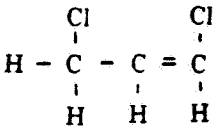
9-28-93

1. CHEMICAL: Dichloropropene (Telone II)

Chemical name: 1,3-Dichloropropene
Common name: Telone II; 1,3-D
Structure:



2. TEST MATERIAL:

Not Applicable.

3. STUDY/ACTION TYPE:

Review final reports on small-scale retrospective ground-water monitoring studies in Grant County, Washington and Merced County, California.

4. STUDY IDENTIFICATION:

1) Title: Small-Scale Retrospective Ground-Water Monitoring Study for Telone Brand Soil Fumigants: Final Report on Study Site in Grant County, Washington

Author(s): James Knutson, Heidi Dixon-White, and David Petty

2) Title: Small-Scale Retrospective Ground-Water Monitoring Study for Telone Brand Soil Fumigants: Final Report on Study Site in Merced County, California

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Submitted for:

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Identifying No.: 029001
DP Barcode: D177255
Date Sent to EFED: 04/28/92

5. REVIEWED BY:

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was not informed about study termination until after the site had been decommissioned.

Ground-water levels fell during the study and by June 1990, the water level had fallen to over 49 feet below the surface. During the course of the study, water levels fell below the tops of the pumps in many wells and were not able to be measured. For this reason, an adequate picture of ground-water flow could not be obtained.

Another more significant problem, a limited number of ground-water samples, also resulted from the lowered water levels across the site. The movement of residues to ground water requires a certain amount of time, and no samples were able to be collected from the majority of the wells three months after the Telone application. In the Nebraska study, the maximum residues were seen in ground water eight months after application. In addition, characterization on the site was inadequate for the purposes of the study.

8. RECOMMENDATIONS:

The submitted studies are not adequate to determine the levels of contamination of 1,3-D and its degradates in ground water. The Ground Water Section believes that several small-scale prospective ground-water monitoring studies are needed to clearly establish the potential for 1,3-D to migrate to ground water as a result of normal field use. Requests for the protocols for these studies have been stated in numerous actions including DP Barcodes D167714, D167581, 179324, and several memoranda to SRRD and RD. These protocols should be submitted to the EPA for approval as soon as possible.

9. BACKGROUND:

Telone II is a broad-spectrum soil fumigant and nematicide, mainly used as a preplant fumigant by chisel injection for nematode control. According to the 1986 Guidance Document for reregistration of this product, the predominant use of Telone II is on vegetables, field crops, citrus, and fruit and nut trees. Application rates are generally high and range from 38.3 lb ai/acre (field crops and vegetables) to 1000 lb ai/acre (citrus, fruit, and nut trees) (EFGWB #90774, 12/21/89).

Telone II is composed of 94 percent by weight 1,3-dichloropropene which exists in two isomeric forms : cis-1,3-D and trans-1,3-D, generally present in a 50:50 ratio. In the environment, the dissipation of 1,3-D occurs by three mechanisms which include gaseous diffusion through the soil, hydrolysis in aqueous solution, and biological metabolism by soil microorganisms (Peterson, 1989).

Supplemental information indicates that 1,3-D is a very mobile compound with Kd's ranging from 0.23 (loamy sand) to 1.09 (clay). Validated laboratory half-lives for 1,3-

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other sites (EFGWB #90778, 12/27/89). Detections of 1,3-D in ground water at the Nebraska retrospective site ranged up to 3.86 ppb.

10. DISCUSSION:

The EPA requested that DowElanco conduct five small-scale retrospective monitoring studies for Telone brand soil fumigants (Telone II and Telone C-17) in varied environments with different use patterns. The Washington study and California studies were begun in June 1989 and October 1989, respectively, and were terminated in October 1990 without EFGWB approval. Analyses were performed for 1,3-D, 1,2-D, and 3-chloroallyl alcohol; no analyses were performed for 3-chloroacrylic acid (EFGWB #90774).

I. GRANT COUNTY, WASHINGTON SMALL-SCALE RETROSPECTIVE STUDY

SITE DESCRIPTION

The 6.6-acre site was located in Grant County, Washington and was cropped with potatoes. Telone II was used on the site in 1978 and 1987 at a rate of 20 gallons per acre (about 190 lbs ai/acre). For this study, the site was treated with Telone at 24.7 gallons per acre (about 235 lbs ai/acre) in November 1989, and potatoes were planted in April 1990. Although Telone was not applied to the surrounding fields in 1989, potatoes had been planted in former years. Documentation of Telone use on these nearby fields was not available.

The site was irrigated with approximately 1.5 - 2.0 inches of water every week from the end of June 1990 to the beginning of September 1990. Irrigation water was derived from a surface water source that was supplied by an irrigation canal north of the field.

Climate. Grant County is characterized by warm, dry summers and cool, moist winters. Temperatures range from an average of 69° F (average daily high of 83° F) in the summers; winter temperatures average 30° F with average daily lows of 21° F. The average snowfall during the winter is 22 inches.

Topography and Soils. The soils on the site belong to the Quincy series which the SCS describes as fine sand with a rapid permeability (6 - 20 inches per hour). The pH of these soils is generally greater than 8.5. Surface slopes on the site are from 0 to 2 percent.

Soil characterization results from borings A2, B4, and C5 indicate that the soils on the site consist of sandy loam in the first two feet, and sand for the rest of the section to the water table (with occasional loamy sand layers). Sand content ranges from 68 - 70 percent in the upper sandy loam; organic matter ranges from 0.9 to 1.1 percent.

Samples were taken from all of the monitoring wells on September 19, 1989 before the analytical methods were established. The first ground-water samples which were able to be analyzed were taken on October 2, 1989. The 1,3-D application took place on November 20, 1989, and sampling continued on a monthly schedule until October 30, 1990. Duplicate ground-water samples were taken from all of the deep wells. No duplicate samples were apparently taken from any of the shallow wells.

Soil Characterization Samples. Soil samples were taken from the well installation borings. The deep borings of well clusters A (A-2) and B (B-4) and shallow well C-5 were sampled to the saturated zone. Samples were analyzed for particle size distribution, organic matter content, field capacity, wilting point, pH, cation exchange capacity, percent base saturation, and concentration of K, Mg, Ca, and P. "Samples were selected for analysis based on changes in lithology as noted by the supervising geologist. Samples submitted for analysis included the one-foot increment above and below any noted change in lithology. If a soil zone was homogeneous and thick, every fifth sample taken within the zone was submitted for analysis."

Soil samples were also collected for residue analysis on November 13 - 15, 1989, five days before the Telone application. Borings were advanced to the water table and sampled in 18-inch increments. Samples were composited in the analytical laboratory so that "6 to 9 feet of contiguous material comprised the composite sample". Portions of the two boreholes were lost due to compaction.

Application. Telone II was applied to the site on November 20, 1989 at a rate of 24.7 gallons/acre (about 235 lbs ai/acre). Soil temperatures were 44° F at 6 inches and 40° F at 18 inches. The product was applied at approximately 18 inches into the soil.

Detection Limits. The detection limits were 1.0 ppb for the alcohols in water, 30 ppb for the alcohols in soil, 0.2 ppb for the volatiles in soil, and 0.05 ppb for the volatiles in water.

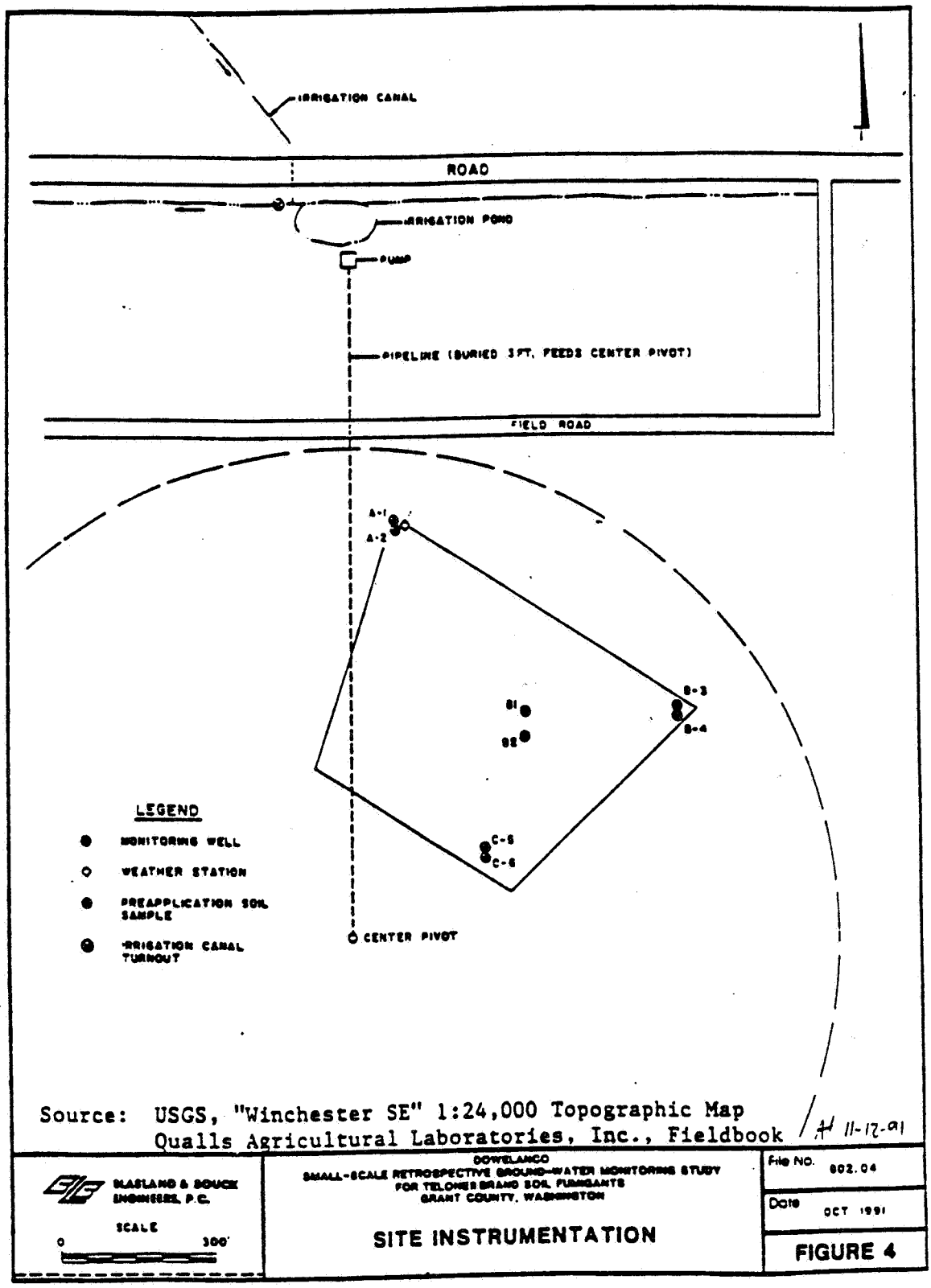
RESULTS:

Ground Water

Ground-water samples were analyzed for both isomers of 1,3-D, the degradate 3-chloroallyl alcohol, and the impurity 1,2-D. An equipment failure occurred in September and October 1990, and no 1,3-D analyses were made for the volatiles (1,2-D and 1,3-D) during these months.

Residues below the quantitation limit were detected in two samples (deep wells B-4 and C-6) collected on January 1, 1990. Detections of cis-1,3-D at 0.03 ppb (below detection limit) were observed in two samples. Duplicate samples from these two

Figure 1



B. Residue Analysis. Table X in the submitted report shows that soil samples for residue analysis were taken at 1.5-foot intervals to the water table. Three of these 1.5-foot samples were composited into one soil sample for analysis; i.e, one sample was analyzed from every 6-foot interval.

A significant problem is created by the fact that a large volume of soil was composited for each six-foot interval, and then a small portion was used for analysis. The larger the sample used for analysis, the greater the opportunity for dilution of any residues in the soil. In this case, samples were large enough to ensure that pesticide residues would not be detected in the soil.

B. Soil Composition. Bulk densities for the soils were not provided. It would also have been useful to have a particle size and composition analysis done on the coarse fragments of the soil cores. Although the driller's logs show gravel and cobbles in several of the cores, the laboratory soil characterization does not mention either in their report.

3. Analytical Problems

A. No ground-water analyses were done for the chloroallyl alcohol on 10/30/90.

B. No analyses were done for 1,3-D or 1,2-D in September or October 1990 because of equipment failure.

C. The documentation that was supplied with the analytical method was inadequate to determine whether the cis or trans isomers could be reliably identified (even if they were not quantifiable) at levels below 0.05 ppb.

D. The report indicates that all ground-water samples were stored in the refrigerator, but does not mention whether precautions were taken to prevent the loss of volatiles.

II. MERCED COUNTY, CALIFORNIA SMALL-SCALE RETROSPECTIVE STUDY

SITE DESCRIPTION

The 3.84-acre site was located in Merced County, California and was cropped with sweet potatoes. Telone II was used on the site in 1986 and 1987 at a rate of about 152 lbs a/acre. In 1988, the site was divided into a northern and southern portion with hotbeds established in the north. The northern part was treated with a mixture of 60 percent Telone II and 40 percent chloropicrin at 197 lb a.i./acre; the southern part of the field was not treated in 1988. No applications of Telone were made in 1989. For this study, the southern portion of the site was treated with Telone at 17.5 gallons per acre (172 lbs ai/acre) in March 1990.

Weather stations on the site recorded 9.86 inches of precipitation from October 1, 1989 through October 31, 1990. The historical average for this period is 12.57 inches. The first significant precipitation event (1.1 inches over two days) occurred about 10 weeks following the Telone application.

Irrigation was applied to the sweet potato hotbeds and the rest of the test site. The hotbeds received approximately six inches of water between February 28 and May 1, 1990 with an application of water every two to four days that would just saturate the upper few inches of soil. The remaining part of the site received a total of about 3-acre feet of water from June 13 through August 29, 1990. Three inches of water were applied once a week through irrigation furrows.

Pan Evaporation. Pan evaporation data were recorded at the Los Banos Reservoir NOAA weather station located approximately 35 miles southwest of the test site.

Ground Water. Three well clusters were installed in May and June 1989. Each cluster consisted of two wells, one shallow and one deep, located approximately 10 feet apart. Each well had five-foot screens placed at 45 - 50 feet for the shallow wells and 50 - 55 feet for the deep wells. Ground-water levels fell during the study. The highest levels were seen in June 1989 when they were at 44.5 feet below the surface. By June 1990, the water level had fallen to over 49 feet below the surface.

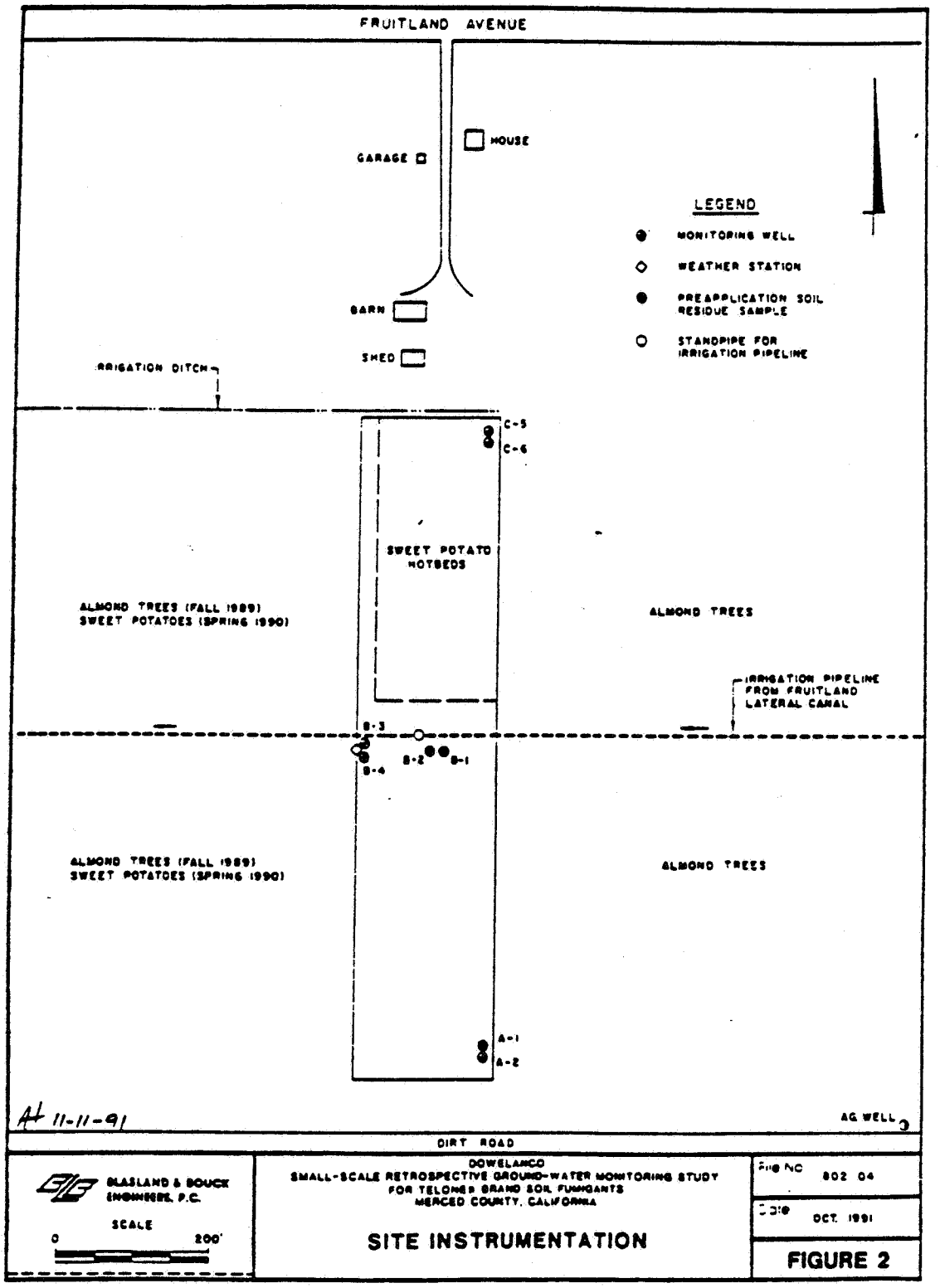
Samples were taken from all of the monitoring wells beginning on October 2, 1989 before the analytical methods were established. The Telone application took place in March 1990 and sampling continued on a monthly schedule until October 3, 1990. Duplicate ground-water samples were taken from all of the deep wells. No duplicate samples were apparently taken from any of the shallow wells.

Soil Characterization Samples. Soil samples were taken from the deep well installation borings (A-2, B-4, and C-6). Samples were analyzed for particle size distribution, organic matter content, field capacity, wilting point, pH, cation exchange capacity, percent base saturation, and concentration of H, K, Mg, Ca, and P.

Soil samples were also collected for residue analysis on March 15 and 16, 1990; two weeks before the Telone application. The samples were taken from two borings, both located in the center of the treatment area. Borings were advanced to the water table and sampled in 18- and 24-inch increments. Samples were composited in the analytical laboratory so that "6 to 9.5 feet of material comprised each composite sample." Portions of both of the boreholes were lost.

Application. Telone II was applied to the site on March 19, 1990 at a rate of 17.5 gallons/acre (about 172 lbs ai/acre) for a total of 38 gallons. Soil temperatures were 13° C at 4 and 20 inches below the surface. The product was applied at approximately 19 inches into the soil.

Figure 2



WELL NUMBER	TYPE OF WELL	DATE
A-1	shallow	10/02/89 11/07/89 05/08/90 06/05/90 07/10/90 08/90 09/90 10/90
A-2	deep	08/90 09/90 10/90
B-3	shallow	05/08/90 06/05/90 07/10/90 08/90 09/90 10/90
B-4	deep	07/10/90 08/90 09/90 10/90
C-5	shallow	05/08/90 06/05/90 07/10/90 08/90 09/90 10/90
C-6	deep	05/08/90 07/10/90 08/90 09/90 10/90

Table 1. Illustration of dates when ground-water samples were **not** able to be taken in California study.
NOTE: Study began in October 1989 and ended in October 1990.

3) Soil Core C5: 1-2', 3-4', 5-9', 10-14', 15-19', 20-24', 25-29', 30-34', 35-39', 40-44', 46-48'

As shown above, the missing intervals were not unique from boring to boring, indicating either that the field was extremely uniform or that intervals for analysis were preselected. Also of interest is the fact that the missing intervals in the Merced County study correspond almost exactly to those missing in the soil characterization samples from the Grant County, Washington site and the Nebraska site.

B. Residue Analysis. The submitted report states that six to 9.5 feet of soil were composited into each sample for residue analysis. A significant problem is created by the fact that a large volume of soil was composited for each sample, and then a small portion was used for analysis. The larger the sample used for analysis, the greater the opportunity for dilution of any residues in the soil. In this case, samples were large enough to ensure that pesticide residues would not be detected in the soil.

C. Soil Texture. In boring A-2, the soil characterization results show that sandy clay loam/clay loam beds were present above the water table. Clay content of these beds, which were at least two feet thick (a gap in the analysis does not allow a true determination of the thickness), totaled 30 percent. In the clay loam layer which was at least one foot thick, the silt content was 28 percent, and the sand content was only 42 percent. In boring C-6, silt content of the soil ranged up to 52 percent in a layer that was at least one foot thick. This zone contained only 28 percent sand and 20 percent clay.

EFGWB prefers that the sites for ground-water studies contain a high percentage of sands with no restrictive layers to the water table. The clay loam and sandy clay loam beds could have served as restrictive layers to ground-water recharge.

REFERENCES

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