State of California

# Memorandum

To John S. Sanders
Branch Chief

Data : April 6, 1995

Place : Sacramento

Phone : 324-4100

From Department of Pesticide Regulation Randy Segawa, Terri Barry, and Pam Wofford

Subject Methyl Bromide Monitoring: Building Fumigation, Yolo County

This study monitored the air concentrations associated with the methyl bromide fumigations of two mills treated on different dates. Mill #1 was fumigated beginning on June 5, 1993, with a total of 5235 pounds of methyl bromide for the 2,600,000 cubic foot building. Mill #2 was fumigated beginning on June 12, 1993, with a total of 4320 pounds of methyl bromide for the 2,160,000 cubic foot building. The treatment period was approximately 22 hours. At the end of the treatment period, the mills were aerated using roof-mounted fans. During the aeration of Mill #1, ambient air samples were collected at 12 locations using charcoal tubes and SKC air samplers. Air samples were collected at eight locations during the fumigation of Mill #2. During the treatment period, the highest 21-hour TWA detected was 1.1 ppm, 30 feet from the building. The highest air concentration measured during the first 15 hours of aeration was 0.13 ppm, 30 feet from the building. The results showed the expected pattern, with the highest concentrations in the predominant downwind direction and decreasing concentrations with increasing distance from the source. A complete description of the monitoring follows.

Approved: John S. Sanders
Branch Chief

Date: 4/6/95

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**Introduction -** The objective of this monitoring was to measure the air concentrations associated with a methyl bromide fumigation of a building. This was one of several building fumigations which have been monitored to date. Data are needed for this type of fumigation because large amounts of methyl bromide are used and the buildings leak an unknown fraction of the applied methyl bromide.

**Materials and Methods -** The buildings fumigated were mills constructed of concrete and used to process rice. Mill #1 was 2,600,000 cubic feet in volume, approximately 770 feet long, 70-200 feet wide, and 30- 100 feet tall (Figure 1). Mill #2 was 2,160,000 cubic feet in volume, approximately 430 feet long, 70-250 feet wide and 30-100 feet tall (Figure 2). Prior to fumigation, all doors and other openings were sealed with plastic tarp. Methyl bromide was introduced into Mill #1 on June 5, 1993, just after midnight. A total of 5325 pounds of methyl bromide were used to treat the building (application rate 2.0 lbs/1000 $ft^3$). The treatment period was approximately 22 hours. At the end of the treatment period, several roof-mounted fans were used to aerate the mill. The aeration period was an additional 24 hours. Mill #2 was fumigated beginning on June 12, 1993, 12:30 AM. A total of 4320 pounds of methyl bromide were used to treat the building. The treatment period for Mill #2 was 21 hours and aeration was accomplished with roof-mounted fans.

The original study plan was to monitor the fumigation and aeration at Mill # 1, since it was the largest one. However, heavy rainfall on June 4, just prior to application prevented air samplers from being set up. Instead, the aeration of Mill #1 and the fumigation of Mill #2 were monitored.

Ambient air samples were collected at 12 locations for Mill #1 and eight locations for Mill #2 using charcoal tubes and SKC air samplers. The air samplers were calibrated to approximately 16 milliliters per minute. For Mill #1, samplers were located 30 to 380 feet from the fumigated building (Figure 1). A series of two samples was collected at each of the 12 locations during the first 15 hours of aeration. The first sampling period was during the first 3 hours of aeration and the second sampling period was for the next 12 hours. For Mill #2, samplers were located 30 to 240 feet from the building (Figure 2). A series of two samples was collected at each of the eight locations during the entire 2 1 -hour fumigation period. The first sampling period covered the first 12 hours of treatment and the second sampling period covered the final nine hours of treatment. The California Department of Food and Agriculture's Chemistry Laboratory Services determined the amount of methyl bromide in the charcoal tube samples by extracting with ethyl acetate and analyzing with a gas chromatograph/electron capture detector. Wind speed, wind direction, temperature and humidity were recorded at five minute intervals with a Met-1® weather station located at the site.

**Results -** During the aeration of Mill # 1, the highest 15-hour time-weighted average air concentration measured during aeration was 0.127 ppm, 30 feet from the mill (Table 1). All positive detections of methyl bromide were located north of Mill #1 (Figure 1). This is consistent with the predominant southeast wind direction during aeration (toward the northwest, Figure 2). Concentrations decreased with distance from the mill. The relatively high concentrations measured at 30 feet from the mill indicate that the methyl bromide released from the roof vents was entrained in the building downwash. If the roof vents were high enough to escape the building downwash, methyl bromide would have been detected further downwind and not near the building.

During the treatment of Mill #2, the highest 21-hour time-weighted average concentration detected was 1.08 ppm, 30 feet from the mill (Table 2). Figure 3 shows that most of the positive detections are to the west of Mill #2 and decrease with increasing distance from the building. This is consistent with the predominant wind direction for this sampling period (Figure 4).

**Conclusions -** The two mills are located at the same site, have similar construction, similar height, and similar fumigation and aeration procedures. Therefore, the ambient methyl bromide concentrations associated with two mills would be expected to differ only because of differences in total volume and the specific weather conditions at the time of fumigation and aeration. Assuming similar weather conditions, Mill #1 would be expected to have higher concentrations associated with its treatment because of its larger size.

Unlike previous studies, the concentrations measured for this study could not be compared to those predicted by the Industrial Source Complex - Short Term (ISCST) model. Because reliable estimates of the interior concentration during fumigation could not be obtained, the leakage rate of methyl bromide during fumigation could not be estimated. In addition, the ISCST model does not predict well in close proximity of other large obstructing buildings. This site had several large buildings in close proximity to both mills.

While these results could not be compared to the ISCST model, they do follow the expected pattern given the predominant wind direction. The highest concentrations were detected in the predominant downwind direction and concentrations decreased with increasing distance from the source. Higher concentrations were detected during treatment, in comparison to those detected during aeration. It is unknown whether these differences in concentration were due to differences in weather conditions or emissions.

The concentrations during aeration appear to be lower than those monitored for other applications, especially when differences in amounts of methyl bromide used are accounted for (Segawa et al., 1992; Segawa et al., 1994). The lower concentrations may be due to the very tall height of the mills (30- 100 feet) and the large number of roof vents (16) that are used to aerate these buildings, in comparison to other monitored sites. The height and roof vents could serve to dilute and spread the methyl bromide over a larger area than other sites that may have all of the methyl bromide concentrated in one vent or stack.

## References

Segawa R., T. Barry, and C. Gana. 1992. Results of Off-Site Air Monitoring Following Methyl Bromide Chamber Fumigations and Evaluation of the ISCST Model. Memorandum to John Sanders, dated September 3, 1992. Department of Pesticide Regulation.

Segawa R., T. Barry, and P. Wofford. 1994. Methyl Bromide Monitoring: Building Fumigation, Stanislaus County. Memorandum to John Sanders, dated August 26, 1994. Department of Pesticide Regulation.

Table 1. Ambient methyl bromide concentrations during the aeration of Mill #1. Aeration and samplers started simultaneously on 6/5/93, 10: 10 PM.

| Location | Distance (ft) | Methyl Bromide (ppm) 22:10-00:50 (2.67 hrs) | 00:50-12:50 (12 hrs) | Time-Weighted Average (15-hr) |
|---|---|---|---|---|
| 1 | 140 | 0.332 | 0.0061 | 0.066 |
| 2 | 100 | 0.136 | 0.0084 | 0.032 |
| 3 | 150 | ND* | ND | ND |
| 4 | 150 | ND | ND | ND |
| 5 | 150 | ND | ND | ND |
| 6 | 30 | 0.575 | 0.025 | 0.127 |
| 7 | 230 | ND | ND | ND |
| 8 | 310 | ND | ND | ND |
| 9 | 30 | 0.241 | 0.021 | 0.060 |
| 10 | 200 | 0.117 | 0.005 1 | 0.025 |
| 11 | 380 | 0.107 | ND | 0.020 |
| 12 | 30 | 0.316 | 0.0090 | 0.064 |

* None Detected, detection limit approximately 0.005 ppm

Table 2. Ambient methyl bromide concentrations during the fumigation of Mill #2. Samplers and fumigation started simultaneously on 6/12/93, 12:30 AM.

| Location | Distance (ft) | Methyl Bromide (ppm) 00:30-12:30 (12 hrs) | 12:30-21:30 (9 hrs) | Time-Weighted Average (2 1 -hr) |
|---|---|---|---|---|
| 1 | 30 | 1.403 | 0.663 | 1.082 |
| 2 | 240 | ND* | ND | ND |
| 3 | 30 | ND | 0.021 | 0.0091 |
| 4 | 200 | ND | ND | ND |
| 5 | 30 | 0.03 1 | 0.102 | 0.062 |
| 6 | 130 | 0.049 | 0.03 1 | 0.041 |
| 7 | 30 | 0.676 | 0.222 | 0.479 |
| 8 | 170 | ND | 0.0080 | 0.0036 |

* None Detected, detection limit approximately 0.005 ppm

Figure 1. Methyl bromide air concentrations (ppm, 15-hour TWA) during the aeration of Mill #1

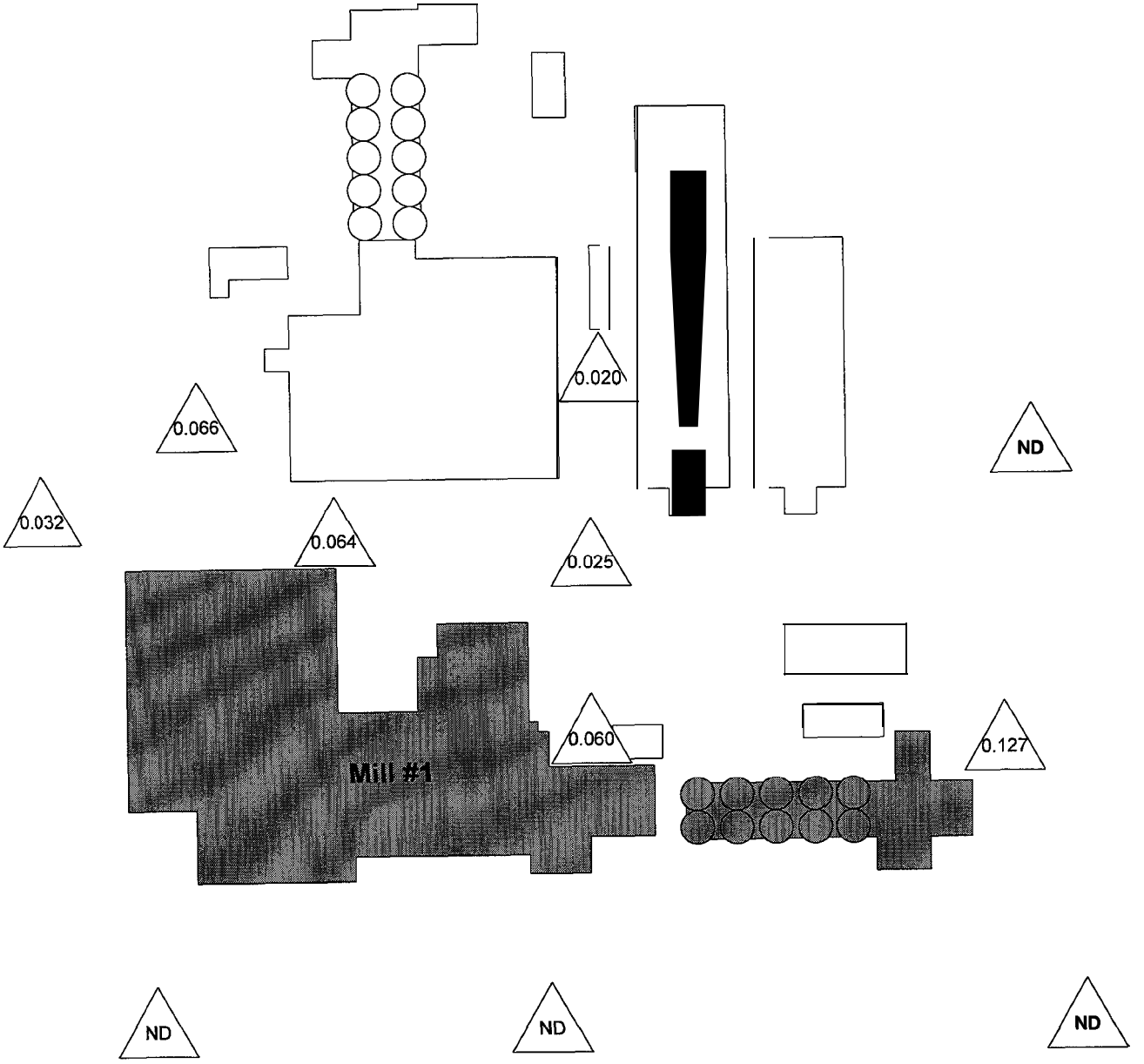

Figure 2. Wind direction and speed during the aeration of Mill #1

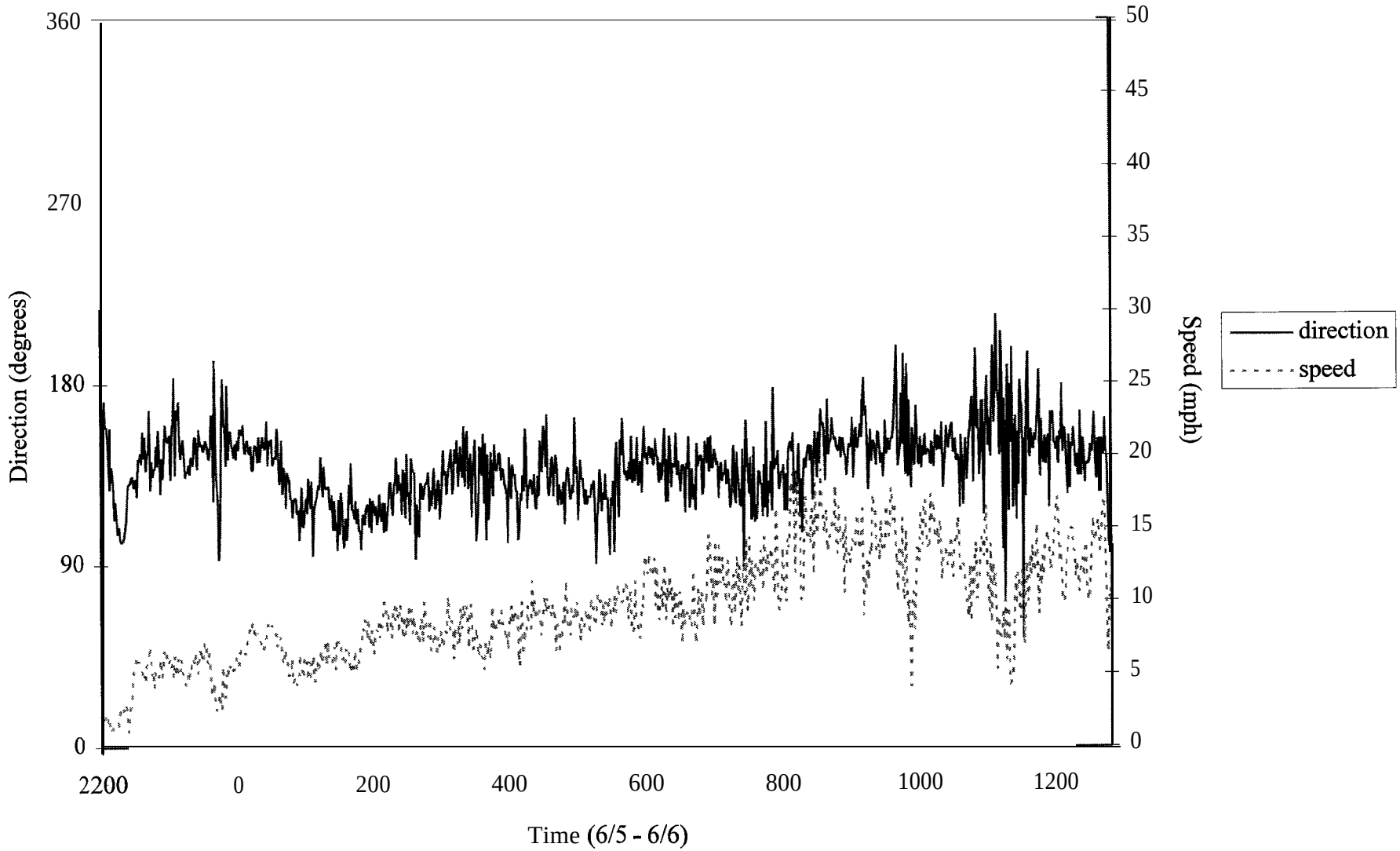

Figure 3. Methyl bromide air concentrations (ppm, 21-hour TWA) during the fumigation of Mill #2

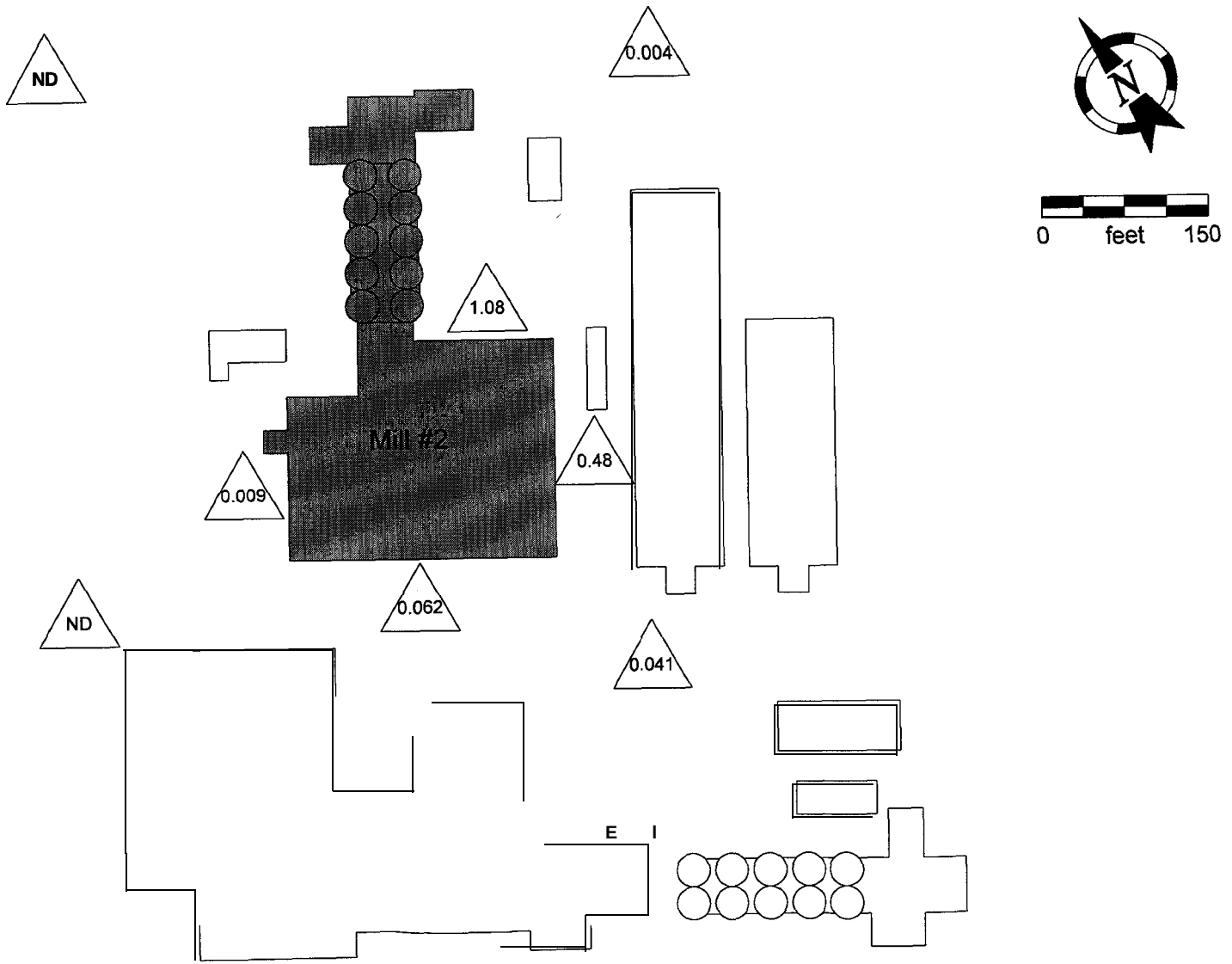
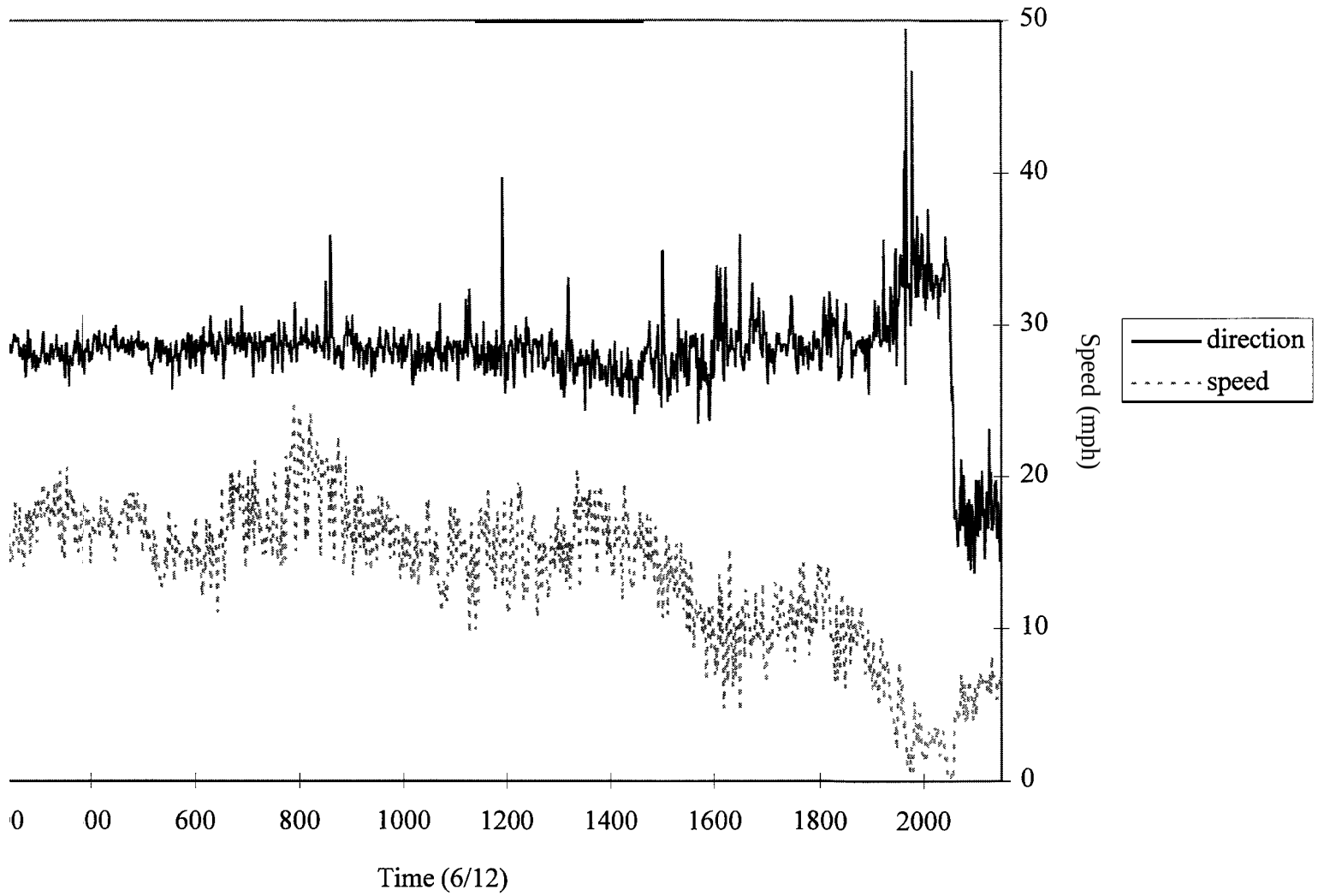
Figure 4. Wind speed and direction during the fumigation of Mi