DBCP: A Lesson in Groundwater Management

INTRODUCTION

This article addresses the issue of water resource contamination by 1,2-Dibromo-3-chloropropane (DBCP). DBCP is a pesticide used from the 1950's to the 1970's that was eventually found in the groundwater of Hawaii and California. The first part of this article explains the history of DBCP's production and use. The second section of the article discusses the relationship between groundwater and pesticides. The third section contains a discussion of three ways to reduce groundwater contamination by restricting pesticide use: non-chemical farming, improved monitoring, and improved regulation. The fourth section presents a brief discussion of the lessons that can be derived from DBCP contamination. The conclusion of the article recommends that action be taken immediately to reduce pesticide use so that groundwater resources can be protected for the future.

I.
HISTORY

DBCP is an amber to dark brown liquid[1] used as a nematocide.[2] Nematodes are worms that attack the roots of plants, and DBCP has been considered a successful product because it was the only nematocide that did not kill plants as well as nematodes.[3] After a six year chemical testing and research program, Dow Chemical marketed DBCP as Fumazone in 1957. Shell Chemical sold DBCP under the product name Nemagon.[4] Dow and Shell were the two primary manufacturers of DBCP[5] and supplied the nematocide to

1. Torkelson, Sadek, Rowe, Kodama, Anderson, Loquvam, and Hine, *Toxicologic Investigations of 1,2-Dibromo-3-Chloropropane*, 3 TOXICOLOGY AND APPLIED PHARMACOLOGY 545, 546 (1961) (hereinafter cited as Torkelson).

2. Safe Drinking Water Committee of the Board on Toxicology and Environmental Sciences of the National Research Council, *Toxicity of Selected Organic Contaminants in Drinking Water*, 4 DRINKING WATER AND HEALTH 209 (1982).

3. Taylor, *DBCP Still Used Despite Dangers*, L.A. Times, June 28, 1979, § I, at 24, col. 2.

4. EPSTEIN, BROWN, AND POPE, HAZARDOUS WASTE IN AMERICA, 76 (1982).

5. 42 Fed. Reg. 57266 (1977).

Occidental Chemical.[6]

In 1954, Dr. Charles Hine of the Medical Center at the University of California at San Francisco completed studies on the effects of DBCP on animals.[7] Shell Chemical provided partial funding for the studies.[8] In 1958 Dr. Hine wrote a confidential report to Shell regarding his findings.[9] Dow ran its own tests, and both results were published in one article in 1961.[10] The authors of the article concluded that exposure to DBCP could cause irritation and/or damage to the skin, eyes, respiratory system, liver, kidneys, sperm cells, and various other tissues.[11]

At the end of June and at the beginning of July, 1977, the Oil, Chemical and Atomic Workers Union (OCAW), asked seven men working at Occidental's Agricultural Chemical division for voluntary sperm analysis in order to investigate rumors of worker infertility. The tests yielded abnormally low sperm counts. In late July of 1977, the National Institute for Occupational Safety and Health (NIOSH), at the request of OCAW, conducted a Health Hazard Evaluation on Occidental workers which excluded the seven men who had originally been tested.[12] The results were the following: "13.1 percent of the exposed, nonvasectomized group were azoospermic [without sperm], 16.8 percent were definitely oligospermic [deficiency of sperm] and 15.8 percent were mildly oligospermic .... of the 412 men examined who provided semen specimens, 75.4 percent were eventually classified as exposed."[13]

On August 17, 1977, Occidental stopped producing and selling DBCP.[14] The vice president and western division manager of Occidental, James Lindley, said he was first informed that DBCP could cause sterility when an officer of OCAW told him about the seven Occidental workers who were found to be sterile.[15] Tests conducted

6. Peterson and Shinoff, *Firms Had Sterility Data on Pesticide*, Wash. Post, Aug. 23, 1977, § A, at 4, col. 3.

7. *Id.* at 1, col. 6; 4, col. 3.

8. Shinoff, *Calif. is Probing Pesticide Link to Sterility, Cancer*, Wash. Post, Oct. 16, 1977, § A, at 11, col. 1.

9. Taylor, *supra* note 3, at cols. 3-4.

10. Torkelson, *supra* note 1.

11. *Id.* at 558-9.

12. *Worker Safety in Pesticide Production: Hearings Before the Subcomm. on Agricultural Research and General Legislation of the Senate Comm. on Agriculture, Nutrition, and Forestry*, 95th Cong., 1st Sess. 109 (1977) (Statement of Dr. Donald Whorton) (hereinafter cited as *Hearings*).

13. *Id.* at 111.

14. *Id.* at 124.

15. Peterson and Shinoff, *supra* note 6, at col. 4.

on those who worked with DBCP in Arkansas also resulted in findings of a significant number of sterile men.[16] Near the end of August, 1977, Dow and Shell temporarily stopped production of DBCP,[17] and at the end of August, Dow recalled DBCP from its worldwide distributors.[18] On September 9, 1977, OSHA issued an Emergency Temporary Standard (ETS) for employee exposure to DBCP.[19] Permanent standards were promulgated on April 17, 1978.[20] The final protective standards read as follows: ". . . [the standard] limits employee exposure to DBCP to 1 part DBCP per billion parts of air . . . as an eight hour time weighted average concentration. The standard also prohibits eye and skin contact with DBCP. The standard provides for employee exposure monitoring, engineering controls and work practices, respirators, personal protective equipment and clothing, employee training, medical surveillance, regulated areas, hygiene practices and facilities, and recordkeeping."[21] On October 27, 1977, the EPA suspended DBCP's use on nineteen food crops.[22]

In the middle of October, the Department of Industrial Relations within the California Department of Occupational Safety and Health, initiated public hearings on DBCP. During the hearings it was revealed that Shell and Dow had known about DBCP's potential health effects since the end of the 1950's, although neither one of these companies had released this information to its customers or workers. Shell and Dow sent notices warning of DBCP's potential effects in July, 1977, when the sterility was discovered. However, the possibility that DBCP caused cancer was not released in these notices.[23] Furthermore these hearings revealed that Dr. Hine's first report to Shell de-emphasized the discovery of sterility. Dr. Hine did, however, claim that he had suggested to Shell that more studies be conducted on sterility. Shell took the position that since no federal agencies required such tests, there was no reason to conduct

16. *Hearings, supra* note 12, at 114-5.

17. Peterson, *Crackdown on Pesticide Linked to Sterility Urged*, Wash. Post, Aug. 24, 1977, § A, at 4, col. 2.

18. Peterson and Shinoff, *Dow Recalling Pesticide DBCP*, Wash. Post, Aug. 26, 1977, § A at 1, col. 1.

19. 42 Fed. Reg. 45586 (1977).

20. 43 Fed. Reg. 11514 (1978).

21. *Id.*

22. 42 Fed. Reg. 57544 (1977) (affecting broccoli, brussel sprouts, cabbage, carrots, cauliflower, celery, cucumbers, eggplant, endive, lettuce, melons, parsnips, peanuts, peppers, radishes, squash, strawberries, tomatoes, and turnips).

23. Shinoff, *supra* note 8, at 11.

them.[24] Hine's research merely motivated Dow and Shell to set a standard of 1 ppm of DBCP for air in the workplace.[25]

In August, 1979, the California Department of Food and Agriculture (CDFA) suspended DBCP's registration in the state. Eventually the suspension became a cancellation, and its registration was not renewed.[26] Shell and Dow voluntarily ceased production of DBCP because they considered the costs too high.

The environmental effects of DBCP soon became apparent to state agencies. Amvac Chemical Corporation in Los Angeles began its own production of about 2,500 gallons per day when its former supplier, Mexico, ceased production. The company's officials claimed they could produce DBCP while protecting the workers,[27] but the California Department of Occupational Safety and Health found that Amvac's exhaust stacks were emitting 500 ppb of the chemical. Observers considered this a "serious health hazard,"[28] but California had no regulations pertaining to air emissions or residue fallout of DBCP.[29]

In March, 1979, the Central Valley Regional Water Quality Control Board (CVRWQCB) discovered DBCP in the groundwater near Lathrop, California, where the former Occidental plant had been located.[30] The amount of DBCP ranged from 4 to 68 ppb. Within two months of this initial discovery, the CVRWQCB discovered DBCP in two wells in Stanislaus County, prompting the agency to expand the scope of its study to include more wells in the county. Inconclusive results lead to a more extensive study which analyzed wells in Yolo, San Joaquin, Stanislaus, Merced, Fresno, Tulare, Ventura, and Riverside Counties. In May, 1979, 90 of 258 wells contained DBCP, and 59 of those wells were located in the eastern San Joaquin Valley.[31]

On July 18, 1979, the EPA issued a Notice of Intent to Suspend

24. Shinoff, *University Pesticide Data Went to Firm*, Wash. Post, Oct. 19, 1977, § A, at 17, col. 4.

25. Taylor, *supra* note 3, at 25, col. 5.

26. California Dept. of Food and Agriculture, Worker Health and Safety Unit, Report HS-650, 1 (1979).

27. Taylor, *supra* note 3, at 25 col. 3; 26 cols. 5-6; 27 cols. 1 and 6.

28. Taylor, *Pesticide Plant Exhaust Called Health Danger*, L.A. Times, May 2, 1979, § II, at 1 col. 6.

29. *Id.*

30. California Dept. of Food and Agriculture, Worker Health and Safety Unit, Division of Pesticide Management, Environmental Protection and Worker Safety, Report HS-623, 2 (1979).

31. *Id.* at 2-3, Table 14.

registrations of certain products containing DBCP.[32] An adjudicatory hearing was held, and on October 20, 1979, Administrative Law Judge Gerald Harwood recommended the suspension of all registrations of DBCP products.[33] On October 29, 1979, the EPA Administrator, Douglas Costle, issued the Final Decision and Suspension Order.[34] The sale, distribution, and use of pesticide products containing DBCP were suspended.[35]

Despite this action, DBCP use continued for a time. At the beginning of 1980, an undercover investigation by the CDFA, initiated by Leo McCarthy (D-San Francisco),[36] revealed that farmers in the San Joaquin Valley were illegally using DBCP. It was being smuggled from Mexico at the cost of $30 to $60 per gallon. DBCP had cost $8 per gallon at the time it was banned in California. Since DBCP is only applied every two to three years, the ban was proving difficult to enforce.[37]

Gradually, the environmental toll led to a cessation of DBCP production and use in the affected states. In the spring of 1981, according to a report by a hydrologist, John Mink, DBCP was found in Hawaii's groundwater.[38] In the fall of 1983, Amvac stopped producing DBCP.[39] Finally in November, 1985, the EPA prohibited the existing stocks of DBCP from being used on Hawaiian pineapples.[40] A private Hawaiian company had asked the EPA if it could use its existing stock of DBCP. EPA denied the request.[41]

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32. 44 Fed. Reg. 43335 (1979).

33. 44 Fed. Reg. 65160 (1979).

34. 44 Fed. Reg. 65135 (1979).

35. 44 Fed. Reg. 65169 (1979) (affecting citrus, cotton, grapes, soybeans, peaches, nectarines, plums, almonds, commercial okra, commercial lima beans, commercial snap peas, blackberries, blueberries, loganberries, dewberries, boysenberries, raspberries, strawberry nursery stock, apricots, cherries, figs, walnuts, bananas, commercial turf, residential turf, commercial ornamentals, residential ornamentals, pineapples, except in Hawaii).

36. Rood, *Farmers Using Contraband Pesticide, State Reveals*, L.A. Times Jan. 27, 1980, § A, at 29 col. 1.

37. *Widespread Use Is Discovered of Banned Pesticide*, L.A. Times Jan. 27, 1980, § A, at 29, col. 1.

38. Hastings, *Latest DBCP Tests Show Pesticide in Underground Water*, BULLETIN & ADVISOR Mar. 21, 1981.

39. Telephone interview with Justin Fuelleman, Amvac Chemical Corp. (Dec. 2, 1985).

40. 50 Fed. Reg. 46512 (1985).

41. Telephone interview with Laurie Perrot, U.S. EPA, Region IX (Dec. 4, 1985).

II.
RELATIONSHIP BETWEEN GROUNDWATER AND PESTICIDES

Groundwater in California is a very important resource for the state's economic growth and development as it supplies 40% of California's water requirements.[42] Therefore, contamination of this valuable resource by pesticides like DBCP could have devastating effects on the state's economy.

Prior to 1979 the scientific community believed that pesticides broke down or were trapped by the soil. Consequently, little thought was given to the possibility of groundwater pollution.[43] This theory was discredited by the widespread discovery of DBCP in California's groundwater. Thus, as a major agricultural state that is dependent on groundwater, California is peculiarly at risk. In 1980, the total annual reported pesticide use for the state was approximately 121 million pounds.[44] However, it is likely that pesticide use was actually much higher, "due to gaps in the pesticide use reporting system."[45] Furthermore, pressure will be great to continue pesticide application as California currently produces half the fruits, nuts, and vegetables in the United States.[46]

In 1978, J.H. Berry estimated that 1 billion pounds of pesticides were used annually in the United States.[47] The estimated 1978 production cost of using chemicals on crops was about $2.2 billion each year with a gross return of about $8.7 billion—a 1 to 4 ratio.[48] However, the $2.2 billion spent on pesticides excluded the external costs to human and animal health and the environment. Even though the amount of pesticides used in 1978 was ten times the amount used in the 1940's, average crop losses due to pests have almost doubled.[49] (Crop yields, however, have remained about the

42. Ramlit Associates Inc., *Groundwater Contamination by Pesticides: A California Assessment*, 1 (Calif. State Water Resources Control Bd. No. 83-4SP 1985).

43. California State Legislature, Assembly Office of Research, *The Leaching Fields: A Nonpoint Threat to Groundwater* (1985) (hereinafter referred to as Assembly Office).

44. Ramlit Associates Inc., *supra* note 42, at 1.

45. *Id.*

46. California Office of the Governor, ECONOMIC REPORT OF THE GOVERNOR, 45 (1985).

47. Pimentel, Krummel, Gallahan, Hough, Merrill, Schreiner, Vittum, Koziol, Back, Yen and Fiance, *Benefits and Costs of Pesticides in U.S. Food Production*, 28 BIOSCIENCE 772, 772 (Dec. 1978) (hereinafter cited as Pimentel) (citing Berry, *Pesticides and Energy Utilization*, paper presented at the Am. Ass'n. for the Advancement of Science Annual Meeting, Wash. D.C. (Feb. 17, 1978)).

48. *Id.*

49. *Id.*

same.[50] Reasons for the constant yields include the use of higher-yielding crop strains, more fertilizers and other soil additives.)[51] These increased losses stem from changes in farming methods that have occurred since the 1940's. Important changes include the following:

1. Planting some crop varieties that are more susceptible to insect pests;[52]
2. Destruction of natural enemies of certain pests, creating the need for additional pesticide treatments;[53]
3. Increasing pesticide resistance in insects.[54] About 400 pests are resistant to at least one pesticide;[55]
4. Reduced crop rotation and crop diversity, corresponding to an increase in the culture of a single crop;[56]
5. Reduced Food and Drug Administration tolerance and increased "cosmetic standards" of processors and retailers for fruits and vegetables;[57]
6. Reduced sanitation, i.e. less attention to the destruction of infected crop residues;[58]
7. Less tillage leaving more crop remains left on the land surface;[59]
8. Growing crops in climates where they are more likely to be infested by insects;[60] and
9. Use of pesticides that have been found to change the physiology of plants, thus making them more susceptible to insect attack.[61]

III.
METHODS TO REDUCE GROUNDWATER CONTAMINATION RESULTING FROM PESTICIDE USE

A. Non-Chemical Farming

One way to prevent groundwater contamination is to reduce the amount of pesticides used in this country. Adopting non-chemical

50. *Id.* at 778.
51. *Id.*
52. *Id.*
53. *Id.*
54. *Id.*
55. Assembly Office, *supra* note 43, at 119.
56. Pimentel, *supra* note 47, at 779.
57. *Id.*
58. *Id.*
59. *Id.*
60. *Id.*
61. *Id.*

farming techniques is one means of achieving this goal. Integrated Pest Management (IPM), which seeks to minimize chemical applications by maximizing the use of natural pest enemies, is one such alternative. In 1983, the University of California had a $1.6 million budget for its statewide IPM program.[62] This program included (1) a computer network, which used three computer models to aid farmers in implementing IPM;[63] (2) the production of IPM manuals, directed at pesticide control advisors (PCA's), that contain information on almost all forms of crop management;[64] and (3) consultation with farmers.[65]

The research and information aspect of the University of California's IPM program has been successful in disseminating practical information to farmers.[66] The program has been especially successful where IPM is implemented for crops that are the target of well-studied pests. Unfortunately, little energy has gone into statewide evaluation of the IPM program,[67] and only a small portion of the funding has been applied to the biological control dimension. One of the program's directors, Dr. Donald Dahlsten, said that, "[o]ver the past few years . . . open staff positions . . . have been filled by persons whose expertise is not in applied biological control."[68]

Another California program seeking to reduce the use of pesticides is the Agroecology Program at the University of California at Santa Cruz (UCSC). This program is, surprisingly, within the Division of Social Sciences, and not within the Division of Agriculture. It combines orthodox farming methods with ecological principles including studies of crops, harmful pests, beneficial pests, soil, and plants.[69] For example, some techniques being analyzed include growing two crops on the same land at the same time (intercropping); utilizing weeds for controlling pests; and using plant and animal wastes to fertilize the soil.[70] The program has not yet applied these innovative techniques to large areas because more research is needed to make the techniques efficient and effective.[71]

Because the Agroecology program at UCSC is within the Divi-

62. Assembly Office, *supra* note 43, at 123.
63. *Id.* at 124.
64. *Id.*
65. *Id.*
66. *Id.* at 125.
67. *Id.* at 126.
68. *Id.* at 146-7.
69. *Id.* at 128-9.
70. *Id.* at 129.
71. *Id.*

sion of Social Sciences as opposed to the Division of Agriculture, scientists are not inclined to study agricultural practices that derive from biological and ecological theories. Unfortunately many farmers want to know these methods of farming and programs like UCSC's are not able to supply them with the information they need.[72]

The non-chemical agricultural methods being investigated in both the IPM and the Agroecology Program share common drawbacks. A single non-chemical technique is often not effective by itself.[73] A given method must be used with numerous other interconnected methods to devise a sound biological pest control strategy.[74] These strategies are difficult to devise because the cultural and biological variations occurring within each planted field preclude standardized pest management plans. Finally, a major factor inhibiting the use of alternative pest control methods is that scientists have limited knowledge about non-chemical farming.[75]

Given the scientific community's relative lack of knowledge about non-chemical farming techniques, farmers may see no viable alternatives to current farming practices. They feel they must rely on pesticides to grow their crops, especially since the result, high quality produce, is fairly predictable. Therefore, until more research is done on ecological and biological pest control, pesticides will continue to be used and the risk of groundwater contamination will continue to increase. More money must go into research that is needed to improve non-chemical farming methods which would eventually decrease the possibility of groundwater contamination. Additionally, academic institutions such as the University of California should make programs in biological aspects of pest control available to more students.

Pest Control Advisors (PCAs) represent another problem. Farmers obtain most of their information regarding pest control from PCAs. Significantly, most PCAs are also pesticide salespersons. Approximately 2,000 active PCAs in California have licenses to advise farmers on pest control.[76] Over 80% of these PCAs have connections to a company that not only pays their salary, but also makes, sells, or applies pesticides.[77] Only 200 to 300 PCAs are in-

72. *Id.* at 129-30.
73. *Id.* at 130.
74. *Id.*
75. *Id.*
76. *Id.* at 151.
77. *Id.*

dependents who are paid by farmers based on fees charged per acre.[78] The independent PCAs have more incentive than the company-affiliated PCAs to recommend the use of fewer pesticides to farmers. Furthermore, PCAs working for the pesticide companies are not trained to apply Integrated Pest Management analysis to crop infestations.[79] According to the California Office of Research, there is no evidence that the PCAs encourage farmers to use pesticides when the need does not exist. However, PCAs working for pesticide manufacturers are obviously caught between the interests of farmers, who want to reduce pests as inexpensively as possible, and the interests of the PCAs' employers, who want to sell pesticides.[80]

The process of becoming a licensed PCA needs to be changed to preclude affiliation with chemical companies. Currently, most PCAs are not trained in any farming methods other than those utilizing pesticides. They need to be trained in both chemical and non-chemical farming methods by educational programs offered through a university or public agency.

Another factor militating against reduction of pesticide use is the tight and powerful relationship between farmers and the chemical industry. Together, these interests lobby for laws and regulations that would maintain the status quo in pesticide production and use. In 1982, the California Farm Bureau Federation had 98,000 members in 52 counties. Its budget was $4 million, and it employed seven lobbyists and a legal staff to promote pesticide use that will increase agricultural productivity in California.[81] Unfortunately, such political orientation inadvertently promotes groundwater contamination.

Given the strength of agribusiness interest groups, funding for IPM and programs like Agroecology will not be easy to obtain. Additionally, farmers are naturally hesitant to risk farming without pesticides. However, such reorientation is necessary to prevent the ongoing contamination of groundwater.

B. Monitoring

A second way to reduce pesticides in California's groundwater is to improve the current monitoring system. Presently in California,

78. *Id.* at 152.
79. *Id.*
80. *Id.*
81. Churchill, *The Farm Bureau—Conservative Voice of Agribusiness*, 1982 CALIFORNIA JOURNAL, 414, 414.

the CDFA is the main regulatory and enforcement agency for pesticides, although this is a secondary responsibility for the agency.[82] The CDFA devised a long range plan called the Groundwater Protection Plan which is designed "to prevent pesticide residues from entering California groundwater due to agricultural use by providing agricultural commissioners with information on which to base decisions regulating use of pesticides on a localized basis."[83] In order for this plan to be implemented, the CDFA, as of January 15, 1986, was:

> compiling two data sets: a statewide well inventory showing results of wells sampled by public agencies for agricultural pesticide residue since 1975, and records of all areas where selected restricted pesticides applied primarily to the soil have been used since 1983. The Department is also beginning work on other data sets which will consist of factors influencing the movement of pesticides to groundwater. . . .[84]

Using the results of this study, the CDFA will help the county agricultural commissioners approach the problems of pesticide use and education more knowledgeably.[85]

The State Water Resources Control Board (SWRCB) is the primary authority for maintaining California's water quality.[86] The SWRCB is the agency which makes plans to identify, control and prevent pesticide pollution of groundwater and is currently devising a list of wells that will be used to monitor pesticides in the most heavily polluted groundwater basins. Due to lack of funds, the monitoring is not rigorous. In fact, some wells are monitored only every few years.[87]

The "hot spots" program is a monitoring system which concentrates on those places where groundwater appears to be "most threatened" by contaminants.[88] The Central Coast, the San Joaquin Valley, and the Los Angeles regions have been targeted, but, as of March 1985 monitoring has only been conducted for the Central Coast Region.[89] However, routine monitoring for pesticides does not take place under the jurisdiction of the SWRCB, except to mon-

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82. Assembly Office, *supra* note 43, at 43.

83. California Dept. of Food and Agriculture, Groundwater Protection Plan Overview 2 (1986).

84. *Id.* at 1.

85. *Id.* at 3.

86. CAL. WATER CODE § 13001 (West 1971).

87. Assembly Office, *supra* note 43, at 45-46.

88. *Id.* at 46.

89. *Id.*

itor known major contamination problems.[90]

Under the Federal Safe Drinking Water Act of 1974,[91] the California Department of Health Services (DHS)[92] must test for six pesticides in public water systems before that water is used in the public drinking supply.[93] This requirement, however, may not effectively monitor water contamination because the six pesticides are either banned now, or their use has decreased since the passage of the Act[94] and only the largest public water systems give their findings directly to the DHS.[95] While county health departments collect the test results from smaller water systems,[96] these findings are not always accurate.[97] The DHS has a monitoring program for DBCP and several other pesticides which have been found in groundwater, but monitoring is not done on a regular basis, and the range of test parameters is narrow.[98]

The Organic Chemical Contamination Act (AB 1803), passed in California in 1983, mandates that the DHS and public water systems sample drinking water for 40 pesticides.[99] The DHS analyzes the data from the monitoring tests to determine the type of regular monitoring program that is required. AB 1803 relies on pesticide use patterns, use practices, and physical and chemical characteristics to determine which pesticides need to be monitored. DBCP is one of the pesticides targeted through AB 1803, but all of the 40 pesticides are monitored only on an irregular basis.[100]

Other problems with the monitoring programs that were conducted in California in the early 1980's were the consequence of time and funding limitations. Much of the data was gathered hastily while agencies were placed in a defensive posture due to the emergency atmosphere created by groundwater pollution discoveries. Consequently, the goals of these monitoring programs were inadequately formulated. Monitoring data was plagued by errors, usually caused by field sampling techniques rather than by labora-

90. *Id.* at 51.
91. 42 U.S.C. § 300f-300j-9 (1982).
92. *Id.* at § 300(g)(2).
93. *Id.* at § 300(i).
94. Assembly Office, *supra* note 43, at 47.
95. *Id.*
96. *Id.*
97. *Id.*
98. *Id.*
99. CAL. HEALTH AND SAFETY CODE § 4026.2 (Deering 1986 Supp.) (referred to in text as AB 1803).
100. Assembly Office, *supra* note 43, at 48-50.

tory techniques.[101] The sampling techniques were not tailored to the limitations of the equipment used to take measurements. Furthermore, there was a lack of available information about the characteristics of the pesticides and variables concerning site characteristics.[102]

Monitoring groundwater is obviously critical in determining the extent of pesticide contamination. Once this information is available, decisions can be made to reduce or eliminate the use of certain pesticides. Since groundwater monitoring is absolutely necessary to a determination of the pesticide contamination threat, it is imperative that current monitoring programs be improved. One issue that must be dealt with is the fragmentation of the regulatory system. In California, the DHS, SWRCB, and CDFA all conduct or regulate groundwater testing. Monitoring would be more effective if coordinated by one agency. Although the CDFA is the main regulatory and enforcement agency responsible for pesticides, it monitors groundwater only in special cases. At the same time, the SWRCB is the lead agency on water quality regulation. The DHS tests for the six pesticides which have either decreased significantly in use or have been banned, and for the 40 pesticides which are monitored only irregularly. Since pesticides are only one type of contaminant found in groundwater, one agency should specialize in pesticide regulation and enforcement while another is responsible for groundwater monitoring. As so envisioned, these two agencies would coordinate their efforts to enhance groundwater monitoring for pesticide contamination.

Another concern is that monitoring is frequently sporadic.[103] Monitoring by the SWRCB[104] and DHS[105] has been erratic in the past. At least part of the reason for this problem is certainly a lack of money. With more money, agency personnel could be expanded and devote more time to enhancement of monitoring programs. For monitoring to be effective, sampling must be frequent and be conducted on a regular basis. If monitoring is effectively implemented, regulators can make informed decisions regarding the nature and the use of pesticides. Unfortunately, it seems that the discovery of pesticide contaminants in groundwater is an indication that the problem is already out of hand.

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101. Ramlit Associates Inc., *supra* note 42, at 49.
102. *Id.* at 48-9.
103. Assembly Office, *supra* note 43, at 52.
104. *Id.* at 51.
105. *Id.* at 47-48.

C. Registration

A third way to reduce pesticide contamination of groundwater is to improve the registration process. The Federal Insecticide, Fungicide and Rodenticide Act (FIFRA)[106] delegates responsibility for pesticide registration in the U.S. to the EPA while the California Environmental Quality Act (CEQA)[107] provides for delegation of responsibility to the CDFA for the registration of pesticides in California. Briefly, both the EPA and CDFA: (1) analyze the risks and benefits to determine if a pesticide should be granted registration; (2) register pesticides for conditional and unconditional uses; (3) register new pesticides for limited use and to allow new uses of pesticides that have already been registered; (4) permit unregistered pesticides to be used when registered pesticides cannot solve a problem; (5) issue restricted use pesticides if it is uncertain whether the chemical will cause adverse effects; (6) require the applicants for pesticide registration to submit specific scientific data on the chemical's characteristics; and (7) demand the registrants send the EPA/CDFA all new information regarding the substance's negative effects.[108] For a pesticide to be eligible to apply for registration, it must first meet minimum standards set by FIFRA.[109]

In 1972 Congress passed the Federal Environmental Pesticide Control Act.[110] The Act mandated that the EPA evaluate and reregister in excess of 50,000 pesticide products. Unfortunately, the information that was supposed to exist for the products was not reliable, and authorities could not determine whether the products were in fact safe or unsafe.[111] The Special Review, the Data Call-In, and Registration Standards are all programs conducted pursuant to the Act that were designed to collect the information necessary to reregister pesticides.[112] The Special Review process begins only when risk has been established. Basically, the risks and benefits of the pesticide are balanced and if the EPA discovers that the pesticide's "risk criteria" are too high, then a "rebuttable presumption against registration" triggers Special Review. The registrant bears the burden to prove that there will not be significant environmental or health damage.[113] The Data Call-In process requires that

106. 7 U.S.C. § 136-136y (1982).
107. CAL. PUB. RES. CODE §§ 21000-21177 (West 1977).
108. Assembly Office, *supra* note 43, at 58-9.
109. 7 U.S.C. § 136a(c) (1982).
110. 7 U.S.C. § 135 (1982).
111. Assembly Office, *supra* note 43, at 61.
112. *Id.*
113. *Id.* at 61-2.

registrants of older pesticides provide the information that EPA needs to determine if the substance should be registered at all. The EPA gives Data Call-In notices to manufacturers that handle the active ingredients that characterize most pesticides. If the notice is ignored, a Notice of Intent to Suspend (NOIS) is issued.[114] In practice the suspension does not occur, because the registration is, " 'put on hold' until compliance."[115] The Registration Standards program simply sets forth the information requirements for determining whether or not a pesticide is eligible for registration.[116]

The CDFA regulates yearly renewals of pesticide registrations[117] and continually makes evaluations of pesticides.[118] The CDFA must reevaluate a pesticide when:

1) It is necessary to protect the environment or public health
2) The CDFA determines that a pesticide may cause, or may have caused, a significant adverse impact, or that an alternative is available that could reduce an adverse environmental effect of a pesticide
3) A pesticide exceeds standards established by CDFA relating, but not limited, to human and environmental safety, excess residue, lack of efficacy, availability of an alternative material or procedure, or false or incomplete data.[119]

CDFA also enforces the laws governing utilization of pesticides.[120] Since the county agricultural commissioner functions as the enforcement officer for these laws at the local level, he/she is responsible for issuing and suspending permits. These permits set forth the quantity of pesticide that can be used[121] and specify the safety precautions that must be taken.[122] The county agricultural commissioner cannot issue a permit for a pesticide that would adversely and seriously affect the environment. Therefore, the commissioner must not issue a permit if the negative effects of a pesticide are greater than its benefits, or if an alternative to the pesticide is less damaging than the pesticide itself.[123]

The state and federal systems of registration have been subject to problems. Only a small number of pesticides that were registered

114. 7 U.S.C. § 136a(c)(2)(B) (1982).
115. Assembly Office, *supra* note 43, at 63.
116. 7 U.S.C. § 136a(c)(2)(A) (1982).
117. CAL. AGRIC. CODE § 12817 (West 1968 and 1986 Supp.).
118. CAL. AGRIC. CODE § 12824 (West 1968 and 1986 Supp.) and CAL. ADMIN. CODE tit. 3, R. 6226 (1972).
119. CAL. ADMIN. CODE tit. 3, R. 6226 (1972).
120. Assembly Office, *supra* note 43, at 65.
121. *Id.* at 67.
122. CAL. AGRIC. CODE § 14006 (West 1968 and 1986 Supp.).
123. *Id.* at § 14006.5.

between 1947 and 1974 were tested for their chronic effects.[124] Furthermore, at least 62 percent of the pesticides registered with the federal government have not been tested for their carcinogenicity.[125] Much of the data currently needed for evaluation of the pesticides, therefore does not exist. Furthermore, the EPA and FDA have discovered that some of the data is inaccurate or fraudulent.[126]

The CDFA does not require much more additional registration information than does the EPA.[127] Consequently, CDFA issues registrations for almost all pesticides that are registered by EPA.[128] Thus, since EPA has not yet reviewed the majority of pesticides scheduled for reregistration,[129] one can assume that California is also faced with a backlog. For example, most of the Special Reviews have not yet been acted on. The data collection needed to make reregistration decisions began in 1984, and EPA estimates that by 1989 it will have analyzed all the data.[130]

In California, the CDFA's renewal and evaluation process is deficient in some areas. Permits are renewed annually when the manufacturers pay their fees,[131] but this process does not provide for any evaluation of the pesticides. The continuous evaluation program does not work either. CDFA scientists have only been able to react to priority pesticide issues, so they have not had time to conduct other evaluations.[132]

The agricultural commissioners do not have sufficient staffs to make adequate decisions concerning a pesticide's potential groundwater effects. Furthermore, the commissioners are in high pressure positions because they must balance the interests of the farmers in their jurisdictions with the interests of the general public and the respective County Board of Supervisors. As a result, the restricted materials permit, which is the commissioners' main enforcement instrument that sets the limits and conditions on the use of restricted pesticides, is rarely used.[133] The CDFA has only put 14 of the top 40 pesticides identified by the DHS on the restricted materials

124. Assembly Office, *supra* note 43, at 69.
125. *Id.*
126. *Id.* at 70.
127. *Id.* at 71.
128. 3 CAL. ADMIN. CODE tit. 3, R. 6192 (1972).
129. Assembly Office, *supra* note 43, at 76.
130. *Id.* at 76-7.
131. *Id.* at 78.
132. *Id.*
133. *Id.* at 79-80.

list.[134]

The pesticide registration process is not as fragmented as the groundwater monitoring procedures; only the EPA and the CDFA are involved. However, non-enforcement of important registration policies will no doubt affect the purity of California groundwater. Many pesticides were registered without the benefit of scientific information now required by EPA. Even with strict requirements now in place, the registration process is not successful because the enforcement mechanisms designed to induce manufacturers to give the necessary information to the government are not utilized properly. It appears that such enforcement procedures work in theory, but the agencies responsible for such enforcement are overburdened. As previously mentioned, even the work involved in collecting the necessary data to reregister pesticide products is extensive.[135] Manufacturers have little or no incentive to gather and submit the information. Furthermore, existing mechanisms are not always fully utilized. In California the agricultural commissioners do not effectively utilize the restricted materials permit which could be used to help control pesticide use.[136] Both the state and federal governments have not adequately implemented monitoring and registration regulations that would help control or eliminate groundwater pollution. If pesticides were properly monitored and registered, groundwater contamination might be minimized. If the manufacturers of DBCP had been required to report Dr. Hine's results, DBCP's groundwater contamination problem might have been avoided. Again, the lack of money and agency staff could be one reason why the regulations are not implemented and enforced. Another reason could be the powerful lobby formed by farmers and chemical companies. For example, the agricultural commissioners "serve at the pleasure of their County Board of Supervisors and are subject to direct political pressures."[137]

One way to alleviate the EPA's workload is to require more stringent environmental and health standards to be met in the research laboratories. However, higher standards demand more time, and requiring more time for research and development could pose a threat to the chemical industry's innovation, because the research process will become too expensive. Research and development is expensive because it takes a long time to develop and test a new

134. *Id.* at 79.
135. *Id.* at 69-70.
136. *Id.* at 79.
137. *Id.* at 80.

chemical for its effectiveness, due to the length of the growing seasons. Also, many stages of production are needed to make certain chemicals, and the equipment is expensive.[138] However, more stringent laboratory standards would certainly help to insure that only safe pesticides enter the market.

IV.
OTHER GROUNDWATER AND PESTICIDE ISSUES RAISED BY DBCP

A major issue raised by the discovery of DBCP in groundwater is the basic uncertainty about the effects of pesticides and chemicals used in farm operations on health and the environment. Specifically, in the case of DBCP, even though tests had been conducted and DBCP was known to cause cancer and infertility, its effects on soil and groundwater were never considered. The mere fact that several agencies are monitoring groundwater for chemicals, including pesticides, demonstrates an increasing appreciation of this pollution problem. Even after DBCP was banned from use in the contiguous United States, its use was still permitted in Hawaii. A lesson should have been learned. If the nematocide was found in California's groundwater, it seems that common sense would have indicated that it would also be present in Hawaii's wells. Had DBCP been banned in Hawaii as soon as it was banned elsewhere, the groundwater in Hawaii might not have become so polluted. Since we now know that the use of pesticides can contribute to groundwater pollution years in the future, pesticides need to be tested before marketing for the possibility that they will cause groundwater contamination.

We also need to think about lowering our cosmetic standards. Fruit and vegetables do not have to be big or colorful to be healthy. If consumers did not demand such high quality produce, fewer chemical treatments would need to be used. With lower cosmetic standards, less pesticides would be applied, and less groundwater contamination would result.

CONCLUSION

The discovery of DBCP in groundwater highlighted many issues concerning groundwater and pesticides. Physical and chemical properties of pesticides need to be researched more thoroughly. With better information about the interaction between the environ-

138. GREEN, PESTICIDES: BOON OR BANE? 30 (1976).

ment and pesticides, decisions regarding the use of pesticides can be more environmentally sound. Until we have the knowledge, it is important that we reduce the current use of millions of pounds of pesticides each year. To achieve these goals, non-chemical farming techniques, monitoring, and registration can be improved. However, the relationship between the chemical industry and the farmers within the context of our political system makes achieving these goals difficult.

The Honorable James Florio stated:

> Because of the very slow movement of groundwater, there is often a long time delay between a contamination incident and its detection in an aquifer. Groundwater contamination which originally occurred decades ago may now be appearing in parts of aquifers being used for water supply. Similarly groundwater contamination occurring today may not appear for decades. Thus the ultimate magnitude of the problem may be worse than it currently appears.[139]

Because time plays such an important role in groundwater contamination, and because it is possible to reduce the use of pesticides, immediate political action is needed. Action to reduce groundwater contamination is of the utmost importance so as to limit future groundwater pesticide pollution. DBCP was used for years before it was discovered in groundwater. And DBCP was just one pesticide. What about the other millions of pounds of pesticides used in this country each year? We may already have done irreversible damage.

Sharon Frey

139. *Hazardous Waste and Drinking Water: Joint Hearings before Subcomm. on Health and the Environment. House Comm. on Energy and Commerce, and before Subcomm. on Transportation and Commerce of the House Comm. on Interstate and Foreign Commerce*, 96th Cong., 2nd Sess. 4 (1980).