

PROTOCOL
for
Environmental Hazards Assessment Program

Survey of California Ground Water Contamination

1. Introduction

1.1 Background

California ground water systems have been contaminated by 1,2-dibromo-3-chloropropane (DBCP), a soil fumigant used primarily for control of nematodes. Unfortunately, both the initial California Department of Food and Agriculture survey and ongoing Department of Health Services survey were designed solely for the purpose of detection and did not quantify the extent of contamination in ground water systems. Additionally, the two previous studies did not address questions concerning the fate of DBCP already in the environment nor did they attempt to gather a data base which could be utilized for predictive modeling.

The evidence that ground water systems can be contaminated by applications of materials in the soil environment is indisputable but the mere detection of contaminants in ground water is not sufficient to assess the extent of ground water contamination. The detection of DBCP in ground water is indicative that other toxic materials may also contaminate the aquifer systems. An initial statewide survey will be designed to document the extent of ground water contamination in California and to provide a baseline criterion to compare future monitoring. A second but equally valuable product would be the accumulation and transformation of existing data bases to accessible computer files. The current accumulated data on pesticide application rates and locations, well inventories, soil surveys and aquifer characteristics are not centralized or readily accessible for monitoring programs.

1.2 Objectives

This study will focus on the following objectives:

1. To accumulate and centralize relevant data sets into computer files which are readily accessible for ground water monitoring.

2. To quantify the extent of ground water contamination in the major California aquifer systems associated with agricultural and silvicultural use.
3. To attempt to develop a data base of soil contamination at depths to validate soil leaching models and provide empirical data for modeling efforts.

1.3 Overview of work plan

The following steps were considered appropriate for this study:

1. Definition of problem - This step would consist of the acquisition and evaluation of existing data bases to determine their value, the editing and reformation of the data deemed to be useful and the creation and storage of the usable files on computer tape or disc. The following data will be scrutinized: 1) U.S. Geological Survey well inventory and water quality data; 2) USDA, Soil Conservation Service Soil Surveys of California; 3) The California Department of Water Resources Inventory of California Ground Water; 4) The California Department of Agriculture Pesticide Application Data.
2. Trial Study - This would consist of the ^①systematic sampling of a selected aquifer for DBCP and EDB to validate sampling and analytical methods, ^②evaluate the effectiveness of the experimental design, ^③isolate logistical problems when expanded to a statewide scope, and ^④project costs for a statewide project.
3. State Study - This would be the large scale study of the major aquifer systems in California.

Step 1 is currently underway with the acquisition and evaluation of the designated data sets. The protocol for step 2, the trial study, is discussed in detail but the detailed protocol for the State Study cannot be developed until

information from steps 1 and 2 are developed.

2. Trial Study

As previously stated, the trial study of a single aquifer will be conducted to validate methods, evaluate the experimental design, isolate problems and project costs for the State study.

2.1 Objectives

Trial study objectives would be the same as previously stated in section 1.2.

2.2 Work Plan

2.2.1 Location

The Santa Clara River Valley Aquifer (Ventura County).

This is a 336 square mile unconfined alluvial aquifer system with moderate to intensive use for irrigation and municipal use. This region is intensively utilized for agriculture with substantial amounts of soil fumigants being applied annually. Citrus, tomatoes, strawberries and beans are among the leading crops but a broad spectrum of other species are also planted.

2.2.2 Available Data Bases

1. Pesticide Application Data per year.

This data is taken from the pesticide use permits which are filled out for restricted materials. The following information is required:

location - county, township, range, section

time - date of application

crop

amount applied - pounds active material

area - acres

This data base is only of moderate accuracy and is not currently accessible

on computers. The data is normally summarized and distributed quarterly in pesticide use reports published by CDFA.

2. USDA Soil Surveys for California.

These surveys map soil associations in regions of California and provide both topographical and 60" scale data characterizing the various soils. Other useful information includes some meteorology, major crops, some physical and chemical tests, and detailed topographical maps.

This data base is not computerized and is of moderate value. Mapping is not exact and large generalizations are present. However, no other soil criteria is available on a statewide basis.

3. USGS Well Inventory.

This data base is computerized and provides the following:

- well locations
- well depth
- depth of perforations
- available water quality data

Although computerized, much of this data is incomplete, especially on older wells. The inventory tape can however be edited to provide a well population for which there is information.

4. DWR aquifer characteristics.

Summary statistics are available for California aquifers. The following information is available in bulletin form.

- physical dimensions of aquifer - maps
- storage capacity
- physical descriptions
- depth zone

The bulletin of aquifer characteristics is a summary of existing studies. Specific data must be taken from cited studies and has not been centralized or computerized.

5. NWS meteorological summaries.

These are published monthly and contain temperature and precipitation data for all monitoring stations in the California network.

2.2.3 Experimental Design

The experimental design described in this section represents one segment of the State design but can be utilized and evaluated as an independent study. The State design is preliminarily divided into 2 parts, the Central Valley aquifer systems and the other aquifer systems in the state. This division is predicated on the enormous disparity in the sizes of the Central Valley ground water systems and the other systems located in the state. The Santa Clara River Valley system would be compared with the smaller ground water systems excluding the Central Valley.

The following description will only address the sample and design considerations of the part of the study pertaining to the smaller aquifer systems. The experimental design addresses the following objectives.

1. Quantification of the extent of ground water contamination within individual aquifers.
2. A comparison of ground water contamination in application areas and non-application areas within aquifers.
3. A comparison of ground water contamination among aquifers.
4. Determination of soil contamination at depth in application areas with ground water contamination and application areas without detectable ground water contamination.

Definitions:

ground water - the shallowest layer of water bearing strata

application area - defined as areas documented to have applied the test materials on a regular basis

non-application area - defined as areas with no record of test material application

sample well - wells having information documenting depth, depth of perforations and drawing from the shallow layer of water bearing strata

Assumptions:

Aquifers can be defined in terms of uniform land areas (cells) and that the distribution of acceptable sampling wells is uniform over the land area (matrix). If this assumption proves erroneous, aquifers will be redefined in land area of uniform well populations.

2.2.3.1 Sampling Cells

Sampling cells of 25 square miles have been selected based on the aquifer sizes listed by DWR. A selection of aquifers, their size and county location are presented.

<u>Aquifer</u>	<u>Size(miles²)</u>	<u>County</u>
Santa Clara River Valley	336	Ventura
Upper Santa Ana Valley	620	Riverside
Salinas Valley	1030	Monterey
Antelope Valley	1620	Kern, Los Angeles
Palo Verde Valley	200	Imperial, Riverside

The 25 mile² cell size should allow a sample test well to be randomly selected from the population of sample wells within the cell. The cell size is small enough to allow adequate sampling within small aquifers

but does not generate overly large sample sizes in the larger aquifers. Cells of this size should be adequately characterized by toxic materials application and allow for a population of fields for soil sampling.

It is projected that a sample size between 500 to 1000 will be generated for this portion of the State study plan.

A total of 13 cells should characterize the Santa Clara River Valley in the trial study.

2.2.3.2 Sample Wells

A population of sample wells and locations will be initially defined from the U.S.G.S. well inventory. A sample test well and alternates within cells will be randomly selected from the existing population. Each well will be manually inspected by program personnel and appropriate county agencies before sampling. This ground truth verification will include attempts to verify well characteristics given on the U.S.G.S. well inventory.

2.2.3.3 Soil Sampling

Only a single application field in cells defined as having contaminated ground water and in cells having no ground water contamination will be selected because of cost constraints. Each field will have 3 replicate core samples taken. The selection of the fields will be based on available soil data, ground water levels and cropping. Actual sampling will be initiated only after water sample analyses have documented sample cells as contaminated or not contaminated.

2.2.4 Field Operations

Field operations include sample well verification, well sampling, sample transportation and storage. Two separate field operations are scheduled. The first consists of well location and verification. The second consists of sampling. Program personnel in coordination with county agencies will be responsible for both operations.

The program chemist will be responsible for sample transportation procedures, storage and analysis.

2.2.5 Sampling Procedures

The well water sampling procedures previously developed by the program will be utilized.

2.2.6 Chemical Analysis

The analytical procedures for EDB and DBCP previously developed by the program chemist will be utilized.