for Field Soil Fumigation

The California Code of Regulations section 6450(e) requires that tarpaulins meet DPR's permeability requirement prior to use for methyl bromide fumigation in California. Approved tarpaulins must have a permeability factor between 5 and 8 milliliters methyl bromide per hour, per square meter, per 1,000 parts per million of methyl bromide under tarpaulin at 30 degrees Celsius. Tarpaulin manufacturers must provide data to DPR that demonstrates that their tarpaulins meet these criteria. The testing-protocol to be used is available from DPR.

Questions and requests for tarpaulin approval should be submitted to:

Mr. Randy Segawa
Department of Pesticide Regulation
Environmental Monitoring Branch
1001 I Street
PO Box 4015
Sacramento, California 95812-4015
Phone: (916) 324-4137
Email: rsegawa@cdpr.ca.gov

The following laboratories have tested tarpaulins for methyl bromide permeability:

Bolsa Research Associates
P.O. Box 37
Hollister, California 95024
(831) 637-9776

National Testing Standards
877 South Rose Place
Anaheim, California 92805
(714) 991-5520

An updated list of approved tarpaulins for methyl bromide field soil fumigation is available on the DPR Home Page at:
http://www.cdpr.ca.gov/docs/dprdocs/methbrom/tarps.pdf.

Alternative Tarpaulins

When used, tarpaulins must have a permeability between 5 and 8 milliliters methyl bromide per hour, per square meter, per 1,000 parts per million of methyl bromide under the tarpaulin at 30 degrees Celsius, and be approved by the Department. This requirement prevents the use "virtually impermeable films" (VIF). Laboratory tests of VIF show methyl bromide permeability one-tenth or less of conventional tarpaulins. VIF may suppress the emissions of methyl bromide, but field tests have been inconclusive. Some research indicates that significant off-gassing occurs when VIF is removed within a few days. If this occurs, VIF may need to remain in place longer or the buffer zone duration may need to be increased. Until further testing is conducted, VIF should not be used under the current regulatory requirements. VIF is allowed under a research authorization. Commissioners should consult with DPR to determine the appropriate permit conditions for research applications with VIF or other experimental tarpaulins.

MONTHLY AIR CONCENTRATION LIMIT

Background

DPR wants to ensure communities are protected from potential exposure to methyl bromide over both the short-term (one day) and longer-term (several weeks). Regulations that went into effect in 2001 protected against short-term exposure. The monthly air concentration limit of 9 ppb is an additional measure to protect against longer-term exposure.

Methods to Limit Monthly Air Concentrations

Several methods, either singly or in combination, may be used to ensure that monthly air concentrations do not exceed 9 ppb. Likely the most common method for limiting the monthly air concentrations is a township cap. DPR has determined that townships using no more than 270,000 pounds in any calendar month have a very low probability of exceeding 9 ppb. Additional scientific information on the derivation of the township cap is given in Appendix C.

Similar to a township cap, Commissioners may develop an allocation plan in consultation with affected parties. Prior to the peak use season, each user can be allocated a specified amount of methyl bromide so that the total does not exceed 270,000 pounds in a township during any calendar month.

Another method to ensure monthly air concentrations do not exceed 9 ppb is to increase the buffer zones for all methyl bromide fumigations in the townships and months where 9 ppb may be exceeded.

Commissioners should consult with DPR prior to implementing any method not described here. In addition, the industry will be submitting a plan to DPR that is designed to also ensure the use does not exceed the township cap.

Identifying Locations that May Exceed the Air Concentration Limit

Annually, DPR will analyze historic and the most recent pesticide use data to determine which townships may approach or exceed 270,000 lbs used per township in a calendar month in the coming year. Townships where use is expected to exceed 80% of the cap (216,000 lbs) will be candidates for additional permit conditions. Each fall, DPR will provide commissioners with information on townships that may need additional permit conditions. Based on past pesticide use data, this potentially could occur in a few townships during August and/or September in Monterey, Santa Cruz, Santa Barbara, and Ventura counties.

Township Cap – Methods for Tracking Use

This section discusses several options for Commissioners to track methyl bromide use within townships. However, Commissioners may use an alternative system. Commissioners should use an existing form (e.g. pesticide use report or notice of intent – NOI) or develop a new form (e.g. notice of completion) to record the following information for each application block: grower identification, pounds of methyl bromide active ingredient (or product), county, township/range, and date of application. Commissioners may require additional information to be reported, at their discretion. If the form is submitted after application, permit conditions should require applicators to submit the form to the commissioners within 24 hours of completing the application. Commissioners may require the form to be submitted for the townships and months identified by DPR. Commissioners may require this form for additional townships and months at their discretion. Commissioners should keep a running total of methyl bromide use within the specified townships. Weekly compilations will likely be sufficient for the first two or three weeks of the month. Daily totals may need to be tracked during the last week or two of the month. If commissioners track using a form that is submitted after the application, NOIs will need to be evaluated once use approaches the cap.

DPR can assist the commissioners with the tracking. For example, if the pesticide use report form is used, DPR has computer programs to calculate the pounds of active ingredient from the amount of product applied, and summarize data for each township. DPR can also assist in coordinating tracking for townships located in more than one county.

Enforcing the Township Cap

If a township cap is used to ensure concentrations do not exceed 9 ppb, Commissioners must deny NOIs once the cap is reached. The requested application will be postponed until the following month. Commissioners may need to consult each other for townships located in more than one county.

An alternative to tracking use and denying NOIs is to develop an allocation plan prior to the peak use season. Commissioners, growers, applicators, or registrants could develop a system to allocate methyl bromide that ensures the township cap is not exceeded.

While section 6450(h) specifies the concentration limit as an average of 9 ppb in any *calendar month*, commissioners have the option of establishing permit conditions so that the concentration limit and township cap is based on a *consecutive 30-day period*. This complies with the regulation (no township approaches the concentration limit during the 28 or 29 days in February) and may give more flexibility in the timing of fumigations. For example, once the cap is reached no additional fumigations can be allowed until the following month if the cap is based on a calendar month. Additional fumigations can probably be allowed the next day if the cap is based on a consecutive 30-day period. However, a cap based a consecutive 30-day period may create a greater tracking workload. Daily totals of methyl bromide use must be tracked if the cap is based on a consecutive 30-day period. In addition, tracking should be initiated one or two weeks prior and continue for one or two weeks after the calendar months identified by DPR.

Increasing Buffer Zone Size – Determining the Appropriate Increase

Air concentrations from methyl bromide fumigations decrease as the distance from the field or source increases. Increasing the size of the buffer zones will decrease exposures. Air concentrations are directly proportional to the emission rate, the pounds per hour volatilizing from the field. For example, decreasing the emission rate by 50% will result in a 50% decrease in air concentrations, assuming the distance from the field, weather, and all other factors remain the same. In the current regulations and permit conditions, the emission rate is determined from the application rate and emission ratio (percent volatilization in a 24-hour period). Increasing the emission ratio will proportionally decrease the air concentrations by increasing the size of the buffer zones. For example, increasing the emission ratio by 10 percent will decrease the air concentration by 10 percent at the buffer zone distance.

Increasing the emission ratios can be used in place of a township limit, or increasing emission ratios can allow a higher township limit. For example, if a township uses 200,000 pounds per month and employs the current emission ratios, it will have the

same subchronic exposure as a township with 220,000 pounds per month (10 percent increase) and a 10 percent increase in the emission ratios.

To determine the appropriate emission ratio increase, Commissioners must estimate the maximum amount of methyl bromide that might be used in a township during a calendar month. The percentage increase over the 270,000 pounds township cap that this amount represents is calculated. The emission ratios should be increased by the same proportional amount. Example: The Commissioner estimates that as much as 300,000 pounds of methyl bromide may be used in Township 01N/01E during September. This represents an 11% increase.

$$\frac{300{,}000 - 270{,}000}{270{,}000} = 0.11 \text{ or } 11\% \text{ increase}$$

For this example, the emission ratios for all methyl bromide fumigations in Township 01N/01E during September should be increased by 11%, or multiplied by 1.11. For this example, fumigations with an emission ratio of 0.25 should be increased to 0.28.

$$0.25 \times 1.11 = 0.28$$

Commissioners should overestimate the amount of methyl bromide that might be used if relying solely on this method to ensure monthly air concentrations do not exceed 9 ppb. Alternatively, increased buffer zones may be used in combination with a corresponding higher township cap to ensure monthly air concentrations do not exceed 9 ppb. As with township caps, Commissioners may increase buffer zones for a consecutive 30-day period instead of a calendar month.

While a single method must be used within a township, different townships may use different methods to ensure monthly air concentrations do not exceed 9 ppb. For example, one township may use a township cap and an adjacent township may use increased buffer zones.

NOTIFICATION REQUIREMENTS

Figure 2. Summary of Notification Requirements provides a complete overview of the requirements for providing notification information to the commissioner and to neighboring property operators about an intended fumigation.

Notification to the Commissioner:

The operator of the property to be treated is required by section 6450.1(a) to provide notification (Notice of Intent - NOI) to the county agricultural commissioner **at least 48 hours** prior to commencing fumigation. The NOI must include the following information:

1) **Hour** the fumigation is intended to commence,
2) **Notice of Intent** Information specified in section 6434(b);
    a) permit number
    b) name and address of permittee and applicator
    c) location of areas to be treated and name of farm (property) operator
    d) site to be treated
    e) acres to be treated
    f) fumigation method
    g) pesticide(s)
    h) volume per acre, and dosage
    i) pests to be controlled
    j) date intended fumigation is to commence
    k) location and identity of areas which may be impacted.

The commissioner should confirm that the information on the NOI is consistent with the Worksite Plan.

For multiple application blocks to be fumigated sequentially, the commissioner may allow one NOI that includes a fumigation schedule for all the application blocks in lieu of a separate NOI for each application block to be fumigated.

Notification to Neighboring Property Operators:

The purpose of the **(initial) notification** is to provide an opportunity to persons who reside on certain properties (see below) to receive information that a permit has been issued by the commissioner.

Regulations section 6450.1(b) require the operator of the property to be treated to assure that the **operator of the property** for the following types of properties that are within 300 feet of the outer buffer zone receive the initial notification information:

1) Schools
2) Residences
3) Hospitals
4) Convalescent homes
5) Onsite employee housing
6) Similar sites identified by the commissioner

Note: "Operator of the Property" includes <u>any</u> person "…who owns the property and/or is legally entitled to possess or use the property through terms of a lease, rental contract, trust, or other management arrangement." Examples include: a principal of a school; a tenant of an apartment complex; a tenant of a single-family dwelling; the administrator of a convalescent home.

The **initial notification** must be in writing in English and Spanish, or by other means approved by the commissioner and must be delivered at least 7 days prior to the submission the NOI. The commissioner has the option of requiring *written* notification in another language in addition to English or Spanish. The commissioner also has the option of requiring *non-written* notification in a language other than English or Spanish. The notification must include:

1) Name of the pesticide(s)
2) Name, business address, and business telephone number of the operator of the property to be treated
3) Name, business address, and business telephone number of the commissioner
4) Earliest and latest dates that the fumigation will start
5) How to request subsequent notification of the specific date and time of the fumigation

Note: Information on methyl bromide is available on the Internet. A list of Web Site addresses where information on methyl bromide can be found is included in Appendix A at end of this manual.

For persons who received the initial notification and who request **subsequent notification**, the operator of the property to be treated must assure that those persons receive specific notification of the date and time of the start of the fumigation and anticipated expiration of the buffer zones. This notification must be provided at least 48 hours prior to the start of the fumigation.

Note:

1) If a request for subsequent notification is received AFTER submission of the NOI and BEFORE the fumigation begins, the 48-hour requirement does not apply, but the specific notice must be provided prior to starting the fumigation.

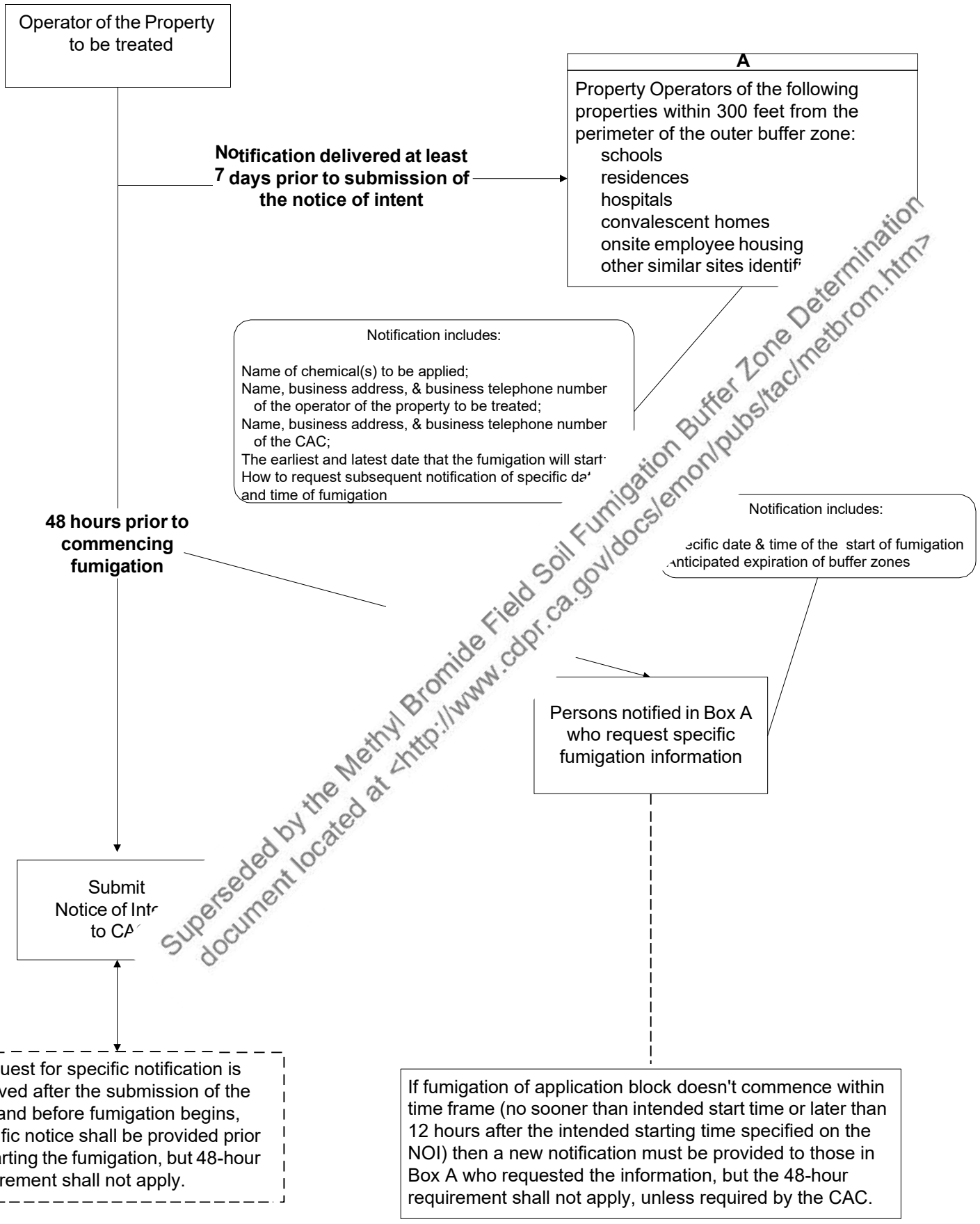
2) If fumigation of the application block doesn't commence within the time frame specified on the Notice of Intent (no sooner than the intended starting time or later than 12 hours after the intended starting time specified on the NOI) then a new notification must be provided to those persons who requested the subsequent notice, but the 48-hour requirement does not apply.

Notification to Employees of Other Property Operators:

Similar to notification of neighbors, sections 6450.2(g) and (h) require notification of employees working on other properties, when the outer or inner buffer zone extends into other properties. The operator of the property to be treated shall provide specific notification to the operator of the other property at least 48 hours prior to fumigation. The specific notification must include: date and time of the start of

fumigation, and anticipated expiration of the buffer zones. The operator of the property to be treated can request that the operator of the other property to notify his/her employees. However, the operator of the property to be treated is ultimately responsible for ensuring that the employees of the other property operator are notified. The other property operator's employees must be given the notification prior to the commencement of work on the day of fumigation. The employees must receive this notification in a manner they can understand, either verbally or in writing. This is consistent with other worker communication and training requirements in sections 6723 and 6724.

FIGURE 2. SUMMARY OF NOTIFICATION REQUIREMENTS



BUFFER ZONE BACKGROUND INFORMATION

The risk characterization by DPR for methyl bromide indicates acute exposure to 210 parts per billion (ppb), [24-hour time-weighted average] provides a 100-fold margin of exposure (100 times less than the no observed effect level in animal tests). The regulatory requirements for methyl bromide are designed to limit peoples' exposure to less than 210 ppb, as a 24-hour average.

Methyl bromide concentrations decrease as the distance from the fumigated field increases. DPR uses monitoring data and a computer model to determine the distance at which 210 ppb occurs, and specifies this distance as the buffer zone size. The size is calculated using specific estimates and assumptions about the methyl bromide emission rate and weather. The buffer zone size is a fixed distance for any given application rate, number of acres, and application method. The fixed buffer zone sizes are used to set a standard for enforcement. The fixed buffer zone sizes do not imply a fixed or constant air concentration; air concentrations at the buffer zone distance are variable. The buffer zone distance cannot be used as a surrogate for estimating air concentrations. For example, if the buffer zone distance is 200 feet, this does not mean that the air concentration is always 210 ppb at 200 feet. In fact, air concentrations should be less than 210 ppb almost all of the time at the buffer zone distance. Similarly, if someone is 190 feet away from the application, does not mean that he/she will be exposed to a harmful amount of methyl bromide.

The buffer zone is not an exclusion zone meant to prohibit entry throughout the buffer zone duration. People may spend short periods of time inside the buffer zone and not exceed an exposure of 210 ppb, as a 24-hour average. Since 210 ppb is a time-weighted average, the equivalent concentration increases linearly as the duration of exposure decreases. For example, 210 ppb for 24 hours is equivalent to 420 ppb for 12 hours, or 5000 ppb for 1 hour.

The data show that 210 ppb is not exceeded even with no buffer zone in some cases, using both empirical data and computer modeling. While the data may support no buffer in some cases, a minimum buffer should be required because of variability in emission rate over a field and other factors not accounted for by the computer model.

BUFFER ZONE DETERMINATION

Two buffer zones are specified in section 6450.2, an **Inner Buffer Zone** and an **Outer Buffer Zone**. *(Ref: Figure 7. Diagram of Inner and Outer Buffer Zones).* The sizes of the buffer zones are dependent upon the size of the application block to be fumigated, the application rate (pounds actual methyl bromide per acre), and the application method to be used. This section describes the procedures necessary for

determining, measuring, and managing the appropriate buffer zone distances required at the fumigation site.

Buffer Zone Determination: Summary

The following steps are used to determine the buffer zone requirements associated with an application block *(Figure 3. Summary of Buffer Zone Determination)*.

1. Determine if the proposed application block is **Isolated** or **Non-Isolated** from other application blocks *(Figure 4. Isolated Application Block Determination)*.

2. Verify that the **Fumigation Method** conforms to a method described in *Table 1. Field Soil Fumigation Methods and Emission Ratios.* If it does not, then the fumigation may not proceed.

3. Determine the **emission rate** and **acreage**. The emission rate is based on the application rate and fumigation method (emission ratio). The acreage is based on the total acreage of all non-isolated application blocks *(Figure 5. Emission Rate and Acreage Determination* and *Table 1).*

4. Determine the appropriate **buffer zone distances** from *Table 4, Inner Buffer Zone and Table 2, Outer Buffer Zone for* the specific fumigation method to be used.

5. Determine the **buffer zone duration** based on the application rate, acreage, and fumigation method *(Tables 5A, 5B, 5C. Buffer Zone Duration).*

Buffer Zone Determinations: Isolated Application Blocks

Application blocks that are fumigated near each other in time and distance will increase the overall air concentrations and require larger buffer zones. The following steps are used to determine if other methyl bromide application blocks will affect the application block under evaluation *(Figure 4).*

An application block is **isolated** if:

1. The distance between application blocks is **more than 1,300 feet** **OR**,

2. **36 hours will elapse** between the end of injection of one application block and the start of injection of the other application block.

   Example: Application blocks 1 and 2 are separated by 200 feet. Injection for application block 1 starts on June 1, 8:00 AM and ends at 4:00 PM. The

block is isolated if the injection for application block 2 does not begin before June 3, 4:00 AM.

The following steps are used to determine the buffer zones for isolated application blocks:

1. Determine the acreage and application rate for the application block. If a bedded or strip application is planned and the recommended application rate on the product label is for the beds only (on some labels listed as "treated area"), an adjustment of the application rate to a broadcast basis should be made. The application rate for strip or bed fumigations is adjusted to an equivalent broadcast application rate. The emission ratios for some strip fumigations are different than a normal broadcast fumigation (see *Table 1*). See the Strip Fumigations section for more information.

2. Find the **Emission Ratio** for the chosen fumigation method in *Table 1.*

3. Determine the **Emission Rate** by multiplying the application rate in pounds per acre by the **Emission Ratio**.

4. Determine the appropriate buffer zone distance from *Table 4, Inner Buffer Zone* and *Table 2, Outer Buffer Zone* for the particular application method to be used by selecting the appropriate acreage in the left-hand column. Next, select the appropriate emission rate from the top row. The buffer zone distance (in feet) is the numerical value where the acreage row and application rate column intersect.

   a. **<u>Inner Buffer Zone Example:</u>**

   The application block is 20 acres. Methyl bromide is applied at a rate of 400 pounds per acre. The Fumigation Method is Tarpaulin/Deep/Broadcast: (*Table 1*). Find the appropriate inner buffer zone distance from *Table 4* for Tarpaulin/Deep/Broadcast.

   Emission Rate = Emission Ratio X Application Rate
   Emission Rate = 0.40 X 400 # / Acre = 160
   Inner Buffer Zone Distance = 600 feet *(Table 4)*

   b. **<u>Outer Buffer Zone Example:</u>**

   The application block is 20 acres. Methyl bromide is applied at a rate of 400 pounds per acre. The Fumigation Method is Tarpaulin/Deep/Broadcast *(Table 1).* Find the appropriate buffer zone distance from *Table 2* for Tarpaulin/Deep/Broadcast.

Emission Rate = Emission Ratio X Application Rate
Emission Rate = 0.40 X 400 # / Acre = 160
Outer Buffer Zone Distance = 1600 feet (*Table 2)*

Buffer Zone Determinations: Non-Isolated Application Blocks

1. Make a list of all of the following application blocks:

   a. The application block under evaluation.

   b. Previously treated blocks within 1,300 feet **AND** those where 36 hours HAVE NOT elapsed between treatments.

   c. Proposed blocks within 1,300 feet **AND** those where 36 hours WILL NOT elapse between treatments.

2. Determine the acreage, application rate, and fumigation method for each application block on the list. The application rate may need to be adjusted for bed or strip fumigations as discussed in the Strip Fumigations section.

   Example:

   Field 1 is 20 acres, 250 pounds/acre of actual methyl bromide, and the fumigation method is Tarpaulin/Shallow/Bed. It is less than 1,300 feet from Field 2 and only 24 hours have elapsed since the fumigation began in Field 1. Field 2 is 7 acres, 400 pounds of actual methyl bromide, and the fumigation method is Tarpaulin/Deep/Broadcast.

3. Determine the **Emission Ratio**, based on the fumigation method for each block on the list *(Table 1)*.

   Example:

   The **Emission Ratio** for Field 1 is 0.80
   The **Emission Ratio** for Field 2 is 0.40

4. Determine the **Emission Rate** for each block on the list by multiplying the application rate by the Emission Ratio.

   Example:

   The **Emission Rate** for Field 1 is 0.80 x 250 = 200
   The **Emission Rate** for Field 2 is 0.40 x 400 = 160

Fields 1 and 2 have an aggregate acreage of 27 acres.

5. The blocks making up the list and the aggregate acreage may be different for each individual block because the point from which the 1,300 feet and 36 hours are measured may be different. **Each block must be evaluated individually.** Also, the buffer zone for each treated block may need to be modified if a nearby block is treated less than 36 hours later.

6. Use the **highest Emission Rate** on the list and aggregate acreage to find the buffer zone distances on *Table 2.* If the Emission Rate is not listed in *Table 2*, go to the next highest value on the table.

7. **Inner Buffer Zone Example:** To calculate the buffer zone distance, take the **highest Emission Rate** shown in step 4, 200 pounds/acre X day.

   Emission Rate = (200 pounds/acre X day)
   Using *Table 4,* at 200 pounds/acre X day and 27 acres, the Inner Buffer Zone would be 1000 feet from the edges of both

8. **Outer Buffer Zone Example:** The highest **Emission Rate** is 200 pounds /acre X day and the aggregate acreage is 27 acres. Using *Table 2*, at 200 pounds /acre X day and 27 acres, the Outer Buffer Zone is 2400 feet from the edges of both fields.

Inner Buffer Zone Measurement and Duration

1. The Inner Buffer Zone is measured from the perimeter of the application block and the restrictions are in effect from the start of the fumigation, but the duration is in effect for 36 hours to 84 hours following the end of the fumigation.

2. No persons are allowed within the Inner Buffer Zone except to transit and perform fumigation handling activities.

Outer Buffer Zone Measurement and Duration

1. The Outer Buffer Zone distance is measured from the perimeter of the application block and the duration is in effect for a minimum of 36 hours to a maximum of 84 hours following the end of fumigation depending on fumigation method, application rate, and number of acres treated.

2. Persons not involved with the fumigation are only allowed to transit or to conduct activities approved by the county agricultural commissioner in the Outer Buffer Zone.

Additional Buffer Zone Considerations

Sloped Fields

A larger buffer zone may be necessary for sloped fields, under certain weather conditions. Cold air drainage can occur during calm, clear nights. Under these conditions, cold air can move downhill due to differences in air density. This type of movement is not accounted for in the calculation of the buffer zone tables. The buffer zone size should be adjusted if these conditions are expected to occur while the buffer zone is in effect, and the application block has a slope that exceeds 5 percent (5-foot drop in elevation per 100-foot distance). The exact adjustment is difficult to determine, but DPR recommends increasing the buffer zone 2 - 3 times under these circumstances. The buffer zone only needs to be adjusted in the downhill direction.

This phenomenon is due to weather, not methyl bromide's chemical characteristics. Methyl bromide will not move downhill because "it is heavier than air." This is a misconception about the behavior of methyl bromide and other "dense" gases. A buffer adjustment is not necessary for a sloped field that will have some air movement.

Application Equipment Calibration

The buffer zone calculations assume an accurate and consistent amount of methyl bromide is injected into the field, at least within 5 - 10 percent. If an application rig is difficult to calibrate accurately or delivers a variable amount of methyl bromide, the emission ratio should be adjusted to account for these errors. For example, if an application rig can only be calibrated to within 20 percent accuracy, the emission ratio should be increased by 20 percent to account for this error.

Buffer Zones Near Schools

Section 6450.2(i) provides additional protection for schools, and specifies that fumigation injection must be completed at least 36 hours prior to the start of a school session, when the outer buffer zone is within 300 feet of a school property. In most cases, this limits fumigations to Saturdays. Use of school facilities for recreation or other activities on weekends is not considered a school session. However, commissioners have the option of providing additional protections for these activities.

Buffer Zone Size Changes Over Time

The buffer zone size may change over time for non-isolated blocks. This may be useful because the time people must vacate a residence is minimized. For example,

if two adjacent 5-acre blocks are fumigated on consecutive days, these blocks are non-isolated and the buffer zone is based on 10 acres. However, the buffer zone for the first block on the first day can be calculated as an isolated 5-acre block. It will not become a non-isolated block until the second day when the adjacent 5-acre block is fumigated. If the buffer zone for a 5-acre block is 500 feet and a 10-acre block is 700 feet, with a residence at 600 feet, the residence does not need to be vacated until the second block is fumigated.

Strip Fumigations

The application rate for bed or strip fumigations may need to be adjusted to an equivalent broadcast application rate. A broadcast application is one where the application of a pesticide occurs uniformly over the area to be treated without regard to arrangement of crops as in rows. Strip fumigations are applications that have alternating fumigated and unfumigated areas, similar to bed fumigations where the beds are fumigated and the furrows are not fumigated. In many cases, the untreated sections are fumigated on a later date. If a bedded or strip application is planned and the recommended application rate on the product label is for the beds only (on some labels listed as “treated area”), an adjustment of the application rate to a broadcast basis should be made. Strip fumigations can be used for broadcast (flat field) fumigations [methods 6450.3(a)(2), (3), and (5)]. Buffer zones for strip fumigations are calculated the same as bed fumigations. The application rate for strip or bed fumigations is adjusted to an equivalent broadcast application rate. For example, when a 20-acre field is treated in alternating strips 10 feet wide, the treated strips make up half the area of the field and the treated area is 10 acres. If the application rate is 400 pounds per acre to the 10-acre treated strip area, the application rate for determining the buffer zone size is 200 pounds per acre, over 20 acres. The emission ratios for some strip fumigations are different than a normal broadcast fumigation (see *Table 1*). The application rate for work hour limits is not adjusted.

Notwithstanding 3CCR Section 6770, commissioners should not allow entry into the treated area prior to the expiration of the REI, including the strips not fumigated, with the following exceptions:

1) to repair, cut, or remove tarps as described in 3CCR Section 6784(b)(3), (4), and (5), or
2) a full-face respirator is worn

For tarp/broadcast fumigations [methods 6450.3(a)(3) and (5)], the REI does not expire until the tarps are removed. This precludes fumigating the area between tarped strips until the tarps have been removed, unless handlers wear a full-face respirator.

Inner Buffer Zone Extending into Roadways

The inner buffer zone may extend into public roads, highways, and other similar sites of travel, upon the approval of the county agricultural commissioner. This language is the same for the outer buffer zone. "Other similar sites of travel" that commissioners may approve include sites/areas where people stay only for a short period of time, as in passing through. This may include trails and paths used for travel such as bicycling, horseback riding or walking/jogging/running; and waterways such as rivers and streams used for travel. This should not include areas where people may stay for more than a few minutes, such as bus stops or road construction zones. The requirements of 6450.2 (e)(3) still apply and the only activities allowed within the inner buffer zone are transit and fumigation handling activities.

Buffer Zones Extending into Other Properties

The inner buffer zone may extend into other properties under the following circumstances:

1) Other property is agricultural, and
2) Other property operator gives written permission, and
3) Inner buffer zone boundary is posted at intervals not exceeding 200 feet, and
4) Employees in other property are notified.

The outer buffer zone may extend into other properties under the following circumstances:

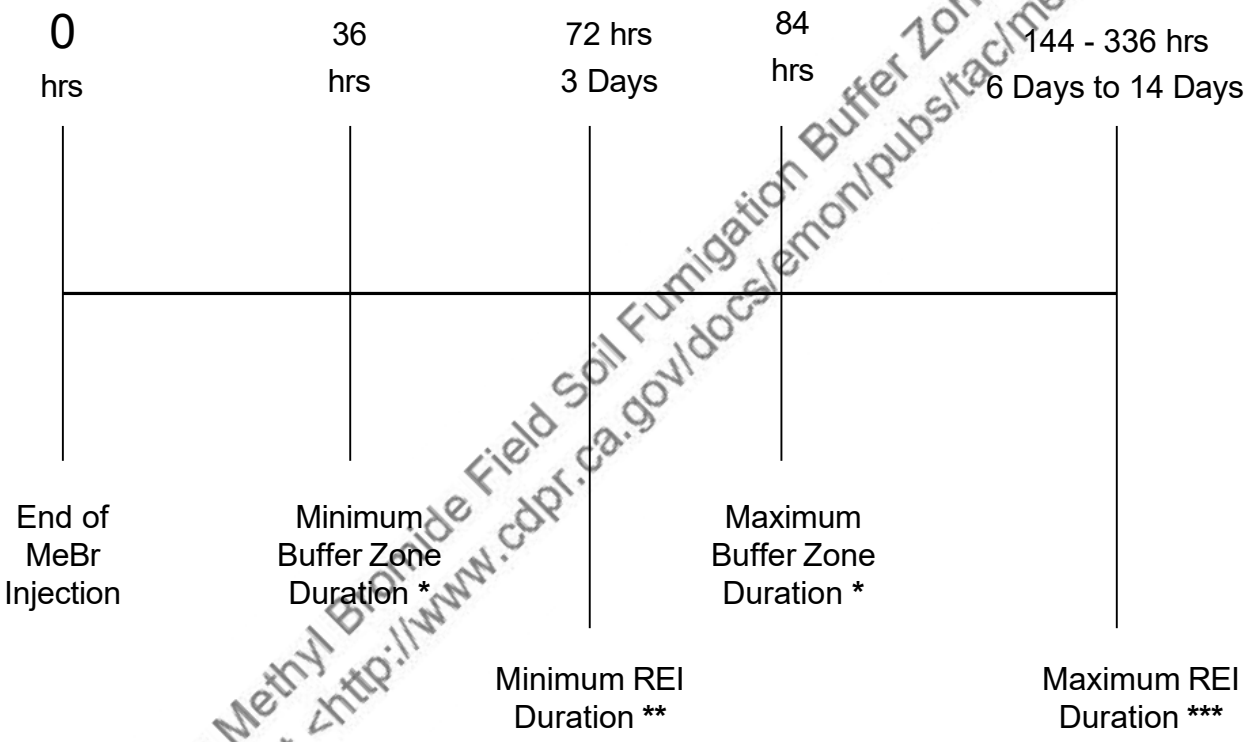
1) Other property operator gives permission, and
2) Outer buffer zone does not contain occupied housing, and
3) The other property does not contain a school, convalescent home, hospital, or other similar site determined by the commissioner, and
4) Employees in other property are notified.

Housing inside the outer buffer zone only needs to be vacated while the outer buffer zone is in effect, 36 – 84 hours, as determined from *Table 5*.

When either the inner and/or outer buffer zone extends into other properties, employees working on the other properties must be notified. The operator of the property to be treated is responsible for assuring that the employees of the other property are notified. Even if the operator of the other property agrees that he/she will provide the notification, the operator of the property to be treated is in violation if the employees of the other property are not notified.

Consistent with other worker notification requirements, the employee notification must be in a manner the employee can understand.

FIGURE 1A. METHYL BROMIDE FIELD SOIL FUMIGATION TIMELINES BUFFER ZONE AND REI DURATION



*** Note: Buffer Zone restriction begins at the <u>start</u> of injection, but the duration is measured from the end of the injection. The Buffer Zone duration minimum is 36 hours and the maximum is 84 hours.**

**** Note: REI restriction begins <u>and</u> is measured from the end of injection.**

***** Note: REI restriction begins <u>and</u> is measured from the end of injection and will expire after 6 days to 14 days depending on the fumigation method used.**

FIGURE 3. SUMMARY OF BUFFER ZONE DETERMINATION

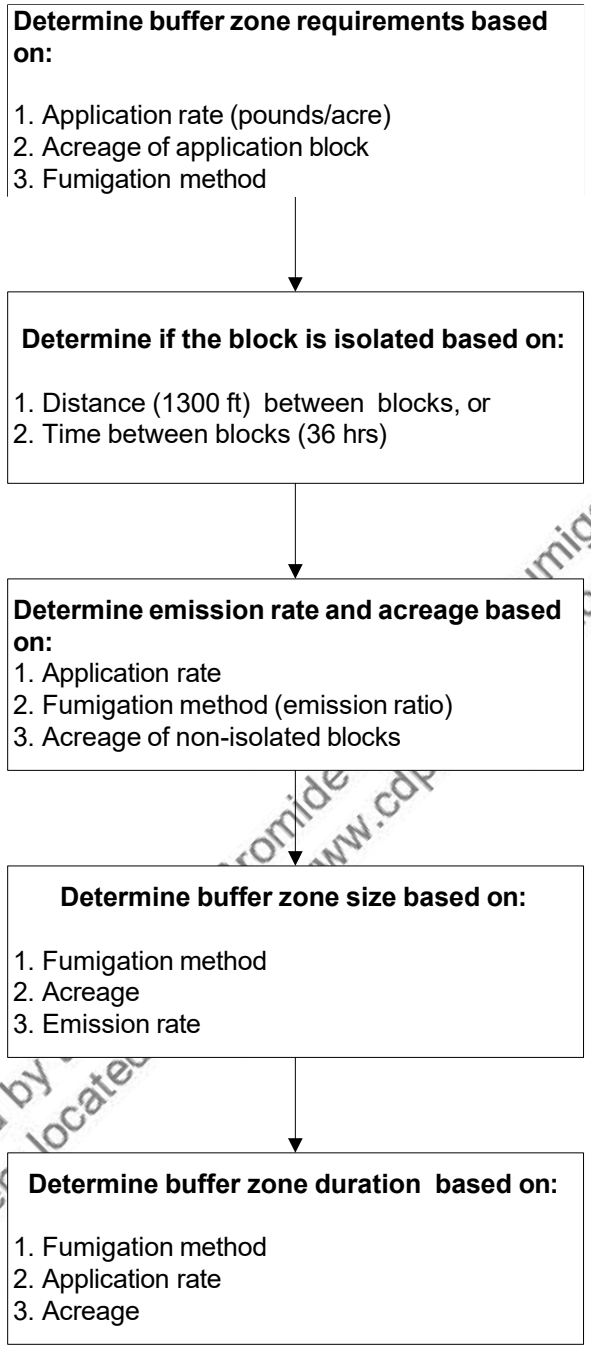


Figure 4

Figure 5
and Table 1

Figures 5 ,6
and Tables 2, 3, 4

Table 5

FIGURE 4. ISOLATED APPLICATION BLOCK DETERMINATION

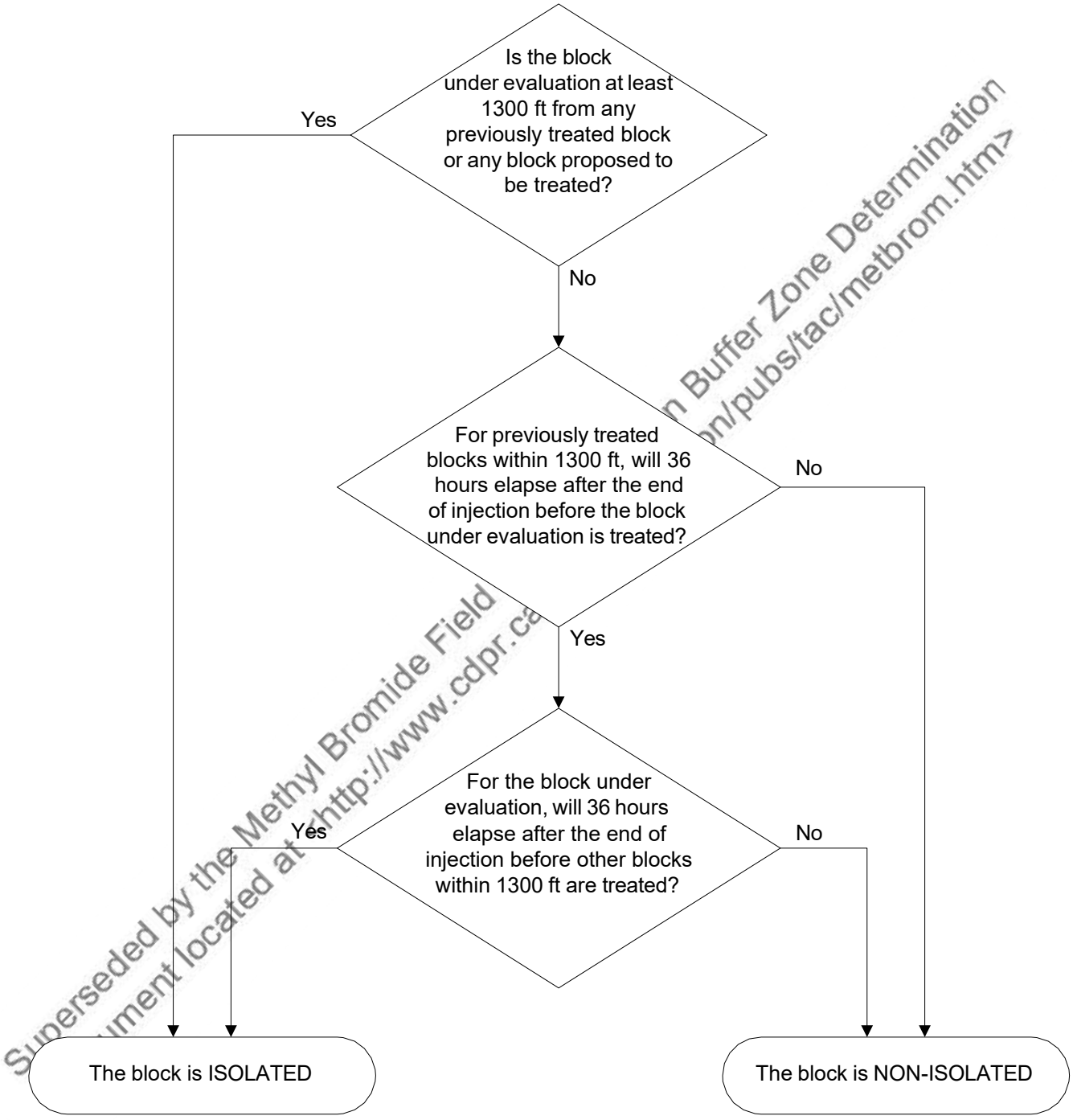


FIGURE 5. EMISSION RATE AND ACREAGE DETERMINATION

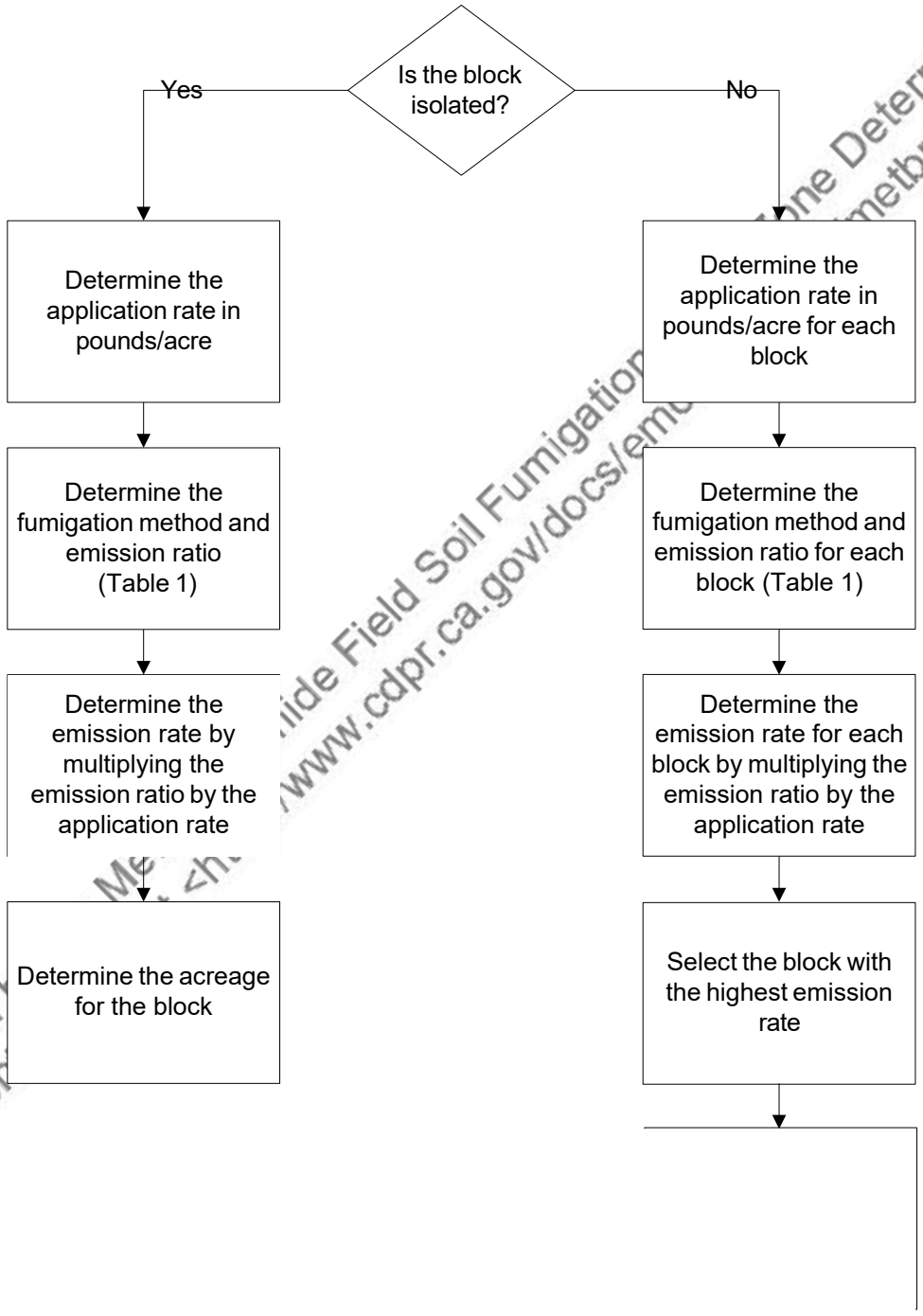


FIGURE 6. BUFFER ZONE SIZE DETERMINATION

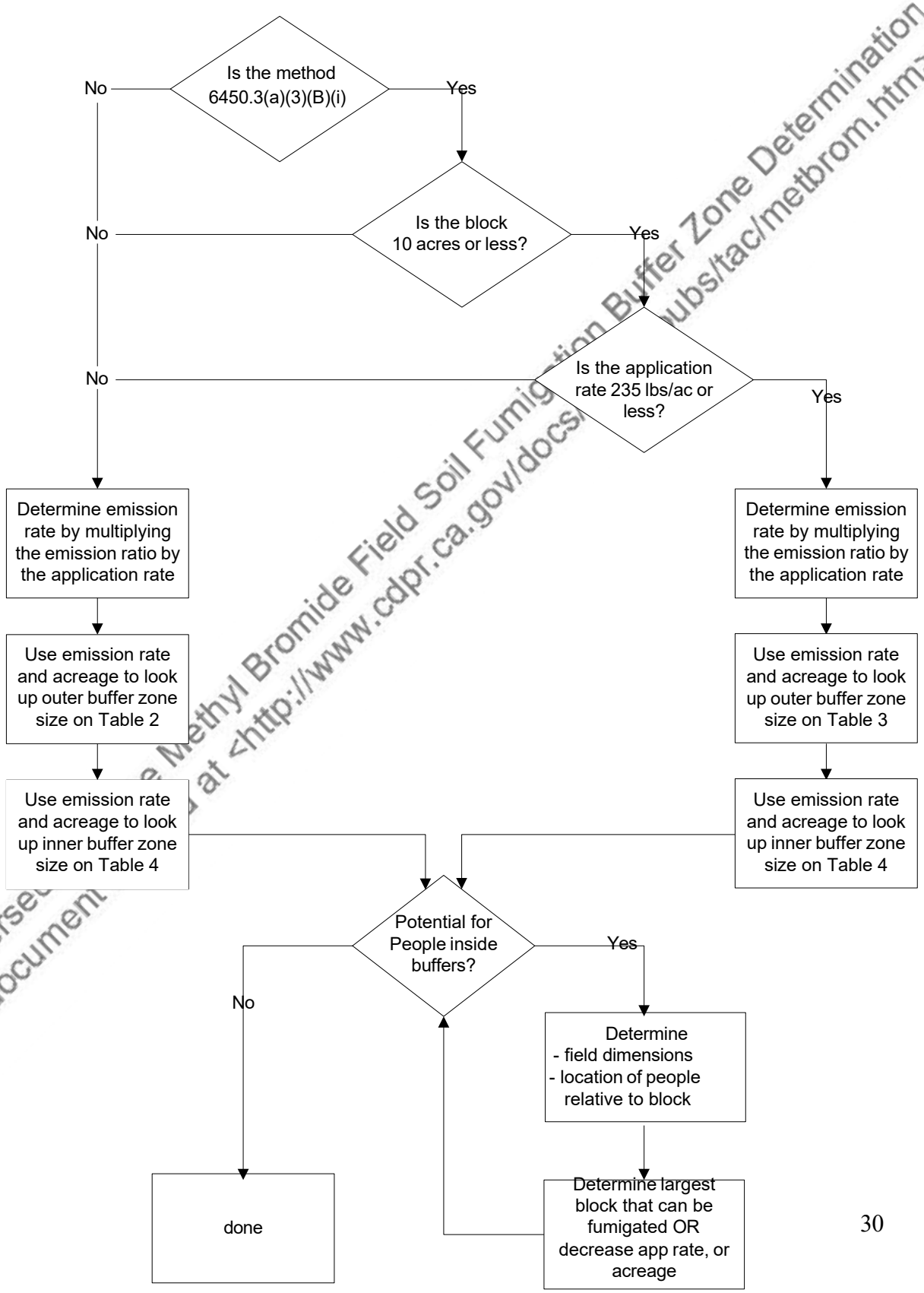
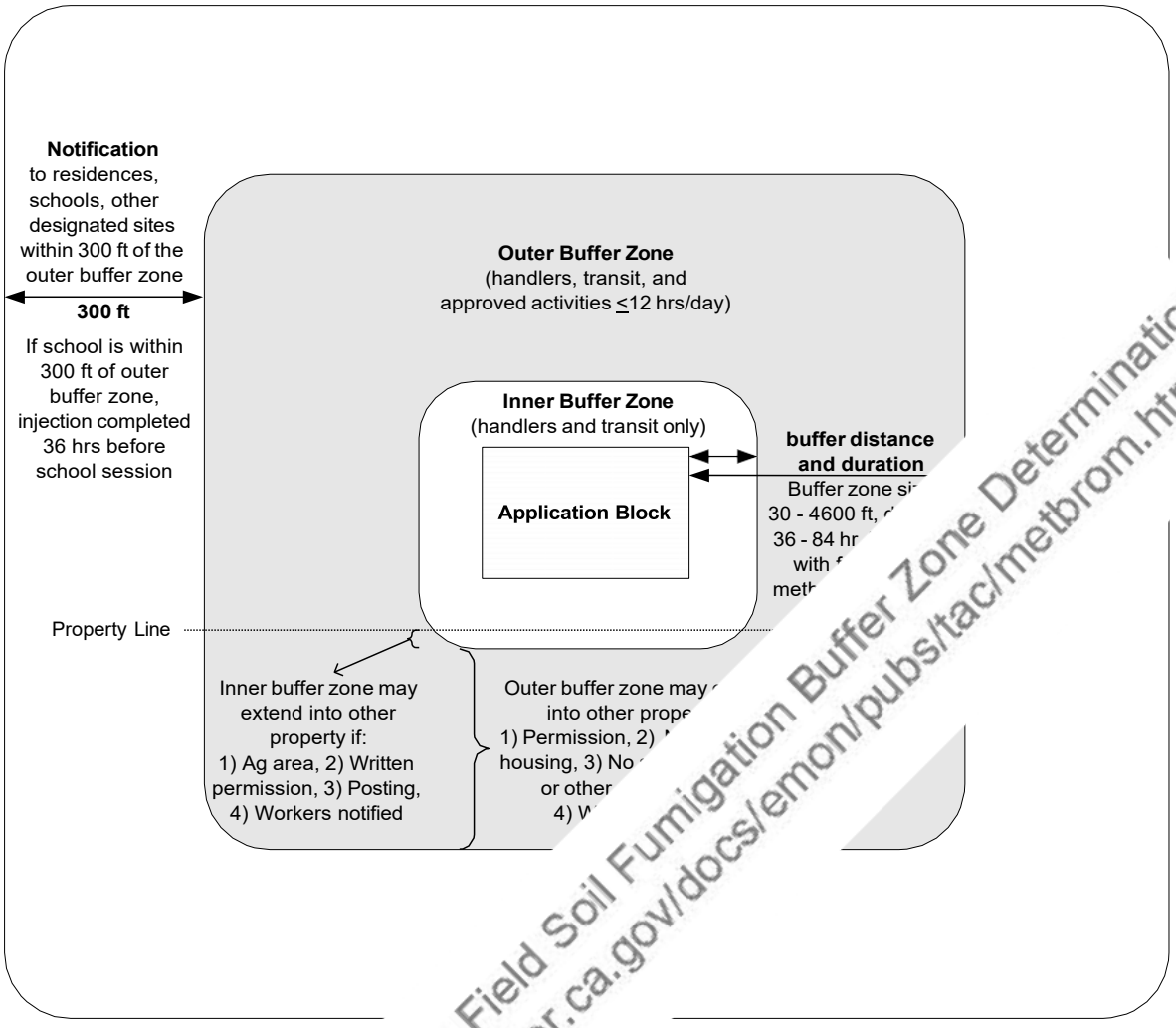


FIGURE 7. INNER AND OUTER BUFFER ZONES AND NOTIFICATION



FUMIGATION METHODS

The following fumigation methods are approved by the Department of Pesticide Regulation for field soil fumigation with methyl bromide used in combination with chloropicrin. The specific fumigation requirements for using these methods are covered in section 6450.3. "Fumigation Methods".

1. Nontarpaulin / Shallow / Bed [6450.3(a)(1)]*
2. Nontarpaulin / Deep / Broadcast [6450.3(a)(2)]**
3. Tarpaulin / Shallow / Broadcast [6450.3(a)(3)]
4. Tarpaulin / Shallow / Bed [6450.3(a)(4)]
5. Tarpaulin / Deep / Broadcast [6450.3(a)(5)]
6. Drip System (Hot Gas) [6450.3(a)(6)]

Each, methyl bromide field soil fumigation must conform to all ...ic to a fumigation method listed in *Table 1. Methyl Bromide F... Methods and Emission Ratios.* An applicator may not "m... requirements of two or more fumigation methods. Eq... ...ion requirements are described in section 6450.3 (a).

* Chisel injection points must be positioned be... the closing shoes.

** If a second tractor is used to further ...rks and compact the soil to ensure maximum sealing of soil s... ...ow within 5 minutes of the injection. If a disk is used, it sho... ...num depth of 2 inches.

NOTE: Other soil fumigati... ...as golf course, greenhouse, potting soil, tree-hole, a... ...n nursery fumigation of less than one acre are not cov... ...ce document.

TABLE 1. METHYL BROMIDE FIELD SOIL FUMIGATION METHODS AND EMISSION RATIOS

Each methyl bromide fumigation must conform to all requirements specific to a Fumigation Method listed below. An applicator may not "mix-and-match" the requirements of two or more fumigation methods. Equipment and fumigation requirements are described in section 6450.3(a).

Section 6450.3(a)	Fumigation Method	Injection Type	Injection Depth (in.)	Injection Spacing (in.)	Tractor Implements	Dilution Fan	Max Rate (lbs/ac)	Emission Ratio
(1)	Nontarp/Shallow/Bed	Rearward chisel	10 - 15	40 or less	Closing shoes & bed shaper *	Yes	200	0.40
(2)(B)1	Nontarp/Deep/Broadcast	Forward chisel	20+	68 or less	None	Yes	400	0.40
(2)(B)2	Nontarp/Deep/Broadcast	Forward chisel	24+	68 or less	Closing shoes, compaction roller	No	400	0.40
(3)(B)1	Tarp/Shallow/Broadcast	Horizontal V-shaped blades	10 - 15	12 or less	None	Yes	400	0.25
(3)(B)1	Tarp/Shallow/Broadcast (STRIP FUMIGATION)**	Horizontal V-shaped blades	10 - 15	12 or less	None	Yes	400	0.40
(3)(B)2	Tarp/Shallow/Broadcast	Rearward chisel	10 - 15	12 or less	Closing shoes, compaction roller	No	400	0.80
(4)(B)1	Tarp/Shallow/Bed	Rearward chisel	6 - 15	12 or less	Closing shoes, compaction roller	No	250	0.80
(4)(B)2	Tarp/Shallow/Bed	Rearward chisel	6 - 15	12 or less	Bed shaper	No	250	0.80
(4)(B)3	Tarp/Shallow/Bed	Rearward chisel	6 - 15	12 or less	Bed former and bed shaper	No	250	0.80
(5)(B)1	Tarp/Deep/Broadcast	Forward chisel	20+	66 or less	None	Yes	400	0.25
(5)(B)1	Tarp/Deep/Broadcast (STRIP FUMIGATION)**	Forward chisel	20+	66 or less	None	Yes	400	0.40
(5)(B)2	Tarp/Deep/Broadcast	Forward chisel	20+	66 or less	Closing shoes, compaction roller	No	400	0.25
(5)(B)2	Tarp/Deep/Broadcast (STRIP FUMIGATION)**	Forward chisel	20+	66 or less	Closing shoes, compaction roller	No	400	0.40
(6)	Drip System-Hot Gas	Drip tubing	1+	NA	NA	NA	225	1.0

* Optionally, closing shoes and a compaction roller can be used.

** Similar to bed fumigations, strip fumigations have alternating treated and untreated rows. In many cases, the untreated sections are fumigated on a later date.

TABLE 2. OUTER BUFFER ZONE DISTANCES (FEET) FOR FIELD SOIL FUMIGATION, EXCEPT METHOD SECTION 6450.3(a)(3)(B)1.

- Select the appropriate "Acreage" in the left-hand column.
- Select the appropriate "Emission Rate" (application rate x emission ratio) from the top row.
- Read the buffer zone distance where the "Acreage" row and the "Emission Rate" columns intersect.

Emission Rate (pounds/acre-day)

Acres	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
1	100	100	100	100	100	100	100	100	110	110	110	120	130	140	150
2	100	100	100	100	100	100	110	120	130	150	160	170	190	210	230
3	100	100	100	100	100	100	120	140	160	180	200	230	250	270	290
4	100	100	100	100	100	110	140	160	190	220	240	270	300	330	350
5	100	100	100	100	110	120	150	180	210	250	280	310	340	370	400
6	100	100	100	100	120	140	170	210	240	270	310	340	370	410	440
7	100	100	100	100	130	160	190	230	260	300	330	370	410	440	480
8	100	100	100	110	140	180	210	250	280	320	360	400	440	480	510
9	100	100	100	120	150	190	230	270	300	340	380	420	470	510	550
10	100	100	100	120	160	200	240	280	320	370	410	450	500	540	580
11	100	100	100	130	170	210	260	300	340	390	430	480	520	570	620
12	100	100	110	140	180	220	270	310	360	410	450	500	550	600	650
13	100	100	110	150	190	230	280	330	380	430	480	530	580	630	680
14	100	100	110	160	200	240	290	340	390	440	500	550	600	660	710
15	100	100	120	160	210	250	300	350	410	460	520	570	630	680	740
16	100	100	120	170	210	260	310	370	420	480	540	590	650	710	770
17	100	100	130	180	220	270	330	380	440	500	550	610	670	730	790
18	100	100	130	180	230	280	340	390	450	510	570	630	700	760	820
19	100	100	140	190	240	290	350	410	470	530	590	650	720	780	840
20	100	100	140	190	240	300	360	420	480	540	610	670	740	800	870
21	100	100	150	200	250	310	370	430	490	560	620	690	760	820	890
22	100	100	150	200	260	320	380	440	510	570	640	710	780	850	920
23	100	110	160	210	270	330	390	450	520	590	660	730	800	870	940
24	100	110	160	210	270	330	400	470	530	600	670	750	820	890	960
25	100	110	170	220	280	340	410	480	550	620	690	760	840	910	980
26	100	120	170	220	290	350	420	490	560	630	710	780	860	930	1000
27	100	120	170	230	290	360	430	500	570	650	720	800	870	950	1000
28	100	120	180	240	300	370	440	510	580	660	740	810	890	970	1100
29	100	130	180	240	310	370	450	520	600	670	750	830	910	990	1100
30	100	130	180	250	310	380	450	530	610	690	770	850	930	1000	1100
31	100	130	190	250	320	390	460	540	620	700	780	860	950	1000	1100
32	100	140	190	260	320	400	470	550	630	710	800	880	960	1000	1100
33	100	140	200	260	330	400	480	560	640	730	810	900	980	1100	1200
34	100	140	200	270	340	410	490	570	650	740	820	910	1000	1100	1200
35	100	140	200	270	340	420	500	580	660	750	840	930	1000	1100	1200
36	100	150	210	270	350	420	510	590	680	760	850	940	1000	1100	1200
37	100	150	210	280	350	430	510	600	690	770	870	960	1000	1100	1200
38	100	150	210	280	360	440	520	610	700	790	880	970	1100	1200	1300
39	100	150	220	290	360	440	530	620	710	800	890	990	1100	1200	1300
40	100	150	220	290	370	450	540	630	720	810	900	1000	1100	1200	1300

TABLE 2. OUTER BUFFER ZONE DISTANCES (FEET) FOR FIELD SOIL FUMIGATION, EXCEPT METHOD SECTION 6450.3(a)(3)(B)1. (CONTINUED)

- Select the appropriate number of "Acres" in the left-hand column.
- Select the appropriate "Emission Rate" (application rate x emission ratio) from the top row.
- Read the buffer zone distance where the "Acres" row and the "Emission Rate" columns intersect.

Emission Rate (pounds/acre-day)

Acres	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175
1	170	180	190	200	210	220	240	250	260	270	280	290	300	310	320
2	240	260	280	290	310	330	350	360	380	390	410	430	440	460	470
3	320	340	360	380	410	430	450	470	490	510	530	550	570	590	610
4	380	410	430	460	490	510	540	560	590	610	640	660	690	710	730
5	430	460	490	520	550	580	610	640	670	700	720	750	780	810	830
6	480	510	540	580	610	640	670	700	740	770	800	830	860	890	920
7	520	550	590	620	660	690	730	760	800	830	860	900	930	960	990
8	550	590	630	670	710	750	780	820	860	890	930	960	1000	1000	1100
9	590	630	670	710	760	800	840	870	910	950	990	1000	1100	1100	1100
10	630	670	720	760	800	840	890	930	970	1000	1000	1100	1100	1200	1200
11	660	710	760	800	850	890	940	980	1000	1100	1100	1200	1200	1200	1300
12	700	750	800	840	890	940	990	1000	1100	1100	1200	1200	1300	1300	1300
13	730	780	830	880	930	980	1000	1100	1100	1200	1200	1300	1300	1400	1400
14	760	820	870	920	970	1000	1100	1100	1200	1200	1300	1300	1400	1400	1500
15	790	850	900	960	1000	1100	1100	1200	1200	1300	1300	1400	1400	1500	1500
16	820	880	940	990	1000	1100	1200	1200	1300	1300	1400	1400	1500	1500	1600
17	850	910	970	1000	1100	1100	1200	1300	1300	1400	1400	1500	1500	1600	1600
18	880	940	1000	1100	1100	1200	1200	1300	1400	1400	1500	1500	1600	1600	1700
19	910	970	1000	1100	1200	1200	1300	1300	1400	1400	1500	1600	1600	1700	1700
20	930	1000	1100	1100	1200	1200	1300	1400	1400	1500	1500	1600	1700	1700	1800
21	960	1000	1100	1200	1200	1300	1300	1400	1500	1500	1600	1700	1700	1800	1800
22	980	1100	1100	1200	1300	1300	1400	1400	1500	1600	1600	1700	1800	1800	1900
23	1000	1100	1100	1200	1300	1400	1400	1500	1500	1600	1700	1700	1800	1900	1900
24	1000	1100	1200	1200	1300	1400	1500	1500	1600	1700	1700	1800	1800	1900	2000
25	1100	1100	1200	1300	1300	1400	1500	1600	1600	1700	1800	1800	1900	1900	2000
26	1100	1200	1200	1300	1400	1400	1500	1600	1700	1700	1800	1900	1900	2000	2100
27	1100	1200	1300	1300	1400	1500	1600	1600	1700	1800	1800	1900	2000	2000	2100
28	1100	1200	1300	1400	1400	1500	1600	1700	1700	1800	1900	1900	2000	2100	2100
29	1200	1200	1300	1400	1500	1500	1600	1700	1800	1800	1900	2000	2100	2100	2200
30	1200	1300	1300	1400	1500	1600	1600	1700	1800	1900	1900	2000	2100	2200	2200
31	1200	1300	1400	1400	1500	1600	1700	1800	1800	1900	2000	2100	2100	2200	2300
32	1200	1300	1400	1500	1500	1600	1700	1800	1900	1900	2000	2100	2200	2200	2300
33	1200	1300	1400	1500	1600	1700	1700	1800	1900	2000	2100	2100	2200	2300	2400
34	1300	1300	1400	1500	1600	1700	1800	1900	1900	2000	2100	2200	2200	2300	2400
35	1300	1400	1500	1500	1600	1700	1800	1900	2000	2000	2100	2200	2300	2400	2400
36	1300	1400	1500	1600	1700	1700	1800	1900	2000	2100	2200	2200	2300	2400	2500
37	1300	1400	1500	1600	1700	1800	1900	1900	2000	2100	2200	2300	2400	2400	2500
38	1300	1400	1500	1600	1700	1800	1900	2000	2100	2100	2200	2300	2400	2500	2500
39	1400	1500	1500	1600	1700	1800	1900	2000	2100	2200	2300	2300	2400	2500	2600
40	1400	1500	1600	1700	1800	1800	1900	2000	2100	2200	2300	2400	2500	2500	2600

TABLE 2. OUTER BUFFER ZONE DISTANCES (FEET) FOR FIELD SOIL FUMIGATION, EXCEPT METHOD SECTION 6450.3(a)(3)(B)1. (CONTINUED)

- Select the appropriate number of "Acres" in the left-hand column.
- Select the appropriate "Emission Rate" (application rate x emission ratio) from the top row.
- Read the buffer zone distance where the "Acres" row and the "Emission Rate" columns intersect.

Emission Rate (pounds/acre-day)

Acres	180	185	190	195	200	205	210	215	220	225	230	235	240	250
1	330	350	360	370	380	390	400	400	410	420	430	440	450	460
2	490	500	520	530	550	560	570	590	600	620	630	640	660	670
3	630	650	670	690	710	730	750	760	780	800	820	830	850	870
4	760	780	800	830	850	870	890	910	930	950	980	1000	1000	1000
5	860	890	910	940	960	990	1000	1000	1100	1100	1100	1100	1200	1200
6	950	970	1000	1000	1100	1100	1100	1100	1200	1200	1200	1200	1300	1300
7	1000	1100	1100	1100	1100	1200	1200	1200	1300	1300	1300	1300	1400	1400
8	1100	1100	1200	1200	1200	1300	1300	1300	1400	1400	1400	1400	1500	1500
9	1200	1200	1200	1300	1300	1300	1400	1400	1400	1500	1500	1500	1600	1600
10	1200	1300	1300	1400	1400	1400	1500	1500	1500	1600	1600	1600	1700	1700
11	1300	1400	1400	1400	1500	1500	1500	1600	1600	1600	1700	1700	1800	1800
12	1400	1400	1500	1500	1500	1600	1600	1700	1700	1700	1800	1800	1800	1900
13	1400	1500	1500	1600	1600	1700	1700	1700	1800	1800	1900	1900	1900	2000
14	1500	1600	1600	1600	1700	1700	1800	1800	1800	1900	1900	2000	2000	2000
15	1600	1600	1700	1700	1700	1800	1800	1900	1900	2000	2000	2000	2100	2100
16	1600	1700	1700	1800	1800	1900	1900	1900	2000	2000	2100	2100	2200	2200
17	1700	1700	1800	1800	1900	1900	2000	2000	2100	2100	2100	2200	2200	2300
18	1700	1800	1800	1900	1900	2000	2000	2100	2100	2200	2200	2300	2300	2300
19	1800	1800	1900	1900	2000	2000	2100	2100	2200	2200	2300	2300	2400	2400
20	1800	1900	1900	2000	2000	2100	2100	2200	2200	2300	2300	2400	2400	2500
21	1900	1900	2000	2000	2100	2200	2200	2300	2300	2400	2400	2500	2500	2600
22	1900	2000	2000	2100	2200	2200	2300	2300	2400	2400	2500	2500	2600	2600
23	2000	2000	2100	2200	2200	2300	2300	2400	2400	2500	2500	2600	2600	2700
24	2000	2100	2100	2200	2300	2300	2400	2400	2500	2500	2600	2600	2700	2700
25	2100	2100	2200	2300	2300	2400	2400	2500	2500	2600	2700	2700	2800	2800
26	2100	2200	2200	2300	2400	2400	2500	2500	2600	2700	2700	2800	2800	2900
27	2200	2200	2300	2400	2400	2500	2500	2600	2700	2700	2800	2800	2900	2900
28	2200	2300	2300	2400	2500	2500	2600	2600	2700	2800	2800	2900	2900	3000
29	2300	2300	2400	2500	2500	2600	2600	2700	2800	2800	2900	2900	3000	3100
30	2300	2400	2400	2500	2600	2600	2700	2800	2800	2900	2900	3000	3100	3100
31	2300	2400	2500	2500	2600	2700	2700	2800	2900	2900	3000	3100	3100	3200
32	2400	2500	2500	2600	2700	2700	2800	2900	2900	3000	3000	3100	3200	3200
33	2400	2500	2600	2600	2700	2800	2800	2900	3000	3000	3100	3200	3200	3300
34	2500	2500	2600	2700	2800	2800	2900	3000	3000	3100	3200	3200	3300	3300
35	2500	2600	2700	2700	2800	2900	2900	3000	3100	3100	3200	3300	3300	3400
36	2500	2600	2700	2800	2800	2900	3000	3100	3100	3200	3300	3300	3400	3400
37	2600	2700	2700	2800	2900	3000	3000	3100	3200	3200	3300	3400	3400	3500
38	2600	2700	2800	2900	2900	3000	3100	3100	3200	3300	3400	3400	3500	3600
39	2700	2700	2800	2900	3000	3000	3100	3200	3300	3300	3400	3500	3500	3600
40	2700	2800	2900	2900	3000	3100	3200	3200	3300	3400	3400	3500	3600	3700

TABLE 2. OUTER BUFFER ZONE DISTANCES (FEET) FOR FIELD SOIL FUMIGATION, EXCEPT METHOD SECTION 6450.3(a)(3)(B)1. (CONTINUED)

- Select the appropriate number of "Acres" in the left-hand column.
- Select the appropriate "Emission Rate" (application rate x emission ratio) from the top row.
- Read the buffer zone distance where the "Acres" row and the "Emission Rate" columns intersect.

Emission Rate (pounds/acre-day)

Acres	255	260	265	270	275	280	285	290	295	300	305	310	315	320
1	480	490	500	500	510	520	530	540	550	550	560	570	580	580
2	690	710	720	730	740	760	770	780	790	800	810	820	840	850
3	900	920	930	950	960	980	990	1000	1000	1000	1100	1100	1100	1100
4	1100	1100	1100	1100	1200	1200	1200	1200	1200	1200	1300	1300	1300	1300
5	1200	1200	1300	1300	1300	1300	1300	1400	1400	1400	1400	1400	1500	1500
6	1300	1400	1400	1400	1400	1500	1500	1500	1500	1500	1600	1600	1600	1600
7	1400	1500	1500	1500	1500	1600	1600	1600	1600	1700	1700	1700	1700	1800
8	1600	1600	1600	1600	1700	1700	1700	1700	1800	1800	1800	1800	1900	1900
9	1700	1700	1700	1700	1800	1800	1800	1900	1900	1900	1900	2000	2000	2000
10	1800	1800	1800	1800	1900	1900	1900	2000	2000	2000	2100	2100	2100	2100
11	1900	1900	1900	1900	2000	2000	2000	2100	2100	2100	2200	2200	2200	2300
12	1900	2000	2000	2000	2100	2100	2100	2200	2200	2200	2300	2300	2300	2400
13	2000	2100	2100	2100	2200	2200	2200	2300	2300	2300	2400	2400	2400	2500
14	2100	2200	2200	2200	2300	2300	2300	2400	2400	2400	2500	2500	2500	2600
15	2200	2200	2300	2300	2400	2400	2400	2500	2500	2500	2600	2600	2600	2700
16	2300	2300	2400	2400	2400	2500	2500	2600	2600	2600	2700	2700	2700	2800
17	2400	2400	2400	2500	2500	2600	2600	2600	2700	2700	2800	2800	2800	2900
18	2400	2500	2500	2600	2600	2600	2700	2700	2800	2800	2800	2900	2900	3000
19	2500	2500	2600	2600	2700	2700	2800	2800	2800	2900	2900	3000	3000	3000
20	2600	2600	2700	2700	2800	2800	2800	2900	2900	3000	3000	3000	3100	3100
21	2600	2700	2700	2800	2800	2900	2900	3000	3000	3000	3100	3100	3200	3200
22	2700	2800	2800	2900	2900	2900	3000	3000	3100	3100	3200	3200	3300	3300
23	2800	2800	2900	2900	3000	3000	3100	3100	3200	3200	3200	3300	3300	3400
24	2800	2900	2900	3000	3000	3100	3100	3200	3200	3300	3300	3400	3400	3500
25	2900	3000	3000	3100	3100	3200	3200	3300	3300	3400	3400	3400	3500	3500
26	3000	3000	3100	3100	3200	3200	3300	3300	3400	3400	3500	3500	3600	3600
27	3000	3100	3100	3200	3300	3300	3400	3400	3500	3500	3600	3600	3600	3700
28	3100	3200	3200	3300	3300	3400	3400	3500	3500	3600	3600	3700	3700	3800
29	3200	3200	3300	3300	3400	3400	3500	3500	3600	3600	3700	3700	3800	3800
30	3200	3300	3300	3400	3500	3500	3600	3600	3700	3700	3800	3800	3900	3900
31	3300	3300	3400	3500	3500	3600	3600	3700	3700	3800	3800	3900	3900	4000
32	3300	3400	3500	3500	3600	3600	3700	3700	3800	3900	3900	4000	4000	4100
33	3400	3500	3500	3600	3600	3700	3800	3800	3900	3900	4000	4000	4100	4100
34	3500	3500	3600	3600	3700	3800	3800	3900	3900	4000	4000	4100	4100	4200
35	3500	3600	3600	3700	3800	3800	3900	3900	4000	4100	4100	4200	4200	4300
36	3600	3600	3700	3800	3800	3900	3900	4000	4100	4100	4200	4200	4300	4300
37	3600	3700	3800	3800	3900	3900	4000	4100	4100	4200	4200	4300	4300	4400
38	3700	3700	3800	3900	3900	4000	4100	4100	4200	4200	4300	4400	4400	4500
39	3700	3800	3900	3900	4000	4100	4100	4200	4200	4300	4400	4400	4500	4500
40	3800	3900	3900	4000	4100	4100	4200	4200	4300	4400	4400	4500	4500	4600

TABLE 3: OUTER BUFFER ZONE DISTANCES (FEET) FOR FUMIGATION METHOD SECTION 6450.3(a)(3)(B)1. TARPAULIN/SHALLOW/BROADCAST ("NOBEL PLOW") FIELD SOIL FUMIGATION WHERE APPLICATION BLOCKS ARE:

1. **10 ACRES OR LESS**
2. **APPLICATION RATES OF 235 POUNDS PER ACRE OR LESS**

Acres	Coastal Counties	Inland Counties
1	60	60
2	60	60
3	60	60
4	60	60
5	60	60
6	60	*
7	70	*
8	80	*
9	90	*
10	100	*

* Use Table 2 to determine buffer zones for acreage larger than listed on this table.

Fumigations using rates greater than 235 pounds per acre are determined using Table 2.

TABLE 4. INNER BUFFER ZONE DISTANCES (FEET) FOR FIELD SOIL FUMIGATION

- Select the appropriate "Acreage" in the left-hand column.
- Select the appropriate "Emission Rate" (application rate x emission ratio) from the top row.
- Read the buffer zone distance where the "Acreage" row and the "Emission Rate" columns intersect.

	Emission Rate (pounds/acre-day														
Acres	**60**	**70**	**80**	**90**	**100**	**110**	**120**	**130**	**140**	**150**	**160**	**170**	**180**	**190**	**200**
1	30	30	30	30	40	50	60	70	80	90	100	120	130	140	150
2	30	30	40	50	60	70	90	100	120	140	150	170	190	210	230
3	30	30	50	60	80	100	120	140	160	180	200	220	250	270	290
4	30	40	60	70	100	120	140	170	190	220	240	270	300	320	350
5	30	40	60	90	110	130	160	190	220	250	280	310	340	370	400
6	30	50	70	100	120	150	180	210	240	270	310	340	370	410	440
7	30	50	80	100	130	160	200	230	260	300	330	370	400	440	480
8	40	60	80	110	140	180	210	250	280	320	360	400	430	470	510
9	40	60	90	120	150	190	230	260	300	340	380	420	460	510	550
10	40	70	100	130	160	200	240	280	320	360	410	450	490	540	580
11	40	70	100	140	170	210	250	300	340	380	430	480	520	570	620
12	50	70	110	140	180	220	270	310	360	400	450	500	550	600	650
13	50	80	110	150	190	230	280	330	370	420	470	520	580	630	680
14	50	80	120	160	200	240	290	340	390	440	490	550	600	650	710
15	50	80	120	160	210	250	300	350	410	460	510	570	630	680	740
16	50	90	130	170	210	260	310	370	420	480	530	590	650	710	760
17	60	90	130	170	220	270	320	380	440	490	550	610	670	730	790
18	60	90	130	180	230	280	340	390	450	510	570	630	690	750	820
19	60	100	140	190	240	290	350	400	460	530	590	650	710	780	840
20	60	100	140	190	240	300	360	420	480	540	600	670	740	800	870
21	60	100	150	200	250	310	370	430	490	560	620	690	760	820	890
22	70	110	150	200	260	310	380	440	500	570	640	710	780	850	910
23	70	110	160	210	260	320	390	450	520	590	650	730	800	870	940
24	70	110	160	210	270	330	390	460	530	600	670	740	820	890	960
25	70	110	160	220	280	340	400	470	540	610	690	760	840	910	990
26	70	120	170	220	280	350	410	480	550	630	700	780	850	930	1000
27	80	120	170	230	290	350	420	490	570	640	720	800	870	950	1000
28	80	120	170	230	300	360	430	500	580	660	730	810	890	970	1100
29	80	130	180	240	300	370	440	520	590	670	750	830	910	990	1100
30	80	130	180	240	310	380	450	530	600	680	760	850	930	1000	1100
31	80	130	190	250	310	390	460	540	620	700	780	860	950	1000	1100
32	80	130	190	250	320	390	470	550	630	710	790	880	960	1000	1100
33	90	140	190	260	330	400	480	560	640	720	810	890	980	1100	1200
34	90	140	200	260	330	410	490	570	650	740	820	910	1000	1100	1200
35	90	140	200	270	340	420	500	580	660	750	840	930	1000	1100	1200
36	90	140	210	270	350	420	500	590	680	760	850	940	1000	1100	1200
37	90	150	210	280	350	430	510	600	690	780	870	960	1000	1100	1200
38	90	150	210	280	360	440	520	610	700	790	880	970	1100	1200	1200
39	90	150	220	290	360	440	530	620	710	800	890	980	1100	1200	1300
40	100	150	220	290	370	450	540	630	720	810	900	1000	1100	1200	1300

TABLE 4. INNER BUFFER ZONE DISTANCES (FEET) FOR FIELD SOIL FUMIGATION. (CONTINUED)

- Select the appropriate "Acreage" in the left-hand column.
- Select the appropriate "Emission Rate" (application rate x emission ratio) from the top row.
- Read the buffer zone distance where the "Acreage" row and the "Emission Rate" columns intersect.

Emission Rate (pounds/acre-day)

Acres	210	220	230	240	250	260	270	280	290	300	310	320
1	170	180	190	200	210	220	240	250	260	270	280	290
2	240	260	280	290	310	330	350	360	380	390	410	430
3	320	340	360	380	410	430	450	470	490	510	530	550
4	380	410	430	460	490	510	540	560	590	610	640	660
5	430	460	490	520	550	580	610	640	670	700	720	750
6	480	510	540	580	610	640	670	700	740	770	800	830
7	520	550	590	620	660	690	730	760	800	830	860	900
8	550	590	630	670	710	750	780	820	860	890	930	960
9	590	630	670	710	760	800	840	870	910	950	990	1000
10	630	670	720	760	800	840	890	930	970	1000	1000	1100
11	660	710	760	800	850	890	940	980	1000	1100	1100	1200
12	700	750	800	840	890	940	990	1000	1100	1100	1200	1200
13	730	780	830	880	930	980	1000	1100	1100	1200	1200	1300
14	760	820	870	920	970	1000	1100	1100	1200	1200	1300	1300
15	790	850	900	960	1000	1100	1100	1200	1200	1300	1300	1400
16	820	880	940	990	1000	1100	1200	1200	1300	1300	1400	1400
17	850	910	970	1000	1100	1100	1200	1300	1300	1400	1400	1500
18	880	940	1000	1100	1100	1200	1200	1300	1400	1400	1500	1500
19	910	970	1000	1100	1200	1200	1300	1300	1400	1400	1500	1600
20	930	1000	1100	1100	1200	1200	1300	1400	1400	1500	1500	1600
21	960	1000	1100	1200	1200	1300	1300	1400	1500	1500	1600	1700
22	980	1100	1100	1200	1300	1300	1400	1400	1500	1600	1600	1700
23	1000	1100	1100	1200	1300	1400	1400	1500	1500	1600	1700	1700
24	1000	1100	1200	1200	1300	1400	1500	1500	1600	1700	1700	1800
25	1100	1100	1200	1300	1300	1400	1500	1600	1600	1700	1800	1800
26	1100	1200	1200	1300	1400	1400	1500	1600	1700	1700	1800	1900
27	1100	1200	1300	1300	1400	1500	1600	1600	1700	1800	1800	1900
28	1100	1200	1300	1400	1400	1500	1600	1700	1700	1800	1900	1900
29	1200	1200	1300	1400	1500	1500	1600	1700	1800	1800	1900	2000
30	1200	1300	1300	1400	1500	1600	1600	1700	1800	1900	1900	2000
31	1200	1300	1400	1400	1500	1600	1700	1800	1800	1900	2000	2100
32	1200	1300	1400	1500	1500	1600	1700	1800	1900	1900	2000	2100
33	1200	1300	1400	1500	1600	1700	1700	1800	1900	2000	2100	2100
34	1300	1300	1400	1500	1600	1700	1800	1900	1900	2000	2100	2200
35	1300	1400	1500	1500	1600	1700	1800	1900	2000	2000	2100	2200
36	1300	1400	1500	1600	1700	1700	1800	1900	2000	2100	2200	2200
37	1300	1400	1500	1600	1700	1800	1900	1900	2000	2100	2200	2300
38	1300	1400	1500	1600	1700	1800	1900	2000	2100	2100	2200	2300
39	1400	1500	1500	1600	1700	1800	1900	2000	2100	2200	2300	2300
40	1400	1500	1600	1700	1800	1800	1900	2000	2100	2200	2300	2400

TABLE 5: BUFFER ZONE DURATION (HOURS) FOR FIELD SOIL FUMIGATION

TABLE 5A:
Nontarpaulin/Shallow/Bed - Section 6450.3(a)(1)

	Application Rate (pounds per acre)										
Acres	**150**	**175**	**200**	**225**	**250**	**275**	**300**	**325**	**350**	**375**	**400**
1 - 10	36	36	36	*	*	*	*	*	*	*	*
11 - 20	36	36	36	*	*	*	*	*	*	*	*
21 - 30	36	36	36	*	*	*	*	*	*	*	*
31 - 40	36	36	36	*	*	*	*	*	*	*	*

* Application rates not allowed

TABLE 5B:
Nontarpaulin/Deep/Broadcast - Section 6450.3(a)(2)
Tarp/Deep/Broadcast - Section 6450.3(a)(5)

	Application Rate (pounds per acre)										
Acres	**150**	**175**	**200**	**225**	**250**	**275**	**300**	**325**	**350**	**375**	**400**
1 - 10	36	36	36	36	36	36	60	60	60	60	60
11 - 20	36	36	36	36	36	60	60	60	60	60	60
21 - 30	36	36	36	60	60	60	60	60	60	60	84
31 - 40	36	36	36	60	60	60	60	60	60	60	84

TABLE 5C:
Tarpaulin/Shallow/Broadcast - Section 6450.3(a)(3)
Tarpaulln/Shallow/Bed - Section 6450.3(a)(4)
Drip System/HotGas - Section 6450.3(a)(6)

	Application Rate (pounds per acre)										
Acres	**150**	**175**	**200**	**225**	**250**	**275**	**300**	**325**	**350**	**375**	**400**
1 - 10	36	36	36	36	36	36	36	36	36	36	36
11 - 20	36	36	36	36	36	36	36	36	36	60	60
21 - 30	36	36	36	36	36	36	36	60	60	60	60
31 - 40	36	36	36	36	36	36	36	60	60	60	60

ENGINEERING CONTROLS

This section describes the equipment modifications and control measures designed to improve worker safety that are to be used for the Fumigation Methods described in section 6450.3 and listed in *Table 1*. Also, this section includes diagrams of approved fumigation equipment configurations.

Fumigant Line Requirements

1. General requirements are covered in regulation section 6450(g). This section requires fumigation equipment to eliminate drip by clearing the fumigant from the injection device (chisel, Nobel Plow) before it is lifted or removed from the soil.

2. There are specific requirements for fumigation lines for the Drip System - Hot Gas fumigation method. These requirements are covered by section 6450.3(a)(6).

Air-Fan Dilution Equipment Description/Diagrams *(Figures 8 and 9)*

1. The fumigation tractor must incorporate a working-area air-fan dilution system consisting of a ducted fan/blower. The air fan dilution system is installed directly above the tractor driver's head *(Figure 8)* to provide a continuous downward flow of air over the driver's body when the equipment is in use. The air-fan dilution requirement only applies to the tractor used to apply the fumigant.

2. The fan/blower must be mounted so that the fan/blower intake is at least 126 inches from the ground.

3. A protective screen must be mounted at the exhaust end of the fan/blower to protect the driver from the fan blades *(Figure 9)*.

4. A diverter device consisting of tubing with a 4-inch inside diameter must be attached to the underside of the protective screen under the fan to direct the air flow to the breathing zone of the copilot *(Figure 8)*. The diverter device must be made of material such as flexible tubing, PVC pipe, sheet metal, or similar durable material.

5. The inside diameter of the air intake must be 21 inches, surrounded by a flat metal ring measuring 11 inches out from the edge of the intake.

6. The total diameter of the air fan dilution system must be 43 inches.

7. The fan/blower must be capable of operating at a minimum of 1,600 revolutions per minute and producing a minimum flow rate of 3,000 cubic feet of air per minute.

8. The application tractor must be equipped with a flexible tube to direct the engine exhaust away from the air intake of the fan described above, to an area behind the tractor and away from any person(s) involved in the application.

Exception: An air-fan dilution system is not required if the fumigation conforms to the requirements for the following fumigation methods:

a) Non-Tarpaulin/Shallow/Broadcast [Section 6450.3(a)(2)(B)2.]
b) Tarpaulin/Shallow/Broadcast [Section 6450.3(a)(3)(B)2.]
c) Tarpaulin/Shallow/Bed [Section 6450.3(a)(4)(B)1,2,3.]
d) Tarpaulin/Deep/Broadcast [Section 6450.3(a)(5)(B)2.]

Chisel Descriptions / Photos

1. Forward-Curved Chisels *(Figure 11)*

2. Rearward-Curved/Swept Back Chisels *(Figure 12)*

Nobel Plow/Modified Nobel Plow Descriptions / Photo *(Figure 10)*

1. The Nobel Plow is an example of a plow consisting of horizontal v-shaped blades mounted by a vertical arm to the tool bar that inject methyl bromide in combination with chloropicrin laterally to a depth of between 10-15 inches, beneath the soil surface. The Nobel Plow has two 32-inch wide plows on spacing that does not exceed 48 inches. The **Modified Nobel Plow** has four 12-inch wide plows on 24-inch spacing.

2. The injection outlets must be evenly spaced across the trailing edge of each blade at 12-inch intervals.

3. In addition, two conventional vertical shanks on each end of the tool bar are to be used in association with shovels used to open and close the soil over the leading edge of the tarpaulin.

FIGURE 8. AIR-FAN DILUTION SYSTEM (TRACTOR MOUNTED/SIDE VIEW)

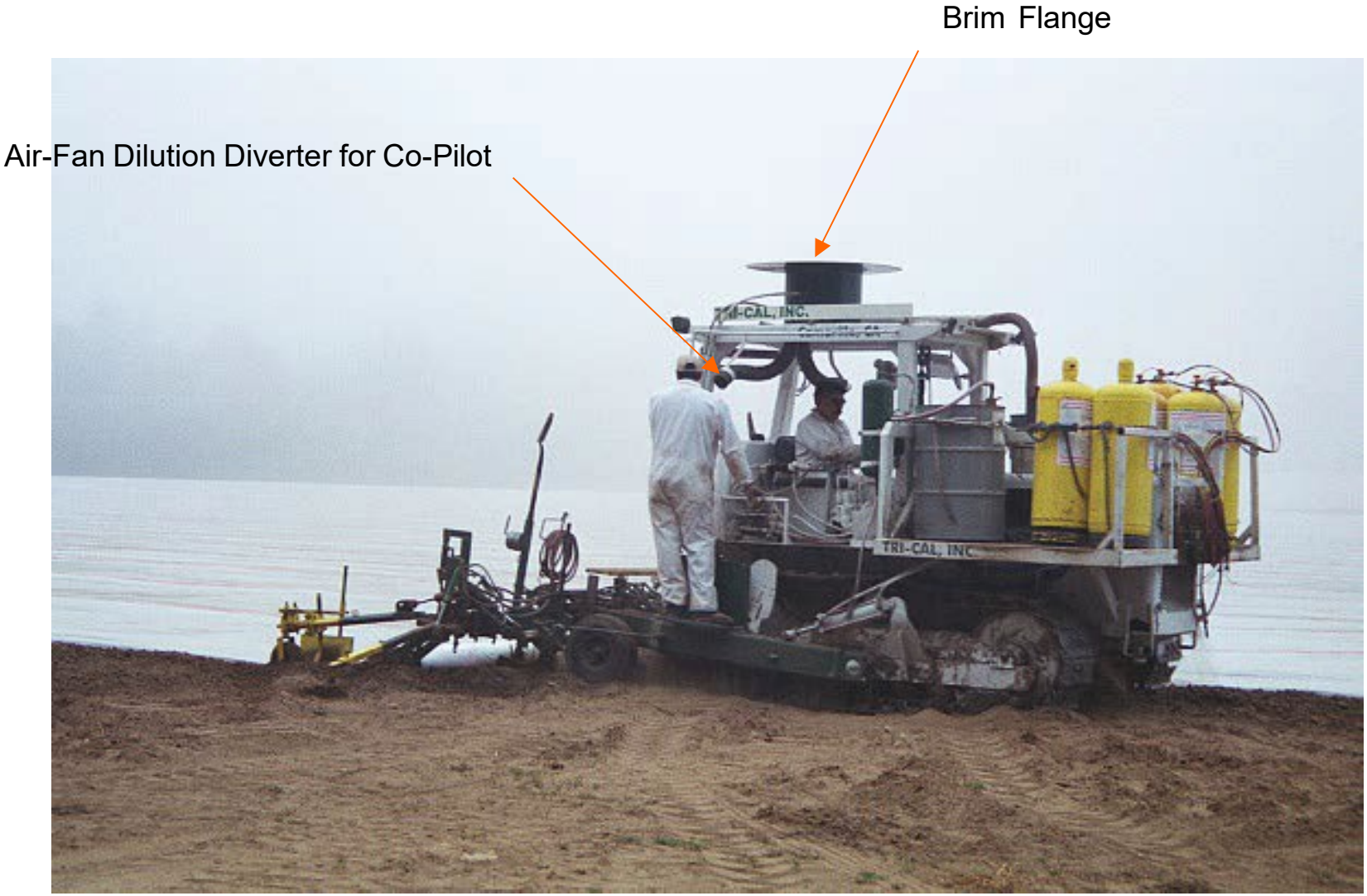


FIGURE 9. AIR-FAN DILUTION SYSTEM
(AERIAL VIEW WITH BRIM FLANGE)

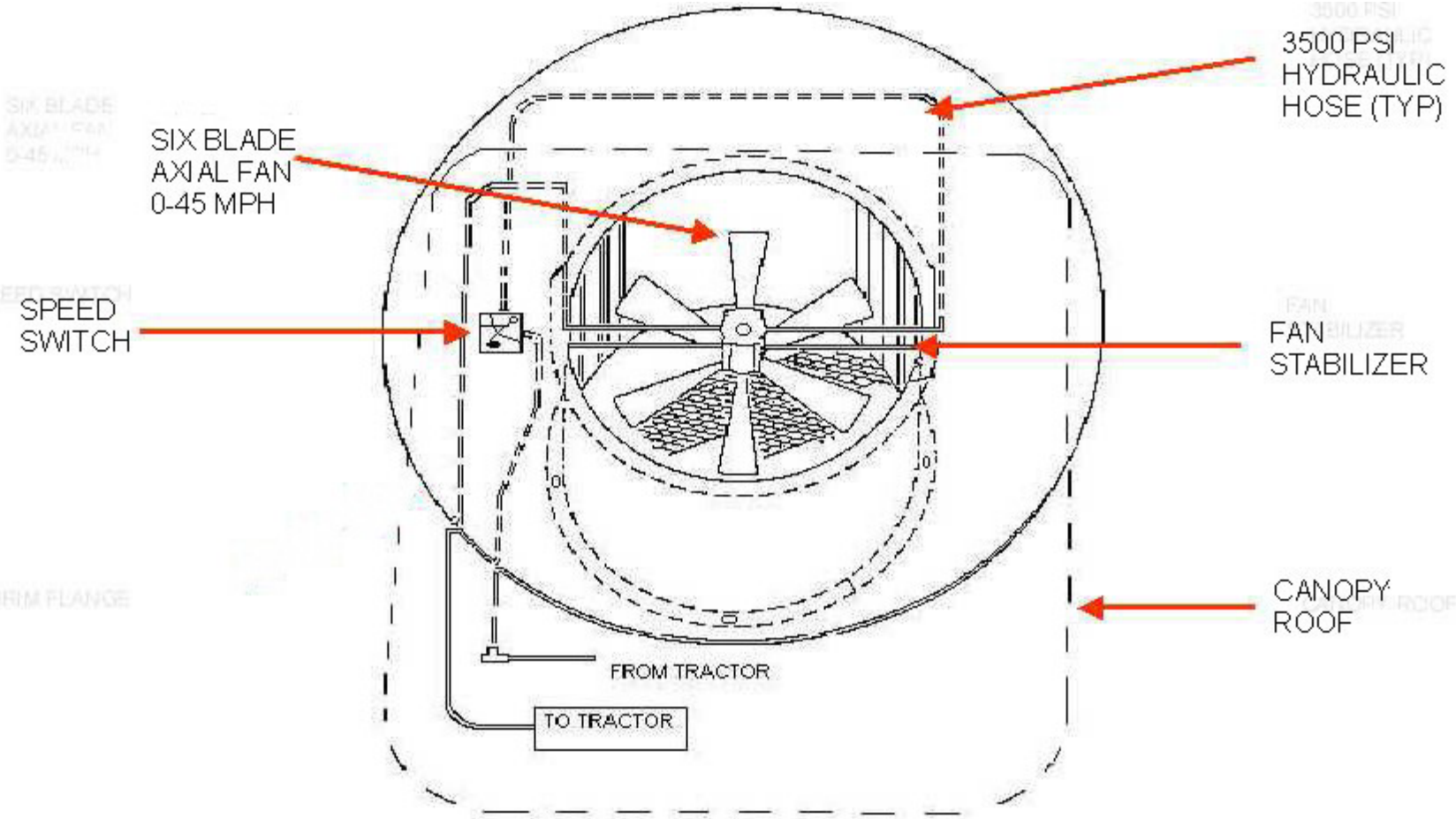


FIGURE 10. MODIFIED NOBEL PLOW

FIGURE 11. FORWARD-CURVED CHISELS

FIGURE 12. REARWARD-CURVED CHISELS

WORKER SAFETY REQUIREMENTS

Fumigation Handling Activities

This section of the manual describes the worker safety requirements for employees involved in methyl bromide field soil fumigation "handling" activities. Section 6450 defines **"fumigation handling activities"** and the worker safety requirements are covered in section 6784. This regulation specifies that fumigation handling activities include employees who are assigned to perform the following:

1) **"Shovelers"** - Employees involved in assisting with covering the tarpaulin with soil at the end of the rows (Note: Shovelers can work ONLY at the ends of the application rows);
2) **"Copilots"** - Employees assisting in the overall operation, ensuring proper tarpaulin placement and condition, and changing cylinders;
3) **"Drivers"** - Operating fumigation equipment;
4) **"Supervisors"** – Employees (handlers) who oversees the fumigation operation, and may assist the applicator by monitoring the smoothness of the mechanics of the fumigation operation, and loading and unloading methyl bromide canisters from supply truck, to and from tractor; and
5) **"Tarpaulin Cutters and Tarpaulin Removers"** – Employees who assists with the fumigation process by cutting tarpaulins using an ATV or a tractor with a cutting wheel to facilitate the aeration portion of the fumigation; or, by punching holes in the tarpaulin prior to planting transplant crops; or, removes the tarpaulin from the fumigation site.

The handlers listed above are the only employees who should be within the inner buffer zone. Observers and other people not performing fumigation-handling activities cannot be within the inner buffer zone, except to transit. Like all worker safety regulations, the requirements in section 6784 do not apply to employers. Additionally, as described section 6000, local, state, or federal officials performing official duties are not considered handlers and are exempt from these requirements.

Drivers of tractors performing fumigation-related activities are allowed inside the inner buffer zone, provided they follow all fumigation handling requirements. For example, tractors forming beds, compacting soil, or laying drip tape are performing fumigation-related activities. Employees performing these tasks may be inside the inner buffer zone and are subject to the work hour limitations for drivers and all other fumigation-handling requirements.

In contrast, drivers of tractors applying other pesticides are not performing a fumigation handling activity and should not be inside the inner buffer zone. Similarly, people only observing are not performing a fumigation handling activity and should not be inside the inner buffer zone.

Employer Recordkeeping

Regulation section 6784(b)(2) requires employers to maintain records for all employees involved in methyl bromide field soil fumigation handling activities. These records must be maintained at a central location for two years and be made available to the commissioner on request. The information must include:

1) Identity of the person involved in fumigation handling;
2) Work activity (Shoveler, Copilot, Driver, Supervisor, Tarpaulin Cutter or Remover)
3) Date(s) worked in any of these activities;
4) Duration worked in any of these activities (See below for "Multiple Task Employees");
5) U.S. EPA Registration Number for specific methyl bromide product(s) handled; and ,
6) Brand name of specific methyl bromide product(s) handled.

DPR does not prescribe a particular format for documenting this information.

Fumigation Handlers Not Employed by a Pest Control Business or Grower

When a grower hires the service of a non-PCB or Farm Labor Contractor to work as shovelers or to cut and/or remove tarpaulin the person responsible for the record keeping is the person who controls, directs, and supervises the employees work activities. 3CCR section 6000 clearly states that the employer is the person who exercises primary direction and control over the employee's work activities. For more information see ENF 01-50 available at http://www.cdpr.ca.gov/docs/enfcmpli/penfltrs/penf2001/2001050.pdf

Restricted Entry Intervals

Restricted entry intervals are specified in section 6450.3, and vary with method of application. Notwithstanding 3CCR Section 6770, commissioners should not allow entry into the treated area prior to the expiration of the REI, including the strips not fumigated, with the following exceptions:

1) to repair, cut, or remove tarps as described in 3CCR Section 6784(b)(3), (4), and (5), or
2) full-face respirator is worn

For tarp/broadcast fumigations [methods 6450.3(a)(3) and (5)], the REI does not expire until the tarps are removed. This precludes fumigating the area between tarped strips until the tarps have been removed, unless handlers wear a full-face respirator.

Respirators

Respiratory protection is required for certain fumigation handling activities. When required, employees shall wear National Institute for Occupational Safety and Health (NIOSH)-certified respirators specifically recommended by the manufacturer for use in atmospheres containing less than 5 ppm methyl bromide (NOTE: SCBA is required for methyl bromide atmospheres greater than 5 ppm). Currently, only 3M manufactures this type of respirator. 3M currently specifies that the respirator cartridge must be changed daily.

The respirator must be worn for the entire duration of the fumigation handling activity. All respirator use must be in conformance with respiratory protection regulations as required in 3 CCR, particularly section 6738(h).

Presently only the 3M chemical cartridge, product #60928 (TC approval sub codes # 84A-0284, 84A-0705, 84A-0285 and 84A-0286) can be used for the purposes of extending worker time limitations per the methyl bromide regulations. These cartridges are available from 3M dealers and distributors. They fit both full-face and half-face respirators. They are available from 3M dealers and distributors and can be accessed by the 3M website (www.3m.com). The below URL generates a California listing, though this may change over time:

http://solutions.3m.com/wps/portal/_s.155/100221/_s.155/87508

Limited Work Hours

As shown in the following chart, work hours for each fumigation handling activity varies with the type of respiratory protection and the number of workdays in a calendar month.

	Number of Workdays in Calendar Month	
Respirator Type	**More than 3 days**	**3 days or less**
None	Not Allowed	Table 7 work hours
Half-face	Table 6 work hours	No work hour limits
Full-face/SCBA/supplied air	No work hour limits	No work hour limits

The regulations prohibit an employee from working in fumigation handling activities more than the hours specified in the charts below, in a 24-hour period, during the injection period and during the REI.

Alternating work hours between Tables 6 and 7 is not allowed, except for employees who did not perform fumigation-handling activities during the previous 30 days. For example, if an employee does not wear a respirator and works three days, the same employee cannot wear a half-face respirator and perform additional fumigation

handling activities unless 30 days have elapsed. However, an employee could wear a half-face respirator for two days, and work one day without a respirator during the same month, following the work hours on Table 7 for all three days.

An employee can work in more than one work task and/or fumigation method in a 24-hour period, as long as the employee's total work hours do not exceed the lowest total hours specified in Tables 6 and 7 for any one work task or fumigation method performed, and without alternating between tables.

The work hour limitations for supervisors, as well as all other fumigation handlers, only pertain to the time performing fumigation handling activities. Since methyl bromide can be applied with many different methods, it is problematic for DPR to develop an inclusive list of all fumigation handling activities. Moreover, a complete list of allowed activities is unnecessary since all fumigation-handling activities are performed near or in the field. All time spent near or in the field counts toward the work hour limits. Activities or time spent outside the inner buffer zone does not count toward the work hour limits.

Table 6. Maximum Work Hours for More than 3 Workdays Per Calendar Month With a Respirator

Fumigation Method	Maximum Application Rate	Activities/Maximum Work Hours in a 24-Hour Period Wearing Half-Face Respirator					
		Application Equipment Driving	Applicator	Shoveling, Copiloting	Supervising	Tarpaulin Cutting	Tarpaulin Removal
Nontarpaulin/Shallow/Bed	200 lbs.	9*	--	--	9*	--	--
Nontarpaulin/Deep/Broadcast	400 lbs.	10*	--	--	No limit[1]	--	--
Tarpaulin/Shallow/ Broadcast	400 lbs.	8*	--	4*	4*	No limit[1]	No limit[2]
Tarpaulin/Shallow/Bed	250 lbs.	No limit	--	8*	8*	No limit[1]	No limit[2]
Tarpaulin/Deep/ Broadcast	400 lbs.	8*	--	4*	4*	No limit[1]	No limit[2]
Drip System – Hot Gas	225 lbs.	--	5*	--	5*	No limit[1]	No limit[2]

[1] Exception: An employee may perform this activity without a half-face respirator provided the employee does not work more than one hour in a 24-hour period. The maximum one-hour work limitation may be increased in accordance with the formula located below.

[2] Exception: An employee may perform this activity without a half-face respirator provided the employee does not work more than three hours in a 24-hour period. The maximum three-hour work limitation may be increased in accordance with the formula located below.

*If the actual methyl bromide application rate is less than the maximum application rate shown in the chart above for the particular fumigation method used, the maximum work hours may be increased in accordance with the following formula:

$$\left(\frac{\text{maximum application rate for method}}{\text{actual application rate}}\right) \times \text{maximum work hours in a 24-hour period} = \text{revised work hours in a 24-hour period}$$

Unlike buffer zone calculations, do not adjust the application rate for strip fumigations.

Table 7. Maximum Work Hours in a Maximum 3 Workdays Per Calendar Month Without a Respirator

Fumigation Method	Maximum Application Rate	Activities/Maximum Work Hours in a 24-Hour Period					
		Application Equipment Driving	Applicator	Shoveling, Copiloting	Supervising	Tarpaulin Cutting	Tarpaulin Removal
Nontarpaulin/Shallow/Bed	200 lbs.	4*	--	--	4	--	--
Nontarpaulin/Deep/Broadcast	400 lbs.	4*	--	--	7	--	--
Tarpaulin/Shallow/ Broadcast	400 lbs.	4*	--	3*	3	4	7
Tarpaulin/Shallow/Bed	250 lbs.	4*	--	4*	4	4	7
Tarpaulin/Deep/ Broadcast	400 lbs.	4*	--	3*	3	4	7
Drip System – Hot Gas	225 lbs.	--	2*	--	2	4	7

*If the actual methyl bromide application rate is less than the maximum application rate shown in the chart above for the particular fumigation method used, the maximum work hours may be increased in accordance with the following formula:

$$\left(\frac{\text{maximum application rate for method}}{\text{actual application rate}}\right) \times \text{maximum work hours in a 24-hour period} = \text{revised work hours in a 24-hour period}$$

Unlike buffer zone calculations, do not adjust the application rate for strip fumigations.

Tarpaulin Repair Response and Tarpaulin Removal Plans

The operator of the property to be treated must include in the Work Site Plan specific information about the tarpaulin repair and tarpaulin removal procedures that are to be followed at the fumigation site.

The **Tarpaulin Repair Response Plan** must identify the responsibilities of the licensed pest control business and/or the permittee with regard to tarpaulin damage and repair activities.

The following information should be included in the tarpaulin repair response plan:

- Person(s) responsible for the repair
- Person(s) certified to test ambient air concentrations of methyl bromide
- Schedule for checking tarpaulins
- Minimum distance(s) from sensitive sites that tarpaulins will be repaired
- Minimum time following injection that tarpaulin will be repaired
- Minimum size of damage that will be repaired
- Maximum time following notification of damage that the pest control business or permittee will respond
- Other factors used to determine when tarpaulin repair will be conducted such as, hazard to the public, residents or workers; proximity to occupied structures; feasibility of repair; and environmental factors such as wind speed and direction.

A list of vendors for methyl bromide testing devices is given in Appendix B.

Two trained employees are not required when testing air during tarpaulin repair. The requirement for a second SCBA only applies to fumigations of enclosed spaces and does not apply to field fumigations.

Tarpaulin Cutting and Removal Procedures

Regulation section 6784(b)(5) requires tarpaulin cutting and tarpaulin removal be discontinued if the presence of gas is readily evident (onset of eye irritation or odor). Also tarpaulins used for broadcast fumigation, must be cut using only mechanical methods (such as, all-terrain vehicle or a tractor with a cutting wheel), and that each panel be cut lengthwise. Employees must not be allowed to use hand-tools such as, shovels or knives to cut the tarpaulins.

"Cutting" Transit Areas (Roads) Prior to Tarpaulin Removal

Tarpaulin covered fields that have been fumigated must not be disturbed by cutting roads through them prior to tarpaulin removal. This practice cannot be construed as "aeration" and is not consistent with section 6450.3. This section contains the only currently accepted (legal) fumigation methods and procedures for field soil fumigation in California.

GLOSSARY

Terms used in this guidance document have the same meanings they have in Title 3 California Code of Regulations section 6000. Additional terms specific to methyl bromide field soil fumigation are defined as follows:

A. **Application / Fumigation** — Includes the time period when the field soil is injected with methyl bromide in combination with chloropicrin until the tarpaulins are removed (tarpaulin fumigation), or until the restricted entry interval has expired (non-tarpaulin fumigation).

B. **Application Block** — A field or portion of a field treated with methyl bromide in combination with chloropicrin in any 24-hour period. The application block for soil fumigation cannot exceed 40 acres. There are two types of application blocks to be considered:

1. **Isolated Application Block**

a. An application block that is separated from the edge of a previously fumigated block by 1,300 feet or more; **or,**

b. An application block where 36 hours have elapsed since the fumigation ended, **and** at least 36 hours will elapse until another proposed application block is to be treated.

2. **Non-Isolated Application Block**

a. An application block that is less than 1,300 feet from the edge of a previously treated block: **and,** less than 36 hours have elapsed since the fumigation began; or,

b. An application block where less than 36 hours will elapse until another proposed application block is to be treated.

C. **Application Rate** — Refers to the amount of actual methyl bromide in the formulated product used at the treatment site, and is expressed in pounds of actual methyl bromide per acre. The application rate for bed or strip fumigations may need to be adjusted to an equivalent broadcast application rate to compute the buffer zones.

D. **Application Site** — The field location listed in the restricted materials permit. It may be more than 40 acres and may be comprised of one or more application blocks. The **Application Site** designation is used for reporting purposes.

E. **Buffer Zone** — The area that surrounds an application block in which certain activities are restricted for a specified period of time to protect human health and safety from existing or potential adverse effects associated with a methyl bromide application. The size of the buffer zone is dependent upon the application rate; the fumigation method, the emission ratio assigned to the fumigation method, and other factors that affect fumigant air concentrations.

This "basic" buffer zone surrounding an application block may need to be modified due to the proximity to occupied structures, distance to adjacent workers or other persons, or distance to completed or proposed field fumigation sites. There are two types of buffer zones used in field fumigation:

1. **Inner Buffer Zone** — The area surrounding an application block where activities are limited to transit and to perform fumigation handling activities.

The Inner Buffer Zone is measured from the edge of the application block to be treated. The Inner Buffer Zone may extend into adjoining agricultural property if the adjoining property operator gives written permission and allows the operator of the property to be treated to post the inner buffer zone boundary on the adjoining property with signs.

2. **Outer Buffer Zone** — The area surrounding an application block where activities are limited to those that are approved by the county agricultural commissioner as identified on the worksite plan.

The Outer Buffer Zone distance is measured from the edge of the application block to be treated. It may not extend into a neighboring property without permission of the neighboring property operator and assurance that no persons will be in the buffer zone area except to transit, perform fumigation handling activities, and commissioner approved activities. However, the Outer

	Buffer Zone may not contain occupied residences or occupied onsite employee housing while the Outer Buffer Zone is in effect. The Outer Buffer Zone must not extend into properties that contain schools, convalescent homes, homes, hospitals, or other similar sites identified by the commissioner.
G. Copilot	The (handler) person who assists the overall operation, ensuring proper tarpaulin placement, changing fumigant cylinders, etc. Normally, the copilot rides on the application rig, but may get off to perform other activities.
H. Driver (Application Tractor)	The (handler) person responsible for operating the application tractor.
I. Engineering Control	The equipment modifications designed to improve worker safety, such as air dilution fans, purging lines with an inert gas, Nobel Plow, chisel modifications, and tarpaulin.
J. Field Workers	Persons who engage in work activities in an application block after the restricted entry interval has expired. Field workers must be informed and protected according to worker safety regulations sections 6760 through 6768.
K. Fumigation Method	A specific application method used for field soil fumigation specified in section 6450.3.
L. Fumigation Handler	Refers to persons involved in assisting with covering the tarpaulin at the end of the rows (shoveling); assisting the overall operation, ensuring proper tarpaulin placement, changing cylinders (copiloting); operating application equipment (driving); supervising; and tarpaulin cutting and removal.
M. Restricted Entry Interval	Period of time after a field is treated during which restrictions on entry are in effect. The Restricted Entry Interval (REI) period for soil fumigation begins when the injection of the fumigant into an application block is completed. Section 6450.3 lists the REIs for each fumigation method.

N. Shoveler	The (handler) person who assists with covering the tarpaulin with soil at the end of the treatment row, as it is formed.
O. Strip Fumigation	Strip fumigations are applications that have alternating fumigated and unfumigated areas, similar to bed fumigations where the beds are fumigated and the furrows are not fumigated. In many cases, the untreated sections are fumigated on a later date. If a bedded or strip application is planned and the recommended application rate on the product label is for the beds only (on some labels listed as "treated area"), an adjustment of the application rate to a broadcast basis should be made.
P. Supervisor	An employee (handler) who oversees the fumigation operation, and may assist the applicator by monitoring the smoothness of the mechanics of the fumigation operation, and loading and unloading methyl bromide canisters from supply truck, to and from tractor.
Q. Tarpaulin Cutter	The employee (handler) who assists with the fumigation process by cutting tarpaulins using an ATV or a tractor with a cutting wheel to facilitate the aeration portion of the fumigation; or, by punching holes in the tarpaulin prior to planting transplant crops.
R. Tarpaulin Puller / Remover	The employee (handler) who removes the tarpaulin from the fumigation site. Persons involved in pulling the tarpaulins from the fumigation site after the restricted entry interval has expired and the tarpaulins have been cut.
S. Township Cap	One method for ensuring that the monthly offsite air concentration does not exceed 9 ppb. Ambient air concentrations will likely not exceed 9 ppb if the amount of methyl bromide active ingredient that can be applied in any township in any calendar month is limited to 270,000 lbs.

APPENDIX A
List of Resources for Methyl Bromide Information:

Department of Pesticide Regulation
http://www.cdpr.ca.gov/docs/dprdocs/methbrom/mb_main.htm

Cornell University
http://pmep.cce.cornell.edu/profiles/fumigant/methyl-bromide/index.html

Extension Toxicology Network (Extoxnet)
http://ace.orst.edu/info/extoxnet/pips/methylbr.htm

U.S. Department of Agriculture (USDA)
http://www.ars.usda.gov/is/mb/mebrweb.htm

University of Florida
http://edis.ifas.ufl.edu/NG001

U.S. Environmental Protection Agency
http://www.epa.gov/pesticides/factsheets/chemicals/methylbromide_factsheet.htm

APPENDIX B
List Of Suppliers (Ambient Air Testing Devices)

Colorimetric Detector Tubes

National Draeger
101 Technology Drive
Pittsburg, PA 15275
(412) 787-8383
www.draeger.com/english/

Sensidyne
16333 Bay Vista Drive
Clearwater, FL 34620
(800) 451-9444
www.sensidyne.com/

Matheson Tri-gas (Northern California)
6775 Central Avenue
Newark, CA 94560
(510) 793-2559
or
Matheson Tri-gas (Southern California)
8800 Utica Avenue
Cucamonga, CA 91730
(714) 987-4611
www.mathesongas.com/

MSA
P.O. Box 426
Pittsburg, PA 15230
(800) MSA-2222
www.msanet.com/

Fumiscopes

Key Chemical & Equipment Company
13195 49th Street No. Unit #A
Clearwater, FL 33762
(727) 572-1159
www.ozline.net/keychem/

APPENDIX C
Scientific Information On Methyl Bromide

1. Toxicology And Risk Assessment

The Department of Pesticide Regulation's (DPR) risk characterization for methyl bromide indicates toxic effects at doses lower than those previously documented. The nervous system and developing fetuses showed the most sensitivity to methyl bromide. In animal tests, the lowest no observed effect level was 40 ppm. Adjusting for differences in body weight and respiration rate, the equivalent concentration for humans is 21 ppm. DPR also adjusts for the uncertainty of extrapolating from animals to humans and for the variable sensitivity to methyl bromide between people. For methyl bromide, DPR applies a 100x uncertainty factor to the no observed effect level. The goal of the regulatory program is to limit the air concentration of methyl bromide that people may breathe to less than 0.21 ppm or 210 ppb.

The 210 ppb goal is a 24-hour time-weighted average. This means a person can be exposed to a higher concentration for a shorter period of time, and still not exceed the 210 ppb goal. For example, a 12-hour exposure to 420 ppb or an 8-hour exposure to 630 ppb is equivalent to 24-hour exposure to 210 ppb. This relationship is the basis for the work hour limitations and the differences between the outer and inner buffer zones.

Additional animal tests were used to determine the toxicity of subchronic or seasonal exposure (several weeks). Based on the subchronic tests, the goal of regulatory program is to limit the average air concentration of methyl bromide over several weeks to less than 9 ppb for children and 16 ppb for adults.

2. Methyl Bromide Physical And Chemical Properties

Methyl bromide (other names: bromomethane, monobromomethane, CAS 74-83-9) is a natural product, as well as manufactured synthetically. Methyl bromide is a gas at normal atmospheric pressure and temperature and a liquid under high pressure or at low temperature, with a vapor pressure of approximately 2000 torr at 25° C (100 times more volatile than water). It is colorless and odorless except at high concentrations. Methyl bromide will somewhat dissolve in water, with a solubility of approximately 13,000 ppm, or 1.3%.

While methyl bromide is "heavier than air," this has little effect on its behavior or movement in most cases. Methyl bromide does not settle, move downhill, or accumulate in holes because of its high density. This is because methyl bromide rarely achieves atmospheric concentrations where its density will influence its behavior. The difference in density between an atmosphere containing 10 ppm of methyl bromide and an atmosphere containing no methyl bromide is negligible. Unless the methyl bromide concentration is more than 1000 ppm, the density has negligible effect. However, higher methyl bromide air concentrations due to temperature differences are more common and pockets or areas of high concentrations can occur under certain weather conditions.

Methyl bromide depletes the ozone, which is why most uses will be phased out by 2005, under the federal Clean Air Act.

3. Monitoring Data

DPR and others conducted off-site and worker air monitoring for methyl bromide field fumigations. More than 40 fumigations have been monitored for off-site air concentrations under a wide variety of conditions, including 13 different methods, 13 different counties, and 11 different months. Several methyl bromide applications exceeded 210 ppb outside the field. Air concentrations are highly variable, with measured concentrations 30 feet from the field ranging from 0.042 – 1.1 ppm, plus 1.7 ppm detected 330 feet from the field for one application. The highest concentrations occur during the first two days following the start of fumigation.

Air concentrations vary with numerous factors such as distance from the field, wind speed, wind direction, application rate, field size and dimensions, and method of application. As expected, air concentrations are highest in the downwind direction, and decrease with distance from the field. Naturally, the higher the application rate or the larger the field size, the higher the air concentrations. Atmospheric stability also has a great influence on air concentrations. Atmospheric stability refers to the mixing of air and depends on convection currents, wind speed variability, and terrain. A stable atmosphere has little air mixing and can occur under different conditions such as night, during the winter, overcast skies, or constant low wind speeds. Stable atmospheric conditions are associated with higher air concentrations. Conversely, unstable atmospheric conditions have a lot of air mixing such as during daylight, summer, clear skies, and variable wind speeds. Unstable atmospheric conditions are associated with

lower air concentrations. The effect of differences in fumigation methods on air concentrations is less clear. Differences in injection depth, tarpaulins, and other factors influence air concentrations, but these effects are confounded by other differences. For example, it is unclear if differences between certain methods are due to differences in injection depth or chisel type.

4. Computer Modeling

The monitoring data provides a snapshot of air concentrations for specific fields, at specific locations, during specific times, and under specific weather conditions. It is difficult to extrapolate the monitoring data from one field to another field. DPR uses computer modeling to supplement the monitoring data and to estimate air concentrations for a wide variety of field conditions.

DPR uses the Industrial Source Complex-Short Term (ISCST) model to estimate methyl bromide air concentrations. This computer model estimates air concentrations based on the emission characteristics, weather, and terrain. The monitoring data documents the air concentrations, weather, and terrain for specific fields, but not the emission rate (how many pounds per day volatilizes from the field). DPR inputs the air concentrations, weather, and terrain data into the ISCST model to estimate the emission rate. To develop buffer zones, DPR expresses the emission rate as the fraction of methyl bromide volatilizing during the peak 24-hour period, the emission ratio. For example, an emission ratio of 0.25 means that 25% of the applied methyl bromide volatilizes during the peak 24-hour period.

DPR calculates buffer zones using the emission rates determined from the monitoring data, and a set of conservative weather assumptions. Comparison of the regulatory buffer zone distances to monitoring data indicates that the buffer zones provide adequate safety approximately 95% of the time. In other words the downwind air concentration at the buffer zone distance is less than 210 ppb for approximately 95% of the fumigations.

5. Buffer Zone Discussion

The buffer zone size is a fixed distance for any given application rate, number of acres, and application method. The fixed buffer zone sizes are used to set a standard for enforcement. The fixed buffer zone sizes do not imply fixed or constant air concentration. There is a general relationship between distance and concentration, with lower concentrations at farther distances. However, air concentrations at the buffer zone distance are variable. The buffer zone distance cannot be used as a surrogate for estimating air concentrations. For example, if the buffer zone distance is 200 feet, this does not mean that the air concentration is always 210 ppb at 200 feet. In fact, air concentrations should be less than 210 ppb almost all of the time at the buffer zone distance. Similarly, if someone is 190 feet away from the application, this does not mean that he/she will be exposed to a harmful amount of methyl bromide. The buffer zone is not an exclusion zone meant to prohibit entry throughout the buffer zone

duration. People may spend short periods of time inside the buffer zone and not exceed an exposure of 210 ppb, as a 24-hour average.

The buffer zone depends on two main factors, the emission rate and weather conditions. The emission rate was determined from 43 monitored fumigations. Most if not all of the monitored fumigations appeared to be high quality applications, with the tarpaulins remaining intact, few methyl bromide leaks, correct calibration, etc. Methods of application that are different from those monitored may have a higher or lower emission rate than anticipated.

DPR chose "conservative" weather conditions to determine the size of the buffer zones. These weather conditions may not be appropriate for all regions of California at all times. Monitoring was conducted in several areas during several seasons, so that most regional and seasonal differences should be accounted for. However, detailed evaluation of historical weather data may show regional or seasonal differences that would lead to higher or lower air concentrations than currently estimated. Height of inversion layers was not measured for any of the studies. The ISCST model indicates that an inversion of 100 feet or less will cause higher methyl bromide air concentrations.

Buffer zone distances are based on the highest downwind air concentrations. Air concentrations in the upwind direction are much lower than the downwind direction. However, since methyl bromide continues to volatilize for several days, it is problematic to establish different buffer zone distances in different directions. Once methyl bromide is applied, volatilization cannot be stopped. If the wind direction changes because of diurnal variation or other changes in weather conditions, the upwind direction during fumigation may be the downwind direction several hours or days after fumigation.

The data show that 210 ppb is not exceeded even with no buffer zone in some cases, using both monitoring data and computer modeling. While the data may support no buffer in some cases, a minimum buffer should be required because the model does not account for all factors that influence air concentrations. Under some circumstances, the unaccounted factors may cause higher air concentrations than estimated by the model.

6. Township Cap Discussion

The cap of 270,000 lbs per township per month is the regulatory measure designed to limit the seasonal exposure to no more than 9 ppb. This use limit is based on DPR's analysis of air monitoring data and pesticide use patterns. The following two fact sheets summarize the monitoring data, DPR's analysis, and the calculation of the township cap.

What were the methyl bromide air concentrations?

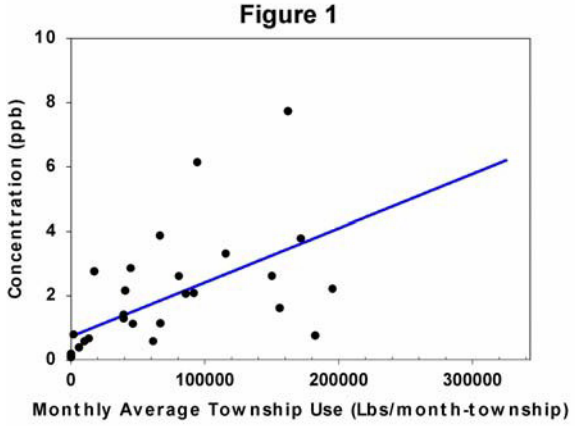
Average methyl bromide air concentrations measured for six to eight weeks during the peak season by the Air Resources Board (2000, 2001) and the Alliance for the Methyl Bromide Industry (2002)

Location	2000 Seasonal Average (ppb)	2001 Seasonal Average (ppb)	2002 Seasonal Average (ppb)
ARB-Air Monitoring Station, Bakersfield	0.19	0.12	Not sampled
ARV-Arvin High School, Arvin	Not sampled	0.075	Not sampled
CRS-Cotton Research Station, Shafter	2.16	2.54	Not sampled
MET-Mettler Fire Station, Mettler	0.084	0.065	Not sampled
MVS-Mountain View School, Lamont	0.092	0.081	Not sampled
SHA-Air Monitoring Station, Shafter	0.79	Not sampled	Not sampled
VSD-Vineland School Dist, Bakersfield	0.099	0.078	Not sampled
CHU-Chualar School, Chualar	0.64	0.56	Not sampled
LJE-La Joya Elem School, Salinas	3.79	2.82	Not sampled
MES-MacQuiddy Elem Sch, Watsonville	Not sampled	5.51	Not sampled
OAS-Oak Ave School, Greenfield	0.39	Not sampled	Not sampled
PMS-Pajaro Middle School, Watsonville	7.68	2.99	Not sampled
SES-Salsepuedes Elem Sch, Watsonville	2.60	1.22	Not sampled
SAL/MAQ-Air Monitoring Station, Salinas	1.29	1.38	1.12
WAT-Watsonville Park Offices, Watsonville	Not sampled	Not sampled	3.79
FRM-Farm Bureau Office, Watsonville	Not sampled	Not sampled	2.62
CPW-County Public Works Yard, Watsonville	Not sampled	Not sampled	2.06
BBC-BB Construction, Salinas	Not sampled	Not sampled	2.08
SHA-Sharps Automotive, Oxnard	Not sampled	Not sampled	0.58
ABD-Abandoned Building, Oxnard	Not sampled	Not sampled	0.76
UWC-United Water Cons. District #2, Camarillo	Not sampled	Not sampled	2.22
PVW-Pleasant Valley Water, Camarillo	Not sampled	Not sampled	1.62
Target concentrations			
Child	*9 or less*	*9 or less*	*9 or less*
Adult	*16 or less*	*16 or less*	*16 or less*

How was the township cap for methyl bromide determined?

The monitoring studies used to determine the township (a land surveying unit 6 by 6 miles) cap showed a wide range of concentrations. These concentrations were related to the amount of methyl bromide being used in the area of the monitoring location. Higher methyl bromide usage corresponded to higher air concentrations. This relationship between monthly air concentration and monthly use was analyzed statistically using regression analysis. The result is shown in Figure 1.

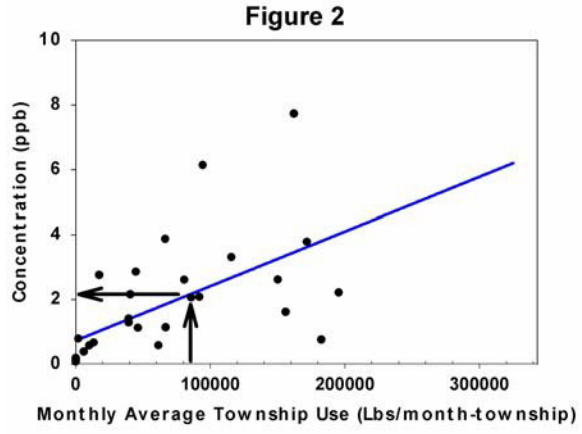
Figure 1



The solid, diagonal blue line in Figure 1 is the regression line and represents an estimate of average exposure at a given level of use for a month long period. For example, at a use rate of 85,700 lbs/month in a township, the average air concentration would be approximately 2 ppb. This value can be found be extending a straight line up from 85,700 lbs/month-township to intersect the regression line, and then to the left to the concentration axis. This operation is shown with arrows in Figure 2.

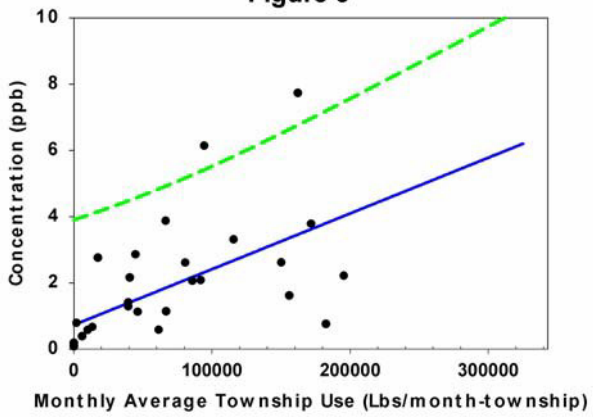
The regression line represents an average concentration. The graph shows measured points both *above* and *below* the average values of the regression line. In order to be health protective, DPR utilizes a point above the average value. This point is the 95th percentile. A 95th percentile target means that 95 percent of one-month concentrations would be below that concentration level. In addition, because the 95th percentile is a statistical estimate, a small uncertainty factor is added and the result is called a 90% confidence interval on the 95th percentile.

Figure 2



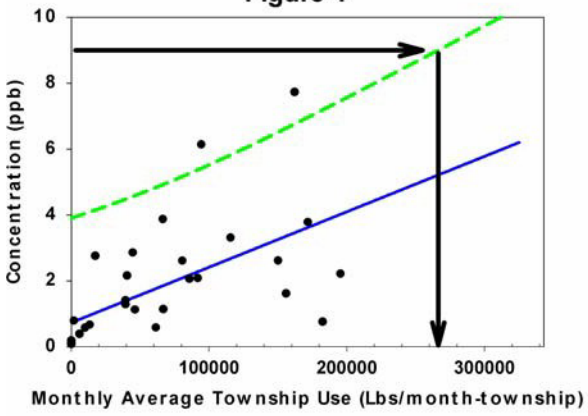
Since the concentration depends on the amount of use, the 90% confidence interval on the 95th percentile depends on the level of use. This dependency is shown in Figure 3 by the green, dashed line. Even with this upper limit, there are two measured points that exceed this level. The dashed line does not represent an absolute threshold, but allows for a small possibility that actual values will occasionally exceed the threshold.

Figure 3



DPR's target for month-long exposures is 9 ppb or less. The target concentration can be converted into an equivalent township cap level by utilizing the relationships in Figure 3. The method for doing this is to draw the target concentration level as a horizontal line, representing 9 ppb. Where this horizontal reference level line intersects the 90% confidence interval on the 95th percentile line will determine a level of use that would result in concentrations mostly below 9 ppb.

Figure 4



These operations are depicted by the arrows in Figure 4. The horizontal arrow near the top of Figure 4 shows the 9 ppb target concentration extending to the right towards the slightly curved confidence line. The second arrow extends vertically downwards to the horizontal axis: monthly average township use. The place where the horizontal 9 ppb line and the confidence line intersect corresponds to 270,000 lbs/month-township. At this level of use, we would have 90% confidence that 95 percent of the measured ambient air concentrations over a one-month period would not exceed 9 ppb.