STATE OF CALIFORNIA EDMUND G. BROWN JR., Governor

DEPARTMENT OF FOOD AND AGRICULTURE

1220 N Street
Sacramento
95814

January 31, 1979

To: All Agricultural Commissioners and Other Interested Parties

Subject: The 1978 MCPA Feasibility Study

Attached is the California Department of Food and Agriculture Feasibility Study for Monitoring MCPA in the air and on foliage. This study was conducted in Butte County during the period early June through late July with the cooperation of the Butte County Agricultural Commissioner's Office. It was intended to produce information which would aid the newly formed Environmental Hazards Assessment Program in developing experimental designs and selecting analytical procedures necessary for in depth studies to be conducted in the 1979-80 fiscal year.

Please direct any comments to Ron Oshima, Program Manager, Environmental Hazards Assessment Program, telephone number (714) 787-4683.

Sincerely

Jake

Jake Mackenzie, Assistant Director
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Attachment

FEASIBILITY STUDY ON ENVIRONMENTAL MONITORING OF MCPA APPLICATIONS IN BUTTE COUNTY, CALIFORNIA 1978

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INTRODUCTION

MCPA (4-Chloro-2-Methylphenoxyacetic acid) is a phenoxy herbicide widely used in rice production for broadleaf weed control. This herbicide is considered to be vital for obtaining acceptable yields in rice with minimal production cost (Soderquist and Crosby, 1975). The typical application is conducted by fixed wing aircraft. During the 1978 season, MCPA was applied to 88,492 acres of rice in Butte County.

Recently grower complaints from the rice growing region in Butte County allege that damage to nontarget commercial crops, namely almonds, kiwis, and pistachios, is occurring as a result of the drift from MCPA applications to nearby rice plantings. Butte County has approximately 90,000 acres of rice owned by 180 growers who may utilize MCPA. There are 16 pest control operator companies registered in Butte County who are engaged in aerial applications of pesticides. A total of 15,976 gallons of MCPA were applied to rice in Butte County for control of weeds during 1978. Rice fields and orchards occur adjacent to each other at the interface between these agricultural areas. MCPA applications for weed control generally occur between June 1 and July 30 when the rice is between 35 and 65 days old and 8 to 10 inches tall (U.C. Agricultural Extension).

The California Department of Food and Agriculture (CDFA) has initiated an Environmental Hazards Assessment program to monitor the impact of herbicides, pesticides, and agricultural chemicals in the environment. It will be fully staffed and operational with funding from the 1979-80 fiscal year. In the interim, several small scale feasibility studies were conducted to obtain needed information to properly plan anticipated monitoring activities and point out problem areas. The purpose of this feasibility study was: 1) to determine whether MCPA could be detected in the air and on foliage in the application area and at downwind sampling sites; 2) to evaluate monitoring methods and current monitoring instrumentation.

METHODS AND MATERIALS

This project monitored weather and air during aerial applications, and sampled orchard foliage. All times reported refer to Pacific Standard Time.

Weather Monitoring

Meteorological measurements consisted of monitoring wind speed and direction, air temperature, relative humidity, and barometric pressure. The wind sensing system consists of a low-threshold stainless steel cup anemometer and lightweight directional vane, both mounted on a prewired crossarm that is attached to the top of a 20 ft telescoping tower. Windspeeds from 0.6 to 50 mph can be recorded with an accuracy of ± 1% or 0.15 mph, whichever is greater. Temperature, relative humidity, and barometric pressure were measured and recorded with a meteorograph stored in a shelter.

Orchard Foliage Sampling

The location of each orchard sampled and its relationship to the application sites is presented in Figure 1. Locations 1 (pistachio) and 2 (almond) were approximately 2 miles south and 1 mile north of any rice fields. The almond trees at location 3 were only 100 ft north of the nearest rice; location 4 (almond) was ¼ mile west of location 3 and 400 yards north of a rice field. Locations 5 (almond) and 6 (almond) were at least 2 miles north of planted rice. One-half mile of grain separated location 7 from rice to the south.

Between May 16 and October 3, six sets of foliage samples were collected from seven locations. Location 1 consisted of a young 260-acre pistachio orchard. Samples of leaves and twigs were taken from three locations within the orchard. The north block was designated 1A; the north half of the south block was labeled 1B; 1C included the south half of the south block. Due to the small tree size, samples from this pistachio orchard were taken from all sides of the trees.

Almond orchard samples were clipped from the southern exposure of the trees up to a height of 10 feet. A minimum of 8 ounces of foliage was taken from each sample location; the leaves and twigs were placed in plastic bags, sealed, and kept cool until analyzed. Five of the six sample collections were made by Butte County personnel.

Foliage samples were analyzed for MCPA, 2,4-D and propanil using procedures developed by the CDFA Chemistry Laboratory.

Air Sampling

Air samples were obtained using both high and low volume air samplers. The high volume (HiVol) samplers (Staplex Model TF1A) were powered by portable gasoline generators located downwind of the instruments. HiVol samplers were originally calibrated at 70 cubic feet per minute (cfm) when purchased but were not recalibrated before use because of a lack of calibration equipment and facilities. Air was drawn through 30 gram beds of Amberlite XAD-4 (polystyrene, divinylbenzene copolymer) macroreticular polymer resin beads (20/50 mesh; Rohm and Haas, Philadelphia, PA) for two hours. After the samples were drawn, the resin was transferred to a clean glass jar and placed on ice in chests for transport to the laboratory. The XAD-4 resin used as the capture media was cleaned before use by the Environmental Toxicology Department at U.C. Davis. This procedure involves washing the resin beads with hydrochloric acid and water, then extracting with acetone in a soxhlet for eight hours and finally drying the beads overnight in an oven.

Recovery efficiencies were determined by spiking the intake of air samplers with a known amount of MCPA using the general procedure of Woodrow and Sieber, 1978. MCPA levels were determined by the CDFA Chemistry Laboratory. A recovery of 60 percent of the spiked amount was determined.

One low-volume air sampler, Misco Model 7750, was operated over a three-week period beginning on June 28. An almond orchard near Goodspeed Watt Road and Pratt Grant Road was used as the sample location for the entire period. The air sampler was positioned in the service yard of this almond orchard and run continuously at a rate of 0.3 ft^3 / min using a power converter to convert AC current to DC. Ethylene glycol (100 milliliters) was used as the collection media (Miles, et al., 1970). The sample media was collected and replaced weekly, resulting in a total of three samples.

MCPA Application Site Descriptions

Site No. 1

The weather station was in operation by 0530. Air temperature was 18°C, relative humidity 83 percent and barometric pressure 1007 mb. The wind blew from the south to southeast at a mean velocity of 8 mph. Six air samplers and three generators were positioned downwind of the 200-acre rice field (Figure 2). Monitoring locations 1 and 2 were established at a distance of 1320 ft from the application site because of a lack of access roads. Locations 3 and 4 were erected at 2640 ft downwind of the application site. Locations 5 and 6 were set up one mile from the site. Monitoring locations 3 and 4,and 5 and 6 were set up forty feet apart on a line perpendicular to the downwind axis at their respective downwind distances. The application began at 0645 and terminated at 0740. All air samples were run for two hours.

Site No. 2

The second monitoring of an application occurred on June 28, 1978 (Figure 2). The team arrived at the 210-acre application site at 0520. The temperature was 18°C, relative humidity 85 percent and the barometric pressure 1020 mb. Wind direction was SSE at 5 mph. The application began at 0610 and was completed at 0800. Six air samplers were operated at distances of 30, 150, 450, 750, 950, and 1150 ft downwind of the site. A post-spray air sample was taken at location 2, 150 ft from the application site. All air samples were taken for a 2 hour interval.

Site No. 3

Air monitoring occurred on the same day, June 28, 1978. The weather station remained at the same location as it was earlier in the morning as the third site was close to the second. The temperature was 20°C, the relative humidity 72 percent and the barometric pressure 1020 mb. Wind direction was SSE at 4 mph. Only four air samplers were used on this site as one generator was still being used at site No. 2 for a post-spray application sample. Air samplers were situated 60, 160, 460, and 660 ft downwind of the 420-acre application site (Figure 2). Sampling was initiated at 0915 and ended at 1315.

Site Nos. 4, 5, 6, and 7

Four additional sites were monitored for MCPA but analytical difficulties in the laboratory made analyses impossible.

RESULTS

Orchard Foliage Samples

Reported herbicide levels at or below the detection levels of the analytical instruments are presented as 0 to ensure that they are not misrepresented as quantitative data. No MCPA, 2,4-D or propanil was detected in the samples of pistachio or almond foliage collected on May 16, 1978; July 25, 1978; August 11, 31, 1978 or October 3, 1978 at any of the 7 foliage sampling locations. Only samples taken on July 6, 1978 contained detectable amounts of MCPA but no 2,4-D or propanil. Pistachio leaves at location 1 (Table 1) showed minute amounts of MCPA. Almond samples taken on the same date also showed minute amounts of MCPA (Table 2).

Air Samples

The data collected monitoring MCPA application site No. 1 is presented in Table 3. The levels of MCPA appear to decrease with distance away from the application site. The 2 air monitoring samples taken at a distance of 1 mile downwind from site No. 1 were not analyzed due to problems in processing and extracting MCPA from the resin in the laboratory.

MCPA air monitoring at application site No. 2 also indicated that the amount of MCPA present in the air decreased with distance (Table 4). The sample taken at 1150 ft downwind of the site could not be analyzed due to difficulties in extracting MCPA from the resin. The single post-application monitoring sample taken at 150 ft downwind of the actual site did produce a detectable amount of MCPA.

MCPA air samples taken from high volume samplers at 60, 160, and 460 ft downwind of the application site were found to have amounts which did not segregate well with distance (Table 5). Again, the air sample taken at 660 ft downwind of the application site was not analyzed due to problems in extracting the herbicide from the resin.

Increased difficulties with pesticide extraction from the XAD-4 resin made analysis of monitoring on sites 4,5,6, and 7 impossible.

Ethylene glycol bubbler samples from the single low volume sampler implemented in this study were analyzed but did not produce detectable amounts of MCPA.

DISCUSSION

This feasibility study was successful in accomplishing our limited objectives. It was not designed to be an in depth monitoring effort to determine quantitative amounts of MCPA downwind of sites or to determine accurate herbicide amounts on foliage samples. The limited objectives were simply to determine whether MCPA could be detected in the air on the XAD type of resin and to evaluate existing procedures for sampling foliage, extracting MCPA from the resin, analyzing for minute amounts of this herbicide, and evaluating field procedures. In this context this feasibility study was successful and will provide the information necessary to plan well organized in depth monitoring efforts in the future.

It must be emphasized that the monitored levels of MCPA in the air monitoring portion of this study should not be taken as accurate measurements of the pesticide at the stated distances. The lack of effective calibration equipment precluded making the necessary adjustments to standardize the volume of air pulled through these high volume samplers. No concentrations in terms of parts-per-million (ppm) could therefore be calculated and reported levels of MCPA should not be used in such calculations. Although trends of MCPA collected in these samplers appeared to relate well with distance at site No. 1 and site No. 2, the lack of sufficient segregation with distance at site No. 3 would be indicative of the danger in utilizing these monitored amounts as being absolute and quantitative. The air monitoring effort did indicate, however, that the high volume sampler combined with XAD-4 resin does offer potential as an efficient means of trapping the MCPA herbicide.

This feasibility study did isolate several problem areas which must be rectified before an in depth study can be initiated.

1. Procedures for extraction of MCPA from the XAD-4 resin must be refined.

2. The current procedures for extracting and analyzing for MCPA on foliage must be evaluated and perhaps altered.

3. Standardized experimental designs must be developed in order to produce the most information with the greatest efficiency of manpower and cost.

4. Greater coordination is needed to obtain necessary information such as application rates, nozzle sizes, and concentration of formulation applied, to produce a complete data base to evaluate such monitoring activities.

The problems defined by this feasibility study can be rectified and we anticipate in depth monitoring studies to be initiated in the 1979-80 fiscal year when the Environmental Hazards Assessment Program will be allotted funding for full staffing and sufficient equipment.

ACKNOWLEDGEMENTS

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The mention of commercial products, their source or their use in connection with material reported herein is not to be construed as either an actual or implied endorsement of such products.

REFERENCES

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2. Soderquist, Charles J., and Donald G. Crosby. 1975. Dissipation of 4-chloro-2-methylphenoxyacetic acid (MCPA) in a rice field. Pesti. Sci. 6:17-33.

3. Woodrow, J.E., and J.N. Seiber. 1978. Portable device with XAD-4 resin trap for sampling airborne residues of some organophosphorus pesticides. Anal. Chem., 59(8):1229-1231.

Table 1. MCPA levels from pistachio foliage collected on 7-6-78.

Locations	MCPA levels (μg/g)
1A	0.05
1B	0.15
1C	0.0

Detection limit 0.02 μg/g

Table 2. MCPA levels from almond foliage collected on 7-6-78.

Locations	MCPA levels (μg/g)
2	0.00
3	0.05
4	0.00
5	0.05
6	0.00
7	0.03

Detection limit 0.02 μg/g

Table 3. Site No. 1 MCPA air sample results collected on 30 grams of XAD-4 resin.

Distance from Application site (ft)	Time (PST)	Quantity (µg)
1320	0640-0840	11.4
1320	0635-0835	10.5
2640	0644-0850	3.7
2640	0653-0850	2.0

Table 4. Site No. 2 MCPA air sample results collected on 30 grams of XAD-4 resin.

Distance from Application site (ft)	Time (PST)	Quantity (µg)
30	0610-0810	330
150	0610-0810	298
450	0615-0815	210
750	0610-0810	125
950	0600-0900	80
150 (post application)	0830-1030	12

Table 5. Site No. 3 MCPA air sample results collected on 30 grams of XAD-4 resin.

Distance from Application site (ft)	Time (PST)	Quantity (µg)
60	0915-1115	65
160	0915-1115	51
460	0915-1115	47

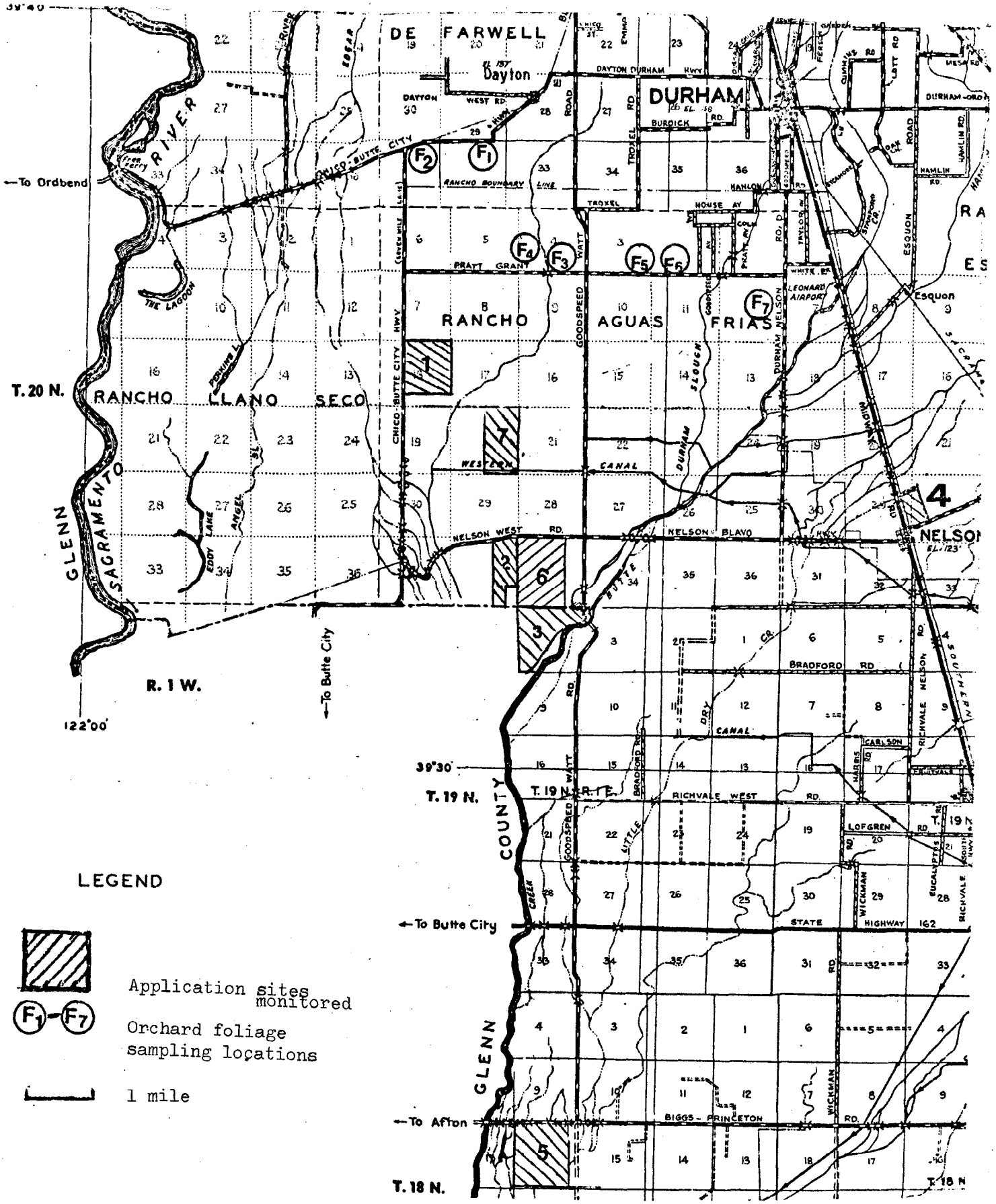

Figure 1. Map of area showing sites monitored during applications of MCPA and locations of orchard foliage sampling.

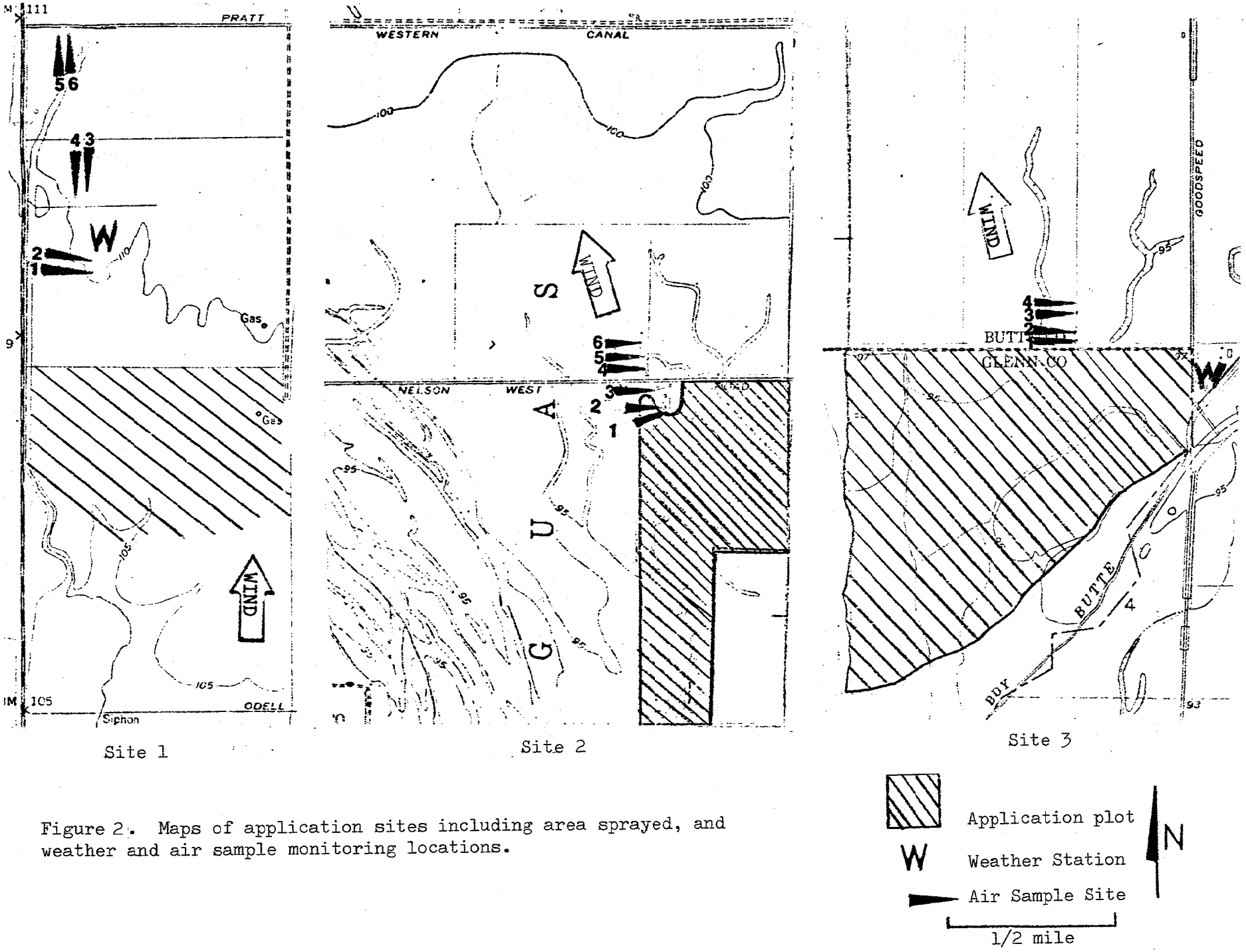

Figure 2. Maps of application sites including area sprayed, and weather and air sample monitoring locations.