



GEORGE R. ARIYOSHI  
GOVERNOR



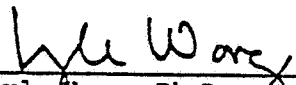
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September 8, 1981

Tables contained herein summarize findings of the Departments of Agriculture and Health in an ongoing program of ground water monitoring for the fumigants, dibromochloropropane (DBCP) and ethylene dibromide (EDB).

Period: April 14, 1980 to August 10, 1981.

  
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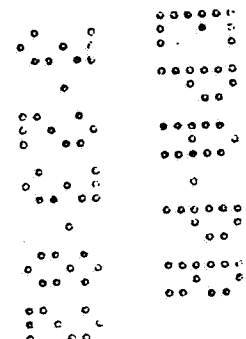


TABLE 1

Ground Water Sampling for DBCP and EDB (ppb) - April 14-17, 1980

| Site  | Dept. of Health <sup>(1)</sup> |      | Maui Land & Pine <sup>(2)</sup> |     | NO <sub>3</sub> -N<br>(ppm) |
|---|--------------------------------|------|---------------------------------|-----|-----------------------------|
|   | DBCP                           | EDB  | DBCP                            | EDB |                             |
| <u>Oahu</u>   |                                |      |                                 |     |                             |
| 1. Kunia Well No. 1 2302-01<br>(BWS - Domestic)                         | N.D.                           | N.D. | N.D.                            | -   | 2.6                         |
| 2. Del Monte Well No. 1 2703-01<br>(Del Monte - Domestic)               | 11                             | 92   | 7.91                            | -   | 3.4                         |
| U.S. Navy Barber's Point<br>Shaft #14-2103-03<br>(U.S. Navy - Domestic) | N.D.                           | N.D. | N.D.                            | -   | 2.9                         |
| 4. U.S. Navy Waiawa<br>Shaft #16-2558-10<br>(U.S. Navy - Domestic)      | N.D.                           | N.D. | N.D.                            | -   | 1.2                         |
| 5. Waipahu Well - 2400-02<br>(BWS - Domestic)                           | N.D.                           | N.D. | N.D.                            | -   | 2.3                         |
| 6. Mililani Well - 2800-01<br>(BWS - Domestic)                          | N.D.                           | N.D. | N.D.                            | -   | 0.6                         |
| 7. Wahiawa Well - 2901-09<br>(BWS - Domestic)                           | N.D.                           | N.D. | N.D.                            | -   | 1.1                         |
| 8. Waiialua Well - 3405-01<br>(BWS - Domestic)                          | N.D.                           | N.D. | N.D.                            | -   | 2.7                         |
| 9. Waiialua Pump 26 3203-02<br>(Waiialua Sugar Co. - Irrigation)        | N.D.                           | N.D. | N.D.                            | -   | 0.36                        |
| 10. Pearl City Well - 2457-02<br>(BWS - Domestic)                       | N.D.                           | N.D. | N.D.                            | -   | 0.49                        |
| 11. Punanani Well - 2557-05<br>(BWS - Domestic)                         | N.D.                           | N.D. | N.D.                            | -   | 0.36                        |
| 12. Waihee Tunnel --2751<br>(BWS - Domestic)                            | N.D.                           | N.D. | N.D.                            | -   | 0.17                        |
| <u>Maui</u>   |                                |      |                                 |     |                             |
| Windmill Beach<br>(Maui Pine - None)                                    | N.D.                           | N.D. | N.D.                            | -   | 0.19                        |
| 2. Pump A Napili Well - 5838-01<br>(Maui County - Domestic)             | N.D.                           | N.D. | N.D.                            | -   | 0.23                        |

TABLE 1  
Ground Water Sampling for DBCP and EDB (ppb) - April 14-17, 1980

| Site   | Dept. of Health <sup>(1)</sup> |      | Maui Land & Pine <sup>(2)</sup> |      | NO <sub>3</sub> -N<br>(ppm) |
|--|--------------------------------|------|---------------------------------|------|-----------------------------|
|  | DBCP                           | EDB  | DBCP                            | EDB  |                             |
| <u>Maui</u> (continued)  |                                |      |                                 |      |                             |
| 3. Honokahau - Honolulu Ditch (Maui Pine - Domestic & Irrigation)                  | N.D.                           | N.D. | N.D.                            | -    | <0.05                       |
| 4. Field 28; Puuhewale Spring (Maui Pine - Wash Water)                             | 0.35                           | N.D. | 0.25                            | -    | 6.6                         |
| 5. Shaft 29, Paia Mill 5422-1 (HC&S - Irrigation)                                  | N.D.                           | N.D. | N.D.                            | -    | 3.0                         |
| 6. Shaft 32, Maliko Gulch 5520-1 (HC&S - Irrigation)                               | N.D.                           | N.D. | N.D.                            | -    | 1.8                         |
| 7. Lower Maliko Spring (Owner unknown - None)                                      | 0.6                            | 0.2  | 0.59                            | -    | 27.8                        |
| Maui High School Well - 5420-1 (Maui County - Infrequent Domestic)                 | N.D.                           | N.D. | 0.18                            | N.D. | 3.7                         |
| 9. Waioloa Ditch - Kamole Forebay (Maui County and HC&S - Domestic and Irrigation) | N.D.                           | N.D. | N.D.                            | -    | 0.11                        |
| 10. Pfaeltzer Cove (Owner unknown - None)  | N.D.                           | N.D. | N.D.                            | -    | 3.3                         |
| <u>Molokai</u>   |                                |      |                                 |      |                             |
| 1. Kalae - Waialala Water System - Steel Reservoir (HCC - Domestic)                | N.D.                           | N.D. | N.D.                            | -    | 0.10                        |
| 2. Wailoku tunnel system (State of Hawaii - Domestic and Irrigation)               | N.D.                           | N.D. | N.D.                            | -    | 0.31                        |
| 3. Near Kaluaapuhi fishpond, south coast (Molokai Ranch - Irrigation)              | N.D.                           | N.D. | N.D.                            | -    | 2.3                         |
| 1. Maunalei Pump House - 5053-1; 5053-2; 5154-1 (Dole Corp. - Domestic)            | N.D.                           | N.D. | N.D.                            | -    | 1.8                         |

TABLE 1  
Ground Water Sampling for DBCP and EDB (ppb) - April 14-17, 1980

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| Site  | Dept. of Health <sup>(1)</sup> |      | Maui Land & Pine <sup>(2)</sup> |     | NO <sub>3</sub> -N<br>(ppm) |
|---|--------------------------------|------|---------------------------------|-----|-----------------------------|
|   | DBCP                           | EDB  | DBCP                            | EDB |                             |
| 2. Upper Maunalei Tunnels - 5053-1;<br>5053-2 (Dole Corp. - Domestic)           | N.D.                           | N.D. | N.D.                            | -   | 0.60                        |
| 3. Well 2 - 4953-01 - Kapahaku<br>Gulch (Dole Corp. - Irrigation)               | N.D.                           | N.D. | N.D.                            | -   | 0.50                        |
| 4. Well 1 - 4853-01 - Palawai<br>(Dole Corp. - Irrigation)                      | N.D.                           | N.D. | N.D.                            | -   | 4.4                         |
| 5. Well 3 - 4954-01 - Kapano Gulch<br>(Dole Corp. - Domestic and<br>Irrigation) | N.D.                           | N.D. | N.D.                            | -   | 0.68                        |
| 6. Well 4 - 4952-1 - Waiapaa Gulch<br>(Dole Corp. - Irrigation)                 | N.D.                           | N.D. | N.D.                            | -   | 0.59                        |

(1) Department of Health: Instrument limitation. DBCP N.D. = <0.05 ppb  
EDB N.D. = <0.1 ppb

(2) Maui Land & Pine: Sensitivity for DBCP 0.1 ppb  
Sensitivity for EDB 1.0 ppb

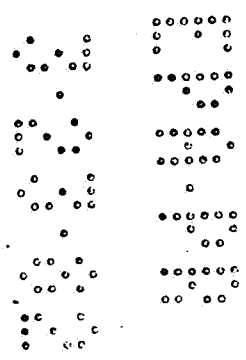


TABLE 2

SPECIAL SAMPLING TO CONFIRM CONTAMINATION OF THE KUNIA DEL MONTE WELL, APRIL 24, 1980

On April 24, 1980 water samples were collected from Kunia Del Monte well and two wells in the immediate area on Oahu. The purpose of this special sampling was to confirm the initial high residue values of DBCP and EDB detected in the Kunia well on April 22 and to ascertain possible aquifer contamination.

| Site                                    | Départment of Health |         | University of Hawaii<br>Agricultural Biochemistry |         |
|---|----------------------|---------|---|---------|
|   | DBCP                 | EDB     | DBCP  | EDB     |
| 1. Kunia Del Monte Well                 | 0.50 ppb             | 300 ppb | 0.64 ppb  | 133 ppb |
| 2. Kunia High Well No. 3<br>(Navy Well) | N.D.                 | N.D.    | N.D.  | N.D.    |
| 3. International Golf Course            | N.D.                 | N.D.    | N.D.  | N.D.    |

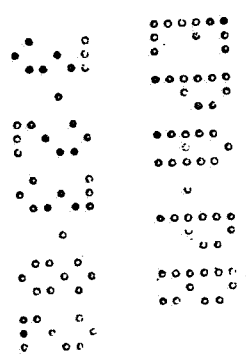




TABLE 4

Ground Water Sampling for DBCP and EDB (ppb) - May 5-7, 1980

| Site   | Dept of Health <sup>(1)</sup> |      | Maui Land & Pine <sup>(2)</sup> |      | NO <sub>3</sub> -N<br>(ppm) |
|--|-------------------------------|------|---------------------------------|------|-----------------------------|
|  | DBCP                          | EDB  | DBCP                            | EDB  |                             |
| <u>Oahu</u>  |                               |      |                                 |      |                             |
| 1. Shaft 3; Oahu Sugar Co. Ewa Pump 15 - 2202-21 (Oahu Sugar - Irrigation)                                     | N.D.                          | N.D. | N.D.                            | N.D. | 3.80                        |
| 2. Pump 5 Oahu Sugar 2203-01 (Oahu Sugar - Irrigation)   | N.D.                          | N.D. | N.D.                            | N.D. | 2.23                        |
| 3. Pump 10 (Ewa) Oahu Sugar Co. - 2006-14 (Oahu Sugar Co. - Irrigation)  | N.D.                          | N.D. | N.D.                            | N.D. | 3.22                        |
| 4. Hoaeae Well - 2301-34 (BWS - Domestic)  | N.D.                          | N.D. | N.D.                            | N.D. | 2.72                        |
| 5. Shaft 17; Waialua Sugar Co., Opaepa - 3404-2 (Waialua Sugar Co. - Domestic and Irrigation)                  | N.D.                          | N.D. | N.D.                            | N.D. | 2.00                        |
| 6. Pump 25, Waialua Sugar Co. 3203-1 (Waialua Sugar Co. - Irrigation)  | 0.037                         | N.D. | N.D.                            | N.D. | 1.66                        |
| 7. Shaft 4; U.S. Army Schofield - 2901-07 (U.S. Army - Domestic)   | N.D.                          | N.D. | N.D.                            | N.D. | 0.68                        |
| 8. Waikele Spring - lower Waikele Gulch, Waipahu (CCH - None)  | N.D.                          | N.D. | N.D.                            | N.D. | 0.81                        |
| 9. Asato Watercress Well - 2359-16, Waiawa Spring (Fred Asato - Irrigation)                                    | N.D.                          | N.D. | N.D.                            | N.D. | 0.81                        |
| 10. Old No. 330-7C, 2803-5 Kunia near Wheeler Field (U.S. Navy - used by Del Monte - Domestic and Irrigation). | N.D.                          | N.D. | N.D.                            | N.D. | -                           |
| 11. Hawaii Country Club Well - 2603-01 (Hawaii Country Club - Irrigation)                                      | N.D.                          | N.D. | N.D.                            | N.D. |                             |
| 1. Shaft 30; Lower Paia - 5423-2 (HC&S - Irrigation)   | N.D.                          | N.D. | N.D.                            | N.D. | 3.78                        |



TABLE 4  
Ground Water Sampling for DBCP and EDB (ppb) - May 5-7, 1980

| Site  | Dept. of Health <sup>(1)</sup> |      | Maui Land & Pine <sup>(2)</sup> |      | NO <sub>3</sub> -N<br>(ppm) |
|---|--------------------------------|------|---------------------------------|------|-----------------------------|
|   | DBCP                           | EDB  | DBCP                            | EDB  |                             |
| 2. Arakaki Watercress Farm,<br>Kanemaela Gulch (Arakaki -<br>watercress and household)  | N.D.                           | N.D. | N.D.                            | N.D. | 12.02                       |
| 3. Honolua Bay (Owner unknown -<br>None)  | N.D.                           | N.D. | N.D.                            | N.D. | 0.32                        |
| Honokohau - Honalua Ditch -<br>Honokohau Gulch (Maui Pine -<br>Domestic and Irrigation) | N.D.                           | N.D. | N.D.                            | N.D. | < 0.05                      |
| 5. Shaft 2; Pioneer Mill Pump F,<br>Lower Honokawai (Pioneer Mill<br>Co. - Irrigation)  | N.D.                           | N.D. | N.D.                            | N.D. | 0.19                        |
| <u>Molokai</u>  |                                |      |                                 |      |                             |
| Kauluwai Well - 0801-01<br>Waiakalae Gulch, (Hawaii Homes<br>Commission - Domestic)     | N.D.                           | N.D. | N.D.                            | N.D. | 0.46                        |
| 2. Kaluakai Well - 0901-1<br>Monawainui Gulch (HHC - Domestic<br>and Irrigation)        | N.D.                           | N.D. | N.D.                            | N.D. | 0.40                        |

(1) Department of Health: Instrument limitation. DBCP N.D. = <0.05<sup>7</sup> ppb  
EDB N.D. = <0.1<sup>7</sup> ppb

(2) Maui Land & Pine: Sensitivity for DBCP 0.1 ppb  
Sensitivity for EDB 1.0 ppb

TABLE 5

Ground Water Sampling for DBCP and EDB (ppb) - May 27, 1980

| Site  | Department of Health |         |
|---|----------------------|---------|
|   | DBCP (1)             | EDB (2) |
| 1. Kunia Well No. 2 - 2402-01<br>(BWS - Domestic)             | N.D.                 | N.D.    |
| 2. Gentry Waipio - 2500-01, 02<br>(BWS - Domestic)            | N.D.                 | N.D.    |
| 3. Crestview Waipio Heights - 2459-19, 20<br>(BWS - Domestic) | N.D.                 | N.D.    |
| 4. Wahiawa - 2901-08<br>(BWS - Domestic)                      | N.D.                 | N.D.    |
| 5. Waialua Sugar Pump No. 24 - 3102<br>(WSC - Irrigation)     | 0.020                | N.D.    |
| 6. Waialua Sugar Pump No. 25 - 3203<br>(WSC - Irrigation)     | 0.033                | N.D.    |
| 7. Waialua Sugar Pump No. 26 - 3203<br>(WSC - Irrigation)     | N.D.                 | N.D.    |
| 8. Hawaii Country Club - 2603-01<br>(HCC - Irrigation)        | N.D.                 | N.D.    |
| 9. Kunia High Well No. 3 - 2803<br>(U.S. Navy - Domestic)     | N.D.                 | N.D.    |

(1) DBCP: Instrument Limitation, 0.02 ppb

(2) EDB: Instrument Limitation, 0.05 ppb

8/6/80

TABLE 6

Maliko Gulch (Maui) Sampling for DBCP and EDB (ppb) - June 30, 1980

| Site  | Department of Health (1) |      |
|---|--------------------------|------|
|   | DBCP                     | EDB  |
| 1. Lower Maliko Gulch<br>(Site No. 1 - none)            | 0.31                     | N.D. |
| 2. "Garthoff Spring"<br>(Site No. 2 - private domestic) | 0.048                    | N.D. |
| 3. Maliko Gulch<br>(Site No. 3 - Irrigation)            | N.D.                     | N.D. |
| 4. Maliko Gulch<br>(Site No. 4 - Irrigation)            | N.D.                     | N.D. |

(1) Instrument Sensitivity: DBCP =  $0.02$  ppb  
 EDB =  $0.1$  ppb  
 $0.05$

TABLE 7  
Soil Core Analysis for DBCP and EDB - Kunia Well

| Sample            | Depth (ft.) | % Solid | DBCP (ppb)               |            | EDB (ppb)          |                    |
|-------------------|-------------|---------|--------------------------|------------|--------------------|--------------------|
|                   |             |         | Wet Weight               | Dry Weight | Wet Weight         | Dry Weight         |
| <u>Hole No. 1</u> |             |         |                          |            |                    |                    |
| Sample 1          | 1           | 81.5    | N.D.*                    | -          | N.D.*              | -                  |
| Sample 5          | 13          | 70.0    | N.D.                     | -          | 4.4<br>4.0         | 6.3<br>5.7         |
| Sample 9          | 25          | 67.1    | N.D.                     | -          | N.D.               | -                  |
| Sample 13         | 37          | 61.0    | 1.2 (Dupli-<br>2.0 cate) | 2.0<br>2.3 | 16.0<br>8.8        | 26.0<br>14.0       |
| Sample 17         | 49          | 60.1    | 2.6<br>2.2               | 4.3<br>3.7 | 116.0<br>86.0      | 193.0<br>143.0     |
| <u>Hole No. 2</u> |             |         |                          |            |                    |                    |
| Sample 1          | 1           | 72.6    | N.D.                     | -          | 1.4<br>1.4         | 1.9<br>1.9         |
| Sample 5          | 13          | 71.9    | N.D.                     | -          | 740.0<br>860.0     | 1,030.0<br>1,200.0 |
| Sample 9          | 25          | 65.2    | 1.2                      | 1.8        | 3,300.0<br>2,900.0 | 5,060.0<br>4,450.0 |
| Sample 13         | 37          | 61.6    | 1.6                      | 2.6        | 190.0<br>170.0     | 308.0<br>276.0     |
| Sample 17         | 49          | 65.2    | 1.2                      | 1.8        | 106.0<br>76.0      | 162.0<br>116.0     |
| Sample 21         | 61          | 61.5    | N.D.                     | -          | 32.0<br>32.0       | 52.0<br>52.0       |
| Sample 25         | 73          | 61.8    | N.D.                     | -          | 10.0<br>10.0       | 16.0<br>16.0       |
| Sample 29         | 92          | 66.1    | N.D.                     | -          | N.D.               | -                  |
| Sample 34         | 141         | 77.1    | N.D.                     | -          | N.D.               | -                  |
| Sample 35         | 151         | 75.2    | 1.6                      | 2.1        | 1.0                | 1.3                |

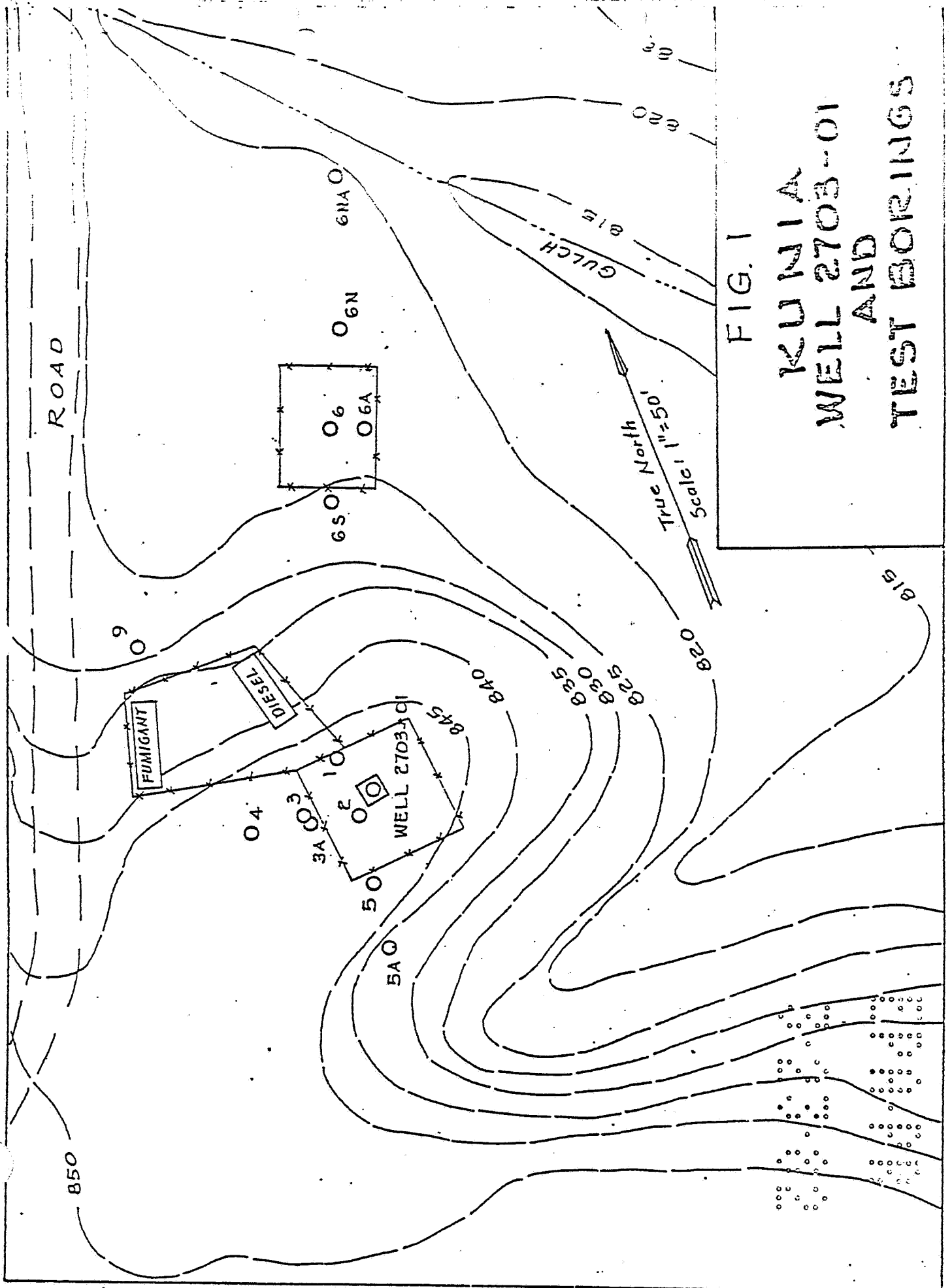


FIG. 1

KUNIA  
WELL 2703-01  
AND  
TEST BORINGS

TABLE 7  
Soil Core Analysis for DBCP and EDB - Kunda Well

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| Sample            | Depth (ft.) | % Solid | DBCP (ppb) |            | EDB (ppb)  |            |  |
|-------------------|-------------|---------|------------|------------|------------|------------|--|
|                   |             |         | Wet Weight | Dry Weight | Wet Weight | Dry Weight |  |
| <u>Hole No. 3</u> |             |         |            |            |            |            |  |
| Sample 1          | 1           | 77.9    | 250.0      | 320.0      | 14,600.0   | 18,700.0   |  |
|                   |             |         | 220.0      | 282.0      | 14,000.0   | 18,000.0   |  |
| Sample 5          | 13          | 69.9    | 37.0       | 53.0       | 32,800.0   | 46,900.0   |  |
|                   |             |         | 36.0       | 52.0       | 28,000.0   | 40,000.0   |  |
| Sample 9          | 25          | 67.8    | 26.0       | 38.0       | 18,400.0   | 27,100.0   |  |
|                   |             |         | 26.0       | 38.0       | 14,800.0   | 21,800.0   |  |
| Sample 13         | 37          | 63.4    | 2.4        | 3.8        | 53.0       | 84.0       |  |
|                   |             |         | 1.8        | 2.8        | 42.0       | 66.0       |  |
| <u>Hole No. 4</u> |             |         |            |            |            |            |  |
| Sample 1          | 1           | 78.9    | 260.0      | 330.0      | 7,400.0    | 9,400.0    |  |
|                   |             |         | 250.0      | 320.0      | 6,200.0    | 7,900.0    |  |
| Sample 5          | 13          | 71.7    | 42.0       | 58.0       | 940.0      | 1,310.0    |  |
|                   |             |         | 46.0       | 64.0       | 880.0      | 1,230.0    |  |
| Sample 9          | 25          | 72.5    | 30.0       | 41.0       | 120.0      | 166.0      |  |
|                   |             |         | 28.0       | 39.0       | 128.0      | 177.0      |  |
| Sample 13         | 37          | 62.8    | 1.0        | 1.6        | 2.6        | 4.1        |  |
|                   |             |         | 1.6        | 2.5        | 3.2        | 5.1        |  |
| Sample 17         | 49          | 63.9    | N.D.       | -          | 2.6        | 4.1        |  |
|                   |             |         |            |            | 2.6        | 4.1        |  |
| Sample 22         | 64          | 61.9    | N.D.       | -          | 12.0       | 19.4       |  |
|                   |             |         |            |            | 13.0       | 21.0       |  |
| Sample 26         | 76          | 58.4    | 1.2        | 2.0        | 4.4        | 7.5        |  |
|                   |             |         | 1.0        | 1.7        | 5.2        | 8.9        |  |
| <u>Hole No. 5</u> |             |         |            |            |            |            |  |
| Sample 1          | 1           | 65.7    | 100.0      | 152.0      | 340.0      | 520.0      |  |
|                   |             |         | 82.0       | 125.0      | 290.0      | 440.0      |  |
| Sample 5          | 13          | 68.6    | 39.0       | 57.0       | 1,240.0    | 1,810.0    |  |
|                   |             |         | 37.0       | 54.0       | 1,180.0    | 1,720.0    |  |

TABLE 7  
Soil Core Analysis for DBCP and EDB - Kunia Well

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| Sample                        | Depth (ft.) | % Solid | DBCP (ppb) |            | EDB (ppb)  |                           |
|-------------------------------|-------------|---------|------------|------------|------------|---------------------------|
|                               |             |         | Wet Weight | Dry Weight | Wet Weight | Dry Weight                |
| <u>Hole No. 5 (continued)</u> |             |         |            |            |            |                           |
| Sample 9                      | 25          | 63.9    | 1.2        | 1.9        | 350.0      | 550.0                     |
|                               |             |         | 1.2        | 1.9        | 320.0      | 500.0                     |
| Sample 13                     | 37          | 66.8    | 1.2        | 1.8        | 250.0      | 370.0                     |
|                               |             |         | 1.0        | 1.5        | 260.0      | 390.0                     |
| Sample 17                     | 49          | 60.2    | 2.0        | 3.3        | 70.0       | 116.0                     |
|                               |             |         | 2.4        | 4.0        | 78.0       | 130.0                     |
| <u>Hole No. 6</u>             |             |         |            |            |            |                           |
| Sample 1                      | 1           | 74.4    | 10.0       | 13.4       | < 5.0      | (Background Interference) |
|                               |             |         | 11.6       | 15.6       |            |                           |
| Sample 5                      | 13          | 70.7    | 70.0       | 99.0       | 100.0      | 141.0                     |
|                               |             |         | 69.0       | 98.0       | 96.0       | 136.0                     |
| <u>Hole No. 7</u>             |             |         |            |            |            |                           |
| Sample 1                      | 1           | 72.2    | N.D.       | -          | 14.0       | 19.4                      |
|                               |             |         |            |            | 17.6       | 24.0                      |
| Sample 5                      | 13          | 71.0    | N.D.       | -          | N.D.       | -                         |
| <u>Hole No. 8</u>             |             |         |            |            |            |                           |
| Sample 1                      | 1           | 79.2    | N.D.       | -          | N.D.       | -                         |
| Sample 5                      | 13          | 74.9    | N.D.       | -          | N.D.       | -                         |

N.D. = None Detectable

Limit of detectability, soil: DBCP = 1 ppb  
EDB = 1 ppb

8/11/80

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TABLE 3

## DBCP-EDB Levels in Perched Water - Munia Well

| Sample            | Depth (ft.) | DBCP (ppb)*  | EDB (ppb)*           |
|-------------------|-------------|--------------|----------------------|
| <u>Hole No. 2</u> |             |              |                      |
| Water Sample 1    | 38.00       | 8.80         | 24,800.0<br>24,800.0 |
| Water Sample 2    | 42.0        | 10.00        | 23,200.0<br>24,000.0 |
| Water Sample 3    |             | 1.00<br>1.00 | 272.0<br>280.0       |
| <u>Hole No. 3</u> |             |              |                      |
| Water Sample 1    | 30.25       | 5.60<br>5.40 | 2,560.0<br>2,520.0   |
| <u>Hole No. 4</u> |             |              |                      |
| Water Sample 1    | 31.82       | 0.38<br>0.42 | 12.8<br>14.0         |

\*Limit of Detectability, water: DBCP = 0.020 ppb  
EDB = 0.020 ppb

8/11/80

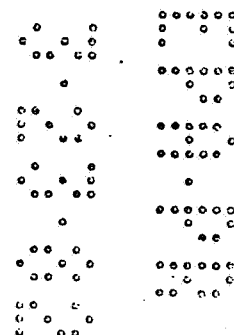




TABLE 9

Ground Water Sampling for DBCP and EDB (ppb) - <sup>July</sup>~~May~~ 27, 1980

| Site  | Department of Health |         |
|---|----------------------|---------|
|   | DBCP (1)             | EDB (2) |
| 1. Hawaii Country Club - 2603-01<br>(HCC - Irrigation)            | N.D.                 | N.D.    |
| 2. Del Monte Well No. 1 - 2703-01<br>(Del Monte - Domestic)       | 0.8                  | 2.9     |
| 3. Del Monte Well - 2803-07<br>(Del Monte - Domestic)             | N.D.                 | N.D.    |
| 4. Waialua Sugar Pump No. 24-3102<br>(WSC - Irrigation)           | 0.022                | N.D.    |
| 5. Waialua Sugar Pump No. 26 - 3203-02<br>(WSC - Irrigation)      | N.D.                 | N.D.    |
| 6. Wilson Lake<br>(WSC - Irrigation & Recreation)                 | N.D.                 | N.D.    |
| 7. Dairy Company (Kipapa Gulch) - 2600-01<br>(Private - Domestic) | N.D.                 | N.D.    |

(1) DBCP: Instrument Limitation, 0.02 ppb

(2) EDB: Instrument Limitation, 0.05 ppb

8/13/80

TABLE 10

Ground Water Sampling for DBCP and EDB (ppb) - July 30, 1980

| Site  | Department of Health |         |
|---|----------------------|---------|
|   | DBCP (1)             | EDB (2) |
| 1. Kunia Well No. 1 - 2302-01<br>(BWS - Domestic)             | N.D.                 | N.D.    |
| 2. Kunia Well No. 2 - 2402-01<br>(BWS - Domestic)             | N.D.                 | N.D.    |
| 3. Hoaeae - 2301-34, 37<br>(BWS - Domestic)                   | N.D.                 | N.D.    |
| 4. Waipahu - 2400-02<br>(BWS - Domestic)                      | N.D.                 | N.D.    |
| 5. Gentry Waipio - 2500-01, 02<br>(BWS - Domestic)            | N.D.                 | N.D.    |
| 6. Crestview Waipio Heights - 2459-19, 20<br>(BWS - Domestic) | N.D.                 | N.D.    |
| 7. Mililani - 2800-01, 04<br>(BWS - Domestic)                 | N.D.                 | N.D.    |
| 8. Waialua - 3405-01<br>(BWS - Domestic)                      | N.D.                 | N.D.    |

(1) DBCP: Instrument Limitation, 0.02 ppb

(2) EDB: Instrument Limitation, 0.05 ppb

8/13/80

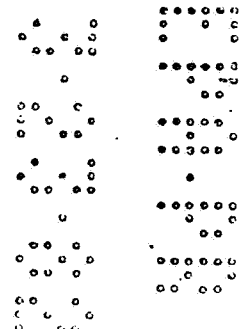


TABLE 11

Maliko Gulch Sampling for DBCP and EDB (ppb) - August 1, 1980

| Site  | Department of Health |                    |
|---|----------------------|--------------------|
|   | DBCP <sup>(1)</sup>  | EDB <sup>(2)</sup> |
| 1. "Garthoff Spring"<br>(Site No. 2 - private domestic) | 0.051                | N.D.               |
| 2. Maeda Residence<br>(Household - Tap)                 | 0.059                | N.D.               |
| 3. Maliko Gulch<br>(Site No. 3 - Irrigation)            | N.D.                 | N.D.               |
| 4. Maliko Gulch<br>(Site No. 4 - Irrigation)            | N.D.                 | N.D.               |
| 5. Maliko Gulch<br>(Site No. 5 - Seepage)               | 2.7                  | N.D.               |

(1) DBCP: Instrument sensitivity, 0.02 ppb

(2) EDB: Instrument sensitivity, 0.05 ppb

8/13/80

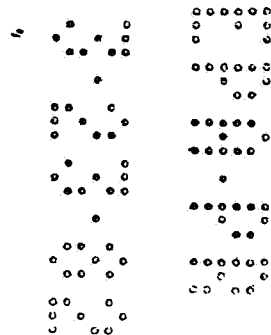


TABLE 12

DBCP/EDB Levels in Kunia Well Water as Function of Time after Start of Pumping and Period of Well Turn Off.

| Date        | Time       | Department of Health |           | Maui Land & Pineapple |           |            |
|-------------|------------|----------------------|-----------|-----------------------|-----------|------------|
|             |            | DBCP                 | EDB       | DBCP                  | EDB       |            |
| May 5, 1980 | 8:35 a.m.  | 14.00 ppb            | 98.00 ppb | 13.20 ppb             | 55.40 ppb | Start Pump |
|             | 8:45 a.m.  | 7.60                 | 41.00     |                       |           |            |
|             | 9:00 a.m.  | 3.80                 | 22.00     |                       |           |            |
|             | 9:15 a.m.  | 2.90                 | 15.00     | 2.40                  | 13.10     |            |
|             | 9:30 a.m.  | 2.30                 | 11.00     |                       |           |            |
|             | 10:00 a.m. | 1.60                 | 8.10      |                       |           |            |
|             | 10:30 a.m. | 1.40                 | 6.30      | 1.50                  | 4.60      |            |
|             | 12:30 p.m. | 0.96                 | 3.40      | 0.90                  | 3.50      |            |
|             | 3:00 p.m.  | 0.74                 | 2.20      | 0.07                  | 2.60      |            |
| May 6, 1980 | 8:30 a.m.  | 0.57                 | 0.99      | 0.60                  | 1.70      |            |
|             | 3:00 p.m.  | 0.54                 | 0.48      | 0.50                  | T         |            |
| May 7, 1980 | 8:30 a.m.  | 0.51                 | 0.27      | 0.50                  | N.D.      |            |
|             | 3:00 p.m.  | 0.52                 | 0.17      | 0.50                  | N.D.      | Pump off   |
| May 8, 1980 | 8:35 a.m.  | 5.20                 | 50.00     | 4.40                  | 29.80     | Start Pump |
|             | 3:00 p.m.  | 0.59                 | 1.00      | 0.50                  | 1.80      | Pump off   |
| May 9, 1980 | 8:35 a.m.  | 9.10                 | 59.00     | 6.80                  | 43.70     | Start Pump |

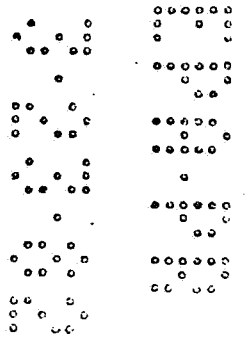


Table 13 - Ground Water Sampling for DBCP and EDB (ppb) - September 3, 1980

| SITE  | DBCP  | EDB  |
|---|-------|------|
| <u>OAHU</u>   |       |      |
| 1. Pearl City Well - 2458-01<br>(BWS - Domestic)                                  | N.D.  | N.D. |
| 2. Haleiwa - Ishimoto Farm<br>(Spring - Irrigation)                               | N.D.  | N.D. |
| 3. Waialua Pump 4<br>(Waialua Sugar - Irrigation)                                 | N.D.  | N.D. |
| 4. Waialua Sugar Pump No. 24 - 3102-02<br>(Waialua Sugar Co. - Irrigation)        | 0.020 | N.D. |
| 5. Waialua Sugar Pump No. 25 - 3203-01<br>(Waialua Sugar Co. - Irrigation)        | 0.029 | N.D. |
| 6. Waialua Sugar Pump No. 26 - 3203-02<br>(Waialua Sugar Co. - Irrigation)        | N.D.  | N.D. |
| 7. Shaft 4, U.S. Army Schofield - 2901-07<br>(U.S. Army - Domestic)               | N.D.  | N.D. |
| <u>MAUI</u>   |       |      |
| 1. Paleka Spring  | 0.03  | N.D. |
| 2. Maliko Tunnel 16 - "GarthoffSpring"<br>(Private - Domestic)                    | 0.072 | N.D. |
| 3. Maliko Tunnel 16 - "GarthoffSpring"<br>(Private - Domestic) (Bottom of runoff) | 0.060 | N.D. |
| 4. Awai Home Tap<br>(Maliko Gulch - Source, Maliko Tunnel 16)                     | 0.070 | N.D. |
| 5. Lower Maliko Spring<br>(Owner unknown - None)                                  | 0.047 | N.D. |

Limit of detectability: DBCP = 0.02 ppb  
 EDB = 0.05 ppb

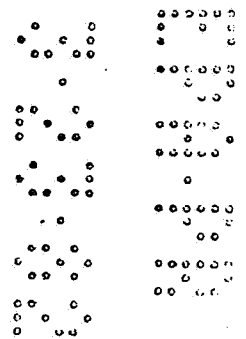


Table 14 - Ground Water Sampling for DBCP and EDB (ppb) - December 10, 1980

| SITE  | DBCP | EDB          |
|---|------|--------------|
| <u>MAUI</u>   |      |              |
| 1. Lower Maliko Spring<br>(Owner unknown - none)        | 0.33 | 0.06 ppb (?) |
| 2. Wailua Ditch<br>(BWS - Irrigation)                   | N.D. | N.D.         |
| <u>MOLOKAI</u>  |      |              |
| 1. Holokai Intermediate School- Tap<br>(BWS - Domestic) | N.D. | N.D.         |
| 2. Hawaiian Homestead - Tap<br>(BWS - Domestic)         | N.D. | N.D.*        |
| 3. Molokai Ranch Headquarters - Tap<br>(BWS - Domestic) | N.D. | N.D.         |

Limit of detectability: DBCP = 0.050 ppb  
 EDB = 0.050 ppb  
 \*EDB = 1 ppb

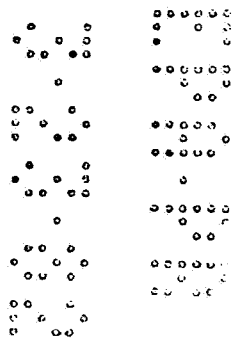


Table 15 - Ground Water Sampling for DBCP and EDB (ppb) -  
February 2 and 3, 1981

| SITE  | DBCP | EDB  |
|---|------|------|
| <u>OAHU</u>   |      |      |
| 1. Kunia Well No. 1 - 2302-01<br>(BWS - Domestic)     | N.D. | N.D. |
| 2. Kunia Well No. 2 - 2402-01<br>(BWS - Domestic)     | N.D. | N.D. |
| 3. Waipahu Well No. 14 - 2400-02<br>(BWS - Domestic)  | N.D. | N.D. |
| 4. Waipio Gentry - 2500-01<br>(BWS - Domestic)        | N.D. | N.D. |
| 5. Mililani Well No. 1 - 2800-01<br>(BWS - Domestic)  | N.D. | N.D. |
| 6. Wahiawa Well No. 3 - 2901-09<br>(BWS - Domestic)   | N.D. | N.D. |
| <u>DOLE PINEAPPLE WELLS - CANNERY WELLS, HONOLULU</u> |      |      |
| 1. Well #1 - Domestic/Industrial                      | N.D. | N.D. |
| 2. Well #2 - Domestic/Industrial                      | N.D. | N.D. |
| 3. Well #3 - Domestic/Industrial                      | N.D. | N.D. |
| 4. Well #4 - Domestic/Industrial                      | N.D. | N.D. |
| 5. Well #5 - Domestic/Industrial                      | N.D. | N.D. |

Limit of Detectability: DBCP = 0.02 ppb  
EDB = 0.05 ppb

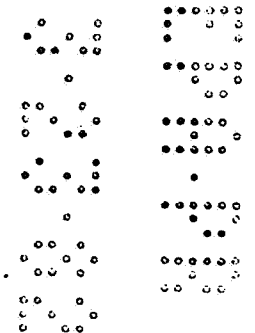


Table 16 - Ground Water Sampling for DBCP and EDB (ppb) -  
February 17 and 18, 1981

| SITE  | DBCP | EDB  |
|---|------|------|
| <u>OAHU - 2/17/81</u>   |      |      |
| 1. Mililani Well No. 1 - 2800-01<br>(BWS - Domestic)          | N.D. | N.D. |
| 2. Mililani Well No. 4 - 2800-04<br>(BWS - Domestic)          | N.D. | N.D. |
| 3. Kunia No. 2 - 2402-01<br>(BWS - Domestic)                  | N.D. | N.D. |
| 4. Kunia No. 2 - 2402-02<br>(BWS - Domestic)                  | N.D. | N.D. |
| 5. Mililani Service Station<br>(Mililani Town - Tap)          | N.D. | N.D. |
| <u>OAHU - 2/18/81</u>   |      |      |
| 1. Mililani Well No. 5<br>(BWS - Domestic)                    | N.D. | N.D. |
| 2. International Country Club - 2603-01<br>(HCC - Irrigation) | N.D. | N.D. |

Limit of Detectability: DBCP = 0.02 ppb.  
EDB = 0.05 ppb

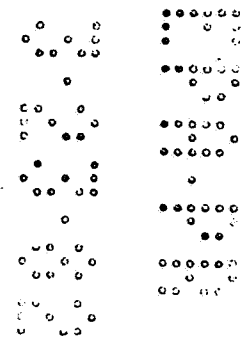




Table 17 - Ground Water Sampling for DBCP (ppb) - February 19, 1981

| Site  | DBCP                  |
|---|-----------------------|
| <u>OAHU</u>   |                       |
| 1. Kunia Well No. 1 2302-01<br>(BWS - Domestic)       | I. 0.002<br>II. 0.002 |
| 2. Kunia Well No. 2 - 2402<br>(BWS - Domestic)        | I. 0.005<br>II. 0.004 |
| 3. Mililani Park - Tap<br>(BWS - Mililani Well Field) | I. 0.014<br>II. 0.010 |
| 4. Mililani - Well Field 2800<br>(BWS - Domestic)     | I. 0.005              |

Limit of detectability: DBCP = 0.001 ppb.

Analysis performed by: State of California  
 Department of Health Services  
 Sanitation and Radiation Laboratory Section  
 Southern California Laboratory Section

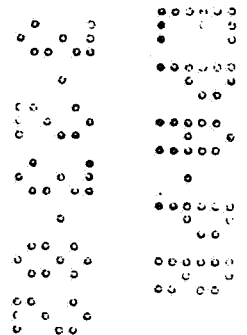


Table 13 - Ground Water Sampling for DBCP and EDB (ppb) - July 13, 1981

| SITE   | DBCP  | EDB  |
|--|-------|------|
| <u>OAHU</u>  |       |      |
| 1. Kunia Well No. 1 - 2302-01<br>(BWS - Domestic)                        | N.D.  | N.D. |
| 2. Kunia Well No. 2 - 2402<br>(BWS - Domestic)                           | N.D.  | N.D. |
| 3. International Country Club - 2603-01<br>(ICC - Irrigation)            | N.D.  | N.D. |
| 4. Waiialua Sugar Pump 24 - 3102-02<br>(Waiialua Sugar Co. - Irrigation) | N.D.  | N.D. |
| 5. Waiialua Sugar Pump 25 - 3203-01<br>(Waiialua Sugar Co. - Irrigation) | 0.041 | N.D. |
| 6. Waiialua Sugar Pump 26 - 3203-02<br>(Waiialua Sugar Co. - Irrigation) | N.D.  | N.D. |
| 7. Mililani Wells - 2800<br>(BWS - Domestic)                             | N.D.  | N.D. |
| <u>KAUAI</u>   |       |      |
| 1. Moloaa Intake - 1120-01<br>(Perch - Domestic & Irrigation)            | 0.211 | N.D. |
| 2. Wailua Homestead<br>(BWS - Domestic)                                  | N.D.  | N.D. |

Limit of detectability: DBCP = 0.02 ppb.  
EDB = 0.05 ppb

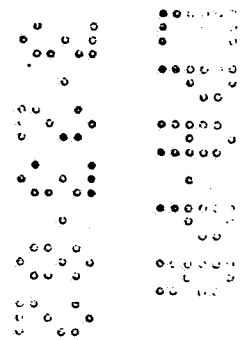
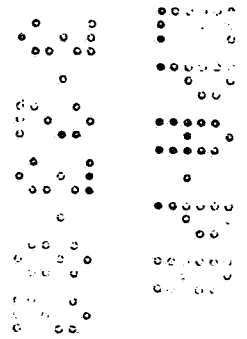


Table 20 - Ground Water Sampling for DBCP (ppb) - August 10, 1981

| SITE   | DBCP |
|--|------|
| <u>MAUI</u>  |      |
| 1. Maliko Tunnel No. 16<br>(Perched - Private Domestic)              | 0.02 |
| 2. Kahului Tap Water - Mua St.<br>(BWS - Domestic)                   | N.D. |
| 3. Haiku Elementary School Well - 5519-01<br>(BWS - None) (Sample 1) | 0.01 |
| 4. Haiku Elementary School Well - 5519-01<br>(BWS - None) (Sample 2) | N.D. |
| 5. Haiku Elementary School - Tap<br>(BWS - Domestic)                 | N.D. |
| 6. Maui High School Well - 5420-1<br>(BWS - Infrequent Domestic)     | 0.06 |

Limit of detectability - DBCP 0.01 ppb



September 10, 1981

MEMO TO: D.D.F. Williams

SUBJECT: DBCP IN MILILANI WELL

Attached is a report on the concentration of DBCP from Mililani Well Field for mass spectroscopy analysis.

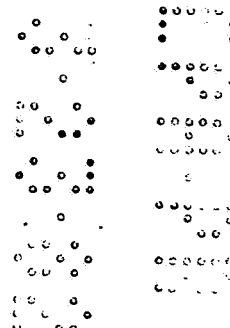
*Karen L. Chenchin*

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Karen Chenchin

KC:vcf

xc: Dr. Lyle Wong



SUMMARY

The primary objective of this study was to concentrate the DBCP residue reportedly detected in the Mililani Well for confirmation by mass spectroscopy. According to earlier analysis, DBCP levels ranged from 2 to 14 parts per trillion, a level too low for mass spectroscopy analysis.

DBCP was concentrated to approximately 1.2 parts per million and initially analyzed by gas-liquid chromatography and tentatively confirmed by gas-chromatography/mass spectroscopy. Results from the U.S. Geological Survey laboratory in Denver confirmed DBCP at 2.5 ppm and 1, 2, 3-trichloropropane at 250 ppm.

EXPERIMENTAL

Materials

- a) XAD-4 adsorbent resin (Rohm and Haas Co., Philadelphia, Pa) was Soxhlet extracted for 24 hours per washing using fresh solvent. The XAD-4 was continuously extracted with methanol (48 hr), acetone (24 hr), and methylene chloride (48 hr). The XAD-4 resin was found to be free of DBCP and stored in methanol.
- b) Columns: 30 cm x 25 mm ID glass columns with Teflon stopcock (Kontes, San Leandro, Ca).
- c) 1,2 dibromo-3-chloropropane (DBCP) and Ethylene dibromide (EDB) analytical standards: Chem Service, Westchester, Pa.
- d) SEP-PAK C<sub>18</sub> cartridge (Waters Associates, Milford, Ma) was conditioned by passing 5 ml of methanol followed by 10 ml of distilled water.

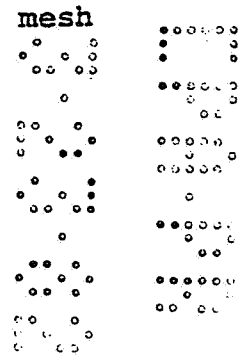
GLC Analysis

A Hewlett-Packard 5830 gas chromatograph, equipped with Ni<sup>63</sup> electron capture detector was used for the analysis of pesticide residue present in the extracted water sample.

Column: 6 ft x 2 mm ID glass packed with Tenax-GC 60/80 mesh (Supelco, Inc., Bellefonte, Pa).

OPERATING CONDITIONS

|  | <u>DBCP</u> | <u>EDB</u> |
|--|-------------|------------|
| Column Temp                                      | 200°C       | 190°C      |
| Injector Temp                                    | 225°C       | 225°C      |
| Detector Temp                                    | 240°C       | 240°C      |
| Carrier Gas Flow Rate<br>(90% Argon 10% Methane) | 20 ml/min   | 28 ml/min  |



### COLUMN PREPARATION

Glass wool was inserted in the columns and approximately 75-cc of XAD-4 adsorbent was added to ca 15 cm. The columns were rinsed upflow with distilled water to 30 percent bed expansion for 10 minutes, followed by gravity flow of 150 ml methanol and 1 liter distilled water. Another plug of glass wool was placed over the resin bed and the water level maintained at about one inch above the glass wool.

### EXTRACTION OF DBCP

Water from the Mililani Well Field (U.S. Geological Survey No. 2800) was allowed to pass through two XAD-4 columns by gravitation at varying flow rates from 4/20/81 to 5/18/81 (38 days). Water flow was adjusted periodically to maintain flow rates of 20 to 50 ml/min. (Refer to Table I.)

The columns and 2 liters of water were airshipped to Maui Pineapple Company, Ltd. on 5/19/81.

The residual water was removed from the columns by aspiration for 5 minutes. A volume of 175 ml of methanol was used to elute the pesticides at a rate of 10 ml/minute. The methanol eluent was then diluted to 20% with distilled water. Pesticide residues were extracted by passing 200 ml of the 20% methanol extract in 25 ml aliquots through conditioned SEP-PAK C<sub>18</sub> cartridges. The cartridges were eluted with 1 to 2 ml of methanol. The methanol eluent was combined, diluted to 50 percent with distilled water, and partitioned with 1.5 ml hexane. The hexane fraction was analyzed by gas-liquid chromatographic (GLC) analysis for DBCP and EDB and sent to the U.S. Geological Survey laboratory in Denver, Colorado, for mass spectroscopy confirmation.

DBCP was also extracted from Mililani Well water samples at Maui Pineapple Company, Ltd. by the above procedure modified for sample volume. A volume of 1.8 liters of water was passed through a 10-cc XAD-4 resin column (30 cm x 16 mm ID) at 9 ml/min.

### RESULTS AND DISCUSSION

DBCP was extracted from Mililani Well Field by XAD-4 columns, concentrated to approximately 1.2 parts per million and initially analyzed by GLC. Written confirmation of DBCP from U.S.G.S. laboratory in Denver had not been received at the time of this report. However, according to Dr. Lyle Wong (Hawaii State Department of Agriculture, Pesticide Branch), DBCP was confirmed at a concentration of 2.5 parts per million in the hexane extract. 1,2,3-trichloropropane was also tentatively confirmed at 250 parts per million.

Recovery of DBCP by the above procedure according to previous work conducted by this laboratory was 80 percent. Approximately 1,000 to 2,000 liters of water were filtered through the XAD-4 columns in Mililani. DBCP residue was detected in extracts from all three XAD-4 columns and averaged 4.5 parts per trillion. (See Table II.) No EDB was detected in all samples.

TABLE II

DBCP LEVELS IN MILILANI WELL WATER

| <u>XAD-4 Column</u>                    | <u>Volume<br/>Water<br/>(Liters)</u> | <u>DBCP<br/>Concentration<br/>ppt</u> |
|--|--------------------------------------|---------------------------------------|
| Mililani Well A                        | ca 1,094                             | 5.4                                   |
| Mililani Well B                        | ca 2,014                             | 4.4                                   |
| Mililani Well C<br>(Extracted at MPCo) | 1.8                                  | 3.6                                   |
|  |                                      | Ave 4.5                               |

KC:vcf  
9/10/81

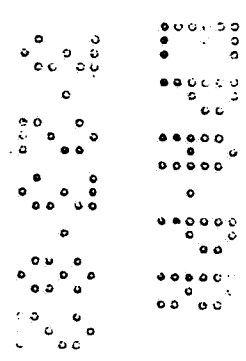


TABLE I.

| MILILANI WELL : Flow Rates |                              |                                |                                |                                |                                     |                       |            |
|----------------------------|------------------------------|--------------------------------|--------------------------------|--------------------------------|-------------------------------------|-----------------------|------------|
| DATE                       | TIME                         | Column A<br>1st Rang<br>ml/min | Column A<br>2nd Rang<br>ml/min | Column B<br>1st Rang<br>ml/min | Column B<br>2nd Rang<br>ml/min      | Sampler               |            |
| 4/12/81                    | 12:30 pm                     |                                | 34                             |                                | 29                                  | L. Wong               |            |
| 4/15/81                    | 3:20 pm                      | 30                             |                                | 28                             |                                     |                       |            |
|                            |                              |                                | 32 revised                     |                                | 28 <sup>20</sup> <sub>revised</sub> | T. Arizumi<br>B. Wong |            |
| 4/16/81                    | 3:10 pm                      | 29                             | 30                             | 26                             | 30                                  | T. ARIZUMI            |            |
| 4/17/81                    | 11:56 am                     | 28                             | 31                             | 23                             | 30                                  | T. ARIZUMI            |            |
| 4/18/81                    | 11:41 am                     | 24                             | 30                             | 27                             | 30                                  | T. ARIZUMI            |            |
| 4/19/81                    | NO READING - GATE LOCKED     |                                |                                |                                |                                     |                       | T. ARIZUMI |
| 4/20/81                    | 9:53 am                      | 12                             | 14                             | 24                             | 30                                  | T. ARIZUMI            |            |
| 4/21/81                    | 1:53 pm                      | 11                             | 14                             | 30                             | 31                                  | T. ARIZUMI            |            |
| 4/22/81                    | 2:32 pm                      | 10                             | 22                             | 23                             | 30                                  | T. ARIZUMI            |            |
| 4/23/81                    | 3:13 pm                      | 15                             | 20                             | 29                             | 30                                  | T. ARIZUMI            |            |
| 4/24/81                    | 3:00 pm                      | 12                             | 17                             | 27                             | 28                                  | T. ARIZUMI            |            |
| 4/25/81                    | NO READING - GATE LOCKED     |                                |                                |                                |                                     |                       | T. ARIZUMI |
| 4/26/81                    | NO READING - GATE LOCKED     |                                |                                |                                |                                     |                       | T. ARIZUMI |
| 4/27/81                    | 10:53 am                     | 18                             | 20                             | 29                             | 30                                  | T. ARIZUMI            |            |
| 4/28/81                    | 3:41 pm                      | 11                             | 19                             | 28                             | 29                                  | T. ARIZUMI            |            |
| 4/29/81                    | 3:40 pm                      | 13                             | 14                             | 30                             | 33                                  | T. ARIZUMI            |            |
| 4/30/81                    | NO READING - NO ACCESS - MUD |                                |                                |                                |                                     |                       |            |
| 5/1/81                     | 2:30 pm                      | 18                             | 22                             | 30                             | 30                                  | T. ARIZUMI            |            |
| 5/2/81                     | NO READING - GATE LOCKED     |                                |                                |                                |                                     |                       | T. ARIZUMI |
| 5/3/81                     | NO READING - GATE LOCKED     |                                |                                |                                |                                     |                       | T. ARIZUMI |
| 5/4/81                     | 5:45 pm                      | 9                              | 16                             | 43                             | 47                                  | T. ARIZUMI            |            |
| 5/5/81                     | 5:22 pm                      | 14                             | 15                             | 49                             | 46                                  | T. ARIZUMI            |            |
| 5/11/81                    | 3:00 pm                      | 3.5                            | 3.5                            | 45                             | 46                                  | B. Wong               |            |
| 5/12/81                    | 1:15 pm                      | 5.0                            | NLO                            | 45                             | 44                                  | L. Wong               |            |
| 5/18/81                    | 9:10 am                      | 4 ml / 6 min                   |                                | 50                             | 49                                  | L. Wong               |            |
|                            |                              | AVE FLOW                       | ca 21.4 ml/min                 |                                | ca 36.8 ml/min                      |                       |            |
|                            |                              | Total Volume                   | ca 1094 L                      |                                | ca 2014 L                           |                       |            |
|                            |                              |                                |                                |                                | 35 days                             |                       |            |
|                            |                              |                                |                                |                                | 54,720 min                          |                       |            |