PERFORMANCE AUDIT

# PESTICIDE REGULATION

## DEPARTMENT OF ENVIRONMENTAL QUALITY

Report to the Arizona Legislature
By the Auditor General
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DOUGLAS R. NORTON, CPA
AUDITOR GENERAL

STATE OF ARIZONA
OFFICE OF THE
AUDITOR GENERAL

LINDA J. BLESSING, CPA
DEPUTY AUDITOR GENERAL

November 30, 1990

Members of the Legislature
State of Arizona

The Honorable Rose Mofford
Governor of the State of Arizona

Mr. Randolph Wood, Director
Department of Environmental Quality

Transmitted herewith is a report of the Auditor General, A Performance Audit of Pesticide Regulation: Department of Environmental Quality. This report is the third in a series of five reports on Pesticide regulation and is in response to Chapter 162, Section 7, of the 1989 Session Laws.

The report addresses the Department of Environmental Quality's efforts to establish programs to monitor for the presence of pesticides in water. We found the statutory criteria for determining which pesticides must be monitored are too broad, and that DEQ will not be able to monitor all of the pesticides identified by this criteria. We also found that although DEQ has yet to estimate how much additional funding will be needed for its monitoring programs, it appears DEQ may need a significant increase in resources in the future.

My staff and I will be pleased to discuss or clarify items in the report.

Sincerely,

Douglas R. Norton
Auditor General

DRN:lmn

STAFF: William Thomson
Peter N. Francis
Arthur E. Heikkila
Dennis B. Murphy
Shan D. Hays
Ned E. Parrish

2700 NORTH CENTRAL AVE. • SUITE 700 • PHOENIX, ARIZONA 85004 • (602) 255-4385

## SUMMARY

The Office of the Auditor General has conducted a performance audit of the Arizona Department of Environmental Quality's activities related to agricultural pesticides. The audit was conducted in response to Chapter 162, Section 7, of the 1989 Session Laws which directed us to review the State's pesticide regulatory program administered by four State agencies, including the Department of Environmental Quality (DEQ).

DEQ has responsibility for several functions involving agricultural pesticides, including identifying and monitoring those pesticides that have the potential to leach into ground water; monitoring soil, surface and ground water for pesticide contamination; overseeing the cleanup of sites contaminated by pesticides; and regulating the storage and disposal of pesticide containers. Our review focused on the Pesticide Contamination Prevention Program which was established by the Environmental Quality Act of 1986. In addition, based on the pesticide-related incidents and accidents handled by DEQ, we also reviewed the Resource Conservation and Recovery Act (RCRA) program as it relates to pesticide cases.

**Statutes Governing The Pesticide Contamination Prevention Program May Need Revision To Make The Program More Manageable** **(see pages 5 through 12)**

While DEQ has made a commendable effort in implementing the Pesticide Contamination Prevention Program, unless adjustments are made, more pesticides than can be monitored will be included on the Ground Water Protection List. The 1986 Environmental Quality Act established the program to identify those pesticides that have the potential to migrate through soil into ground water. During the first phase of the program, pesticide manufacturers and formulators are required to submit information about the environmental persistence and mobility of their products. DEQ must then review this information and determine if the pesticide falls within the statutory criteria of those pesticides that must be placed on the Ground Water Protection List.

University of Arizona consultants hired by our Office to review DEQ's technical analysis concluded that the Department should be commended for

its efforts in evaluating the information submitted by pesticide manufacturers. DEQ has made appropriate scientific determinations, and formed conclusions that appear valid and defensible.

However, DEQ does not have the resources or the capability to monitor and enforce the statutory requirements for all of the ingredients in the pesticides likely to be included on the Ground Water Protection List. To date, using the criteria specified by statutes, 133 (more than two-thirds) of the 194 pesticide-active ingredients covered by the program's requirements will be included on the Ground Water Protection List. All of these must then be monitored by the Department after the list is formally adopted. However, not all of the active ingredients on the list pose a threat to ground water. Given limited resources, the Department needs the statutory flexibility to reduce and prioritize the number of pesticides to be monitored. Our consultants recommend that current statutory criteria be used as a method of screening or as a "flagging" tool, and that DEQ be allowed to use additional methods, such as computer modeling, to determine those pesticides that should be placed on the Ground Water Protection List. A scientific advisory panel could also be established to assist DEQ in making technical decisions.

**DEQ Needs To Plan How It Will Meet Its Growing Pesticide Monitoring Workload** **(see pages 13 through 20**

To comply with statutory requirements, DEQ will be required to perform considerably more monitoring of water for the presence of pesticides. While Federal and State laws assign the Department broad responsibility for monitoring both soil and water for contaminants, and several DEQ units are involved in water monitoring, to date very little monitoring has been done for pesticides. The Pesticide Unit, which administers the Pesticide Contamination Prevention Program, is not currently required to perform monitoring. However, once the Ground Water Protection List is adopted in 1991, the Department will need to inaugurate a substantial soil and ground water monitoring program. As previously noted, the number of pesticides identified for inclusion on the Ground Water Protection List far exceeds the Department's current monitoring resources.

Other units will also need to increase their pesticide monitoring activities. State law requires DEQ to conduct ongoing monitoring of both surface and ground water for a variety of contaminants, including pesticides. Very little monitoring of surface water for pesticides has been done, and an ongoing program to monitor ground water Statewide has yet to be implemented. Monitoring for pesticides in public drinking water systems has also been limited; however, new Federal regulations will require more extensive monitoring of public drinking water systems.

Because considerably more monitoring for pesticides will be required in the future, DEQ needs to plan now how it will meet its increased monitoring responsibilities. DEQ needs to develop plans that establish program priorities, specify levels of activity, and estimate resource and funding needs.

**DEQ's Enforcement Of Hazardous Waste Laws Relating To Pesticides Could Be Strengthened** **(see pages 21 through 26)**

DEQ could improve its enforcement of hazardous waste laws which require responsible parties to clean up pesticide-contaminated sites. We performed a limited review of DEQ's actions, under the authority of the Federal Resource Conservation and Recovery Act (RCRA), on pesticide-contaminated sites, and found DEQ's actions on pesticide-related cases have not always been timely. For example, after numerous RCRA violations were identified, one pesticide formulator was inspected annually from 1981 through 1989. However, neither DEQ nor the Environmental Protection Agency (EPA) ever cited what actions the company should take to clean up the site. Following these repeated violations, DEQ issued a Letter of Warning in 1989, and after 13 months has not received a response as required. Low priority assigned to pesticide cases, inadequate staff resources, and the lack of administrative penalty authority all impact DEQ's ability to respond to pesticide-related RCRA cases in a timely manner.

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## INTRODUCTION AND BACKGROUND

The Office of the Auditor General has conducted a performance audit of the Arizona Department of Environmental Quality's activities related to agricultural pesticides. This audit was conducted in response to Chapter 162, Section 7, of the 1989 Session Laws, which directed us to review the State's pesticide regulatory program administered by four State agencies, including the Department of Environmental Quality (DEQ).

DEQ has responsibility for several functions involving agricultural pesticides including: reviewing technical data regarding leaching potential of pesticides; monitoring pesticides with the potential to leach into ground water; monitoring soil, surface, and ground water for pesticide contamination; overseeing the cleanup of sites contaminated by pesticides; and regulating the storage and disposal of pesticide containers.

- **Pesticide Contamination Prevention Program** - The 1986 Environmental Quality Act directed DEQ to establish a Pesticide Contamination Prevention Program designed to identify those pesticides that have the potential to pollute ground water. The Pesticide Unit in the Office of Water Quality, Water Assessment Section, is responsible for administering this program, the only program in the Department dedicated exclusively to pesticides. The Pesticide Unit is developing a Ground Water Protection List consisting of those pesticide-active ingredients that have the potential to pollute ground water. Manufacturers and formulators of agricultural-use pesticides must submit scientific data on the environmental persistence and mobility of pesticides to the Pesticide Unit for review.

  Once the Ground Water Protection List is developed, the Pesticide Unit will then focus on monitoring soil and water in the agricultural areas of the State where these pesticides are primarily used, to further assess the mobility and persistence of active ingredients, and determine if these pesticides have migrated into ground water. Under the program, DEQ has the authority to modify the instructions on pesticide labels, or cancel the registration of a pesticide that may be a threat to ground water and public health.

- **Water Monitoring** - Several other units within DEQ are responsible for monitoring the State's water resources for contaminants, including pesticides. The Department is required to perform routine, background monitoring of both surface and ground water. Responsibility for these water monitoring activities has been assigned to the Point Source and Monitoring Unit within the Water Assessment Section, and the Groundwater Monitoring and Assessment Unit in the Groundwater Hydrology Section. However, most of these units' activities focus on pollutants other than pesticides.

  The Drinking Water Compliance Unit in the Office of Water Quality, Compliance Section is responsible for overseeing monitoring of drinking water quality in Arizona. This unit regulates approximately 1,700 public drinking water systems in the State. To ensure that drinking water complies with Federal standards, all drinking water systems that serve at least 15 service connections or 25 persons for at least 60 days a year are required to submit the results of water samples to the Department. In some cases, sample analyses must include testing for certain pesticides for which Federal standards have been established.

- **Site Cleanup And Container Disposal** - Finally, the Department is responsible for overseeing the cleanup of pesticide-contaminated sites and the regulation of pesticide container disposal. Units in both the Office of Water Quality and the Office of Waste Programs are involved in site remediation, although only a small number of the sites included in these units' responsibilities involve pesticides. The Emergency and Remedial Section of the Office of Waste Programs oversees Federal Superfund and State Water Quality Assurance Revolving Fund (WQARF) clean up efforts in Arizona. The Hazardous and Solid Waste Section in the Office of Waste Programs is responsible for enforcing the Federal Resource Conservation and Recovery Act (RCRA) requirements, and directs the cleanup of hazardous waste sites. This section also inspects facilities that generate or store hazardous materials, including pesticide formulations.

## Staffing And Budget

DEQ Fiscal Services staff stated that because of the limitations of their accounting system, they were unable to provide us with pesticide-related expenditures and staffing information.

## Audit Scope

While DEQ has a number of programs which at times may handle pesticide related cases or incidents, our audit focused primarily on the Pesticide Contamination Prevention Program. This program was established by the EQA of 1986, and is the Department's only program exclusively devoted to pesticides. We also examined Department monitoring programs currently in place since monitoring will be a major emphasis of the Pesticide

Contamination Prevention Program in the future. Finally, in accordance with the requirements established in the 1989 Session laws, we reviewed pesticide-related incidents and accidents reported to or handled by DEQ for the period August 13, 1986 through June 30,1989. (See report #90-6, page 31.) As a follow-up to this work, we performed a limited examination of DEQ's Resource Conservation and Recovery Act (RCRA) program as it relates to pesticide cases. Specifically, our audit addresses three areas:

- the problems DEQ will encounter in administering the future monitoring requirements of the Pesticide Contamination Prevention Program,
- the Department's increasing water monitoring responsibilities,
- the enforcement of hazardous waste laws, and the timeliness of clean-up efforts.

Our audit was conducted in accordance with generally accepted government auditing standards.

The Auditor General and staff express appreciation to the Director and staff of the Department of Environmental Quality for their cooperation and assistance during the audit.

## FINDING I

## STATUTES GOVERNING THE PESTICIDE CONTAMINATION PREVENTION PROGRAM MAY NEED REVISION TO MAKE THE PROGRAM MORE MANAGEABLE

The statutes governing the Pesticide Contamination Prevention Program may need to be modified to allow the Department of Environmental Quality to carry out monitoring and enforcement requirements. DEQ has made a commendable effort in implementing the initial phase of the program. However, current statutory requirements for establishing the Ground Water Protection List will render the monitoring and enforcement aspects of the program unmanageable.

### Ground Water Contamination Has Occurred

Pesticides used in agriculture have been found in Arizona's ground water.[1] Pesticide residues were first detected in the State's ground water in 1979. At that time, the Department of Health Services (DHS) sampled wells in Maricopa and Yuma Counties for the presence of the pesticide DBCP, and found DBCP contamination in 53 of the 159 wells sampled. In 1984, DHS conducted two pesticide sampling programs, a follow-up screening for DBCP and an initial screening for the pesticide EDB. The EDB screening project focused on the areas where this pesticide was believed to have been used, and detected contamination in 18 of the 44 wells sampled. Although DBCP and EDB remain the only pesticides that have been confirmed by DEQ in Arizona's ground water as a result of agricultural applications, sampling for other pesticides has been limited.

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(1) Pesticides have also been found in ground water in a number of other states as a result of agricultural use. In 1988, the Federal Environmental Protection Agency (EPA) reported that 46 pesticides had reached ground water in 26 states.

## Purpose Of The Program

The 1986 Arizona Environmental Quality Act (EQA) required the establishment of a Pesticide Contamination Prevention Program within DEQ. Arizona Revised Statutes (A.R.S.) §49-301 et seq. govern the Pesticide Contamination Prevention Program. This legislation, modeled after a similar statute enacted in California in 1985, is designed to protect Arizona's ground water resources from pesticide contamination. DEQ's Pesticide Unit has been assigned responsibility for the program that is comprised of the following four major components.

- **Information submittal** - A.R.S. §49-302.A requires pesticide registrants to submit technical information regarding the environmental fate characteristics of their products to DEQ(1). Data are required for ten properties that affect pesticide mobility and persistence.(2) Registrants of agricultural-use pesticides registered in the State prior to the establishment of the Pesticide Contamination Prevention Program, were required to submit information on these ten properties to the Department by December 1, 1987. However, the Department was authorized to grant extensions for the submission of dissipation studies until December 1, 1990.

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(1) The environmental fate characteristics of a pesticide are those properties that influence pesticide mobility and degradation in the environment. Mobility refers to a pesticide's ability to migrate through soil to ground water. Degradation refers to a pesticide's persistence in the environment.

(2) For each agricultural-use pesticide registered in Arizona, registrants are required to submit the following information for each active ingredient:

A. Properties Influencing Pesticide Mobility
   1. water solubility
   2. vapor pressure
   3. octanol-water partition coefficient
   4. soil adsorption coefficient
   5. Henry's law constant

B. Properties Influencing Pesticide Persistence
   1. hydrolysis
   2. photolysis
   3. aerobic soil metabolism
   4. anaerobic soil metabolism
   5. field dissipation

- **Establishment of a Ground Water Protection List** - DEQ must develop a list of pesticides registered in Arizona that have the potential to pollute ground water. A.R.S. §49-303 requires DEQ to establish specific numeric values or standards that can be used to measure the tendency of a pesticide to leach into ground water. DEQ must place those pesticides that exceed the standards for both mobility and persistence on the Ground Water Protection List. Since July 1987, the Pesticide Unit has focused its efforts on the review of data provided by registrants and the development of the Ground Water Protection List.

- **Pesticide monitoring** - Once the Ground Water Protection List is formally established, DEQ must monitor soil and ground water for the presence of the pesticides on the list. Sampling must be conducted Statewide in areas where these pesticides are primarily used. Monitoring is to begin within one year after a pesticide is placed on the Ground Water Protection List. DEQ is also required to develop a standard monitoring protocol and testing procedures for all pesticides on the list. DEQ has conducted a limited amount of soil and ground water monitoring, and has initiated development of sampling methods and testing procedures.

- **Enforcement** - If pesticides are found in soil or ground water, DEQ must take enforcement actions to prevent further contamination. The Department is to determine if the directions for use on the pesticide label can be modified to ensure that continued use of the pesticide would not pose a threat to ground water in the State. If the pesticide label can not be modified and the pesticide is found to cause cancer, mutations, birth defects, or is toxic, the Director is to notify the State Chemist to cancel the registration of the pesticide.

## DEQ Has Made A Commendable Effort In Implementing The Program

The Department's review of data submitted by pesticide registrants has been basically sound. We asked a panel of experts to evaluate the data call-in process.(1) They found that the Pesticide Unit's review of the data on environmental fate characteristics has been reasonable and adequate. However, team members noted minor procedural problems that have resulted from legislative requirements and staffing levels.

**Experts commissioned to review the data call-in process** - We contracted for a team of scientists to assess the Department's implementation of the Pesticide Contamination Prevention Program. A team of four faculty members from the University of Arizona was selected to evaluate DEQ's

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(1) Data call-in refers to the submission and review of environmental fate data for the purpose of identifying pesticides that have the potential to leach into ground water.

review of the environmental fate data and comment on future program requirements. Comments concerning the program were also obtained from a nationally recognized expert from the University of California, Davis. A listing of these experts and their backgrounds is contained in the Appendix.

The team evaluated both the legal and technical aspects of the Pesticide Contamination Prevention Program. Team members reviewed the statutes and rules concerning the program. In addition, members from the University of Arizona met with Pesticide Unit staff to discuss the data call-in process and obtain copies of applicable procedures. These team members also reviewed two completed data submittal packages for pesticide-active ingredients, the correspondence files for these pesticides, and the Pesticide Unit's review comments.(1) The purpose of this review was to determine if DEQ's conclusions have been valid and defensible. A report of the group's findings is included in the Appendix. A copy of this report was sent to an expert from the University of California, Davis, to obtain his comments about the team's findings. His comments are also included as part of the Appendix.

**DEQ's review process is basically sound** - Team members found that the Pesticide Unit's review of data submittals has been reasonable and adequate, and reviewers agreed that the procedures eventually developed by DEQ were appropriate, adequate, and scientifically sound. In addition, the University of Arizona scientists report that DEQ's review of the environmental fate data submitted by product registrants, appeared to be extensive and generally consistent with DEQ's requirements. Finally, the team stated that DEQ's decisions to reject or accept data appeared to be valid.

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(1) Team members reviewed the correspondence files for six pesticide-active ingredients. These active ingredients were selected for review by team members and DEQ staff because they were considered to be representative of all active ingredients for which complete data had been received and reviewed by DEQ. Team members also selected at random from this group two active ingredients, Trifluralin and Sethoxydim, for more detailed review.

**Problems identified by scientists** - Team members identified a few weaknesses in the review process. First, the team indicated that relying on only one person to review this highly technical environmental fate data, places the State at risk should turnover occur. Second, the team noted that DEQ staff have been inconsistent in documenting the rationale for their decisions. Finally, files containing correspondence between DEQ staff and registrants were found to be incomplete, sometimes missing letters and summaries of telephone conversations.

## Current Statutory Requirements Will Make The Program Unmanageable

The monitoring and enforcement components of the program will be difficult to implement because of the large number of pesticides expected to be placed on the Ground Water Protection List. The statutorily mandated criteria used to determine which pesticides will be placed on the list, may result in the identification of an excessive number of pesticides. Currently, the Department lacks the resources to effectively monitor all pesticides expected to be included on the list. Team members recommend that the statutes be revised to allow the Department more flexibility in determining which pesticides will be placed on the list.

**Statutes specify pesticide review criteria** - The Environmental Quality Act established the procedures to be used in determining which pesticides are placed on the Ground Water Protection List. A.R.S. §49-303.A requires the Department to establish specific numeric values or standards for certain environmental fate characteristics that affect pesticide mobility and persistence.(1) These values are to be used to identify pesticides that have the potential to leach into ground water.

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(1) A.R.S. §49-303.A. requires DEQ to establish specific numeric values for two indicators of pesticide mobility: water solubility and the soil adsorption coefficient. The Department must also establish numeric values for several indicators of pesticide persistence, including hydrolysis, aerobic soil metabolism, anaerobic soil metabolism, and field dissipation.

Pesticides that exceed one or more of these specific numeric values, or are less than the numeric value in the area of soil adsorption coefficients for both mobility and persistence, are to be placed on the Ground Water Protection List by DEQ.

**Statutory criteria may result in overidentification of pesticides** - Use of these procedures may result in the identification of too many pesticides. The proposed Ground Water Protection List contains 133 pesticide-active ingredients, more than two-thirds of the 194 active ingredients for which data submittals were required. The supervisor of the Pesticide Unit said the Ground Water Protection List will include a number of pesticides that have a low leaching potential. For instance, the pesticide Paraquat is currently included on the proposed Ground Water Protection List because it is persistent and exceeds the specific numeric value for water solubility, an indicator of pesticide mobility. However, the Pesticide Unit supervisor believes it is extremely unlikely that Paraquat will migrate into ground water because it adheres tightly to soil (high soil adsorption coefficient).

Regardless of whether the statutory criteria unnecessarily places pesticides on the Ground Water Protection List, the Department does not have adequate resources to conduct the monitoring required by the Pesticide Contamination Prevention statutes (see Finding II, page 13). Given existing budget constraints, team members believe the proposed Ground Water Protection List is too extensive to be adequately monitored. The cost of monitoring for listed pesticides in soil and ground water is expected to be extremely high. One team member estimates that a monitoring program for 133 pesticides would cost between $500,000 and $1 million annually.

**DEQ needs more flexibility** - The Department should be granted more flexibility in determining the specific pesticides to be included on the Ground Water Protection List. According to team members, the current legislatively imposed methodology for evaluating pesticide leaching potential is inappropriate for developing the Ground Water Protection List, and they recommend including only the most mobile and persistent compounds. Team members also suggest that specific numeric values not be

used as the sole determinant of a pesticide's leaching potential, but should be used as a starting point for identifying potential problem compounds. Several team members recommend that a screening model be used to further assess the leaching potential of pesticides. (Computer modeling has been used in Florida to examine pesticide leaching potential.) One team member said that a number of computer models are currently available. Given the information provided by the team, we believe selection of the models to be used and how they are to be used, should be left to the discretion of the Department.

A scientific advisory committee could also be established to provide technical assistance to the Department in determining which pesticides are to be included on the Ground Water Protection List. One team member recommends that an advisory committee be established to review program activities and staff decisions. This committee should interact with program staff in a supportive manner. A scientific advisory committee could also assist DEQ staff in determining which active ingredients should be included on the list. In addition, another team member suggested that an advisory committee could review the current specific numeric values.

**RECOMMENDATIONS**

1. The Legislature should consider revising the Pesticide Contamination Prevention statutes in A.R.S. §49-301 et seq. to provide DEQ with more flexibility in determining which pesticides are placed on the Ground Water Protection List.

2. If DEQ is given more program flexibility, then the Legislature should consider establishing a scientific advisory committee to provide technical assistance to DEQ in determining which pesticides should be included on the Ground Water Protection List.

## FINDING II

## DEQ NEEDS TO PLAN HOW IT WILL MEET ITS GROWING PESTICIDE MONITORING WORKLOAD

To comply with statutory requirements, the Department of Environmental Quality will need to increase its efforts to monitor for pesticides. Although several units within the Department have some monitoring responsibilities, to date, very little monitoring has been done for pesticides. DEQ needs to plan more effectively, set priorities, and estimate the costs of meeting its future monitoring obligations.

### DEQ's Monitoring Responsibilities

State and Federal laws assign DEQ three general responsibilities for monitoring both soil and water for contaminants, including pesticides. The Pesticide Contamination Prevention Program established by the Environmental Quality Act, mandates the Department to monitor soil and ground water as part of the State's efforts to prevent pesticide contamination of ground water. In addition, A.R.S. §49-225 establishes a statewide water quality monitoring program for both the State's surface and ground water. Finally, the Federal Safe Drinking Water Act requires DEQ to oversee monitoring of public drinking water systems.

### Monitoring Is Important

Monitoring is an essential component of environmental protection programs. Information about the occurrence and distribution of contaminants is necessary to support informed decision making and effective management of the State's natural resources. Monitoring is also an important part of programs designed to ensure compliance with water quality standards. Sampling data must be gathered for the assessment of existing water quality and the forecasting of future trends. Sampling is also necessary at known contamination sites to determine the extent of the problem and the need for cleanup.

Monitoring by DEQ and other agencies have identified pesticide contamination in soil and water in a number of areas in the State. For example, ground water in parts of Yuma and Maricopa Counties has been found to be contaminated with DBCP and EDB, two agricultural-use pesticides that have now been banned by the Environmental Protection Agency. Pesticide contamination has also been documented in surface water and sediments along the middle Gila River between Phoenix and the Painted Rock Reservoir, and DDT residue has been found in soil in portions of Maricopa County.

**Increased Monitoring For Pesticides Will Be Required In The Future**

In the future, DEQ will need to increase its pesticide monitoring efforts substantially. Despite the involvement of a number of Departmental units, limited monitoring for pesticides in soil and water has been done. However, both current and anticipated Federal and State regulations will require much more extensive monitoring for pesticides in the future.

**Pesticide Contamination Prevention Program** - DEQ's Pesticide Unit is not currently required to perform monitoring activities. However, after the Ground Water Protection List is adopted in 1991, the unit will need to develop a substantial soil and ground water monitoring program.

The Pesticide Unit, responsible for administering the Pesticide Contamination Prevention Program, to date, has not been required to perform monitoring activities. The unit has instead concentrated its efforts on reviewing data submitted on pesticides, and developing a Ground Water Protection List (see Finding I, page 5.) Although not required to do so, the unit has also conducted limited sampling for the detection of agricultural pesticides. These monitoring activities were exploratory in nature, and designed to assess the extent of contamination and develop sampling methods. For a three-year period from July 1987 to July 1990, unit staff collected 243 samples. Aside from sampling for special projects (e.q., the Maryvale cancer cluster study), sampling has been confined to six areas of the State: Yuma, the lower Gila River basin (near Yuma), the Phoenix Active Management Area (AMA), the Tucson AMA, the Gila River Basin, and Safford. Focusing its efforts on ground water, the unit had collected only 29 soil samples at the time of our audit.

Once the Ground Water Protection List is formally adopted (anticipated to occur in mid-1991), substantial ground water monitoring and soil sampling will be required. Ground water monitoring must be conducted in the agricultural areas of the State that have not been previously sampled. The Pesticide Unit has not collected any samples in the agricultural areas surrounding Willcox, the Mojave Valley, Parker, Casa Grande, Coolidge, and Eloy. According to the supervisor of the Ground Water Monitoring and Assessment Unit, additional sampling is also needed in the areas previously sampled by Pesticide Unit staff.

Soil sampling will be needed in all agricultural areas of the State to determine where pesticides have migrated below the root zone or eight feet. Monitoring for pesticide residues in the soil will allow unit staff to identify the areas in which ground water contamination might occur in the future. Extensive sampling is needed to determine the level of soil contamination in the State. An expert from the Soil and Water Science Department at the University of Arizona believes, to accurately assess chemical leaching in the soil, it may be necessary to sample ten or more sites in a 40-acre field. He also thinks six samples should be collected at each site to measure chemical concentrations at different depths.

**Statewide water quality monitoring** - Very little ongoing monitoring for the presence of pesticides in surface or ground water has been done by other DEQ Units. To meet statutory requirements, more needs to be done.

The Department is required by State and Federal laws to monitor water quality in Arizona. A.R.S. §49-225 requires DEQ to conduct ongoing monitoring of surface and ground water and analyze samples collected for a variety of pollutants, including pesticides. Under the Federal Clean Water Act, monitoring of surface and ground water quality is also required if states wish to receive certain Federal grants.

Although DEQ has implemented a surface water quality monitoring program, very limited monitoring for the presence of pesticides has been done. In conjunction with the U.S. Geological Survey, the Department operates a

Statewide network of 60 monitoring sites that are sampled periodically for a variety of substances including microbiological organisms, inorganic compounds, and metals. However, samples collected at these sites are not currently analyzed for pesticides. In addition, DEQ has gathered samples as part of EPA's Priority Pollutant monitoring project. These samples were analyzed for a variety of contaminants, including some pesticides.

In addition, the Department has not implemented a program to monitor ground water quality Statewide. The DEQ unit responsible for monitoring of ground water quality has focused its efforts on areas of known or suspected contamination, rather than performing ongoing, routine monitoring throughout the State. This type of sampling, known as target monitoring, is not designed to assess general water quality. Only two sampling projects undertaken by the unit were designed to assess general quality. In addition, few of the unit's target monitoring projects have involved monitoring for pesticides. The unit's monitoring efforts are extremely limited because staff members have been assigned a number of other responsibilities. The unit supervisor estimates that his staff members each spend only five to 15 days per year in field-related activities.

More monitoring of pesticides is necessary to meet statutory requirements. The supervisor of the DEQ unit responsible for ground water monitoring said he would like the Department to establish an extensive system of regional monitoring networks for the collection of ground water quality data. Regional networks could then be established for each ground water basin in the State. Under this proposal, regional networks would be established initially in the State's four Active Management Areas and also in those areas with substantial population growth.

**Public drinking water supply monitoring** - Finally, monitoring for pesticides in public drinking water supplies has been limited. However, as a result of new Federal directives, more monitoring for pesticides will be required in the future, and DEQ's responsibilities for administering this program will increase.

DEQ has been designated responsibility by EPA for the administration of the Federal Safe Drinking Water Act (SDWA) in Arizona. The act requires that public drinking water suppliers periodically monitor for the presence of contaminants for which drinking water standards have been established.[1] Federal drinking water standards, called Maximum Contaminant Levels (MCLs), have been established for six pesticides. To ensure that the water they provide complies with established standards, public drinking water systems must report monitoring results to DEQ.

At the present time, monitoring for pesticides in public drinking water systems is very limited. DEQ requires those systems that utilize surface water to test for Endrin, Lindane, Methoxychlor, Toxaphene, 2,4-D, and 2,4,5-TP Silvex every three years.[2] Systems using only ground water are not presently required to routinely monitor for any pesticides. Under current DEQ rules, the Department can require ground water-based systems to monitor for these pesticides, if they are found to be vulnerable to contamination. However, DEQ has not performed vulnerability assessments of these drinking water systems.

DEQ's responsibilities are likely to increase as a result of new Federal directives that will mandate more pesticide monitoring. The 1986 amendments to the Federal Safe Drinking Water Act require the EPA to regulate 83 contaminants, including 20 additional pesticides. The EPA is also proposing monitoring requirements for another 29 unregulated contaminants including at least 10 pesticides. Proposed Federal regulations (expected to go into effect in January 1991) would increase the Department's workload. DEQ will be required to conduct vulnerability assessments to determine the requirements each drinking water system will need to meet. In addition, Department staff will have more sampling data to review.

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(1) To be classified as a public drinking water system, a system must have at least 15 service connections or serve an average of at least 25 people for at least 60 days per year.

(2) The Department's Arizona Drinking Water System Compliance Status Report for July 1988 through August 1989 indicates that 43 public drinking water systems, serving 1,568,220 people, were required to sample for these pesticides.

## DEQ Needs To Plan More Effectively

DEQ has not adequately planned how it will meet its future pesticide monitoring obligations. Given resource constraints, DEQ needs to set priorities and specify the level of monitoring activity necessary to satisfy basic program requirements. DEQ also needs to estimate the amount of additional funding that will be necessary for pesticide monitoring.

**Better planning needed** - Although DEQ has prepared general strategies to direct its future monitoring programs, detailed monitoring plans prioritizing its program efforts still need to be developed. The Department has developed general planning documents such as the Ground Water Protection Strategy and the Ground Water Quality Monitoring Strategy. However, these strategies do not relate resources to planned monitoring activities, nor do the planning documents include criteria for establishing monitoring priorities, procedures for selecting sampling locations, or determining contaminants to be monitored.

By contrast, other states have developed plans for prioritizing what areas will be monitored and for which pesticides. The California Department of Food and Agriculture has developed a procedure for monitoring pesticides on the Ground Water Protection List that recognizes the Department's resource constraints. California plans to focus its pesticide monitoring activities in areas adjacent to established Pesticide Management Zones and also in those areas where pesticides are heavily used or where soils are vulnerable to leaching. In selecting sampling locations, the Florida Pesticide Review Council has also established criteria that consider a number of hydrogeological factors (the depth to ground water, soil permeability, and recharge capacity).

California and Florida have also developed procedures to prioritize the pesticides they will monitor. California has limited the number of pesticides on its ground water protection list to 16. The 16 include pesticides that have been found in ground water in California, and those pesticides that have been identified as potential leachers and are applied to or injected into the soil by ground-based equipment, chemigation, or in conjunction with floor or furrow irrigation.

California has developed a procedure to further rank these pesticides. Monitoring efforts focus on those pesticides with the most adverse health effects and the highest volume of application. Florida's Pesticide Review Council also prioritizes pesticides for monitoring. Factors used to determine which pesticides to test for include the pesticide's level of persistence and mobility, the method of application, and those with chronic and acute toxicity.

**Future funding needs** - The substantial amount of additional monitoring required will be costly. When the Ground Water Protection List is established, the Pesticide Contamination Prevention Program will require the Department to conduct both ground water and soil monitoring in all agricultural areas of the State. The costs of sample collection alone are expected to be high, due to the limited number of samples that can be collected each day and the travel costs involved. To date, the Department has not estimated how much additional funding will be needed to implement this program.

Additional funding will also be needed to fully implement a system for Statewide monitoring of ground water quality. With existing resources, a regional network covering the entire State could not be established for more than five years, and the amount of additional funding that would be necessary for monitoring ground water quality is unknown. Details of the proposed network need to be specified so that additional funding requirements can be determined.

Because more sampling will be done in the future, costs for sample analysis will also increase. The Department of Health Services (DHS) has developed methods of testing for the presence of most of the pesticides on the proposed Ground Water Protection List. The manager of the Office of Environmental and Analytical Chemistry at DHS estimates it will cost approximately $800 to analyze each sample for every pesticide on the proposed Ground Water Protection List. An expert from the University of Arizona's Soil and Water Science Department believes this estimate of laboratory analysis costs is very low. The cost to analyze samples is expected to be high because of the large number of pesticides on DEQ's proposed Ground Water Protection List and the technical difficulty of analyzing samples drawn from a variety of media.

Finally, the cost of conducting vulnerability assessments of public drinking water systems needs to be determined. No estimates of the cost of such assessments have, to date, been developed.

## RECOMMENDATIONS

1. The Department should prepare detailed plans to direct all major monitoring programs. These plans should specify the resources needed to implement programs, and should also establish procedures for prioritizing monitoring efforts.

2. The Department should determine the amount of additional funding that will be needed for sample collection and analysis to carry out the monitoring requirements of the Pesticide Contamination Prevention Program (A.R.S. §49-307).

3. The Department should also determine the amount of additional funding that will be necessary to implement a Statewide, ground water quality monitoring program as required in A.R.S. §49-225.

4. The Department should develop plans for conducting vulnerability assessments of public drinking water systems, and determine the amount of additional funding necessary to conduct these assessments.

## FINDING III

## DEQ'S ENFORCEMENT OF HAZARDOUS WASTE LAWS RELATING TO PESTICIDES COULD BE STRENGTHENED

DEQ could improve its enforcement of the hazardous waste laws that require responsible parties to clean up pesticide contamination. Although pesticides are often a lower priority than other hazardous wastes, DEQ could improve the timeliness of its actions in pesticide cases. Providing DEQ with additional resources and administrative authority could enhance the Department's ability to take timely and effective action.

### Scope Of Review

DEQ has several departments and programs that are involved with pesticides to some degree. For example, its Hazardous Waste Compliance Unit enforces the Federal Resource Conservation and Recovery Act (RCRA) which covers certain pesticides. The Site Assessment Unit performs site evaluations for possible inclusion on the Federal Superfund list or for cleanup by the State Water Quality Assurance Revolving Fund. DEQ's Emergency Response Unit responds to pesticide spills and other events which present an imminent danger.

During our audit we focused on the pesticide-related RCRA cases handled by DEQ's Hazardous Waste Compliance Unit. We focused on this unit because the RCRA files we reviewed in our compilation of Incidents and Accidents (see Report #90-6, page 31), indicated a possible problem with timeliness, and because RCRA is one of the few programs in which DEQ has enforcement authority. Other programs had few pesticide-related cases or focused on remediation instead of enforcement. Our analysis consisted of a review of pesticide-related RCRA cases and of EPA evaluations regarding overall RCRA program performance.

## DEQ Enforces Federal Hazardous Waste Law

As directed by Arizona Revised Statutes 49-922 and under an agreement with EPA, DEQ enforces the 1976 Federal Resource Conservation and Recovery Act (RCRA) in Arizona. RCRA regulates the management of hazardous wastes, including certain pesticides, in order to protect human health and the environment. In federal fiscal year 1990, Arizona received $1,073,598 in federal funds and the state authorized further expenditures of $564,259 for the program. Pesticide-related cases are only a small portion of DEQ's RCRA enforcement activities: of 184 cases closed in 1989, we identified only 12 that appeared to involve pesticides.

In Arizona, commercial pesticide applicators and pesticide formulators (companies which dilute and repackage pesticides) must comply with RCRA requirements for disposing of containers, residue, and rinse solutions. Farmers are exempt from RCRA regulations regarding pesticides used only by them, as long as they dispose of containers and residues according to the pesticide label instructions.

Current laws do not address all hazardous waste threats to the environment. RCRA provides only limited authority over abandoned or inactive sites. The Federal Superfund enables the government to clean up the worst of such sites, but Arizona's sparse population and other factors prevent most Arizona sites from qualifying for Federal cleanup. Arizona's Water Quality Assurance Revolving Fund allows DEQ to clean up some sites, but only if they threaten to contaminate surface or ground water.

## DEQ Has Not Been Timely

DEQ has not taken timely action in some RCRA cases involving pesticides. Our review of pesticide-related incidents and accidents indicated DEQ lacked timeliness in RCRA enforcement. Our analysis of EPA evaluations also showed the overall RCRA program has had timeliness problems, although DEQ has made progress in resolving them.

**Case resolution has been slow** - At the time of our review in April 1990, 15 cases were still open out of the 21 pesticide-related RCRA cases identified in our compilation of incidents and accidents for the period August 13, 1986 to June 30, 1989. These cases had been open an average of 2 1/4 years as of April 1, 1990. Timeliness is important to prevent environmental damage from toxins dispersed by wind or migrating through the soil towards ground water. Delays can cause problems for landowners who cannot predict their ultimate cost or sell their property until a RCRA case is resolved, and may damage DEQ's credibility and in turn impair the Department's effectiveness. As the following examples illustrate, the process could be accelerated.

- **Example 1** - In 1980, a pesticide formulator (a company which dilutes and re-packages pesticides) applied for and received permission to generate hazardous wastes, although it did not submit the required financial responsibility information. In 1981, DHS[1] inspected the site and identified numerous RCRA violations. Soil at the site was badly contaminated, and the company had accumulated thousands of barrels encrusted with pesticide residue. In addition, the company did not comply with several regulations designed to protect employees and the public from the hazardous wastes. That year, DEQ requested the company to begin a site assessment and cleanup process, and to comply with other RCRA regulations. The owner elected not to comply with DEQ's request. Between 1981 and 1989, DEQ conducted annual inspections and found similar violations at every visit. The company owner appears to have limited financial resources, and has repeatedly sought an inexpensive solution to his contamination problems, causing delays and possibly adding to the total cost of cleanup.

  Finally, in 1989, eight years after the first inspection, DEQ conducted the latest of its annual inspections of the site. DEQ identified 16 RCRA violations, including failure to control entry to the site, all of which were repeat violations. Furthermore, cleanup of the soil contamination had not begun. DEQ issued a Letter of Warning, but thirteen months later had received no response. Although these letters carry a response deadline of from 20 to 40 days after receipt, the Department has not followed up on the failure to respond.

  **Comment** - DEQ has attempted to resolve this problem but has achieved only incremental improvements. The Department has consistently identified the same violations, but has never taken any action more serious than issuing a Letter of Warning, and has not followed up promptly on the owner's failure to meet deadlines. Consequently, the

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(1) In 1987, the Environmental Health Services division of the Department of Health Services (DHS) was removed from DHS to form DEQ. RCRA actions prior to 1987 were the responsibility of DHS.

owner has continued generating hazardous wastes and violating RCRA statutes for nearly a decade since his first discovered violation. DEQ officials explained that working patiently with the owner is preferable to taking action that might close down the business and leave cleanup responsibility to the government.

- **Example 2** - In 1984, DEQ responded to an anonymous complaint by inspecting the airport location of an aerial pesticide applicator, and found that parathion (a highly toxic organophosphate pesticide) contaminated the soil. Although the company changed its practices to avoid further contamination, RCRA required it to remediate the site. The owner cooperated in negotiating an agreement with DEQ, and submitted a proposed site assessment plan - the first step in remediation - only nine months after the inspection. DEQ, however, did not respond to the proposal until 15 months later. The company moved quickly to revise and carry out the site assessment plan, and DEQ promptly gave instructions on preparing a cleanup plan.

  However, the company did not submit a cleanup proposal until 15 months after receiving DEQ's instructions. DEQ rejected the proposal for in situ treatment, since it would require a research permit and an EPA-approved "closure plan." The Department ordered the company to choose between disposing of the soil in a landfill or allowing DEQ to write a remediation plan; the company had 20 days to respond. Over a year later, the company submitted a proposal to use waste-eating bacteria to treat the site. DEQ received this proposal in February, 1988, but had not responded by August, 1990, two and a half years later.

  **Comment** - DEQ has not taken timely action in this case. Because the site is enclosed and the company changed its procedures to avoid further contamination, DEQ has assigned a low priority to this cleanup. As in Example 1, the company's search for an inexpensive cleanup technique has delayed progress.

**EPA also found problems with timeliness** - EPA's mid-1989 evaluation of DEQ's entire RCRA program noted that no action had been taken in a large backlog of cases. In 82 cases, the Department had taken no enforcement action within 100 days of identifying a RCRA violation; and 135 cases were pending at the time of the EPA review. EPA's mid-1990 evaluation, however, noted "significant achievements" in addressing the case backlog criticized in the mid-1989 evaluation. According to the mid-1990 report, DEQ had only 19 cases not addressed by enforcement action in 100 days, and the Department had taken action on all but four of the 135 cases which were pending at the time of the mid-1989 evaluation. Our audit work did not encompass DEQ's most recent pesticide-related cases, but EPA's comments cover all RCRA cases including those related to pesticides.

## Several Factors Cause Slow Resolution

Low priority assigned to many pesticide cases, inadequate staff resources, and the lack of administrative penalty authority hamper DEQ's ability to resolve pesticide-related RCRA cases in a timely manner. Although priorities appear appropriate, additional resources and a change in statute could improve DEQ's performance in this area.

**Many pesticide-related cases receive low priority** - DEQ prioritizes cases based on potential harm, so the resolution of some pesticide waste problems may be postponed in favor of more dangerous cases involving ignitable, corrosive, or explosive substances. According to DEQ,limited resources require that cases be prioritized. Pesticide related cases closed in 1989 included cleanup of contaminated soil at the former location of a pesticide warehouse, and investigation of a complaint that a pest control company rinsed out its trucks in a shared alley. Although important, these cases may be less urgent than cleaning up a site where industrial solvents could leach into public drinking water, for example.

DEQ has taken prompt action where pesticide-related cases have taken higher priority due to the public health dangers they represented. For example,

- A young child was hospitalized after playing in an area where torn bags of pesticides had been illegally dumped. DEQ deferred to the Arizona Commission on Agriculture and Horticulture in penalizing the responsible party, but worked with the landowner to have the site cleaned up and prevent further incidents.
- A farmer accidentally contaminated a semi-public well and nearby soil with a banned pesticide. DEQ pursued criminal penalties against the farmer and obtained satisfactory cleanup of soil and water within 18 months of the incident.

**Limited resources can affect case timeliness** - In 1988, four of the Hazardous Waste Compliance Unit's nine positions were vacant, causing a backlog and affecting unit timeliness well into 1989. (Department officials report a continuing problem with retaining staff, as the private sector offers many opportunities for experienced environmental specialists.) DEQ filled the vacancies and made significant progress in

addressing the backlog, but recent changes may again slow enforcement actions. On July 1, 1990, DEQ transferred two RCRA compliance positions to another section. This action will probably result in some slowdown in RCRA cases, as the remaining staff will have a greater workload than before.

**Penalty authority needed** - A statutory change giving DEQ administrative penalty authority recommended by EPA could help expedite resolution of RCRA cases. Under present law, the Attorney General must seek penalties for RCRA violations through the courts. This is both difficult and time consuming. DEQ staff report pursuing a case in court can take as long as three years and require considerable staff time throughout. By contrast, 28 states can impose administrative penalties for RCRA violations without going to court. Maximum penalties in these states range from $1,000 per day to $25,000 per day. Although statutory penalties for RCRA violations are high - up to $10,000 per day per violation in Arizona - DEQ could make use of smaller penalties administratively, freeing the Attorney General to pursue larger penalties for the highest priority violators in the courts.

EPA encourages RCRA-authorized states to use administrative penalties. The Agency is considering making the ability to impose administrative penalties a prerequisite for RCRA authorization.

## RECOMMENDATIONS

1. The Legislature should consider amending current statutes to give DEQ the authority to impose administrative penalties on RCRA violators.

2. DEQ should continue its efforts to improve its timeliness in resolving RCRA cases.

3. DEQ should request the additional resources necessary to implement an effective enforcement program.

# ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

ROSE MOFFORD, GOVERNOR
RANDOLPH WOOD, DIRECTOR

November 29, 1990

Mr. Douglas R. Norton, Auditor General
Office of the Auditor General
2700 North Central Avenue, Suite 700
Phoenix, Arizona 85004

Dear Mr. Norton:

Thank you for the opportunity to meet with your staff members on November 20, 1990, regarding our review of performance audit reports entitled Pesticide Regulation: Department of Environmental Quality and Pesticide Regulation: Programwide Issues. We also appreciate the receptivity of your office to our concerns about these reports. The comments should be used as appendices to the reports.

During our November 20 meeting we discussed the footnote to Table 1, on page 2 of Pesticide Regulation: Programwide Issues. Although the revised preliminary report draft contains a change in the footnotes. I consider that a more accurate statement would be:

1. The Department's accounting system does not break out expenditures that are specifically related to pesticides. This is because of the many mandates that ADEQ must carry out, and hazardous substances in addition to pesticides it must regulate. However, estimates of the costs for handling pesticide-related matters were provided by both ADEQ programs covered by the audit.

To facilitate the review process, our specific comments are provided as attachments to this letter.

Our most significant concern regarding the performance audit of the Pesticide Contamination Prevention Program is the audit's reliance on the report by J.F. Artiola, J. Chernicky, M. Brusseau and J. Watson, which was commissioned by your office. After carefully evaluating their report, we believe that the consultants were not given all the information that they needed for the purpose of performing an adequate review of the program. Members of my staff disagree with several conclusions reached by the consultants. Their rebuttal is attached to this letter.

As currently written, the performance audit of the pesticide related cases managed by the hazardous waste program may give readers the impression that the two example cases cited are representative of all cases handled by the program. In fact, members of your staff requested information on 107 cases managed

by the hazardous waste program. Of these cases, only 29 were still active cases at the time of the audit. Eleven of the cases have been open for three or more years. Most of the unresolved cases involve long term monitoring (post-closure care) or extensive remedial work. Seventy-three percent of the audited cases have been resolved by the efforts of my staff. The tremendous cost of environmental contamination clean up forces small businesses into considering alternatives that are rejected due to legal or technical obstacles. This results in "false starts" by the responsible party that cause considerable delays. Where there is no imminent or substantial endangerment to environment or human health, the Arizona Department of Environmental Quality (ADEQ) affords the responsible party many opportunities to voluntarily resolve the problem in an affordable manner.

The auditor's reports failed to acknowledge that ADEQ always takes immediate actions to abate imminent hazards. For example, during 1987 - 1989, ADEQ secured immediate hazard abatement for 36 of 65 pesticide incident reports received during this period. Fifteen of the remaining 29 cases were determined to pose no threat to human health and the environment. The remainder were handled by other agencies, including local authorities. Hazardous waste program policy dictates that immediate hazards must be abated for all cases received by the various units having responsibility. Such interim protective measures include erection of fencing, removal of abandoned drums, removal of grossly contaminated soil, and placement of cap materials such as clay on top of contaminated sites. Once a site has been stabilized, long term remedial measures are scheduled with the responsible party.

It is also important to note that only 14 percent of ADEQ's hazardous waste cases involve pesticides. In fact, only 41 of approximately 350 commercial chemical products listed as hazardous wastes are pesticides. The universe of hazardous substances that ADEQ must respond to includes many immediately dangerous compounds that are not pesticides such as explosives, cyanides and flammables.

During the past two years, ADEQ has taken many significant enforcement actions against violators. For example, we have assessed greater than $30,000 in civil penalties from four facilities. These were the first civil actions ever taken in the history of the State of Arizona for violation of environmental protection laws. Seven additional cases were referred to the Attorney General's Office for civil penalties during the past year.

In summary, our pesticide related cases are managed by eliminating the immediate hazards and then ranking them with all other pending hazardous waste cases that must be resolved. The time required to resolve each case often depends on the responsible party's willingness to make the significant financial commitment that is always necessary for rapid correction of problems. Our limited manpower resources are used to address the most dangerous environmental problems. Existing laws and rules afford responsible parties the right to legal due process that is often used by them to delay final problem resolution. Although we are always striving to improve our performance, we believe the compliance progress made and environmental protection afforded by the approximately 200 hazardous waste cases that we were able to close last year is a respectable achievement.

Please call me directly at 257-6917, if you wish to discuss this letter or the enclosed materials.

Sincerely,

Randolph Wood

Randolph Wood, Director

Attachments

**ATTACHMENT ONE** November 29, 1990

# COMMENTS ON AUDITOR GENERAL'S OFFICE REVISED PRELIMINARY REPORTS ON PESTICIDE REGULATION: DEPARTMENT OF ENVIRONMENTAL QUALITY

## General Comments

A factor affecting timeliness discussed with the auditors during their staff interviews was laboratory turnaround time. ADEQ uses the Arizona Department of Health Services State Laboratory for its laboratory services because we are assured of good chain of custody procedures and expert witnesses. However, the lab has its own manpower problems which have resulted in 6 to 8 months between sample submittal and sample result reporting for some samples. The Office of Waste Programs routinely collects split samples at sites contaminated by hazardous waste to ensure that honest and accurate results are reported by responsible parties. Remedial projects often involve several phases of sampling and a report must be submitted for each phase. ADEQ must wait for our lab results to come in before completing the review of reports submitted by facility owners.

The report makes no statements about the program's outreach and education efforts. In fact, there are many examples of such activity and services provided by the program. These include our efforts to resolve the issue of pesticide container burning, public presentations on pesticide container disposal, technical assistance meetings and phone consultations.

The report neglects to acknowledge the program's attempts to resolve pesticide clean up projects through the use of nationally accepted technical and scientific standards. These include health risk assessments, geohydrological investigations, statistically sound sampling methods, and proper laboratory quality assurance/ quality control procedures. The application of these methods ensures legally defensible clean up decision making which we believe is important for preserving the Department's public accountability.

Specific Comments

**Executive Summary, page 3:**

> "...after numerous RCRA violations were identified, one pesticide formulator was inspected annually from 1981 through 1989. However, neither DEQ nor the Environmental Protection Agency (EPA) ever cited what actions the company should take to clean up the site. Following these repeated violations, DEQ issued a Letter of Warning in 1989, and after 13 months has not received a response as required."

**Response:** EPA issued a compliance order to the facility in question on February 8, 1983. The final order was issued on April 18, 1983. A consent agreement was entered between EPA and the facility owners on June 20, 1983. Following inspections in 1984, 1985, 1986 and 1987, EPA and the company co-signed another consent agreement. Letters of warning were sent to the company by ADEQ after the 1987 and 1989 inspections. A response to ADEQ's last letter of warning dated July 27, 1990, was received by ADEQ on September 4, 1990. ADEQ responded to the facility's September 4, 1990 submittal on October 22, 1990, and received a new submittal on November 12, 1990.

The wording of the auditor's report implies that nothing has been done. However, ADEQ and the EPA have clearly responded to the violations documented by the inspections. It should also be noted that the EPA is the lead regulatory agency for this case.

**Finding III, Scope of Review, page 21:**

The report states that the audit focused on the cases handled by the Hazardous Waste Compliance Unit because other ADEQ programs emphasize remediation instead of enforcement.

**Response:** ADEQ has identified 126 pesticide related cases that have been or are currently active in other ADEQ programs. All of these cases are handled through some existing enforcement authority (Solid Waste Management Act, Environmental Quality Act, Environmental Nuisance Law or Comprehensive Environmental Response Compensation and Liability Act). If corrective action is immediately necessary to protect human health or the environment, ADEQ eliminates the hazard immediately. Costs incurred by the Department may be recovered through existing authorities. Cases that are handled by the state and federal "Superfund" authorities also include enforcement through orders that include site clean up and cost recovery.

**DEQ Enforces Federal Hazardous Waste Law, page 22:**

The second paragraph implies that all commercial applicators and pesticide formulators must comply with RCRA and that farmers are exempt.

**Response:** Because only 41 of approximately 350 commercial chemical products listed as hazardous wastes are pesticides, and there are hundreds of pesticides used in Arizona, it is possible that some applicators and formulators do not handle pesticides that are regulated as hazardous waste when discarded. In addition to following pesticide label instructions, farmers must also follow specific RCRA and ADEQ Solid Waste rules in order to be exempt. These rules include reuse of container rinsate as a pesticide product, and application to ADEQ for a Solid Waste permit if containers are disposed of on-site.

**Case Resolution has been slow, page 23:**

ADEQ identified 107 cases related to pesticides that were handled by the Waste Compliance Unit during the past three years. Fifty-five percent of the cases were remedial cases and several others have been kept open because they involve post closure monitoring of a stabilized disposal site. ADEQ has very high standards for closure of a site that has been contaminated by pesticides. ADEQ evaluates the potential for environmental or public harm and immediately requests or orders interim corrective measures to reduce risks posed by the site. These immediate control actions include fencing, removal of "free product", and capping the most heavily contaminated areas with clay or other physical barriers. In most cases, the land owner or responsible party must demonstrate to ADEQ that the pesticides at the site have been removed to non-detectable levels or to levels based on a health risk assessment conducted by the Arizona Department of Health Services. Technical guidance is provided to responsible parties as they attempt to remediate their site and demonstrate that it has been adequately remediated. The submittals undergo an internal review process by ADEQ's environmental scientists and engineers. When samples are collected, both ADEQ and the facility obtain and analyze samples. Delays are caused by poor quality submittals, technologically unsound remediation proposals, laboratory turnaround time, conflicting laboratory results, staffing limitations and the legal due process. ADEQ believes that it is necessary to oversee these projects to ensure that contaminated sites are restored to a safe condition. Cases that do not involve site remediation or post closure monitoring are usually resolved within one year of their initiation as a new case.

**Specific Examples of Cases, pages 22 and 23:**

In example 1, the report states that ADEQ has never taken any action more serious than issuing a Letter of Warning.

**Response:** In addition to the responses previously stated, we wish to point out that EPA and ADEQ have been working together on this difficult project for years. EPA has taken formal enforcement actions and ADEQ has issued several letters of warning. The company is undertaking a clean up of the site through the EPA consent agreement. ADEQ agrees that the compliance history for this company justifies an additional enforcement action. However, the Office of Waste Programs has prioritized its cases to select a few cases out of its caseload for escalated enforcement action. Despite the problems we have documented, this company was not identified as one of those cases that we feel can be referred to the Attorney General's Office at this time. If manpower resources are increased, additional cases will be targeted for escalated enforcement action.

Page 23 of the report states that ADEQ has not taken timely action at an aerial pesticide applicator site contaminated with Parathion. The report also states that the Department rejected a proposal from the operator for in-situ treatment, since it would require a research permit and an EPA-approved "closure plan."

**Response:** ADEQ has repeatedly attempted to obtain a reasonable and scientifically based clean up plan from this operator with no success. ADEQ has met with the responsible party on numerous occasions to instruct him regarding the technical content of an acceptable clean up plan. The research permit or closure plan have always been options available to this operator. We have informed him that he must submit these appropriate documents in their entirety if he wishes to pursue either of those options. Following the last meeting, ADEQ decided that the operator does not have the financial or technical means to adequately close the site. Faced with this problem, we considered performing the clean up work with government money or attempting to compel a "deep pockets" to do the clean up work. During the course of this decision making, ADEQ visited the site in March, 1988, and conducted a record review in July, 1989. The site visit and a Preliminary Assessment done by EPA for the site revealed that there is no imminent danger to human health or the environment, including waters of the state, posed by the site. The record review showed that the responsible party cannot afford the clean up. In order for ADEQ to utilize State money to clean up the site, we need to be able to demonstrate that there are substantial risks to human health or the ground waters or surface waters of the state. Our previous evaluations show that the site does not qualify for either state or federal money. Under these circumstances, the Office of Waste Programs decided to place future attempts to have the site remediated on hold pending additional staff resources or new legal authorities.

**Many Pesticide-Related Cases Receive Low Priority, page 25:**

Two cases were given as examples of ADEQ's rapid response to incidents that pose immediate threats to human health or the environment. The second case states that ADEQ pursued criminal penalties against the farmer.

**Response:** ADEQ cooperated with the Attorney General's Office during case development, prosecution and sentencing of the responsible individual. However, the Attorney General's Office actually obtained the penalties. ADEQ did compel the farmer to clean up the site using our administrative authorities.

**RESPONSE TO SUMMARIES OF J.F. Artiola, J. Chernicky, M. Brusseau and J. Watson in Appendix of Pesticide Regulation: Department of Environmental Quality**

The reviewers from the University of Arizona address several areas in their summaries of comments, attached to the audit report. ADEQ, through this response, wishes to address some of the issues raised. These issues fall into the general categories of Guidelines for Data Packages, Staffing Adequacy, Filing and Record keeping, Organic Carbon and Organic Matter, Use of $K_d$ for Soil Adsorption Coefficient, Monitoring and Testing, and Adequacy of Specific Numeric Values. These are discussed below.

**Guidelines for Data Packages**

Guidelines are established by the USEPA for submittal of studies to support federal registration of pesticides. These Pesticides Assessment Guidelines (Subdivisions D and N) are made available to the registrants at any time through NTIS (National Technical Information Center). Since all pesticides registered in Arizona and subject to the data call-in are federally registered, it is assumed that the registrants of the pesticides are in possession of or are familiar with the guidelines.

ADEQ acknowledges that the review protocol was not completely developed prior to the Data Call-In. This was due to the extremely short time frames established by the original legislation. Much of the protocol was developed in close association and communication (and debate) with pesticide manufacturers.

## Staffing Adequacy

Dr. Yu has not been solely responsible for the implementation of the Pesticide Contamination Prevention Program. Initial decisions on how to handle various classes of compounds and particular situations were made on a consensus basis involving members of the Environmental Fate Analysis Team. There were several individuals involved in data review during the first two years of the program, and there are currently one and a half positions involved in the data call-in process.

A person in the ADEQ staff has been designated as a "trainee" in the review process. A procedural manual has been developed to document the process. The bulk of the work in "grandfathering" pesticides during the data review process is complete, and pesticide manufacturers are tying up loose ends in the data submittal process. It should also be recognized that as the data review work subsides, so does the criticality of a "staff limited" operational framework. Staff efforts in the future will be more oriented toward the monitoring aspects of the program.

## Record-keeping and Communication

ADEQ Pesticide Contamination Prevention Program files in the office are highly organized into sub-categories including Review Correspondence/Rebuttals, Time Extensions, Data Gap Notices/Product Status, Formulator/Supplier Notices, Exemptions/Cancellations, and Miscellaneous Correspondence. This system of organization was lost when the files were copied and mailed to the reviewers, making the record less organized and more difficult to follow. The U of A reviewers would have had fewer problems if the review had been conducted at ADEQ.

Due to the very frequent contacts between registrants and ADEQ staff, requests for decisions, and all decisions made by ADEQ staff, are in writing. Whenever a request for a determination from a registrant was made by telephone, ADEQ staff always require that the request be made in writing. ADEQ responses are required to be in writing.

Registrants do not always enter the correct information as reflected in the submittals in the Data Summary Form; therefore, ADEQ staff has been assuring that data on the summary sheets is correct. All accepted data is properly documented on the forms prior to entry into computer databases. Registrants are mailed a letter indicating that all requirements have been met after such determination is made. Registrants are also provided status update reports on a regular basis to advise them of the status of their submittals.

## Organic Carbon and Organic Matter

Registrants were informed of the Arizona agricultural soil requirements during the mail out of the Data Call-In package (July, 1987). At the same time, they were informed of these requirements during each meeting between ADEQ staff and Western Agricultural Chemical Association. ADEQ staff also stressed in these meetings that the conversion factor of 1.724 would be used to convert % organic matter to % organic carbon if there was no information indicating how the latter was derived in the submittals. Given the circumstances, ADEQ staff has done its best to convey this information to the registrants.

## Use of $K_d$ for Soil Adsorption Coefficient

ADEQ feels that $K_d$ is the more appropriate measure of soil absorption than $K_{oc}$ given the typically low organic carbon content of Arizona's soils. Whether $K_d$ or $K_{oc}$ should be used in the Data Call-In has been given a great deal of consideration. Use of $K_{oc}$ assumes that soil organic carbon is the sole component responsible for the adsorption of a chemical on soil. In addition to pesticide sorption by soil organic matter, clay minerals also adsorb a certain amount of a chemical. This is a particularly important consideration in Arizona where, because soil organic carbon is so low, there is a greater potential for soil mineralogy to be a dominant influence on pesticide sorption.

The role of soil organic carbon in chemical adsorption is not clear. In contrast to the widely accepted belief that soil organic carbon is the predominant component in chemical adsorption, many scientists have indicated otherwise. Valverde-Garcia et al (1988), Murray and Hall (1989), and Fernandez et al (1988) conclude that there is an insignificant relationship between the adsorption of certain pesticides and soil organic carbon and also indicate that, in some cases, the soil clay type might have a significant influence on adsorption.

## Monitoring and Testing

ADEQ has attempted to make the requirement for analytical protocol development more reasonable by proposing statutory revisions. These efforts have not succeeded.

Several approaches to translating the GWPL into a feasible monitoring strategy are currently being considered. Emphasis is being placed on narrowing the scope of the GWPL from a practical standpoint as well as limiting the areas of concern (e.g. irrigated agricultural) by focusing on representative areas in vulnerable locations.

## Adequacy of Specific Numeric Values

The Arizona Environmental Quality Act HB 2518 required that the Specific Numeric Values (SNV's) be set by ADEQ by December 1, 1987 in order to generate the Groundwater Protection List. The statute also required that, at a minimum, these SNV's had to be as stringent as those published by the USEPA. ADEQ was then faced with the prospects of adopting the USEPA values, adopting values derived by California or deriving it's own set of values. Since 1) the USEPA values were compiled based on the experiences of a number of prominent researchers, 2) the California values were subjected to a great deal of controversy, 3) Arizona did not have a suitable database, and ADEQ selected the USEPA values to be able to meet the statutory time frames. The values selected were those that were published in the Federal Register, Volume 50, No. 1283 on Friday, September 20, 1985.

The Specific Numeric Values (SNV's) developed by California are not suitable for Arizona because of the differences that exist between these two states in terms of climate, geology, cultural practices, agricultural soil conditions, cropping system and other factors.

## APPENDIX

The Office of the Auditor General contracted with several experts to evaluate DEQ's Water Contamination Program. Listed below are the names and background of each expert.

- **Dr. Janick F. Artiola**, assistant research scientist and laboratory manager in the Department of Soil and Water Science at the University of Arizona, is a specialist in organic/inorganic soil and environmental analytical chemistry, waste management, and environmental monitoring.

- **Dr. Mark L. Brusseau**, assistant professor in the Department of Soil and Water Science at the University of Arizona, is a specialist in environmental chemistry, soil physics, and contamination hydrology.

- **Dr. Jon P. Chernicky**, assistant research scientist in the Department of Plant Science at the University of Arizona, is responsible for the development of chemical and nonchemical weed control strategies for cotton. Dr. Chernicky's recent work includes the study of herbicide transport in Arizona soils.

- **Dr. James N. Seiber**, professor in the Department of Environmental Toxicology and associate dean for research for agricultural and environmental sciences at the University of California, Davis, has also served as the chair of the American Chemical Society's Division of Agrochemicals.

- **Dr. John E. (Jack) Watson**, associate extension specialist in the Department of Soil and Water Science at the University of Arizona, is a specialist in soil environmental quality, soil physics, and modeling of bacterial colony growth. Dr. Watson's recent research has focused on the modeling of water and agrichemical movement through soils.

A copy of their report is attached.

# REVIEW COMMENTS ON:
# ARIZONA PESTICIDE CONTAMINATION PREVENTION PROGRAM
# DATA CALL-IN PROCESS

Submitted in fulfillment of work contracted by
the State of Arizona Office of Auditor General

Janick F. Artiola[1], Mark Brusseau[1], Jon Chernicky[2], Jack Watson[2]

[1]Soil and Water Science Department, University of Arizona, Tucson, AZ 85721,
[2]Maricopa Agricultural Center, University of Arizona, Tucson, AZ 85721

Final Report

July 13, 1990

## Introduction

A review of the Pesticide Contamination Prevention Program as implemented by the Arizona Department of Environmental quality was conducted at the request of the Office of Auditor General. This document contains a general summary of the consultants' findings, an abbreviated listing of key points and the individual detailed reports submitted by each consultant.

## OVERVIEW
(J. Watson)

The outstanding highlight of this program has been the commitment, technical competency and responsiveness of the ADEQ staff assigned to conduct the data call-in. Legislatively mandated, unreasonable deadlines and personnel limitations were effectively managed by the department staff to establish a fairly sound program. The procedures and protocols established were considered reasonable and adequate by each of the reviewers. The decisions arrived at by ADEQ staff were deemed defensible and, basically valid, based upon a review of two data submittal packages.

This is by no means an exemplary program, however. Problems existed, and some continue, due to legislative requirements and staffing levels. Further, considering present budget constraints, it is uncertain if enough well qualified staff can be obtained to effectively conduct the program in the future. Because the (state of the art) technology in environmental testing is undergoing rapid changes and is a highly technical field, staff recruited to conduct the program will need a strong technical background. This implies the need for a well defined mission and legislative commitment to an adequate program budget.

The department was primarily limited to one full time technical staff person to perform the data call-in and reviews. The dependence of the program on a single individual is a situation that should not be permitted to continue. It places the state at risk should the next staff person with similar responsibilities lacks the strong scientific and technical background of the present individual. Further, to maintain an effective, ongoing program an agency needs some "institutional memory". Depending upon a single individual to maintain this memory with respect to a highly technical program is a dangerous precedent at best and could result in a completely ineffective program.

The most glaring technical problem was the lack of clarity regarding the soil requirement for percent organic carbon. Whether the requirement is given for percent organic matter or organic carbon is uncertain, although it likely refers to percent organic matter. Since there is such a large difference between the two, and this difference is greatly magnified and reflected in soil adsorption coefficients, the department must clarify the requirement.

Generally, all reviewers agreed that the procedures and protocols eventually developed by ADEQ are appropriate, adequate and scientifically sound. However, the short time lines imposed by the legislation created a situation in which procedures had to be established during the data call-in process rather than preceding it. Some inconsistencies were bound to occur under such conditions.

Two randomly selected data packages were reviewed. ADEQ review of the data packages appeared extensive and generally consistent with protocols. Decisions by ADEQ to accept or reject data appeared valid. Some problems occurred with incomplete documentation by staff regarding reasons for actions taken/decisions reached.

Reviewers gave different amounts of attention to these provisions and have different responses. A general consensus exists that they are fairly reasonable, but there are concerns regarding certain specific provisions. (Soil adsorption coefficients, interpretation and use of SNV's, monitoring provisions are examples of stated areas of concern.)

Reviewers most frequently mentioned the following points. The need to clarify the soil organic matter/organic carbon requirement. The selection of a value that is clearly appropriate for Arizona conditions is crucial. A more effective approach would be to change the legislation so that the organic carbon distribution coefficient is used to evaluate mobility, rather than the site specific soil adsorption coefficient. Although soil organic carbon content of test soils would still be important, the dependence of the program on the soil adsorption coefficient value reported and the organic carbon content would not be so critical.

Documentation of staff decisions and rationale is inconsistent. This area desperately needs improvement so future staff and registrants have historical examples to which they can refer.

Clearly, Arizona-like conditions are necessary for certain types of data. The need exists for careful evaluation of which data is necessary and the conditions under which the data should be obtained. This type of review would best be conducted by an advisory committee meeting frequently with ADEQ staff over a period of time. A more critical issue, however, is the use of the supplied data to evaluate the potential for groundwater contamination. Other approaches, such as computer modeling of different scenarios using the supplied data would provide better insight about groundwater contamination potential. The legislatively imposed methodology for evaluation of Specific Numeric Values creates an unwieldy situation. Only the most mobile and persistent compounds should be included on the Ground Water Protection List. The present list of approximately 130 products is too extensive to be adequately monitored, given realistic budget constraints. Therefore, the method used to establish the GWPL should be sensitive to environmental conditions and product chemistry. The present SNV approach does not effectively handle either very well.

**SUMMARIES OF J.F. Artiola, J. Chernicky, M. Brusseau, and J. Watson**

**1. Assessment of the adequacy of DEQ's procedures and protocols followed in reviewing data submittal.**

JFA
It appears that DEQ provided a good approach for reviewing data submittals.
Poor job of requesting specific methodology, especially for older pesticide packages.
DEQ needs to have a comprehensive document listing all general and specific requirements for data packages. All criteria for evaluation of these packages must also be included in this document.
DEQ pesticide review program is a one man operation. This is dangerous and insufficient.
Better record keeping procedures for correspondence files should be implemented.

JPC
Given the personnel limitations good job done on the review of data packages.
Deadlines and personnel available by DEQ unreasonable.
Dr. Yu is the only person in DEQ responsible for the data packages. DEQ will be in a difficult position if he leaves.
$K_{ow}$ not part of the numerical requirements. Maybe it should be dropped.
The use of AZ-like soil conditions is justified.
Recommend to use $K_{oc}$ instead of $K_d$ as the latter is too specific.
All other procedures and protocols deemed acceptable

MB
In general, procedures and protocols followed by DEQ were adequate and sound.
DEQ personnel were responsive to questions.
Files not complete, some data missing. All phone conversations should be included in files.
Data reports were messy. All acceptance of data and waivers should be fully documented for consistency and even-handedness.
For acid pesticides the requirement that the pH should be lower than the $pK_a$ will result in an estimate of $K_{ow}$ that may be larger than would occur under natural Arizona soil conditions. (see also JFA's comments, page 1).
Some questions about soil metabolism study requirements.

JW
Initially, a lack of clarity appears to have existed regarding data submittal requirements.
Presently available "Review Protocols" appear adequate.
Glaring inconsistency regarding percent organic carbon versus percent organic matter.

## 2. Review of a case study

JFA
From the review of the Trifluralin (Treflan EC) pesticide data package, chosen at random from a pre-selection of six correspondence packages, the following conclusions can be made:

1. The pesticide manufacturer (ELANCO) put forth a good effort in providing comprehensive package of pesticide numerical data studies.

2. In general, upon review of these data packages the quality of the data provided and conclusions derived were found to be in agreement with those of ADEQ.

3. ADEQ gave a waiver to the manufacturer for data that did not quite conform to the requirements of an AZ soil. However, in this case the waiver was deemed acceptable. Nonetheless, ADEQ should document the reason for the waiver either in the correspondence file or in a section of the Data Summary Sheet.

4. In general, ADEQ reviewed extensively, reported and interpreted the data provided by the manufacturer correctly. DEQ limited the summary of the data provided to the minimum requirements as specified in the Data Summary Sheet. This approach is acceptable. But if extra data are provided by the manufacturer, provisions should be made to enter a summary of it in the correspondence and/or data summary sheets for future potential use/reference.

JPC
Inconsistency in the use of O.C. and O.M in form, notes without initials, and missing (apparently) letters and phone conversations. DEQ may not have made clear the requirement of usage of AZ-like soils.
Inconsistent enforcement of requirements. Sethoxydim package was found to be complete. But, missing written statements and reasons for lowering of requirements and/or waivers.

MB
The data reports submitted for trifluralin seemed to be adequate and consistent with protocols developed by DEQ. The decisions made by DEQ to accept the data appear to be valid.

JW
Sethoxydim review. Staff made an effort to verify that data submitted by registrants were supported by documents.
Correspondence files indicate some inconsistencies in communication of data requirements, and data evaluation.
Established detailed protocol lacking at initiation of program.
The program is very dependent upon professional judgements by one staff person. Although

his decisions were generally sound, it is a difficult assignment for any one individual, and should not be permitted to continue.

**3.Statutory provisions governing the environmental fate testing. Are current provisions appropriate given current scientific knowledge?**

JFA

The provisions governing environmental fate testing of pesticides are adequate and reasonable.

Question: Does a mechanism or provision in the law exist that can prevent the registration and thus use of a pesticide (regardless of data call-ill compliance) if this pesticide has been found the be present in GW of several states?

JPC

| | |
|---|---|
| Statute 49-301. | All definitions are in order |
| Statute 49-302. | Replace $K_d$ with $K_{oc}$ $K_{ow}$ not specified in SNV's. so why must it be reported? Summary data should be more than three pages long. DEQ should not get EPA involved in review of formulation ingredients. Redundant effort and not enough resources available. |
| Statute 49-303. | Suggest use of $K_{oc}$ instead of $K_d$, as CA does. DEQ should not be evaluating the toxicological properties of either active ingredients or degradation products. |
| Statute 49-304. | Ok as stated. |
| Statute 49-305. | Second sentence. Assumption that pesticides applied topically may not present a danger to GW is false. All applied pesticides eventually will reach the soil. |
| Statute 49-306. | Ok as stated. |
| Statute 49-307. | Suggest that given the cost and personnel requirements for pesticide monitoring (sampling and analysis) DEQ does not have the resources to do an adequate job as this time. |
| Statute 49-308. | Eight foot depth unreasonable for AZ due to average depth to GW of >200 ft. Suggest strengthening point source legislation (loading, mixing sites ...etc). |
| Statute 49-309. | Ok as stated. |

MB

Use $K_{oc}$ rather than $K_d$. Otherwise, in general, provisions appear appropriate.

JW

Length of time to establish a standard protocol is generally unrealistically short.

Section 49-303.B.2 basically misuses the Specific Numeric Values listed in R18-6-102.

The soil monitoring requirement for the department, as specified in the legislation, is not scientifically sound.

A more appropriate approach for evaluation of GWPL chemicals would be modeling rather than SNV's.

## 4. Review of AZ specific values for appropriateness

JFA

The properties and specific numeric values used to evaluate pesticides are a subset of the Flagging criteria listed in 40 CFR part 153. These criteria were developed to be applicable to the whole of the US and nowhere specifically.

Solubility <30 ppm. It is likely that this requirement will lowered in the future. This is because soluble pesticides usually have low partition coefficients, thus making them more mobile. However field data will have to be collected as CA has done (see document on setting revised numerical values by CA).

It is recommended that the $K_{oc}$ parameter be also adopted in AZ as a means for comparing pesticides.

The present regulation for $K_d$ are 5 or more. This is equivalent to a minimum $K_{oc}$, of about 193, based on an %O.C. of 2.6. Again, it is likely that this partition coefficient minimum will be raised in the future.

Hydrolysis is also a well correlated parameter with potential contamination. This parameter, like the other two discussed will also be probably adjusted in the future. However the mean depth to groundwater in AZ is likely much larger than that of CA. Therefore, the CA revised values which suggest a half-life of 14 days or less may be unnecessary for AZ conditions.

The present criteria for soil metabolism as listed in both the federal and AZ regulations are very difficult to evaluate or express an opinion about.

However, it is the belief of this reviewer that parameters related to biological degradation of pesticides in soils will likely turn out to be least sensitive in determining the potential of a pesticide for GW contamination.

It is recommended that in time and with sufficient monitoring data, the numerical values for pesticides be revised.

JPC

Most numerical values are unreasonable since they were adopted from CA, which has a shallower vadose zone. Solubility should be more than 30 ppm. Field dissipation studies limitations render half the herbicides used in cotton as unacceptable. It would be more appropriate to use leaching models to evaluate pesticide fate.

MB

There is no discussion given that specifies how the SNVs used by DEQ were determined. Although they apparently came from FIFRA, the means by which they were determined should be provided. Perhaps AZ should develop its own SNVs like CA, or use the same values determined by CA.

JW
The SNV's are appropriate for a "flagging" criteria if legislatively permitted to be used correctly, but are not appropriate as presently used for developing a Ground Water Protection List. They do not provide the department with a reliable basis for determining if residues discovered below 8 feet exist there due to "normal" agricultural practices.

## 5. Review of soil requirements for AZ-specific conditions.

JFA
The use of 2.6% organic carbon (as listed in attachment II) is an overestimate of the typical organic carbon (O.M.) content in the plow layer of AZ agricultural soils. While some AZ soils may indeed have this much O.C., the typical O.C. content of AZ agricultural soils is more like 0.5-1.5% in the plow layer.
Note: The requirements stated for organic carbon content must not be confused with organic matter (O.M.) content.
It is recommended that all data be reported in %O.C., not % O.M.. This is also necessary to compute $K_{oc}$ which relates better to the partitioning of a pesticide between water and given soil with a known %O.C.
The soil pH range criteria on (6.5-8.5) is acceptable and within the acceptable range of soil pH for most AZ agricultural soils. However, the median pH is likely above 7.5 in AZ.
Data from states such as CA that may have similar agricultural environments could be used. I believed CA has a program which is further ahead than AZ, in development and monitoring. It is very likely that some of the numerical values will have to be revised in the future.
Generic pesticide data should be compiled from publications, other states, and EPA and compared with that gathered thus far by ADEQ for consistency. These data include: solubility and Henry's Law constant, and $K_{ow}$.
The requirement for the generation of these data could be waived if they had already been filed in and accepted by a federal repository or agency such as EPA.

JPC
Pesticide data from the midwest should not be considered, as they were developed under different soil conditions. Pesticide data from CA and NM desert areas should be considered acceptable. The 2.6% O.C. is inappropriate. Typical O.M. content in AZ is 0.5 to 1.5%. There is an inconsistency in the data sheets in requiring O.M. rather than O.C. Use O.C. since conversion to O.M. is controversial.

MB
Use of specific AZ test conditions is in principle reasonable and necessary. Care should be exercised when considering data from other states.

JW
Some Arizona soil test conditions are necessary, but those described may not be the most appropriate.

## 6. Analytical sample testing capabilities by DEQ

JFA
It is apparent that DEQ does not have either the funding, personnel or resources to initiate such a comprehensive soil and groundwater monitoring program as required by the program implementation schedule (figure 6 of the AZ pesticide contamination program description). Funding for soil sample and pesticide residue analysis will have to increase several times above its present level if DEQ is to begin monitoring key areas within the state for all or subgroups of the listed pesticides.
At the same time DEQ should be developing a realistic yet comprehensive soil sampling program to monitor potential pesticide residues and movement within the root zone. For this soil core sampling techniques, number of samples and spatial and temporal locations should be carefully considered.

JPC
The current groundwater protection list has over 130 active ingredients plus major metabolites. Once the data call-in is complete active ingrediants: formulation ingredients are to be reviewed.
Monitoring active ingrediants as well as formulation ingredients is beyond the realm of DEQs personnel and budget.

MB
No information provided for review.

JW
The cost of monitoring at the level prescribed in the legislation will be astronomical, and cannot be accomplished as presently envisioned.
Sampling methodology should be reviewed for both technical and legal acceptability.
The ADHS Laboratory Method Reporting Limits may work to identify spill areas, for example, but they will not be helpful in determining if a certain compound exists in the vadose zone water at a concentration of concern to human health.

## 7. Based on the above analyses recommend legislative or administrative policy or procedural changes which may be needed or desirable.

JFA
DEQ personnel for review and assessment of data call-in program should be expanded. Data base for each pesticide should be organized and expanded to include all generic numeric values when available from EPA, other state programs and the literature.
DEQ should focus on developing a good monitoring plan for active ingredients only. This must include expanding DEQ personnel and analytical capabilities.
The inert ingredients and metabolites program should at this time be put on hold.

JPC

The state program is in its infancy and is a paper tiger. DEQ can enforce data call-in but lacks resources and personnel to implement the monitoring program.
The data call-in for inerts and metabolites due to start in 1-91 should be dropped entirely.
The program is supposed to deal with prevention. To that effect this program should deal with more strict guidelines for potential point sources such as mixing and loading sites.
With the limited resources and rapid employee turnover that DEQ has been faced with it is amazing that they have done a respectable job in conducting the data call-in process.

MB

The pesticide contamination prevention program is reactionary in the way it is designed. The procedure for canceling a registration only after it has been found in the GW is not prevention. True prevention, as the program implies would be accomplished by denying registration for pesticides that fail the specified criteria of SNVs.

JW

Develop an advisory committee for routine technical and legal reviews and advice.
Correct %OM/%OC errors in data evaluation.
Determine a tentative monitoring methodology and soil concentrations needed to estimate vadose zone water concentrations.
Develop alternative strategies and cost estimates to accomplish legislative goals.
Fully fund the program.
Develop a monitoring strategy that accurately reflects groundwater pollution potential rather than "flags" efficient water management techniques as creating a pollution hazard.
Base monitoring strategy and evaluation parameters on results of a modeling effort to provide guidance to what will be an evolving effort.

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COLLEGE OF AGRICULTURAL AND
ENVIRONMENTAL SCIENCES
AGRICULTURAL EXPERIMENT STATION
(916) 752-1142
FAX: (916) 757-3906

DEPARTMENT OF ENVIRONMENTAL TOXICOLOGY
DAVIS, CALIFORNIA 95616

July 16, 1990

Mr. Peter N. Francis
Performance Audit Manager
State of Arizona
Office of the Auditor General
2700 North Central Avenue, Suite 700
Phoenix, AZ 85004

Dear Mr. Francis:

As you requested in your June 18, 1990 letter, I reviewed the draft report on the Arizona data call-in process, from scientists at the University of Arizona. I will make my comments on the major items that were in the scientist's draft reports. This list is not in any particular order, but I believe that it covers the primary concerns of the UA scientists:

1. **Use of Arizona agricultural soil.**

   Several comments were made on this point, and the general feeling was that it is appropriate to require Arizona-like soils for (a) photolysis on soil, (b) Anaerobic soil metabolism, (c) Aerobic soil metabolism, (d) Soil adsorption coefficient (3 types are required), and (e) Terrestrial field dissipation. What is meant by 'Arizona-like' should be clearly communicated to the registrants, which has apparently not been done effectively in past communications.

2. **Adsorption coefficient.**

   Virtually all of the UA scientists commented on the inconsistency in the requirement in the sense that $K_d$ is the parameter asked for by AZ (CA uses $K_{oc}$) and AZ's requirement was not specific as to whether $K_d$ determination should be on a soil less than 2.4% in organic matter or in organic carbon. My opinion is that $K_{oc}$ should be the parameter required (not $K_d$) and it should be determined on a range of Arizona-like soils as specified in the Protocol for Data Submittals.

3. **Soil photolysis.**

   A few of the scientists questioned whether soil photolysis should be required of chemicals which are soil incorporated.

My opinion is that it should not be required for any chemicals because (a) it is not one of the SNVs and (b) field dissipation -- which is required -- includes photolysis as well as other dissipation routes.

4. **Sample collection protocol.**

There were several comments on the lack of sample collection protocols to determine pesticide movement through the soil column. Without any additional information available to me, I suggest that such protocols must be developed and provided to the registrants in order to insure comparability of data in terms of type of sampling equipment, depth of sampling, replication of sampling, how sampling sites are selected, use of controls, etc.

5. **Role of models in groundwater protection.**

Several comments were made on the role of models in predicting or flagging potential groundwater contaminants, as a further step which AZ could take once the SNVs were submitted. I agree that models can be useful, but it is difficult to write them into regulations given the variety of models available and disagreement among investigators on which models are most appropriate. I suggest that the door be left open for use of models by AZ regulators, but with little specificity on which models and how they are to be used.

6. **Role of pH in determining $K_{oc}$, $K_{ow}$, and H of ionizable compounds.**

One commentor (Brusseau) correctly pointed out that the Protocol for Data Submittals requires that pH adjustment be made to ensure that the compound is not ionized when the determination is made. For acids, this means lowering the pH to below the pKa. (For bases, it would require raising the pH). If this is done, the $K_{oc}$ and $K_{ow}$ and H will be larger than might occur under environmental pH (5-9) conditions.

My opinion is that both data are needed; one test for each parameter should be run at a pH that ensures the compound is not ionized; a second test should be run at pH 7. The SNV from the pH 7 test is the one which should be used in the evaluation criteria unless the registrant can provide a convincing argument that it is not appropriate to use it.

7. **Should $K_{ow}$, soil photolysis, Henry's constant and vapor pressure be required since they are not included among the criteria to be used by AZ in evaluating potential GW contaminants?**

This question came up in several comments. It is my opinion that nothing should be required that will not be used by AZ in making a GW contamination determination. However, if AZ is trying to build a data-base for the eventual use of computer environmental fate modelling, these parameters will be needed at some point.

This is a basic question which needs to be answered; Require only the essentials vs require all parameters that might be useful somewhere along the line (I would favor the former, with expansion of data only as needed with additional regulations).

8. **Are the SNVs required by Arizona the appropriate ones? Obviously, they are quite different from those being used in CA (see below).**

| | AZ | CA |
|---|---|---|
| Water solubility | 30 ppm | 3 ppm |
| Soil adsorption coefficient | 5 ($K_d$) | 1900 ($K_{oc}$) |
| Hydrolysis $t_{1/2}$ | 25 wks | 2 wks |
| Aerobic $t_{1/2}$ | 3 wks | 87 wks |

It would be much simpler for all concerned, if a common set of criteria be used by AZ, CA, and EPA. It is, unfortunately, not possible to get all parties to agree on what criteria should be used for each parameter. The advantage of AZ's and EPA's are that they are less stringent than CA in most cases (except aerobic $t_{1/2}$) so that they may result in a shorter (probably more reasonable) list of candidate chemicals for further regulation.

Perhaps AZ should set up a scientific advisory panel process to address this question in detail — not to be swayed by a few off-hand comments. This list is in fact the crux of the prevention strategy based on physicochemical properties and should be as good as it can be based on available information.

9. **Does AZ have sufficient manpower to review and evaluate the data, and conduct monitoring for problem chemicals?**

All of the scientists felt that UA was fortunate to have a single person who was handling the workload now, but that many more people would be needed in the future if the regulations were to be extended beyond 'paper tiger' status. I agree; data review, field sampling, and laboratory analysis are all time-consuming and expensive operations when done properly. AZ must commit to an appropriate and stable funding level to carry the load through. However, much of this could be done through contracts with commercial labs rather than an increase in the state payroll. In my opinion, CA makes the mistake of expanding its agencies to do all the work 'in house' when contracts with outside labs might be more appropriate.

10. **How good must the data be?**

Several scientists commented on data quality needs. I believe that some latitude should be given to the registrant, so that the registrant can use existing data as much as possible (even when it was not done exactly as per AZ protocol), particularly when the SNVs will be clearly exceeded by virtue of a property (such as water solubility) which goes to the essence of groundwater protection.

This is true particularly with the properties such as VP, H, $K_{ow}$, etc. which are not now needed for a determination of GW contamination (see points 3 and 7).

Along the same line, a few UA scientists were concerned that the trifluralin hydrolysis test by Elanco was not carried out beyond 30 days when literature data indicates the $t_{1/2}$ is 116-132 days.

Because the SNV for hydrolysis is set at 25 weeks (175 days), it seems that the registrant should have been asked to carry out the test longer (up to 175 days) to get a better characterization. Had the SNV been 14 days as in CA, a 30-day test would have been sufficient.

I hope that these comments will be useful and apologize for the delay in getting them to you.

Best regards,

James N. Seiber
Professor

JSN:jg
francis.2