



METHYL BROMIDE: FRAMEWORKS FOR VIEWING PESTICIDE RISKS

Introduction

This case study examines how the nation and California have dealt with methyl bromide, a pesticide and fumigant used on a variety of crops including strawberries and tomatoes. Methyl bromide is an interesting pesticide on which to focus because everyone concedes that it is highly toxic. There is little scientific disagreement about the *acute* toxicity effects of methyl bromide although, as discussed below, there is debate over whether methyl bromide can cause birth defects or cancer in humans and the concentration level at which methyl bromide becomes a health hazard. Because everyone admits that methyl bromide is acutely toxic, we can focus greater attention in this case on how our regulatory and legal system has dealt with the potential for injury. Even here, as you will see, we cannot totally escape the debate over what level and type of scientific proof, if any, should be necessary before we regulate a given chemical.

A principal theme in this case study of methyl bromide is the importance that context can play in the way that we and others see a particular environmental issue. In this case study, we will look at methyl bromide in four different contexts:

- The context of pesticide organizations trying to ban or regulate the use of methyl bromide in California based on scientific evidence that chronic exposure to the chemical can cause birth defects in animals

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- The context of an individual suffering acute injury as the result of inhaling methyl bromide
- The context of workers' effort to reduce exposure to methyl bromide
- The context of national and international environmental organizations concerned about the depletion of stratospheric ozone

In examining disputes over methyl bromide in these various contexts, ask yourself several questions. First, what becomes the center of focus in each of the various contexts? Second, agriculture argues that the risk from methyl bromide must be balanced against the costs to agriculture (and thus to the national economy) if methyl bromide is banned; to what degree do you find this argument sympathetic in each of the various contexts? Third, how does the political and institutional dynamic vary among the various contexts. Finally, what lessons do the four contexts teach an environmental justice advocate concerned about how to prevent or restrict the use of toxic or potentially toxic substances in agricultural operations.

Context is very important because it often influences the framework by which we shape and address a problem. When individuals come together around an issue, they, consciously or unconsciously, collect and assimilate the individual perspectives that they bring to with them. These various perspectives often suggest a course of action for the group as a whole to follow and to promote. The course of action that is chosen in turn effects the group's goals and the likelihood that it will achieve its goals.

Background on Methyl Bromide

The following are some general background information on the health effects of methyl bromide, the risk assessment and management of methyl bromide, and the strawberry industry which makes the greatest use of methyl bromide in California.

Uses of Methyl Bromide

Methyl Bromide is one of the world's most widely used pesticide which has been used since 1932. It is a broad spectrum pesticide used in the control of pest insects, nematodes (which are unsegmented worms of the phylum or class *Nematoda*), weeds, pathogens, and rodents. In the United States, about 28,000 tons (60 million pounds) of methyl bromide are used annually in agriculture, primarily for soil fumigation (87%). Strawberries (10.5% of the total U.S. use) and tomatoes (21.2%) are the crops which use the most methyl bromide. Other crops which use the pesticide as a soil fumigant include tobacco, peppers, grapes, and nut crops. Globally, about 76,000 tons of methyl bromide are used each year, with North American use the highest (41%), followed by Europe (26%), Asia (24%, including Israel and the Mid-East), with South American and Africa combined using the least (9%).

Methyl bromide is used not only as a soil fumigant, but for several other purposes. About

19 percent of the chemical is used to fumigate harvested agricultural commodities during storage—including those being exported from and imported into the United States—and to fumigate structures such as food processing plants, warehouses, mills, grain elevators, and residences. A small amount is also used in the production of other chemicals.

For many of California's major fruit and vegetable crop, methyl bromide is the product of choice. There were 18.7 million pounds of methyl bromide used in California in 1991. The most significant uses were the following: 24 percent to treat strawberry fields before planting; 18 percent for structural fumigations; 11 percent to treat greenhouse soil before planting of nursery stock; 10 percent to treat vineyards before planting and processing grapes after harvest; 8 percent for treatment of soil before planting of stone fruit; and for treatment of fruit after harvest; and 7 percent to treat carrot acreage before planting.

The vast majority of methyl bromide is manufactured by three companies: two located in Arkansas (Great Lakes Chemical and Ethyl/Albemarle) and one in Israel (Dead Sea Bromine). These companies utilize naturally occurring bromide salts which are concentrated in underground brine deposits (as is the case of Arkansas) or highly concentrated above ground sources like the Dead Sea.

Methyl bromide is a colorless gas or volatile liquid which is usually odorless, but has a sweet, chloroform-like odor at high concentrations. Since the chemical is a gas at ordinary temperatures, it is compressed and applied as a liquid. When used as a soil fumigant, methyl bromide is injected into the soil at a depth of 12 to 24 inches before a crop is planted. This will effectively sterilize the soil, killing the vast majority of soil organisms. Immediately after the methyl bromide is injected the soil is covered with plastic tarps, which hold the methyl bromide in the soil. The tarps are removed 24 to 72 hours later. In some cases, guards are posted around the fields for several days to ensure that the tarps stay on and people stay out as the gas percolates through the soil, killing weeds, plant viruses, insects, and rodents. The gas is often mixed with tear gas to warn people if it is leaking.

About 50 to 95 percent of the methyl bromide injected into the soil eventually enters the atmosphere. Methyl bromide runoff from fields into surface waters is rare due to the way the chemical is normally applied. If it contacts surface water, the average half-life for methyl bromide under field conditions has been calculated to be 6.6 hours at 11 degree Celsius. Methyl bromide quickly evaporates at temperatures ordinarily encountered in fumigation.

Health Effects of Methyl Bromide

Acute Toxicity

No one argues about whether methyl bromide is toxic; the arguments focus instead on whether methyl bromide can ever be used safely and on whether methyl bromide causes birth defects or cancer. In humans, methyl bromide is readily absorbed through the lungs. Most

problems occur as a result of inhalation. About 1,000 human poisoning incidents caused by methyl bromide exposure have been documented with effects ranging from skin and eye irritation to death. Most fatalities and injuries occurred when methyl bromide was used as a fumigant.

Inhalation of 1,600 ppm for 10-20 hours, or 7,900 ppm for 1.5 hours is lethal to humans. The lowest inhalation level found to cause toxicity in humans is 35 ppm in air.

Methyl bromide is a dangerous cumulative poison. First symptoms often are due to damage to the nervous system, and may be delayed from 48 hours to as long as several months after exposure. This delay, combined with methyl bromide's lack of odor, means that the victim may not realize that exposure is occurring until much time has passed.

Symptoms of poisoning vary widely. Soon after inhalation of large doses, symptoms may include headaches, dizziness, nausea, chest and abdominal pain, and a dry throat. Three to 12 hours after vapor inhalation, symptoms include slurred speech, blurred vision, temporary blindness, mental confusion, and sweating. More severe symptoms may include lung swelling; congestion; hemorrhaging of the brain, heart, and spleen; severe kidney damage; and numbness. Death may occur within 1-30 hours, usually from respiratory failure.

Although skin absorption is not an important route for methyl bromide intoxication, the skin is affected by contact with this chemical. Methyl bromide can cause enormous blisters that are rarely deep enough to destroy the entire skin layer. Small amounts of skin or eye contact bring on shortness of breath and itching. If absorbed through the skin, nausea and vomiting may result. Clothing that can not "breathe" may delay the evaporation of the pesticide from the skin. Continued contact with skin can cause death. Ingestion of methyl bromide may cause hand tremors, and convulsions.

Acute toxicity tests have been run on a variety of animals, including rats, mice, guinea pigs, and rabbits. Common animal responses to high doses often include lung irritation, fluid accumulation in the lungs, paralysis, and kidney, liver, and nervous system damage. In one of the more dramatic experiments, 16 beagles were exposed to methyl bromide for seven days. Although the experimenters expected to examine the effects on the dogs over the course of a year, the dogs lasted for only two days. The dogs suffered severe neurotoxicity that included delirium, thrashing, and self-destructive acts such as slamming their heads and bodies into cage walls. The beagles either died or were euthanized.

Chronic Toxicity

Chronic exposures to methyl bromide can cause dizziness, vision and hearing disturbances, depression, confusion, hallucinations, euphoria, personality changes, and irritability. If exposure is severe enough, lung irritation followed by lung swelling and bronchial pneumonia may occur.

There is growing evidence that methyl bromide exposure can cause birth defects in animals,

although no direct evidence that it has a similar affect on humans. As recently as 1992, the United States Department of Agriculture flatly stated that no reproductive problems involving methyl bromide had been observed in test animals. As the Department of Agriculture noted, inhalation of methyl bromide for 6-7 hours per day during gestation had been reported to cause no birth defects on rabbits and rats. However, more recent studies have shown statistically significant correlations between exposure to methyl bromide and birth defects and developmental harm in rabbits.

Turning to other chronic effects, the overall scientific evidence indicates that methyl bromide is a mutagen, but that its potential to cause genetic mutations is relatively low. Mutagenic effects were seen in a mouse cell test and two different tests on bacteria. In addition, fruit flies showed mutagenic effects as did human white blood cells. However, rat liver cells did not display mutagenicity after exposure to methyl bromide.

Methyl bromide is considered to be a potent cell growth stimulant and is thus a potential promoter of cancerous growth. In one study of industrial workers exposed to various brominated compounds, exposure to methyl bromide was suggested as the possible common factor in two fatal cases of testicular cancer. the mortality rate for this cancer was significantly higher than expected.

In another study, methyl bromide inducted tumors in the stomach of the rat. The chemical was given through the stomach in an oil solution for 90 days. In 13 of the 20 rates given high doses, malignant growths developed quickly and in high numbers near the site of application. Some tumor growth was observed in rats given much lower doses. No effects were seen in rats exposed to very low doses of methyl bromide for 90 days. Due to a very limited amount of information on the cancer causing effects on humans the EPA has determined that the compound is not classifiable.

Sources of Human Exposure

Humans are generally poisoned through direct inhalation of methyl bromide, often during or after its application to crops and to structures. Workers involved in the manufacture and use of the chemical run the greatest risk of toxic exposure. Although fields to which the gas is applied are usually covered with tarps to keep the methyl bromide in the soil and to limit emissions, subsequent removal of the tarps can lead to severe levels of toxic exposure. Studies have also shown that even with the tarps in place, harmful concentrations of methyl bromide may sometimes nevertheless drift several miles from the site of fumigation, thereby posing a threat to nearby residents and workers who may become exposed.

Exposure Standards for Methyl Bromide

In 1992, California's Department of Pesticide ("DPR") completed a risk assessment of methyl bromide and concluded that the existing standards did not provide for adequate margins

of safety. The following two DPR memoranda discuss the risks from the use of methyl bromide as both a structural fumigant and in agricultural operations and set forth new exposure standards.

In the two memoranda, DPR sets two new standards for air concentrations of methyl bromide: 60 ppb in the context of inhalation exposure in structural fumigation, and 210 ppb in the context of agricultural operations. Both standards assume only subchronic exposure to methyl bromide (i.e., exposure lasting over several days or weeks). DPR has not established standards based on chronic exposures lasting months or even years. Such a standard presumably would require even lower air concentrations of methyl bromide. Several other California agencies, acting under different environmental statutes, also have set their own, different standards:

- As explained below, methyl bromide is listed as a reproductive toxin under Proposition 65 when used as a structural fumigant. The Office of Environmental Health Hazard Assessment, which determines acceptable standards under Proposition 65, has set an exposure standard of 21 ppb. This standard was based on the same data that DPR used to set its 60 ppb standard for structural fumigation, but used a more stringent safety factor of 1,000 (as required under Proposition 65).
- California's Air Toxicology and Epidemiology Section, acting under California's Air Toxics "Hot Spots" program, has recommended that air concentrations of methyl bromide not exceed 1.3 ppb. This standard was based on animal studies in which rats exposed on a chronic basis to methyl bromide developed nasal cavity lesions.

There are also a number of federal standards. For example, the Agency for Toxic Substances and Diseases Registry established a minimum risk level (MRL) for methyl bromide of 50 ppb for acute exposure and 5 ppb for chronic exposure. An MRL is an estimate of daily human exposure to a hazardous substance that is likely not to produce an appreciable risk of adverse noncancer health effects over a specified duration of exposure.

The Strawberry Industry in California

Because the fight over methyl bromide in California and elsewhere has often focused on the strawberry industry, it is worth also taking a moment to give you a bit of background on strawberry growing in California. The following excerpt is drawn from an article in the November 1995 issue of the *Atlantic Monthly* by Eric Schlosser entitled *In the Strawberry Fields: Migrant Workers and the California Strawberry Industry*:

The rise of the strawberry industry is in many ways emblematic of changes that swept California agriculture during the 1980s. The strawberry has become the focus of a California industry whose annual sales exceed half a billion dollars. American farmers now receive more money for fresh strawberries each year than for any other fresh fruit grown in the United States except apples. And strawberry pickers are not only the poorest migrants but also the ones most likely to be illegal immigrants.

A strawberry field is not a beautiful sight. It lacks the charm and character

of a citrus grove, an apple orchard, or even a field of corn. Strawberries now begin and end in plastic. Before planting, an entire field is sealed with plastic sheeting and injected with methyl bromide. Then the sheeting is removed and workers install drip-irrigation hoses in the beds, cover the beds with new, clear plastic, and insert the plants through the plastic by hand. This plastic helps retain heat, keeps the soil moist, and prevents erosion. At the end of the harvest, workers rip the plants from the ground and throw them away, along with the plastic and the drip-irrigation hoses. Second-year plants tend to produce smaller berries.

In a good year strawberries can be one of the most profitable row crops in California. But they are also one of the riskiest. The fruit attracts a wide variety of pests, including aphids, eelworms, and red spider mites. Even more threatening is the weather. No matter how carefully a grower prepares the field, no matter how well-bred the plants, the size of the harvest will be determined in large part by the weather.

Framework #1: Organized Efforts to Ban or Regulate Methyl Bromide

Because of the toxic effects of methyl bromide, anti-pesticide and other environmental organizations have been trying to ban, or at least more closely regulate, the agricultural use of the chemical for some time. According to U.S. Environmental Protection Agency, alternatives to methyl bromide do exist:

Pest control tools exist today which manage many of the pests controlled by methyl bromide. An alternative to methyl bromide depends upon the specific target pest and crop. There is no one alternative for all of the uses of methyl bromide, but there are several pest control tools which can manage the pests currently controlled with methyl bromide. Viable alternative materials need not be identical to methyl bromide, but must effectively and economically manage those pests which are now being controlled by methyl bromide. Numerous chemical and non-chemical pesticides are available now which effectively control many of the pests for which methyl bromide is used. In addition, research on alternatives is underway and will likely result in a wide range of options, depending on the pest, crop, and current use of methyl bromide. While economic disparities may occur in the short-term, alternatives will likely be viable in the long-term.

The following alternatives to methyl bromide are often pest specific, and use can reduce economic pest levels when used as part of an overall integrated pest management program. While not all of the alternatives listed here are ready to be used by the agricultural industry, all have shown a good potential to control pests currently controlled by methyl bromide, and will likely be in place and available by or before year 2001.

! SOIL: Chemical alternatives include 1,3-dichloropropene, dazomet, chloropicrin,

and metam sodium, as well as selective contact insecticides and herbicides. Non-chemical alternatives include crop rotation, organic amendments, steam, solar heating, biological control agents, cultural practices, and plant breeding.

- ! **COMMODITY:** Chemical alternatives include phosphine and carbonyl sulfide. Non-chemical alternatives include irradiation, controlled atmospheres, utilizing nitrogen and carbon dioxide, & heat/cold.
- ! **STRUCTURAL:** Chemical alternatives include sulfuryl fluoride and phosphine, as well as contact insecticides and rodenticides. Non-chemical alternatives include controlled atmospheres utilizing nitrogen and carbon dioxide, & heat/cold.

Agriculture, nonetheless, has complained of the potential costs of taking methyl bromide off the market. The following excerpts from a 1995 report of Congress' General Accounting Office summarizes the agricultural concerns:

EPA, USDA [the U.S. Department of Agriculture], and industry representatives generally agree that chemical substitutes and other alternatives are available today to manage many of the pests currently controlled with methyl bromide. They further agree that no one substitute or alternative is available for methyl bromide's many uses and that research is needed to identify the alternatives or combinations of alternatives that can economically and effectively replace the pesticide's individual uses. USDA and the agricultural community, however, are less optimistic than EPA that economical and effective alternatives will be identified by the time the ban on methyl bromide goes into effect in 2001. EPA, USDA, and industry are sponsoring or conducting research on alternatives, but it is not clear at this point what this research will be able to achieve over the next 5 years.

USDA officials pointed out that numerous scientific, economic, and environmental variables have to be considered in evaluating potential replacements. Selecting a replacement can be further complicated because a use can be quite specific. For example, alternatives for preplant soil fumigation (a technique for killing pests in the soil before planting) will need to be selected on the basis of such factors as the crop grown, the pests present in the soil, the climate, and the geographical location. Government and industry researchers believe that considerable research and field testing are needed to define the alternatives' efficiency, applicability, and cost-effectiveness in given situations.

USDA, the Methyl Bromide Working Group—which represents methyl bromide producers and distributors—and the Crop Production Coalition believe that very few new chemical alternatives will be available when the ban on methyl bromide goes into effect. They said that substantial development costs, research

requiring multiple planting cycles, and federal/state regulatory reviews are involved in putting a new chemical on the market. They noted that moving a new pesticide from development to commercialization can take up to 10 years and cost a manufacturer from \$50 million to \$70 million. As part of this process, the manufacturer must develop the health and safety data that EPA requires to register a pesticide for use. According to EPA, to date, no new chemicals and only a few uses of existing chemicals have been submitted to EPA as potential alternatives to methyl bromide.

[USDA has identified six existing chemicals as potential alternatives to methyl bromide.] For each of the alternatives identified by USDA, EPA has found potentially serious environmental and/or health and safety concerns. According to USDA officials, regulatory actions by EPA to ban or limit the use of these or other pesticides because of health and environmental concerns could exacerbate the economic effects of the methyl bromide phaseout by eliminating potentially effective alternatives.

In 1993, EPA reviewed the costs and benefits of its regulatory action to phase out the production and importation of methyl bromide. This study included information on the costs and effectiveness of potential new alternatives by the year 2001 and on the costs and benefits of improving the use of existing alternatives. On the basis of this study, EPA estimated that the total costs of a phaseout of methyl bromide between 1994 and 2010 would be \$1.7 billion to \$2.3 billion. EPA's cost analysis examined the likely range of costs for the alternatives and coupled these assumptions with monte carlo analysis, presenting a set of costs (median, mean, minimum, and maximum) that could be expected with a methyl bromide phaseout in 2001. The \$1.7 billion figure represented the estimated median cost, and the \$2.3 billion figure represented the mean cost. The minimum and maximum costs were estimated at approximately \$7 million and roughly \$16 billion, respectively.

In 1993, USDA published a study of the effects on U.S. agriculture of banning methyl bromide, under the National Agricultural Pesticide Impact Assessment Program. The study showed that actions to ban or restrict methyl bromide's use in the United States would be costly because currently available alternative control practices are less effective or more expensive than using methyl bromide. The study estimated that the annual economic loss to producers and consumers from banning the agricultural uses of methyl bromide included in this study would be about \$1.3 billion to \$1.5 billion. Of this amount, \$800 million to \$900 million would be attributed to the loss of methyl bromide for soil fumigation and \$450 million to its loss for the fumigation of quarantine imports. An additional economic loss of about \$200 million would occur if Vorlex -- the alternative identified as having the most potential for succeeding methyl bromide -- were no

longer available. (The manufacturer had indicated to EPA that it planned to stop producing Vorlex because of high reregistration costs.)

Environmental organizations disagreed and claimed that USDA vastly overstated the essentialness of methyl bromide. According to Pesticide Action Network North America Regional Center (PANNA), USDA's own data indicated that a methyl bromide ban would adversely affect only a few crops in specific areas, including strawberries in California, and strawberries, eggplants, cucumbers and peppers in Florida. Even under a ban, only one crop grown in California will experience yield losses more than 10% while in Florida, several methyl bromide dependent crops may experience serious impact. PANNA also argued that the USDA study ignored the existence of many nonchemical alternatives to methyl bromide which were already used by both organic and conventional growers including soil pasteurization, crop rotation, biological control and improved water management.

In 1995, the California Department of Food and Agriculture (CDFA) concluded that California would be placed at an economic disadvantage if it were to lose the use of methyl bromide in 1996.

- ! The potential short-term loss between \$287.7 and \$346.3 million in revenue losses to the state economy.
- ! The potential loss of 8,220 to 9,894 full-time jobs in the state.
- ! The potential loss of \$241 million in trade volume to certain California export markets because certain countries will not accept California products without methyl bromide treatment.
- ! The loss of revenues and jobs at California ports, which would lose the ability to treat imported and exported commodities. In 1994/95 alone, California ports treated 260 million pounds of import and export commodities with methyl bromide.
- ! The loss of crop production for commodities that provide the majority of U.S. production and contribute a great deal to the state economy. California currently produces 94% of U.S. apricots, 100% of almonds, 78% of lettuce, 93% of nectarines, 80% of lemons, 80% of strawberries and 90% of grapes. All these products rely on methyl bromide to protect them from pests and disease.
- ! The reduction of yields for California's nursery industry by as much as 40 to 60 percent. Currently, California leads the nation in nursery production and provides more than 25,000 full-time production workers each year.

The study also indicated that the loss of methyl bromide would also place California's

agricultural exports in jeopardy. Many countries, for example, require that commodities be treated with methyl bromide prior to shipment to their countries. According to the study, this would threaten important markets such as Japan, Korea, Mexico, Egypt, Pakistan and Peru.

However, the report states that methyl bromide doesn't just impact agriculture. A number of other industries rely on the product to destroy dangerous pests and disease. Certain countries require items such as blue jeans, computers and heavy equipment, which are packed using wood containers or pallets, be treated with methyl bromide before shipment. As well, methyl bromide is used to eliminate termites and other pests in structural properties.

Efforts in California to ban or limit the use of methyl bromide for health reasons have focused on three areas of state law: (1) Proposition 65, which regulates the use of chemicals known to cause cancer or reproductive toxicity, (2) laws and regulations designed to protect against toxic "hot spots," and (3) the California Birth Defects Prevention Act.

Proposition 65

Proposition 65 prohibits commercial businesses from exposing people to carcinogens or teratogens without warning them first or from using such chemicals in a way that is likely to endanger drinking water. Prior to 1991, methyl bromide was not listed under Proposition 65 because there was no evidence showing that it was a carcinogen or teratogen. In January 1991, however, California officials received a study indicating that methyl bromide caused birth defects in animals, including absence of gall bladders, fused sternbrae (spine), and decrease fetal weight. Officials completed an initial review of the study in May 1991, and decided that more data was needed. Additional data was submitted in December 1991 and, after further review, California officials accepted the study in January 1992. A preliminary risk assessment was completed in February 1992, and in April 1992 the state proposed adding methyl bromide to its Proposition 65 list.

Methyl bromide was officially added to the Proposition 65 list on January 1, 1993 as a reproductive toxicant. The chemical was listed, however, based only on its use for structural pest control.¹ Governor Wilson determined that the warning provisions would only apply to structural uses because this was the only context where levels of exposure were deemed high enough to carry a risk of birth defects. Wilson's determination were challenged unsuccessfully by organizations working to ban methyl bromide. When methyl bromide is applied to a home for structural fumigation, therefore, California regulations require that all occupants in the adjacent homes be notified and in some cases evacuated for several days. However, when methyl bromide is applied in fields adjacent to homes, schools, or businesses, no notification is required by the

Fumigation of residences also has been the greatest source of deaths in California from methyl bromide. Fifteen deaths were reported in California between 1982 and 1990 resulting from residential methyl bromide fumigation. Most of the deaths occurred when people have illegally entered dwellings before all the poisonous gas had dissipated.

state.

Although California chose not to list methyl bromide for these other uses, the state took several actions on this front. California, for example, initiated monitoring studies to determine if exposure mitigation measures are necessary to provide a greater margin of safety for agricultural workers who apply methyl bromide.

Protection Against Hot Spots

The California Air Toxic Hot Spot Information and Assessment Act, adopted in 1987, regulates the amount of methyl bromide that can be emitted from fumigation facility stacks. The law has required substantial reductions in methyl bromide emissions with an aim to better protect residents who may live or work within up to two miles from such fumigation facilities. The law has been criticized for not imposing similar requirements on agricultural uses of methyl bromide.

In 1993, the California Department of Pesticide Regulation, recognizing the hazards of agricultural methyl bromide applications, proposed warning zones around fields where methyl bromide is applied which would extend as far as four miles, depending on a combination of the following factors: the amount of methyl bromide applied per acre, the ratio of chloropicrin to methyl bromide, the depth of injection, the thickness of the covering tarp, and the total acreage to be treated. Taking into account all of the variables above, standardized charts were to be consulted to establish the size of the buffer zone.

Nothing has yet come of the proposal. Presently there is a 30 foot minimum that must be established around any agricultural application of methyl bromide. Many have argued that this falls far short of affording proper protection from toxin drifts. For example, under the current system used by California Department of Pesticide Regulation, buffer zones are calculated from the field edge to the edge of *occupied* structures on the affected property. Methyl bromide activists argue that this is a poor method and provides little of the intended protection. Teachers in particular point out that the method is wholly inadequate as it applies to schools. At Amesti Elementary School in Watsonville, the strawberry fields practically abut the playgrounds, with only ten feet at most between the school fences and the field. Playgrounds, although places where school children can often be found during the day, are not legally considered “occupied structures” and therefore are not taken into account when buffer zones are established.

California Birth Defects Prevention Act (SB950)

In 1984, the California state legislature passed the California Birth Defects Prevention Act (SB950), requiring that every pesticide registered for use in the state be subjected to a series of toxicity health effects tests, to be completed by 1991. The statute was adopted in response to findings by the National Research Council, indicating that relatively few toxic chemicals in widespread use in the early 1980's had sufficient toxicity data to conduct assessments of potential health risks. The adoption of SB950 meant that, in order for a pesticide to remain in use, tests

would to have show conclusively that the all animal study requirements promulgated by the U.S. EPA under FIFRA for cancer, reproductive harm, chromosomal damage, and birth defects had been met. In theory, SB950 simply converted an existing U.S. EPA requirement for pesticide use into a state requirement. SB950 was significantly more powerful than its federal counterparts in U.S. EPA regulations in one way: its imposition of stricter deadlines on submission test results and mandate for removal of the chemical from use if the deadlines were not met.

The apparent strength of this additional requirement, however, soon proved illusory. In 1987, manufacturers of close to one hundred common pesticides, including methyl bromide, reported that they could not and would not meet the 1991 deadline. As a result, the California legislature amended the law in 1991, giving manufacturers until March 30, 1996, a date they themselves had submitted, to complete the studies. The legislature set March 1996 as a “drop dead” deadline, after which time those pesticides with missing health data would be suspended for use in the state.

In late 1995, with the March 1996 deadline rapidly approaching, methyl bromide producers and users appealed to California Governor Pete Wilson for a further extension of the deadline. According to the director of the State Department of Pesticide Regulation, the extension was justified in part because state and federal agencies had squabbled over the technicalities of what studies should be required of the pesticide manufacturers until January 1995. Environmental organizations disagreed. According to the Pesticide Action Network, for example, the issue was simple: “They failed to provide data twice. It wasn’t that complicated data to provide.”

Governor Wilson responded to agriculture’s appeal by calling for a Special Session of the state legislature for the express purpose of extending the use of methyl bromide in California. In calling for the Special Session, Wilson said that forbidding use of the chemical would

devastate California’s agricultural industry and threaten thousand of jobs. California is now at a critical juncture. If we are to remain a competitive economic force, ... we must act now to prevent the suspended use of methyl bromide.

Governor Wilson also argued that the request for an extension was legitimate because the health studies had been delayed by “legitimate scientific debate” among state and federal regulators over how health studies and research should be performed.

Environmental groups strongly disagreed. The following testimony by Dr. William Pease, a toxicologist with the Environmental Defense Fund, is typical of the views of the environmental groups opposed to continued use of methyl bromide:

Granting a last minute exemption will overturn the data generation incentives created by SB 950 and replace them with a new message: toxic chemical manufacturers will be rewarded for failing to provide the data needed to protect public health. Undercutting SB 950's incentives will have consequences that

extend far beyond ... methyl bromide At issue is whether the legislature will repudiate one of the state's most innovative statutes and return to an approach that encourages chemical manufacturers to treat Californians like guinea pigs, exposing them to inadequately tested toxic chemicals.

[After noting the current air and exposure standards that have been set for methyl bromide, Dr. Pease continues on to note that new] data indicates that registrants [i.e., the manufacturers of methyl bromide] have found neurotoxic effects in two different animal studies at levels lower than used to date for regulatory standard setting. A subchronic inhalation study in rats detected peripheral nerve generation and reduced brain weight at the lowest dose tested. A short term inhalation study in dogs detected neurobiological effects and decreased spleen weights at the lowest dose tested. Both studies have major deficiencies and were unable to determine a methyl bromide exposure level without adverse effects. Study authors noted that the "cumulative effect for methyl bromide induced neurotoxicity" makes it particularly difficult to determine exposure levels without adverse effects. It is clear that further data are required to characterize a safe level of exposure to methyl bromide that protects against its neurotoxicity.

The existence of data gaps in this critical area is disturbing, and reflects a history of compromise with methyl bromide registrants by state regulators at DPR that has undermined implementation of SB 950.

- DPR has apparently decided to waive the SB 950 requirement to conduct a chronic dog study and will not pursue obtaining the data on chronic exposure needed to protect public health. No scientific rationale has been provided to justify this decision, which appears to have been made by agency administrators against the advice of toxicologists responsible for evaluating the health risks of methyl bromide.
- The toxicology data record for methyl bromide presents a long history of registrants submitting inadequate studies, which require years of effort by DPR toxicologists to make acceptable. The record is replete with DPR findings of "major deficiencies" in virtually every submitted study. Registrants have not made a good faith effort to conduct toxicity tests expeditiously: in 1991, there were five outstanding data gaps on methyl bromide; five years later there are still 3 tests missing.
- Methyl bromide registrants have consistently benefited from providing poor quality data in response to SB 950, delaying the development of more stringent exposure limits and risk mitigation measures, as well as undermining the adequacy of the database for evaluating whether methyl bromide is a reproductive toxicant in

humans. For example, when methyl bromide was being considered for listing as a reproductive toxicant under Proposition 65, registrants emphasized the design flaws in their own rabbit teratology study to persuade the Developmental and Reproductive Toxicity Scientific Advisory Panel that the data were not sufficient to support listing.

In February, 1996, the California Senate approved a bill sponsored by Senator Henry Mello, D-Watsonville. The bill sought to overturn the scheduled state ban on methyl bromide and to extend the testing period for the pesticide through to December 1997. In early March, the California Assembly provided their support for the extension, and on March 12, Governor Wilson signed the bill into law. At the time, Wilson remarked that there was “an urgent and grave need to act on this matter.” He argued that “the restriction was fundamentally unfair” and that “the issue is one of common sense and fairness. We simply cannot afford to put California’s trade and agricultural economics at a disadvantage.”

At the same time as they endorsed the Mello bill, both houses of the state legislature rejected a set of amendments to the bill proposed by Senator Nicholas Petris, D-Oakland. The amendments would have required a phasing out the use of methyl bromide in California by January 1, 2001; prior written notice to people living and working in areas where the pesticide is applied; and the establishment of half-mile buffer zones between treated fields and schools.

To many opponents of pesticide use, SB950—even before it was amended—was too liberal toward the agriculture industry. Once tests have been completed, for example, SB950 requires that the director cancel the registration of any pesticide active ingredient that “presents significant adverse health effects, including reproduction, birth defects, or infertility anomalies.” It is up to the director’s discretion to determine what are “significant adverse health effects” and whether or not its registration ought to be removed.

According to SB950, chemical manufacturers themselves must conduct the toxicity tests. At first blush, holding the manufacturers responsible may appear to be a strength, not a weakness. Certainly, it can be argued that because the manufacturers are the ones developing such potentially harmful pesticides as methyl bromide, they ought to bear the burden of performing the appropriate tests. However, a company with a vested interest in manufacturing and distributing a potentially unsafe chemical might have a far more difficult time being objective in its testing than would an impartial third party. Were the bill designed to take this potential conflict of interest into account, it might require of pesticide manufacturers that they pay for any chemical testing, but that the testing itself be performed by another organization altogether. Additionally, such a requirement could safeguard the government from having to deal with the problems faced in 1991 and again this year when certain pesticide tests had not yet been completed in accordance with the bill deadlines.

Framework #2: The Revilla Drive Complaint

The following are excerpts from a report written and filed by an Agricultural Inspector/Biologist after responding to a complaint from residents of Revilla Drive in Monterey County concerning leakage of methyl bromide from a neighboring strawberry field. The report explains the facts and concludes with a listing of apparent violations of state law and the Agricultural Inspector's recommended enforcement action.

The above incident is not unique. In 1987, 140 people were evacuated from a California labor camp and 71 fell ill after children tore holes in a tarp covering a fumigated field. Complaints about methyl bromide drift do not occur only when there have been violations of state law or where tarps have been accidentally torn. In 1992, an off site drift of methyl bromide from a strawberry field in Oxnard, California made six people ill.

Complaints of methyl bromide drift from the Revilla Drive residents did not stop after the above incident resulting from a torn tarp. Neighbors continue to claim that they suffer from overexposure to methyl bromide during fumigation. To try to get action out of the local Agricultural Commissioner and the State Department of Pesticide Regulations, the residents have organized a local anti-pesticide group, Farm Without Harm, and obtained the help of the Environmental Working Group, a national Washington, D.C.-based environmental group. When the local agricultural commissioner decided to allow additional fumigation of local strawberry fields owned by Martin Rubio in July 1997, the local residents appealed the decision to the DPR. DPR refused to reverse the local agricultural commissioner, but imposed a number of additional restrictions on Rubio's fumigation:

- A 200-foot buffer zone for residents, rather than the 30-foot zone mandated by state law.
- A reduction in the amount of methyl bromide that Rubio can use (from 350 to 300 pounds per acre).
- A reduction in the land that can be fumigated at one time. Fumigations must take place in 10-acre blocks (while before Rubio could have fumigated in 50-acre blocks).
- A requirement that fumigations end by noon each day.

DPR also sent staff to Castroville to monitor the air during the fumigation and agreed to let the Environmental Working Group conduct its own air monitoring. The following excerpts from an August 18, 1997 article in the *San Francisco Chronicle* summarizes what happened next.

An environmental group that tested the air near a Castroville strawberry field says dangerous amounts of the pesticide methyl bromide were spread by wind into nearby back yards—even though the chemical was applied in accordance with state law.

Bill Walker, spokesman for the Washington, D.C.-based Environmental

Working Group, said the tests show that even California's strict usage rules for methyl bromide gas are not sufficient to protect people in rural areas. "These results confirm that even under the best possible circumstances, you cannot reliably predict how methyl bromide is going to behave," Walker said. "The (state rules) intended to protect people amount to playing Russian roulette with wind conditions, heat and humidity."

Walker's test results apparently contradict test results obtained by the California Department of Pesticide Regulation, which also monitored the July 28 and August 1 field fumigations near Revilla Drive. Paul Gosselin, assistant director of the Department of Pesticide Regulation, said his agency is studying the environmentalists' results. But he defended the state's testing, and noted that only a handful of the results differ significantly.

"The vast majority of our test results matched up closely," Gosselin said. "They are drawing these conclusions from very preliminary data."

State testers took air samples around the two 10-acre test plots using dozens of charcoal-filled canisters. During the first fumigation, only one canister detected levels of methyl bromide higher than the allowable 24-hour average of 210 parts per billion, and that result was discarded because the device was located only 25 feet from the edge of the field, instead of the required 30 feet. Eight of the state's canisters registered no pesticide residues.

But the Environmental Working Group, using what they say are more sophisticated silicon-lined canisters, said they detected 24-hour average levels of methyl bromide as high as 350 parts per billion outside the mandatory 30-foot buffer zone—67 percent higher than the allowable levels.

The most surprising result was a 24-hour average measurement of 245 parts per billion in a back yard on Revilla Drive, more than 200 feet from the edge of the field. Levels of the fumigant spiked as high as 490 parts per billion in the same back yard, Walker said, apparently pushed there by the area's swirling winds.

Gosselin said the high measurement might as easily be a mistake, and that even 490 parts per billion is not enough methyl bromide to harm a human. "The 210 parts per billion is not a bright-line standard," Gosselin said. "We have built in a 100-fold safety standard. There is a more than adequate margin of safety."

Kert Davies, spokesman for the Environmental Working Group, said that Gosselin's reassurances mean little to people living on Revilla Drive, who have suffered symptoms such as nausea and bleeding noses and bowels after accidental exposure to the pesticide. "First they say that a level of 210 is unacceptable, and

then they say, well, it's really OK to breathe 100 times that much," Davies said. "We know this stuff can hurt you, and there are people out there who are getting sick."

The Environmental Working Group has argued that the charcoal-filled testers used by the state are not accurate enough, and cited the Castroville tests to urge the Department of Pesticide Regulation to update its technology. The group, which advocates banning methyl bromide, also urged state regulators to stiffen existing regulations on methyl bromide use.

Gosselin said his agency is exploring whether to begin using different testing equipment, and is reviewing numerous studies to determine whether more restrictions—or even a ban—should be imposed on methyl bromide. But the agency's decisions will be based on science and provable studies that can be duplicated, he said, not one-time events like the testing in Castroville. "Farmers have come to expect that as science produces data indicating that a pesticide should be restricted or taken away, that is going to occur," Gosselin said. "But these decisions must be based on sound science."

Walker said his group's tests fit the definition of sound science, and the results must be taken seriously. "This elaborately controlled experiment still resulted" in pesticide drifting far from the treated field, Walker said. "The computer models generated in the Department of Pesticide Regulation's offices don't hold true in the real world."

On the following several pages you will find (1) DPR's summary of its monitoring, concluding that the buffer zone established by DPR provided an adequate margin of safety, and (2) the report of the Environmental Working Group summarizing its monitoring results and critiquing DPR's monitoring.

Farm Without Harm has recently begun to turn its attention to potential health problems at local schools, as described in the following excerpts from an October 1997 article from the *San Francisco Chronicle*.

Just three weeks ago, 260 of the 650 students at Amesti Elementary School in Watsonville stayed home after farmer Will Garrouette fumigated a portion of a 40-acre strawberry field adjacent to the school. The two-day sickout cost the Pajaro Valley Unified School District about \$10,000 in state attendance revenue and brought a blistering response from district officials.

"No matter what side of the pesticide issue you're on, you don't use kids to fight your political battles for you," said Terry McHenry, associate superintendent for the district. "You don't scare kids from a farming community

and make them afraid of farming. They've been farming near that school for 50 years with no problems. We have been assured this (fumigation) is safe.”

But teachers and parents at Amesti say their sickout was a last-resort measure, taken only after appeals to stop the fumigation were dismissed. Garrouette fumigated another portion of the field on Saturday, and some parents say they will keep their children home today and tomorrow for safety's sake.

“I don't belong to any (political) group, I'm just a parent concerned about my children's health,” said Jim Scott-Behrends, who has three children at Amesti. “We're asking the state regulators to ban all fumigations near the school.”

The conflict in Watsonville has grown more divisive since the September 25 sickout at Amesti, pitting teachers against school officials and concerned parents against the area's powerful farming community. Farmworkers picketed a local meeting with state pesticide regulators, accusing parents of scare tactics. Teachers have accused school officials of ignoring complaints about pesticides drifting into playgrounds and classrooms.

Parents say they will continue to keep their children home periodically rather than risk pesticide exposure, and school officials say increased absences could financially ruin the district. In the Pajaro Valley, most of the schools are bordered by farms. “This is a growing season, and farmers are fumigating all over the valley,” McHenry said. “We can't afford to have this disrupt the educational process. Kids belong in school.”

Conflicts over agricultural pesticides have increased in recent years as a boom in farming has collided with population growth in many California farm communities. Public skepticism about pesticide safety has been compounded by alarming increases in rates of childhood cancers and asthma—which many experts now link to the thousands of man-made chemicals in the environment.

Pesticide regulators say the chemicals are safe, if applied properly, and blame much of the protest on people who are not accustomed to living in a farming area. “People are moving in who haven't lived in a rural area before, and they call about any strange odor,” said Rick Bergman, deputy agricultural commissioner for Santa Cruz County. “The truth is that we have a 100-fold safety margin on most pesticides—that is, one-hundredth of the amount that would cause no observable effect (in a laboratory study).”

But teacher Marilyn Garrett, a 16-year district veteran, has little faith in such official assurances. Garrett was one of a group of lactating mothers who filed a lawsuit against the Food and Drug Administration in 1969 after tests found DDT

in their breast milk. “That's what they told us about DDT, that it's totally safe,” Garrett said. “They used to drive trucks down the beach and just spray DDT on people. Then years later, we find it causes cancer—and it's everywhere.”

Garrett, a bilingual third-grade teacher, co-founded the environmental group Farm Without Harm as a response to concerns about pesticide proliferation. “Nobody should have to worry about living next to a farm,” Garrett said. “Nobody should be spraying poisons near children. And it's a disgrace that the (school) district is more concerned about their daily attendance money than the health of the children.”

Framework #3: Methyl Bromide in the Workplace

There are about 20,000 strawberry workers in California. Most are Hispanic, live in poverty, and receive an annual wage of about \$8500 a year. Farm workers call strawberries *las frutas del diablo*, the fruit of the devil. Bending in jackknife position for hours to gather fragile berries causes back injuries—and picking the fruit exposes them to pesticides.

Workers involved in the manufacture and use of methyl bromide run the greatest risk of toxic exposure and resulting injury. Farm workers who follow fumigation tractors to help spread tarps over treated soil are exposed to dangerously high levels of methyl bromide. As a result, California has drastically reduced the number of hours an individual can work in methyl bromide fumigations. Anecdotal reports from California strawberry and Florida tomato workers describe permanently dimmed eyesight and loss of feelings in fingers, which farm workers blame on work in methyl bromide fields. During 1986, seven workers in the Diamond Walnut processing plant in Stockton, California were sent to the hospital as a result of methyl bromide fumigation. Other workers complained of severe headaches and cracked and bleeding lips following fumigation. Between 1982 and 1993, California physicians reported 454 cases of methyl bromide poisoning (282 from agricultural applications and 172 due to structural fumigations). 18 people died in California from excessive exposure to methyl bromide during the same period (all as a result of fumigation operations). Methyl bromide ranked eighth out of all pesticides in the number of acute illnesses caused by the pesticide.

These statistics, moreover, almost certainly understate the actual extent of injury from methyl bromide exposure. Records of farmworker injuries are incomplete and inaccurate. Many times, workers, their employers, and health professionals do not recognize the signs and symptoms of overexposure to methyl bromide. Symptoms, illnesses, and diseases caused by chronic exposure to methyl bromide are especially difficult to diagnose. Even state officials acknowledge that reported pesticide injuries represent just a portion of actual cases.

Farm worker and other worker organizations have worked to ban, regulate and limit the use of methyl bromide. In 1991, workers at the Diamond Walnut plant in Stockton, California went on strike. As part of their platform, they protested the use of methyl bromide in the

fumigation areas and the arbitrary exposure to which the workers, who themselves were often undertrained and ill-equipped, were subject to. For years, the United Farm Workers (UFW) has demanded a ban on the use of methyl bromide. In 1995, the UFW helped kill a bill for the extension of the use of methyl bromide beyond the 1996 deadline. However, in 1996, the UFW was not able to prevent the adoption of the extension previously described.

Framework # 4: Methyl Bromide as an Ozone Depleter

Once it is used, methyl bromide drifts into the upper atmosphere where it destroys the earth's protective stratospheric ozone layer. Damage to the ozone layer causes hundreds of thousands of cases of cataract induced blindness and non-melanoma skin cancer each year as well as immune suppression and disruption of global ecosystems.² Probably the most serious consequence of excessive UV-B exposure is direct suppression of the human immune system, which reduces the ability to combat infection. Immunosuppression can in turn increase the number of severity of bacterial and viral diseases—such as chicken pox, measles, and herpes—as well as cancer and other health problems. Excessive UV-B exposure may also activate the HIV virus, hastening the onset of full-blown AIDS. Although it does not yet have the notoriety that chlorofluorocarbons (CFC's) or halons have as a significant ozone depleter, scientists believe that methyl bromide is a significant contributor to ozone depletion. Although some complex atmospheric processes are not fully understood, scientists have concluded from laboratory measurements that bromine, a major component of methyl bromide, is very efficient in destroying ozone. Some scientists have estimated that methyl bromide use is responsible for at least 10% of present ozone depletion and that this share could climb to as much as 15% by the year 2000 if we continue to use the chemical at present levels.

² In 1995, the Center for Disease Control (CDC) reported that skin cancer is the most rapidly increasing cancer in the United States. CDC concluded that death rates from melanoma -- the most deadly form of skin cancer -- rose 34 percent from 1973 to 1992, making melanoma the fastest growing killer among cancers in men (particularly over the age of 50). Over 31,000 Americans died from melanoma from 1988 to 1992, including 2,210 people in Florida and 3,700 in California. The CDC estimates that 7,200 people will die nationwide from malignant melanoma in 1995. Another study conducted by Boston University researchers found that the rate of melanoma increased more than 300 percent from 1950 to 1989.

As ozone depletion continues, these numbers are expected to rise. Scientists predict a sustained 1 percent decrease in stratospheric ozone will lead to a 2 percent increase in the incidence of non-melanoma skin cancer.

Since the cornea and the conjunctiva (the outer surface and lining) of the eye are approximately six times more sensitive to UV-B radiation than skin, ozone loss can also have chronic effects on human and animal eyes, including cataracts. Currently more than 20 percent of all cataracts are caused by exposure to UV radiation. Scientists estimate that for every 1 percent decrease in the ozone layer, 100,000 to 150,000 additional cases of cataract-induced blindness will occur worldwide.

In defense of the pesticide, some have correctly pointed out that methyl bromide is a naturally occurring chemical that is released not only through human activity, but through natural sources, such as oceans, as well. It has, however, been estimated that approximately 60-70% of the bromines from methyl bromide reaching the stratosphere are the result of deliberate human use. Moreover, although scientists have long believed that the remaining 30-40% comes from oceans and other natural emissions, recent research from the National Oceanic and Atmospheric Administration (NOAA) suggests that oceans absorb more methyl bromide than they release, thereby placing even more responsibility than was once thought on human methyl bromide use.

Much of what makes methyl bromide so dangerous an ozone depleter are its own destructive capacities. This is demonstrated by a 1995 United Nations Environment Programme (UNEP) report, compiled by 226 of the world's leading atmospheric scientists, which concludes that even though methyl bromide remains in the stratosphere for less than two years compared to CFCs, which have a lifespan of several decades, the bromine from methyl bromide is 50 times more destructive, atom per atom, to the stratospheric ozone layer than chlorine from chlorofluorocarbons. As a result, the World Meteorological Organization has concluded that a halt in methyl bromide emissions will have a rapid impact on the extent of stratospheric ozone loss.

Due to a growing concern about the ozone layer's depletion, human use of methyl bromide has been addressed in both national and international arenas. On the international front, the 124 signatory nations to the Montreal Protocol, the major international forum on ozone-depleting substances, officially recognized methyl bromide as an ozone depleting chemical in 1992. In November of that same year, the Montreal Protocol treaty was amended to require developed country parties to freeze by 1995 the production of methyl bromide at 1991 levels. Industrial countries also agreed to stop all use of methyl bromide by the year 2010.

In 1990, Congress amended the Clean Air Act to require EPA to identify ozone-depleting substances and phase out their production. In December 1993, EPA issued regulations under the Clean Air Act that (1) freeze the production and importation of methyl bromide at 1991 levels until January 1, 2001, and (2) ban the production or importation into the United States for domestic use after that date. EPA chose a relative long, 7-year phase out period in part to help facilitate the smoothest possible transition, economically and agriculturally, to alternative pesticide use.

In November 1995, however, President Clinton announced to a group of agricultural growers in California's Central Valley that he would support delaying the federal phaseout plan if no alternatives existed and international competitors were still using methyl bromide. As newspapers at the time observed, California and Florida were shaping up to be key states for the President's re-election in 1996.

In January 1996, EPA officially announced that it would support legislative changes to the Clean Air Act to permit continued production of methyl bromide after 2001. EPA noted that parties to the Montreal Protocol had recently agreed to a 2010 deadline. If the United States set

a faster deadline, according to the Department of Agriculture, United States farmers would be “at a significant competitive disadvantage in international agriculture and trade when the U.S. phase out takes effect in 2001.”

Faced with considerable opposition from environmental groups, the proposed amendment to the Clean Air Act went nowhere during 1996. In 1997, international negotiations again moved the issue to front stage. The signatory nations to the Montreal Protocol met and decided to strengthen its measures against methyl bromide. Industrial countries agreed to move up their deadline for phasing out all use of methyl bromide to 2005 (with interim reductions of 25 percent by 1999, 50 percent by 2001, and 70 percent by 2003, based on 1991 consumption levels). The developing world, which previously had no-phaseout plans, agreed to cut its consumption of methyl bromide 20 percent by 2005 and then phase out remaining use by 2015.

Faced by complaints from U.S. farmers that they should not have to phase out their use of methyl bromide faster than the rest of the world (suffering, they argue, a competitive disadvantage), however, the Clinton Administration is again considering whether to delay the U.S. deadline:

The Clinton Administration is mulling over options for changing the Clean Air Act to extend the US deadline for phasing out production and importation of methyl bromide, perhaps to 2005, the date just set for industrialized nations under an international treaty. An Environmental Protection Agency official says the administration has not settled on any position and is consulting with members of Congress. However, he notes there is a desire to “narrow the difference” between the 2001 deadline set by the Clean Air Act for ozone depleting chemicals and the international deadline set for industrialized nations.

Meanwhile, Rep. Gary Condit (D-Calif.) is asking the administration to help ensure that methyl bromide remains available “on an equal basis” in all countries. In a September 22 letter to President Clinton, he noted that developing countries, such as Mexico and Chile, will access to the soil fumigant for another 18 years. Rep. Condit said the interim reductions in methyl bromide consumption for industrialized nations agreed to at the recent meeting “flies in the face of the commitments the administration made to farmers in Fresno, Calif., during your visit in summer 1995. You are keenly aware of the great anxiety in the agricultural community about the current prospects of not finding an alternative for methyl bromide and the desire to look at legislative solutions to this problem. I would therefore ask for your support that the adoption of any new proposal on methyl bromide will not place US agriculture at a competitive disadvantage with foreign agriculture and that the use of methyl bromide remain available on an equal basis throughout the world.”

Legislation addressing the methyl bromide phaseout issue may be

introduced before the current House session ends this fall, according to a spokesman for Rep. Condit. Rep. Dan Miller (R-Fl.), is also drafting a bill on methyl bromide and is expected to introduce his proposal shortly. In the previous Congress, Rep. Miller sponsored legislation that would have made the US ban dependent on the availability of a “viable, cost-effective substitute.”

Questions for Thought

*1. Assume that you are an anti-pesticide group that would like to rid the environment of a pesticide that is very similar to methyl bromide. What lessons does this case study teach you about how you would approach a campaign? Would you try to focus attention on the story of individuals suffering acute injuries, on overall statistics and studies showing the toxicity of the substance, on the pesticide’s particular risk to workers, or on the effect of the pesticide on more general environmental issues like ozone depletion? Why? What do you see as the advantages and disadvantages of the various strategies?

2. Even before it was amended, did SB950 permit the manufacturers too much time to conduct toxicity tests on methyl bromide? What should the bill have provided?

Some have complained that SB950 takes the approach that an existing pesticide like methyl bromide is “innocent until proven guilty.” Proponents of the bill point out that it would be unfair to pesticide manufacturers and farmers to ban existing products without giving them time to conduct tests on the products first to see if the products are safe. Does this place the burden of risk in the wrong place (i.e., on those exposed to the products while the tests are being completed)? And should the government give manufacturers seven years to perform the tests?

3. Once experimental results showed that methyl bromide caused birth defects in some animals, should the State of California have immediately banned the substance? Should the State wait for more information under SB950 given the circumstances? In the face of the experimental results, what action(s) do you believe California should have taken?

In this regard, consider two sets of arguments that the manufacturers and users of methyl bromide are likely to make. First, they are likely to argue that animal tests do not tell us whether methyl bromide is a *human* teratogen. The debate over the relevance of animal tests is elaborated in the following excerpt from PHANTOM RISK:

The most direct approach in animal studies is to expose animals to a chemical, then wait and see what happens. This, in a highly controlled form, is the basis of standardized cancer screening tests and other toxicologic assays.

For several reasons, scientists have great difficulty in studying the effects of small chemical exposures in animals. Small effects are undetectable by animal studies of any reasonable size; an exposure that causes one excess cancer death in

a million rats (which for humans is the level of safety that American regulators typically strive for) would produce no detectable effects in a test using 100 animals (the typical size of such a test). Animals, like humans, frequently develop chronic disease in old age, and an investigator seeking an effect of some exposure must contend with a high background rate of naturally occurring disease.

To increase the sensitivity of a study, investigators commonly expose animals to high doses of a test substance, often the maximum tolerated dose (MTD). But then the relevance of the study to low-level human exposure becomes unclear. Some way is needed to extrapolate to exposure levels that are more typical of human exposure.

A second problem is the relevance of *animal tests* to *human health risks*. It depends on how similar the exposure is to actual human exposures, biological similarities and differences between the animals and humans, and the nature of the effects produced by high doses in the animals. A human is not a 70-kilogram rat.

The question of relevance of high-dose animal tests to human health is one of the most interesting controversies in science today. One side—most prominently represented by the eminent epidemiologist [Julian] Peto and eminent biochemist [Bruce] Ames—argues that such tests provide little useful information for calculating risks to humans from low-level exposure. The other side (much of the toxicological establishment and all regulatory laws) concedes the point but argues that no better alternative exists. A few scientists and physicians (most prominently [Samuel] Epstein) are far more ready to infer distressing implications from positive results of high-dose animal studies.

Recently (March 1992), National Public Radio offered a nice analogy, in a balanced program on the role of animal studies in risk assessment. If a glass bottle is dropped from a height of ten feet onto a concrete floor, it will probably break. But what about dropping ten bottles from a height of one foot? Or a thousand bottles from 1/100 feet? Or a million bottles from 1/100,000 feet? By linear extrapolation, which underlies much risk assessment in the United States, we would expect one bottle to break in each case. Whether such extrapolations are warranted depends on how the system fails. For the glass bottles a “linear dose-response model” is clearly absurd. In toxicology the situation is much less clear.

Second, manufacturers and users of methyl bromide are likely to point out that determining whether a substance can cause birth defects is simply the first step in risk assessment. They will argue that the government, before it regulates, should know not only whether methyl bromide can cause birth defects, but also (1) what are the risks at various levels of dosage (for humans), (2) how much exposure do people have to methyl bromide, and (3) what is the risk associated

with that level of exposure.

How would you respond to these various arguments?

*4. If you were to design a law regulating the use of pesticides in California, what would the law provide? In designing your law, consider the following issues:

- What standard would you use for determining whether a pesticide should be used in the state? Would you consider economic factors?
- How would you deal with the inevitable uncertainty regarding the risks presented by a particular pesticide? Would you permit a pesticide on the market if there were *any* uncertainty regarding the potential health effects? If you would not ban a pesticide merely because there was some very slight uncertainty, how much evidence of risk would you want before precluding the pesticide?
- How would you deal with pesticides that are already on the market at the time that your bill becomes law?

5. Does Proposition 65 make any sense? If a substance is “known to the state to cause cancer or reproductive toxicity,” shouldn’t it just be banned? Does it do any good merely to require the user to give a “clear and reasonable warning” before “knowingly or intentionally” exposing an individual to the substance?

6. Do you think that a safe level of exposure to methyl bromide can be determined? Why? If you think that a safe level can be determined, what is the safe level and what are the reasons for that determination?