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Arkansas Agricultural Chemical Ground-Water Management Plan

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ARKANSAS AGRICULTURAL CHEMICAL GROUND-WATER MANAGEMENT PLAN

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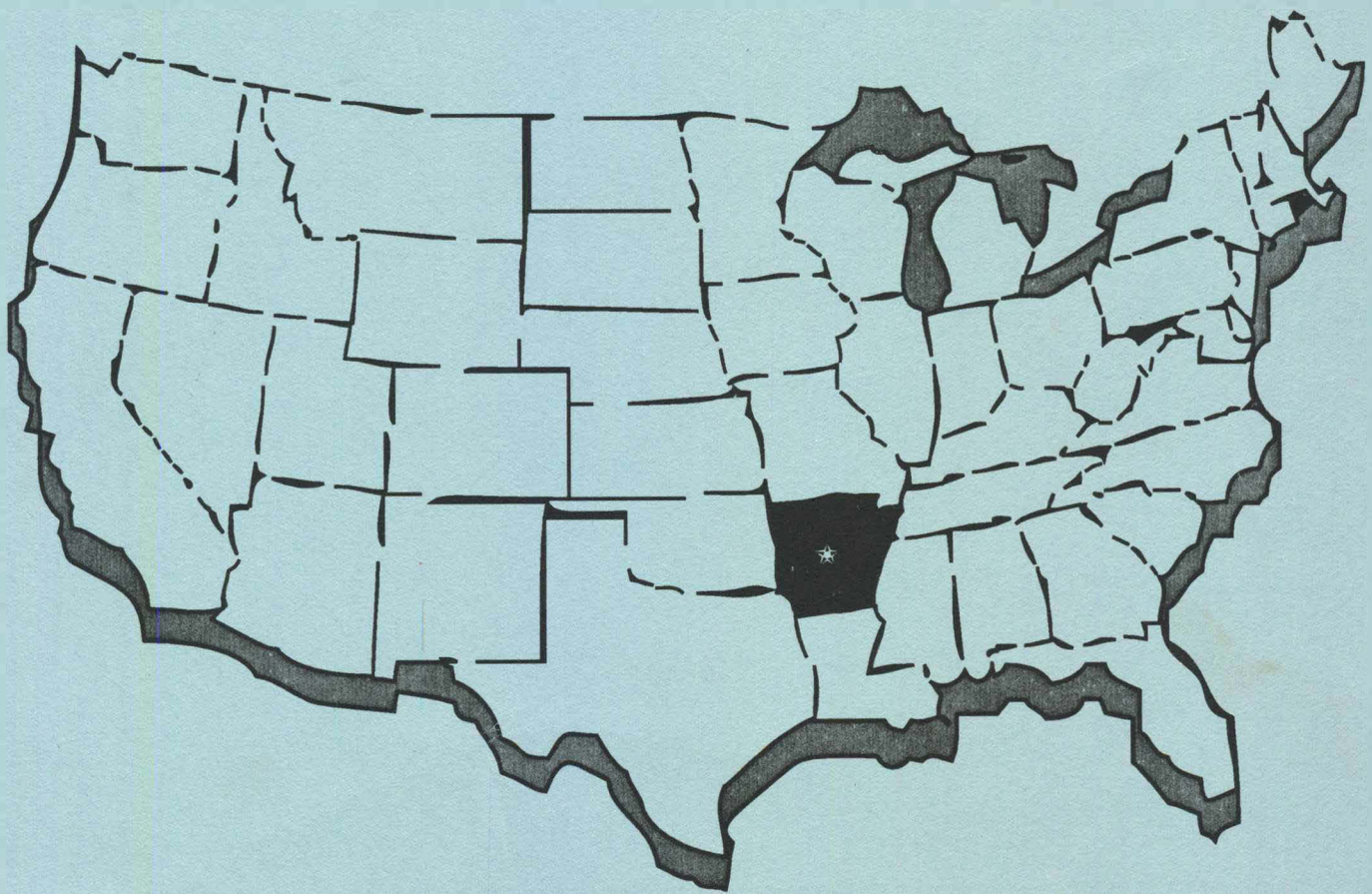

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INTRODUCTION

The Arkansas Agricultural Chemical Ground-Water Management Plan (SMP) is based on the Draft State Pesticide Ground-Water Management Plan Guidance and The Pesticides and Ground-Water Protection Strategy prepared by the U.S. Environmental Protection Agency (EPA). The need for a plan to protect ground water from contamination by agricultural chemicals and agents arises from evidence nationwide that using these chemicals can, in some instances, lead to contamination. In February 1988, EPA proposed a strategy to regulate certain pesticides by prohibiting their use in areas vulnerable to leaching unless a state develops and implements an acceptable management plan. The advantage of a state plan as opposed to a federal plan is that a state plan can provide protection for ground-water resources without unnecessarily restricting pesticide use. State plans can be more sensitive to local conditions such as soil types, farming practices and hydrogeological considerations.

EPA's Office of Pesticides and Toxic Substances has encouraged the development of the SMP to manage pesticide use so that such use will not result in unreasonable risks to human health and the environment. Agencies with responsibilities regarding the protection and conservation of ground-water resources have contributed their input and expertise in addressing each of the components outlined in EPA's guidance documents. The management plan guidance document stipulates which topics are to be addressed in the SMP, and this plan has been developed consistent with those topics. Section topics, while addressed separately, are often interrelated. Therefore, successfully implementing one section may depend upon successfully implementing all other sections. Some of the sections were considered especially integral to the success the SMP and were addressed accordingly. For instance, preventing unacceptable pesticide contamination rather than relying on remediation, is a primary goal of the SMP. To that end, emphasis was placed on prevention measures — especially education — and a monitoring/modeling program to assess potential problems and to assess the SMP's overall effectiveness.

The SMP describes the general policies and regulatory approaches that the state will use to protect ground water from pesticide contamination. This plan is a generic coordination mechanism between all responsible and participating agencies. It provides for specific responses when it is deemed nec-

essary to develop a chemical-specific management plan. The SMP is responsive to the President's Water-Quality Initiatives, EPA's Pesticides and Ground-Water Strategy, the state's philosophy toward ground-water protection, federal and state environmental law, including regulations on 2,4-D, 2,4-DB, MCPA and other state restricted-use herbicides, rules and regulations pertaining to public water systems and to general sanitation (Appendix B), and to the Arkansas Wellhead Protection Program (Appendix H).

Arkansas defines ground water as part of "the waters of the state." As such, it is subject to the full protection afforded by the Arkansas Water and Air Pollution Control Act (Apendix B). This act stipulates that water-quality standards are based upon present, future and potential uses of the waters of the state and a statistical evaluation of past water-quality conditions. The standards are designed to enhance the quality, value and beneficial uses of Arkansas' water, to aid in the prevention, control and abatement of water pollution, to provide for the protection and propagation of fish and wildlife and to provide for recreation in and on the water (Arkansas Water and Air Pollution Control Act, Regulation 2, Section B). Efforts implemented under this plan are designed to not only maintain present ground-water uses and not impair potential uses, but to ensure that overall water quality is maintained and, when possible, improved.

The seven principles that govern the SMP are:

1. Agricultural chemicals are beneficial and important to the economy of Arkansas.

2. State and local government should be primarily responsible for ground-water protection, with federal expertise and information augmenting their efforts.

3. The use of agricultural chemicals and agents should not impair any present use of ground water or cause a public health hazard.

4. Safe drinking water supplies, including those drawn from private wells, should be protected.

5. Ground-water quality monitoring by state agencies, local governments and other interested parties should initially be directed to areas of the state most vulnerable to contamination.

6. Agricultural chemical use and practices should not pollute ground water.

7. Education and voluntary implementation of Best Management Practices are integral components of this plan.

The SMP provides a basic framework to respond to problems as they arise. Whenever a problem is identified and a decision is made to develop a chemical-specific plan, an initial assessment of the possible extent of the problem will be conducted. As the problem is defined, implementation of pre-

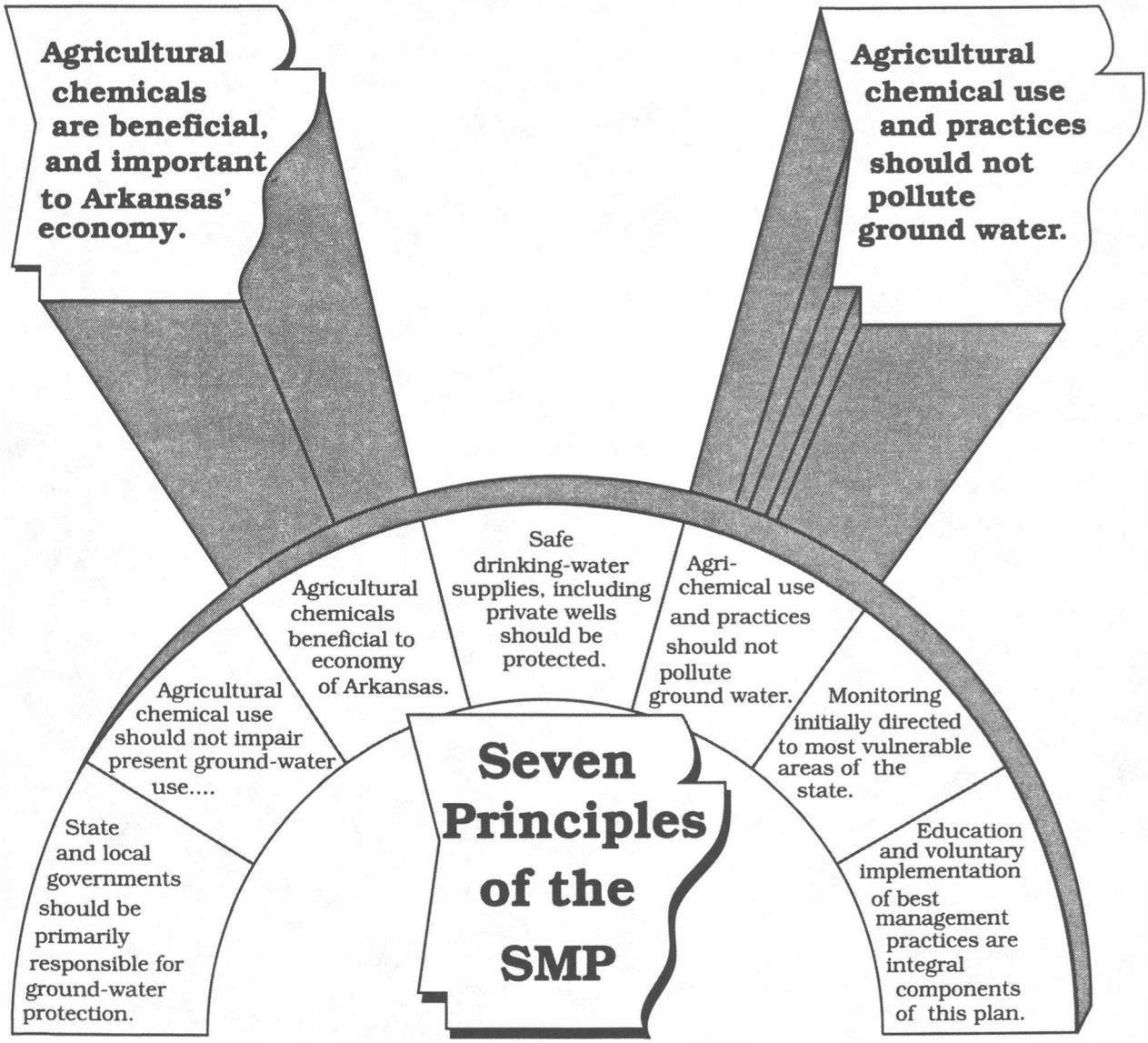


Figure Int-1

ventive best management practices (BMPs) will be encouraged. The results of these preventative measures will be analyzed by field tests and/or modeling that will provide a more refined set of BMPs. These could include the consideration of use restrictions, including state-limited-use designations, label restrictions or requiring alternative product use.

A monitoring program aimed specifically at pesticide detection is under development. Should pesticides be detected and existing BMPs found ineffective, field tests and/or modeling will be conducted to improve them. The results of BMP monitoring and implementation will be evaluated continually to refine chemical-specific plans. The SMP briefly outlines existing programs and ground-water protection efforts that relate to pesticides.

SECTION 1
STATEMENT OF PHILOSOPHY

The goal of the Arkansas Agricultural Chemical Ground-Water Management Plan is to prevent the state's ground water from being polluted by agricultural chemicals and if pollution is found, to restore the water quality. This goal provides for the protection of the public health and welfare, the propagation and protection of terrestrial and aquatic life, the protection of the environment, the operation of existing industries and agriculture, and the maintenance and enhancement of the long-term economic health of the state. The SMP also recognizes that preserving ground-water quality is far less costly and more ecologically sound than restoring ground water to its natural state, a process that may not be technically or economically viable.

Banning agricultural chemical use altogether would be the only sure way to protect ground water from agricultural chemical pollution. However, considering the overwhelming benefits afforded to the state by careful and prudent agricultural chemical use, banning these chemicals is not a viable solution to the problem of potential agricultural chemical pollution in ground water. Ground-water quality, as it relates to agricultural chemical use, is described in terms of the amount of agricultural chemicals found in the ground water.

The National Primary Drinking Water Standards promulgated or proposed by EPA sets maximum contaminant levels (MCLs) for 13 pesticides and proposes MCLs for four others. These MCLs are the initial "reference points" upon which prevention and response strategies are based. The Arkansas Department of Health (ADH) is developing chemical-specific action levels (AL) based on human data and workplace safety standards. The AL, or 50 percent of the MCL, whichever is lower, is the trigger for a response, including response monitoring and any other appropriate response as dictated by events. A guiding principle of the SMP is that ground water should not be exposed to pesticides in an amount that exceeds these action levels or any other action levels promulgated in the future by EPA or the Arkansas Department of Health. The plan recognizes that certain "ecologically sensitive ground water supported areas" may require special consideration because of the unique wildlife found there.

Non-degradation of ground-water quality, as used in this plan, does not imply zero-contaminant discharge; therefore, detecting a trace level of a chemical does not necessarily mean that the ground water in which

the chemical was detected is polluted as defined under the SMP. However, reaching the MCL of a given chemical does constitute a polluted state. This does not, however, imply a license to contaminate ground water up to the MCL. While an MCL is the significant reference point at which ground water is considered polluted and unsafe for human consumption and/or detrimental to the environment, an MCL is not a level to which pollution may be allowed to rise before a response is initiated or a problem is acknowledged. Once an MCL has been reached, prevention has failed and appropriate remedial action must ensue.

Careful monitoring, appropriate prevention and response strategies, including education and technology transfers can help ensure that present ground-water uses can be maintained and that agricultural chemical use will not lower ground-water quality or pose a public health hazard.

The SMP recognizes that agricultural chemicals are not the only potential pollutants that threaten the state's ground water. Industrial waste, urban runoff, salt water from oil field waste, commercial fertilizers, and animal and human waste all have the potential to contaminate an aquifer. The SMP is a management/action plan focusing specifically on pesticides as they relate to ground-water quality.

The SMP is a two-tiered management system relying on the best professional judgment of participating agencies to carry out the plan. The first tier relies on education and voluntarily implemented best management practices. A second tier will be implemented according to rule when necessary, for instance when the AL or 50 percent of the MCL has been reached.

The first tier — prevention — is initiated for point and nonpoint sources and could include a BMP for a specific pesticide if the pesticide has physio-chemical properties that indicate a possibility of impacting ground water, or trace levels of the pesticide are detected in the ground water. If trends, established by monitoring over time, indicate increasing concentrations such that a standard is likely to be violated, the second tier could be imposed.

The plan recognizes that many factors must be considered when prioritizing the state's ground-water protection needs. Ground water of exceptional quality is of particular concern because its use or potential use as drinking water makes it more valuable than lower quality water. This same water, however, may be in an area where little, if any, agricultural chemicals are applied to the land, thereby reducing the ground water's actual vulnerability. Determining which waters are most at risk involves assessing the current quality of the ground waters of the state, examining the geology in which they are held, determining the current and potential uses for these ground waters, cataloging the amount and type of agricultural chemicals or agents applied to crops in a given area, taking into account pesticide degradation metabolite rates and assessing the possibility of the movement of the chemicals or agents to

ground water by examining current use patterns, including application rates, timing, storage and disposal of unused chemicals or used chemical containers. Other factors such as transportation of agricultural chemicals and spills that cause point-source contamination are also considered in this plan (Figure 1.1).

Protection strategies apply to current and future uses of mapped and unmapped ground waters of the state. When considering the appropriate level of protection or cleanup, the responsible agencies will consider the availability of alternative water sources, possible hydrogeological interconnections between aquifers and between aquifers and surface waters, any naturally occurring concentrations of background components, and traditional and potential beneficial uses of the water.

The first priority is to protect those ground waters which are used for drinking water sources or have the potential to become drinking water sources. Other important waters are those that are slightly saline and not presently used for drinking water but which have the potential for such use. Also included are moderately saline waters, when they are used for livestock and irrigation because higher quality sources are unavailable or are of insufficient quantity (Table 1.1).

The second priority is to protect moderately saline ground waters which could potentially be used or may be interconnected with better quality waters. Potential uses should be determined individually, and factors such as the economic and technical possibility of treatment, the projected needs for, and impact on these ground waters should be considered.

Ground-water Classification

The following classification system has been suggested by the Arkansas Department of Pollution Control and Ecology as the basis for a more refined area-specific classification that would be determined at some later date as the need arises. The state has used EPA's classification system and has roughly classified its aquifers accordingly as described below. Currently, the system is used by the Department of Pollution Control and Ecology in planning prototype studies and in the selection of ecologically sensitive ground water supported areas where special protection is needed. The main emphasis in the classification system is on the protection of drinking water. An underground source of drinking water (USDW) has been defined under the Underground Injection Control Program as an aquifer or its portion that: supplies any public water system; or contains a sufficient quantity of ground water to supply a public water system; and currently supplies drinking water for human consumption; or contains fewer than 10,000 mg/L total dissolved solids (TDS).

This ground-water classification system divides ground water into three categories and labels them as Classes I, II and III.

Class I or Special Ground Waters —

Those aquifers or portions thereof that are the source of the base flow of water levels for an ecologically sensitive system that, if polluted, would destroy a unique habitat, or serve as an irreplaceable source of drinking water for at least 3,000 persons.

Class II — All other ground water that is used as an existing or has the potential to become an underground drinking water source. For example, any ground water with total dissolved solids less than 10,000 mg/L TDS. These aquifers would be afforded the same level of protection as Class I waters other than the extra protection given to special aquifers regarding landfill placement criteria and other possible polluting activities.

Class III — Ground water that is not now or is not considered as a possible underground source of drinking water. This is ground water that contains more than 10,000 mg/L TDS or those aquifers or portions thereof that not considered as possible underground safe drinking water sources for other reasons.

Criteria for Class I and II Aquifers

1. Dissolved oxygen — as naturally occurs.

2. Oils and grease — None other than as of natural origin.

3. Color and turbidity — None other than as of natural origin.

4. Coliform bacteria — Less than 5 percent of all monthly samples may be positive.

5. Taste and odor — None other than of natural origin.

6. pH — The pH shall not be below 6 or above 9.

7. Chemical constituents — Varies with aquifer but must be above SDWA standards.

While some aquifers and geographic areas fall clearly into one classification or another, determining whether or not the ground water in a specific location fits the criteria for classes I, II or III will have to be made on a site-specific basis whenever a pesticide is detected. In the following list, some of the most-used aquifers in the state have been grouped into the classifications that seem appropriate for them. For Class I ground water, the break point for ground water that served as an irreplaceable source of drinking water for a significant number of persons was established as 3,000 persons served by single community supply. Also, all limestone aquifers that outcropped in the Interior Highlands were considered sufficiently sensitive ecologically to warrant a Class I designation.

The quantity and quality of the water in an aquifer varies considerably within different portions of the same aquifer. The Midway Group, for example, yields a significant amount of water only in a small area of Saline County. Otherwise, the Midway is unproductive. Also, some confined aquifers in Arkansas eventually become too mineralized downdip from their outcrop areas to be considered USDWs and at that point may become Class III aquifers. A Class I aquifer may shift into a Class II aquifer at the point where the mineralization process exceeds

1,000 mg/L but is less than 10,000 mg/L TDS. Hence the classification of an aquifer is valid only for the portion of the aquifer where analysis has determined its quality.

The major aquifers of the Coastal Plain have been mapped so that the areas where their water becomes usable is known. Most of the aquifers of the Interior Highlands have yet to be mapped. The aquifers listed in Table 1.2 have been classified according to their highest and best use.

Since Arkansas falls naturally into two major geologic regions — the Coastal Plain and the Interior Highlands — the classification system is divided accordingly (Figure 1.2). And, as the aquifers of the Coastal Plain are far more productive and are therefore used much more extensively than those of the Interior Highlands, much more is known about them. Hence, they may be classified with much greater specificity. Many of the formations of the Interior Highlands are used only for domestic purposes with an occasional small public or community well. Therefore, rather than list all of these formations they have been grouped under the category of "surficial Paleozoic rocks" and only the major or especially sensitive formations are listed separately (Table 1.2).

Ecologically Sensitive Ground-Water Supported Areas

These areas have been identified by the Arkansas Natural Heritage Commission as habitats for endangered species. Ground water that helps support these habitats warrant special attention for the purposes of this plan.

1. The Cave Springs Cave — Ozark cavefish and gray bat habitat.
2. Logan Cave — Ozark cavefish and gray bat habitat.
3. Civil War Cave — Ozark cavefish habitat.
4. Hell Creek Cave — Cambarus zophonastes habitat.
5. Castle Cave — southern cavefish habitat.
6. Marble Falls Cave — Ozark big-eared bat habitat.
7. Blanchard Springs Caverns — outstanding cave ecosystem and gray bat habitat.
8. Mammoth Spring — largest spring in Arkansas and habitat for the Ozark hellbender.
9. Queen Wilhelmina State Park Spring Seeps — habitat for stygobromus montanus.

Table 1.1. Aquifer and well characterisitics in Arkansas
[Gal/min = gallons per minute; mg/L = milligrams per liter; ft. = feet. Sources: Reports of the U.S. Geological Survey and Arkansas Geological Commission]

Aquifer Name and Description	Well Characteristics				Remarks
	Depth (ft.)		Yield (gal/min)		
	Common Range	May Exceed	Common Range	May Exceed	
Alluvial aquifer: Sand and gravel at the base grades upward to silt and clay near the surface. Confined to unconfined.	100-150	200	1,000-2,000	5,000	Water used primarily for irrigation. Generally hard and contains much iron. Intruded by saline water in places. Water level declines by as much as 80 ft. in Arkansas, Cross and Poinsett counties.
Cockfield aquifer: Interbedded fine to medium sand, clay and lignite. Confined except in the outcrop.	350-500	700	100-350	500	Used mostly for domestic purposes and for municipal supplies in Chicot and Desha Counties. Water is soft, sodium bicarbonate or sodium chloride type. Contains as much as 1,800 mg/L of chloride in parts of extreme southeastern Arkansas.
Sparta Sand aquifer: Massive fine to medium sand with interbedded clay and lignite. Generally confined.	500-1,000	1,200	500-1,500	3,000	Equivalent to Memphis Sand ("500-foot Sand") in northeastern Arkansas. Principal source of water for municipal and industrial uses in much of the Gulf Coastal Plain south of latitude 35^0 N. Water-level declines of as much as 320 ft. in Columbia, Union and Jefferson counties. Declines have induced localized saline-water contamination in some places. Saline in downdip areas.
Wilcox aquifer: Fine to medium sand, silt, clay and lignite. Generally confined.	750-1,000	1,500	50-500	2,000	Greatest yields in eastern and northeastern Arkansas. Known as "1,400-ft.Sand" near Memphis, Tenn. Water is a soft, sodium bicarbonate type. Saline in downdip areas. Equivalent to Fort Pillow Sand in Tennessee.
Nacatoch Sand aquifer: Massive cross-bedded sand, limestone lenses and calcareous clay. Confined.	500-800	1,100	150-300	500	Equivalent to the McNairy aquifer in Missouri. Contains freshwater in parts of southwestern and northeastern Arkansas. Used mostly for municipal and industrial supplies. Water is soft, sodium bicarbonate type. Saline in downdip areas.
Ozark aquifer: Sandstone and sandy dolomite. Confined.	600-2,400	3,000	150-300	500	Includes the Roubidoux Formation and Gunter Sandstone Member of the Van Buren Formation. Principal source of water for municipal and industrial wells in northern Arkansas. Yields hard or very hard calcium-bicarbonate-type water.

TABLE 1.2. CLASSIFICATION OF MAJOR AQUIFERS

Source: Arkansas Department of Pollution Control and Ecology Section 106 Report on Ground Water

Interior Highlands

Class I

Quarternary Deposits
Big Fork Chert
Arkansas Novaculite
Roubidoux Fromation
Gunter Sandstone Member
Paleozoic Age limestone and dolomite formations (Boone, Pitkin, Fernvale, Cotter and Jefferson City formations)

Class II

Surficial Paleozoic Rocks (Hale, Atoka, Batesville, St. Peter, Prairie Grove, Powell, Everton, Savanna Hartshorne, Jackfork, Stanley and McAlester formations)

Coastal Plain

Class I

Quarternary Deposits
Cockfield Formation
—Sparta Sand
—Cane River Formation
—Carrizo Sand
Wicox Group
Nacatoch Sand
Trinity Group
—These three constitue the Memphis Sand in Northeast Arkansas.

Class II

Jackson Group
Cook Mountain Formation
Midway
Other limestone, marl and sandstone formations of the Cretaceous Age

Class III

All remaining formations and deeper portions of all aquifers that are below the fresh and saltwater interface.

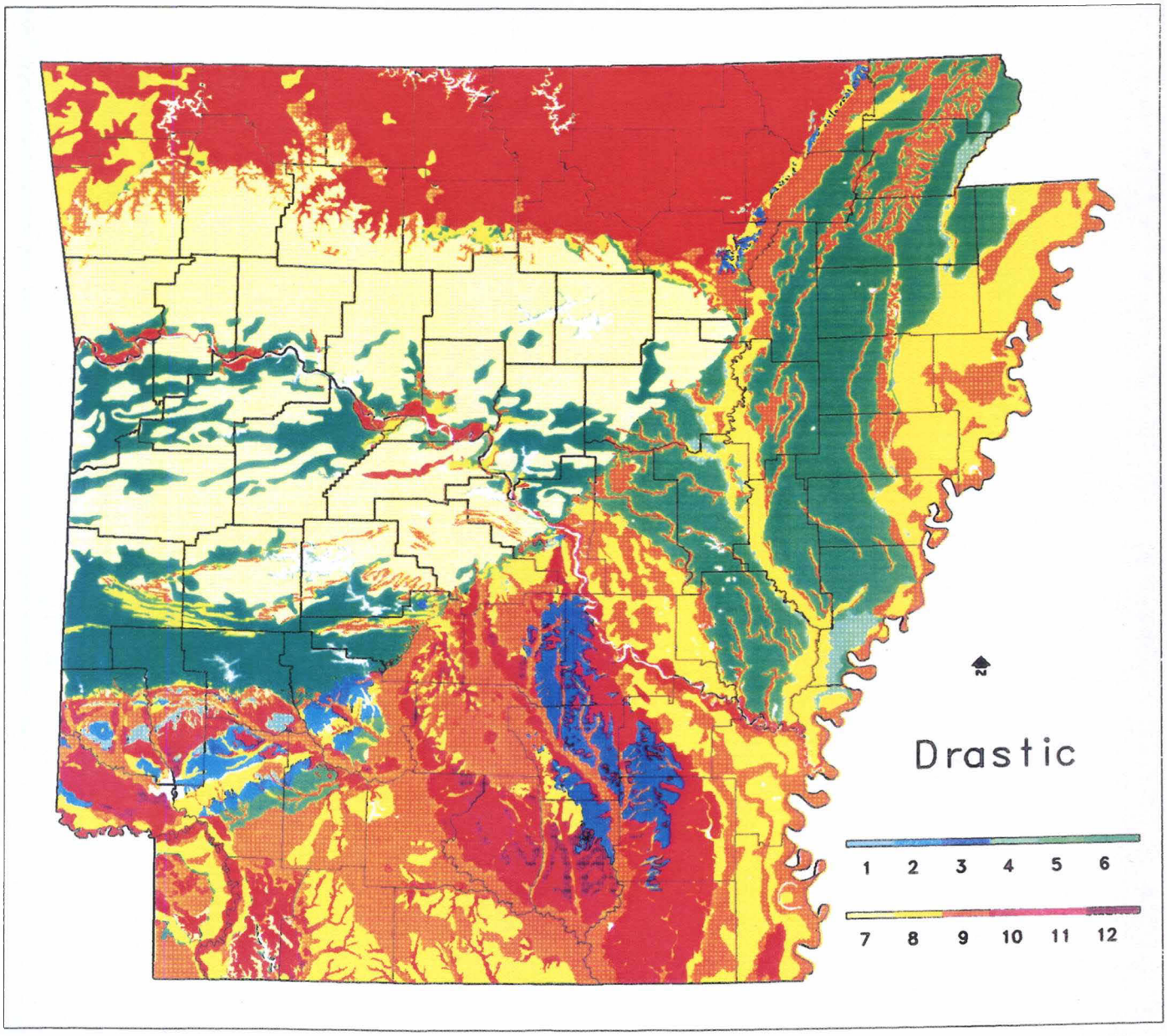


Figure 1.1. Map of Aquifer Sensitivity to Pesticide Contamination. One (light blue) represents the least sensitive areas, while twelve (dark red) represents the most sensitive areas.
Source: Arkansas Soil and Water Conservation Commission. Scale 1:2000042.

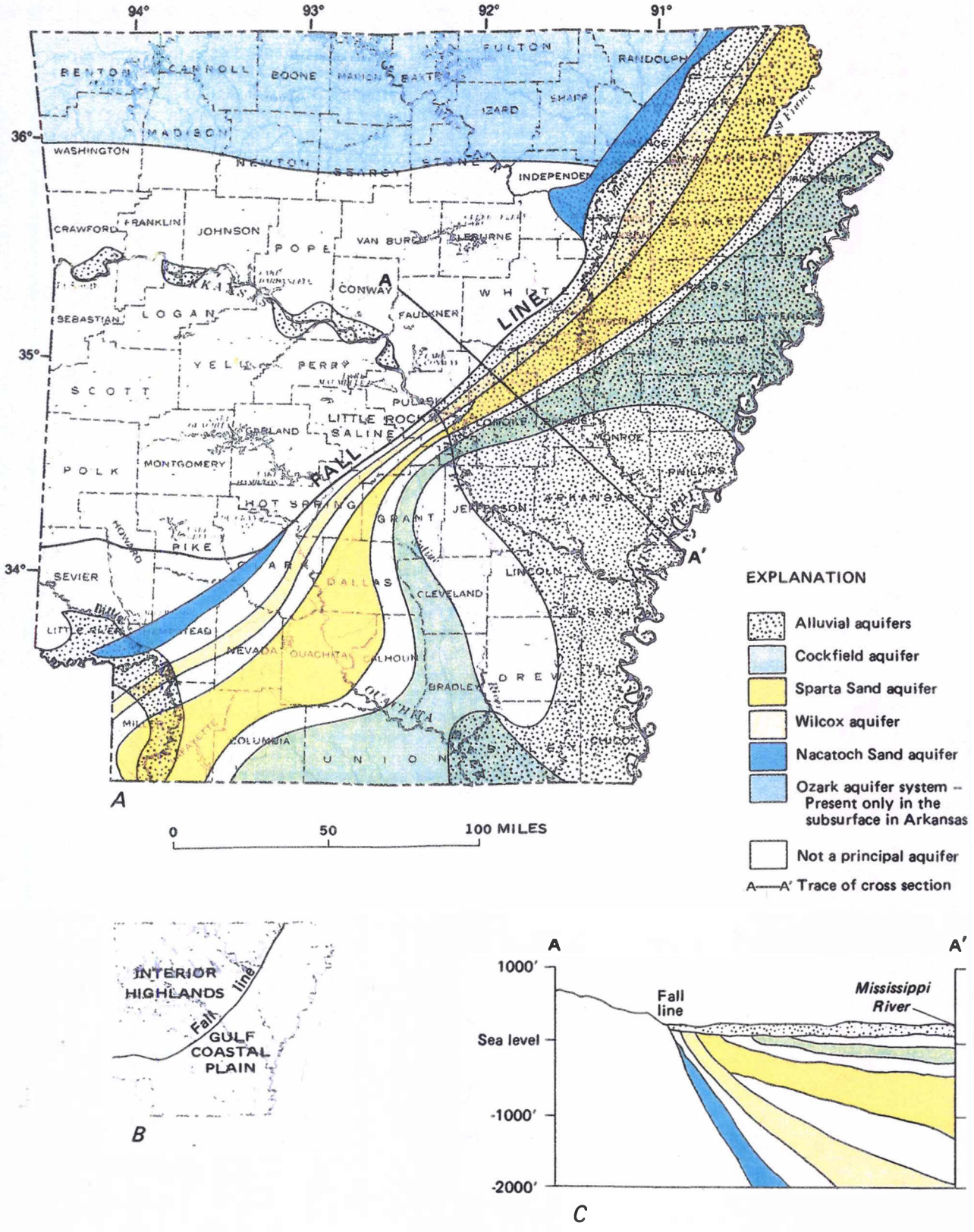


Figure 1.2. Principal Aquifers in Arkansas. A) Geographic distribution. B) Physiographic diagram and divisions. C) Generalized cross section (A-A') *See table 1 for a more detailed description of the aquifers.* Sources: A and C Ludwig, 1972 and compiled by A.H. Ludwig from U.S. Geological Survey Files. B, Raisz, 1954.

SECTION 2
LEGAL AUTHORITY

This section describes and discusses the state's general ability to implement the SMP successfully. It details the state's remedial action authority and its authority to impose preventive measures against pesticide pollution of the state's ground water, including the authority to conduct or to require others to conduct ground-water monitoring, to supply or require others to supply alternate sources of ground water or to provide remedial action to restore ground water, to close public wells, and to prohibit pesticide use in specified areas (See Appendix B for text of environmental legislation).

THE ARKANSAS STATE PLANT BOARD

The Arkansas State Plant Board is primarily responsible for regulating pesticides and other agricultural chemicals in Arkansas. One of the primary legal tools available to the Plant Board is its primacy for pesticide enforcement and for applicator certification of restricted-use pesticides under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), including the authority to ensure that pesticide applicators follow EPA-approved label instructions. In addition, Arkansas Act 389 of 1975, the Pesticide Use and Application Act, and Arkansas Act 410 of 1975, the Pesticide Control Act, empower the Plant Board to regulate and control these agricultural chemicals to ensure their intended and beneficial use.

ASPB has the authority to prohibit or restrict the application of a pesticide. Violations of the pesticide acts and regulations are stopped by issuing a written Stop Sale, Use or Removal Order on the pesticide, aircraft, equipment or device involved in accordance with Act 410, Section 13.

Arkansas Pesticide Control Act— The Act recognizes that pesticides are valuable to agricultural production in Arkansas and that they aid in protecting human health from insects, rodents, weeds, and other life forms that may be regarded as pests. The Act also recognizes that these chemicals, while beneficial when used properly, pose a potential threat to human and animal health as well as the environment generally. In addition, the Act notes that as new pesticides are developed, synthesized or discovered they too must be regulated to ensure that they are used in a beneficial and environmentally sound manner and that they do not cause injury to human health. The Act is administered by the Arkansas State Plant Board. The Plant Board is authorized under this Act

to inspect pesticides wherever found. It may sample and analyze or cause to be analyzed samples to determine compliance with the Act and any regulations adopted under the Act.

Section 18 sets forth the Plant Board's options when an applicator or the holder of an application license violates any one of 17 actions enumerated in the section or is convicted of a criminal violation of FIFRA or is assessed a civil penalty for a violation of FIFRA.

Arkansas Pesticide Use and Application Act — This Act regulates the distribution, use and application of pesticides to control pests as defined by the Act. It recognizes that pesticides perform a valuable service in protecting human health and the environment including farmlands from insects, rodents, weeds and other life forms that may be regarded as pests. But if these same pesticides are used improperly, they present a potential danger to human and animal health and to the environment. The Act is administered by the Arkansas State Plant Board.

Section 5 empowers ASPB to prohibit the use of a pesticide in a given area once certain conditions have been met. It states:

> (a) The Plant Board shall administer and enforce the provisions of this Act and shall have authority to issue regulations after a public hearing following due notice to all interested persons to carry out the provisions of this Act. Where the Plant Board finds it necessary to carry out the purpose and intent of this Act, such regulations may relate to the time, place, manner, amount, concentration, or other conditions under which pesticides may be distributed or applied, and may restrict or prohibit [the] use of pesticides in designated areas during specified periods of time to prevent unreasonable adverse affects by drift or misapplication to: (1) Plants, including forage plants, or adjacent or nearby lands; (2) Wildlife in adjoining or nearby lands; (3) Fish and other aquatic life in waters in reasonable proximity to the area to be treated; (4) Humans, animals or beneficial insects.

Regulations on 2,4-D, 2,4-DB, MCPA and Other State-Restricted Herbicides — Ground water is not specifically referred to in the regulations, but it is implied that through safe handling, application and storage methods ground water will not be adversely affected. Section 5, D, Owner's Responsibility, states: No person shall knowingly cause or engage a custom-applicator to apply state-restricted use herbicides to his land, crop, waters or plants unless the custom applicator has a valid permit.

The Arkansas Department of Pollution Control and Ecology

The Arkansas Department of Pollution Control and Ecology is charged with the overall responsibility to protect water quality

in Arkansas through the Arkansas Water and Air Pollution Act. This Act provides a mechanism through which pollution problems, including those caused by pesticides or other agricultural chemicals, may be prevented or remediated.

ADPC&E may monitor or require others to monitor ground water. The department is empowered by the Arkansas Water and Air Pollution Act in Subchapter 2, Water Pollution, 8-2-201, to "conduct investigations, research, surveys, and studies and gather data and information necessary or desirable in the administration or enforcement of pollution laws." In addition, Subchapter 2, Information and Inspections, 8-4-216 empowers the department to require that monitoring and appropriate record keeping and reporting be done upon reasonable request.

The department has the authority to declare an emergency when the public health and welfare are threatened and the department deems it necessary to act quickly to minimize or alleviate the threat. The department may under these conditions determine that a drinking water supply is unsafe and, with the concurrance of ADH, prohibit its use by closing the well or some other appropriate action.

Arkansas Water and Air Pollution Control Act — The most comprehensive Arkansas Act dealing with water quality, and therefore, the concentration of agricultural chemicals and other agents in ground water is the Arkansas Water and Air Pollution Control Act.

The Act states in Section 8-4-217, Unlawful Action, that: (a) It shall be unlawful for any person to: (1) cause pollution, as defined in section 8-4-102, of any waters of this state.

Pollution is defined in Section 8-4-102 as "such contamination or other alteration of the physical, chemical or biological properties of any portion of the waters of the state, or such discharge of any liquid, gaseous, or solid substance in any waters of the state as will, or is likely to, create a nuisance or render the waters harmful, detrimental or injurious to the public health, safety or welfare; to domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses; or to livestock, wild animals, birds, fish, or other aquatic life."

Waters of the state are defined in Section 8-4-102 (8) as "all streams, lakes, marshes, ponds, watercourses, waterways, wells, springs, irrigation systems, drainage systems, and all other bodies or accumulations of water, surface and underground, natural or artificial, public or private, which are contained within or flow through or border upon any portion of the state."

The Arkansas Pollution Control and Ecology Commission primarily administers and enforces this Act through the Department of Pollution Control and Ecology. The department has wide-ranging powers that enable it to protect the waters of the state as stated in **Subchapter 2, Water Pollution, 8-4-201**, including:

(1) Enforcement of Laws. To administer and enforce all laws and regula-

tions relating to the pollution of any waters of the state;

(2) Investigations and Surveys. (a) To investigate the extent, character and effect of the pollution of the waters of the state; (b) To conduct investigations, research, surveys, and studies and gather data and information necessary or desirable in the administration or enforcement of pollution laws; and (c) To make such classification of the waters of this state as it may deem advisable;

(3) Standards. To establish and alter such reasonable pollution standards for any waters of this state in relation to the use to which they are or may be put as it shall deem necessary for the purpose of this chapter;

(4) Program. To prepare a comprehensive program for the elimination or reduction of the pollution of the waters of this state;

(5) Plans of Disposal Systems. To require to be submitted and to approve plans and specifications for disposal systems, or any part of them, and to inspect the construction thereof for compliance with the approved plans thereof.

Rules and Regulations, 8-4-202, states:

(a) The Arkansas Pollution Control and Ecology Commission is given and charged with the power and duty to adopt, after notice and public hearing, and to modify, repeal, promulgate, and enforce rules and regulations implementing or effectuating the powers and duties of the department and the commission under this chapter.

(b) Without limiting the generality of this authority, these rules and regulations may, among other things, prescribe: (1) Effluent standards specifying the maximum amounts or concentrations and the physical, thermal, chemical, biological and radioactive nature of the contaminants that may be discharged into the waters of this state or into publicly owned treatment facilities; (2) Requirements and standards for equipment and procedures for monitoring contaminant discharges into such facilities, the collection, reporting and retention of data resulting from such monitoring; and (3) Water quality standards, performance standards and pretreatment standards.

8-4-206, State water control agency — General authority, states:

(a) In addition to any other powers which it may have under this chapter or any other legislative act, the Department of Pollution Control and Ecology is authorized and empowered to act as the "state water pollution agency" for the state of Arkansas for the purposes of the Federal Water Pollution Control Act Amendments of 1972.

(b) As the state water pollution control agency, the department may, among other things, approve projects for the construction of disposal systems for the purposes of loans and grants from the federal Environmental Protection

Agency or any other federal agency and may take any action necessary or appropriate to secure for the state the benefits of the federal act.

8-4-207, State water pollution control agency — powers and duties generally states:

(b) The director is further authorized to set and revise schedules of compliance and include such schedules within the terms and conditions for permits issued under this chapter to assure compliance with applicable state and federal effluent limitations and water quality criteria including requirements concerning recording, reporting, monitoring, entry, inspection and sampling as provided in this chapter and such other requirements [as] are consistent with the purposes of this chapter.

8-4-211, Orders — Commission's general authority states:

The Arkansas Pollution Control and Ecology Commission is given and charged with the power and duty to make, issue, modify and revoke orders: (1) Prohibiting or abating the discharge of sewage, industrial waste or other wastes into any waters of the state. (2) Requiring the construction of new disposal systems, or any parts thereof, or the modification, extension or alteration of existing disposal systems, or parts thereof, or the adoption of other remedial measures to prevent, control or abate pollution; and (3) Setting standards of water quality, classifying waters, or evidencing any other determination by the commission under this chapter.

8-4-216, Information and inspections states:

(a) The owner or operator of, or contributor of, sewage, industrial waste, or other wastes to any disposal system, or an industrial user of a publicly owned treatment system, when requested by the director of the Department of Pollution Control and Ecology, shall furnish to the department any information which is relevant to the subject of this chapter. He shall establish and maintain such records, make such reports, install, use, and maintain such monitoring equipment or methods, including where appropriate, biological monitoring methods, sample such effluents and provide such other information as the director may reasonably require.

8-4-217, Unlawful actions states:

(a) It shall be unlawful for any person to: (1) Cause pollution, as defined in section 8-4-102, of any of the waters of the state; or (2) Place or cause to be placed any sewage, industrial waste, or other waste, or other wastes in a location that is likely to cause pollution of any of the waters of this state; or (b) (1) It shall be unlawful for any person to engage in any of the following acts without having first obtained a written permit from the

commission: (c) To construct, install, operate any building, plant, works, establishment or facility, or any extension or modification thereof, or addition thereto, the operation of which would result in discharge of any wastes into the waters of this state or would otherwise alter the physical, chemical, or biological properties of any of the waters of this state in any manner not already lawfully authorized; or (d) To construct or use any new outlet for the discharge of any wastes into the waters of this state; or (e) To discharge sewage, industrial waste, or other wastes into any of the waters of the state.

8-4-220. Violation of chapter, orders, rules, etc. — Order of commission without hearing states:

(a) When the Arkansas Pollution Control and Ecology Commission finds that an emergency exists requiring immediate action to protect the public health or welfare, it may, without notice or hearing, issue an order reciting the existence of such emergency and requiring that such action be taken as it deems necessary to meet the emergency.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) — The federal Comprehensive Environmental Response, Compensation, and Liability Act (42USC Sections 9601-9607), called CERCLA, and the federal Superfund Amendments and Reauthorization Act (SARA) provides for response actions when hazardous substances, pollutants or contaminants are released into the environment. The term environment is defined in the law to include all air, water (ground and surface water) and soils within the United States.

The federal government may initiate response action when there is a release or a substantial threat of release into the environment of a hazardous substance, pollutant or contaminant. Past and present owners, operators and other involved parties, including financial institutions and shareholders, persons arranging for hazardous waste disposal, and transporters of hazardous substances are liable for response costs. Liability extends to both cleanup costs and to damages for injury to natural resources. The federal act also authorizes citizen suits for violations of any standard or regulation under CERCLA. This act is administered primarily by the Department of Pollution Control and Ecology.

Resource Conservation and Recovery Act (RCRA) — RCRA seeks to control and regulate hazardous wastes to ensure that they have been safely and appropriately disposed of. The Act seeks to prevent damage to the environment from unregulated waste disposal practices. This Act is administered primarily by the Department of Pollution Control and Ecology.

THE ARKANSAS DEPARTMENT OF HEALTH

The legal authority for the ADH to promulgate rules and regulations to protect public health originates in Act 96 of 1913, as amended. Section 6 of this Act states:

> Power is hereby conferred on the Arkansas State Board of Health to make all necessary and reasonable rules and regulations of a general nature for the protection of the public health.

ADH's "Rules and Regulations Pertaining to General Sanitation", Sections II and III prohibit pollution of ground water and surface water with poisonous or deleterious substances (e.g. pesticides and other agricultural chemicals).

The department has been granted primacy by the U.S. Environmental Protection Agency to administer the state's Public Water Supply Supervision Program (PWSSP) under the Safe Drinking Water Act, as amended. The PWSSP is administered through the ADH's Division of Engineering (DOE). The DOE handles all provisions of the SDWA except the Underground Injection Control Program which is split between the Department of Pollution Control and Ecology and the Oil and Gas Commission. General responsibilities under the SDWA include drinking water quality monitoring for compliance with specific standards, public water system inspections (source, treatment and distribution), engineering plan reviews, vulnerability assessments, compliance determinations (enforcement), operator training and technical assistance.

ADH's "Rules and Regulations Pertaining to Public Water Systems" incorporate language to insure that drinking water provided to customers of public water systems meets certain water quality standards, as established under the SDWA, and provides minimum protection zones to act as a buffer around both ground and surface water sources.

(1) Sections V and VI address water quality and the ADH's authority to issue orders to insure that adequate water quality and service is provided.

(2) Section VIII addresses the proximity of ground-water sources to possible contamination and the required protective zone. Section XXII.C also requires that the engineering report submitted on a proposed well site include possible sources of contamination within 1,320 feet of the well.

(3) Section IX.B.3 addresses the ownership of restricted zones around surface water sources and Section IX.B.4 addresses restricted activities in the watershed.

ADH also has EPA approval of its Wellhead Protection Program. The program does not incorporate any new regulations, but emphasizes local government controls to protect wells from possible sources of contamination. The ADH will provide technical assistance to those public water systems that wish to develop a management plan for wellhead protection.

The Safe Drinking Water Act (SDWA) — This Act seeks to ensure that public drinking water supplies are safe. Enacted in 1974, the Act has jurisdiction over ground-water aquifers when they are the primary drinking water source in a given area. This Act is administered primarily by the Department of Health.

The Arkansas Soil and Water Conservation Commission

Act 217 of 1969 designates the ASWCC as the agency responsible for state level water planning and authorizes the "Arkansas Water Plan" to be formulated. It is a comprehensive and coordinated plan for the protection, development and utilization of the state's water and related land resources.

The Arkansas Soil and Water Commission, through Act 154 of 1991, The Arkansas Ground-Water Protection Management Act, is empowered to determine critical ground-water areas in the state. While this Act speaks directly to water quantity in a given aquifer, it also speaks to water quality. The commission has determined, and continues to determine, critical ground-water areas as directed by Act 154. Determining ground water vulnerability to agricultural chemical degradation is vital to the success of the SMP. On September 20, 1989, the Arkansas Soil and Water Commission adopted the Rules for Utilization of Groundwater. These rules established a procedure for reporting ground-water use. Obtaining reliable ground-water use data is critical when determining critical ground-water areas. Section 401.3, Definitions, states that critical ground-water conditions exist when ground water has been degraded or trends indicate probable future degradation that would render the water unusable as a drinking water source or for the primary use of the aquifer.

Arkansas Ground-Water Protection and Management Act — This Act recognizes that Arkansas has an abundance of quality ground water, but that in some areas of the state it is being depleted rapidly such that future generations may not have the benefit of the resource. This Act is designed to prevent the loss of ground water through over use. It seeks to conserve and perpetuate the quantity of the ground water available in Arkansas by establishing critical ground-water areas within the state, and the provisions of the Act state that only critical ground-water areas shall be affected by the Act. It provides a mechanism for determining water rights, for reporting ground-water use, for education and information and water conservation cost-sharing programs. These programs are administered statewide. The Arkansas Soil and Water Commission administers this Act and may limit ground-water withdrawals in accordance with the provisions set forth in it.

Section 4, Ground-Water Protection states:

> In order to protect the ground water of the state, the commission shall de-

velop a comprehensive ground-water protection program. This shall contain as a minimum the following components as the commission deems necessary: (a) Assessment and monitoring of the availability of ground water and its quality; (b) The classification of ground water and the establishment of ground-water criteria and or standards; and (c) The management of ground water pursuant to this Act including the issuance of water rights, protection of ground-water quality, and establishment of an education/information program. (d) This program will not be inconsistent with, nor shall it preempt or supersede, any regulatory authority currently or in the future vested with the Arkansas Department of Pollution Control and Ecology or the State Plant Board or the Arkansas Department of Health, provided however, that no permit or prior authorization from these agencies shall be required to implement the provisions of this Act.

The Arkansas Water Well Construction Commission

The Arkansas Water Well Construction Commission promulgates rules and regulations for water well construction in the state in accordance with Act 641 of 1969, known as the Arkansas Water Well Construction Act. It recognizes the importance of proper construction and maintenance of underground water wells. The Act "provides for the proper development and use of underground water." As it relates to the SMP, the Act ensures that wells have been properly constructed or repaired including proper sealing and abandonment of water wells. The Act provides a mechanism for the inspection and closing of an existing well.

Section 7, Inspections. (a) The committee is authorized to inspect any water well, [or] abandoned water well. Duly authorized representatives of the committee may at reasonable times enter upon, and shall be given access to, any premises for the purpose of such inspection; (b) upon the basis of such inspections, if the committee finds applicable laws, rules or regulations have not been complied with, or that a health hazard exists, the committee shall disapprove the well. If disapproved, no well shall thereafter be used until brought into compliance and any health hazard eliminated; (c) any person aggrieved by the disapproval of a well shall be afforded the opportunity of a hearing before the committee.

Section 8, Existing Installations. No well in existence on the effective date of this Act shall be required to conform to the provisions of Section 7 of this Act, or any rules or regulations adopted pursuant thereto; provided however, that any well now or hereafter abandoned or repaired, including any well deemed to have been abandoned, as defined in this Act, shall be brought into compliance

with the requirements of this Act and applicable rules or regulations with respect to abandonment of wells; and further provided that any well supplying water which is determined to be a health hazard must comply with the provisions of this Act and applicable rules and regulations within a reasonable time after notification of such determination has been given.

Table 2.1. Summary of Legal Authorities

Agency	Authority
Arkansas State Plant Board	Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)
	Arkansas Act 389 of 1975, the Pesticide Use and Application Act
	Arkansas Act 410 of 1975, the Pesticide Control Act
Arkansas Department of Pollution Control and Ecology	Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)
	Resource Conservation and Recovery Act (RCRA)
	Arkansas Act 472 of 1949, the Water and Air Pollution Control Act
Arkansas Department of Health	Safe Drinking Water Act
	Arkansas Act 96 of 1913, as amended
Arkansas Soil and Water Conservation Commission	Arkansas Act 217 of 1969 Arkansas Act 154 of 1991, Groundwater Protection and Management Act
Arkansas Water Well Construction Commission	Arkansas Act 641 of 1969, the Water Well Construction Act

SECTION 3
BASIS FOR ASSESSMENT

Arkansas' commitment to protect its ground water from pollution by agricultural chemicals requires the following assessments:

1. Determination of ground-water quality and extent of contamination by agricultural chemicals — present and future.
2. Nonpoint source contamination prevention and response.
   a. Determination of areas of the state vulnerable to contamination by pesticides.
      i. Aquifer sensitivity assessment.
      ii. Assessment of pesticide use by county.
   b. Determination of contamination potential of specific agricultural chemicals.
   c. Determination of appropriate best management practices (BMPs) for specific pesticides, specific crops and specific locations.
   d. Evaluation of the effectiveness of prevention and response measures.
3. Point-source contamination prevention and response.
   a. Determination of point sources with high potential for contamination by agricultural chemicals.
   b. Basis for assigning priorities to these sites.
   c. Determination of appropriate BMPs and other prevention measures.
   d. Evaluation of the effectiveness of prevention and response measures.

In responding to these requirements, the state will use a combination of ground-water monitoring, modeling, literature review, field studies and the best professional judgement of state personnel. The following paragraphs elaborate on the above assessment goals, outlining the tools and approaches that will be used to achieve them.

1. GROUND-WATER QUALITY

To evaluate the current status of the state's ground water and to assess changes that may occur in the future, a microcomputer database will be developed and continually updated. The Agricultural Chemicals Database (ACD) will include pertinent

data collected by state and federal agencies, or contractors, and results from ground-water monitoring to be conducted under this plan. To maximize the amount of data available for the ACD, sampling activities will be coordinated with all state and federal agencies that collect ground-water data. For example, results from the U.S. Geological Survey's Ozark Plateaus and Mississippi Embayment Ground-Water Sampling Network — part of the National Water Quality Assessment Program — will be incorporated into the ADC.

The Arkansas Department of Pollution Control and Ecology (ADPC&E), the Arkansas Department of Health (ADH), the University of Arkansas, and the U.S. Geological Survey have conducted monitoring programs recently that included pesticides in their list of parameters. For the evaluation of current levels of pesticide contamination, these data and the results from initial monitoring will be used. Under the response component of this plan, monitoring will also be used to determine the extent of contamination when it is detected and to evaluate the effectiveness of response measures. Monitoring and response are discussed at length in separate sections.

Where appropriate, modeling will be applied to area-specific data to generalize it to other similar areas in the state. Of necessity, monitoring will begin on a limited basis. The use of modeling will allow extrapolation from initial, limited-monitoring data to other areas that have not been sampled. To allow extrapolation, a geographic information system will be used to identify areas of the state that are similar in terms of soil, geology, crops and pesticide use.

2A. Areas of the State Vulnerable to Nonpoint Source Contamination by Pesticides

To determine appropriate prevention measures, an assessment of aquifer vulnerability to contamination by agricultural chemicals is being developed. This as-

Table 3.1. Assigned Weights for Features of Pesticide DRASTIC.

Feature	Assigned Weight
Depth to Water.	5
Net Recharge	4
Aquifer Media	3
Soil Media	5
Topography	3
Impact of the Vadose Zone Media	4
Hydraulic Conductivity of the Aquifer	2

sessment is based on many variables. Aquifer characteristics such as depth to ground water, soil series, and bedrock permeability are included to determine aquifer sensitivity to water-borne contaminants. Pesticide use data are included to indicate which sensitive aquifers, if any, are recharged from areas of high pesticide use. Such aquifers will be designated as vulnerable to nonpoint source contamination by pesticides.

An aquifer sensitivity index, DRASTIC, has been developed for the U.S. Environmental Protection Agency (EPA) by the National Water Well Association (Aller et al., 1985, 1987). As shown in Table 3.1, this index includes various characteristics of the area overlaying the aquifer and the depth to ground water. The weights given to the variables were determined by consensus among many scientists. The Arkansas Soil and Water Conservation Commission, having collected the necessary data, has applied the DRASTIC model to Arkansas' aquifers to evaluate their sensitivity to water-borne contamination (Appendix K). In conjunction with a geographic information system (GIS) the DRASTIC results have been used to generate an aquifer sensitivity map (Figure 1.1). This is the first step in assessing vulnerability to pesticide contamination.

The second step is collecting local pesticide use data. Currently, there is no such collection of data. However, for major crops, total acreage grown in each county is reported every year by the Arkansas Agricultural Statistics Service. Using these data, University of Arkansas Cooperative Extension Service (CES) personnel are deriving an estimate of pesticide use for each county. CES experts, with many years of experience, are using best professional judgment of the pesticide use practices of Arkansas' farmers to estimate the percent of different crops receiving particular pesticides. These estimates, in conjunction with recommended pesticide application rates, will be applied to the total acreage of the crops grown in a county, resulting in an estimate of pesticide use for that county. There are limitations in this approach, because of the use of estimates. However, this plan calls for tracking agricultural chemicals for which chemical-specific state management plans are required. In the future, this will provide firmer data on local pesticide use.

Combining the aquifer sensitivity map and county pesticide use estimates will provide a map on which aquifer sensitivity overlays pesticide use data, resulting in a map of aquifer vulnerability to pesticide contamination. Those areas with congruent high aquifer sensitivity and high pesticide use are considered to be the most vulnerable to contamination.

2B. Determination of the Contamination Potential of Specific Pesticides

Whether a pesticide is likely to migrate to ground water depends on characteristics of the site where it is applied and on attributes

of the pesticide itself. These include half-life, solubility in water, volatility and adsorption. Information about these characteristics for many pesticides is available from EPA and/or the USDA Soil Conservation Service (SCS). As this information is needed by most states instituting state management plans, it is expected that it will be available for collection and that the state will not have to invest in specific research in this area.

In conjunction with these pesticide characteristics, modeling will be used to evaluate the migration potential of specific pesticides under local conditions, including weather patterns. For this purpose three models, which simtulate the fate of a pesticide as it moves thorugh the ground, are being considered for implementation in the context of GIS. These are CMLS (Nofziger and Hornsby, 1988), GLEAMS (Knisel, 1980) and LEACHMP (Wagenet and Hudson, 1986). Modeling will help to identify areas in the state, if any, in which the use of a specific pesticide will be restricted. Further, given the history of pesticide use in Arkansas, modeling will point to specific, currently used pesticides that should receive high-priority consideration as the monitoring program begins.

2c. Determination of Appropriate Best Management Practices

This plan considers BMPs an integral part of the prevention and response components. A large body of information has been generated and published concerning the effectiveness of various BMPs. Many are generic in that they provide techniques for reducing pesticide use, regardless of the crop, pesticide or soil. Several states have published these for their farmers. CES, working with the State Plant Board, will collect this information and publish it in a format suitable for distribution by county agents. BMPs for specific pesticides will be adapted from the literature when a chemical-specific SMP calls for them; or if necessary, the Plant Board will seek funding to research the needed BMPs.

2d. Evaluation of Prevention and Response Measures

A monitoring program will be used to evaluate the effectiveness of prevention measures instituted for nonpoint source contamination. When monitoring indicates continued good quality of the ground water, prevention measures will be considered adequate. Any pesticide detection, at or above the detection limit will require more stringent prevention techniques including more intensive monitoring, further education and possibly mandatory BMPs. When the concentration of a detected chemical reaches the response trigger — 50 percent of the MCL or the action level set by ADH, whichever is lower — it will indicate that prevention measures have failed. At this point, the State Plant Board will institute response measures, possibly including restricted use or a use moratorium on that pesticide. When response measures are

instituted, monitoring will continue to evaluate their effectiveness.

To evaluate prevention and response measures for nonpoint source contamination, monitoring results will be used in conjunction with ground-water models. In these cases, models will be used to estimate the length of time necessary for a prevention or response measure to affect the underlying aquifer. This will allow the monitoring program to be tailored to the specific situation and possibly reduce the frequency and cost of monitoring.

3A. Assessment of Point Sources of Contamination

Review of the literature indicates that pesticide mixing/loading areas have a high potential for contaminating ground water (Habecker, 1989) if proper containment and storage structures are not present or if applicators do not work carefully. There are estimated to be 300 such sites in Arkansas. As a group, they are the most conspicuous threat of point source contamination. Other point sources of pesticide contamination will be identified on a case-by-case basis.

3B. Basis for Prioritizing Sites

The mixing/loading sites in the state do not all present the same potential for contamination. To address the most serious problems first, a priority listing of sites will be compiled. Under its authorities the Plant Board will institute an inspection program for mixing/loading sites. Using an inspection format designed to address all aspects of the operation, Plant Board agents will gather information to allow the sites to be ranked on contamination potential. This ranking will be used as a basis for determining monitoring sites when funds become available for the mixing/loading site monitoring program.

3C. Evaluating Best Management Practices for Mixing/Loading Sites

BMPs for mixing/loading sites are well developed and documented. These procedures are straight forward and absolutely necessary for proper pesticide handling. They will be published in an appropriate format and distributed to all licensed applicators. They will also be incorporated into the applicator training sessions.

3D. Evaluation of Prevention and Response Measures

A continuing monitoring program, the results of which will be included in the Agricultural Chemicals Database, will be used to assess the effectiveness of prevention and response measures. Should a contamination event be verified, an investigation to determine its extent and source will be conducted to assess the possible threat to human health and the effectiveness of any response measures implemented.

Table 3.2. Assessment Needs and Responses

Needs	Responses
1. Ground-water quality and extent of pesticide contamination.	Agricultural Chemicals Database. To include previous monitoring results and results from SMP monitoring.
2. Nonpoint source contamination.	
a. Aquifer Vulnerability.	Aquifer sensitivity assessment using DRASTIC and pesticide use patterns, by county.
b. Contamination potential of specific pesticides.	Collection of Data — half-life, solubility, volatility and absorption — and computer modeling.
c. Assessment of BMPs.	Information collection and input from universities.
d. Evaluation of prevention and response measures.	Monitoring and modeling.
3. Point-Source Contamination.	
a. Determining point sources.	Literature and some monitoring results indicate pesticide mixing /loading areas are the most serious problem.
b. Prioritizing point sources.	Survey of mixing/loading sites by ASPB.
c. Assessment of BMPs.	BMPs for mixing/loading sites are well known.
d. Evaluation of prevention measures.	Monitoring.

SECTION 4
GROUND-WATER CONTAMINATION PREVENTION

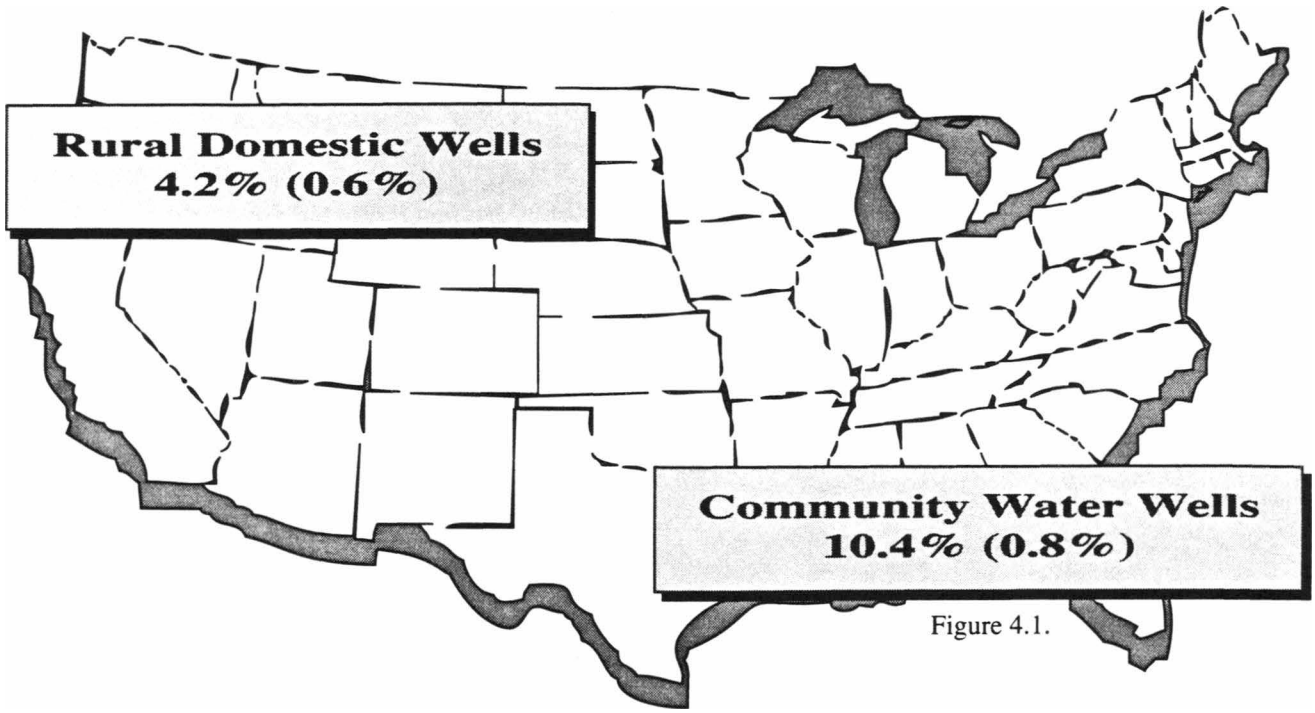


Figure 4.1.

EPA Nationwide Pesticide Detections and Detections above the MCL ( ).

Limited ground-water monitoring in Arkansas indicates that contamination by pesticides is not currently a widespread problem. In 1988, the U.S. Geological Survey (USGS) in cooperation with the Arkansas Department of Pollution Control and Ecology (ADPC&E) monitored 16 wells in Lonoke County, a mainly agricultural area, for 33 pesticides (Leidy and Morris, 1990). No concentrations equal to or above analytical detection limits were found. Results from another USGS monitoring program in northeastern Arkansas have not yet been published, but preliminary results from 10 wells sampled in 1990 show three detections — DEF at .02 ug/L and metolachlor at 4.6 ug/L in one well and metolachlor at .2 ug/L in another. All 10 wells were sampled again in 1991, but analysis results are not yet available.

Two studies by the University of Arkansas have also monitored for pesticides in ground water. In one study, researchers monitored 119 wells, springs and municipal water supplies, mainly in eastern Arkansas, for 18 pesticides (Cavalier *et al.*, 1989). The results were negative except for one

irrigation well in which three herbicides — alachlor, atrazine and metolachlor — were detected at 5.5, 5.8 and 6.9 micrograms per liter, respectively. Previous and subsequent samples taken from this well gave negative results, and it was concluded that the detection resulted from a localized spill. In another University of Arkansas study, 25 springs in northwestern Arkansas were monitored for six herbicides, nitrate and phosphate (Dehart *et al.*, 1991). No herbicides were detected. A third study, in progress, is focusing on mixing/loading sites, but no results have been published.

These monitoring results indicate that some pesticide contamination has occurred but only in isolated instances. For comparison, the U.S. Environmental Protection Agency (EPA) in its initial report on pesticide contamination in drinking water wells nationwide estimates that 0.8 percent of all community water system wells and 0.6 percent of rural domestic wells contain pesticides at or above EPA maximum contaminant levels or health advisory levels (MCL or HAL) (U. S. Environmental Protection Agency, 1990). EPA also estimates that 10.4 percent of community wells and 4.2 percent of domestic wells contain one or more pesticides at or above the analytical detection limit (Appendix A). While data collected in Arkansas are not sufficient to generate estimates comparable to the EPA estimates, they do indicate that pesticide contamination of ground water in Arkansas is less frequent than in the nation as a whole.

Arkansas' relatively unpolluted aquifers exist despite a long history of agricultural chemical use. The depth of most of the aquifers underlying the agricultural areas and the relatively impermeable soils, which make it possible for Arkansas to be the top rice producing state, are probably partly responsible for this. However, much credit should also be given to the state pesticide control programs and the applicators licensed thereunder. Licensing commercial applicators began in 1939 under Act 394 of 1939. Legislation in 1975, Acts 389 and 410, added additional licensing categories, including private applicator (farmers doing their own applications), and gave the Arkansas State Plant Board (ASPB) authority to license pesticide dealers. Under these authorities, the Plant Board, cooperating with the University of Arkansas Cooperative Extension Service (CES), has provided education, guidance and regulation for pesticide users for more than 50 years.

This management plan, including the prevention component, builds on work that has been done for many years. The ongoing certification and licensing program for pesticide applicators is in essence an educational endeavor. The state has also provided many other educational opportunities to the agricultural community through its universities and the extension service. Following this tradition, Arkansas believes that education is the most effective way to prevent ground-water contamination by pesticides. Research at the state's universities combined with prompt dissemination of information through the state's network of county

agents and other state personnel will continue to be the primary prevention technique.

In dealing with ground-water contamination by pesticides, prevention is the best and, in many cases, the only alternative. This plan emphasizes prevention through a combination of education, voluntary compliance, and if needed, through regulation. Any regulations developed shall maintain, in so far as possible, the integrity of the agricultural community in terms of its ability to produce crops and be competitive in national and international markets.

In accordance with the state's commitment to the agricultural community, this plan reserves the most drastic prevention technique, use moratoria, until all other prevention techniques have been exhausted. When possible, Arkansas will develop and implement the safeguards necessary to assure the continued quality of its ground water without this tool. The plan does, however, call on the state's farmers to examine their management practices with an eye toward reducing pesticide use through better management and improved farming techniques. It also calls for manufacturers to accelerate the development of less toxic, more environmentally benign products.

While the focus is on prevention of ground-water contamination, the state will not implement any ground-water protection strategy which has been determined to, or is reasonably suspected to, negatively impact surface water quality and vice versa. In particular, best management practices (BMPs) will be considered in this light before they are recommended to state farmers.

This plan will use all of the information now available from all sources. Large amounts of money have been spent on research and experimentation to find safe ways to handle and apply pesticides. This includes federal- and state-sponsored research and monitoring and research at many land-grant universities across the nation, including Arkansas. In order to obtain the best results from limited resources, available information concerning the extent of observed contamination, the circumstances under which it most frequently occurs, and results of pollution control efforts, including BMPs, must be collected and carefully studied. Some of this information has been collected and has contributed to this plan. Continuing to gather and assimilate these data will be given a high priority.

One way to disseminate useful information as it becomes available is to include it as part of the applicator training which precedes certification or recertification. All applicators of restricted-use or state limited-use pesticides are required to be licensed annually through the Plant Board. Certification based on training provided by the Plant Board in conjunction with CES is required prior to licensing. In light of this plan's emphasis on ground-water protection, the Plant Board and CES will review current training materials for adequacy. Presently, it is expected that material will be added concerning the hydrologic cycle and the potential of pesticides to contaminate ground water. BMPs for mixing/loading sites will also be added

and the responsibility of applicators in preventing ground-water contamination will be given more emphasis. Reviewing certification training materials will be standard practice to ensure that information relevant to new chemicals falling under state management is complete and accurate.

Ground-water pollution by pesticides falls into two main categories: nonpoint source (NPS) and point source. Nonpoint source pollution of ground water by pesticides has been documented in twenty-six states, including 46 different pesticides (Williams et al., 1988). Research from several states (Habecker, 1989) shows that point-source contamination of ground water has also occurred, presenting serious problems. In both categories, potential for contamination exists in Arkansas and this plan addresses both. In the following sections prevention of nonpoint source contamination is addressed first, followed by prevention plans for point-source contamination.

Nonpoint Source Contamination

Nonpoint source contamination is contamination that results from the normal use and application of agricultural chemicals and agents to crops, rangeland, etc. This type of contamination occurs over wide areas rather than at a single, well-defined location. Remediation of NPS pollution is costly and difficult, perhaps nearly impossible in some cases. The rate at which pollutants migrate through the soil to ground water depends on many factors, including characteristics of the chemical, local soil and bedrock characteristics, and depth to the aquifer. Thus, some farm lands will be more vulnerable to NPS contamination than others.

One step in preventing NPS contamination is development of a pesticide vulnerability map for Arkansas. A description of how this map is being developed can be found in the Basis for Assessment section of this document (also see Appendix K). Briefly, the map will be based on aquifer sensitivity, the distribution of pesticide use and other local conditions. At present, only estimates of pesticide use are available. However, the State Plant Board is investigating alternative methods for tracking pesticide use. When in place, tracking will help refine the vulnerability map. The map will provide a basis for determining which farming areas are most in need of protection. Information from the map will allow farmers to know when or if they are farming in an area of special vulnerability. Also, the map will be instrumental to the monitoring program, suggesting areas that should be given priority.

In addition, with this map and information about the characteristics of specific pesticides such as persistence, solubility, volatility and adsorption, the Plant Board, with the Arkansas Water Resources Research Center (AWRRC), will develop a predictive model specific to each chemical subject to SMP control. The model will indicate whether, following label instructions, a chemical may be used in sensitive areas or whether it should be used only in con-

junction with a state limited-use program. Or, the model might indicate that use should be banned in these sensitive areas, making it necessary to find a more benign substitute.

Continued and/or excessive application of pesticides as a normal agricultural practice may result in the leaching of pesticides through the soil to ground water. Obvious prevention measures have to do with reducing the amounts of pesticide applied and eliminating or limiting pesticide use in the most vulnerable areas to the extent that they can be determined. Reducing pesticide use is a component of most BMPs designed to make farming more environmentally sound and sustainable. The state will be an active participant in developing and adapting improved BMPs for Arkansas' major crops including rice, soybeans, cotton, sorghum and wheat. Through the network of county agents and Plant Board personnel, information about these BMPs will be continually disseminated to the agricultural community.

Though chemical- and crop-specific BMPs must be developed and introduced to the agricultural community, there are BMPs available now that address pesticide use reduction, regardless of product. Integrated pest management, which recommends limited pesticide use as one of many tools for pest management, could significantly reduce pesticide use if implemented by all farmers. Together with CES and university agronomists, the Plant Board will begin evaluating integrated pest management techniques as they apply to the major crops of Arkansas. These techniques include using pest and disease resistant varieties, scouting techniques to identify and quantify pest infestations to reduce pesticide applications to the minimum needed, determining which natural predators might be introduced and developing better systems of record keeping. This information, when deemed ready, will be disseminated to state farmers through county extension agents. As appropriate, demonstration projects will be started to emphasize the benefits of integrated pest management.

Use of voluntarily introduced BMPs and educational programs will be the major prevention technique, as long as contamination is not detected. When contamination is detected at a concentration below the reference point which triggers a response, other, more stringent, measures will be introduced, including mandatory education and mandatory compliance with BMPs. Detection at higher levels will trigger the response component of this plan.

Prevention Monitoring — As a major prevention tool, ground-water monitoring for pesticides will be instituted by the Plant Board. Through monitoring, early detection of minor contamination, i.e., pesticide levels below the response trigger, will provide an opportunity to focus prevention measures on problem areas before concentrations become hazardous. Prevention monitoring will focus on the most vulnerable areas, with special attention to mixing/loading sites. Plans for monitoring are discussed in detail in Section 6, Monitoring.

Point-Source Contamination

Point-source contamination refers to contamination that originates at a relatively confined area or point. Ground-water contamination emanating from point sources results in plumes of contaminated ground water that initially are relatively localized.

Investigation of mixing/loading sites has revealed pesticide contamination of soil and/or ground water in several states (Habacker, 1989). In Wisconsin, 20 sites were investigated of which 18 were contaminated by one or more pesticides. In Minnesota, Illinois and Ohio, ground water contaminated by pesticides was found at 9 of 10 sites. These studies indicate that mixing/loading sites — commercial, non-commercial and private — should be given a high priority in any prevention plan. Among the potential problems that must be addressed are backsiphoning at wells, uncontained, large or repeated spills, improper disposal of waste pesticides and rinsate and unsafe storage and transportation practices.

This plan calls for four separate but related prevention measures to deal with mixing/loading sites: voluntary BMPs, site inspections, a mixing/loading site monitoring program, and eventual promulgation of stronger state regulations pertaining to mixing/loading sites. These measures are considered in the following paragraphs.

Potential problems that may occur during the mixing and loading process can be avoided by the well-trained applicator. As part of a general review of the applicator training program, the Plant Board will compile information on BMPs that pertain to mixing/loading sites. Publications from the USDA Soil Conservation Service (SCS), CES, EPA and other states will provide all or most of this information. When compiled, this information including wellhead buffer zone recommendations, plans for storage and containment structures, proper rinsing and rinsate disposal procedures, and proper container disposal will be distributed immediately to all licensed applicators. The material will also be incorporated into the applicator training manuals and emphasized in all future training programs.

Under current law, the Plant Board is authorized to inspect the pesticides and equipment used by licensed applicators, as well as storage and disposal areas. The Plant Board will institute a program to inspect mixing/loading sites. For these inspections, the Plant Board will develop an inspection format that will assure every potential source of contamination is covered. Information derived from the inspections will be used in various ways. First, site deficiencies noted during inspection will be immediately called to the applicator's attention to encourage voluntary compliance with recommended BMPs. Second, information from the inspections will be used to prioritize the sites for the monitoring program. Finally, summary information from the inspections along with monitoring results will help define statewide potential for contamination presented by these sites. This information will help the Plant Board determine when stron-

ger regulations and/or increased enforcement activities are needed.

As noted earlier, evidence from other states is accumulating that documents the hazards to ground water posed by pesticide mixing/loading sites. Monitoring is needed in Arkansas to determine the magnitude of the problem and the level of prevention to be instituted. Thus, the prevention monitoring program will focus both on vulnerable areas and on mixing/loading sites. Results from the mixing/loading site inspections and the best professional judgment of Plant Board agents will be used to identify the sites most in need of monitoring. The number of sites monitored will depend on available funds. As indicated, the results of this monitoring will be used to determine the level of preventive measures needed; however, detections at or above the response trigger are to be handled as described under the point source heading in Section 5, Response.

The need for additional regulations or stronger enforcement will be determined from the monitoring results and site inspections. In addition, EPA is expected to promulgate regulations concerning container design and adequate cleaning procedures soon. The Plant Board will periodically review its regulations in light of monitoring and inspection results and the need for compliance with EPA regulations. When necessary, the Plant Board will issue updated regulations. Any new regulations requiring significant capital expenditure by farmers or applicators will be phased in to lessen negative economic impact.

Backsiphoning of nutrients and pesticides into wells during chemigation is another potential point source. Federal and state regulations will continue to be enforced by state agencies. Under the authority of Arkansas Act 641 of 1969, the Arkansas Water Well Construction Commission (AWWCC) requires anti-backsiphoning devices to be used when agricultural chemicals are applied during irrigation. Act 641 also contains enforcement provisions that AWWCC will apply as appropriate in preventing backsiphoning incidents. In addition, the Plant Board in reviewing its applicator training program will pay particular attention to including adequate education on this problem.

Non-Agricultural Pesticide Use

Thus far, this plan has focused on pesticide use in traditional farming. There are, however, other significant categories of pesticide use in Arkansas. These are silviculture and rights of way maintenance, including highways, railroads and utilities, as well as urban uses, including lawn and golf course application. Applicators in these categories are certified and licensed by the Plant Board, and new training materials concerning pesticides and ground water will be presented to these applicators through the training program. As time and funds allow, the monitoring program will be used to evaluate the extent, if any, of ground water contamination resulting from these uses.

TABLE 4.1. SUMMARY OF PREVENTION PLAN

NONPOINT SOURCE CONTAMINATION PREVENTION.

- ∞ Supplemental applicator training on ground water.
- ∞ Voluntary Compliance with Agricultural BMPs.
  Collection and dissemination of BMPs by CES.
  Introduction of integrated pest management.

- ∞ Monitoring.
  Vulnerability assessment.
  Monitoring the most vulnerable areas and statewide monitoring.

- ∞ Tracking of the distribution of pesticides designated to be used only under the SMP.

- ∞ Mandatory BMPs may be instituted when low-level contamination is detected and voluntary compliance is deemed to have failed.

POINT-SOURCE CONTAMINATION PREVENTION.

- ∞ Pesticide mixing/loading site investigations.
- ∞ Monitoring at mixing/loading sites presenting the greatest threat to ground water.
- ∞ Voluntary compliance with mixing/loading site BMPs.
- ∞ Promulgation of more stringent regulations for mixing/loading sites, if needed.

SECTION 5
RESPONSE TO CONTAMINATION

The state of Arkansas is committed to emphasizing prevention as the major component of this plan. The prevention section outlines methods to prevent ground-water contamination by agricultural chemicals, which are expected to be successful. However, it is the state's intention to be prepared to respond promptly and appropriately to any detection of pesticides in the ground water discovered during monitoring or reported through any other means. To meet this requirement, this plan provides for different levels of action depending on the specifics of the particular incident, including the use and value of the aquifer and the type and concentration of the contaminant.

This plan requires a cooperative effort between various state and federal agencies. For example, the Arkansas Department of Health (ADH) has responsibility for all public water supplies under the Safe Drinking Water Act, including the emerging wellhead protection program. Thus, ADH will have a major role in responding to detected pesticide contamination at public water supplies. Under the Clean Water Act, the Arkansas Department of Pollution Control and Ecology (ADPC&E) has major responsibility for preventing contamination of surface and ground water and would be the responding agency for a pesticide contamination incident at an irrigation or industrial well. In either case, as lead agency the Plant Board is responsible for public notification, when warranted; instituting responses, such as mandatory best management practices (BMPs); and reporting to EPA. EPA may be involved to provide funds for remediation or safe drinking water where a health risk is involved. Also much of the research on ground-water remediation and BMPs is funded at the federal level.

Responsibility for coordinating response efforts must be clearly defined for all pesticide contamination incidents. To this end, the roles and responsibilities of the State Plant Board, ADPC&E and ADH are delineated by an Intra-State Service Agreement, a copy of which is attached as Appendix O. Under this agreement, each agency has designated an individual to be a member of the Pesticide Response Coordination Team. Each team member is responsible within his or her agency to mobilize the resources needed for an appropriate response. He or she is also responsible for maintaining communications with the other agencies. Together, the team will coordinate the efforts of the agencies to assure timely and appropriate response without duplication of efforts.

Detection Requiring Response

There must be a criterion for deciding when a detection requires a response. Analyses for contaminants will be made in accordance with those test methods specified in 40 CFR 141, Subpart C, or their equivalent. ADH is setting action levels for many of the pesticides used in Arkansas. A confirmed and verified detection of a pesticide at a concentration equal to or exceeding the action level or a concentration equal to or exceeding 50 percent of the MCL, whichever is lower, will require a response. The State Plant Board may, however, in the context of a chemical-specific state management plan, adjust this 'response trigger' to reflect the hazard associated with the particular chemical.

Confirmation and Verification

As used in this plan, confirmation of a detection means re-analysis of the sample in question using gas chromatography/mass spectrometry. When a detection is confirmed, the contamination will be verified. Under this plan, verification means the collection and analysis of a new sample from the well in question. The verification process will begin immediately to minimize changes in or around the well that might cause a different result. The agency making the original detection will be responsible for confirmation and verification.

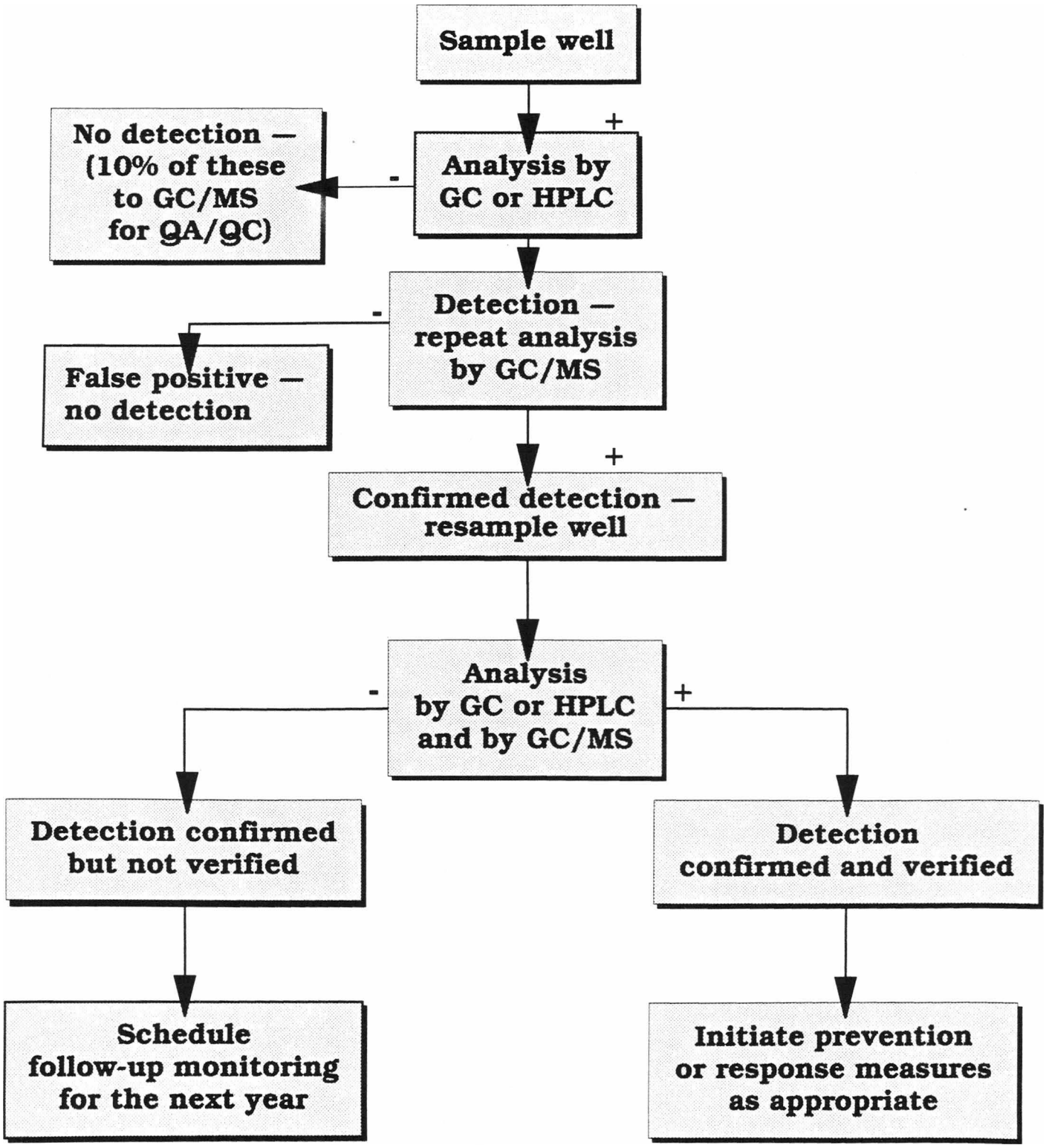
Confirmation and verification of contamination will require further response as outlined below. It is also possible that a confirmed detection will not be verified, i.e., the contaminant will not be found in the sample taken for verification. Such a result also requires action. At a minimum, the suspect well will be scheduled for annual sampling during each of the following two years to guard against the reappearance of the contaminant. Also, circumstances at the well site, e.g., empty pesticide containers or proximity to a mixing/loading site, noted during sampling or resampling may warrant further investigation.

Public Notification

A confirmed and verified detection requires written notification to the Arkansas State Plant Board. The Plant Board will then report information on detections at or above the response trigger to the public in the manner specified in Section 11, Public Awareness and Participation. While detections below the response trigger do not require public notification, information about such detections will be shared between all concerned agencies.

The Plant Board will also notify the appropriate representative of the basic producer of the detected pesticide. Said notification will include informing the producer that it may be accruing liability in Arkansas because of contamination by one of their products. It will also state the possibility that Arkansas may have to restrict or forbid the use of the chemical, either locally or statewide. When appropriate, it may include the state's intention to further research the proper use of this pesticide and invite the producer's

Figure 5.1. Diagram of Analysis, Confirmation and Verification Procedure



Note: + and - refer to positive and negative analysis results.

participation. Communication with the producer thereafter will depend on how the situation evolves and on how the producer responds. At a minimum, the Plant Board will inform the producer regarding changes in the situation.

Extent and Significance of Contamination

A confirmed and verified detection, will be immediately investigated to determine whether there is risk of human exposure to contamination. Under the Safe Drinking Water Act, ADH is charged with this responsibility for public water systems. ADH also investigates suspected drinking-water contamination in private wells. However, under the attached inter-agency agreement, assistance may be requested from ADPC&E when necessary. The investigation involves determining the areal extent of the contamination and the concentration of the contaminating pesticide. The proximity of any private drinking water wells will be determined. If nearby domestic wells are located, they will be sampled, and owners will be notified of the results. When an alternative supply of safe drinking water is needed, ASPB will help coordinate assisstance through the state Office of Emergency Services.

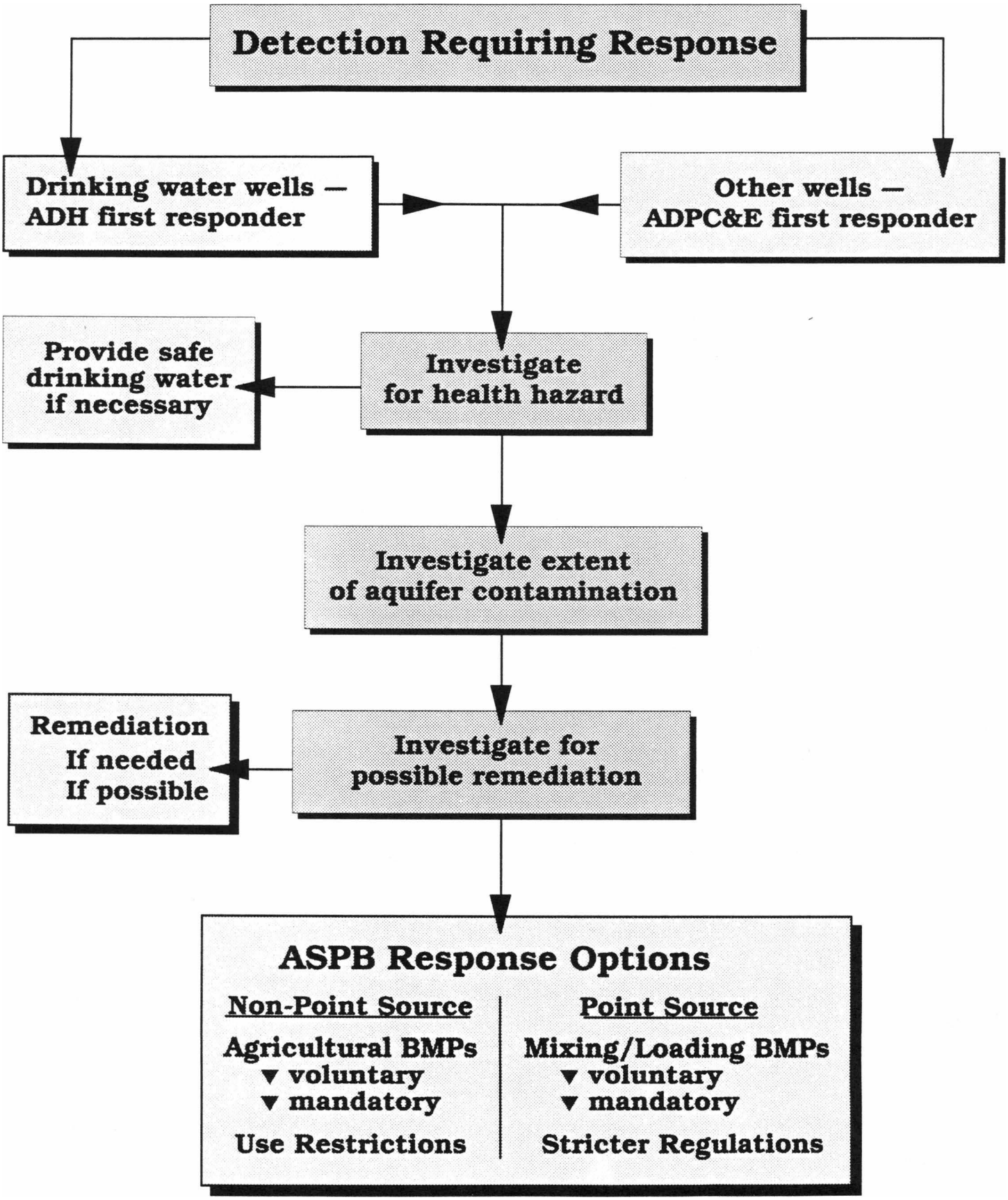
Source of Contamination

In conjunction with the above investigation, every effort will be made to identify the source of contamination, including location and the time of the release. To accomplish this, the investigating agent(s) may choose to monitor nearby wells, interview local residents and officials, consult the State Plant Board concerning applicator records and known applications of the contaminant in question, and use previously developed pollution vulnerability models. The investigation will determine whether the incident is a result of point source or nonpoint source contamination and, in the latter case, whether it was the result of normal use. Further response will be based on the results of this investigation. The following paragraphs address responses appropriate to nonpoint source incidents. Thereafter, point source contamination responses are detailed.

Response to Nonpoint Source Contamination Incidents

The focus of this section is on contamination resulting from the normal use of pesticides over a wide area. In this context, response options include notification and education of the appropriate local population, voluntary or mandatory compliance with BMPs, development and implementation of more effective BMPs, and, when unavoidable, a use restriction or moratorium in the affected area. Point-of-use remediation or the provision of safe water will be considered as necessary. Monitoring will be used in all cases as a diagnostic tool and as a tool to evaluate response effectiveness. Response choice will depend on the concentration of the contaminant and the extent of the contamination.

Figure 5.2. The Response Program



Prior to response implementation, a major concern will be determination of the area where response is necessary. Arkansas' Pesticide Vulnerability Map, being derived from the DRASTIC Index and local pesticide use information placed in the Geographic Information System (GIS), is appropriate to this purpose. The GIS data will be used in conjunction with monitoring and ground-water modeling to delineate the area in which pesticide use must be reduced or restricted in order to stop further contamination.

That the response should be appropriate to the level of contamination is a guiding principle in responding to nonpoint source incidents. Thus without indication of contamination, the prevention component of this plan stresses education of applicators and the voluntary introduction of BMPs to the farming community. When pesticide contamination is detected at levels below the MCL, but at or above the 'response trigger,' and it is known to be the result of normal use, the state will respond by investigating the use of that pesticide in the area. As a result of the investigation, the Plant Board may reduce or prohibit use of that pesticide.

To be effective, a response to nonpoint source contamination requires cooperation from the affected segment of the agricultural community. Whenever possible this involvement will be voluntary, based on self interest. Mandatory cooperation will be required only if voluntary measures are not effective. Thus, throughout any response scenario, the state will emphasize information exchange with pesticide users in the affected area.

Initially, all available information regarding the incident will be brought to the attention of the affected segment of the agricultural community. This will include the extent of the contamination, the concentration of the contaminant and the outlook for the future if the level of contamination were to increase, i.e., what future response actions may have to be taken, including a possible moratorium on the use of that pesticide. The affected segment of the farming community must understand that the contamination is a result of their actions combined with the vulnerability of the aquifer from which they obtain water. As the latter cannot be changed, a change in the farmers' management practices is required to reduce the level of contamination.

The desired change is reduction in use of the offending pesticide. To achieve this, the State Plant Board in cooperation with CES will disseminate information on BMPs relevant to the crops being grown and the pesticide of concern. In addition to specific BMPs, integrated pest management will be stressed as an alternative allowing continued high crop production in the context of reduced pesticide use. Appropriate to this, the State Plant Board may ask CES to prepare a short course on integrated pest management that would give farmers hands-on experience in field scouting and information about biological pest control, including sources from which farmers can purchase controls such as predators and antagonists.

It is hoped that voluntary reduction of pesticide use will be the only response needed. However, Arkansas will institute more stringent measures should voluntary cooperation prove ineffective. When monitoring indicates a deteriorating situation, decisions on what measures to use will be made on a case-by-case basis, depending on the rate of deterioration and level of contamination relative to the MCL. Available responses include required education and mandatory BMPs under which farmers would have to prove the use of the BMP before being able to acquire the pesticide in question. The most stringent response will be a temporary or permanent prohibition of use of the pesticide in the area of contamination.

As a further response to the detection of nonpoint source pollution, the State Plant Board and cooperating agencies will act to discover and implement better BMPs for that specific pesticide. This may include seeking information bearing upon safe use of the particular chemical, from other states, the federal government and producers of the pesticide. It also includes seeking funds to conduct specific research projects. Before a pesticide is prohibited, all less drastic response options will be taken. If a moratorium is declared, the State Plant Board and cooperating agencies will assist in identifying safe and effective alternatives.

Response to Point Source Contamination Incidents

Prevention of further contamination of the ground water as well as remediation of the contamination, if possible, are the major goals of these responses. In addition, responsibility for the incident will be determined whenever possible. Under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), EPA has the authority to require corrective measures be taken by parties responsible for contamination or to recover from them the cost of cleaning up a site resulting from leaks, spills, etc.

Identifying the party(ies) responsible for the contamination incident is the first step in preventing them from repeating the behavior that led to the incident. State Plant Board employees such as field agents and pest control inspectors who have responsibilities in the area will participate in the identification effort. If the incident has come to light as the result of a citizen's complaint, the complaining party can be expected to help identify those at fault. The Plant Board will conduct this investigation under the authorities of Arkansas Acts 389 and 410, which provide for disciplining offenders with suspension or cancellation of certification. At its discretion, the Board may decide that further, or remedial, education is a sufficient response to prevent further contamination. The responsible party(ies) may also be subject to fines under the aforementioned acts.

Further contamination may occur as the

result of continued movement of the chemical through the aquifer. Ground-water modeling will be used to anticipate the extent and direction of such contamination and monitoring will be used to substantiate the extent of pollution. ADPC&E will evaluate the extent of aquifer contamination, assisted by ADH when public or private drinking water supplies are involved. On a case-by-case basis, the extent and level of contamination, the use and value of the aquifer, and the degree of threat to human health will determine whether remediation can or should be undertaken. At this juncture, ADPC&E agents, in consultation with EPA when necessary, will make the decision on remediation. On a case-by-case basis EPA may provide funding assistance for remedial actions if a threat to human health is perceived. Best professional judgement will be used to select appropriate remedial techniques when required. Possible techniques include solute elution, gas phase extraction, abiotic or biotic degradation, and removing contaminated soil. ADPC&E will have oversight for remediation and will coordinate with ADH in cases where drinking-water sources are involved.

If remediation proves infeasible or too costly, and if the water is used for human or animal consumption, point-of-use remediation will have to be considered. For individual households or farms, various filters are available to provide safe water. Filters have been found to be very effective, but they are not maintenance free. Failure to maintain them can lead to other health problems such as the growth of microorganisms on the filter media. At a minimum, this solution would require continued surveillance. As it does not eliminate the source of contamination, this alternative is low on the list of possible responses and will be used only as a temporary response to provide safe drinking water when absolutely necessary.

Monitoring as a response to contamination will continue to be used throughout the duration of the problem. In light of the specific situation, a two-fold monitoring program will be instituted to evaluate the extent of the contamination, and in the context of remediation, evaluate progress toward restoration of ground water to its natural state.

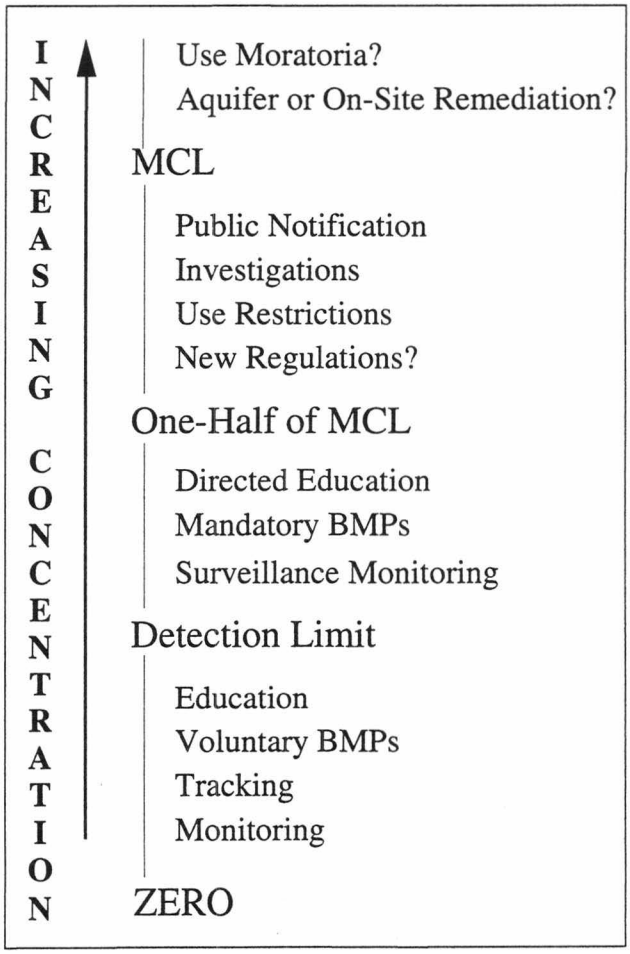


Figure 5.3. Protection increases with concentration.

SECTION 6
MONITORING

The decision to give the states major responsibility in managing pesticide use through state management plans was prompted by the understanding that local conditions, where agricultural chemicals are used, play a large role in determining the potential for ground-water contamination. The states are expected to be in the best position to determine where local conditions warrant concern about contamination and to determine with greater accuracy than the federal government those places that are sensitive to contamination and have high levels of pesticide or other chemical usage. With this ability to differentiate between locales, the states are expected to be better able to devise and implement comprehensive monitoring programs, providing protection against undetected ground-water contamination.

The geography of Arkansas is such that most of its farms are in the Delta, the Coastal Plain and along the river basins. It is here that large acreages of crops such as rice, soybeans and cotton are grown, and the largest amounts of pesticide are used. While northwestern Arkansas has a large poultry industry and other confined animal operations, including cattle and hog production, the main concern there is nitrate pollution of ground water resulting from improper storage and application of manures. Much of the rest of the state is forested and traditional farming is limited. However, silviculture, or tree farming, is common in many of these areas raising concerns about herbicide contamination that might result from herbicide use in conjunction with clear cutting. There is additional herbicide use associated with the maintenance of rights of way, including highway, railroad and utility rights of way, in all parts of the state. Finally, there is urban use of pesticides, mainly for golf courses and lawns. Use under this category is increasing in Arkansas because of suburban development around cities, increased tourism, and the growing number of retirement communities with associated golf courses. Because no area of significant size in the state is free from pesticide use, a comprehensive statewide monitoring program will be time consuming and expensive.

There are already several ground-water monitoring programs in Arkansas that include pesticides in their list of parameters. The Arkansas Department of Health (ADH), under the Safe Drinking Water Act, has tested every underground public water supply at least once for a limited number of pesticides. In contrast to surface water supplies, there has been no requirement for

continued monitoring unless a detection occurred. However, in 1991 the U.S. Environmental Protection Agency (EPA) published maximum contaminant levels (MCLs) for 17 pesticides, including 12 that had not been previously regulated. Table 6.1 lists these pesticides and their MCLs. By 1993, ADH must begin periodic monitoring for all 17 at all public water systems, regardless of water source. On May 19, 1992 EPA announced a final phase V rule for drinking water contaminants including nine additional pesticides. These are listed in Table 6.2 with their MCL's.

This new rule will go into effect late in 1993 and shortly thereafter ADH will begin monitoring periodically for the listed contaminants including the nine pesticides.

This plan does not call for monitoring public water supply wells. Instead, arrangements will be made to access ADH monitoring results for inclusion in the Agricultural Chemicals Database (ACD). See Appendix G for a list of contaminants monitored by ADH.

The United States Geological Survey (USGS) has also done extensive groundwater monitoring in Arkansas. A cooperative project between the U.S. Geological Survey and Arkansas Geological Commission was initiated in 1969 for long-term monitoring of ground-water quality statewide. This program consists of 26 monitoring wells within various aquifers of the state. Samples are collected on a 5-year rotational basis. Analysis includes common constituents, trace metals and a scan for the presence of organic chemicals.

Several recent cooperative programs between USGS and Arkansas Department of Pollution Control and Ecology (ADPC&E) have investigated various sources of groundwater contamination within the state. One current cooperative program with ADPC&E involves an investigation of pesticide contamination of ground water in northeastern Arkansas. This investigation of pesticide contamination of the alluvial aquifer considers the following criteria: thin or absent clay cap, use of shallow wells, and nearby pesticide use. Table 6.3 shows the parameters for this study.

The Ozark Plateaus unit of the National Water Quality Assessment Program (NAWQA) has initiated a retrospective analysis of all ground-water data from much of northern Arkansas. This examination of historical data will be followed by the implementation of a ground-water sampling network in the region. A similar study will be initiated in the near future in the Mississippi Embayment area, which comprises a large portion of eastern Arkansas.

Another ground-water monitoring program is the prototype area study being done by ADPC&E. Eight areas in the state, each representative of either a geologic region, aquifer recharge area, significant community water supply, type of community or economic activity common in the state, are included in an ongoing effort to increase the state's database on ground water. One prototype area is the farming community in Lonoke County where ADPC&E monitored 15 wells

for 33 pesticides in 1988.

The pesticides for this study are shown in Table 6.4. ADPC&E is moving to make monitoring in the prototype areas a permanent, ongoing program under which each site selected will be monitored every three years. In the ADPC&E prototype areas where agricultural chemicals are on the analyte list, additional monitoring under this plan will be unnecessary. Rather, ADPC&E data for these areas will become part of the Agricultural Chemicals Database.

It is the intent of this plan that the monitoring component will not duplicate other efforts already underway in the state.

Monitoring under this plan will be coordinated with other state and federal agencies. The state's most vulnerable areas that are not currently being monitored for pesticides will be the initial focus for monitoring. Data from all monitoring programs, including this one, will be combined to form the Agricultural Chemicals Database. Inter-agency agreements will assure the cooperation needed to develop a comprehensive database.

Under this plan, two types of monitoring will be undertaken. The first, referred to as prevention monitoring, is a tool for assessing the state's ground water for pesticide contamination and determining the effectiveness of prevention measures. When fully instituted, prevention monitoring will address all vulnerable aquifers in the state and will continue as long as needed. The second type, response monitoring, is a tool to be used in the context of specific contamination incidents when the concentration detected warrants a response. For each incident, a monitoring plan will be developed to determine the extent of contamination and the potential for remediation. When remediation is undertaken, monitoring will continue in order to evaluate the results. Data from both monitoring programs will become part of the database.

Prevention Monitoring

As envisioned in the plan, *prevention monitoring* could be called at-risk or problem-identification monitoring and will continue as a permanent part of the prevention program. As noted before, no area of the state is without pesticide use; therefore, at least theoretically, the entire state is at risk. However, there are aquifers identified by the vulnerability map that are particularly at risk, and as noted in Section 4, Ground-Water Contamination Prevention, improper management of pesticide mixing/loading sites has a high probability of impairing ground-water quality. Prevention monitoring will focus on high-risk areas — as determined by aquifer sensitivity and pesticide use patterns — and mixing/loading sites.

As in other states with large farming communities, Arkansas has a long history of pesticide use. Until now, farmers have had little instruction about underlying ground-water conditions and concern for ground-water contamination has been secondary to the need for pest control in determining application rates and timing. It is in areas where a history of heavy pesticide use coin-

cides with aquifer sensitivity that nonpoint source pollution is most likely to occur. The first priority of the monitoring program is to evaluate the effect of previous pesticide use on the ground water in these areas.

Using the ground-water vulnerability map being developed under this plan, areas in the state will be ranked by degree of vulnerability. Monitoring will begin in the most vulnerable locations, and as time and funding permits, proceed down the list. For each area selected, monitoring to evaluate point and nonpoint source contamination will be undertaken.

As repeatedly emphasized in this plan, pesticide mixing/loading sites are potentially hazardous to ground water. Previously cited evidence (Habecker, 1989) indicates that monitoring at mixing/loading sites is imperative. When an area is chosen for monitoring, the mixing/loading sites in that area will be prioritized based on information collected during on-site inspections by Plant Board personnel. The number of high-priority mixing/loading sites to be monitored in the chosen area will be determined on a case-by-case basis. A balanced approach dictates that the number must be adequate to evaluate the situation but not so large as to overly delay monitoring in other sensitive areas.

The number and location of monitoring wells for nonpoint sources in a selected area will also be determined on a case-by-case basis. Attention will be focused on shallow aquifers and recharge areas for deeper aquifers. To this end, the Arkansas State Plant Board (ASPB) is designating funds for ground-water modeling that will provide information for determining the most useful monitoring locations. Because modeling is time consuming, monitoring of mixing/loading sites is expected to begin before significant nonpoint source monitoring in the initial area selected. Thereafter, with modeling complete, the two efforts can proceed simultaneously.

Another concern of prevention monitoring is the need for statewide information on pesticide contamination. Monitoring in vulnerable areas and at mixing/loading sites will not address the concerns of Arkansas residents who live in other areas. While the risk level is greatest in the vulnerable areas, contamination may occur elsewhere. Wells representative of all areas of the state need to be monitored to assess the degree, if any, of pesticide contamination. For this assessment, the six Arkansas ecosystems identified by ADPC&E will be used as the regions to be monitored. For each region, a monitoring plan will be developed that includes mixing/loading sites, domestic wells and irrigation wells. While needed, this statewide assessment is secondary to assessing the most vulnerable areas. It will be undertaken only after the sensitive areas have been assessed or when special funding can be secured.

Results from the initial round of monitoring will determine the nature of the ongoing program. As monitoring continues, first priority will be given to sites in the state where pesticide contamination below the

response trigger is detected. As these detections occur, prevention measures will be instituted and monitoring will continue to evaluate their effect, if any, and to alert the state to any areas where contaminant concentrations are increasing. Response to concentrations above the response trigger is discussed under Response Monitoring.

Second priority will be given to areas classified as sensitive to pesticide contamination that were found to be uncontaminated during earlier monitoring. The frequency of sampling for these wells will be decided in light of the results from earlier monitoring, changes in pesticide use and budgetary considerations.

In summary, three important concerns have been identified as the focus for prevention monitoring: (1) sensitive aquifers, (2) mixing/loading sites and (3) the need for statewide information. This plan recognizes the need for monitoring programs that address all three. Ideally, they would begin immediately. Realistically, funding to fully implement this plan may not be sufficient to make this possible; thus, priorities have been established as described above. To accomplish as much as possible, the Plant Board will seek additional funding to carry out those aspects of prevention monitoring for which sufficient funds are unavailable.

Methods and Procedures — Samples collected in the prevention monitoring program will be analyzed at the Water Quality Laboratory, Arkansas Water Resources Research Center, University of Arkansas, Fayetteville. QA/QC procedures approved by EPA will be in place and followed during sampling and analysis. Analyses for pesticides will be made in accordance with those test methods specified in 40 CFR 141, Subpart C, or their equivalent, using gas chromatography or high-performance liquid chromatography. Detections will be confirmed using gas chromatography/mass spectrometry.

As the high cost of analysis will affect the number of samples that can be analyzed, the Plant Board and associated agencies will investigate and consider implementation of newly emerging analysis technologies when significant cost reductions may be forth coming and when this can be done without the loss of precision and accuracy. Examples of such technologies include immunoassay screening tests, which are used to reduce the number of samples for which a full analysis is necessary, and other less expensive analysis procedures being tested at the University of Arkansas' department of agronomy using Empore filters. All new technologies will be fully evaluated before being placed into routine use.

Ground-Water Monitoring Parameters — It is expected that pesticides used in a particular area can be determined well enough to allow analysis to be limited to relatively few parameters. Given the number of pesticides in use, it is impossible to analyze every sample for every possible analyte. Best professional judgment, ground-water modeling, screening and pes-

ticide use data will be considered when determining a list of pesticide analytes for a sample.

Monitoring Wells — Insofar as possible, wells used in the monitoring program will meet the standards specified by EPA in its guidance document for SMPs. When a specific area has been designated for monitoring, available wells will be inventoried. It is expected that enough suitable wells will be found to avoid constructing new wells solely for monitoring. If it becomes necessary to include questionable wells in the monitoring program, they will be documented. This documentation will include references to questionable aspects of the well and justification for using it as a sampling point.

If normal prevention monitoring results in a detection below the response trigger, the contaminated well will be scheduled for more intensive monitoring — at least once a year. This will continue until the concentration exceeds the response trigger or until no pesticide is detected during two consecutive monitoring periods.

Response Monitoring

As defined in Section 5, Response to Ground-Water Contamination, the response trigger — which is a pesticide detection at a concentration equal to the action level or 50 percent of the MCL, whichever is appropriate — necessitates response monitoring. Responsibilities are distributed in line with the major functions normally performed by the agencies. ADH is responsible for all public water supplies and is charged with the protection of human health throughout the state. For these reasons, ADH will be the first to respond whenever a drinking water well, public or private, is found to be contaminated by pesticides. For all other wells, ADPC&E will be the first respondent.

Except for small, point-source incidents at isolated wells, it is expected that both agencies will eventually be involved in response monitoring. In as much as ADPC&E has overall responsibility for protecting ground water, it will be in charge of determining whether aquifer contamination has occurred even if the original detection was at a drinking water well. Also, ADPC&E has oversight for remediation when appropriate, including monitoring to evaluate the effect of the response. Similarly, contamination at an industrial or irrigation well may be near enough to one or more domestic wells to warrant ADH investigation into the possible threat to human health. This would entail monitoring.

Best professional judgment will be used to design a response monitoring plan for each contamination incident, i.e. any confirmed and verified detection at or above the response trigger. At a minimum, the extent of the contamination must be determined by monitoring and any nearby drinking water wells must be sampled. Monitoring will continue throughout the duration of the incident to detect any change in the concentraion of the contaminant, including changes resulting from remediation.

Table 6.2 Analytes for PMP Monitoring
like 6.3

ARKANSAS STATE PLANT BOARD MONITORING - SUMMER 1997

ANALYTE LIST

(3 columns - like 6.3)

CHEMICAL NAME	TRADE NAME
2,4,5-T	Brush-rhap, Esteron, Weedar
2,4,5-TP	Silvex, Kuron
2,4-D	2 plus 2, Aqua Kleen, Banvel 720, Crossbow Curtail, Dacamine, Envert, Landmaster, Tiller, Tordon RTU, Weedar 64, Weedar 64-A, Weedar Emulsamine, Weedmaster, Weedone 170, Weedone 638, Weedone 2,4-DP, Weedone CB, Weedone LV4, Weedone LV6
2,4-DB	Butyrac, Rescue
3,5-Dichlorobenzoic acid	
5-Hydroxydicamba	
Aciflurofen	Blazer, Bullet, Galaxy, Storm, Tackle
Alachlor	Arena, Bronco, Cannon, Confidence Freedom, Judge, Lariat, Lasso, Saddle, Stall
Aldicarb	Temik
Ametryn	Evik
Atraton	
Atrazine	Aatrex, Attrabute, Atratol, Bicep, Bullet, Colonel, Conquest, Extrazine, Laddok, Lariat, Marksman, Pramitol, Prozine , Rhino, Sutazine
Barban	
Bentazon	Basagran, Galaxy, Laddok, Storm
Bromacil	Hyvar, Krovar, Ureabor, Urox
Butachlor	Machete
Butylate	Sutan, Sutazine
Carbofuran	Furadan, Throttle, Rampart
Carbofuran phenol	
Carboxin	Vitavax-200, Vitavax 34
Chlorpropham	Furloe, Sprout Nip
Cyanazine	Bladex, Conquest, Extrazine
Dicamba	Banvel, Banvel 720, Fallow Master Marksman, Trooper, Weedmaster
Dichlorprop	Weedone 170, Weedone CB

Dichlorvos	Aminatrix, Canogard, Dedevap, Doom, Lindan, Marvex, Nuvan, Phosvit, Riddex, Task, Vapona ,Vaponite
Dinoseb	Dynamite, Premerge
Diphenamid	Enide
Diuron	Karmex, Krovar, Surefire
EPTC	Eptam, Eradicane, Genep EPTC
Ethoprop	Prophos
Fenamiphos	Nemacur
Fenarimol	Rubigan
Fluometuron	Cotoran
Hexazinone	Velpar
Linuron	Gemini, Lorox, Lorox Plus, Prelude
S,S,S-Tributylphosphorotrithioate	Merphos, Folex
Metolachlor	Bicep, Dual, Prelude, Turbo
Metribuzin	Canopy, Lexone, Preview, Salute, Sencor, Turbo
Mevinphos	Phosdrin
MGK 264	
Molinate	Arrosolo, Ordram
Napropamide	Devrinol
Neburon	Neburea, Nebunex, Noruben
Norflurazon	Evital, Solicam, Zorial Rapid 80
Pebulate	Tillam
Pentachlorophenol	PCP
Picloram	Tordon, Tordon RTU
Prometon	Conquer, Pramitol
Prometryn	Capture
Propanil	Arrosolo, Stam
Propazine	Milogard
Propham	Chem Hoe
Simazine	Amizine, Aquazine, Pramitol, Princep,
Simetryn	
Swep	
Tebuthiuron	Spike
Terbutryn	Clarosan, Igran, Prebane, Terbutrex, Plantonit
Tetrachlorvinphos	Appex, Debantic, Garade, Gardona, Rabon, Rabond
Triademefon	Bayleton
Vernolate	Reward, Surpass, Vernam

Table 6.1. Phase II National Primary Drinking Water Standards for Pesticides

Pesticide	Final MCL (mg/L)	Repproposed MCL (mg/L)
Alachlor	00.002	—
Aldicarb	—	00.003
Aldicarb Sulfoxide	—	00.003
Aldicarb Sulfone	—	00.003
Atrazine	00.003	—
Carbofuran	00.04	—
Chlordane	00.002	—
Dibromochloropropane (DBCP)	00.0002	—
2,4-D	00.007	—
Ethylene Dibromide (EDB)	00.00005	—
Heptachlor	00.0004	—
Heptachlor Epoxide	00.0002	—
Lindane	00.0002	—
Methoxychlor	00.04	—
Pentachlorophenol	—	00.0001
Toxaphene	00.0003	—
2,4,5-TP (Silvex)	00.05	—

Table 6.2 Phase V National Primary Drinking Water Standards for Pesticides

Pesticide	MCL (mg/L)	Repproposed MCL (mg/L)
Dalapon	0.2	—
Dinoseb	0.007	—
Diquat	0.02	—
Endothall	0.1	—
Endrin	0.002	—
Glyphosate	0.7	—
Oxamyl (Vydate)	0.2	—
Picloram	0.5	—
Simazine	0.004	—

Table 6.3. Pesticides for USGS Eastern Arkansas Study

Disyston	Methyl Parathion	Alachlor
Phorate	2,4-D	Cyanazine
Propazine	2,4,5-T	Ametryne
Aldrin	Mirex	Metribuzin
Lindane	Silvex	Metolachlor
DDD	Trithion	Methomyl
DDE	Methyl Trithion	Oxamyl
DDT	2,4-DP	Carbaryl
Dieldrin	DEF Trifluralin	Aldicarb
Endosulfan	Perthane	Aldicarb Sulfone
Endrin	Simetryne	Aldicarb Sulfoxide
Ethion	Simazine	3-Hydroxy-Carbofuran
Heptachlor	Prometone	1-Naphthol
Heptachlor Epoxide	Prometryne	Propham
Methoxychlor	PCN's	Sevin
Malathion	Chlordane	Toxaphene
Parathion	PCB's	
Diazinon	Atrazine	

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Table 6.4. Analyte List for ADPC&E Monitoring Program, Lonoke County, Arkansas, 1988

P,P' DDT	Heptachlor	Propachlor
P,P' DDD	Heptachlor epoxide	Alachlor
DDD	Chlorpyrifos	Atrazine
P,P' DDE	Diazinon	Cyanazine
Aldrin	Malathion	Metribuzin
Chlordane	Methyl parathionAroclor	Metolachlor
Endosulfan alpha	1232 PCB	Alpha benzine hexachloride
Endosulfan beta	Aroclor 1254 PCB	Beta benzine hexachloride
Endosulfan sulfate	2,4-D	Delta benzine hexachloride
Endrin	2,4,5-T	Fonofos (dyfonate)
Lindane	Silvex	Pendimethalin

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SECTION 7
ENFORCEMENT

The state agencies with significant enforcement powers regarding the SMP are the Arkansas State Plant Board, the Arkansas Department of Pollution Control and Ecology and the Arkansas Department of Health. The Arkansas Water Well Construction Commission has limited enforcement powers.

The federal government, through the U. S. Environmental Protection Agency, has enforcement options available to it as designated in the Resource Conservation and Recovery Act; the Federal Insecticide, Fungicide and Rodenticide Act; the Toxic Substances Control Act; the Federal Water Pollution Control Act; the Safe Drinking Water Act; the Clean Water Act; and the Comprehensive Environmental Response, Compensation, and Liability Act of 1980. The federal government's enforcement role is similar to its other roles in protecting the environment. It has recognized that while technical, financial and philosophical leadership is required of the federal government, the states should have the opportunity to develop and implement programs of their own, in lieu of a federal program, providing state initiatives are at least as restrictive as those developed by the federal government. Accordingly, enforcing these laws is commonly delegated to appropriate state agencies. For instance, the Arkansas State Plant Board derives its enforcement powers from the Federal Insecticide, Fungicide and Rodenticide Act, as well as from state legislation. See Appendix B for text of Arkansas environmental law cited.

ARKANSAS STATE PLANT BOARD

As the state agency primarily responsible for pesticide use, and therefore misuse, the Plant Board may institute criminal proceedings against any person it finds has violated the provisions of FIFRA, the Arkansas Pesticide Control Act and Regulations (Act 410 of 1975), the Pesticide Use and Application Act and Regulations (Act 389 of 1975) and Regulations on 2,4-D, 2,4-DB, MCPA and other restricted Use Herbicides.

Arkansas Pesticide Control Act — Section 12 of Act 410 details the Plant Board's enforcement options. These options range from serving written notice to anyone whose actions or the results thereof are found to have violated the act to instituting criminal proceedings within the county where the violation has occurred or through the Attorney General.

The Plant Board may enter onto any

premises or lands at reasonable times to inspect pesticide storage or disposal areas, or sample pesticides being applied or to be applied. If access is denied, the Plant Board may seek a search warrant from a court of competent jurisdiction. It may also seek a temporary or permanent injunction restraining any person from violating any provision of this Act or the rules and regulations made under it.

Section 13 enables the Plant Board to issue a Stop Sale, Use or Removal Order when it has cause to believe that a pesticide or device used in association with pesticides is being improperly used and, therefore, in violation of the Act or rules and regulations promulgated under the Act. This order prohibits the pesticide from being sold, distributed, used or removed until the provisions of the Act have been complied with and the pesticide or device has been released in writing under conditions specified by the Plant Board or the violation has otherwise been disposed of as provided in the Act by a court of competent jurisdiction.

Section 14 provides a mechanism for adjudication of an alleged violation of the Act after a Stop Sale, Use or Removal Order has been issued. Subsection 2 of Section 14 provides a mechanism for the disposal of pesticides or pesticide use devices once they have been condemned. Disposal may be accomplished through the destruction, sale or any other means so ordered by the court.

The Plant Board may subpoena witnesses or documents when it deems it necessary to carry out the provisions of this Act, as stated in Section 17. Furthermore, if a violation of the Act is determined to have occurred the offender shall be found guilty of a misdemeanor and fines may be assessed as stipulated in Section 18.

Pesticide Use and Application Act — The Pesticide Use and Application Act (Act 389 of 1975) provides similar enforcement options to the Plant Board as Act 410 of 1975.

Act 389 of 1975, Section 21, Enforcement, states:

(a) For the purpose of carrying out the provisions of this Act, the Plant Board may enter upon any public or private premises at reasonable times, in order to;

(1) have access for the purpose of inspecting any equipment subject to this Act;

(2) inspect or sample lands actually or reported to be exposed to pesticides, and lands from which such pesticides may have originated;

(3) inspect storage or disposal areas;

(4) inspect or investigate complaints of injury to humans or land;

(5) sample pesticides being applied or to be applied;

(6) observe the use and application of pesticides.

As in Act 410, Act 389 allows the Plant Board recourse through the courts to carry out the provisions of the Act. The Plant Board may apply to a court of competent jurisdiction for a search warrant if it is denied access to any land where access is sought

for the purpose of carrying out the Act.

Provisions are made in Section 19 for fines and criminal proceedings when any person is found to have violated the provisions of this Act. Additionally, the Plant Board may issue subpoenas under Section 20.

Arkansas Department of Pollution Control and Ecology

While the Plant Board is primarily responsible for agricultural chemical control, the Department of Pollution Control and Ecology is primarily responsible for water quality in Arkansas. The Arkansas Water and Air Pollution Control Act (Act 472 of 1949, as amended) stipulates that violations of provisions of the Act may be punishable as a misdemeanor or felony depending upon conditions set forth in the Act. Additionally, the department may institute a civil action in any court of competent jurisdiction when it is deemed necessary to restrain violations of the Act or to compel compliance with it. The department may seek to recover from violators expenses incurred by the state when such expenses occur resulting from actions taken to carry out the provisions of Act 472. This includes payment to the Arkansas Game and Fish Commission in compensation for the destruction of wildlife, fish and aquatic life. Penalties, including imprisonment and fines or both, are stipulated in Section 8-4-103 of the Arkansas Water and Pollution Control Act.

Arkansas Department of Health

The Arkansas Department of Health is concerned with water quality, including ground water, where human health may be negatively affected. Pesticide pollution in the state's ground water is potentially harmful to residents of the state. Therefore, laws and rules and regulations adopted under those laws, while perhaps not addressing pesticides or other agricultural chemicals specifically, do carry an implied responsibility to provide drinking water that is safe from those chemicals and that meets federal requirements as stipulated under the federal Safe Drinking Water Act.

The Arkansas Department of Health has been granted the authority to assess administrative penalties for violations of any regulations adopted by the Board of Health. An opportunity for hearing is required prior to assessment of the administrative penalty. Regulations have yet to be developed specifying the exact procedures to be used in determining the assessment and the amount of the proposed penalties.

Section 5 of Act 96 of 1913, as amended, grants the State Board of Heath general supervision and control of all matters pertaining to the health of the residents of Arkansas.

Section 6 of that Act states: Power is hereby conferred on the Arkansas State Board of Health to make all necessary and reasonable rules and regulations of a general nature for the protection of the public health. The section then discusses the

board's authority concerning disease control, including quarantine powers.

ADH in its Rules and Regulations Pertaining to General Sanitation stipulates in Section X (10) that: Every firm, person or corporation violating any of the provisions of this chapter, or any of the orders, rules or regulations made and promulgated in pursuance hereof, shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be punished by a fine of not less than one hundred dollars ($100) nor more than five hundred dollars ($500), or by imprisonment not exceeding one (1) month or both, and each day of violation shall constitute a separate offense. (ACA 20-7-101).

Arkansas Water Well Construction Commission

The Arkansas Water Well Construction Commission promulgates rules and regulations for water well construction in Arkansas. The authority to do so is derived from Arkansas Act 641 of 1969 known as the Arkansas Water Well Construction Act. It recognizes the need to regulate water well construction in Arkansas to protect potable water supplies because they are essential to the safety, welfare and general health of the people of Arkansas. As it pertains to agricultural chemical use, AWWCC requires back siphoning devices to be used. The Act provides the AWWCC the necessary provisions to carry it out through inspections, rig permits, certificates of registration, licensing, exemptions in certain cases, enforcement and penalty assessment.

Should the AWWCC have reasonable grounds to believe that provisions of Act 641 or any rules or regulations promulgated under it have been violated, a written notice is issued to the person or persons alleged to have violated the Act. The notice stipulates the provision, or regulation alleged to be in violation and states the facts alleged to constitute the violation. The notice is served in a manner required by law for the service of process upon a person in civil action. Provision is made for a response to the alleged violation. The AWWCC may require a person or persons served with such a notice to appear at a hearing after which an appropriate remedial action order may be issued. Section 18 of Act 641 stipulates the penalties for noncompliance with the Act or regulations and rules promulgated under it.

SECTION 8
AGENCY ROLES AND RESPONSIBILITIES

This section identifies and briefly describes state and federal agencies' roles and responsibilities in the development and implementation of the Agricultural Chemical Ground-Water Management Plan (SMP). The coordination mechanisms to be used between participating agencies, state and local entities, and appropriate federal agencies are included. In addition, specific agency roles and technical and administrative tasks to be performed under this plan are described briefly.

The state and federal agencies that have an interest in, roles to perform, or responsibilities to fulfill under the SMP are:

Arkansas State Plant Board,

Arkansas Department of Pollution Control and Ecology,

Arkansas Soil and Water Conservation Commission,

Arkansas Cooperative Extension Service,

Arkansas Department of Health,

United States Department of Agriculture, Soil Conservation Service,

Arkansas Water Well Construction Commission,

Arkansas District, United States Geological Survey, Water Resources Division,

Arkansas Highway and Transportation Department,

Arkansas Water Resources Research Center,

Arkansas Forestry Commission,

Arkansas Game and Fish Commission,

Arkansas Geological Commission,

and the U.S. Environmental Protection Agency.

COORDINATION MECHANISM

The Agricultural Chemical Ground-Water Management Plan Committee is an ad hoc committee that was created to coordinate state agency actions to protect Arkansas' ground water from pollution caused by agricultural chemicals, notably pesticides. The Plant Board was designated as the lead agency for the committee and is responsible for administering its activities.

The Plant Board has chosen the Arkansas Water Resources Research Center as a consultant for the development of the SMP. AWRRC will provide information concerning plan development and implementation to the Arkansas State Plant Board. ASPB will present this information to all participating agencies and will provide information and coordination for all agencies conducting vulnerability assessments, ground-water

contamination prevention measure implementation, enforcement, monitoring and response to ground-water contamination.

The Arkansas State Plant Board is responsible for maintaining the channels of communication between AWRRC, the Environmental Protection Agency and cooperating agencies and entities concerning activities associated with the SMP.

Arkansas State Plant Board

The Arkansas State Plant Board is the lead agency concerning pesticide use and application. ASPB's duties are to make rules and regulations, under the laws — particularly the Federal Insecticide Fungicide and Rodenticide Act (FIFRA) — that have been enacted by the legislature and to take action against persons violating these regulations.

All laws and regulations administered by ASPB are for the protection of the consumer, the environment and the agricultural industry of the state. They include regulatory control on consumer goods, services and products, and services used in agricultural production, as well as programs designed to control and prevent the dissemination of destructive plant insects and diseases and household pests and structural pests. Public hearings are held by ASPB on controversial matters or when major proposals are made to change existing regulations.

The Board collects license and inspection fees from all sectors of the agricultural industry under its jurisdiction and is self supporting except for survey and quarantine programs, the apiary work, portions of the pesticide program, and the public grain warehouse program. These programs are funded through general revenues.

The State Plant Board is the appropriate organization in Arkansas to deal with pesticides because of the broad interest-base of its 16 Board members. Pesticide manufacturers and dealers, aerial applicators and pest control operators are represented by members on the Board. Also represented are those who use large quantities of pesticides, such as cotton growers, rice farmers, horticulturists, nurserymen and foresters. Consumers are represented by two Board members appointed especially for this purpose by the governor. Other industries with indirect interests in pesticides are represented, such as feed, fertilizer and food oil manufacturers. Special expertise is provided by two ex officio representatives of the University of Arkansas. This broad range of interests provides for maximum objectivity in promulgating and enforcing pesticide regulations and coordinating statewide efforts in the certification of pesticide applicators.

The State Plant Board has regulatory responsibility for all pesticides used in Arkansas and for applicator certification. Statutory authority for executing this responsibility is provided by Arkansas legislative acts and regulations and by FIFRA. These laws and regulations provide the mechanism and framework for the pesticide-related functions of the Plant Board,

which in this instance shall be: identifying, examining, certifying, licensing, inspecting, surveillance, reviewing performance, revoking certification and penalizing those who misuse restricted-use pesticides.

Through its ongoing registration, licensing and permit programs and by expanding programs such as dealer licensing with its required records and reports, the Plant Board is able to identify users of restricted-use pesticides. All who use such pesticides for hire are examined in writing by Plant Board personnel to ensure competent pesticide use. Private applicators may be examined as specified by the Plant Board or the Arkansas Cooperative Extension Service. The Plant Board will, however, issue all certificates and licenses. In all cases, a person who qualifies for a plant Board license to use restricted-use pesticides will qualify under the amended FIFRA as a certified applicator, and vise versa. Plant Board personnel make after-the-fact inspections of the work of all certified applicators and survey work in progress. Cases of misuse or questionable use of pesticides are reviewed by the Board or one of its hearing committees. When due cause is found, a revocation proceeding will be initiated and appropriate penalties sought.

The Arkansas Department of Pollution Control and Ecology

The Arkansas Department of Pollution Control and Ecology is the state agency primarily responsible for environmental regulation in Arkansas. The Water Division administers the state's water programs under authority of the Arkansas Water and Air Pollution Control Act. The Water Division is organized into four branches: the NPDES Branch, the State Permits Branch, the Planning Branch, and the Inspection Branch.

The NPDES Branch is responsible for issuing and enforcing water discharge permits and the regulation of pretreatment requirements for publicly owned treatment works in Arkansas. The permit program administered by the NPDES Branch is an authorized program under the Environmental Protection Agency's National Pollutant Discharge Elimination System (NPDES) regulations. Permits issued under this program customarily satisfy state and federal requirements for water discharge permits.

The State Permits Branch is responsible for issuing and enforcing state water permits not covered by the NPDES program, such as so-called "no discharge" permits for lagoons and land application of waste water. The State Permits Branch is responsible for coordination and the issuance of water quality certifications in connection with Section 404 permit applications. The State Permits Branch also administers the salt water disposal program under Regulation No. 1 and the underground injection control program.

The Planning Branch is responsible for state ground-water planning, budgeting and grants management. The Planning Branch is also responsible for water-quality planning and the development of water-quality standards. It coordinates nonpoint source

water pollution and water toxics activities of the department. The Planning Branch also performs effluent computer modeling for the Water Division.

The Inspection Branch performs all inspections related to water permits and water pollution enforcement. It routinely performs inspections in response to complaints, as well as in connection with ongoing compliance monitoring. Inspectors are stationed at numerous sites across the state, and each inspector has primary responsibility for the local district in which he or she is stationed.

Arkansas Soil and Water Conservation Commission

The Arkansas Soil and Water Conservation Commission is the principal water management agency of the state. The commission was created by Act 14 of 1963, which consolidated the activities of several agencies having responsibilities in the field of conservation and in the development and management of the state's land and water resources. The commission is the lead agency for implementation of nonpoint source pollution management programs in the state. These programs include those funded by EPA through Section 319(h) of the U.S. Clean Water Act.

The commission's principal activities and responsibilities include: cooperating with and assisting Arkansas' 76 conservation districts in the development and implementation of the State Soil Conservation Plan, which include BMPs to prevent ground-water contamination; adjudication, negotiation and administration of interstate compacts pertaining to the apportionment of water; administration of the state dam safety program and flood plain management program; and administration of state financial administration programs for water, waste disposal and solid waste system development.

The commission also has undertaken the Farm—A—Syst program, which is a trial cooperative effort with CES to help property managers to identify farmstead wellheads that may be contaminated by farm and domestic activities and to provide technical assistance toward correcting problems where the potential for ground-water contamination exists because of poorly constructed wells or unsuitable management practices.

University of Arkansas Cooperative Extension Service

The Smith-Lever Act of 1914 created the Cooperative Extension System, whose role is informational and educational. The basic function of the Cooperative Extension is ..."to aid in diffusing among the people of the United States useful and practical information on subjects relating to agriculture and home economics, and to encourage the application of the same..." The Cooperative Extension Service results from a partnership between federal (USDA), state land-grant universities) and county governments.

Accordingly, the University of Arkansas Cooperative Extension Service (CES) is responsible for educational programs for farmers, ranchers, home owners, producer groups and other persons and groups in Arkansas in the fields of agriculture, home economics, community resource development and youth development.

The amended FIFRA requires that all who apply or supervise the application of restricted-use pesticides must be certified. While the Plant Board issues the certification and may revoke pesticide applicator licences, CES is the designated agency for training pesticide applicators for certification. The objective of the program is to provide training, leading to certification, for any pesticide applicator who will be applying or supervising the application of restricted-use pesticides.

Arkansas Department of Health

The Division of Environmental Health Protection, Arkansas Department of Health, is the primary inspection authority under the SDWA for certain non-community water systems, of which more than 500 are monitored. The Division also monitors semi-public Water Supplies under the authority of state Act 96 of 1913 (ACA 20-7-109), and it provides technical assistance, training, and public education to owner/operators of individual water supply systems.

In the non-community public water system program, the Division of Environmental Health Protection regularly monitors establishments that are permitted by the Division and that use their water system as part of the services they provide to the public. Those monitoring duties include bacteriological sampling and sanitary surveys to examine the water source, treatment facilities, distribution, pumping and storage facilities, sanitary defects, and obvious sources of potential contamination.

Semi-public water supplies are addressed by the sanitarian on a complaint basis or when such a water system is proposed in conjunction with the development of subdivisions, mobile home and recreational vehicle parks, etc., in unsewered areas. The Division is presently engaged in developing the semi-public water supplies into a comprehensive program in which to equitably address all such systems regarding water quality protection, disinfection, etc.

The general sanitation rules and regulations enables the sanitarian to legally respond to the pollution of ground and surface water and requires compliance with all state and federal laws and regulations.

The Division of Environmental Health Protection provides technical assistance, training and education to private water supply users in helping them maintain a safe drinking water supply. Bacteriological quality of private water supplies is not regulated by the state and the public is dependent upon sanitarians for their help in the taking of water samples or explanation of proper water sampling techniques, the explanation of sample results, instruction on disinfection of wells or when the use of a continuous chlo-

rinator is indicated for the water supply. Sanitarians can supply the private water supply user reference material on sampling, disinfection and well construction.

The Division of Environmental Health Protection investigates water quality complaints at some, non-community systems (food service establishments), all private wells, and all semi-public water systems. Complaints about ground or surface water may include bacteriological, inorganic, organic, radiochemical, turbidity, color or odor problems. Because the Division has field personnel in every county in the state, and that these field sanitarians because of the widely varied responsibilities are well known within their respective counties, the Division of Environmental Health Protection is invariably the initial contact made on all water complaints.

The Division of Environmental Health Protection takes enforcement action, as dictated by the violation, under SDWA, General Sanitation Rules and Regulations, and Semi-Public Water Supplies Rules and Regulations.

The Arkansas Department of Health, Division of Engineering is responsible for the Public Water System Supervision Program, under SDWA, in Arkansas. This program consists of multiple elements including compliance monitoring, enforcement, technical assistance, training and public education. The division is responsible for administering the Federal Safe Drinking Water Act in Arkansas and enforcing the state's Rules and Regulations Pertaining to Public Water Supply Systems.

The program staff monitors the water quality in more than 700 community public water supply systems (PWS) and more than 1,200 non-community public water systems. This program includes the following activities:

1) Conducting inspections and sanitary surveys of community PWS's. The surveys include examination of the source, treatment facilities and distribution, pumping and storage facilities for compliance with regulations and for the presence of sanitary defects.

2) Collecting and analyzing chemical, microbiological and radiological samples to determine compliance with the SWDA primary drinking water standards.

3) Reviewing analytical reports from each of the above analyses to verify compliance with the SDWA primary drinking water standards. Compliance with secondary, non-health standards is also checked and technical assistance is provided if necessary.

4) Investigating water quality complaints. The division's staff of engineers and environmental specialists are frequently contacted by the public to answer questions or to investigate water quality problems. Problems related to the public water supply system are handled by the Division of Engineering, while plumbing related problems are referred to the Department's Division of Plumbing and Natural Gas.

5) Providing technical assistance to public water systems and consulting engineers. The division's staff have a tremendous amount of experience in solving treat-

ment plant problems, pumping problems, pressure problems, and public education problems that a water system may encounter from time to time.

6) Examining and certifying water works operators. The division administers water works operator examinations, provides training to new and current operators, and issues and renews water works operator licenses.

7) Taking enforcement action as necessary against persistent violators of SDWA primary drinking water standards.

USDA Soil Conservation Service

The Soil Conservation Service (SCS) offers assistance to land users, through local soil and water conservation districts. The SCS develops resource conservation plans that contain best management practices (BMPs) for voluntary implementation. These management practices offer a guide to land users that can support EPA's program under Section 319 of the Clean Water Act to protect water quality from agricultural nonpoint sources of pollution.

Federal cost-share programs are also available for land users through the SCS and local soil and water conservation districts for implementing BMPs as well as nonstructural measures that provide nonpoint source pollution controls. These programs are Public Law 566, watershed protection programs, and resource conservation and development programs.

The SCS also assists the SCD in public participation, conservation education and training to land users in awareness, implementation and participation in a sound nonpoint source management program.

The SCS generates no ground-water data but assists the Arkansas Cooperative Extension Service and other agencies in sample collection. The SCS maintains a delivery system to farmers through a soil and water conservation district office in each county of the state. Each office has a field office technical guide, pesticide data base, water quality manuals and water resource maps to aid in the delivery of technical assistance in the form of pesticide recommendations, ground-water pollution sources, avenues of ground-water contamination and conservation plans. Recommended conservation practices and pesticides are evaluated in relation to the water resources to protect , the nature of the pesticide and other pertinent factors.

Arkansas Water Well Construction Commission

The Arkansas Water Well Construction Commission (AWWCC) is responsible for the administration of the Water Well Construction Act; adopting, amending or repealing regulations governing the installation, construction, repair and abandonment of water wells and pumping equipment; licensing water well contractors; testing and registering water well drillers and pump installers; inspecting water wells; filing and maintaining water well construction reports; and enforcement of the Act and Regulations

promulgated under it. The Commission is also required to arbitrate complaints filed by citizens as they relate to well construction.

Regulations providing minimum requirements for well construction were adopted in 1970 and have been revised numerous times. The definition of "water well" was expanded in 1987, to include geothermal heat pump wells or wells constructed for air conditioning and heating. Regulations were adopted in 1988 that required persons engaged in monitoring well construction to comply with the EPA's RCRA, Ground-Water Monitoring Technical Enforcement Guidance Document.

The Commission licenses approximately 200 businesses engaged in well construction and has on file approximately 70,000 water well construction reports. The Commission maintains a full-time staff of less than four persons and sometimes relies on extra-help investigators in some areas of the state.

The Commission provides technical assistance for county sanitarians, water well contractors, consulting engineers, plumbing inspectors, extension agents, environmental engineers, prosecutors and the general public.

The Commission coordinates with and obtains additional expertise and information from the Arkansas Soil and Water Conservation Commission, the Arkansas Geological Commission, the Attorney General's Office, The USGS, The Department of Pollution Control and Ecology, the Department of Health, The University of Arkansas, the National Water Well Association, The Arkansas Water Well Contractors Association, the Arkansas Association of Conservation Districts, and numerous other state, federal and private associations.

The staff makes random inspections of abandoned wells and newly constructed water wells, and it investigates complaints filed by the public. During an inspection or investigation, the staff ensures that the contractor has met all licensing and reporting requirements and that the well complies with appropriate regulations. If an "intentional" violation is discovered, an administrative hearing is conducted. Persons found in violation may be assessed a civil penalty by the Commission of up to $500 a day and ordered to remedy the problem. In lieu of an administrative hearing, persons suspected of being in violation may be prosecuted and, if found in violation, may be fined up to $500 per offense per day and may receive a jail sentence of up to six months. The commission is also authorized to seek an injunction to prevent any person from violating any of the provisions provided by the Water Well Construction Act.

The Commission suspects that many ground-water, point-source pollution problems relate to poor well construction, well abandonment and pump installation. The Commission has recommended that exemptions for domestic pump installation be removed. Legislative action to remove the exemption has been considered during the last two legislative sessions.

Department of the Interior, U.S. Geological Survey, Water Resources Division, Arkansas District

The U.S. Geological Survey was established by Congress March 3, 1879, to provide a permanent federal agency to conduct the systematic scientific "classification of the public lands, and examination of the geological structure, mineral resources, and products of national domain." The mission of the Water Resources Division is to provide the hydrological information and understanding needed for the optimum utilization and management of the nation's water resources for the overall benefit of the people of the United States.

This is accomplished by the Arkansas District, in large part, through cooperation with other federal, state and local agencies by systematically collecting data needed for the continuing determination and evaluation of the quantity, quality, and use of the water resources of Arkansas; by conducting analytical and interpretive water resources investigations describing the occurrence, availability, and the physical, chemical, and biological characteristics of surface and ground water; by disseminating water data and results of investigations and research through reports, maps, computerized information services, and other forms of public releases; and by coordinating the activities of federal agencies in the acquisition of water data for streams, lakes, reservoirs and ground water.

Jointly funded and cooperative water-resources investigations exist between the Arkansas District and state agencies, including the Arkansas Department of Health, Arkansas Department of Pollution Control and Ecology, the Arkansas Game and Fish Commission, Arkansas Geological Commission, Arkansas Soil and Water Conservation Commission, Arkansas State Highway and Transportation Commission and the University of Arkansas and the University of Arkansas at Little Rock.

All ground-water data collected by the USGS is stored and available to the public in various computer-accessible data bases. Well location, construction, and other pertinent well and aquifer information is stored in the USGS Ground Water Site Inventory (GWSI) data base. Water quality data, stored locally in the National Water Information System data base (NWIS II), are routinely transferred to the National Water Storage and Retrieval System (WATSTORE). These data are then routinely transferred to EPA's STORET data storage and retrieval system.

Arkansas State Highway and Transportation Department

Rights of way under the jurisdiction of the AHTD are kept free of unwanted vegetation by the application of non-restricted herbicides by licensed applicators. AHTD carries on a self-imposed monitoring program of its herbicide applicators to ensure compliance with Arkansas Acts 410 of 1975 and

389 of 1975. Soil samples are taken and analyzed to ensure that there is no build up of residual herbicides in the soil that could negatively impact ground-water quality. Daily reports are maintained for all herbicide applications on AHTD rights of way.

Arkansas Water Resources Research Center

The Arkansas Water Resources Research Center or AWRRC, located at the University of Arkansas in Fayetteville, conducts research, training and information dissemination as mandated under the Water Resources Research Act of 1984. AWRRC operates under the guidance and supervision of the U.S. Department of the Interior, Geological Survey. The Center, along with sister institutes across the nation, originally was established by the Water Resources Research Act of 1964 (P.L. 88-379). The enabling legislation has been amended twice, in 1978 as P.L. 95-467 and again in 1984 as P.L. 98-242. This act established a center for water research at land-grant institutions in each state and certain U.S. possessions, unless a state legislature voted to locate its center at a different site.

AWRRC is staffed by a director, three associate directors and an administrative staff. Other researchers and students studying water topics become associated with the Center on a project-by-project basis. AWRRC benefits from its location at the university and the expertise it gains from faculty and graduate student studies and research; however, it has a statewide mission and interacts with other academic campuses.

The Center is focusing much of its research on the effects of agricultural pesticides and nutrients, especially nitrate, on ground and surface water. Scientists working with AWRRC are examining the effects that animal waste disposal has on groundwater quality and its impact on ground water, receiving streams and reservoirs. This research does not focus solely on contamination, but attacks the problem by evaluating and developing BMPs to minimize water/soil impacts and to maximize animal wastes as agricultural resources.

The Center operates the AWRRC Water Quality Laboratory, located in the Biotech Research Center at the University of Arkansas. This laboratory, which opened in June 1991, offers water researchers a centralized, state-of-the-art facility. The laboratory's mission is to analyze water samples using quality control procedures that are in compliance with Environmental Protection Agency requirements.

AWRRC cooperates closely with the Arkansas Department of Health, Arkansas Department of Pollution Control and Ecology, the Arkansas Soil and Water Conservation Commission, the Arkansas Cooperative Extension Service, the Arkansas State Plant Board, the Arkansas Fish and Game Commission, the Arkansas Geological Commission, the Arkansas Water Well Construction Commission, the Arkansas

District U.S. Geological Survey, the Arkansas District U.S. Army Corps of Engineers and the USDA Soil Conservation Service. In addition, the Center provides information to, or cooperates with, private associations as well as city and county governments.

AWRRC maintains a library of Technical Completion Reports at its offices. This library is available to all interested parties including the public. The Center acts as a "speakers bureau" for inquiries, and it publishes a quarterly newsletter that is mailed to approximately 800 persons. The newsletter and the Center's policy of open access to the media comprises AWRRC's efforts to inform the public about its operations and research findings. Additionally, as a water-related training facility, the Center keeps students of water quality on the leading edge of technologies and methods they will need as water-quality managers and researchers in their professional careers.

Arkansas Forestry Commission

The purpose of the Forestry Commission is to administer a public service program in the protection and development of the private forest lands in the state in cooperation with the U.S. Department of Agriculture, the College of Agriculture of the University of Arkansas, other state agencies, farmers, forest owners, and other residents or organizations.

Arkansas Game and Fish Commission

The responsibility of the Game and Fish Commission is to manage the state's fish and wildlife, providing as much hunting and fishing as possible without jeopardizing future supplies. The commission's activities are basically law enforcement, fisheries management, endangered species and game protection.

Arkansas Geological Commission

The functions of the Geological Commission serve to inform the public and encourage development of the state's mineral resources by service to the public, to industry and to individuals through mapping, subsurface investigations, water resources activities, chemical analyses, geographical services and the distribution of reports and publications.

U.S. Environmental Protection Agency (EPA)

The EPA has developed its Pesticides and Ground-Water Strategy upon which this and other management plans across the country are or will be ultimately based. EPA, therefore, is the national lead agency is the SMP concept.

It has developed, along with the states, the overall goal of protecting the environment, including human health, from pesticides in ground water.

EPA's activities in the SMP include the

requiring of environmental fate data to identify pesticides likely to contaminate ground water; prescribing appropriate labelling for individual pesticides; establishing criteria for identifying chemicals with ground-water contamination potential as candidates for restricted use; training applicators of restricted-use pesticides in the prevention of ground-water contamination; establishing and enforcing maximum contamination levels (MCLs) and health advisories for pesticides with leaching potential; establishing procedures governing storage, mixing, loading and disposing of pesticides to prevent point-source ground-water contamination; actively promoting the development of state ground-water protection programs as an overall coordination mechanism for ground-water protection activities; ensuring the coordination of ground-water protection activities; and conducting basic research on ground-water contamination.

State Agency
Roles and Responsibilities

Under the Agricultural Chemical Ground-Water Management Plan

Arkansas State Plant Board

Lead agency in development, implementation and prosecution of SMP

Reports to EPA.
Public notification of detection.
Monitoring program (with AWRRC)
Maintain Agricultural Chemicals Database.
Ground water modeling (with AWRRC).
Pesticides/ground water vulnerability map (with ASWCC and CES).

Prevention

Licensing and certification of pesticide applicators, program review and revision as needed (with CES).
Review of mixing and loading sites supervision program.
Inspections of mixing and loading sites.
Initiate voluntary BMPs.
Confirmation of pesticide detections with GC/MS.

Response

Investigate possible violations of Acts 389 and 410 of 1975.
Initiate better BMPs.
Research chemical- and crop-specific BMPs.
Communication with pesticide producers.
Promulgate new regulations if needed.

Arkansas Department of Pollution Control and Ecology

Ground-Water Monitoring

Continue prototype program.

Prevention

Establish and/or revise pollution standards for water quality.
Administer laws and regulations relating to water pollution.

Response

Initial response to all detections except domestic water wells and public water supplies.
Supervision of any aquifer remediation.
Coordinate SMP activity with Arkansas State Plant Board.
Classify waters of the state as necessary.

STATE AGENCY ROLES AND RESPONSIBILITIES

UNDER THE AGRICULTURAL CHEMICAL GROUND-WATER MANAGEMENT PLAN

ARKANSAS DEPARTMENT OF HEALTH

Ground-Water Monitoring

Monitor public water supplies for pesticides under National Primary Drinking Water Standards.

Response

Initial response to detection in domestic water wells and public water systems.
Investigate all other detections for health hazards to domestic water well or public water supply users.
Investigate suspected drinking-water contamination in domestic wells.
Coordinate SMP activities with Arkansas State Plant Board.

UNIVERSITY OF ARKANSAS COOPERATIVE EXTENSION SERVICE

Cooperate with ASPB in disseminating information about BMPs, including agricultural and mixing and loading site BMPs.
Cooperate with ASPB in training, educating and certifying pesticide applicators.
Develop pesticide use data by county.
Develop educational materials, including ground water hydrology, potential for pesticide contamination and integrated pest management techniques.

ARKANSAS SOIL AND WATER CONSERVATION COMMISSION

Development of the ground water sensitivity map.

ARKANSAS WATER WELL CONSTRUCTION COMMISSION

Enforce anti-backsiphoning regulations.

ARKANSAS WATER RESOURCES RESEARCH CENTER

For ASPB: ground water monitoring, sample analysis, ground water modeling,

SECTION 9
RESOURCES

The resources needed to develop and implement the Arkansas Agricultural Chemical Ground-Water Management Plan (SMP) are addressed by identifying the personnel and technical expertise available, by estimating the physical and operating costs of the SMP and by examining current and projected funding. Resource requirements can be divided sequentially into developmental and initial implementation resource requirements, and subsequent plan revision and implementation resource requirements.

The SMP is not a static plan that once adopted will remain unchanged. Rather, it recognizes that ground-water quality, including the impact of pesticides, is a dynamic and rapidly evolving area. For example, as problems or potential problems are identified and assessed, and solutions found, best management practices (BMPs) will be revised or developed, which automatically will become an operational aspect of the SMP.

Funding for the implementation of these and other developments under the SMP will be sought as needs are identified. In addition, resource requirements will shift through time as the SMP matures from initial development and implementation through continued implementation, assessment and revision, including chemical-specific plans, and revision implementation. The SMP is a chemical-generic plan. As it develops chemical-specific aspects, this component will be revised to reflect changing cost estimates.

CURRENT AND PROJECTED FUNDING

Projections are for current U.S. Environmental Protection Agency (EPA) and state funding levels to continue at $90,000 annually and $15,000 annually, respectively. ASPB's contribution will be derived from pesticide applicator and other pesticide related user fees. These funds will be allocated for various aspects of the SMP as needed, including monitoring, education programs, modeling, and continued research. ASPB is committed to seeking additional funding when necessary to carry out a component of the SMP that may otherwise go unfunded. Specific funding priorities are being determined as programs and projects are developed, but in broad terms because contamination prevention is recognized as the key in a successful ground-water quality maintenance program, funds

will be allocated accordingly for user and applicator education and continued research into and development of BMPs. In the short term, funds for modeling, laboratory equipment, two additional ASPB field agents and pesticide sensitivity mapping — all part of a critical vulnerability assessment as well as long-term implementation — will be allocated in amounts necessary to begin implementation of the plan.

Other expenditures by federal, state and local agencies may contribute to the overall success of the SMP but may not necessarily fall within the formal scope of the plan. For instance, the Arkansas Department of Health (ADH) Division of Engineering spends about $1.5 million dollars annually to monitor water quality in more than 700 community public water supply systems and more than 1,200 non-community public water systems as mandated under the Safe Drinking Water Act (SDWA). This amount is likely to increase because of the need to test for pesticides that EPA has set maximum contaminant levels (MCL) for under the National Primary Drinking Water Standards. The United States Geological Survey (USGS) is monitoring pesticides at 26 wells in Arkansas and is involved in a pesticide/clay-cap study in northeastern Arkansas. The Arkansas Department of Pollution Control and Ecology (ADPC&E) has eight prototype areas across the state that it regularly monitors for ground-water quality. The Arkansas Soil and Water Conservation Commission (ASWCC) has completed a pesticides sensitivity map to aid in assessment and planning under the SMP. These programs and projects contribute to the success of the SMP, and following EPA guidance have been integrated into the SMP. They were not created expressly under the SMP, however, these programs and others like them are included because their goals dovetail with those of the SMP.

Arkansas State Plant Board

The Arkansas State Plant Board's (ASPB) Division of Feeds, Fertilizers and Pesticides is administered by a director and three assistant directors. They oversee work done by 26 Agricultural Specialist(s). These persons are responsible for carrying out ASPB's portion of the SMP. ASPB has proposed adding two additional field agents to deal specifically with ground-water and pesticide topics articulated under the SMP.

According to ASPB's class specification, field agents "are responsible for enforcing regulations pertaining to seed, feed, fertilizer, pesticides, lime, nursery stock and insects."

Their diverse duties do not necessarily fall under the SMP, but many duties, including inspecting aircraft spray systems, licensing aircrafts and operators, checking pesticide applicator and vendor records, issuing violation notices, and conducting investigations of chemical misuse relate specifically to responsibilities under the SMP.

Arkansas Water Resources Research Center

The Arkansas Water Resources Research Center (AWRRC) and its research faculty have significant experience in the collection and analysis of stream, lake and ground-water samples. The value and quality of previous AWRRC studies are attested to by the fact that the reports are requested by scientists from state and federal agencies, and industry. In addition many have been published in national and international journals. Another method of evaluating the quality of AWRRC research is to note that AWRRC has administered repeated contracts/studies for many agencies.

AWRRC research faculty have significant experience with various aspects of nonpoint source and edge-of-field studies. For example AWRRC has worked closely with the U.S. Soil Conservation Service "Sonora Project," which is investigating nonpoint source pollution of Beaver Lake.

The AWRRC Water Quality Laboratory, located in the Biotech Research Center at the University of Arkansas has a gas chromatograph (GC) and a high pressure liquid chromatograph (HPLC) for use in pesticide detection. Additional support and extraction equipment is planned for the laboratory and, therefore, for implementation of the SMP. If a detection should occur, confirmation will be made at an outside laboratory using mass spectrometry.

The Water Quality Laboratory has been developed to provide a certified analytical laboratory and is a cooperative effort of researchers from the disciplines of agronomy, botany, engineering, geology, microbiology, and zoology.

The laboratory provides a rapid, high quality analysis of samples submitted by researchers. The data provided by the analyses is certified as meeting or exceeding approved standard analytical methods. These data are returned to the researcher for integration into their studies and for inclusion in a general data base.

Altheimer Laboratory, University of Arkansas

The University of Arkansas' Altheimer Laboratory is a pesticide residue research facility designed to assist farmers and researchers in methods for using pesticides as safely as possible. There, researchers study the fate of pesticides in the environment. Current research topics include pesticide fate in rice culture, disposal of pesticide leftovers from rinsate and other disposal sources, degradation of pesticides at various soil depths, and a surface water monitoring program in Jefferson, Mississippi, Lawrence and Phillips counties.

SECTION 10
INFORMATION DISSEMINATION

The Arkansas Agricultural Chemical Ground-Water Management Plan (SMP) prescribes many on-going processes, all of which have as their goal the protection of ground water from pesticide pollution. One such process is that of disseminating information about safe pesticide use. This section discusses how information pertinent to the SMP is relayed to appropriate audiences. It identifies those audiences, and it explains the rational for their inclusion. This section describes how pesticide users are informed about compliance with application requirements where pesticide use is governed by the SMP. Three major communication venues are used: licensing and certification training, field agents, and public education about the application of general-use pesticides and other agricultural chemicals and agents.

The Arkansas State Plant Board's (ASPB) work-plan for certifying pesticide applicators, as amended, (Appendix D) forms the foundation upon which the information dissemination process is based. This work-plan identifies pesticide users and application categories. It outlines the certification process, which by and large is one of education and training prior to certifying an applicator. The certification process is integral not only to this section but to the Contamination Prevention section as well.

Commercial, non-commercial and private applicators need to know and understand the dynamics of the interplay between pesticide application and ground-water quality. These are the people who use pesticides day in and day out. Their understanding and cooperation regarding safe pesticide use and ground-water quality is crucial to safeguarding ground water from pesticide contamination. Other groups, such as researchers, students, environmentalists, government officials, law enforcement officials, water managers, and property owners and managers have to varying degrees an interest or responsibility in safeguarding ground water from pesticide pollution. These persons may use pesticides from time to time or they may be in a position that requires them to make decisions regarding pesticides, including zoning laws, enforcement activities, or emergency responses to spills.

ASPB will make available through various outlets — including press releases, brochures, pamphlets, its newsletter, seminars, workshops and technology transfers, and memoranda to federal, state

and local officials — information that ASPB deems necessary for the implementation and prosecution of the SMP. Specific information on the certification program is disseminated by the Plant Board and the Arkansas Cooperative Extension Service (CES). Plant Board, CES and industry speakers are available to interested groups. CES agents, through their radio and television programs, local newspaper columns and individual farmer contacts will inform their constituents about BMPs or other pertinent information. ASPB personnel, while on farms, at farm supply dealerships, grain elevators, etc. will inform their constituents. The aforementioned can be described as an informal network of information dissemination, that taken as a whole provides adequate information dissemination to most people most of the time. A more formal process, however, is applicator certification. This process systematically educates, trains, informs and up-dates pesticide users before they are allowed application privileges.

CES is the principal cooperating agency in the certification process. It has the responsibility for educating and training applicators in safe and effective pesticide use. The responsibilities of CES are delineated by a contract for services (Appendix D). CES specialists, supported by county and university staff, conduct schools for specific segments of pesticide users such as pest-control operators and aerial applicators. CES specialists present workshops and grower meetings for farmers and foresters, and they conduct training sessions for special groups such as golf course superintendents and seed treaters. Training to cover general competency standards is based on U.S. Environmental Protection Agency (EPA) core manuals. EPA provides core questions for applicator testing and approves the overall certification process. Training on specific standards is based upon CES publications insofar as possible. These are supplemented by textbooks and/or study materials available from such groups as the National Pest Control Association and the National Golf Course Superintendents Association.

Farmstead Assessment System Program

The Arkansas Soil and Water Conservation Commission (ASWCC) and CES are conducting a program to identify farmstead wellheads that may be contaminated by farm and domestic activities and to provide technical assistance toward correcting problems where the potential for groundwater contamination exists because of poorly constructed wells or unsuitable management practices.

Some agricultural practices pose a high risk to ground-water and drinking water supplies if they are not conducted properly. The Farmstead Assessment System Program, known as Farm-A-Syst, (Appendix J) provides farmstead residents and agricultural producers using domestic wells accurate, first-hand information about how their farmstead structures and activities, such as

manure handling, pesticide storage and domestic sewage disposal, might affect their drinking water. Much of the information gained in the assessment will be reassuring, but some of it will identify practices and/or structures that need modification to protect the ground water. By identifying those wells where improvements are needed, it is possible to direct the efforts of agencies providing technical assistance to land owners. The Farm-A-Syst program helps protect rural drinking water supplies by helping well owners and users make appropriate management decisions.

The Farm-A-Syst pilot program in Arkansas is part of an EPA Region 6 effort to evaluate the Farm-A-Syst program region wide. This program is directed toward privately owned rural domestic wells in two target areas. The program may be extended statewide if funds are available. The program consists of a series of 12 work sheets that help rural residents and agricultural producers assess how effectively their farmstead practices protect their drinking water. Well owners and users who identify practices that endanger their well receive information on ways to modify their practices or structures and where they can go for additional assistance. A follow-up survey of those owners and users who receive technical assistance and/or information will be made to evaluate the effectiveness of the Farm-A-Syst program in protecting rural drinking water supplies.

This program, while not conceived as a component of the SMP, shares ground-water protection goals with the SMP, and in keeping with EPA's Pesticides and Ground-Water Strategy, which stresses coordinated and integrated ground-water protection measures, Farm-A-Syst is potentially a valuable tool for protecting Arkansas' ground water.

SECTION 11
PUBLIC AWARENESS AND PARTICIPATION

Public participation is crucial to the development and success of the Arkansas Agricultural Chemical Ground-Water Management Plan (SMP). To that end, the Arkansas State Plant Board (ASPB) formed the Arkansas Agricultural Chemical Ground-Water Management Plan Committee, or SMP Liaison Committee, to help formulate and implement the SMP. This ad hoc committee is composed of 30 or more representatives from various state agencies, academe, environmental groups and trade associations who have some interest, responsibility or expertise that can contribute to the plan's successful implementation.

Committee members share a goal of protecting Arkansas' ground water, not only from pesticide pollution but from other pollutants as well. This common goal, however, may be approached from differing perspectives. Input from throughout the state is vital to ensuring the development of a balanced, well-thought-out plan. A thorough discussion of ideas, philosophies and methodologies can help ensure that the SMP fulfills its goal.

The Coordination Mechanism subsection of Section 8, Agency Roles and Responsibilities, further discusses the committee's role. Responses to a questionnaire used in the preparation of the SMP and other comments on the plan can be found in Appendix N.

While committee members represent many of the interest groups concerned with the plan from across the state, their participation does not preclude adherence to the Arkansas Administrative Procedure Act, A.C.A. §25-15-201 et seq., Act 434 of 1967 as amended, or the Arkansas Freedom of Information Act, A.C.A. §25-19-101 et seq., Act 93 of 1967 as amended (Appendix B).

These acts provide a legal frame work and set forth procedures for informing the public about rule making by state agencies, open records and open meetings. Under the Administrative Procedure Act, 20 days notice must be given before a rule may be adopted, amended, or repealed. The act stipulates the actions, processes and time frame that must be followed prior to important regulatory actions. As a matter of course, the Plant Board advertises in appropriate newspapers when a situation calls for public notification. This will continue under the SMP.

The Arkansas Freedom of Information Act (FOIA) defines public records and public meetings. It describes the public's right to

have access to those records or meetings, and it set limits on public access in specific areas. The intent of the law is to provide the public with the information it needs to be an informed electorate. The Plant Board recognizes that the development, implementation and continued prosecution of the SMP is subject to these public access/participation laws and that only those areas specifically exempted from disclosure under the FOIA will be closed to the public.

Reasons for notifying the public fall into two categories. These are administrative and procedural changes to the SMP and responses to pesticide detection. Administrative or procedural changes require public notification as provided under the Administrative Procedure Act. When significant alterations to the SMP are being considered, public meetings, sponsored by the Plant Board, will be held, and interested parties will be allowed to participate in any significant alteration of the plan. Response notification can be divided into emergency and non-emergency notification. Emergency notification would occur only in extreme cases where an imminent health hazard exists because of a point-source spill or some other emergency condition. Non-emergency notification would occur when a pesticide has been confirmed in ground water used as a drinking water source or some other use such as drinking water for livestock or irrigation, but the confirmed level of contamination does not exceed state and federal safety standards. EPA health advisory levels (HAL) provide the guidance for emergency and non-emergency notification.

While maximum contaminant levels (MCL) are an important flag, the plan recognizes that response actions must begin when an action level is reached and, therefore, before an MCL is reached. Where the appropriate response is public notification, it will be accomplished through releases to the media for publication and broadcast. *Public notification* is the widespread dissemination of information throughout a community as opposed to *selective notification,* which is dissemination to an interested party or group, such as applicators and researchers or to private well owners who may have a problem with their drinking water source but that source does not affect the general public.

Agents of the Arkansas Department of Health, Arkansas Cooperative Extension Service, ASPB or other agencies will inform the public through personal contacts or any other appropriate means as the need arises. The well owner, well operator or water system manager (perhaps a local government) will receive written notification. The public will be informed through traditional media outlets, i.e. newspapers, radio and television. Interested parties, such as grower associations, researchers and industry will be informed through memoranda or other announcements as appropriate. In addition, ADH, ADPC&E or other federal, state or local agencies or entities may take actions that serve to inform the public of significant detection.

SECTION 12
RECORDS AND REPORTING

The Arkansas State Plant Board will maintain all records of the plan's development and implementation for three years as directed in EPA's Pesticides and Ground-Water Strategy. These records include but are not limited to monitoring and sampling conducted, analyses results, permits issued, types and numbers of enforcement actions taken and records of any regulatory or administrative actions. The Plant Board will make these records available to EPA upon request or during scheduled reports as directed in the Pesticides and Ground-Water Strategy.

Records pertaining to the development, implementation and maintenance of the plan will be kept by the Director of the Division of Feeds, Fertilizers and Pesticides of the Arkansas State Plant Board. The Director may delegate the maintenance of these records to an appropriate staff member.

REPORTS TO EPA

MID-YEAR AND YEAR-END REPORTS — During these two reporting periods, which coincide with two of the four reporting periods normally required under the Consolidated Pesticide Agreement Guidance, the following information will be reported to the Region 6 EPA Office, Pesticides Section.

1. The number of ground-water samples taken and the number analyzed.
2. The number of samples that detected the subject chemical.
3. The number of inspections performed whether solely for purposes of determining compliance with provisions of the SMP or for other purposes, but that included a determination of whether provisions of the SMP where being followed.
4. The number and a summary of completed enforcement actions related to non-compliance with the SMP.
5. A summary of significant findings or actions.

YEAR-END REPORTS — In addition to the above information, the following information will be furnished in a year-end report.

1. Monitoring results.
2. Accomplishments.
3. Identification of any special issues within the state relating to the SMP.
4. Identification of needed modifications to the SMP.
5. Description of available projected

resources for the next year with a comparison to the resources needed to carry out the plan.

Biennial Reports — Every second year at year's end, the Plant Board will submit to EPA an assessment of the effectiveness of the SMP in preventing ground-water contamination. Because of technical, time-constraint and other considerations, this report will not be limited to information drawn solely from ground-water sampling. In addition to monitoring results, the report will include such considerations as changes in surface water residues that may correlate to ground-water contamination, soil monitoring data, agricultural chemical use information, citizen complaints and research data and information.

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