Air Resources Board

John D. Dunlap, III, Chairman
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M. Rooney
...ary for Environmental Protection

Pete Wilson
Governor

MEMORANDUM

TO: Douglas Y. Okumura, Chief
Environmental Monitoring and Pest
Management Branch
Department of Pesticide Regulation

FROM: George Lew, Chief
Engineering and Laboratory Branch
Monitoring and Laboratory Division

DATE: November 16, 1998

SUBJECT: FINAL REPORT FOR THE 1998 DIAZINON AIR MONITORING

Attached is the final "Report for the Application (Kings County) and Ambient (Fresno County) Air Monitoring of Diazinon During Winter, 1998." The separate volume of appendices for the report have been forwarded to Pam Wales of your staff and are available upon request. As per your August 28, 1998 memorandum your staff did not have any comments on the draft report.

These results are intended for identifying the presence of diazinon in ambient air. Additional air monitoring near the use of diazinon may be necessary to determine if there is a need for mitigation. The locations of the ambient monitoring sites and the monitoring period should be evaluated when the diazinon use data becomes available.

If you or your staff have questions or need further information, please contact me at (916) 263-1630 or Mr. Kevin Mongar at (916) 263-2063.

Attachment

cc: Ray Menebroker, SSD (w/Attachment and Appendices)
Cosmo Insalaco, Fresno County Agricultural Commissioner (w/Attachment)
David L. Crow, SJVUAPCD (w/Attachment)
Pam Wales, DPR (w/Attachment and Appendices)
Sharon Seidel, OEHHA (w/Attachment)
Dennis Bray, Kings County Agricultural Commissioner (w/Attachment)

State of California
California Environmental Protection Agency
AIR RESOURCES BOARD

Report for the Application (Kings County) and Ambient (Fresno County) Air Monitoring of Diazinon During Winter, 1998

Engineering and Laboratory Branch

Monitoring and Laboratory Division

Project No. C97-070 (Application)
C97-069 (Ambient)

Date: November 6, 1998

Kevin Mongar, Project Engineer

Cynthia L. Castronovo, Manager
Testing Section

George Lew, Chief
Engineering and Laboratory Branch

Summary

Report for the Application (Kings County) and Ambient (Fresno County) Air Monitoring of Diazinon During Winter, 1998

This report presents the results of application and ambient air monitoring for diazinon during the peak use period of January. Application monitoring was conducted from January 26 to January 30, 1998 and ambient monitoring from January 12 to February 2, 1998. Application monitoring was conducted around the use of diazinon on a 40 acre dormant peach orchard. Ambient monitoring was conducted to coincide with the use of diazinon as an insecticide on dormant almond and stonefruit orchards. Tables 4 and 7 present the results of application and ambient air monitoring for diazinon respectively. Summaries of sample results are reported in Tables 5 (application) and 8 (ambient). Laboratory results, in units of ng/sample, equal to or above the estimated quantitation limit (EQL) are reported to 3 significant figures. Air concentration results, in units of ng/m^3 and pptv, are reported to 2 significant figures. Results below the EQL but equal to or above the minimum detection limit (MDL) are reported as "detected". Results below the MDL are reported as "<MDL".

The air concentrations, expressed in units of ng/m^3 (or pptv), associated with the MDL and EQL are dependent on the volume of air sampled which varies from sample to sample. For a 24-hour sampling period at 3 Lpm these air concentrations would be 2.1 ng/m^3 (0.17 pptv) and 10 ng/m^3 (0.83 pptv) as associated with the MDL and EQL respectively.

A background sample was collected from each side of the field prior to the application study. All four of the 13-hour background samples collected during the application study were found to be above the EQL. The highest background concentration, 75 ng/m^3, was observed at the north sampling position. Of the twenty-eight application samples collected (spikes, blanks, collocated and background samples excluded) all were found to be above the EQL of 44.5 ng/sample. The highest diazinon concentration, 5500 ng/m^3 (440 pptv), was observed at the west sampling site during the 3rd (4 hour) sampling period.

Of the 60 ambient samples collected (spikes, blanks and collocated samples excluded), thirty-three were found to be above the EQL, seventeen were found to be "detected", and ten were found to be <MDL. Of the 12 samples collected at the urban background site (ARB) in Fresno, three had diazinon results above the EQL with a maximum concentration of 40 ng/m^3 (3.2 pptv). The highest ambient diazinon concentration observed during the study was 160 ng/m^3 (13 pptv) at the Parlier monitoring site.

Acknowledgments

Staff of the ARB Air Quality Surveillance Branch collected the ambient samples. Neil Adler assisted in the collection of application samples. Assistance was provided by Doug Edwards of the Fresno County Agricultural Commissioner's Office. Chemical analyses were performed by Bob Okamoto of the ARB Testing Section Laboratory.

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**Report for the Application (Kings County)
and Ambient (Fresno County) Air Monitoring
of Diazinon During Winter, 1998**

I. Introduction

At the request of the California Department of Pesticide Regulation (DPR) (October 31, 1995 Memorandum, Sanders to Lew), the Air Resources Board (ARB) staff previously determined airborne concentrations of the pesticide diazinon over a six week ambient monitoring program in populated areas of Fresno County. A final report, "Report for the Ambient Air Monitoring of Diazinon in Fresno County During Winter, 1997", was forwarded to DPR on April 23, 1998 (Lew to Okumura). An additional 3 weeks of ambient monitoring and a 3 day application monitoring study were conducted during January, 1998. Application monitoring was conducted in Kings County near the use of diazinon on a 40 acre dormant peach orchard. Ambient monitoring, in Fresno County, was conducted to coincide with the use of diazinon as an insecticide on dormant almond and stonefruit orchards. This monitoring was done to fulfill the requirements of AB 1807/3219 (Food and Agricultural Code, Division 7, Chapter 3, Article 1.5) which requires the ARB "to document the level of airborne emissions .... of pesticides which may be determined to pose a present of potential hazard..." when requested by the DPR. Method development, field monitoring and sample analyses were conducted by ARB Testing Section staff.

The "Protocol for the Application and Ambient Air Monitoring of Diazinon in Fresno County During Winter, 1998", is enclosed separately as Appendix I (page 1 of a separate volume of appendices to this report).

The ARB Testing Section report, "Diazinon Method Development and Diazinon Results for Application and Ambient Monitoring Samples", is enclosed separately as Appendix II (page 17 of the separate volume of appendices to this report). The method development results and sampling/analysis Standard Operating Procedures (SOP) are also enclosed in Appendix II (page 38 of the separate volume of appendices to this report).

The pesticide use recommendation and the pesticide use report for the application study is enclosed separately as Appendix III (page 47 of the separate volume of appendices to this report).

The DPR's October 31, 1995 memorandum, "Monitoring Recommendations for Diazinon" is enclosed separately as Appendix IV (page 49 of the separate volume of appendices to this report).

The application and ambient field log sheets are enclosed separately as Appendix V (page 55 of the separate volume of appendices to this report.

The application meteorological monitoring results are enclosed separately as Appendix VI (page 62 of the separate volume of appendices to this report).

II. Chemical Properties of Diazinon

The following information regarding the chemical properties of diazinon was obtained from the DPR's October 31, 1995 "Monitoring Recommendation for Diazinon" (page 49 of appendices).

Pure diazinon (CAS:333-41-5) is a clear colorless liquid with a faint ester-like odor. Technical grades are yellow. Diazinon has a molecular formula of $C_{12}H_{21}N_2O_3PS$, a formula weight of 304.35 g/mole, and a specific density of 1.116-1.118 at 20 °C. It has a water solubility of 71.1, 53.5, and 43.7 mg/L at 10, 20, and 30 °C respectively, a Henry's Constant of 1.13×10^{-7} atm·m^3/mol at 20 °C, and a vapor pressure of 8.47×10^{-5} mmHG at 20 °C. Diazinon is miscible with a variety of organic solvents.

The hydrolysis half-life ($t_{1/2}$) of diazinon in water (20 °C) is 11.8 hours (pH 3.1); 185 days (pH 7.4); 136 days (pH 9.0) and 6 days (pH 10.4). Reported soil half-lives following incubation of 10 ppm diazinon are 12.5 weeks (sterile sand loam); 6.5 weeks (sterile organic soil); <1 week (non-sterile sand loam); and 2 weeks (non-sterile organic soil). Exposure of diazinon to UV light produces hydroxydiazinon. The photolytic $t_{1/2}$ for this reaction, in aqueous buffer solution (25 °C and pH 7.0), has been calculated to be 15 days. The $t_{1/2}$ of diazinon is approximately 3.2 weeks in a neutral solution at room temperature. Diazinon and its oxidative product diazoxon, have been found in fogwater. The distribution of diazinon (1.6 ng/m^3) was 76.1% (vapor phase); 19.8% (dissolved phase); 3.7% (air particles); and 0.4% (water particles). The distribution of diazoxon was 13.4%, 81.7%, 4.9%, and 0.02% respectively.

The acute oral LD_{50} of diazinon for rats ranges from 240 to 480 mg/kg. The LD_{50} (96 hour) for rainbow trout is 16 mg/L, and 2.6 to 3.2 mg/L for bluegill sunfish. The OSHA 8-hour time weighted average for a personal exposure limit is 0.1 mg/m^3. Diazinon has entered the risk assessment process at DPR under the SB 950 (Birth Defect Prevention Act of 1984) based on its potential for reproductive and mutagenic adverse health effects.

III. Sampling

A sketch of the sampling apparatus is shown in Figure 1 of Appendix I (appendices pg. 9). Samples were collected by passing a measured volume of ambient air through XAD-2 resin. The XAD-2 resin tubes were obtained from SKC (#226-30-06). Calibrated rotometers were used to set and measure sample flow rates (3.0 L/minute). The rotometers were calibrated using a certified digital bubble flowmeter. The sampling system was operated continuously with the exact operating interval noted. Samplers were leak checked prior to and after each sampling period with the sampling cartridges installed. Any change in the flow rates was recorded in the field log book (see appendices pg. 55). The resin tubes were protected from direct sunlight and rain and supported

about 1.5 meters above the ground (or roof) during the sampling period. At the end of each sampling period the tubes were capped and placed in culture tubes with an identification label affixed. The field log book was also used to record start and stop times, sample identifications and any other significant comments. Subsequent to sampling, the sample tubes were transported on dry ice, as soon as reasonably possible, to the ARB Monitoring and Laboratory Division, Testing Section laboratory. The samples were stored in the freezer or extracted/analyzed immediately.

A. Application Monitoring

The use pattern for diazinon suggested that application-site monitoring should be conducted during the months of January or February in Fresno County, and that the monitoring be associated with an application to almond or stonefruit orchards. A three day monitoring period was to be established with intended sampling times as follows: (where the first sample is started at the start of application) application + 1 hour, followed by one 2-hour sample, one 4-hour sample, two 8-hour samples and two 24-hour samples. Information collected included: 1) the elevation of each sampling station with respect to the field, 2) the orientation of the field with respect to North (identified as either true or magnetic), 3) an accurate record of the positions of the monitoring equipment with respect to the field, including the distance each monitor is positioned away from the edge of the field and an accurate drawing of the monitoring site showing the precise location of the monitoring equipment and any wind obstacles with respect to the field, 4) the field size, 5) the application rate, 6) formulation and 7) method and length of application.

An 40 acre plot of peaches was chosen for the application monitoring site. The site was just south of Fresno County in Kings County. Refer to Figure 2 for a diagram of the application site. Refer to Appendix III (page 44 of appendices) for a copy of the pesticide use recommendation and the pesticide use report. Details regarding the site and application are summarized below in Table 1.

Table 1.
Application Information

Range/Township/Section:	R21E/T17S/S16
Product Applied:	Diazinon 50W, Clear Crop
Type of Application:	"Ground" spray (blower) rig
Application Rate:	4 lbs. Diazinon 50W per acre in 200 gallons of water (2 lbs. Diazinon A.1. per acre)(max label rate)
Applicator:	Crinklaw Farm Services

Prior to the application, background samples were taken at each position to establish if any diazinon was detectable in the air before the application (i.e., from nearby applications). The background samples were collected from 1700 on January 26 to 0930 on January 27, 1998 (16.5 hours). The January 27, 1998 application started at 0930 and ended at 1330. Referring to Figure 2, with the rows oriented east/west, the application started at the southeast side. Table 2 lists the approximate sampling periods.

Table 2.
Application Sampling Periods

Period		Date	Time
1	Application plus 1 hour	1/27/98	0930 to 1500
2	2 hour	1/27/98	1500 to 1700
3	4 hour	1/27/98	1700 to 2100
4	8.5 hour	1/27-28/98	2100 to 0530
5	7.5 hour	1/28/98	0530 to 1300
6	23 hour	1/28-29/98	1300 to 1200
7	24 hour	1/29-30/98	1200 to 1200

Four samplers were positioned, one on each side of the field. A fifth sampler was collocated at the east position. The west, north, east and south samplers were positioned approximately 24 yards, 25 yards, 16 yards and 24 yards from the field respectively. All of the samplers were at the same elevation as the field.

The meteorological station was set up to determine wind speed and direction, relative humidity and air temperature. The meteorological station was positioned at the southwest edge of the field (oriented toward geographic north) the data was collected at a height of approximately 20 feet. This station continued to operate continuously throughout the sampling period collecting data at 1 minute intervals using a data logger. The meteorological station data is available on a 1.44 MB diskette (comma delimitted format). Appendix VII (page 62 of the appendices) lists the meteorological station data in 15 minute averages for the test period. ARB staff noted the degree of cloud cover, on the sample log sheet, at the start of application and whenever sample cartridges were changed. The skies were overcast during the background sample collection, clear through the first 4 sampling periods and were overcast with occasional rain and fog during the remainder of the monitoring periods.

B. Ambient Monitoring

The use patterns for diazinon suggested that ambient monitoring should take place in Fresno County during a 30- to 45-day sampling period in the months of January or February. Actual monitoring took place from January 12 to February 2, 1998. Four sampling sites were selected by ARB personnel from the areas of Fresno County where almond and stonefruit farming is predominant and in relatively high population areas or in areas frequented by people. Sites were selected with considerations for both accessibility and security of the sampling equipment. The five sites are listed in Table 3.

Table 3.
Ambient Sampling Sites

REE	Kings Canyon Unified District Office 675 W. Manning Reedley, CA 63654 Range/Township/Section: 23E/15S/27-NW1/4 of NE1/4	(209) 637-1200 Carl Campbell
ARB	Air Resources Board, Ambient Air Monitoring Station 3425 N First, Suite 205B Fresno, CA 228-1825 Range/Township/Section: 20E/13S/22-SE1/4 of SE1/4	(209) 228-1825 Peter Ouchida
CEN	Centerville School 48 S. Smith Centerville, CA 93657 Range/Township/Section: 23E/14S/8-NW1/4 of NW1/4	(209) 228-1825 Rosemary Debillar, Principal
SAN	Fairmont Elementary School 3095 N. Greenwood Sanger, CA 93657 Range/Township/Section: 22E/13S/22-SE1/4 of SW1/4	(209) 875-6521 Richard Supelveda
PAR	Parlier High School 601 3rd Street Parlier, CA 93648 Range/Township/Section: 22E/15S/24-SW1/4 of NE1/4	(209) 646-3573 Glenn Bundy, Principal

The Kings Canyon Unified District Office is in a residential and business area in Reedley. There are walnuts and stonefruit orchards 1 to 2 miles to the south and east. The sampling unit was placed on the roof of a single story building at a height of approximately 12 feet. The sampling cartridges were positioned approximately 4 feet above the roof. Thus, air was sampled through the cartridges at a height of approximately 16 feet.

The Centerville School is on the west edge of the residential area of Centerville. Stonefruit orchards bordered the school on the south and west sides (across the street). The sampling unit was placed on the roof of a single story building at a height of approximately 12 feet. The sampling cartridges were positioned approximately 4 feet above the roof. Thus, air was sampled through the cartridges at a height of approximately 16 feet.

The Fairmont Elementary School is in a residential and agricultural area of Sanger. There are small plots of almonds and walnuts about ½ mile to the southwest, west and north of the school. The sampler was on the roof of a 1-story class room. The sampling unit was placed on the roof of a

single story building at a height of approximately 13 feet. The sampling cartridges were positioned approximately 4 feet above the roof. Thus, air was sampled through the cartridges at a height of approximately 17 feet.

The Parlier High School is at the north edge of a residential area in Parlier. There are stonefruit orchards several hundred yards to the north and east and grapes to the west of the school. The sampler was on the roof of the 1-story high school office. The sampling unit was placed on the roof of a single story building at a height of approximately 11 feet. The sampling cartridges were positioned approximately 4 feet above the roof. Thus, air was sampled through the cartridges at a height of approximately 15 feet.

The background monitoring was conducted at the ARB's ambient air monitoring station in downtown Fresno. The sampler was placed on a second story roof near other ARB monitoring equipment and the sample height was approximately 4 feet above the roof (approximately 35 feet above the ground).

The samples were collected by ARB personnel over a three week period from January 12 - February 3, 1996. Twenty-four hour (approximately) samples were taken Monday through Friday (4 samples/week) at a flow rate of 3.0 liters per minute. Twelve discrete sampling-days were monitored at each site for a total of 60 samples (plus 15 collocated samples, 3 trip blanks and 27 quality assurance spikes).

IV. Analytical Methodology

"The Standard Operating Procedures for Sampling and Analysis of Diazinon" are enclosed as Appendix III (page 38 of appendices). The procedures specify that the exposed XAD-2 resin tubes are stored in an ice chest on dry ice or freezer until desorbed with 2.5 mL of ethyl acetate. The sorbent is spiked with 500 ng of diazinon-D_{10} prior to extraction. The splitless injection volume is 4 μL. A gas chromatograph with a DB-17MS capillary column and a mass selective detector (MSD) is used for analysis. The MSD is operated in selected ion monitoring mode.

V. Application and Ambient Results

Tables 4 and 7 present the results of application and ambient air monitoring for diazinon respectively. Summaries of sample results are reported in Tables 5 (application) and 8 (ambient). Laboratory results, in units of μg/sample, equal to or above the estimated quantitation limit (EQL) are reported to 3 significant figures. Air concentration results (in units of ng/m^3 and pptv) are reported to 2 significant figures. Results below the EQL but equal to or above the minimum detection limit (MDL) are reported as "detected". Results below the MDL are reported as "<MDL".

The equation used to convert diazinon air concentration from units of $\mu g/m^3$ to volume/volume units at 1 atmosphere and 25 °C is:

$$pptv=(ng/m^3) \times \frac{(0.0820575 \text{ liter-atm/mole-°K})(298 °K)}{(1 \text{ atm})(304.35 \text{ gram/mole})} = (.08035) \times (ng/m^3)$$

The MDL and EQL are based on a USEPA detection limit calculation. The MDL equals 3.14 times the standard deviation of analysis of seven replicate low level matrix spikes. The EQL equals 5 times the MDL. The analytical MDL and EQL for diazinon are 8.88 ng/sample and 44.5 ng/sample respectively. The air concentrations, expressed in units of ng/m^3 (or pptv), associated with the MDL and EQL are dependent on the volume of air sampled, which varies from sample to sample. For a 24-hour sampling period at 3 Lpm these air concentrations would be 2.1 ng/m^3 (0.17 pptv) and 10 ng/m^3 (0.83 pptv) as associated with the MDL and EQL respectively.

A. Application Monitoring Results

Application sample results are also summarized as associated with each sampling period "wind rose" in Figure 3. The "spokes" of the wind rose correspond to the direction of origin of the wind (with respect to geographic north). For example, the wind was predominantly from the east/southeast during the background sampling period. The segments of each spoke correspond to incremental increases in wind speed of 2 mph each. The length of the spoke (and each segment) corresponds to the portion of the sampling time that the wind was from that direction (at that velocity).

All four of the 13-hour background samples collected were found to be above the EQL. The highest background concentration, 75 ng/m^3, was observed at the north sampling position. Of the twenty-eight application samples collected (spikes, blanks, collocated and background samples excluded) all were found to be above the EQL of 44.5 ng/sample. The highest diazinon concentration, 5500 ng/m^3 (440 pptv), was observed at the west sampling site during the 3rd (4 hour) sampling period.

Referring to the field log sheets (page 62 of the appendices), some samples were collected under fog and rain conditions.

B. Ambient Monitoring Results

Of the 60 ambient samples collected (spikes, blanks and collocated samples excluded), thirty-three were found to be above the EQL, seventeen were found to be "detected", and ten were found to be <MDL. Of the 12 samples collected at the urban background site (ARB) 10 had diazinon results above the MDL.

Referring to the field log sheets (page of the appendices), some samples were collected under fog and rain conditions.

VI. Quality Assurance

Field quality control (QC) for the application monitoring included the following:

1) Four field spikes (same environmental and experimental conditions as those occuring at the time of ambient sampling) prepared by the Testing Section staff. The field spikes were obtained by sampling ambient air during the background sampling at 3 L/minute (collocated with a background sample);
2) four trip spikes;
3) replicate samples (collocated) collected at one of the four sampling sites;
4) a trip blank; and
5) background samples.

The DPR's October 31, 1995 memo, "Monitoring Recommendation for Diazinon", stated that "Field blank and field spike samples should be collected at the same environmental (temperature, humidity, exposure to sunlight) and experimental (similar air flow rates) conditions as those occurring at the time of sampling." The background samples were collected at the same environmental and experimental conditions as those occurring at the time of sampling (except for total sample volume). However, no "field blanks" were collected. Collection of true field blanks would involve rather complicated procedures and is not practical under field conditions. The trip blank was collected at the time of the sampling but did not experience the same environmental and experimental conditions except for transport and storage.

Field QC for the ambient monitoring included the following:

1) Five field spikes (same environmental and experimental conditions as those occurring at the time of ambient sampling) prepared by the Testing Section staff; the field spikes were obtained by sampling ambient air at the background monitoring site for 24 hour periods at 3L/minute (collocated with an ambient sample);
2) five trip spikes;
3) five lab spikes;
4) replicate (collocated) samples taken for three dates at each sampling location; and
5) trip blanks collected once per week (see comment above regarding field blanks).

The instrument dependent parameters (reproducibility, linearity and LOD) are discussed in the SOP (page 13 of the appendices) and in the analytical report (page 21 of the appendices). A chain of custody sheet accompanied all samples. Rotameters were calibrated before the monitoring using a calibrated digital bubblemeter. The rotameter calibrations were also checked at the end of the study.

VII. Quality Assurance Results

A. Method Development

Refer to Appendix 1 (page 38 of the appendices), "Standard Operating Procedure for the Sampling and Analysis of Diazinon", for discussion and results of method development studies.

B. Trip Blanks

The application and ambient trip blank results were all less than the MDL of 7.50 ng/sample for diazinon.

C. Application Background Sample Results

All four of the application background samples had results greater than the EQL for diazinon. These background concentrations were at levels similar to those observed during the ambient study.

D. Collocated Sample Results

The results of application and ambient collocated samples are listed in Table 6 and Table 9 respectively. The relative difference (RD = difference/average x 100) is listed. There are no established acceptance criteria for collocated samples for this program. Generally though, relative difference results of up to 40% (i.e., the average ± 20%) are reasonable.

For the application study, seven pairs of collocated samples were collected. Six of the pairs had a relative difference of less than 40% and the remaining pair was 56%.

For the ambient study, fifteen pairs of collocated samples were collected. Nine of the pairs had a relative difference of less than 40%, one pair had one value above and the other below the EQL and the remaining five pairs were either "detected" or <MDL.

E. Laboratory Spikes

Laboratory spikes are prepared at the same time and at the same level as the trip spike and field spike sets. The laboratory spikes are kept in a freezer until extraction and analysis. The extraction and analysis of laboratory, trip and field spikes normally occurs at the same time. Laboratory spikes for the application and ambient studies were prepared by Testing Section staff.

The laboratory spike results for the application and ambient studies are listed in Tables 10 and 13 respectively. Each of the nine sampling cartridges was spiked with 100 ng of diazinon. The average recoveries for the application and ambient lab spikes were 57% and 75% respectively.

F. Trip Spikes

Trip spikes are prepared at the same time and at the same level as the laboratory spike and field spike sets. The trip spikes are kept in a freezer until transported to the field. The trip spike samples are kept on dry ice in an ice chest (the same one used for samples) during transport to and from the field and at all times while in the field except for trip spike sample log-in and labeling. Trip spikes for the application and ambient studies were prepared by Testing Section staff.

The trip spike results for the application and ambient studies are listed in Tables 11 and 14 respectively. Each of the nine sampling cartridges was spiked with 100 ng of diazinon. The average recoveries for the application and ambient trip spikes were 63% and 80% respectively. These results are consistent with the lab spike results and indicate that the sample transport, storage and analytical procedures used in this study produce acceptable results for diazinon.

G. Field Spikes

Field spikes are prepared at the same time and at the same level as the laboratory spike and trip spike sets. The field spikes are kept in a freezer until transported to the field. The field spike samples are kept on dry ice in an ice chest (the same one used for samples) during transport to and from the field and at all times while in the field except for the sampling period. Field spikes were collected at the same environmental and experimental conditions as those occurring at the time of ambient sampling. The field spikes were obtained by sampling ambient air through a previously spiked cartridge. (i.e., collocated with an ambient or background sample). Field spike sets for the application and ambient studies were prepared by Testing Section staff.

The field spike results for the application and ambient studies are listed in Tables 12 and 15 respectively. Each of the nine sampling cartridges was spiked with 100 ng of diazinon. The average recoveries for the application and ambient field spikes were 48% and 77% respectively. The recovery for application field spike sample FS04 was 7%. This very low result may be due to the fact that the corresponding background (north) sample result was 2.25 times higher than the spike level. To minimize the effect of random error on the recovery result the spike level should be at least 5 times higher than the corresponding collocated sample result. Thus the application field spike samples should have been spiked at a level of about 1000 ng/sample. With the exception of field spike sample FS04, these results are consistent with the lab and trip spike results and indicate that the sampling, sample transport, storage and analytical procedures used in this study produce acceptable results for diazinon.

FIGURE 1. DIAZINON AMBIENT MONITORING AREA

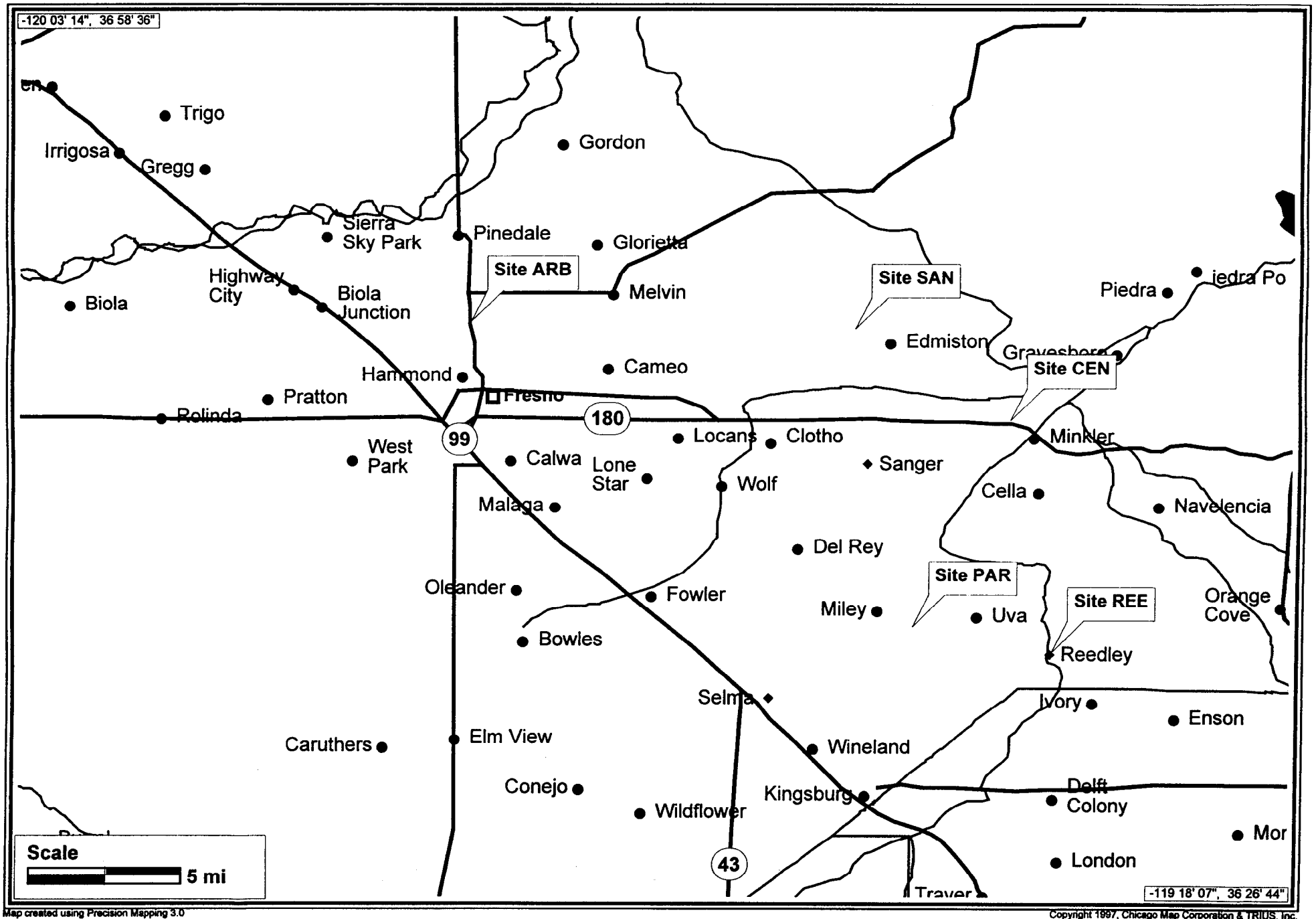
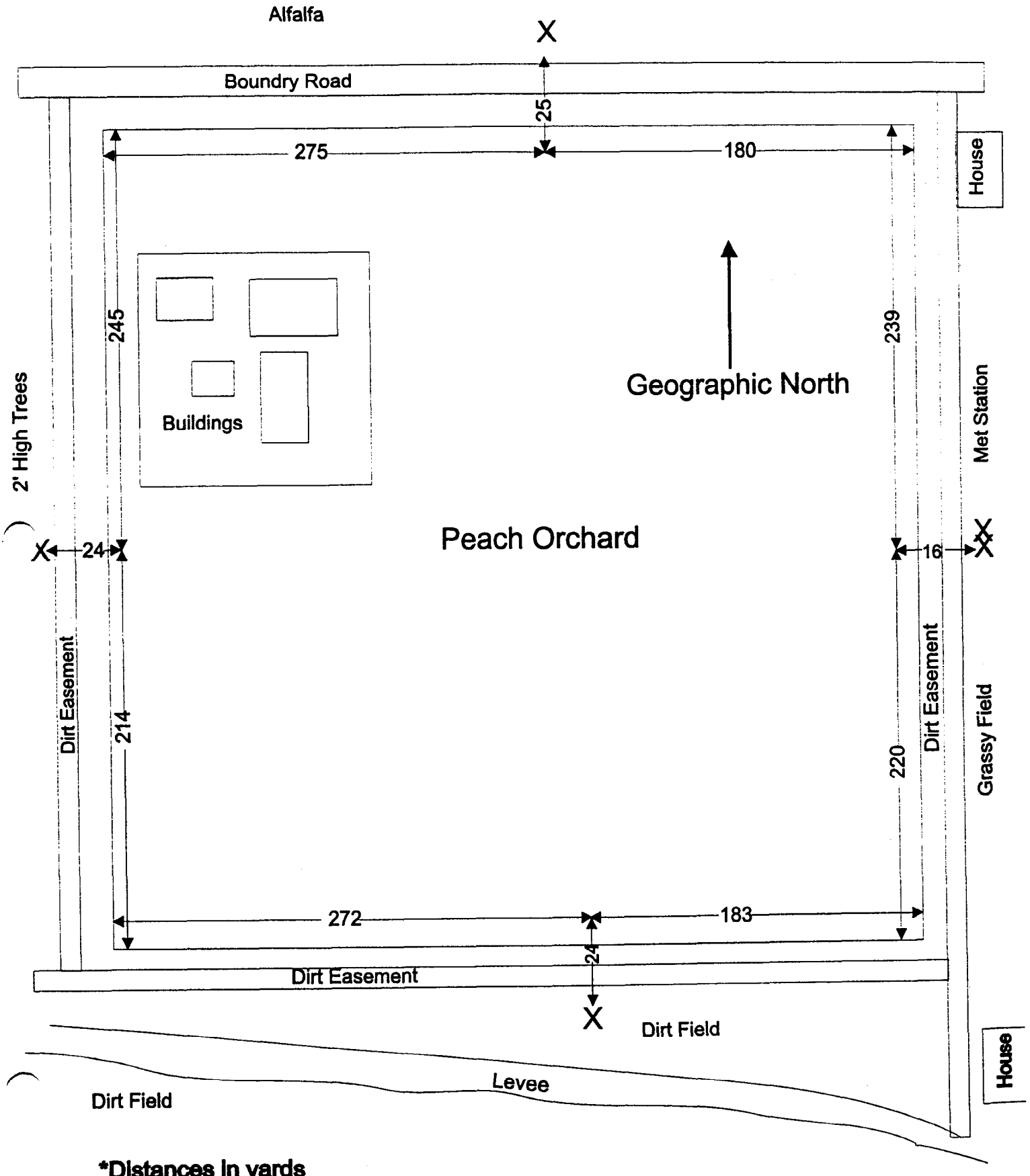


Figure 2
Diazinon Application Site



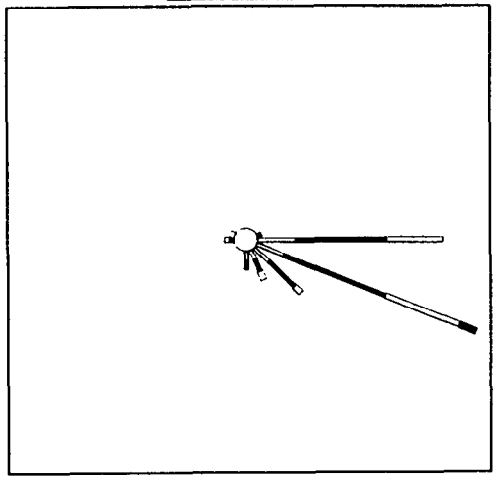
*Distances in yards

FIGURE 3. DIAZINON APPLICATION DATA (ng/m3)

BACKGROUND
16.5 Hours

[N] 150

[W] 34



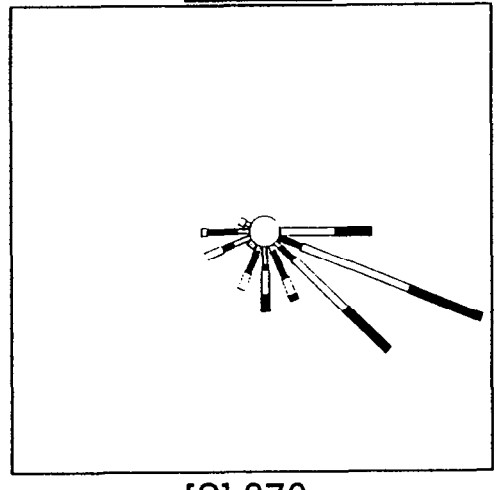
[E] 29

[S] 28

PERIOD 1
5.5 Hours

[N] 3100

[W] 3800



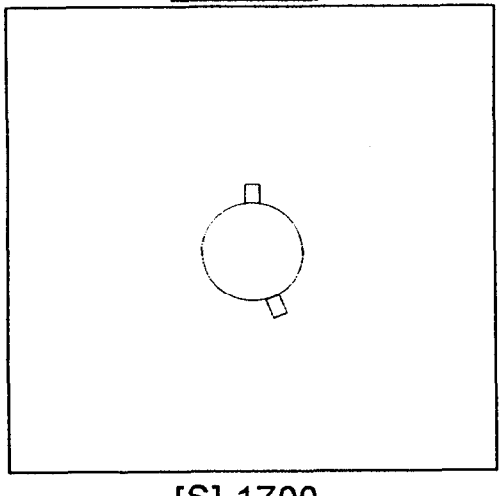
[E] 1700

[S] 870

PERIOD 2
2.0 Hours

[N] 2900

[W] 5200



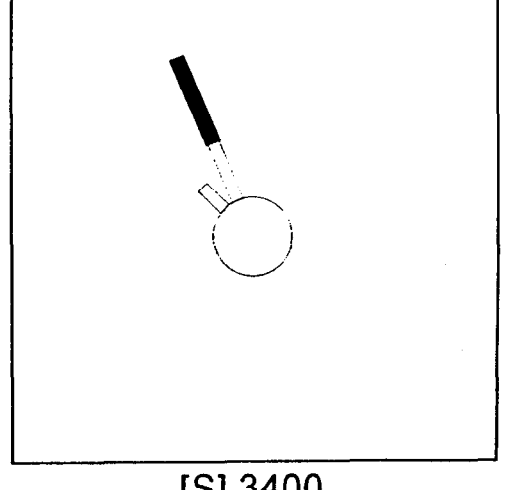
[E] 1800

[S] 1700

PERIOD 3
4.0 Hours

[N] 3500

[W] 5500



[E] 3000

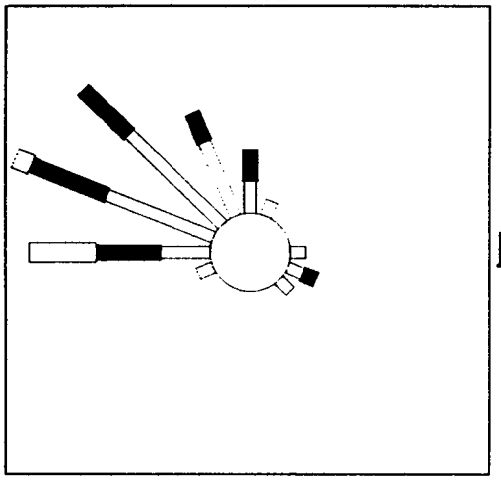
[S] 3400

FIGURE 3. DIAZINON APPLICATION DATA (ng/m3)

PERIOD 4
8.5 Hours

[N] 800

[W] 1500



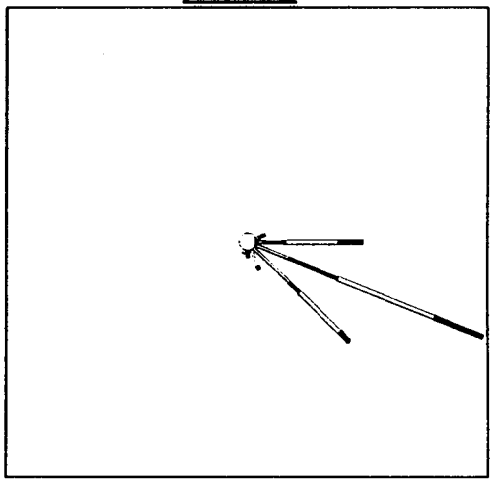
[E] 1100

[S] 1300

PERIOD 5
7.5 Hours

[N]150

[W] 3000



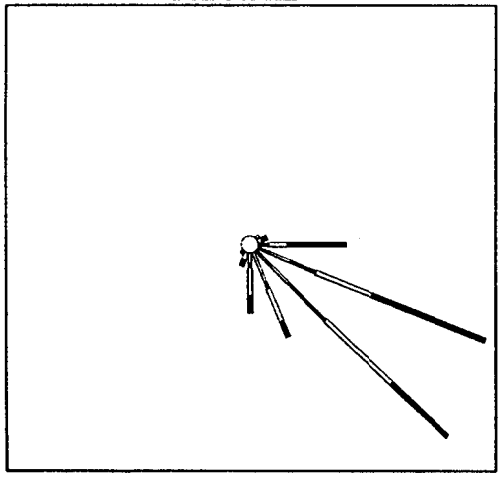
[E] 84

[S] 170

PERIOD 6
23 Hours

[N] 940

[W] 2400



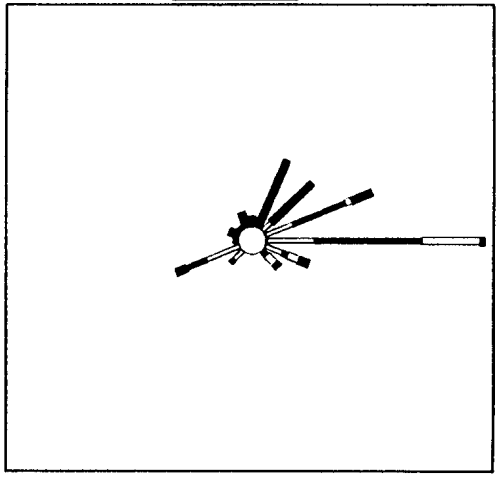
[E] 94

[S] 58

PERIOD 7
24Hours

[N] 170

[W] 600



[E] 130

[S] 125

Table 4. Diazinon Application Monitoring Results

Log Number	Sample ID	Start Date Time	Finish Date Time	Cubic Meters	Diazinon Amount (ng/sample)	Diazinon Conc. (ng/m3)	Diazinon Conc. (pptv*)
1	EB	1-26-98 1715	1-27-98 0930	2.9	8.40E+1	2.9E+01	2.3E+00
3	NB	1-26-98 1705	1-27-98 0950	3.0	2.25E+2	7.5E+01	6.0E+00
5	WB	1-26-98 1655	1-27-98 0940	3.0	1.03E+2	3.4E+01	2.8E+00
7	SB	1-26-98 1645	1-27-98 0935	3.0	8.56E+1	2.8E+01	2.3E+00
9	TB	1/27/98 0930	1/27/98 0930	0.0	<MDL	NA	NA
10	E01	1-27-98 0930	1-27-98 1450	1.0	1.60E+3	1.7E+03	1.3E+02
11	E01D	1-27-98 0930	1-27-98 1450	1.0	1.23E+3	1.3E+03	1.0E+02
12	S01	1-27-98 0935	1-27-98 1455	1.0	8.33E+2	8.7E+02	7.0E+01
13	W01	1-27-98 0940	1-27-98 1500	1.0	3.66E+3	3.8E+03	3.1E+02
14	N01	1-27-98 0950	1-27-98 1505	0.95	2.96E+3	3.1E+03	2.5E+02
15	E02	1-27-98 1450	1-27-98 1650	0.36	6.36E+2	1.8E+03	1.4E+02
16	E02D	1-27-98 1450	1-27-98 1650	0.36	6.07E+2	1.7E+03	1.4E+02
17	S02	1-27-98 1455	1-27-98 1655	0.36	4.93E+2	1.4E+03	1.1E+02
18	W02	1-27-98 1500	1-27-98 1700	0.36	1.86E+3	5.2E+03	4.2E+02
19	N02	1-27-98 1505	1-27-98 1705	0.36	1.04E+3	2.9E+03	2.3E+02
20	E03	1-27-98 1650	1-27-98 2105	0.76	2.26E+3	3.0E+03	2.4E+02
21	E03D	1-27-98 1650	1-27-98 2105	0.76	2.30E+3	3.0E+03	2.4E+02
22	S03	1-27-98 1655	1-27-98 2110	0.77	2.64E+3	3.4E+03	2.8E+02
23	W03	1-27-98 1700	1-27-98 2115	0.76	4.21E+3	5.5E+03	4.4E+02
24	N03	1-27-98 1705	1-27-98 2120	0.77	2.70E+3	3.5E+03	2.8E+02
25	E04	1-27-98 2105	1-28-98 0520	1.5	1.66E+3	1.1E+03	9.0E+01
26	E04D	1-27-98 2105	1-28-98 0520	1.5	1.87E+3	1.3E+03	1.0E+02
27	S04	1-27-98 2110	1-28-98 0530	1.5	1.97E+3	1.3E+03	1.1E+02
28	W04	1-27-98 2115	1-28-98 0535	1.5	2.32E+3	1.5E+03	1.2E+02
29	N04	1-27-98 2120	1-28-98 0540	1.5	1.20E+3	8.0E+02	6.4E+01
30	E05	1-28-98 0520	1-28-98 1250	1.4	1.13E+2	8.4E+01	6.7E+00
31	E05D	1-28-98 0520	1-28-98 1250	1.4	2.01E+2	1.5E+02	1.2E+01
32	S05	1-28-98 0530	1-28-98 1300	1.4	2.25E+2	1.7E+02	1.3E+01
33	W05	1-28-98 0535	1-28-98 1312	1.4	4.13E+3	3.0E+03	2.4E+02
34	N05	1-28-98 0540	1-28-98 1320	1.4	2.09E+2	1.5E+02	1.2E+01
35	E06	1-28-98 1250	1-29-98 1140	4.1	3.84E+2	9.4E+01	7.5E+00
36	E06D	1-28-98 1250	1-29-98 1140	4.1	3.28E+2	8.0E+01	6.4E+00
37	S06	1-28-98 1300	1-29-98 1145	4.1	2.38E+2	5.8E+01	4.7E+00
38	W06	1-28-98 1312	1-29-98 1150	4.1	9.93E+3	2.4E+03	2.0E+02
39	N06	1-28-98 1320	1-29-98 1200	4.1	3.82E+3	9.4E+02	7.5E+01
40	E07	1-29-98 1140	1-30-98 1130	4.3	5.38E+2	1.3E+02	1.0E+01
41	E07D	1-29-98 1140	1-30-98 1130	4.3	5.24E+2	1.2E+02	9.8E+00
42	S07	1-29-98 1145	1-30-98 1135	4.3	5.84E+2	1.4E+02	1.1E+01
43	W07	1-29-98 1150	1-30-98 1145	4.3	2.57E+3	6.0E+02	4.8E+01
44	N07	1-29-98 1200	1-30-98 1150	4.3	7.47E+2	1.7E+02	1.4E+01

<MDL = Value was below the MDL of 8.88 ng/sample.
*pptv at 1 atm and 25 C

Table 5. Summary of Diazinon Application Monitoring Results (ng/m3)

Sampling Period	North	East	East-D	South	West
Background	75	29	-	28	34
1	3100	1700	1300	870	3800
2	2900	1800	1700	1400	5200
3	3500	3000	3000	3400	5500
4	800	1100	1300	1300	1500
5	150	84	150	170	3000
6	940	94	80	58	2400
7	170	130	125	140	600

Table 6. Diazinon Application Collocated Sample

Log Number	Sample ID	Diazinon Conc. (ng/m3)	Average (ng/m3)	Relative Difference
10	E01	1.7E+3		
11	E01D	1.3E+3	**1.5E+3**	**26%**
15	E02	1.8E+3		
16	E02D	1.7E+3	**1.7E+3**	**4.7%**
20	E03	3.0E+3		
21	E03D	3.0E+3	**3.0E+3**	**2.0%**
25	E04	1.1E+3		
26	E04D	1.3E+3	**1.2E+3**	**12%**
30	E05	8.4E+1		
31	E05D	1.5E+2	**1.2E+2**	**56%**
35	E06	9.4E+1		
36	E06D	8.0E+1	**8.7E+1**	**16%**
40	E07	1.3E+2		
41	E07D	1.1E+2	**1.2E+2**	**15%**

Table 7. Diazinon Ambient Monitoring Results

Log Number	Sample ID	Start Date Time	Finish Date Time	Cubic Meters	Diazinon Amount (ng/sample)	Diazinon Conc. (ng/m3)	Diazinon Conc. (pptv*)
1	ARB01	1/12/98 1220	1/13/98 0830	3.6	Det.	Det.	Det.
2	PAR01	1/12/98 1307	1/13/98 0920	3.6	4.60E+1	1.3E+01	1.0E+00
3	REE01	1/12/98 1330	1/13/98 1000	3.7	5.17E+1	1.4E+01	1.1E+00
4	CEN01	1/12/98 1400	1/13/98 1030	3.7	<MDL	<MDL	<MDL
5	SAN01	1/12/98 1430	1/13/98 1050	3.7	<MDL	<MDL	<MDL
6	ARB02	1/13/98 0830	1/14/98 0815	4.3	Det.	Det.	Det.
7	PAR02	1/13/98 0920	1/14/98 0900	4.3	9.59E+1	2.3E+01	1.8E+00
8	REE02	1/13/98 1000	1/14/98 0945	4.3	1.50E+2	3.5E+01	2.8E+00
9	CEN02	1/13/98 1030	1/14/98 1020	4.3	Det.	Det.	Det.
10	SAN02	1/13/98 1050	1/14/98 1045	4.3	<MDL	<MDL	<MDL
11	ARB03	1/14/98 0815	1/15/98 0900	4.5	Det.	Det.	Det.
12	ARB03D	1/14/98 0815	1/15/98 0900	4.5	Det.	Det.	Det.
13	PAR03	1/14/98 0900	1/15/98 1111	4.7	1.37E+2	2.9E+01	2.3E+00
14	PAR03D	1/14/98 0900	1/15/98 1111	4.7	1.38E+2	2.9E+01	2.4E+00
15	REE03	1/14/98 0945	1/15/98 1140	4.7	1.28E+2	2.7E+01	2.2E+00
16	REE03D	1/14/98 0945	1/15/98 1140	4.7	1.24E+2	2.7E+01	2.1E+00
17	CEN03	1/14/98 1020	1/15/98 1209	4.6	Det.	Det.	Det.
18	CEN03D	1/14/98 1020	1/15/98 1209	4.6	Det.	Det.	Det.
19	SAN03	1/14/98 1045	1/15/98 1233	4.6	<MDL	<MDL	<MDL
20	SAN03D	1/14/98 1045	1/15/98 1233	4.6	<MDL	<MDL	<MDL
21	ARB04	1/15/98 0900	1/16/98 0906	4.3	Det.	Det.	Det.
22	PAR04	1/15/98 1111	1/16/98 0945	4.1	9.06E+1	2.2E+01	1.8E+00
23	REE04	1/15/98 1140	1/16/98 1009	4.0	7.00E+1	1.7E+01	1.4E+00
24	CEN04	1/15/98 1209	1/16/98 1029	4.0	<MDL	<MDL	<MDL
25	SAN04	1/15/98 1233	1/16/98 1046	4.0	<MDL	<MDL	<MDL
26	TB04	1/16/98 1130	1/16/98 1130	0.0	<MDL	NA	NA
27	ARB05	1/20/98 0830	1/21/98 0830	4.3	<MDL	<MDL	<MDL
28	PAR05	1/20/98 1045	1/21/98 1030	4.3	6.96E+1	1.6E+01	1.3E+00
29	REE05	1/20/98 1100	1/21/98 1050	4.3	6.39E+1	1.5E+01	1.2E+00
30	CEN05	1/20/98 1115	1/21/98 1115	4.3	<MDL	<MDL	<MDL
31	SAN05	1/20/98 1130	1/21/98 1130	4.3	<MDL	<MDL	<MDL
32	ARB06	1/21/98 0830	1/22/98 0800	4.2	Det.	Det.	Det.
33	ARB06D	1/21/98 0830	1/22/98 0800	4.2	Det.	Det.	Det.
34	PAR06	1/21/98 1030	1/22/98 1025	4.3	1.12E+2	2.6E+01	2.1E+00
35	PAR06D	1/21/98 1030	1/22/98 1025	4.3	1.21E+2	2.8E+01	2.3E+00
36	REE06	1/21/98 1050	1/22/98 1045	4.3	9.14E+1	2.1E+01	1.7E+00
37	REE06D	1/21/98 1050	1/22/98 1045	4.3	9.05E+1	2.1E+01	1.7E+00
38	CEN06	1/21/98 1115	1/22/98 1107	4.3	Det.	Det.	Det.
39	CEN06D	1/21/98 1115	1/22/98 1107	4.3	4.57E+1	1.1E+01	8.5E-01
40	SAN06	1/21/98 1130	1/22/98 1122	4.3	Det.	Det.	Det.
41	SAN06D	1/21/98 1130	1/22/98 1122	4.3	Det.	Det.	Det.
42	ARB07	1/22/98 0800	1/23/98 0815	4.4	Det.	Det.	Det.
43	PAR07	1/22/98 1030	1/23/98 1030	4.3	2.83E+2	6.6E+01	5.3E+00
44	REE07	1/22/98 1045	1/23/98 1050	4.3	7.49E+1	1.7E+01	1.4E+00
45	CEN07	1/22/98 1107	1/23/98 1110	4.3	Det.	Det.	Det.
46	SAN07	1/22/98 1122	1/23/98 1130	4.3	7.81E+1	1.8E+01	1.4E+00
46B	TB07	1/23/98 1130	1/23/98 1130	0.0	<MDL	NA	NA

<MDL= Value was below the MDL of 8.88 ng/sample
Det.= Value was below the EQL of 44.5 ng/sample but above the MDL
*pptv at 25 C and 1 atm.
NA = Not Applicable

Table 7. Diazinon Ambient Monitoring Results

Log Number	Sample ID	Start Date Time	Finish Date Time	Cubic Meters	Diazinon Amount (ng/sample)	Diazinon Conc. (ng/m3)	Diazinon Conc. (pptv*)
47	ARB08	1/26/98 1220	1/27/98 1150	4.2	1.38E+2	3.3E+01	2.6E+00
48	PAR08	1/26/98 1310	1/27/98 1230	4.2	6.74E+2	1.6E+02	1.3E+01
49	REE08	1/26/98 1340	1/27/98 1250	4.2	1.92E+2	4.6E+01	3.7E+00
50	CEN08	1/26/98 1400	1/27/98 1320	4.2	1.31E+2	3.1E+01	2.5E+00
51	SAN08	1/26/98 1415	1/27/98 1340	4.2	1.12E+2	2.7E+01	2.1E+00
52	ARB09	1/27/98 1150	1/28/98 1210	4.4	6.19E+1	1.4E+01	1.1E+00
53	PAR09	1/27/98 1230	1/28/98 1255	4.4	4.87E+2	1.1E+02	8.9E+00
54	REE09	1/27/98 1250	1/28/98 1307	4.4	1.56E+2	3.6E+01	2.9E+00
55	CEN09	1/27/98 1320	1/28/98 1326	4.3	4.16E+2	9.6E+01	7.7E+00
56	SAN09	1/27/98 1340	1/28/98 1342	4.3	8.79E+1	2.0E+01	1.6E+00
57	ARB10	1/28/98 1210	1/29/98 1250	4.4	1.78E+2	4.0E+01	3.2E+00
58	ARB10D	1/28/98 1210	1/29/98 1250	4.4	1.55E+2	3.5E+01	2.8E+00
59	PAR10	1/28/98 1255	1/29/98 1130	4.1	2.74E+2	6.7E+01	5.4E+00
60	PAR10D	1/28/98 1255	1/29/98 1130	4.1	2.87E+2	7.1E+01	5.7E+00
61	REE10	1/28/98 1307	1/29/98 1143	4.1	1.36E+2	3.4E+01	2.7E+00
62	REE10D	1/28/98 1307	1/29/98 1143	4.1	1.29E+2	3.2E+01	2.5E+00
63	CEN10	1/28/98 1326	1/29/98 1206	4.1	5.05E+1	1.2E+01	9.9E-01
64	CEN10D	1/28/98 1326	1/29/98 1206	4.1	4.97E+1	1.2E+01	9.8E-01
65	SAN10	1/28/98 1342	1/29/98 1230	4.1	1.19E+2	2.9E+01	2.3E+00
66	SAN10D	1/28/98 1342	1/29/98 1230	4.1	1.12E+2	2.7E+01	2.2E+00
67	ARB11	1/29/98 1250	1/30/98 1350	4.5	<MDL	<MDL	<MDL
68	PAR11	1/29/98 1130	1/30/98 1230	4.5	1.33E+2	3.0E+01	2.4E+00
69	REE11	1/29/98 1140	1/30/98 1250	4.5	Det.	Det.	Det.
70	CEN11	1/29/98 1206	1/30/98 1313	4.5	Det.	Det.	Det.
71	SAN11	1/29/98 1230	1/30/98 1330	4.5	Det.	Det.	Det.
72	TB11	1/30/98 1330	1/30/98 1330	0.0	<MDL	NA	NA
73	ARB12	2/2/98 1230	2/3/98 1220	4.3	Det.	Det.	Det.
74	PAR12	2/2/98 1300	2/3/98 1400	4.5	7.46E+1	1.7E+01	1.3E+00
75	REE12	2/2/98 1315	2/3/98 1430	4.5	Det.	Det.	Det.
76	CEN12	2/2/98 1340	2/3/98 1450	4.5	Det.	Det.	Det.
77	SAN12	2/2/98 1355	2/3/98 1525	4.6	Det.	Det.	Det.
78	TB12	2/3/98 1525	2/3/98 1525	0.0	<MDL	NA	NA

<MDL= Value was below the MDL of 8.88 ng/sample
Det.= Value was below the EQL of 44.5 ng/sample but above the MDL
*pptv at 25 C and 1 atm.
NA = Not Applicable

Table 8. Summary of Diazinon Ambient Monitoring Results (ng/m3)

Sample Start Date	ARB	CEN	PAR	REE	SAN
1/12/98	Det.	<MDL	13	14	<MDL
1/13/98	Det.	Det.	23	36	<MDL
1/14/98	Det.	Det.	29	27	<MDL
1/14/98	Det.	Det.	29	27	<MDL
1/15/98	Det.	<MDL	22	17	<MDL
1/20/98	<MDL	<MDL	16	15	<MDL
1/21/98	Det.	Det.	26	21	Det.
1/21/98	Det.	11	28	21	Det.
1/22/98	Det.	Det.	66	17	18
1/26/98	33	31	160	46	27
1/27/98	14	96	111	36	20
1/28/98	40	12	67	34	29
1/28/98	35	12	71	32	27
1/29/98	<MDL	Det.	30	Det.	Det.
2/2/98	Det.	Det.	17	Det.	Det.

Maximum	40	96	160	46	29
Average	11	15	49	22	9.8
# Samples	12	12	12	12	12
# >EQL	3	4	12	10	4
# "Det."	7	5	0	2	3
# <MDL	2	3	0	0	5

Only the higher value of each collocated pair was used to calculate the above statistics.
Det. results were factored into the average as (MDL+EQL)/2 = 6.2 ng/m3
<MDL results were factored into the average as MDL/2 = 1.0 ng/m3; assume 4.32 m3 sample volume

<MDL= Value was below the MDL of 8.88 ng/sample
Det.= Value was below the EQL of 44.5 ng/sample but above the MDL

Table 9. Diazinon Ambient Collocated Sample Results

Log Number	Sample ID	Diazinon Conc. (ng/m3)	Average (ng/m3)	Relative Difference
11	ARB03	Det.		
12	ARB03D	Det.	Det.	Det.
32	ARB06	Det.		
33	ARB06D	Det.	Det.	Det.
57	ARB10	4.00E+1		
58	ARB10D	3.49E+1	**3.75E+1**	**14%**
17	CEN03	Det.		
18	CEN03D	Det.	Det.	Det.
38	CEN06	Det.		
39	CEN06D	1.06E+1	Det.	Det.
63	CEN10	1.24E+1		
64	CEN10D	1.22E+1	**1.23E+1**	**1.5%**
13	PAR03	2.91E+1		
14	PAR03D	2.93E+1	**2.92E+1**	**0.80%**
34	PAR06	2.61E+1		
35	PAR06D	2.82E+1	**2.71E+1**	**7.7%**
59	PAR10	6.74E+1		
60	PAR10D	7.07E+1	**6.90E+1**	**4.7%**
15	REE03	2.73E+1		
16	REE03D	2.66E+1	**2.70E+1**	**2.9%**
36	REE06	2.12E+1		
37	REE06D	2.10E+1	**2.11E+1**	**0.91%**
61	REE10	3.35E+1		
62	REE10D	3.17E+1	**3.26E+1**	**5.5%**
19	SAN03	Det.		
20	SAN03D	Det.	Det.	Det.
40	SAN06	<MDL		
41	SAN06D	<MDL	<MDL	<MDL
65	SAN10	2.91E+1		
66	SAN10D	2.72E+1	**2.82E+1**	**6.5%**

<MDL= Value was below the MDL of 8.88 ng/sample
Det.= Value was below the EQL of 44.5 ng/sample but above the MDL

Table 10. Diazinon *Application Laboratory* Spike Results

Sample Name	Diazinon Amount (ng/sample)	Expected Diazinon Amount (ng/sample)	Percent Recovery
LS01	58.6	100	59%
LS02	58.8	100	59%
LS03	51.9	100	52%
LS04	57.4	100	57%

Table 11. Diazinon *Application Trip* Spike Results

Sample Name	Diazinon Amount (ng/sample)	Expected Diazinon Amount (ng/sample)	Percent Recovery
TS01	60.9	100	61%
TS02	63.4	100	63%
TS03	66.6	100	67%
TS04	59.6	100	60%

Table 12. Diazinon *Application Field* Spike Results

Sample Name	Diazinon Amount (ng/sample)	Background Diazinon Amount (ng/sample)	Net Diazinon Amount (ng/sample)	Expected Diazinon Amount (ng/sample)	Percent Recovery
EFS01	129	84	45.0	100	45%
SFS02	160	86	74.0	100	74%
WFS03	171	103	68.0	100	68%
NFS04	232	225	7.0	100	7%

Table 13. Diazinon *Ambient Lab* Spike Results

Sample Name	Diazinon Amount (ng/sample)	Expected Diazinon (ng/sample)	Percent Recovery
LS01	72.8	100	73%
LS02	72.4	100	72%
LS03	76.5	100	77%
LS04	72.1	100	72%
LS05	80.9	100	81%

Table 14. Diazinon *Ambient Trip* Spike Results

Sample Name	Diazinon Amount (ng/sample)	Expected Diazinon (ng/sample)	Percent Recovery
TS01	82.3	100	82%
TS02	83.7	100	84%
TS03	85.4	100	85%
TS04	73.1	100	73%
TS05	77.7	100	78%

Table 15. Diazinon *Ambient Field* Spike Results

Sample Name	Diazinon Amount (ng/sample)	Collocated* Diazinon Amount (ng/sample)	Net Diazinon Recovered (ng/sample)	Expected Diazinon (ng/sample)	Percent Recovery
FS01	103	21.8	81.3	100	81%
FS02	98.7	21.8	76.9	100	77%
FS03	99.6	21.8	77.8	100	78%
FS04	98.2	21.8	76.4	100	76%
FS05	95.0	21.8	73.2	100	73%

*The field spikes were collocated with sample ARB4 which is reported as "detected" in Table 7.
The actual amount found, 21.8 ng/sample, in sample ARB4 was used for the background correction above.