MITC in Our Air

Air Monitoring Results
Poisoning Cases, and
The Need for Action to Protect Workers and Families

By Carol Dansereau
Farm Worker Pesticide Project
March 2009

Available on line, including summary in Spanish at www.fwpp.org
(MITC in our Air3.25.09)

MITC in Our Air
Air Monitoring Results, Poisoning Cases, and the Need to Protect Workers and Families

Table of Contents

MITC in Our Air

Air Monitoring Results, Poisoning Cases, and the Need for Action to Protect Workers and Families

Every year millions of pounds of metam sodium are applied as a fumigant to soils in Washington State and elsewhere in the United States. Unfortunately, it is clear that this pesticide's breakdown product, MITC, poses a threat to more than just weeds, nematodes and plant pathogens.

This report discusses MITC air testing results from Washington State's pesticide drift monitoring program administered by the Department of Health (DOH) and from other recent studies. MITC was present in the air almost constantly during the fall fumigation season in Eastern Washington and "Levels of Concern" (LOCs) were exceeded on numerous occasions. Those LOCs do not necessarily ensure safety, particularly for children and other vulnerable individuals, as we discuss in Chapter 3.

Our report also discusses recent MITC poisoning cases in Washington State, including an October 2008 episode that sent an infant, other children and adults to the hospital in the Pasco area. Reported cases such as these likely represent only the tip of the iceberg of acute poisonings. They fail to capture health effects that are delayed and that result from repeated exposures to MITC over time.

State and federal policymakers are poised to make decisions that will directly affect whether workers and residents will be protected from MITC and other pesticide exposures. In 2008 EPA re-registered metam sodium for use on a wide variety of crops, mandating "mitigation measures" to reduce exposures to MITC. EPA's analyses indicate that even with full mitigation compliance, concentrations of MITC in the air are likely to exceed "Levels of Concern". Moreover, EPA's new rules for metam sodium and other fumigants are under attack from interest groups that wish to see key mitigation requirements removed. There is also question as to whether the new rules will be enforced. The Washington State Department of Agriculture (WSDA) submitted a letter to EPA in late October noting that it may not be able to enforce the new rules.

At the same time, funding for Washington State Department of Health's pesticide programs including investigation of poisoning episodes, tracking and analysis of these, air monitoring, and other activities are on the chopping block. Major cuts threaten the ability of DOH to address and prevent MITC exposures and illnesses.

While data from a second year of DOH-sponsored MITC testing are not yet publicly available, it is vital that information be publicized now regarding the monitoring results that are available, recent poisonings, and imminent policy decisions. This report provides that information and makes recommendations to state and federal policy-makers. The time to act to protect children and adults from MITC in the air is now.

CHAPTER 1
BACKGROUND

What is MITC? Metam sodium (sodium methyl-dithiocarbamate) is the key ingredient in various pesticide products, such as Vapam and Sectagon, used to fumigate soils before planting. It breaks down quickly upon contact with water to form the toxic gas methyl isothiocyanate (MITC) which flows through the soil killing weeds, nematodes and plant pathogens.[1] MITC also escapes from the fields where it is applied drifting onto workers and residents.

About 51 to 55 million pounds of metam sodium were used in the United States in 2002.[2] According to EPA, the largest use of metam sodium for soil fumigation in the U.S. occurs in the Pacific Northwest and California.[3] Over 15 million pounds of metam sodium were used on potatoes in Washington State in 2003, and over 10 million pounds were used on that crop in the state in 2005. [4] Metam sodium is also used as a soil fumigant prior to planting fruit trees in the Northwest, but information on the volumes applied is not publicly available.[5]

What laws limit MITC in the air? State and federal law and the labels for metam sodium products prohibit application "in a way that will contact workers or other persons, either directly or through drift." [6] These regulatory statements embrace the rights of individuals to not be exposed to pesticides, without needing to prove injury as a prerequisite to those rights. State and federal agencies charged with enforcing pesticide laws have generally failed to enforce this no-contact standard, however. Instead, they have adopted a stance of allowing exposures as long as they are at "acceptable" levels. Agency officials, researchers and others speak in terms of "over-exposures" to pesticides, thereby implicitly signaling tolerance for exposures that are not considered to be "over-exposures".[7] US EPA has also maintained that "drift" only includes pesticide off-site migration *during and right after* applications, labeling post-application volatilization and movement as separate and less restricted.[8]

While the de facto approach to pesticide drift has been one of tolerating "acceptable" exposure levels, there are no air standards for pesticides, such as those that exist for pollutants from cars, power plants and industrial facilities. Instead discussions revolve around how concentrations of pesticides in the air compare to "Levels of Concern" (LOCs; also known as "reference doses" or "Reference Exposure Levels") when these exist. LOCs are unenforceable benchmarks, rather than standards.

LOCs are concentrations of pesticides in the air that are supposed to represent levels below which health effects will not occur, and above which one might have concerns about potential effects. They are based on studies generally submitted by pesticide manufacturers that examine the effects of various levels of exposure in terms of specific physical impacts in those exposed. Researchers determine the lowest concentration of a pesticide that triggers an effect (Lowest Observable Adverse Effect Level, LOAEL) and the concentration that produces no effect (No Observable Adverse Effect, NOAEL). EPA and other agencies then extrapolate from the no effect concentrations to establish

LOCs, generally dividing by one or more safety or uncertainty factors. For example, the agency might divide the concentration by 10 if the LOC is to be based on an animal study to account for potential greater susceptibility of humans compared to the animals studied. Each step of the LOC development process involves value judgments in terms of what assumptions to make and how cautious to be.

"Levels of Concern" For MITC. In this report, we compare MITC concentrations measured in the air in Washington State to three LOCs. These are the LOCs to which Department of Health and Washington State University refer in documents and presentations related to MITC drift monitoring results.

- **EPA's Acute LOC: 66 micrograms of MITC per cubic meter of air (66 ug/m^3) which is the same as 22 parts per billion (22ppb).** The "acute" LOC for MITC represents the level considered by EPA to be safe for a short period of time - less than 24 hours.
- **EPA's Subchronic LOC: 15 ug/m^3 or 5 ppb.** This is the concentration EPA considers safe for an intermediate period of time, 1 to 30 days.[9]
- **California's Subchronic LOC: 3 ug/m^3 or 1 ppb**. This is California's take on the "acceptable" concentration of MITC in the air over an intermediate period of time, which is more protective than EPA's.[10]

Health Effects associated with MITC include eye and respiratory irritation, headaches, nausea, abdominal pain, diarrhea, weakness, skin rashes, difficulty breathing, anxiety, blurry vision, chest tightness, and other problems.[11] The LOCs referred to in this report were calculated based on studies testing for these sorts of effects. They do not address other potential health effects such as cancer, as is discussed below in Chapter 3. Also discussed in that chapter are other serious flaws in how these LOCs were established which further put into question the wisdom of considering these levels of MITC to be safe to breathe, especially for vulnerable individuals.

MITC-induced symptoms may resolve quickly, but they can also last for a long time. A farm worker in Washington State who fell asleep in his car 100 yards from the field where he was monitoring a fumigation felt burning in his lungs for one and a half months and shortness of breath for 2 months, for example. (He had no prior history of asthma or allergies.) [12] An individual injured in an MITC exposure episode in Arvin, California in 2002, was hospitalized for a week, and still required treatment with supplemental oxygen at the time of her discharge.[13] California researchers have also found that MITC can cause asthma in individuals with no history of asthma or allergies, as well as exacerbate asthma in those who already have it. [14]

This report focuses on MITC, the subject of drift monitoring and the culprit in numerous poisoning events in Washington State, California and other states. It should be noted, however, that metam sodium itself poses risks of acute health effects for the workers who apply it. Metam sodium is also classified as a probable human carcinogen by EPA.[15]

The Air Testing Program. For many years, farm workers and others urged Washington State agencies to monitor the air for drifting pesticides. A two year pilot program was finally established in 2007 by the state legislature which directed DOH to test for MITC and for organophosphates. DOH contracted with Washington State University (WSU) for sample collections for MITC which occurred in the fall of 2007 and the fall of 2008. The results from 2007 have been posted on the DOH website. This report describes those results, and also results from studies WSU did independently in 2005 and 2006. Other results not yet available to us include data from: MITC and organophosphate testing in 2008, testing for another byproduct of metam sodium called MIC, and testing for natural isothiocyanates in the air where mustard greens are used instead of metam sodium.

CHAPTER 2
MITC DRIFT MONITORING RESULTS

All the MITC studies addressed in this report were done in Franklin County, Washington State, a rural county known for growing potatoes. In 2007 WSU engaged in 1) "residential monitoring" which involved placing air monitors near five homes and one business in a potato growing area, and 2) "near-field monitoring" which involved placing air monitors around two different potato fields and taking samples before, during and after applications. "Chemigation" was used to fumigate the soil on one of the fields, "shank injection" on the other. In 2006 WSU had independently done a similar near-field study, and in 2005 it had carried out similar residential monitoring.

I. OVERVIEW OF KEY RESULTS

Key Results from these studies include the following. Details and sources are provided in Part III of this Chapter.

- Nearly Constant Exposures. MITC was consistently present in the air during all of the studies. Roughly 94% of all of the samples taken in all of the residential and near-field studies combined had quantifiable concentrations of MITC in them. Exposure to MITC appears to be a daily fact of life for farm workers and community members in areas of Franklin County when metam sodium is applied to potatoes. Clearly, there is widespread non-compliance with requirements that metam sodium is to be applied in a manner that does not result in pesticide contact with workers and other people.

- MITC Present Above the Acute Level of Concern. MITC concentrations in the air exceeded EPA's acute LOC many times, indicating that there is reason to be concerned about potential health effects. Acute LOC exceedances were documented in all of the following monitoring studies: residential 2007, residential 2005, near-field chemigation 2007, near-field chemigation 2006, and near-field shank 2006. Exceedances were found even in studies like the residential 2005 study which did not do shorter term sampling which is more likely to capture peaks which exceed the LOC. (Test tubes were changed every 12 hours throughout that study. Four hour samples were not collected.) Only the near-field shank study in 2007 did not find acute LOC exceedances. Maximum downwind concentrations found in the other near-field studies were 279 ug/m^3 (93 ppb; four times the LOC), 987 ug/m^3 (329 ppb; nearly 15 times the LOC), and 141 ug/mg^3 (47 ppb; more than twice the LOC) for 2007 (chemigation), 2006 (chemigation), and 2006 (shank injection) respectively.

- MITC Present Above Subchronic Levels of Concern. The subchronic LOCs represent concentrations of MITC which are considered cause for concern if exposures last 24 hours or more. Analysis of whether these were exceeded was stymied by the fact that gaps of time without sampling limited the number of periods of time where sampling data is available for 24 or more hours.

Nonetheless, exceedances of EPA's subchronic LOC (5ppb) were documented in the residential 2007, residential 2005 and near-field chemigation 2007 studies. Exceedances of the more protective California subchronic LOC (1 ppb) were documented in all of these studies, and also during the near-field shank 2007 and near-field shank 2006 studies. According to DOH, the average air concentration over the seven weeks of residential monitoring in 2007 was 1.5 ppb, which exceeds the California subchronic LOC. The MITC concentration average for the full study period in the near-field chemigation study in 2007 was 4.7 ppb which is greater than the California LOC, and close to EPA's subchronic LOC. Study-long averages have not yet been calculated for the other studies but far more than half of all the samples taken in those studies had concentrations of MITC at levels at or greater than 1 ppb.

- Exposures across the years. DOH and WSU documents to date have not discussed *chronic* LOCs (applying to periods such as 6 months, a year, or longer) because the fall fumigation exposure period lasts less than that length of time. EPA's reregistration documents for metam sodium note, however, that individuals may experience MITC exposures year after year to MITC, a fact which should not be ignored. It should also be noted that metam sodium is used for certain other crops and on potato fields in the spring, albeit likely in lower volumes. Using the data from the 2007 residential study, and assuming zero exposures beyond the study period, the annual average for the six monitoring sites is 0.20 ppb in 2007, which exceeds the California chronic LOC of 0.1 ppb.

According to DOH, the testing results suggest that the fall fumigations in south Franklin County contribute to fairly uniform air concentrations in nearby residential areas. The concentrations of MITC in the air tend to increase in the weeks directly prior to the cut-off date for Columbia River irrigation water.

MITC concentrations associated with shank injection were far lower than those associated with chemigation. But acute LOC exceedances were documented in near-field shank injection studies in 2006, and subchronic LOC exposures were documented in 2006 and 2007 at the shank sites.

II. THESE RESULTS ARE "SNAPSHOTS". SOME INDIVIDUALS MAY EXPERIENCE HIGHER MITC EXPOSURES.

It is important to keep in mind that the MITC concentrations measured from 2005 through 2007 reflect only what was measured under the particular circumstances during testing. They are snapshots that do not necessarily represent the worst case scenario. Washington residents could breathe higher concentrations of MITC at other times and in different settings because:

- Applicators in near-field studies were aware that air testing was occurring and researchers noted that they adhered to label requirements. When applications

are not being monitored, some applicators may take more risks, particularly as pressure mounts to complete chemigations before the irrigation cut-off. For example, while the chemigation applicators in the 2007 near-field study stopped and started during the study due to high winds, applicators not under study might have failed to do so.

- A low pressure system was used in 2006 with end guns operating. A low pressure system was also used in 2007, this time without end guns. Both high pressure systems and end gun use can increase MITC drift.
- The residential locations used in 2005 and 2007 may not accurately reflect exposures for individuals who live or work closer to fumigation sites. The sampling locations were selected based on where the bulk of the population lives rather than to represent worst case exposure scenarios.
- Because pesticide use data are not publicly available in Washington State it is impossible to know how many fields in the region were being fumigated in the sampling areas during the studies. More acres may be used for potatoes in some years than were used during the years when residential testing was done. More neighboring fields may be fumigated concurrently in some scenarios than were fumigated during the near-field studies. We do know that in 2006, the monitored shank and chemigation fields were fumigated at different times, whereas in some years those two fields may be fumigated concurrently.
- Metam sodium was applied at a rate of 170 pounds per acre (40 gallons per acre). While the researchers characterize this rate as "typical", the legal rate is 320 pounds per acre (75 gallons per acre). Higher application rates could lead to higher concentrations of MITC in the air. For example, as discussed above, in 2007, the 8-day time weighted average MITC concentration was 4.7 ppb, slightly less than EPA's subchronic LOC of 5 ppb, and greater than California's subchronic LOC of 1 ppg. If 320 pounds per acre had been applied in 2007, a rate that is 1.88 greater than 170 pounds per acre, the resulting 8-day average might have been 1.88 greater, or 8.8 ppb. That number exceeds both the California and the EPA subchronic LOCs.[16]
- Applications on larger fields than those studied in the near-field studies may result in higher MITC concentrations in the air. The fields in the near-field studies were 90, 154, 33 and 119 acres. According to EPA's reregistration decision, the *average* potato field size in the Pacific Northwest is 120 acres.[17]
- Weather conditions such as warm temperatures and inversions played a role in the peak air concentrations documented to date. It is entirely possible that in future years warmer temperatures and a greater coincidence of inversions with peak fumigation periods, could lead to higher MITC concentrations. In the 2005 study researchers noted that "(a) major rain event during the first week of the study may have resulted in the lower MITC concentrations that we observed near detection over this period."[18]
- Test tubes were changed every 12 hours in some studies or portions of studies, every 4 hours in others. Shorter-term samples were rare. The air concentrations collected represent the average of what was in the air over those sampling periods. Twelve hour samples may have missed 4 hour peaks

that exceeded acute LOCs. Four hour samples may have missed one or two hour peaks which exceeded the LOCs.

- The presence of corn stubble on a field may increase MITC drift, as was hypothesized in the October 2008 poisoning case discussed below. In the 2007 near-field chemigation tests, fumigation with metam sodium followed incorporation of mustard greens into the soil. In the 2007 shank study and both the shank and chemigation studies in 2006 fumigation with metam sodium occurred on fields coming from corn silage, but we do not have details on how much corn stubble was present in those cases.

III. DETAILED RESULTS

The following pages describe each study and its results in detail. Appendix 1 presents much of this information in a chart for quick comparison.

A) Residential Monitoring.

Residential monitoring is the term used to describe air testing done in areas where people live and/or where they work in non-farm worker jobs. Monitors set up outside of homes or businesses collect air samples which provide a snapshot of what is in the air people are breathing. Test tubes on the monitors may be changed at varying intervals depending on the resources available to researchers and their goals. Twelve hour samples, i.e. ones taken when test tubes are changed every 12 hours, enable scientists to determine what the average levels of MITC were in the air over the course of half a day, but do not indicate the degree to which there are highs and lows of MITC in the air. Four hour samples by contrast give researchers a little better picture regarding peaks within a 12 hour period.

1) Residential Results from 2007.[19] Under Washington State's pilot pesticide drift monitoring program, air sampling for MITC was conducted three days per week from September 17 through November 3rd in 2007 at 6 locations in Franklin County.[20] Two 12-hour samples were taken for each day of testing during this time period, except for the week of October 22nd. During that week four hour samples were taken on each of the three testing days enabling researchers to have a better idea of whether there were peaks of exposure within the testing days. Monitors were placed at four residences and one commercial location for the full time period. Sampling at a 5th residential location began three weeks into the testing program.

The 2007 residential monitoring for MITC revealed exposure problems:

Nearly Constant Drift

- Over the 7 weeks MITC was routinely found in the air. It was detected at quantifiable levels on all but two of the 26 dates on which sampling occurred. MITC was found in 543 of 609 samples collected (89%) above the level of quantification.[21]

Acute LOC Exceedances

- On October 23rd, levels of MITC measured via four hour samples in the early morning exceeded EPA's Level of Concern (LOC) for acute health effects at all six locations. The exceedances were also measured in the previous four hour samples from two of the six locations covering the final hours of October 22nd and the very early hours of October 23rd for two of the six locations.[22]
- The highest concentration measured was 40 ppb, almost twice the acute LOC (22 ppb). Note that since testing was done on only three days per week, it is not possible to know whether there were higher peaks than this during non-test days. Note also that these four hour measurements represent the average of what was in the air during that four hour interval; there may have been spikes higher than 40 ppb during the four hour interval.

Subchronic LOC Exceedances

- Exceedances of EPA's subchronic LOC (5 ppb) were documented for sampling intervals of 24 hours or more at one or more sites on three different days.[23] It is impossible to know whether there were other subchronic LOC exceedances, because there were gaps during which the air was not sampled, limiting the number of periods of 24 hours or more for which air sampling data is available.
- California's more protective subchronic LOC (1 ppb) was exceeded in at least six 24 hour periods. Each of the six locations where air monitors were placed had at least one 24 hour period in which MITC was present in the air above the California subchronic LOC.[24]
- As noted above because of testing gaps, it is impossible to determine whether the California subchronic LOC was exceeded on additional days. More than one third of all samples taken, however, showed concentrations above 1 ppb.
- The average air concentration over the entire 7 week sampling period was 1.5 ppb, which is above the California subchronic LOC.[25]

Chronic Exposures

- Chronic LOCs establish levels of MITC considered to be of concern for specified longer periods of exposures, for example, more than 6 months. DOH and WSU make no reference to these LOCs because the fall fumigation study period was less than two months long. However, if one assumes that there is zero MITC in the air over the rest of the year, the long-term estimated concentration for the six testing sites ranged from 0.15 ppb to 0.25 ppb, and the average of the 6 sites is 0.20 ppb. None of these estimated concentrations or the average for all the sites exceed EPA's long term LOC of 0.5 ppb, but all exceed California's more stringent chronic LOC of 0.1 ppb.[26], [27] It is important to make note of this, and to also note that: i) many individuals will experience annual MITC exposures in the fall for multiple years, raising questions about chronic exposures and risks over time, as mentioned in Chapter 3 below, and ii) For some individuals, MITC may be in the air other times of the year from spring-time potato field fumigations, from apple tree pre-planting fumigations, and other activities.

According to DOH, results from the 2007 and 2005 residential testing "suggest that the fall fumigant applications to potato fields in South Franklin County contribute to fairly uniform air concentrations in nearby residential areas."[28] DOH and WSU have noted that air concentrations of MITC appear to increase towards the end of the fall fumigation season as the state's irrigation cut-off approaches. [29]

2) Residential Results from 2005[30]

In 2005, WSU monitored the air three days per week from September 26th through October 25th at 3 residences and one commercial location. Only "12 hour samples" were taken. In other words, on the sampling days, test tubes were changed every 12 hours, and not more frequently. This made it impossible to know the peak exposures people experienced within the 12 hour sampling periods, thereby reducing the ability to identify exposures above the acute LOC. Researchers noted in their report on the study that "(a) major rain event during the first week of the study may have resulted in the lower MITC concentrations that we observed near detection over this period."

The findings in 2005 were consistent with those in 2007:

Nearly Constant Drift

- MITC was measured in the air throughout the study including on every day on which samples were collected. MITC was detected in 199 of 201 samples (99%) taken.[31]

Acute LOCs

- Although test tubes were changed every 12 hours, an exceedance of EPA's acute LOC of 22 ppb (66 ug/m^3) was documented at one location on October 21st. (Highest concentration was 67 ug/m^3) Averages for 12 hour samples at other monitors that day ranged from 49.0 ug/m^3 to 61.7 ug/m^3. It is possible that peak exposures within those 12 hour sample periods exceeded the LOC, but the sampling regimen was not frequent enough to document such exceedances. (Four hour samples were done late in the season in 2007 because of this concern. Funds were insufficient for collecting more precise 4 hour samples through most of the 2007 season, however.)

Subchronic LOCs

- The time-weighted average concentration of MITC in the air over 30 days was 10 ug/m^3 (3.3 ppb), which is greater than the California subchronic LOC.[32]
- Over at least one 24 hour period (October 5), the average MITC concentration exceeded EPA's subchronic LOC (5 ppb, 15 ug/m^3). Because of gaps during which sampling was not done, it is not possible to determine whether additional 24 hour periods had average concentrations exceeding that LOC, but there were numerous 12 hour samples that measured concentrations of MITC greater than 15 ug/m^3 (5ppb).[33]

- More than half of the samples taken had MITC concentrations at or above 3 ug/m^3 (1 ppb), the California subchronic LOC level. The California LOC was exceeded for 24 hours at one or more locations on at least 7 days.[34] Again, gaps in testing make it impossible to determine whether the multiple 12 hour periods for which concentrations exceeded 1 ppb were part of 24 hour periods of exceedance.[35]

As noted above, combined with the 2007 results, these air test data indicate that there are fairly uniform region-wide air concentrations of MITC during the fall fumigation season. Increases in air concentrations of MITC in the air occur as the irrigation cut-off approaches.

B) Near-Field Monitoring

Near-field monitoring is the term used to describe air tests done around the perimeter of a specific field in association with pesticide applications on that field. Thus far in all of the WSU and the Department of Health near-field studies, metam sodium users have been aware of and involved in the monitoring effort.

1) Near-field Results from 2007.[36] Under the Washington State pesticide drift air monitoring program administered by the Washington State Department of Health, Washington State University tested the air around two different potato fields that were treated with metam sodium in the fall of 2007. Air monitors were placed about 50 feet (15 meters) outside of each field on the northern, southern, eastern and western sides. Samples were taken from before fumigation began until up to 8 days after it had ended. At some points, test tubes were changed every 4 hours, at other points every 8 hours, and at others every 12 hours. The more frequent test tube changes (i.e. every four hours) happened during and just after the applications. There were some periods during which sampling was not done during and after applications leading to gaps in the information available regarding MITC concentrations in the air.

The first field was chemigated with the metam sodium product, Sectagon 42 at a rate of 40 gallons per acre (about 170 pounds per acre.)[37] Chemigation delivers fumigants to the soil via the irrigation system. The application occurred on about three fourths of a 120 acre field, approximately 90 acres of land. No end gun was used, and low pressure drop lines were used, measures that can reduce MITC drift. The application was halted during periods of high wind, and restarted when wind speeds declined. Mustard was incorporated into the soil before the fumigation.

The 2nd field was a nearby 153.8 acre field which was treated with metam sodium via shank injection during three 6 to 12 hour shifts over a 52 hour time frame. In shank injection a tractor pulls equipment which injects the fumigant into the soil with knife-like blades called shanks. The metam sodium is injected below the surface of the soil and applied in a narrow band as the equipment moves across the field.[38] Rollers pulled behind the shanks compact the soil surface to form a surface seal. Applications did not occur at night, as they did with chemigation, and they did not stop and start in response to winds.

Sectagon 42 was applied at a rate of 40 gallons per acre (170 pounds/acre). The field was coming off of corn silage, so some stubble may have been present, but details were not available for this report. The chemigation and shank injection applications occurred nearly concurrently.

Chemigation Results. Despite stopping for wind and otherwise reportedly adhering fully to label requirements, the drift monitoring results are cause for concern:

Nearly Constant Drift

- MITC was found in quantities above the level of quantification in 126 of 128 samples collected (98%). On all sides of the field, MITC was present in the air during every period in which sampling was done.[39] Whatever the source, MITC was present from before the application through the final period of sampling. It may well have been present thereafter as well.

Acute LOC

- EPA's acute LOC was exceeded several times including north of the field during the first mid-application testing period, west of it during the 2nd mid-application period, and east and north of it during the third. Three of four sites had one four hour period that exceeded EPA's acute LOC. [40]
- The maximum single concentration detected was 283 ug/m^3 (93 ppb), a level which is more than four times higher than EPA's acute reference dose.
- Even the *average* of the concentrations measured at the four sites around the field exceeded EPA's LOC for acute health effects during the mid and late application four hour testing periods. People are not present at all sides of a field at the same time, so the more pertinent information is the concentrations that people downwind from the field are breathing. Still, it is telling that the *average* of concentrations found on all sides of the field was as high as 77 ug/m^3 (25 ppb), i.e. higher than EPA's acute LOC of 22 ppb.

Subchronic LOCs

- Materials available from WSU and DOH to date do not explore whether Subchronic LOCs were exceeded. It is apparent, however that EPA's subchronic LOC of 5 ppb was exceeded over a 24 hour period on October 26th and 27th east, south and north of field.[41] This is apparent because each of two back to back 12 hour samples exceeded 5 ppb, so the average for that 24 period exceeded 5 ppb as well. Less obviously, the EPA subchronic LOC was also exceeded over a 29 hour period beginning at 3:30 on October 18th and ending October 20th at 12:15 a.m. The time weighted average of concentrations from consecutive samples during that period was 15.2 ug/m^3 north of the field, which is equivalent to the subchronic LOC of 5 ppb.[42]
- Analysis of average concentrations over periods of 24 hours or more are complicated by the fact that there were periods of time during which no sampling occurred. When we only have data for non-consecutive time periods it is impossible to know whether a person was exposed to concentrations above the subchronic LOCs during various 24 hour periods.[43] Calculating the

time-weighted averages of pesticides in the air by ignoring the gaps between sampling periods (i.e. calculating as though the sampling periods were consecutive) results in a value of 4.7 ppb for the 8 day sampling period.[44] This exceeds California's LOC of 1 ppb (3 ug/m^3). These concentrations may have remained in the air after sampling stopped. That information is not available.

- 76 of 128 samples (56%) had MITC at concentrations higher than 3 ug/m^3 (1 ppb), California's subchronic LOC. Even before the application began, samples showed concentrations exceeding the California subchronic LOC. The average concentrations at all of the locations around the field exceeded the California LOC for at least 24 hours on two different occasions. For some locations, the exceedance period lasted 36 or 48 hours.[45]

Shank Results. MITC concentrations around the field treated by shank injection were much lower, and in 2007 exceedances of EPA's acute level of concern were not found. The highest single sample concentration at the shank site was 10 ppb compared to 93 ppb at the chemigation site. Note, however that:

Constant Drift

- MITC was present in the air from before the application and through the last sampling. Of 120 samples collected at the shank injection site, 120 had MITC at levels above the level of quantification. (100%)[46]

Subchronic LOCs

- Several samples showed MITC concentrations above 15 ug/m^3 (5 ppb), EPA's subchronic LOC, and at least two other samples had concentrations close to that. Gaps in testing, however, preclude analysis as to whether the average concentration for a consecutive 24 hour period exceeded 5 ppb. So we do not know if subchronic LOCs were exceeded or not.
- 67 of 120 samples had concentrations above the California subchronic LOC (3 ug/m^3, 1 ppb). That LOC was exceeded for 24 hours or more on each side of the field. East of the field there were two 24 hour exceedance episodes and south of the field there was one. Monitors west and north of the field each showed one 24 hour exceedance episode and a 60 hour period of concentrations above the California subchronic LOC.[47]
- As with the chemigation field testing, gaps in sampling preclude full examination of subchronic exposures. Calculating time weighted averages by ignoring those gaps results in a value of 1.5 ppb, a value which exceeds California's subchronic LOC.[48]
- Even the *average* concentration from samples from all around the field exceeded 1 ppb (3 ugg/m3) (the California subchronic LOC) for a 24 hour period post-application. [49] As noted above, this average is less important than the single concentrations measured on individual sides of the field, i.e. the levels with which bystanders in those locations would come in contact. An average masks the severity of exposures for bystanders downwind of a fumigation site, so it is telling that even the average exceeds the LOC.

2) Near-field Results from 2006.[50] In 2006 WSU conducted the near-field monitoring for MITC as well, but the shank injection near-field testing occurred 3 weeks later than the chemigation near-field testing did. The chemigation field was 33 acres, and the adjacent shank field was 119 acres. Both fields were rotating from corn silage to potato. Sectagon 42 was applied at a rate of 40 gallons per acre (170 pounds per acre). Testing occurred during and up to four days after fumigation at eight locations around each field. Sampling was done at 4 and 8 hour intervals at a distance of 30 meters (about 98.5 feet) from the fields[51], with some 2 hour samples taken during the fumigation(s). The chemigation was done with a low pressure system with end guns operating. Researchers noted that there were nearly ideal weather conditions, and that there were cooler temperatures during the shank injection application. (Cooler temperatures may reduce MITC drift.)

Chemigation Results. Sampling revealed numerous LOC exceedances:

Nearly Constant Drift

- MITC was found in quantifiable levels in 122 of 122 samples collected. MITC was present in the air from before the application through the last sampling period.[52]

Acute LOC Exceedances

- There were substantial exceedances of EPA's acute LOC. During chemigation (2 hour samples) there were exceedances at 2 of the 8 testing locations around the field's perimeter. During the initial post-application four hour testing period, there were exceedances at 4 of these locations, and during the next four hour period, exceedances occurred at 5 locations. Twelve hours out from the application's end, exceedances were measured at 3 locations.[53]
- The highest concentration measured was 987 ug/m^3 (329 ppb) nearly 15 times higher than the acute LOC of 66 ug/m^3.
- The maximum *field averaged* concentration was 224 ug/m^3 (75 ppb), well over three times higher than the acute LOC. As noted previously, this average of concentrations found at points around a field obscures the peak exposures that individuals on the downwind side of the field experience.

Subchronic LOCs[54]

- There were no periods of 24 hours or longer during which sampling was conducted without pause. However, sixty-nine of 122 samples had concentrations at or above 15 ug/m^3 (5 ppb), the EPA subchronic LOC.
- California's more protective subchronic level of concern was exceeded almost all of the time both during and after the application. 101 of 122 samples (82%) had concentrations at or above 3 ug/m^3 (1ppb). No analysis has been done to calculate an average over the entire study.

Shank Results. As in 2007, these results were notably lower than levels measured near the chemigation field. Researchers noted that cooler temperatures during the later

application period for this site may have been a factor. Warmer temperatures can increase volatilization and drift of MITC. Nonetheless, there were LOC exceedances:

Nearly Constant Drift

- MITC was detected in 111 of the 124 samples that were collected. It was present before the application began at 6 of the 8 locations around the field. It was present in all of the final samples that were collected.[55]

Acute LOC

- EPA's acute LOC was exceeded including at two locations during the application, and four in the first post-application four hour period.[56]
- The maximum concentration found was 141 ug/m^3 (47 ppb) immediately after completion of the application, a concentration that is more than twice the EPA acute LOC.

Subchronic LOCs[57]

- There were no 24 hour consecutive hours in which sampling was done, so it is impossible to determine whether subchronic LOCs were exceeded.
- EPA's subchronic LOC concentration was reached or exceeded in 48 of 124 samples taken (38%),
- Seventy-seven of 124 samples (62%) were at or above the California subchronic LOC concentration, and three periods of exceedances over 24 hours were documented. An average has not yet been calculated for the full sampling period.

IV. DATA NOT YET PUBLICLY AVAILABLE

The 2007 results discussed above reflect only part of the studies conducted in 2007 and 2008 by DOH under the pesticide air monitoring program established by the state legislature in 2007. Additional MITC-related studies for which data is not yet available as this report is released include: i) residential and near-field testing for MITC in the fall of 2008, ii) monitoring in 2008 next to fields where biofumigation (mustard greens) was used instead of metam sodium, and iii) testing for methyl isocyanate (MIC), one of the other breakdown products of metam sodium, which will happen in the spring of 2009. Data is also not yet available for the organophosphate testing that was done in 2008.

CHAPTER 3
LOCs MAY NOT BE ADEQUATELY PROTECIVE

Much of the discussion above focused on whether Levels of Concern are exceeded or not. It is troubling that multiple LOC exceedances were documented, particularly in light of the factors that worked against capturing the worst case peak exposures, and limitations on evaluating subchronic exposures. While exceedances of LOCs do not necessarily mean that adverse effects are happening, they do mean that we need to be concerned that they might be, according to health officials.[58] Clearly the multiple exceedances of LOCs documented via MITC air testing in 2005, 2006 and 2007 are a call to action to better protect agricultural area workers and residents.

But reliance solely on LOCs is a flawed approach. There is substantial reason to doubt that exposures to concentrations of MITC *below* LOCs are truly safe, especially for vulnerable individuals. Moreover, exposures to MITC and other pesticides violate the rights of individuals to not be exposed.

The MITC LOCs are based on limited data and questionable assumptions. The EPA Acute LOC is based on a single study involving human volunteers whose eyes were exposed to MITC via goggles. They did not breathe MITC. Blink rates and eye irritation were used to establish the lowest observable effect and the no observable effect levels on which the LOC is based. In real exposures, of course, the nose and mouth are exposed at the same time as the eyes, which could mean that the actual no effect level for irritation is lower than that used as the basis of the LOC development.[59] More importantly, as EPA acknowledges "Compared to eye irritation, the systemic and respiratory effects are more adverse in nature." Those effects may even be irreversible, and yet the LOC is not based on studies investigating them. EPA asserts that impacts on the eyes are an acceptable surrogate for respiratory impacts for now, an assumption which is not supported by persuasive evidence. Indeed, EPA openly acknowledges that reported MITC poisoning cases include some in which there were systemic or respiratory effects without eye irritation. [60]

The EPA and California subchronic LOCs were also derived from a single study. That one involved rat exposures over 28 days. EPA's own description of the study in its decision-making document notes that the study found a no effect level for systemic effects to be 1.7 ppm. The agency is supposed to base its LOCs on the lowest no effect level found in a study, but it inexplicably based its LOC on a different higher no effects level (6.8 ppm) found for nasal cavity abnormalities.[61]

In particular, the LOCs don't ensure protection for vulnerable people. The human eye irritation study included only healthy adults ages 18 to 67. Individuals with possible sensitivity to environmental irritants, including people with asthma or upper respiratory allergies, were specifically excluded.[62] EPA divided the NOAEL level by a safety factor of 10 to reflect variability among people, but it is not at all clear that ten times lower levels are safe for vulnerable individuals. Are infants, other children, the elderly, asthmatics, those with allergies, people with lung cancer and others with lung disease

truly safe inhaling MITC at or below the LOC? The answer is not at all clear. Scientific studies have not been done to ensure that LOCs protect vulnerable individuals.

The consequence of EPA being wrong are extreme for exposed individuals. Note that the California study showing new cases of asthma and exacerbation of existing asthma mentioned above involved exposures to air concentrations of MITC that ranged from 140 to 1600 ppb over periods of time ranging from 4 to 166 hours[63]. Air testing results in Washington State indicate that some individuals here could experience exposures in the same range of severity and duration. Note also that a 68 year old woman with history of emphysema in another California MITC poisoning episode spent a week in the hospital because of her exposure, and still needed treatments with oxygen at the time of her discharge. During the exposure she experienced nausea and marked trouble breathing, elevated heartbeat, and other symptoms.[64] The lead author of an article reviewing that poisoning episode noted that the Arvin poisoning case demonstrated "that sensitive individuals may develop serious respiratory illnesses at doses that cause only ocular irritation, mild respiratory irritation, or short-term systemic effects in other subjects with similar exposures." He notes that there is an average asthma prevalence of 5% in the US, and an additional 5% prevalence of smoking-related lung disease.[65]

The LOCs don't account for multiple pesticide exposures. People are generally exposed to airborne MITC in the presence of other degradation products like methyl isocyanate (MIC), hydrogen sulfide, carbon disulfide, methylamine and formaldehyde. In addition, other pesticides are used on potatoes and on other crops. Exposures to these could increase the risks posed by contact with MITC.

The LOCs don't address other serious health effects, like cancer, and the potential for harm from chronic ongoing lower level MITC exposures. Metam sodium itself is classified by EPA as a probable human carcinogen.[66] Regarding MITC, the agency says that existing cancer studies are insufficient to determine whether or not MITC exposure is likely to cause cancer. It notes that although there is a limited duration of exposure in a given year, "there is potential for exposure to occur annually for many years. Moreover, metaplasia of the respiratory epithelium, a lesion often associated with cancer, was observed after only 28 days of exposure in the subchronic inhalation study in rats with MITC." As a result EPA is asking metam sodium manufacturers to do inhalation cancer studies in rats and mice for MITC.[67] Meanwhile exposures continue without any understanding as to whether people are being exposed to a cancer-causing or cancer-promoting chemical. If MITC is carcinogenic, is there a 1 in a million, 1 in a 1000 risk, or some other risk that those exposed are facing?

The same can be said regarding other potential effects of MITC. Despite some studies raising concerns about MITC's effects on the immune, hormone, and reproductive systems, for example, none of these are reflected in the LOCs that do exist. EPA is allowing ongoing exposures, while asking pesticide manufacturers to do further studies, as mentioned below. The daily presence of MITC in the air throughout the fall fumigation season as documented by air testing in 2005 through 2007 raises concerns about the long-term health of Washington residents, especially children and other

vulnerable individuals. It should also be noted that metam sodium is applied on some potato fields in the spring, and as a pre-plant fumigant for fruit trees, as well, leading to potential MITC exposures for some individuals at other times of the year as well.

Exposures below LOCs violate the right to not be exposed and the precautionary principle. It is important to not lose sight of the fact that LOCs are a concept which grow out of a mindset which assumes that some exposures may be okay. The Farm Worker Pesticide Project and countless others believe that we all have a basic right to not be exposed to toxic chemicals. We have a right to breathe uncontaminated air without having to first meet some burden of proof that pesticide exposures will cause us injury. This principle is incorporated in regulatory provisions mandating that pesticides be handled in a manner that does not result in *contact* for others through drift or other routes, as discussed in Chapter 1 above.

In short, reliance on LOCs as the sole benchmark for analyzing MITC air testing results is inappropriate. Those LOCs may not be adequately protective. By their very nature they contradict the right to breathe clean air and to not be exposed to pesticides.

CHAPTER 4
MITC POISONING CASES

Washington State Cases in October of 2008. On October 17, 2008, 22 individuals were exposed to MITC drifting from a potato field near Pasco, Washington. Symptoms included coughing, congestion, headaches, nausea, and nose and throat irritation. Twelve of the 22 exposure victims were treated at the hospital, including a 2-week old infant, four young children, four teens and three adults.[68] The potato field had been chemigated with metam sodium despite the presence of corn stubble on the field. According to news accounts the corn stubble acted like a chimney and released gases from the soil into the atmosphere. The stubble also impeded the movement of the fumigant into the soil, leaving it to disperse into the air as a gas. A second MITC exposure event after October 17th involved two Pasco-area residents, according to news accounts and DOH staff, but information is not publicly available on that case or on the details of the case discussed above. Whether DOH will be able to adequately investigate these two cases, and share those findings and lessons with others is unclear, given pending budget cuts, as discussed in Chapter 5 below.[69]

Previous Washington State Reported Cases. DOH prepared a review of reported metam sodium poisoning cases in October of 2005 for US EPA. The report noted that "Although the proportion of cases involving fumigants is not large (4% in a recent 5 year period), fumigant-related illnesses can be severe, long-lasting, and can involve large numbers of people. DOH reported on 12 metam-sodium events involving 34 people investigated between 2000 to 2004. Some of the cases involved exposed workers; others involved drift to community residents. Another case occurred in 2005 involving one worker.

California MITC Poisonings. A number of major MITC poisoning episodes involving hundreds of individuals have occurred in California over the last 10 years. In Earlimart, 170 people suffered health effects from MITC drifting off a potato field in 1999, for example, and residents more than a mile away were impacted.[70] As a second example, in Arvin, 252 people experienced health effects due to MITC drifting from a shank injection application of metam sodium nearby. [71] As a third example, a train derailment in 1991, released over 19,000 gallons of metam sodium into the Sacramento River. In addition to killing all aquatic life as it traveled, the plume exposed residents along the river to MITC gases. Local emergency rooms, private physician's offices, and the medical triage area at an evacuation center collectively reported that over 700 residents were seen and evaluated for spill-related complaints.[72] (While this report focuses on exposures associated with drift during metam sodium applications, reliance on metam sodium creates ongoing risks of spills during transportation and storage. Spills may occur as accidents. There is also potential for terrorists or others to cause them intentionally.)

Reported Cases are the Tip of the Iceberg. It is generally accepted that pesticide poisoning cases included in Washington State's annual pesticide incidents report represent only the tip of the iceberg. DOH focus groups with farm workers and other investigations have revealed widespread non-reporting for various reasons. [73] Research

in California is illuminating regarding the breadth of MITC poisoning cases that remain unreported. In the Arvin case, for example, the extent of those exposed was originally not understood. Only after a community meeting and door-to-door interviews did state officials and others discover that hundreds of individuals had experienced health effects.

As just one example of an unreported MITC case in Washington State, a family contacted DOH a few years ago. The family lived in a home surrounded by fields and included a premature baby and two older girls. The parents called DOH because they smelled the tell-tale odor of MITC in the air as a fumigation proceeded nearby. The children's eyes were red, and the parents wondered what to do. DOH staff told them to leave the area. The case was not counted in the state's annual pesticide incident report because only one symptom was reported, and no one went to the doctor.[74]

Chapter 5
IMMINENT STATE AND FEDERAL DECISIONS

Even as drift monitoring data are posted on DOH's website and as the investigation continues in the October MITC poisonings of infants, small children, teens and adults, policy-makers are making major decisions affecting MITC in the air.

A) EPA's New Fumigant Rule

1) What the Rule Does. In July of 2008 EPA formally re-registered metam sodium for use on a wide range of crops. These include potatoes, various fruit trees (replanting), and other crops. It is requiring "mitigation measures " to reduce exposures, including: buffer zones; posting requirements; new worker protection requirements; changes to worker training programs; good agricultural practices; and other requirements. [75]

Acknowledging that the toxicological database for MITC is not complete, EPA is also requiring that pesticide manufacturers do tests and submit data on various health effects: neurotoxicity, developmental toxicity, reproduction and fertility, unscheduled DNA synthesis in mammalian cells in culture, and carcinogenicity.[76] EPA is allowing ongoing use of metam sodium while awaiting this additional information, because of its belief that "mitigation implemented to address acute bystander risk will also serve to address intermediate and long-term bystander risk." [77]

The agency is also requiring that the manufacturers develop an ambient air monitoring program in high metam sodium use areas. The air tests must help EPA evaluate potential peaks of MITC in the air, and potential community-level chronic air concentrations. [78] EPA's rule does not state whether the air monitoring data will be publicly available.

Because of the large data gaps and substantial amount of research underway, EPA will begin to review the fumigant registrations in 2013.[79] (Note that reregistration reviews tend to take years. The review that culminated in the current rules began many years ago.)

2) Limitations of the New Rule. If implemented and enforced, the new fumigant rule could reduce concentrations of MITC in the air. Unfortunately its potential for adequately protecting people is limited in various ways.

> **Buffer Zones Will Not Ensure MITC Concentrations Below EPA's Acute LOC, let alone Subchronic LOCs.** [80] The most significant potential reductions in MITC levels in the air are associated with the new buffer zone requirements. Growers using metam sodium will be required to establish a buffer zone between the edge of their field and bystanders, so that MITC in the air will hopefully disperse before reaching those bystanders. The size of the buffer zone is determined by various factors: application rate, field size, application equipment and method, and emisson-control measures (e.g. tarps). The smallest buffer zone would be 25 feet, and the maximum would be 2640 feet (1/2 mile).[81] In addition, applications would no longer be legal

within 1/4 mile (1320 feet) of schools, state licensed daycares, nursing homes, assisted living facilities, elder care facilities, hospitals and in-patient clinics, and prisons, if occupied during the buffer zone period.[82]

EPA's own documents indicate that the buffer zones it will require for non-handler workers, residents, pedestrians and other bystanders will not prevent exposures at and above the acute LOC, even though as noted above exposures below the LOC level are themselves not necessarily safe. According to EPA the buffer zone distances required to achieve the "22 ppb target air concentration", i.e. the acute LOC, "would have been prohibitively large and likely would have been impossible for most growers to implement."[83] MITC poisoning cases have been documented more than 1 mile from fumigation sites.[84]

EPA provides an analysis of the effectiveness of a likely buffer zone requirement for a typical Pacific Northwestern field using central pivot chemigation with low release height and no end guns. It assumes that the field is 120 acres, which is what the agency considers the average soil fumigation field size in the Pacific Northwest, and that the "typical" application rate in this region of 140 pounds per acre will be used, rather than the 320 pounds per acre that could legally be applied based on the label. The buffer zone for this scenario, barring reductions based on credits available to some growers[85], would be 700 feet. According to EPA, "the risk level corresponding to the buffer zone distances at the 95th percentile maximum distribution is equivalent to saying a person at the location on the perimeter of the buffer zone where the maximum concentration occurs during the worst case 24 hour period following the fumigation of a specific field during a 5 year period would have a 15% chance of exposure below the Level of Concern (i.e. MOE$\geq$10) for these typical use scenarios." What this means in plain English is that a worker or resident who is downwind from the field will have an 85% chance of breathing air contaminated at or above the acute LOC level at the edge of the buffer zone. This is the assumption even in the absence of other fields fumigating at the same time that might also put MITC in this person's air. It is the assumption, even just basing the calculation on a 24 hour average, and not looking at the potential for peaks above the LOC during 1 or 4 hour periods. Nor does the calculation deal with subchronic exposures and risks.[86]

EPA declares that it believes that the buffer zones it does mandate combined with other mitigation measures will "adequately address the risk of acute fumigant exposure to bystanders and will greatly reduce the magnitude and frequency of exposure incidents". The definition of "adequately addressing risk" in the absence of achieving even the acute LOC is unclear as is the basis for EPA's belief.[87]

EPA's modeling program estimates MITC average concentrations over 24 hours. But as 4 and even 12 hour sampling have shown, exceedances of acute LOCs can occur within a 24 hour period for which the average does not exceed that LOC. Moreover, for a 24 hour exposure period, EPA's subchronic LOC of 5 ppb should be used. By definition, 24 hours is a subchronic period.

The MITC air data from Washington State show acute exceedances in residential areas, likely outside of the 700 foot buffer zones that might be required for certain large fields in Washington State, per EPA's example above. It is possible that MITC concentrations in air masses moving through agricultural areas in general will be lowered if growers reduce application plot size, and coordinate with neighbors in order to reduce buffer zone sizes. It is difficult to determine whether this will happen, and the degree to which growers will have the flexibility and desire to stagger applications that way. Compliance with other measures could also reduce MITC in the air, although it is unclear as to whether growers already adhere to the good application practices and other measures in the new rule. It should also be noted that staggering fumigations over a longer period of time might lengthen the period of time during which people inhale MITC, increasing the chance of subchronic LOC exceedances.

The near-field MITC measurements in Washington State studies in 2006 and 2007 could also be reduced by the fumigant rule measures. The same questions and concerns as noted above with respect to residential air exist for these sites.

Workers Will Come in Contact with MITC in Concentrations Above LOCs.

Workers involved in the application of metam sodium face the greatest risks of anyone. They may be exposed to metam sodium itself which is a probable human carcinogen and is associated with eye, skin and respiratory health problems. Workers then face potential exposure to MITC on the job. Finally, they may face continued MITC exposure at home over the course of the fumigation season.

EPA's Reregistration document explicitly notes "(i)n many cases with maximum personal protective equipment (PPE) exposure still exceeds the Agency's level of concern for short-term and long-term exposures."[88] Similar statements are made elsewhere in the document with respect to particular exposure scenarios and routes (dermal, respiratory).

The agency also explicitly uses a concentration higher than the acute LOC as its benchmark in establishing requirements regarding respirators and air monitoring for workers. Workers have a choice of using respirators or relying on air monitoring until it shows MITC concentrations of 100 ppb in the air.[89] The acute LOC is 22 ppb, so the agency is explicitly authorizing exposures higher than the LOC. Similarly once respirators are being worn because MITC air concentrations have reached 100 ppb, air monitoring is to continue. Only when ambient air reaches 1000 ppb, must operations cease. The decision document explains that "(a)t air concentrations greater than 1000 ppb the respirator is not designed to protect handlers from inhaling more than 100 ppb of MITC."[90]

Health-Protective Alternatives to Metam Sodium Are Not Addressed

EPA's analysis of benefits in its registration decision document includes the assumption that growers will switch to pesticides like chloropicrin and 1,3-dichloropropene, which have their own health risks and costs, if they are unable to use metam sodium. The document fails to discuss another alternative: planting mustard and incorporating the plant as "mustard green manure" into the soil prior to planting potatoes.[91] This alternative is referred to as "biofumigation".

Some grower organizations have stated that reliance on mustard greens alone is not a viable option.[92] Yet, there is evidence to counter that belief. A study by WSU published in 2003, for example, concluded that "mustard green manures may offer farmers an equally effective, but less expensive, alternative to fumigants for control of soilborne pests. In a spring wheat – potato rotation, potato yields following white mustard or oriental mustard, green manures averaged 32.5 tons/acre with or without metam sodium. An average of 86% of the tubers met the US #1 grade. Water infiltration rates were 2 to 10 times greater in the fields receiving mustard green manures compared to those not receiving them. The WSU researchers concluded that in similar potato cropping systems, farmers replacing metam sodium with mustard green manures could potentially improve their soil's infiltration rate while saving an estimated $66/acre.[93]

Results of testing for natural isothiocyanates near a field where only mustard greens were used as a fumigant were not available as this report was released. Preliminary statements made by WSU researchers indicate that natural isothiocyanates will not likely be found to be a problem at sites where mustard greens are used in the absence of metam sodium. [94]

3) Enforcement and Implementation of the New Rule Are in Doubt

In issuing its "final" rule, EPA requested additional comments, purportedly to help it clarify implementation issues. Farm worker and community groups deeply concerned about health effects from MITC and other fumigant, have renewed requests to EPA to phase out metam sodium and other fumigants, using buffer zones and other measures as interim protections during a phase-out period. They have urged the agency to not back pedal on the fumigant rule, but EPA has received many comments from metam sodium users, sellers and producers urging it to weaken the fumigant rule.

The Washington State Department of Agriculture which implements federal pesticide law in Washington State submitted a letter to EPA on October 28, 2008 criticizing EPA's fumigant "proposals" as "unnecessary' and "cumbersome". WSDA maintained that the new requirements "may result in elimination of certain agricultural crops as viable commodities for US production." The letter makes no reference to health protection benefits associated with restrictions on the use of metam sodium. WSDA particularly urges EPA to reconsider its buffer zone distances. It requests that strong consideration be given to delaying implementation of the fumigant rule.

WSDA's letter also expresses "strong concerns regarding the capacity of the state to enforce all of the provisions" of the fumigant rule that will be on the label. Given these statements and the ongoing failure of WSDA management to provide air monitors to investigators for drift cases, there is a serious question as to whether the fumigant rule will be enforced in Washington State.

B) Washington State's Pesticide Programs Are Slated for Massive Cuts

The Washington State Department of Health Pesticide Program engages in vital work related to protecting Washington residents from pesticide exposures such as:

- Investigating pesticide poisoning cases to identify and help address causes of exposure. Under current staffing levels, DOH struggles to keep up with the hundreds of poisoning cases referred to it each year.
- Tracking, compiling and analyzing those cases to inform trainings, policy discussions and program development within DOH and at other agencies. DOH also staffs the state's Pesticide Incident Reporting and Tracking (PIRT) Panel which helps DOH produce an annual state pesticide incidents report. PIRT provides a forum through which DOH and other agencies addressing pesticide issues coordinate with one another.
- Providing trainings to workers, employers and others to prevent pesticide poisonings.
- Overseeing the pesticide drift monitoring program which gathers basic information about pesticides in the air.

The budget submitted by Governor Christine Gregoire to the state legislature for 2009-2011 severely undermined DOH and its pesticide programs with massive cuts:

- PIRT was explicitly eliminated, as was it's annual compilation and analysis of pesticide cases in the state, and its sharing of this data with other agencies, the public and policy makers.
- Drift monitoring was not renewed.
- The DOH pesticide program was slated to lose approximately half of its budget and half of its staff. This huge loss would make it impossible for the program to manage its current caseload of pesticide poisoning cases, and to carry out its other vital work.
- The Washington Poison Center was also slated to suffer enormous cuts, which could cause it to close altogether. In addition to giving immediate essential information to callers about what to do in poisoning situations, the Center funnels cases to DOH for investigation.

If cuts happen, the spotlight that has begun to illuminate what is in the air will be abruptly turned off. Investigations and tracking of poisoning cases will be derailed and diminished. Cases like the two MITC poisoning cases in October 2008 will be poorly investigated if at all. They will be hidden from public view. No comprehensive reports will present these and other cases, facilitating analyses and action to prevent others from suffering the same fate.

As we release this report, the legislature is hard at work examining these issues. Bills altering aspects of the Governor's initial proposal are under discussion.

CHAPTER 6
CONCLUSIONS AND RECOMMENDATIONS:

People deserve clean air. They have a right to not be exposed to MITC and other pesticides and to live without risk of sudden poisoning. Drift monitoring results and recent poisoning cases make it clear that farm workers and agricultural area residents, including children, are not adequately protected, however. Their rights are abridged and their health is at stake.

This situation is unacceptable and must be corrected. Fumigant rules must be strengthened and a timeline must be established for phasing out metam sodium. WSDA and EPA must fully enforce these rules, and they must defend the rights of children and adults to not come in contact with MITC. DOH must be adequately funded and fully authorized to investigate, track, and analyze pesticide poisoning cases and to monitor the air for pesticide drift. Working with PIRT, DOH must continue to produce its invaluable annual report on pesticide incidents in Washington State. Federal and state officials must chart a course which moves growers away from reliance on highly dangerous pesticides like metam sodium and towards safe sustainable alternatives. Our specific recommendations include the following:

A. Recommendations to President Obama and US Environmental Protection Agency Administrator Jackson

1) Strengthen and Enforce the Fumigant Rule and Other Pesticide Policies

- Do not succumb to pressure to weaken or delay implementation of the rule's provisions.
- Strengthen the rule by increasing buffer zone sizes and worker protections to achieve at least the LOCs, clarifying that air monitoring data from manufacturer studies must be publicly available, and establishing a timeline for phasing out the use of metam sodium.
- Require full enforcement by state agencies including the Washington State Department of Agriculture as a condition of delegation of enforcement authority under the Federal Insecticide Fungicide and Rodenticide Act (FIFRA). Rescind that delegation if state enforcement is inadequate.
- Use the strengthened fumigant rule as a model for broader pesticide program reforms, including
    - A precautionary approach including aggressive alternatives assessments that prioritize and advance truly safe and sustainable alternatives to hazardous pesticides,
    - Requiring air monitoring for a wide array of drift-prone pesticides
    - Protecting the most vulnerable including children, the elderly, and those with asthma, and other respiratory illnesses.
    - Protecting against all health effects, including those associated with subchronic or chronic exposures.

2) Launch a bold new program to transition growers to safe and sustainable alternatives to hazardous pesticides.

- Establish a process that fully includes farm workers and other affected communities, as well as growers and others, to develop effective programs and policies that transition growers to alternatives,
- Adopt a comprehensive package of far-reaching and effective policies and programs to transition growers to alternatives. Elements of the package should include but not be limited to researching alternatives that are truly safe and effective, financial assistance and risk sharing for growers during and after transitions, revisions of grading programs, amendments to trade policies, government procurement rules favoring safely and justly grown food, policies to promote fair wages for growers and farm workers, market promotion measures for safely and justly grown foods, technical assistance to growers, and other measures.
- Provide ample funding for existing and new programs associated with transitions to safe and sustainable agriculture.

B. Recommendations to Governor Gregoire

1) Revise your budget proposals to:

- Reinstate funding and staffing for the Washington State Department of Health's Pesticide Program enabling it to continue its current work including but not limited to pesticide investigations, training, an annual report on pesticide illnesses, analyzing drift testing results.
- Insist that the state's Pesticide Incident Reporting and Tracking (PIRT) Panel continue to exist, providing its low cost assistance to DOH staff as it compiles the annual pesticide incident report. Rescind language in your proposed budget eliminating the requirement that there be annual tracking and compiling of pesticide cases. Appoint a toxicologist who does not have a financial conflict of interest to the vacant toxicologist position on the PIRT Panel.
- Reinstate funding for the Washington Poison Center so it can respond to poisoning victims and so it can direct cases to DOH for investigation.
- Continue and expand the pesticide drift monitoring program to facilitate collection of more data on MITC, organophosphates, and other agricultural pesticides as well.

2) Direct the Washington State Department of Agriculture to fully enforce the new EPA fumigant rule, to cease in its efforts to weaken that rule, and to provide inspectors with drift monitoring equipment. Direct the agency to embrace a new approach to agricultural pesticide issues which encompasses and advances protection of health, and which fully includes farm workers and other affected communities in agency decisions.

3) Launch a bold new state level program to transition growers to safe and sustainable alternatives to hazardous pesticides.

- Establish a process that fully includes farm workers and other affected communities, as well as growers and others, to develop effective programs and policies that transition growers to alternatives,
- Adopt a comprehensive package of far-reaching and effective policies and programs to transition growers to alternatives. Elements of the package should include but not

be limited to researching alternatives that are truly safe and effective, financial assistance and risk sharing for growers during and after transitions, revisions of grading programs, amendments to trade policies, government procurement rules favoring safely and justly grown food, policies to promote fair wages for growers and farm workers, market promotion measures for safely and justly grown foods, technical assistance to growers, and other measures.
- Provide ample funding for existing and new programs for transitions to safe and sustainable alternatives.
- This program should support and build upon parallel efforts at the national level.

4) Direct the State Department of Health to continue monitoring pesticide drift, investigating pesticide poisonings, producing a top-notch annual report on pesticide exposure and illness, training workers and others, and otherwise carrying out actions to protect health. Direct the agency to be a powerful force for precaution-based pesticide policies that ensure protection for all people in our state, including farm workers, children, the elderly, those with asthma and other illnesses, pregnant women, and others vulnerable individuals.

C. Recommendations to the State Legislature

1) Require and adequately fund essential activities related to preventing pesticide exposures and helping those who have been poisoned. Among other things:

- Provide full funding to DOH's Pesticide Program, the Washington Poison Center, and the Pesticide Incident Reporting and Tracking (PIRT) Panel.
- Require continued pesticide drift monitoring, production of the annual PIRT report, and other activities that protect health.
- Remove PIRT from bills eliminating boards and commissions, and ensure that it continues to exist.

2) Launch a bold new program to transition growers to safe and sustainable alternatives to hazardous pesticides, working with the Governor and/or using legislation and legislative work sessions in the summer and fall.

- Establish a process that fully includes farm workers and other affected communities, as well as growers and others, to develop effective programs and policies that transition growers to alternatives,
- Adopt a comprehensive package of far-reaching and effective policies and programs to transition growers to alternatives. Elements of the package should include but not be limited to researching alternatives that are truly safe and effective, financial assistance and risk sharing for growers during and after transitions, revisions of grading programs, amendments to trade policies, government procurement rules favoring safely and justly grown food, policies to promote fair wages for growers and farm workers, market promotion measures for safely and justly grown foods, technical assistance to growers, and other measures.
- Provide ample funding for existing and new programs associated with transitions to safe and sustainable agriculture

Endnotes

[1] US EPA, Overview of the Use and Usage of Soil Fumigants, June 15, 2008, p 5-6
[2] US EPA, Reregistration Eligibility Decision (RED) for Methlydithiocarbamate Salts – Metam Sodium/Potassium and MITC, July 9, 2008 (Hereafter "US EPA RED") p.12
[3] US EPA RED, p. 33
[4] National Agricultural Statistics Service (NASS), on-line database, http://www.pesticidemanagement.info/nass/act_dsp_usage_multiple.cfm. The figure given represents pounds of metam sodium itself and does not include other ingredients in the pesticide product used to apply it. NASS data is based on responses to surveys of growers about their pesticide use.
[5] See for example, T.J. Smith et al, WSU Extension Agent for Chelan, Douglas and Okanogan Counties, "Orchard Soil Fumigation", included in Oregon Stte University Extension's Online Guide to Plant Disease Control, April 18, 2008; http://plant-disease.ippc.orst.edu/articles.cfm?article_id=43
[6] Sectagon 42 label page 2. See also, WAC 16-233-210(1); WAC 296-307-13010(1) and parallel federal regulations.
[7] For example, a Washington State Department of Health fact sheet on MITC published in November of 2008 says: "If air testing shows concentrations above the level of concern at certain times and places, farmers and the government can work together to prevent the problem." Implicit in this wording is the assumption that exposures below "levels of concern" are not to be addressed.
[8] US EPA Fact Sheet, Spray Drift of Pesticides, December 1999; http://www.epa.gov/pesticides/factsheets/spraydrift.htm
[9] EPA relied on studies testing impacts of exposures of 1-8 hours and 28 days respectively for its acute and its subchronic LOCs. In the absence of data specific to exposures between 8 hours and 28 days long, EPA chose to extrapolate from the 1-8 hour study for exposures up to 24 hours. It extrapolated from the 28 day study to set LOCs for periods of exposure lasting from 24 hours to 30 days.
[10] We compare Washington State drift monitoring results to California's subchronic LOC as well as EPA's because it is important to be cautious when the health of children and adults is at stake.
[11] US EPA Human Health Risk Assessment: Metam Sodium, April 12, 2007, p. 9; DOH Fact Sheet on Methyl Isothiocyanate, November 2008; US EPA Office of Prevention, Pesticides and Toxic Substances, 2000, Review of metam sodium incident reports (EPA-HQ-OPP-200400159-0009) as cited in Journal of Pesticide Reform, Spring 2006, Vol . 26, No. 1, Fumigant Factsheet: Metam Sodium.
[12] DOH Case number 02005, described in a DOH document entitled, "Washington State Cases of Pesticide-Related Illness Investigated by the WA Department of Health, Pesticide Program 1994-2001, Definite, Probable and Possible cases, 10/3/03"
[13] O'Malley et al, "Illness Related to Shank Application of Metam-Sodium, Arvin, California, July 002", Journal of Agromedicine, Vol. 10(4) 2005; p. 35
[14] Cone et al, "Persistent Respiratory Health Effects After a Metam Sodium Pesticide Spill", Chest, 106(2) August 1994. A train derailment led to a spill of metam sodium into the Sacramento River. The plume traveled down the river exposing individuals along the way, including those who then exhibited persistent respiratory health effects, "reactive airways dysfunction syndrome". The estimated short-term air concentrations to which individuals were exposed ranged from 140 to 1600 ppg, with duration of exposure as short as 4 hours and as long as 166 hours.
[15] US EPA RED Fact Sheet: Methyl dithiocarbamate Salts – Metam Sodium/Potassium and MITC, July 10, 2008
[16] Calculation provided by Karl Tupper, Pesticide Action Network
[17] US EPA RED, p. 31.
[18] Hebert, "MITC Residential Community Air Assessments: South Franklin County, Washington", 4/2006; p. 7
[19] 2007 MITC Residential Community Air Assessment, Franklin County, WA; FEQL 1207A; on DOH website: http://www.doh.wa.gov/ehp/Pest/driftresults.htm
[20] This time period is said to be the main period for metam sodium applications on potato fields. Metam sodium applications do occur at other times of the year. Testing for another metam sodium byproduct, MIC, is occurring as a potato field is fumigated with metam sodium in the spring of 2009, for example. Because growers are not required to publicly report pesticide use, however, data is unavailable for this report regarding actual volumes and timing of metam sodium applications. Pesticide use reporting is required in California, but not in Washington State.
[21] Analysis by author using data in 2007 residential air report posted on DOH website.

[22] DOH Summary of Analytical Report for 2007 MITC Residential Community Air Assessment; Franklin County; and author analysis of data posted on DOH website.
[23] DOH, Summary of Analytical Report for 2007 MITC Residential Community Air Assessment: Franklin County.
[24] Author's analysis of data posted on DOH website.
[25] DOH, Summary of Analytical Report for 2007 MITC Residential Community Air Assessment: Franklin County
[26] Analysis provided by Karl Tupper, Pesticide Action Network.
[27] This type of analysis has been employed by the California Department of Pesticide Regulation (DPR) in assessing active ingredients for potential designation as Toxic Air Contaminants. See for example, DPR, Endosulfan Risk Characterization Document, Vol. II: Exposure Assessment, HS-1647, May 2008; http://www.cdpr.ca.gov/docs/whs/pdf/hs1647.pdf.
[28] DOH, Summary of Analytical Report 2007 MITC Residential Community Air Assessment: Franklin County, WA.
[29] DOH Public Meeting, Yakima, WA, November 20, 2008. The state limits grower access to water in late October, making applications of metam sodium via chemigation impossible. Shank injection can occur after the irrigation cut-off, but only while soil temperatures remain above a certain level.
[30] MITC Residential Community Air Assessment: South Franklin County, WA, FEQL-NG-0605 on DOH's website: http:www.doh.wa.gov/ehp/PEST/historicalair.htm
[31] Analysis by author using data posted on DOH's website.
[32] MITC Residential Community Air Assessment, 2005, p. 4
[33] Author's analysis of results posted on DOH website.
[34] This number is based on back-to-back 12 hour periods of air sampling noted by the author which revealed exceedances of the subchronic REL during each of those periods. DOH did not do a summary of this 2005 data as it did for the 2007 data gathered under its own program. Thus, it did not identify potential additional subchronic LOC exceedances over 24 hour periods of sampling based on averaging concentrations from consecutive 12 hour periods where one period did not exceed the LOC concentration.
[35] Author's analysis of results posted on DOH website.
[36] Analytical Summary Report, Near-Field Emissions of MITC Following Shank Injection and Chemigation Metam Applications, Project No. FEQL 1207B, on the DOH website: http://doh.wa.gov/ehp/Pest/driftresults.htm
[37] These figures reflect the volumes of the active ingredient in the fumigant used: metam sodium. They do not include volumes of other ingredients in the fumigant product.
[38] EPA Health Effects Division, Metam Sodium: Occupational and Residential Exposure Assessment for the Reregistration Eligibility Decision Document, May 21, 2004, p. 14.
[39] Analysis by author using results posted on DOH website.
[40] Analysis by author using results posted on DOH website.
[41] Analysis by author using results posted on DOH website. Note that it is impossible to be sure whether these concentrations or others found during the drift monitoring were caused by fumigation of this field and/or by fumigation of other fields in the area.
[42] Analsyis done by Karl Tupper, Pesticide Action Network.
[43] Funding that ensures consecutive testing makes it possible to better analyze the degree of risk people are facing from pesticides in the air. Researchers were limited with respect to testing frequency by limits on their funding.
[44] Analysis provided by Karl Tupper, Pesticide Action Network
[45] Analysis by author using results posted on DOH website.
[46] Analysis by author using results posted on DOH website.
[47] Analysis by author using results posted on DOH website.
[48] Analysis by Karl Tupper, Pesticide Action Network, using results posted on DOH website.
[49] Analytical Summary Report 2007 p. 7
[50] Analytical Summary Report, Optimizing Fumigant Efficacy While Minimizing Off-target Volatile Emissions, 3/2007; On DOH webite at: http://www.doh.wa.gov/ehp/Pest/historicalair.htm
[51] Email communication with Vince Hebert, WSU, February 4, 2009
[52] Analysis by author using results posted on DOH website.
[53] Analysis by author using results posted on DOH website.
[54] Analysis by author using results posted on DOH website.

[55] Analysis by author using results posted on DOH website.
[56] Analytical summary report, and author analysis.
[57] Analysis by author using results posted on DOH website.
[58] DOH, MITC Fact Sheet, November 2008
[59] Office of Environmental Health Hazard, California. Revised Findings on the Health Effects of Methyl Isothiocyanate, January 31, 2002, p. 5
[60] US EPA RED, p. 16
[61] US EPA, Metam Sodium: Phase 5 Revised Chapter of the Reregistration Eligibility Decision Document, April 12, 2007; p. 22
[62] O'Malley et al, Illnesses Related to Shank Application of Metam Sodium, Arvin, California, July 2002, Journal of Agromedicine, Vol. 10(4) 2005, at p. 28
[63] Cone et al, Persistent respiratory health effects after a metam sodium pesticide spill, Chest, 1994, 106: 500-508
[64] O'Malley et al, "Illnesses Related to Shank Application of Metam-Sodium, Arvin, Californi, July 2002, Journal of Agromedicine, Vol. 10(4) 2005, at 35.
[65] O'Malley, Illnesses Related to Shank Application, at 39.
[66] See footnote 14.
[67] US EPA RED MITC, p. 93
[68] "Officials investigate pesticide exposure", Capital Press article by Mitch Lies, January 8, 2009, as confirmed via a personal conversation with Barbara Morrissey of the Washington State Department of Health. At the time of printing this report FWPP's public disclosure act request for documents for the two cases was pending.
[69] The Washington State Department of Agriculture which enforces pesticide regulations in Washington State has issued a notice of intent to fine the farmer $15,000 fo four infractions associated with the poisoning episode. The department is also proposing to suspend the applicator's license for one year. Capital Press, February 12, 2009, "$15,000 sought for metam exposure"
[70] O'Malley et al, Modeling of Methyl Isothiocyanate Air Concentrations Associated With Community Illnesses Following a Metam-Sodium Sprinkler Application, American Journal of Industrial Medicine 46:1-15 (2004)
[71] O'Malley et al, "Illnesses Related to Shank Application of Metam-Sodium, Arvin, Californi, July 2002, Journal of Agromedicine, Vol. 10(4) 2005
[72] Cone et al, Persistent Respiratory Health Effects After a Metam Sodium Pesticide Spill, Chest 1994; 106:500-08.
[73] See for example, DOH's reports, Learning from Lstening: Results of Yakima Farmworker Focus Groups About Pesticides and Health Care, June 17, 2004, revised on June 21, 2004, and DOH, Improving Data Quality in Pesticide Illness Surveilance, June 17 and 21, 2004. See especially p. 12. Analysis showed that for medical records reviewed the pesticide incident surveillance system captured only 60% of the eligible cases among farm workers. Many cases do not get to a doctor and therefore are not included in medical records.
[74] Conversation with DOH staffperson Barbara Morrissey, January 2009
[75] US EPA RED Fact Sheet on MITC, July 10, 2008. Go to EPA's website for additional documents pertaining to the reregistration decision: http://www.epa.gov/oppsrrd1/reregistration/soil_fumigants/
[76] US EPA RED, p. 92
[77] US EPA RED, p. 23
[78] US EPA RED, p. 80
[79] US EPA RED, p. 24
[80] This report does not go into many details of the EPA fumigant rule that raise concerns for workers and community members. For example, buffer zones may encompass land with yards, employee housing, and other areas if occupants provide written agreement that they will voluntarily vacate the buffer zone during the entire buffer zone period , i.e. during fumigations and until 48 hours after they cease. Employees may feel obliged to give permission, and it is a burden to be barred from one's home for days.
[81] US EPA RED, p. 35
[82] US EPA RED, p. 29
[83] US EPA RED, p. 33

[84] See for example, O'Malley et al, Modeling of Methyl Isothiocyanate Air Concentrations Associated With Community Illnesses Following Metam-Sodium Sprinkler Application, American Journal of Industrial Medicine 46:1-15 (2004), p. 3
[85] Growers can get credits and reduce buffer zone sizes for things like high barrier tarps, soils with high organic matter, high clay content soil, and low soil temperatures. (RED at 41)
[86] US EPA RED p. 39. In the RED, EPA also calculates risks based on averages of concentrations from around the field, not just for the downwind location, but this is of little relevance to the real world. (People do not inhale the average of the air concentrations found around a location. They breathe what is delivered to them at their particular location.)
[87] US EPA RED, p. 33
[88] US EPA RED, p. 51
[89] US EPA RED, p. 53
[90] US EPA RED, p. 53, 54
[91] US EPA RED, p. 81
[92] Public Comments at DOH Public Meeting on air monitoring results, November 20, 2008, Yakima, WA.
[93] McGuire et al, Mustard Green Manures Replace Fumigant and Improve Infiltration in Potato Cropping System, Crop Management, August 2003
[94] Statements of Dr. Vince Hebert at a public meeting on pesticide drift monitoring results, January 9, 2008.