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Managing Agricultural Contamination of Ground Water: The Institutional Framework

by

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(ABSTRACT)

Contamination from agricultural fertilizers and pesticides has been recognized as a serious threat to underground drinking water sources. Through separate federal acts and amendments the states have been given various levels of support with which to attack this contamination problem. However, these federal acts have not provided enough protection for ground water from agricultural chemicals. The states must develop their own management programs for ground water quality protection. Each state needs to consider what type of policy it will use as the foundation of its program. The policy can provide uniform ground water quality throughout the state, provide for limited degradation throughout the state, or allow variances in ground water quality for different locations. The strategies available to be used in the construction of a program consist of regulation, imposition of liability, economic incentives, and education. Finally, the states need to realize the basic mechanics needed for program support. The states of Nebraska, California, New Mexico, and Arizona serve as examples to show methods through which ground water quality protection can be realized. Some major obstacles still exist in the development of effective state ground water quality protection. These obstacles must be overcome to provide effective management of agricultural contamination of ground water.

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Table of Contents

I. INTRODUCTION

The U.S. Environmental Protection Agency (EPA) has estimated that about 50 percent of the nation's population depends on ground water as a drinking water supply, and ground water use has nearly tripled in the last three decades.[1] As ground water contamination has become more apparent, and with this large proportion of the population dependent on this resource, substantial efforts have been made to determine the extent of ground water contamination, especially in urban areas. Hazardous waste sites have been found to have the greatest effect on ground water. These are followed by landfills, surface impoundments, and open dumps as the facilities most responsible for contaminating ground water.[2] These discoveries have led to improved facilities for prevention of leaching and the placement of monitoring stations to make sure the preventative methods are working satisfactorily.

Ground water contamination has not only been found around urban communities but also in rural communities located within or bordering upon agricultural land. In these areas much more than 50 percent of the population uses ground water for drinking water. In the grain belt states nearly all rural residents drink untreated and unmonitored ground water. It was originally believed

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1 U.S. General Accounting Office, Federal and State Efforts to Protect Ground Water, February 21, 1984, p. ii.

2 Ibid.

that chemicals used on these lands were harmless to mammals and that the soil would filter the chemicals, thus protecting the ground water. In the late 1970's, however, ground water contamination by pesticides was discovered. In 1979, DBCP was found in a number of wells in several states, and aldicarb was discovered in New York's ground water. On Long Island, New York, almost 2000 private drinking water wells have been contaminated with aldicarb, with about 1000 of them having concentrations that exceed the New York water quality standard of 7 ppb. Since 1979 almost 2500 wells in California have been found to be contaminated with DBCP, including at least 1473 wells that exceed the California Department of Health Services standard of 1 ppb. Ground water contamination from EDB,1,2-D and simazine has been traced to lawful agriculture use in California.[3] A 1984 review of research noted the occurrence of 12 pesticides in ground water in 18 states.[4] A 1986 review reported that at least 17 pesticides have been found in groundwater in 23 states as a result of routine agricultural practices.[5] And research worldwide over the past 10 years has shown that the most extensive source of nitrates delivered to groundwater and surface water is agriculture.[6] The conclusion which can be made is that certain pesticides can and do travel from the site of application, through soil and rock layers, and leach to ground water.

Modern agricultural technology has done much to change farming, rural America, and the nature of ground water contamination. After World War II, agriculture entered a period of rapid, technology-induced transformation, where the emphasis was placed on production. The family farm operator was under considerable pressure to expand production and increase farm efficiency.[7] The farmers that chose to expand changed their old practices such as crop rotation and physical control techniques such as tillage, and began to rely heavily on farm chemicals. An example of the new farm practice is given in the following quotation from a farm family:

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[3] Committee on Ground Water Quality Protection, Ground Water Quality Protection: State and Local Strategies, 1986, p. 132. [Herein after cited as Committee on Ground Water.]

[4] George R. Hallberg, "From Hoes to Herbicides: Agriculture and groundwater quality," Journal of Soil and Water Conservation, November-December, 1986, pp. 358, 360.

[5] Ibid.

[6] Ibid.

[7] James B. Wadley, "The Future of Government Regulation of Agriculture: Biting the Hand That Feeds Us?", Northern Illinois University Law Review, Vol. 3, 1983, p. 307.

"...in 1957, Dick put into practice all the lessons he'd learned at Iowa State University while earning a master's degree in animal husbandry. Fences were taken out between fields. Concrete was poured in livestock lots to confine cattle and hogs. All 300 acres were planted to corn. Planting was done before May 5 on ground that had been plowed the previous fall and left exposed to wind and water erosion all winter. We used tremendous amounts of fertilizers, herbicides and insecticides."[8]

Chemicals were cheap, increased productivity, decreased labor requirements, increased product quality, and, from the information available at that time, were safe.[9] Use of inorganic nitrogen fertilizers had increased eleven-fold between 1950 and 1980, and agricultural use of pesticides has tripled since 1964.[10] The use of pesticides and nutrients is an integral part of agriculture today, helping farmers produce consistently high yields while controlling insects and unwanted plants. Blackmer and Meisinger estimate that some investments in nitrogen fertilizer have a payback of nearly 10 fold.[11]

Knowledge that pesticides can reach ground water as a result of agricultural use became apparent less than ten years ago, providing

not much time to develop a new body of knowledge about a complex set of physical and chemical interactions that take place in a remote environment we can't observe, except through holes we poke here and there. Yet that's what pesticide regulatory agencies are called on to do today...to protect ground water from contamination by pesticides used in agriculture, with incomplete understanding of how and why groundwater contamination occurs.[12]

The public health hazards of pesticide contamination of groundwater are of concern because of the potential for long-term and widespread exposure to the public. Farmers and their families are without doubt the population group at the greatest risk, with the most to gain or lose, depending on how the problem is handled. Mortality from some cancers is significantly higher in rural farm

[8] Dick and Sharon Thompson, Farming Without Chemicals, EPA Journal, June 1984, p. 33.

[9] Kenneth Ostlie, "Integrated Pest Management: A Tool to Manage the Risk of Ground Water Contamination," Pesticides and Groundwater: A Health Concern for the Midwest, The Freshwater Foundation, October 16-17, 1986, p. 320.

[10] John M. Halstead, Estimated Health Effects of Exposure to Agricultural Chemicals: Overview, Dept. of Agricultural Economics, Virginia Polytechnic Institute & State University, 1987, p. 1.

[11] Sandra S. Batie, "Institutions and Ground Water Quality," Proceedings of a National Symposium on Agricultural Chemicals and Ground Water Pollution Control, March 26-27, 1987, p. 24.

[12] Mary Brown, "Reducing Agricultural Pesticide Residues in California Ground Water," Pesticides and Groundwater: A Health Concern for the Midwest, The Freshwater Foundation, October 16-17, 1986, p. 283.

families. Excessive mortality from leukemia, myeloma, and non-Hodgkin's lymphoma has shown consistent association with herbicide use in many Corn Belt states.[13]

The characteristics of quality that should be protected are not easily specified. Water used for human and animal consumption must meet health criteria, but these criteria are subject to much scientific debate. For example, consider standards for acceptable levels of nitrate-nitrogen in potable water supplies. The U.S. Public Health Service has set this level at 10 ppm, primarily to protect infants against methemoglobinemia ("blue baby" syndrome).[14] Raising this level has been discussed since much evidence suggests a higher standard would be consistent with adequate protection of infant health.[15] However, if this standard were raised to even 20 ppm, it would create a far lower factor of safety than exists for most other potentially hazardous chemicals. And it should be noted that the European Economic Community recently lowered its standard for nitrate from 22.6 to 11.3 ppm.[16] As evident from consideration of this single chemical, certain standards are the subject of considerable controversy. A considerable degree of uncertainty exists in determining probability of exposure, effects of chronic versus acute exposure, and even the sources of many ground water contaminants.[17] In addition, many chemicals currently used do not have established health standards.[18]

The detection of pesticides in groundwater has added an unwelcome dimension to the ongoing debate in the farm community about agricultural chemical use. Farmers have no desire to pollute ground water since they and their families rely on it for the primary drinking water source. Thus ground water contamination by pesticides presents the farmer with a dilemma since he is relying on agricultural pesticides to achieve efficient production of agricultural products while he is extremely reliant on ground water. So the farmer himself is the focus for environmental and health

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[13] George R. Hallberg, *supra* note 4, p. 362.

[14] Pierre Crosson, "Implementation Policies and Strategies for Agricultural Non-Point Pollution," Conference on Agricultural Nonpoint Source Pollution Management, October 20-21, 1983, p. 27.

[15] Ibid.

[16] George R. Hallberg, *supra* note 4, p. 362.

[17] John M. Halstead, *supra* note 10, pp. 1-2.

[18] Ibid.

concerns, as well as the focus of social, political, and economic forces generated by this issue.[19] Many farmers are considering, or have already taken, concrete actions to begin dealing with agricultural ground water contamination. Yet, key practical problems such as who should take responsibility for control and for defining remedial actions have not been answered. What level of ground water quality should be protected? Who will and should bear the liability and pay the costs for remedial actions?

A. Institutional Influences Leading to Ground Water Contamination

Federal and state governments, through their agricultural policies and environmental policies, have impacted the use of agricultural chemicals on the farm. One of the greatest privileges in the United States is the right of the individual to own land. In exercise of private land rights, farmers have been allowed to use a broad array of agricultural practices, with the federal and state governments being slow to interfere. This lack of willingness by the governments to restrict farmers' use of land has allowed the development of practices that have led to ground water contamination.

Some observers have suggested that groundwater contamination by agricultural chemicals is related to long-standing U.S. farm policies.[20] No single, integrated U.S. farm policy exists; instead, a series of policies exists, piled one upon the other and often inconsistent in intent and effect.[21] On one hand the federal government encourages farmers to protect the environment with

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[19] Kenneth Ostilie, *supra* note 9, p. 320.

[20] Thomas W. Curtis, Agricultural Chemicals and Groundwater Protection: The Need for a New Federal/State Partnership, Draft Manuscript, National Governors' Association, 1986, Washington D.C., p. 5.

[21] A. Desmond O'Rourke, The Changing Dimensions of U.S. Agricultural Policy, Prentice - Hall, Inc., Englewood Cliffs, N.J., 1978, p. 86.

environmental protection policies, as has been the purpose of recent soil conservation programs. On the other hand, the federal government supports farm income through price support loans and guaranteed crop market prices. Over the last few decades, these price supports have contributed to the evolution of farming methods that make more intensive use of cropland and encourage monoculture in place of crop rotation. Pesticides and fertilizers are virtually required for this type of cropping presently practiced over wide areas of the nation. These farming programs tend to penalize the farmer who would like to undertake a more organic[22] approach to farming. The farm programs do this indirectly by creating an environment that favors conventional agriculture relative to alternative agriculture. Besides encouraging intensive practices on whatever land is in program crops, the farm programs also encourage the maximum allowed acreage to be put into program crops. This maintains the farmer's base acreage[23] and maximum eligibility for program benefits. Farmers who keep some land in permanent pasture or rotate crops are penalized, finding themselves unable to participate in relatively attractive farm programs, since the land not used for crops will not be included in base acreage calculations.[24] Another disincentive to alternative farming practices created is that since farm programs pay by the bushel, organic farmers receive less program benefits per crop than do conventional farmers--presumably reducing the incentive to be an organic farmer.[25] Farm programs have given the farmer incentive to use more chemical fertilizer and pesticides on his fields to produce more bushels per acre.

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[22] Organic farming is a production system which avoids or largely excludes the use of synthetically compounded fertilizers, pesticides, growth regulators, and livestock feed additives. To the maximum extent feasible, organic farming systems rely upon crop rotations, crop residues, animal manures, legumes, green manures, off-farm organic wastes, mechanical cultivation, mineral-bearing rocks, and aspects of biological pest control to maintain soil productivity and tilth, to supply plant nutrients, and to control insects, weeds, and other pests. [Taken from "USDA Report and Recommendation on Organic Farming," U.S. Government Printing Office, Washington, D.C., 1980, p. 9.]

[23] Base acreage is a means to control output and to allocate government payments. The apportionment of base acreage is determined from the farmers historical planting practices. Base acreage is used to compute allowable planting and acreage diversion in qualifying for benefits under government commodity programs. [Taken from Cochrane and Ryan, American Farm Policy, 1948-1973, University of Minnesota Press, Minneapolis, 1976, p. x.]

[24] James E. Anderson, "Farm Programs and Alternative Agriculture," Proposed 1985 Farm Bill Changes: Taking the Bias Out Of Farm Policy, March 1985, p. 4.

[25] Sandra S. Batie, *supra* note 11, p. 28.

The common practice of consulting chemical sales representatives to determine chemical application rates can also be an influence leading to ground water contamination. This problem can arise from those sales persons who may advise applying a greater application than necessary, or from sales persons who advise applying a chemical when or where it is not needed. Since the objective of the chemical sales person is to sell chemicals, and since they are not necessarily aware of the local conditions of the farmlands for which they are recommending chemical application, even the most sincere sales person can recommend an unnecessary chemical application. And any application of a chemical which is in access of uptake of the plant will either have to adsorb to the soil, become part of surface water runoff, evaporate to the atmosphere, or leach to contaminate the ground water.

B. *Agricultural as a Unique Problem*

The policy of the United States government has been to foster and encourage agricultural activity, obstensibly the family farm system of agriculture.

> Congress believes that the maintenance of the family farm system of agriculture is essential to the social well-being of the Nation and the competitive production of adequate supplies of food and fiber. Congress further believes that any significant expansion of nonfamily owned large-scale corporate farming enterprises will be detrimental to the national welfare. It is neither the policy nor the intent of Congress that agricultural and agricultural-related programs be administered exclusively for family farm operations, but it is the policy and the express intent of Congress that no such program be administered in a manner that will place the family farm operations at an unfair economic disadvantage.[26]

Agricultural activity, in addition to providing an essential to life, has therefore been viewed as creating social benefits beyond the commodities produced.

The fact that agriculture creates adverse environmental impacts, together with the fact that the forms of governmental support adopted can intensify these impacts, has received only belated recognition. As environmental protection has evolved into a major social concern, governments

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[26] James B. Wadley, *supra* note 7, p. 304.

have found themselves in the position of supporting the very activities responsible for substantial environmental degradation.

Beyond the issue of direct governmental support of agriculture, application of environmental controls to farming confronts serious obstacles. The government has required industrial firms, electric utilities, and municipal waste disposal plants, under threat of substantial penalties, to take measures to reduce the pollutants dumped into the environment. But the farmer is a unique case because of the special virtues traditionally attributed to agriculture. Another constraint is the precarious financial condition of many individual farmers relative to other polluters such as industrial firms. An additional consideration arises from the intimate connection between agriculture and land; state and federal environmental controls traditionally have avoided substantial reliance on land-use controls of a broadly applicable type that would be necessitated by the diffused nature of agricultural pollution.

Regulators and public health officials at the state and federal level deal with the problem in vastly different ways. Some say, "Don't look under that rock" and "Let sleeping dogs lie." Others rush ahead, anxious to impose new restrictions, pass new laws, and clamp down regardless of whether the consequences of their actions are understood.[27]

> At the federal level, most of the public involvement will probably come from EPA and not USDA. This is because water quality protection has never been a major mission of USDA nor of the Congressional agricultural committees. Water quality is not a major concern of the Farm bills either, nor does the federal water quality legislation provide a role for USDA. . . . But even more fundamentally, there tends to be different "mind sets" in USDA and EPA with respect to water quality. USDA sees water quality as mostly a problem of information. . . . In contrast, EPA's view has been mainly that existing problems are problems of policy. . . . Therefore, despite USDA's vast network of resources, and despite USDA's comparative advantage of working with farmers, there is essentially a "clash of cultures" between USDA and EPA.[28]

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[27] Charles M. Benbrook, "Changing Responsibilities in the Agricultural Community," Pesticides and Groundwater: A Health Concern for the Midwest, The Freshwater Foundation, October 16-17, 1986, p. 299.

[28] Sandra S. Batie, *supra* note 11, pp. 32-33.

C. Intergovernmental Relations in the Protection of Ground Water

Ground water contamination is a nationwide problem, but the sources of contamination vary from region to region. Contamination from oil and gas production is concentrated in the south, hazardous wastes primarily in industrial states, and pesticides and herbicides in agricultural states. Within these regions the amount of contamination will be determined by the amount of a contaminant originally present, and the local hydrogeologic conditions. Ground water problems are highly site-specific, depending upon unique local conditions. Decisions necessary to protect ground water from agricultural chemicals or other contaminants carry significant implications for local land use and development. Since these land use controls have traditionally been a state/local issue,[29] federal involvement historically has been limited. However, the federal government has enacted several laws in response to specific problems that demonstrate congressional intent to preserve the quality of ground water, recognizing it as an important source of our nation's water supply.[30] But no existing comprehensive federal legislation focuses on ground water protection. Some believe that adequate authority is contained in the existing acts to allow the federal government to fulfill its role in groundwater protection,[31] without the need to create another act specifically designed for groundwater protection.

While mandating minimum standards, most federal environmental legislation provides for delegation of administrative responsibility to the states, subject to continuing federal oversight. Most of the states have accepted the administrative responsibility for many EPA programs.[32]

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[29] Thomas W. Curtis, *supra* note 20, p. 3.

[30] U.S. GAO, *supra* note 1, p. 1.

[31] Robert L. Farrett and Robert M. Ward, "Agricultural Land Use Planning and Groundwater Quality," Growth and Change, Vol 14, No. 1, January 1983, p. 36.

[32] U.S. EPA, Overview of State Ground Water Program Summaries, Vol. 1, March '85, p. 23 [Herein after cited as Overview.]

However, since ground water contamination is a relatively new environmental issue, some states lack the necessary statutory authority and management capability to adequately address the problem. The relationship between the states and the federal government in dealing with groundwater contamination problems needs to be more carefully defined.[33]

> While most of the planning, analysis, and implementation must take place at the State level, development of appropriate control measures will require a coordinated effort on the part of all levels of government--Federal, State, and local--working together in a mutually supportive partnership. Federal agencies play a variety of roles. They (1) provide invaluable technical assistance and other incentives, (2) support research and demonstration capability for the development and dissemination of needed methodologies and innovative management approaches, and (3) support important networks of services and programs at the local level. This assistance must continue to be focused and made available at the local level by field representatives of the parent agencies involved in nonpoint source research and control. Local water quality management agencies and decision-makers provide the necessary detailed knowledge of what are, by nature, highly site-specific problems and solutions.[34]

The states have delegated responsibilities to their local governments that are fundamentally related to protection of ground water from contamination.[35] Ground water is usually not protected through a specifically designed regulatory system, but rather indirectly through traditional local government powers such as land use controls and health codes.[36] As state governments attempt to address the ground water protection issue, greater coordination between state and local governments, or perhaps a redistribution of powers, will become necessary.

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[33] Thomas W. Curtis, *supra* note 20, p. 4.

[34] U.S. EPA, Report to Congress: Nonpoint Source Pollution in the U.S., January 1984, pp. 4-14.

[35] James C. Buresh, "State and Federal Land Use Regulation: An Application to Groundwater and Nonpoint Source Pollution Control," The Yale Law Journal, Vol. 95, 1986, p. 1439.

[36] Tom James et al., "Elements of Institutional Capacity For Ground Water Pollution Control," National Symposium on Institutional Capacity for Ground Water Pollution Control, June 20-21, 1985, p. 10.

II. FEDERAL PROGRAMS

Within the considerable range of federal programs, two are particularly relevant to the issue of ground water contamination from agricultural sources: environmental protection programs and farm programs. Each involves a complex array of activities, which are discussed in the first two sections of this chapter. The third section will introduce the general constitutional and legal constraints which could be faced during the application or enforcement of a federal program. The discussion will involve the case study of a federal program which was held to be unconstitutional. It will show where primary challenges can be made against a federal act, and what is required to overcome such challenges.

A. Environmental Protection

The U.S. Congress has adopted a variety of legislation for the purpose of protecting the nation's environment. Primarily, each act was adopted as a means of addressing a problem recognized as significant at the date of enactment. Thus, as a new problem arose which had not been addressed by a previous act, an old act was amended, or a new act was created. Presently, taken together, these acts provide what can be a confusing menagerie of provisions that could be used to provide authority and aid to programs intent on protecting a specific component of the environment. In this section, seven federal acts are examined for their ability to provide protection for ground water from agricultural nonpoint source contamination. The first six acts were created to provide protection for the environment directly while the seventh act provides indirect protection for the environment.

1. Safe Drinking Water Act

The Safe Drinking Water Act (SDWA),[37] which became effective in 1974, for the first time put drinking water quality under general control of the federal government. Prior to 1974 drinking water quality was largely a state concern. Through this act Congress has sought to prevent water suppliers from providing contaminated drinking water to consumers and to provide the means by which underground sources of supply can be protected from contamination. The Act defines a contaminant as "any physical, chemical, biological, or radiological substance or matter in water which may have any adverse effect on the health of persons."[38] A public water system is defined as "a system for the provision to the public of piped water for human consumption, which has at least fifteen service connections or regularly serves an average of at least twenty-five individuals daily at least 60 days out of the year." A public water system will be either a "community water system" or a "non-community water system." A community water system is a public water system which serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents. A non-community water system is a public water system that is not a community water system.[39]

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[37] 42 U.S.C.A. sections 300f et seq.

[38] 42 U.S.C.A. sections 300f(1)(B) and 300f(6) (1986).

[39] 40 CFR part 141.2 (1987).

The Administrator of EPA[40] is required to publish maximum contaminate level (MCL) goals and promulgate national primary drinking water regulations for each contaminant which in his or her judgment may have any adverse effect on the health of persons and which is known or anticipated to occur in public water systems.[41] The maximum contaminant level is defined as "the maximum permissible level of a contaminant in water which is delivered to any user of a public water system."[42] MCL's have been adopted for 10 inorganic chemicals, and have also been adopted for organic pesticides. Some MCL's for organic pesticides apply to all community water systems, while others apply only to community water systems which serve a population of 10,000 or more individuals.[43] An MCL has also been adopted for nitrate (as N), which is 10. mg/l.[44] The MCL for nitrate is applicable to both community water systems and non-community water systems except when at the discretion of the state, nitrate levels not to exceed 20 mg/l may be allowed in a non-community water system if the supplier of water demonstrates to the satisfaction of the state that: 1) such water will not be available to children under 6 months of age, 2) there will be continuous posting of the fact that nitrate levels exceed 10 mg/l and the potential health effects of exposure, 3) local and state public health authorities will be notified annually of nitrate levels that exceed 10 mg/l, and 4) no adverse health effects shall result.[45] States may also establish standards beyond those set by the Administrator.[46] The states will be given primary enforcement responsibility for public water systems provided the Administrator has determined that the state meets certain conditions provided in the act.[47] Enforcement responsibility will remain with the federal govern-

[40] Unless otherwise noted "Administrator" will mean the Administrator of EPA.

[41] 42 U.S.C.A. section 300g-1(b)(3)(a) (1986).

[42] 42 U.S.C.A. section 300f(3) (1986).

[43] 40 CFR parts 141.11 (b) and 141.12 (1987).

[44] 40 CFR part 141.11 (b) (1987).

[45] 40 CFR parts 141.11 (a) and (d) (1987).

[46] 42 U.S.C.A. section 300g-2(a)(1) (1986)

[47] *See* 42 U.S.C.A. section 300g-2 (1986).

ment until the state programs have been approved.[48] Even while the states have primary enforcement responsibility, the Administrator may take action if the state fails to enforce its program.[49]

SDWA provides three programs for protection of underground sources of drinking water: the underground injection control (UIC) program, the sole-source aquifer designation program, and the wellhead protection program. Under the UIC program, the Administrator has published regulations for state underground injection control programs. Underground injection is the subsurface emplacement of fluids by well injection,[50] where well injection is the subsurface emplacement of fluids through a bored, drilled or driven well; or through a dug well where the depth of the dug well is greater than the largest surface dimension.[51] This broad definition should encompass many pits on the farm where excessive agricultural chemicals could be dumped. The UIC program establishes a permitting requirement for injection wells to be administered by EPA or by states under EPA delegation.

Through this act the Administrator may also determine, on his own initiative or upon petition, to designate an aquifer as a sole source aquifer.[52] To be designated, an aquifer must be the sole or principal drinking water source for an area that, if contaminated, would create a significant hazard to public health.[53] Any state, municipal, or local government or political subdivision thereof or any planning entity may identity a critical aquifer protection area over which it has authority or jurisdiction and may petition the Administrator to protect the recharge zone of this aquifer.[54] If the Administrator designates an aquifer as the sole or principal drinking water source for an area, no commitment for federal financial assistance (through a grant, contract, loan guarantee, or otherwise)

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[48] 42 U.S.C.A. section 300g-3(2) (1986).

[49] 42 U.S.C.A. section 300g(a) (1986).

[50] 42 U.S.C.A. section 300h (d)(1) (1986).

[51] 40 CFR part 146.03 (1983).

[52] 42 U.S.C.A. section 300h-3(e) (1986).

[53] Ibid.

[54] 42 U.S.C.A. section 300h-6(c) (1986).

may be entered into for any project which the Administrator determines may contaminate the aquifer through a recharge zone.[55]

A third ground water protection provision of SDWA is the requirement for each state to develop a program to protect well head areas within their jurisdiction from contaminants which may have any adverse effect on the health of persons.[56] A well head protection area encompasses the surface and subsurface area surrounding a water well or wellfield, supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water well or wellfield.[57] The state government is responsible for the development and implementation of the program. Each department, agency, and instrumentality of the executive, legislative, and judicial branches of the federal government having jurisdiction over any potential source of contaminant identified by the state program is made subject to all requirements of an approved state program.[58] Federal funding will be provided for the development and implementation of each state well head protection program,[59] but no funding will be provided which would be used to bring individual sources of contamination into compliance.[60] This act also provides separate funding for states to carry out ground water resource protection programs.[61]

A state which has assumed primary responsibility for enforcement of an underground injection program to prevent underground injection which endangers drinking water sources may receive a grant which will cover up to 75 percent of the costs experienced in carrying out the underground water source protection program. Several states have appropriated funds from this act to use in a ground water protection program. For example, for fiscal year 1983, Arizona used $129,000 of UIC and sole source aquifer protection funds for ground water protection; for fiscal

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[55] 42 U.S.C.A. section 300h-3(e) (1987).

[56] 42 U.S.C.A. section 300h-7(a) (1986).

[57] 42 U.S.C.A. section 300h-7(e) (1986).

[58] 42 U.S.C.A. section 300h-7(h) (1986).

[59] 42 U.S.C.A. sections 300h-7(k) and (d) (1986).

[60] 42 U.S.C.A. section 300h-7(f)9-(2) (1986).

[61] 42 U.S.C.A. section 300j-2(b) (1986).

years 1980 through 1983 Illinois used $237,416; for fiscal years 1978 through 1983 Maine used $50,045; for fiscal years 1981 through 1983 Massachusetts used $100,000; and for fiscal years 1981 through 1983 Rhode Island used $234,000 in its ground water protection program.[62]

2. Federal Insecticide, Fungicide, and Rodenticide Act

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)[63] became effective in 1947, replacing the Insecticide Act of 1910. The original purpose of this act was to regulate pesticides for the protection of farmers and, later, consumers. This focus changed to also include the protection of the environment in 1972 with the passage of the Federal Environmental Pesticide Control Act, which superseded much of the older FIFRA (for the purposes of this report the old name FIFRA will still be used). FIFRA is the primary federal law for controlling the use of pesticides. Under this act, the term "pesticide" means (1) any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest and (2) any substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant.[64]

Under FIFRA all pesticides must be registered with the Administrator of EPA unless specifically exempted.[65] In the registration process, factors taken into consideration are the economic, social, and environmental costs and benefits stemming from use of the pesticide. Risk is often quantified in terms of the number or probability of certain health effects in a given population, and benefits are most often stated in increased crop yields, lower food costs, reduced chance of disease, or the cost savings with respect to the use of alternative control measures. The benefits must be demonstrated to exceed the risk prior to pesticide registration.[66] A pesticide may fail registration if

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62 U.S. GAO, *supra* note 1, *see* pp. 26-80.

63 7 U.S.C.A. sections 136 et seq.

64 7 U.S.C.A. section 136(u) (1986).

65 7 U.S.C.A. section 136a (1986).

66 Environment Reporter, part 51:1629, The Bureau of National Affairs, Inc., Washington D.C., 1982

the Administrator believes it will cause unreasonable adverse effects on the environment.[67] The Administrator can also cancel or change the classification of a pesticide if it appears that, when used in accordance with widespread and commonly recognized practice, the pesticide generally causes unreasonable adverse effects on the environment.[68] However, a registration may be cancelled only on legally sufficient grounds.[69] Mere allegation that there have been "accidents" involving registered compounds is legally insufficient basis for cancelling registration of the compound.[70] The substantial question of safety should trigger issuance of notice of cancellation of the registered product, thereby shifting to the manufacturer the burden of proving it to be safe.[71]

A pesticide which is registered will be classified for general use, restricted use, or both.[72] When the Administrator determines that the pesticide, when applied in accordance with directions and labeling, will not generally cause unreasonable adverse effects on the environment, he (or she) will classify the pesticide for general use. If the pesticide may generally cause, without additional regulatory restriction, unreasonable adverse effects on the environment, he will classify the pesticide for restricted use, which usually entails the presence of or application by a certified applicator (other requirements may be imposed under certain conditions). This classification scheme can be applied to the pesticide directly, or to the particular use or uses to which the determination applies.

However, this classification scheme will not necessarily provide a high degree of protection due to interpretation of the term "application by a certified applicator." A person may be certified as a private applicator or commercial applicator. One certified as a private applicator can only use or supervise the use of any pesticide which is classified for restricted use for purposes of producing

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[exerpt from EPA's formal testimony before the House Appropriations subcommittee on the Department of Housing and Urban Development and Independent Agencies].

67 7 U.S.C.A. section 136 a(c)(6) (1986).

68 7 U.S.C.A. section 136d(b) (1986).

69 *Pax Co. of Utah v. U.S.*, 324 F. Supp. 1335 (1970); *Environmental Defense Fund, Inc. v. Ruckelshaus*, 439 F2d 584 (1971).

70 *Pax Co.*, ibid.

71 *Environmental Defense Fund, Inc., supra* note 69; *Southern Nat. Mfg. Co., Inc. v. Environmental Protection Agency*, 470 F2d 194 (1972).

72 7 U.S.C.A. section 136 a(d)(1) (1986).

any agricultural commodity on property owned or rented by him or his employer or (if applied without compensation other than trading of personal services between producers of agricultural commodities) on the property of another person.[73] A commercial applicator is a person who uses or supervises the use of any pesticide which is classified for restricted use for any purpose or on any property other than as provided in the description of a private applicator.[74] While a person seeking to be classified as a commercial applicator may be required to participate in a certification program to be licensed under a state licensing program approved by the Administrator, a person seeking to be classified as a private applicator can be so certified after completing a certification form, and after the Regional Administrator determines that there is reasonable assurance that the proposed activity will not result in a violation of applicable water quality standards.[75] Another weakness arises from the fact that, unless otherwise prescribed by its labeling, a pesticide is considered to be applied under the direct supervision of a certified applicator if it is applied by a competent person acting under the instructions and control of a certified applicator who is available if and when needed, even though such certified applicator is not physically present at the time and place the pesticide is applied.[76] These two weaknesses -- the ease with which a farmer can obtain a private applicator certification and not requiring the certified applicator to apply the pesticide, or even be present during its′ application -- show that a state should not rely on restricted-use registration to protect ground water from contamination.

The states have been delegated authority to regulate the sale or use of any federally registered pesticide or device in their particular state, but only if and to the extent the regulation does not permit any sale or use prohibited by this act.[77] Upon approval of the Administrator, a state shall have primary enforcement responsibility for pesticide use violations while meeting the requirements

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[73] 7 U.S.C.A. section 136 (e)(2) (1986).

[74] 7 U.S.C.A. section 136 (e)(3) (1986).

[75] 40 CFR part 121.24 (1979).

[76] 7 U.S.C.A. section 136 (e)(4) (1986).

[77] 7 U.S.C.A. section 136v (a) (1986).

of this act.[78] However, whenever the Administrator determines that a state having primary enforcement responsibility for pesticide-use violations is not carrying out such responsibility, the Administrator may void, in whole or in part, the state's primary enforcement responsibility for pesticide-use violations.[79]

Amendments to FIFRA have recently been proposed in both the House and Senate which would include extensive provisions aimed at protecting ground water against contamination from pesticide use.[80] The House bill (HR 2463), introduced May 19, 1987, would require EPA to determine whether a pesticide has the potential to leach to the ground water whenever that pesticide is registered or reregistered. If it is found to be a potential leacher, or if the pesticide has been detected at ground water sampling points in three or more locations, EPA may require the registrant to conduct ground water monitoring. EPA would use information obtained from this monitoring to decide how to handle the pesticide. This bill also would authorize EPA to issue a ground water residue guidance level (GRGL) for any registered pesticide. A GRGL would have to be issued for a pesticide that has been determined to be a potential leacher. The GRGL would be set at the maximum contaminant level under SDWA if such a level had been determined.

The Ground Water Safety Act of 1987 was introduced June 24, 1987 in the Senate. This bill could be passed with a package of amendments to FIFRA, or by itself. This bill goes further than the House bill in the establishment and enforcement of the GRGLs. EPA would also be required to establish GRGLs when a pesticide is detected in a drinking water well or wellfield serving a public water system, or upon petition from a state or federal agency. The GRGLs would be based solely on health considerations; economic benefits of the pesticide could not be considered. Under this legislation, EPA would have to restrict the use of any pesticide found to be present in any amount equal to or exceeding 25% of the GRGL. If the level is equal to or above 50% of the GRGL, EPA would have to notify the affected state who would then have to take action within

[78] 7 U.S.C.A. section 136w-1 (a) (1986).

[79] 7 U.S.C.A. section 136w-2 (1986).

[80] The information concerning the House bill is taken from the Environment Reporter, The Bureau of National Affairs, Vol 18, no. 6, June 5, 1987, p. 509. The information concerning the Senate bill is taken from the Environment Reporter, The Bureau of National Affairs, Vol 18, no. 10, July 3, 1987, p. 743.

180 days to bring the pesticide concentration to or below the GRGL. This action could include banning use of the pesticide in that area.

3. Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act (RCRA),[81] enacted in 1976, was a response to growing public awareness of serious problems relating to the disposal of solid wastes, particularly those with hazardous characteristics. The Administrator is to integrate all provisions of this act for purposes of administration, enforcement, and to avoid duplication, to the maximum extent practicable, with the appropriate provisions of FIFRA, while nothing in this act is to be construed to apply to any activity or substance which is subject to SDWA and the Clean Water Act (CWA).[82] The objective of RCRA is to "promote the protection of health and the environment and to conserve valuable material and energy resources."[83] To this end waste that is generated should be treated, stored, or disposed of so as to minimize the present and future threat to human health and the environment.[84] Future open dumping on land is to be prohibited, and existing open dumps are to be converted to facilities which do not pose a danger to the environment or to health.[85] An open dump is any facility or site where solid waste is disposed of which is not a sanitary landfill.[86] Since this act confronts solid waste disposal, it could be used to prohibit farmers from dumping empty pesticide containers on their land.

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[81] 42 U.S.C.A. sections 6901 et seq.

[82] 42 U.S.C.A. section 6905 (a, b) (1986).

[83] 42 U.S.C.A. section 6902 (a) (1986).

[84] 42 U.S.C.A. section 6902 (b) (1986).

[85] 42 U.S.C.A. section 6902 (a)(3) (1986).

[86] 42 U.S.C.A. section 6903 (14) (1986).

The term "solid waste" includes any solid, liquid, semi-solid, or contained gaseous material, including agricultural products along with a wide range of materials.[87] The collection and disposal of solid wastes is primarily the function of state, regional, and local agencies.[88] Each state must develop a plan which shall identify 1) the responsibilities of state, local, and regional authorities in the implementation of the plan, 2) the distribution of federal funds for the development and implementation of the plan, and 3) the means for coordinating regional planning and implementation under the state plan.[89] As part of the minimum requirements, the state plan must prohibit the establishment of new open dumps within the state and contain requirements that all solid waste shall be utilized for resource recovery or disposed of in sanitary landfills or otherwise disposed of in an environmentally sound manner.[90] The plan shall also provide for such practices as may be necessary to use or dispose of such waste in a manner that is environmentally sound.[91] Within a reasonable time after the enactment of such a plan, any solid waste management practice or disposal of solid waste which constitutes the open dumping of solid waste is prohibited.[92]

RCRA also requires EPA to develop and promulgate criteria for identifying the characteristics of hazardous waste and for listing hazardous wastes "taking into account toxicity, persistence, and degradability in nature, potential for accumulation in tissue ... and other hazardous characteristics."[93] EPA presently uses four criteria as characteristics of hazardous waste: ignitability, corrosivity, reactivity, and toxicity.[94] EPA has also listed many substances as hazardous wastes, subdividing them into three major groups: hazardous wastes from 1) non-specific sources, 2) specific sources, and 3) discarded commercial chemical products and associated off-specification ma-

[87] 42 U.S.C.A. section 6903 (27) (1986).

[88] 42 U.S.C.A. section 6901 (a)(4) (1986).

[89] 42 U.S.C.A. section 6943 (a)(1) (1986).

[90] 42 U.S.C.A. section 6943 (a)(2) (1986).

[91] 42 U.S.C.A. section 6943 (a)(6) (1986).

[92] 42 U.S.C.A. section 6945 (a) (1986).

[93] 42 U.S.C.A. section 6921 (a) (1986).

[94] 40 CFR part 261 subpart C (1987).

terials, containers and spill residues.[95] RCRA gives EPA authority to seek injunctive relief concerning hazardous wastes under certain circumstances.

> Notwithstanding any other provision of this chapter, upon receipt of evidence that the past or present handling, storage, treatment, transportation or disposal of any solid waste or hazardous waste may present an imminent or substantial endangerment to health or the environment, the Administrator may bring suit on behalf of the United States in the appropriate district court against any person ... who has contributed or who is contributing to such handling, storage, treatment, transportation or disposal to restrain such person ... or ... to order such person to take such other action as may be necessary, or both.[96]

EPA has developed standards and restrictions concerning hazardous wastes. These include 1) standards for owners and operators of hazardous waste treatment, storage, and disposal facilities,[97] 2) interim status standards for owners and operators of hazardous waste treatment, storage, and disposal facilities,[98] and 3) land disposal restrictions.[99] EPA administers a permit program under RCRA for disposal of hazardous wastes that can be delegated to the states. This permit program has a significant agriculturally related exception:

> A farmer disposing of waste pesticides from his own use which are hazardous wastes is not required to comply with the standards in this part or other standards in [the parts just mentioned] for those wastes provided he triple rinses each emptied pesticide container in accordance with [part] 261.7(b)(3) and disposes of the pesticide residues on his own farm in a manner consistent with the disposal instructions on the pesticide label.[100]

Thus it appears that the normal use or disposal of agricultural chemicals is not directly effected by this act.

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[95] 40 CFR part 261 subpart D (1987).

[96] 42 U.S.C.A. section 6973 (a) (1986).

[97] 40 CFR 264 (1987).

[98] 40 CFR 265 (1987).

[99] 40 CFR 268 (1987).

[100] 40 CFR part 262.70 (1987).

4. Clean Water Act

The Clean Water Act (CWA)[101] (a term used to encompass the Federal Water Pollution Control Act Amendments of 1972 as amended in 1977 and at other times) has the declared objective of restoring and maintaining the chemical, physical, and biological integrity of the Nation's waters.[102] Although primarily directed toward surface water pollution, CWA contains several provisions that relate to ground water.[103] EPA's implementation of the sections of CWA addressing ground water has focused primarily on the provisions which pertain to state and local planning assistance.[104] The Administrator is to prepare or develop comprehensive programs for preventing, reducing, or eliminating the pollution of ground water and improving the sanitary condition of ground water.[105] He is also to publish criteria for ground water quality.[106] Ground water monitoring is encouraged by making it a condition for states and interstate agencies to receive grants to assist them in administering programs for the prevention, reduction, and elimination of pollution, including enforcement.[107].

In contrast with previous legislation, a feature of this act is its recognition that water quality problems derive from nonpoint as well as point sources of waste discharges which have been the objectives of previous programs. The Administrator is to issue guidelines for identifying and evaluating the nature and extent of nonpoint sources of pollutants, and provide information including processes, procedures, and methods to control pollution resulting from agricultural activities.[108] The

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[101] 33 U.S.C.A. sections 1251 et seq.

[102] 33 U.S.C.A. section 1251 (a) (1986).

[103] U.S. GAO, *supra* note 1, p. 1.

[104] Timothy R. Henderson et al., Groundwater: Strategies for State Action, Environmental Law Institute, 1984, p. 43.

[105] 33 U.S.C.A. section 1252 (a) (1986).

[106] 33 U.S.C.A. section 1314 (a)(1)(2) (1986).

[107] 33 U.S.C.A. section 1256 (a, e) (1986).

[108] 33 U.S.C.A. section 1314 (f) (1986).

act also makes provisions for the Administrator to conduct studies and research programs to determine best management practices (BMPs) to control agricultural pollution.[109] Prior to 1987, most of the efforts to deal with agricultural nonpoint source pollution were contained in section 208[110] of the act, which requires each state to formulate plans for controlling nonpoint pollution. This section also provides for cost sharing for farmers who will adopt agricultural BMPs.[111] It has also been used to fund a variety of ground water activities, including classifying ground water aquifers, determining the extent of ground water contamination, and developing state plans for managing ground water supplies.[112] Two other sections of CWA authorize states to use federal funds to protect ground water. Section 106[113] authorizes states to receive federal funds designed for preventing, reducing, and eliminating water pollution. This authority includes enforcement activities. Section 205(j)[114] allows states to receive federal funds for managing water-quality programs. Several states have appropriated funds from this act to use in a ground water protection program. In fiscal year 1983 Arizona used $1,349,000 from different sections in CWA to use in its ground water protection program; in fiscal years 1981 through 1983 Illinois used $215,838; in fiscal years 1978 through 1983 Maine used $305,622; in fiscal years 1981 through 1983 Massachusetts used $268,000; and in fiscal years 1981 through 1983 Rhode Island used $184,488.[115]

In the recent amendment to CWA, the Water Quality Act of 1987, section 319[116] provides for nonpoint source management programs. This act prescribes that the Governor of each state will prepare a report for the EPA Administrator which identifies those navigable waters within the state which, without additional action to control nonpoint sources of pollution, cannot reasonably

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109 33 U.S.C.A. section 1254 (p) (1986).

110 33 U.S.C.A. section 1288 (1986).

111 33 U.S.C.A. section 1288 (j)(1) (1986).

112 U.S. GAO, *supra* note 1, p. 13.

113 33 U.S.C.A. section 1256 (1986).

114 33 U.S.C.A. section 1285(j) (1986).

115 U.S. GOA, *supra* note 1, *see* pp. 26-80.

116 FWPCA section 319 (1987).

be expected to attain or maintain applicable water quality standards or the goals and requirements of this act. The report must describe the process, including intergovernmental coordination and public participation, for identifying best management practices and measures to control each category and subcategory of nonpoint sources. Upon approval of the submitted report, the Administrator is authorized to make grants for the purpose of assisting the state in implementing the approved management program. Such a grant can be used to carry out ground water quality protection activities which the Administrator determines are part of a comprehensive nonpoint source pollution control program.

The regulatory provisions of CWA do not apply specifically to the protection of ground water, thus have been used to protect the more visible problem of surface water contamination. In two federal court cases the courts held that CWA does not include ground water within it regulatory scheme. In *Exxon Corp. v. Train,*[117] EPA denied Exxon permission to continue disposal of wastes into formally producing deep oil wells. In its' decision for Exxon, the court stated "...the legislative history demonstrates conclusively that Congress believed it was not granting the Administrator *any* power to control disposals into groundwater." In *United States v. GAF Corporation,*[118] the federal government sought temporary and permanent injunctive relief against the drilling of deep wells for subsurface disposal of organic chemical wastes by injection, without the approval of EPA. Again the court found for the party using the wells. In both cases the federal courts held that subsurface discharges do not constitute "discharge of a pollutant" into the waters of the United States.[119]

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[117] 554 F2d 1310, 1329 (1977).

[118] 389 F. Supp. 1379 (1975).

[119] 33 U.S.C.A. section 1362 (12) (1986): (A) any addition of any pollutant to navigable waters from any point source, (B) any addition of any pollutant to the waters of the contiguous zone or the ocean from any point source other than a vessel or other floating craft.

5. Comprehensive Environmental Response, Compensation and Liability Act

The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA),[120] or Superfund, authorizes EPA to take direct action to respond to releases of hazardous substances from disposal sites and to assist in cleaning up emergency spill situations.[121] It is clear that this authority covers protection of ground water since "ground water" is in the statutory definition of "environment"[122] and "natural resources."[123] However, it does not appear that Superfund can be used to control agricultural nonpoint source contamination of ground water.

Superfund consists of three basic features which are especially relevant to ground water protection. First, any release of a hazardous substance in excess of specified quantities must be reported immediately to EPA.[124] The Superfund Amendments and Reauthorization Act of 1986[125] has expanded the definition of "release" to include the abandonment or discarding of containers containing any hazardous substance or pollutant or contaminant.[126] This definition would appear to include discarding pesticide containers. However, the complete section which contains the requirement to report the release also states that this section does not apply to the application of a pesticide product registered under FIFRA or to the handling and storage of such a pesticide product by an agricultural producer.[127] The question can then be raised as to whether this exemption (notably that concerning handling) applies to discarded pesticide containers. If it does not, then regulations could be created against the discarding of the pesticide containers, which if not followed would cause legal action to be taken against the offender. In this manner Superfund would be ap-

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[120] 42 U.S.C.A. section 9601 et seq.

[121] Timothy R. Henderson et al., *supra* note 104, p. 41.

[122] 42 U.S.C.A. section 9601(8) (1986).

[123] 42 U.S.C.A. section 9601(16) (1986).

[124] 42 U.S.C.A. section 9603(a) (1986).

[125] PL 99-499; October 17, 1986.

[126] Ibid, Section 101.

[127] 42 U.S.C.A. section 9603(e) (1986).

plicable to control the contamination of ground water by agricultural pesticides, if only through restricting the amount of pesticide containers discarded on the farmers' property.

Second, Superfund contains liability provisions authorizing EPA to hold polluters liable for costs incurred by government for remedial action, and to force the polluters to undertake cleanup and containment at their own expense.[128] While this action could be taken against those responsible for an accidental spill, it cannot be taken against those applying a pesticide product registered under FIFRA.[129]

Third, a Hazardous Substances Superfund (previously known as the Hazardous Substances Response Fund) is created to finance government responses (such as containment and clean up) to actual or threatened releases of substances that may harm the health or environment, including ground water.[130] The funds will be appropriated to the Superfund equivalent to the taxes received in the Treasury from taxes on crude oil received at refineries, imported petroleum products, taxes on certain uses or exports of crude oil, and other taxes and penalties created under CERCLA,[131] as well as all monies collected from penalties under the Clean Water Act[132] from any onshore or offshore facility from which oil or a hazardous substance is discharged in violation of CWA. There is authorized to be appropriated, out of any money in the Treasury not otherwise appropriated, to the Hazardous Substances Superfund for fiscal years 1987 thru 1991, one-quarter billion dollars for each year.[133] This conceivably could be used to clean up aquifers contaminated by agricultural pesticides.

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128 42 U.S.C.A. section 9607(a) (1986).

129 42 U.S.C.A. section 9607(i) (1986).

130 42 U.S.C.A. section 9631 (1986).

131 42 U.S.C.A. section 9507 (a,b) (1986).

132 CERCLA section 311(b)(6)(B) (1987).

133 42 U.S.C.A. section 9705 (e)(3)(b) (1987).

6. Toxic Substances Control Act

The Toxic Substances Control Act (TSCA),[134] passed within weeks of RCRA, gives the Administrator broad powers to test chemical substances. The Administrator shall by rule require that testing be conducted on any chemical substance or mixture if he (1a) finds a reasonable basis to conclude that the manufacture, distribution in commerce, processing, use, or disposal of a chemical substance[135] or mixture, or that any combination of such activities, presents or will present an unreasonable risk of injury to health or the environment, or (1b) finds that a chemical substance or mixture is or will be produced in substantial quantities, and it enters or may reasonably be anticipated to enter the environment in substantial quantities or there is or may be significant or substantial human exposure to such substance or mixture; and (2) if there are insufficient data and experience with which to reasonably determine or predict the effects such activities involving a substance has on health or the environment, and (3) testing of such substance with respect to such effects is necessary to develop such data.[136] Such testing is intended to develop data with respect to the health and environmental effects for which there is an insufficiency of data and experience and which are relevant to a determination that the activities involving the chemical or mixture do or do not present an unreasonable risk of injury to health or the environment.[137]

TSCA also contains regulatory authority, but significant restrictions apply. If the administrator finds that the manufacture, processing, distribution in commerce, use, or disposal of a chemical substance or mixture, or that any combination of such activities, presents or will present an unreasonable risk or injury to health or the environment, he must apply one or more of the following requirements to such substance or mixture to the extent necessary to adequately protect against such risk using the least burdensome requirements, including (1) a requirement prohibiting

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[134] 15 U.S.C.A. sections 2601 et seq.

[135] Any organic or inorganic substance of a particular molecular identity, unless specifically excluded. *See* 15 U.S.C.A. sections 2602 (2)(A), and (2)(B) (1986).

[136] 15 U.S.C.A. section 2603 (1986).

[137] 15 U.S.C.A. section 2603 (a) (1986).

or limiting the manufacturing, processing, or distribution in commerce of such substance or mixture; (2) a requirement prohibiting or limiting the manufacture, processing, or distribution in commerce of such substance or mixture for a particular use, or a particular use in a concentration in excess of a level specified by the Administrator in the rule imposing the requirement; and (3) a requirement for labeling instructions.[138] In promulgating any of the requirements, the Administrator must consider (1) the effects of such substance or mixture on health and the environment and the magnitude of the exposure of human beings and the environment to such substance or mixture, (2) the benefits of such substance or mixture for various uses and the availability of substitutes for such uses, and (3) the reasonably ascertainable economic consequences of the requirement, after consideration of the effect on the national economy, small business, technological innovation, the environment, and public health.[139] If the Administrator determines that a risk of injury to health or the environment could be eliminated or reduced to a sufficient extent by actions taken under another federal law (or laws) which he administers in part or in whole, he may not promulgate a requirement under this act unless he finds, at his discretion, that it is in the public interest to protect against such risk under this act. To make this decision, the Administrator must consider (1) all relevant aspects of the risk, (2) a comparison of the estimated costs of complying with actions taken under this act and under other acts, and (3) the relative efficiency of actions under this act and under other acts to protect against such risk of injury.[140]

While ground water is not expressly mentioned in TSCA, the act defines "environment" to include water, air, and land and the interrelationship which exists among and between water, air, and land and all living things.[141] This presumably covers ground water. However, the term "chemical substance" expressly excludes any pesticide, as defined in FIFRA, when manufactured, processed, or distributed in commerce for use as a pesticide.[142] Therefore it appears that this act

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[138] 15 U.S.C.A. section 2605 (a) (1986).

[139] 15 U.S.C.A. section 2605 (c) (1986).

[140] Ibid.

[141] 15 U.S.C.A. section 2602(5) (1986).

[142] 15 U.S.C.A. section 2602(2)(B)(ii) (1986).

can not be used to control agricultural contamination of ground water by pesticides. But the definition of "chemical substance" does lend this act to cover agricultural fertilizers. Therefore this act could be used to require tests to be conducted on the effects of fertilizers on the risk of injury to health or the environment.

7. Endangered Species Act

The purposes of the Endangered Species Act (ESA)[143] "are to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, [and] to provide a program for the conservation of such endangered species and threatened species...."[144] This act states that each federal agency shall insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of habitat of such species which is determined to be critical to their survival.[145] Agencies therefore are under substantial mandate to use all methods and procedures which are necessary to prevent loss of any endangered species, regardless of cost.[146]

This act has become a factor in the registration and use of pesticides. Labels of pesticides must be changed by Feb. 1, 1988, to include directions for protecting endangered species, according to pesticide registration notices mailed by EPA in late May, 1987.[147] The labels of affected pesticides will be described in county-specific bulletins, which will be sent to county Extension offices, farm supply dealers, and other groups: the use of listed pesticides in identified ranges of endangered

143 16 U.S.C.A. sections 1531 et seq.

144 16 U.S.C.A. section 1531(b) (1982).

145 16 U.S.C.A. section 1536(a)(2) (1982).

146 *Roosevelt Campobello Intern. v. U.S.E.P.A.*, 684 F2d 1041 (1982).

147 Environmental Reporter, Current Developments, The Bureau of National Affairs, Inc., Vol 18, no 5, May 29, 1987, p. 483.

species will be prohibited.[148] Those using pesticides will be obligated to obtain and comply with the pesticide endangered species bulletins for the counties in which they operate.[149] While this restriction in pesticide use has developed by applying ESA for the protection of endangered species, it could be used as an indirect method of controlling agricultural pesticide contamination of ground water.

In a survey conducted from June to September of 1983 by the U. S. Office of Technology Assessment, one of the questions asked the states was whether selected federal laws and programs have been a help or a hindrance to them.[150] Although most of the states viewed favorably the contribution federal acts have made to their handling of contamination programs, a relatively large number of states noted that some federal acts also have negative effects on their efforts. Several states pointed out problems with some of the federal acts. Two major issues were raised about how the Clean Water Act[151] has hindered state efforts to deal with ground water contamination. First, ten states noted that the act has promoted surface water quality protection efforts to the detriment of ground water quality and has diverted resources away from ground water issues. Second, one state noted that the lack of explicit authority in the law to address discharges to ground water has prevented them from doing so. Two major issues were also raised concerning the Safe Drinking Water Act.[152] Six states stated that the provisions of the Sole Source Aquifer program[153] and the Underground Injection Control program[154] were not applicable to or were of little value for conditions existing in their state. Six states also noted administrative problems with implementation of

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148 Len Richardson, "Striking a Balance - Protecting Endangered Species Means New Restraints," Agrichemical Age, July 1987, p. 17.

149 Ibid.

150 Office of Technology Assessment, Protecting the Nation's Groundwater From Contamination, U.S. Government Printing Office, Washington, D.C., Vol. 1, 1984, p. 98. [The remainder of the discussion in this section (A) will be taken from this report.]

151 33 U.S.C.A. sections 1251 et seq.

152 42 U.S.C.A. sections 300f et seq.

153 42 U.S.C.A. section 300h-3 (1986).

154 42 U.S.C.A. section 300h (1986).

the Underground Injection program. Concerning the Resource Conservaton and Recovery Act,[155] twelve states commented on three major points of concern. First, eight states cited problems with administration of implementation of program requirements, such as difficulty in dealing with EPA staff and coordinating with other EPA programs. Second, five stated noted funding problems for such things as monitoring, laboratory facilities, and increasing needed staff. Finally, three states cited technical shortcomings within the law, such as the lack of information about the adverse effects of various concentrations of contaminants, and the ommission of some known toxic or carcinogenic chemical from the acts hazardous waste list. The Comprehensive Environmental Response, Compensation, and Liability Act[156] had two problems cited with it. Three states noted administrative problems related to problems with coordination and the slow rate of progress in program implementation. One state mentiond the lack of funding to comply with the requirements under the act to evaluate sites. Technical shortcomings were noted by two states with respect to the Federal Insecticide, Fungicide, and Rodenticide Act,[157] which stated that some registered pesticides have contaminated ground water.

B. Farm Programs

Farm programs generally are based on the underlying assumption that government intervention is necessary and desirable in agricultural economic affairs.[158] The language of most farm legislation has made it clear that the farmer is intended as the primary beneficiary of agricultural policies.[159] This intent is most obvious in the case of price support programs but also has been a

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[155] 42 U.S.C.A. sections 6901 et seq.

[156] 42 U.S.C.A. sections 9601 et seq.

[157] 7 U.S.C.A. sections 136 et seq.

[158] A. Desmond O'Rourke, *supra* note 21.

[159] Ibid.

major factor in other programs. For example, maintenance of productivity of land has been an important basis for soil erosion control. Such programs encourage farmers to incorporate agricultural techniques which will reduce soil erosion, thus protecting the farmer's land, while also reducing the flow of soil and nutrients into surface water.

Indirectly, incentives implicit in programs designed to stabilize agricultural income and increase producer prices has stimulated the use of chemicals in agriculture.[160] Several traditional farm programs measures can be shown to encourage agricultural chemical use, including, for example, acreage restrictions, price supports for commodity crops, and income support for farmers.[161] Acreage restrictions have been used to take cropland out of use for environmental conservation purposes or to reduce production of commodity crops. Since restrictions were not placed on the other land the farmer owned, this acreage would be used more intensively through increased fertilizer and pesticide use to get more bushels to the acre. Price and income supports have usually taken the form of government readiness to loan money on harvested crops. In simple terms, an analogy can be made between the procedure of the loan program and that of a pawn shop. In a pawn shop an item is given to the broker for a sum of money, and the item is held for some time until it can be sold. If within that time the original owner wants the item back, he can return to the shop and return the sum received in exchange for the item. In the loan program, the farmer gives the government his commodity in exchange for a value which is higher than could be achieved at the prevailing market price. If, in a given amount of time, the market price for the commodity rises above that which the farmer received from the government, the farmer can return the sum received from the government in exchange for his crop, and sell it at the prevailing market price.[162] The major corps historically supported by farm programs tend to rely on chemically oriented production practices. USDA estimates, for example, that 85 percent of the herbicides and 70 percent

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[160] S.R. Johnson, "Problems, Issues, and Control Options For Agricultural Chemicals," Proceedings of a National Symposium on Agricultural Chemicals and Ground Water Pollution Control, March 26-27, 1987, p. 4.

[161] Sandra S. Batie, *supra* note 11, p. 26.

[162] Personal communication with Dr. Sandra S. Batie, Department of Agricultural Economics, Virginia Polytechnic Institute & State University, January 6, 1988.

of the insecticides are applied to only 4 crops: corn, cotton, soybeans, and wheat.[163] Since price and income supports are available for these crops, it would be safe to assume that some farmers would change to this crop production to be eligible for farm programs, thus increasing the amount of chemicals released to the environment.

Recent farm legislation reflects more environmental sensitivity, but incentives for environmental degradation remain. The most recent major farm bill, The Food Securities Act of 1985 (1985 Farm Bill)[164] provides an example. Its purpose is to conserve national resources, prevent the wasteful use of soil fertility, and preserve, maintain, and rebuild the farm and ranch land resources in the national public interest.[165] Interstate and foreign commerce in cotton, wheat, corn, tobacco, and rice are regulated to the extent necessary to provide an orderly, adequate, and balanced flow of these commodities in interstate and foreign commerce.[166] To this end, two policies which can be shown to encourage agricultural chemical use are used in this bill: price supports and land diversions.

This bill provides price supports for milk, wheat, feed grains (corn, sorghum, oats, barley, and rye), cotton, rice, peanuts, soybeans, and honey.[167] Many of these commodities involve application of substantial quantities of commercial chemicals. Under Title XII part A - Conservation Reserve - the Secretary of Agriculture is to institute a conservation acreage reserve program to take highly erodible cropland out of crop production and place it in conservation in exchange for payments to farmers in cash or commodities.[168] Also in a program termed conservation compliance, if a farmer begins production on highly erodible land planted since 1980, or on land set aside, diverted, or otherwise not cultivated under a crop reduction program, he is ineligible for farm programs unless he begins a conservation plan by the earlier of 1990 or within two years of completion of a soil

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163 The Conservation Foundation, Groundwater Protection, Washington D.C., 1987, p. 148.

164 7 U.S.C.A. sections 1281 et seq.

165 7 U.S.C.A. section 1282 (1985).

166 Ibid.

167 7 U.S.C.A. sections 1446 (d)(1), 1445b-3(b), 1444e(a), 1444-1(a), 1445c-2, 1446(i), 1446(j), 1446(b) (1986).

168 7 U.S.C.A. section 3831 (1985).

survey and completes the conservation plan by 1995.[169] To be in compliance the farmer must also not convert wetlands to cropland.[170] Environmental protection is an obvious intent of these provisions; however, as discussed in Chapter Three, taking farmland out of production while not restricting the farmer to a level of crop production on his remaining acreage, will encourage the farmer to increase production on his remaining acreage to compensate for lost production from the land set aside. This is most easily achieved by increasing chemical application. Provisions in this legislation for protecting certain aspects of the environment therefore can lead to increased chemical loadings and potential for increased contamination of ground water.

C. *Legal Constraints on the Federal Government*

The power for Congress to develop legislation to protect the nation's water against pollution can be taken from its constitutional authority to control interstate commerce.

> It is the power to regulate; that is, to prescribe the rule by which commerce is to be governed. This power, like all others vested in Congress, is complete in itself, may be exercised to its utmost extent and acknowledges no limitations other than are prescribed in the Constitution.[171]

Interstate commerce covers every type of movement of persons and things, whether for profit or not.[172] The material involved in such movement cannot discount it as commerce.[173] The jurisdictional element of water pollution upon which the exercise of the authority of Congress depends is

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[169] 7 U.S.C.A. section 3811 (1985).

[170] 7 U.S.C.A. section 3821 (1985).

[171] *Gibbons v. Ogden*, 22 US 1, 196 (1824).

[172] Sidney Edelman, "Federal Air and Water Control: The Application of the Commerce Power to Abate Interstate and Intrastate Pollution," George Washington Law Review, Vol 33, 1965, p. 1071.

[173] Ibid, pp. 1071-1072.

its interstate character, which depends on whether or not the pollution travels or is transported from the state of its origin and across its boundaries into another state.[174] However,

> The commerce power is not confined in its exercise to the regulation of commerce among the States. It extends to those activities intrastate which so affect interstate commerce, or the exertion of the power over it, so as to make the regulation of them appropriate means to the attainment of a legitimate end, the effective execution of the granted power to regulate interstate commerce.[175]

When Congress has acted to regulate activities which appear intrastate in character but which, taken in total effect will probably have an adverse effect on commerce, the Court "will certainly not substitute its judgement for that of congress unless the relation of the subject to interstate commerce and its effect upon it are clearly nonexistent."[176] Therefore, the regulation of water pollution which endangers the health or welfare of the public is certainly within the reach of the commerce power of Congress.

Many federal programs concerning agriculture appear to be based on the common underlying assumption that governmental intervention in agricultural economic affairs is both necessary and desirable.[177] However, one federal program was found to give too much control to the federal authorities. This federal program held to be unconstitutional was the Agricultural Adjustment Act of 1933 (AAA).[178]

> Beyond cavil the sole object of the legislation is to restore the purchasing power of agricultural products to a parity with that prevailing in an earlier day; to take money from the processor and bestow it upon farmers who will reduce their acreage for the accomplishment of the proposed end, and, meanwhile, to aid these farmers during the period required to bring the prices of their crops to the desired level.[179]

The taxation scheme developed in this act provided for a tax automatically to go into effect for a commodity when the Secretary of Agriculture determined that payments were to be made to the farmer for reducing production of that commodity. The rate of the tax was to be fixed with the purpose of bringing about crop reduction and price raising and was to equal the difference between

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[174] Ibid, p. 1070.

[175] *United States v. Wrightwood Dairy Co.*, 315 US 110, 119 (1942).

[176] *Stafford v. Wallace*, 258 US 495, 521 (1922).

[177] James B. Wadley, *supra* note 7, p. 303.

[178] 7 U.S.C.A. sections 601 et seq.

[179] *U.S. v. Butler*, 297 US 1, 58-59 (1936).

the "current average farm price" and "fair exchange value."[180] The tax could be altered to such amount necessary to prevent accumulation of surplus stocks. The Secretary could exempt a commodity from the tax if he/she found that the policy of the act would not be promoted by the levy of the tax. The whole revenue from the levy was to be applied to aid crop control; none of it was to be placed in the general fund. Thus every dollar collected in processing taxes was to go to the farmer in benefit payments. "Farmers should not forget that all the processing tax money ends up in their own pockets."[181] In 1933 the United States presented a claim against the defendants for processing taxes on cotton levied under authority of this act. The defendant challenged the authority of the United States to make this claim. This case was brought before the Unites States Supreme Court at the end of 1935 in *United States v. Butler.*[182]

The Court first concluded that the act was not an exertion of the taxing power but that the act was one regulating agricultural production, with the tax a mere incident of such regulation.[183] However, the court stated that

> It does not follow that, as the act is not an exertion of the taxing power and the exaction not a true tax, the statute is void or the exaction uncollectible. For ... if this is an expedient regulation by Congress, of a subject within one of its granted powers, "and the end to be attained is one falling within that power, the act is not void because, within a loose and more extended sense than was used in the constitution," the exaction is called a tax.[184]

This led to what the Court asserted as "The great and controlling question in this case" - the contention of the government that article 1, part 8 of the Constitution gives it authority to expend funds raised by the tax solely to aid crop control.[185] The clause relied upon by the federal government as authorization for the legislation confers upon Congress power "to lay and collect taxes, duties, imposts, and excises, to pay the debts and provide for the common defense and general welfare of the United States." However, the Court noted that the government did not contend

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[180] Ibid, p. 58.

[181] Ibid, p. 58.

[182] 297 US 1, (1936).

[183] Ibid, p. 61.

[184] Ibid.

[185] Ibid, p. 62.

that this provision granted power to regulate agricultural production upon the theory that such legislation would promote the general welfare. The government conceded that the phrase "to provide for the general welfare" qualifies the power "to lay and collect taxes." The view that the clause grants power to provide for the general welfare, independently of the taxing power, has never been authoritatively accepted.[186] The Court stated that Congress does not have the right to raise and appropriate money to any and to every purpose according to its will and pleasure. If the tax is not proposed for the common defense or general welfare, but for other objects wholly extraneous, it would be indefensible upon constitutional principles: the powers of taxation and appropriation extend only to matters of national, as distinguished from local, welfare.[187] The Court decided the processing tax was not imposed for the general welfare; therefore it could not be collected.[188] At this point the Court changed the direction of its discussion since it found AAA to be unconstitutional on the grounds that it invaded the reserved rights of the states to regulate agriculture. The taxing power may not be used as the instrument to enforce a regulation of matters of state concern with respect to which Congress has no authority to interfere.

In reaching its decision, the Court rejected the government's assertion that whatever might be said against the validity of the plan if compulsory, it was constitutionally sound because the end is accomplished by voluntary co-operation. The Court gave the following response to this assertion:

> There are two sufficient answers to the contention. The regulation is not in fact voluntary. The farmer, of course, may refuse to comply, but the price of such refusal is the loss of benefits. The amount offered is intended to be sufficient to exert pressure on him to agree to the proposed regulation. The power to confer or withhold unlimited benefits is the power to coerce or destroy. If the cotton grower elects not to accept the benefits, he will receive less for his crops; those who receive payments will be able to undersell him. The result may well be financial ruin. The coercive purpose and intent of the statute is not obscured by the fact that it has not been perfectly successful. It is pointed out that, because there still remained a minority whom the rental and benefit payments were insufficient to induce to surrender their independence of action, the Congress has gone further, and, in the Bankhead Cotton Act, used the taxing power in a more directly [threatening] fashion to compel submission. This progression only serves more fully to expose the coercive purpose of the so-called tax imposed by the present act. It is clear that the Department of Agriculture has properly described the plan as one to keep a nonco-operating minority in line. This is coercion by economic pressure. The asserted power of choice is illusory... The act invades the reserved rights of the states. It is a

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[186] Ibid, p. 64.

[187] Ibid, p. 67.

[188] John T. Schlebecker, A History of American Farming, 1607-1972, The Iowa State University Press, Ames, Iowa, 1975, p. 241.

statutory plan to regulate and control agricultural production, a matter beyond the powers delegated to the federal government. The tax, the appropriation of the funds raised, and the direction for their disbursement, are but parts of the plan. They are but means to an unconstitutional end... . The Congress cannot invade state jurisdiction to compel individual action; no more can it purchase such action... . Congress has no power to enforce its commands on the farmer to the ends sought by the Agricultural Adjustment Act. It must follow that it may not indirectly accomplish those ends by taxing and spending to purchase compliance. The Constitution and the entire plan of our government negative any such use of the power to tax and to spend as the act undertakes to authorize.[189]

Many additional questions were presented and argued by the defense but were not considered or decided by the Court. These questions included whether the exaction of the tax is in violation of the due process clause of the Fifth Amendment and whether the processing tax is wanting in uniformity and so violates article 1, part 8, c. 1, of the Constitution.[190]

The Agricultural Adjustment Act was also held to be unconstitutional in another case, *Wallace v. Smith* (1935),[191] due to provisions giving the Secretary of Agriculture power to license processors, associations of producers, and others engaged in handling agricultural commodities in interstate or foreign commerce, and giving the Secretary power to fix terms and conditions of, and power to revoke, such licenses.

After the original Agricultural Adjustment Act was declared, partially at least, to be invalid, it was amended by the Agricultural Marketing Agreement Act of 1937,[192] which re-adopted much of the original Act. This amendment overhauled AAA of 1933 by removing those parts within the original act which had been declared unconstitutional. The amendment states "No processing taxes or compensating taxes shall be levied or collected under sections 601-608, 608a-608c, 608d-612, 613-619, 620, 623, 624 or this title." The constitutionality of the Agricultural Marketing Agreement Act of 1937 was challenged in *Le Verne Co-op. Citrus Ass'n v. U.S.* (1944),[193] involving a minor issue, when temporary restraining orders were issued against lemon handlers to prohibit shipment in interstate and foreign commerce. The appellants claimed the Act made no provision for a stay against the restraining order while the final decision was pending in review proceeding, thus they

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189 *U.S. v. Butler, supra* note 182, pp. 68-74.

190 Ibid, p. 62.

191 11 F. Supp. 782 (1935) [see AAA sections 1, 2, 8(3), 7 USCA sections 601, 602, 608(3).]

192 7 U.S.C.A. sections 601 et seq. [*See* sections 671-674 (1940) particularly.]

193 143 F2d 415 (1944).

were being denied due process. The court stated that there was no question but that the Agricultural Marketing Agreement Act satisfies the requirements of due process: there is no indication that a complaining party could not secure a stay from the Secretary while the petition for modification was before him, or from the district court while review proceedings were before it.

In 1938, Congress adopted the Agricultural Adjustment Act of 1938[194] to provide encouragement for farmers to incorporate soil conservation practices. Although this Act is used to regulate farm production, there are three basic differences between it and AAA of 1933 (beside the exclusion of processing taxes.)[195] First, the stated purpose of this Act is to encourage soil conservation which will benefit the general welfare of all the people, while the benefits of the '33 Act were directed to a particular group. Second, in the '33 Act the federal government contracted directly with individual farmers, while in this Act various committees work with the farmers. This Act created an organization for the administration of farm programs known as the Agricultural Stabilization and Conservation Service (ASCS). This organization administers federal crop acreage allotments, commodity price support, and certain agricultural conservation programs.[196] It operates through state, county, and community committees for the handling of farm program matters at their respective levels.[197] The state committees supervise the county and community committees. The primary responsibility for determining which farmers receive conservation grants, additional allotments of released acreage and price support loans and payments rests with the county committees. The primary function of the community committee is to elect the county committee. The third basic difference between these Acts arises in the manner through which program restrictions are imposed on farmers. In this Act two-thirds of the farmers of a given commodity in a particular area must approve of a proposed program which will effect crop production in order for the program to be adopted. Even with its adoption, a farmer may still choose to follow the program require-

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[194] 7 U.S.C.A. sections 1281 et seq.

[195] Personal communication with Mr. Wayne Rasmussen, Agricultural Historian, U.S. Department of Agriculture, January 12, 1988.

[196] *Henderson v. ASCS, Macon County, Alabama*, 317 F. Supp. 430 (1970).

[197] Ibid. The following discussion of these committees is also taken from this case.

ments and receive its benefits. The '33 Act also had the two-thirds vote, but with the program adoption all the farmers had to abide by the program requirements. This new approach to regulate farm production, combined with the expanded reading of the Commerce Clause by the Supreme Court which gives the federal government more power to control "local" affairs,[198] led to the court's approval of AAA of 1938. This Act, together with the Agricultural Marketing Agreement Act, constitutes the statutory basis for most of the current major price stabilization and support programs for basic farm commodities.[199]

The primary challenges to the constitutionality of the authority granted to the Secretary of Agriculture have come after the passage of the Agricultural Adjustment Act of 1938. In *U.S. v. Andrews* (1939),[200] the court simply stated "The amended Agricultural Adjustment Act is constitutional." In *Usher v. U.S.* (1944),[201] the court went further by stating "The passage of Agricultural Adjustment Act and the authorization of Secretary of Agriculture to issue regulations under such act is within constitutional power of Congress." In other cases since 1938, the questions raised but not answered in the original AAA have been brought forward again and considered in these later cases. In *U.S. v. Stangland* (1957),[202] the court directly answered specific challenges to the constitutionality of the act. First, it stated that the AAA is not unconstitutional under the Commerce Clause and the Due Process Clause.[203] Citing *Wickard v. Filburn* (1942),[204] the court stated AAA is constitutional under Commerce Clause authority, and also stated that this act certainly did not deny due process since a farmer has the choice to put himself under the act and gain its benefits.

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198 Personal communication with Dr. Leon Geyer, Department of Agricultural Economics, Virginia Polytechnic Institute and State University, January 5, 1988.

199 James B. Wadely, *supra* note 7, pp. 302-303.

200 26 F. Supp. 123, 124 (1939).

201 146 F2d 369 (1944).

202 242 F2d 843 (1957).

203 Const. Art. 1, part 8, c.3 and Const. Amend. 5.

204 317 US 111 (1942).

Second, the *Stangland* court held that the AAA does not effect an unconstitutional delegation of legislative power. Referencing *Currin v. Wallace*[205] the court stated that the Constitution has never denied Congress the necessary flexibility and practicality to lay down policies and establish standards while leaving to selected instrumentalities the making of subordinate rules and the determination of facts to which the policy as declared by the legislature is to apply. Thus Congress can delegate legislative power to administrative bodies.

Third, the court held that the AAA is not unconstitutional on the ground that the act did not apply uniformly. Referring to *Currin v. Wallace*,[206] the court said Congress is not restricted to the making of uniform rules in connection with the commerce power. And in laying taxes, neither Congress nor the states are confined to a formula or rigid uniformity in framing measures of taxation; they may tax some kinds of property at one rate and others at another, and exempt others altogether. They may lay an excise on the operations of a particular kind of business and exempt another type of business closely related to the other.[207]

Finally, the U.S. Supreme Court decision in *Wickard v. Filburn* (1942)[208] can be used to symbolize the extent and nature of governmental regulation of agriculture. In this case, the Court upheld federal regulation of the size of a farmer's crop intended solely for on-farm consumption based on the theory of congressional authority to regulate commerce. Even though the farmers' activity is local and though it may not be regarded as commerce, it may still, whatever its nature, be reached by Congress where impacts on interstate commerce occur. Although the effect of consumption of home grown crops taken individually may be trivial, combined with others similarly situated, it is far from trivial.[209] The prospect raised by this conclusion is that farmer's agricultural operations may be regulated based on their potential rather than actual impact on interstate com-

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[205] 306 US 1 (1939).

[206] Ibid.

[207] *Chas C. Steward Mach. Co. v. Davis.*, 301 US 548 (1937).

[208] 317 US 111 (1942).

[209] This decision did not overthrow *Wallace v. Smith, supra* note 191.

merce, notwithstanding that the activity involved itself is intrastate in nature.[210] However, even a casual examination of recent governmental programs affecting and involving agriculture reveals that a large portion of those programs are not regulatory at all because they have been structured on a voluntary participation basis as opposed to a mandatory participation basis.[211]

The latitude given the federal government by this more liberal interpretation of power bestowed on them by the constitution has allowed the federal government to participate is subsidy programs to encourage soil conservation, which typically include federal regulations that are a prerequisite to receiving aid. In the same manner a subsidy program could be used through which the federal government could regulate agriculture to provide for ground water protection. "As long as the regulations are reasonable, the federal government has the power to regulate in connection with its aid programs."[212] The government can also provide a tax incentive policy where expenditures for ground water protection practices can be deducted from the farmer's income tax, or used as a tax credit. Such policies are currently used for soil conservation expenditures. A "per-acre" nitrogen restriction by the federal government should be held to be valid since more evidence is surfacing which associates agricultural nitrogen use with nitrates in ground water. Similar restrictions are presently used for agricultural pesticides.[213] Finally, the government could impose an excise tax on chemical nitrogen.[214] Several taxes of a regulatory nature are presently imposed similar to a possible nitrogen tax. For example, there is a tax on diesel fuel used by anyone for a highway vehicle. Through any of these policies, or combination of these policies, the federal government should be able to encourage reduction of agricultural contamination of ground water.

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[210] James B. Wadley, *supra* note 7, p. 301.

[211] Ibid, pp. 301-302.

[212] D.L. Uchtmann and W.D. Seitz, "Controlling Non-point Source Water Pollution: A Legal Perspective," Natural Resources Journal, V. 19, July '79, p. 592. The rest of the discussion in this section will be based on this citation, pp. 592-594, and 605-607.

[213] *See* FIFRA *supra* in section A.2. of this chapter.

[214] U.S. Constitution Article I section 8 gives Congress power to lay and collect taxes, duties, imposts, and excises.

III. STATE PROGRAMS FOR GROUND WATER QUALITY PROTECTION

Despite an increasing federal role in pollution control, and mounting national concern over ground water contamination as evidenced by recent interest in adopting additional federal legislation, most observers believe that states will retain the major role in protecting ground water quality.[215] Legal authority exists at the state level to consider the different local factors affecting ground water quality, and the states retain paramount responsibility to protect the health of their citizens. Most states have taken steps to protect ground water from contamination although the extent and effectiveness of existing protection programs vary greatly. Also, the Carter and Reagan Administrations have emphasized state, rather than federal, responsibility in ground water protection.[216] A state government has a wide diversity of options for providing ground water quality protection. The purpose of this chapter is to show what programs are available to control water pollution and how they can be effected to provide for ground water quality protection -- in particular, protection from agricultural nonpoint source contamination of ground water.

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[215] Timothy R. Henderson et al., *supra* note 104, p. 27.

[216] Ibid, pp. 28-29.

Although an almost endless number of approaches and organizational arrangements can be used by state government for ground water quality protection, such programs share the need to perform certain basic functions. Because of these common needs, several essential program elements can be identified that collectively provide a generalized institutional framework. This chapter presents the elements of such a generalized framework and evaluates various options available within the various program elements. Although such categorization must be somewhat arbitrary, this chapter has been subdivided into four sections to present the elements necessary in an effective state program for ground water quality protection. First, alternative state policies for specifying the level of protection to be provided ground water are evaluated. Establishing a ground water policy as the first step in program development will provide a state a goal toward which the remainder of its efforts can be directed. Second, consideration will be given to alternative management strategies for controlling entry of contaminants into ground water consistent with the policy adopted. The strategies available can be combined into four categories: 1) regulation, 2) imposition of liability, 3) use of economic incentives, and 4) education. While each strategy will be discussed separately, various combinations of individual strategies are possible as the states construct their management programs. Third, consideration will be given to the necessary program mechanics and support. Ten items will be discussed which have been shown to be necessary for an effective program. Finally, four case studies will be presented illustrating selected aspects of state ground water protection programs.

A. Ground Water Policy Options

In developing a comprehensive, coordinated ground water protection program, a state should develop a policy to act as the foundation on which the program can be constructed. By agreeing on this policy at an early stage, future conflict can be reduced and a coherent program developed. The establishment of a ground water protection policy will require a great deal of compromising since environmentalists may want to maintain the pristine quality of ground water while development interests may want to engage in activities with potential for ground water contamination with few or no restrictions. To reconcile, or at least accommodate, these competing interests, the state will have to be able to assess its present and future ground water needs, determine the relative importance of the competing interests, and predict the impacts of various activities on ground water quality. The final policy selected by the state will have been affected by prevailing values as reflected in its economic and environmental protection priorities.

State ground water protection policies can be placed into three basic categories: nondegradation, limited degradation, and differential protection. While it is unlikely that a state ground water quality protection policy will fit perfectly into one of these three categories, this breakdown will provide a frame of reference for states looking to develop or adjust their policy.

1. Nondegradation

Nondegradation is the most protective policy, calling for the protection of ground water at its existing quality, and in some cases calling for improvement. The nondegradation concept is strongly preservationist and is based upon a perceived ethical duty to maintain the natural environment for future generations.[217] With respect to surface water, nondegradation policy regarding water resources is well established in the Clean Water Act. In its opening section, CWA states: "The objective of this Act is to restore and maintain the chemical, physical and biological integrity of the nation's waters."

A nondegradation policy generally is subjected to limitations and exemptions during implementation. A typical nondegradation policy would operate under a general presumption against allowing degradation but could contain provision for exceptions based on a determination that 1) sufficient need for economic or social development exists and 2) appropriate beneficial present and

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[217] Stacy Ruda, "The Federal Water Pollution Control Act's Antidegradation Policy and its Application to Groundwater," University of San Francisco Law Review, Vol. 20, Spring 1986, pp. 634-635.

future uses of the waters will not be precluded. Under this approach, parties desiring to conduct activities likely to produce degradation would be required to prove that their ground water contamination is unpreventable, with no other practicable method available, or that the benefits associated with the activity causing the degradation are clearly greater than the costs of degradation.

The most compelling argument for a nondegradation policy is that existing water quality may be needed to meet future needs. Future water needs are difficult to forecast, and a decision to allow ground water contamination now may prove to be a vital mistake in the future. Once ground water is contaminated, it usually stays contaminated for an extended period of time. A nondegradation policy would be suited to areas with large numbers of private wells where ground water is not treated before use. If ground water were contaminated, the treatment of the water at each private well would prove impractical, and the importation of treated water would be costly. Another reason for using a nondegradation policy is that not enough is known about the wide range of potential ground water contaminants. For some carcinogens no safe level exists, or the permitted level of contaminant is very minute.

The most compelling argument against a nondegradation policy is that development and expansion could be severely limited. With a nondegradation policy, ground water protection is given priority over activities which by their very nature degrade ground water, such as oil and gas mining. A state may be reluctant to adopt a policy imposing significant restrictions on such economic activities. A state utilizing this policy must either accept this reduction in economic activities, or limit the scope of this policy so it will apply to limited areas within the state where desired economic expansion will not be unnecessarily denied.

2. Limited Degradation

Limited degradation is similar to nondegradation in striving for minimum degradation of existing ground water quality, but it provides blanket authorization for degradation up to a given standard. A state adopting this policy acknowledges that some contamination of ground water may occur, but it aims to maintain the ground water at as high a quality as possible. A systematic approach to implementing a limited degradation philosophy is the adoption and enforcement of ground water quality standards. Any ground water that is above the set standard may be used until the contaminant concentration falls to the standard, but further contamination is forbidden.

Many of the arguments for a limited degradation policy would parallel those of the nondegradation policy. However, the limited degradation policy has the advantage of protecting ground water from contamination only to the level given by the state, which would likely be the level required to protect public health and welfare (including a safety factor to accommodate uncertainty). This policy does not require that ground water remain in its pristine state for its own sake and therefore provides greater flexibility for pursuit of activities that impact quality.

A problem associated with implementation of a limited degradation policy arises in conducting ground water monitoring to determine when the set ground water contamination standards have been met. Unless an extensive ground water monitoring system is established, ground water contamination above the set standards would probably not be noticed until it has been monitored at a water supply source. By that time extensive contamination may have occurred in the aquifer, making that water source unusable for its intended purpose for an extended period of time. As in the case of nondegradation, limited degradation may also be economically inefficient by holding all ground water in the state to the same high standard.

3. Differential Protection

Differential protection is a use-oriented policy, calling for different levels of ground water quality protection based on present ground water needs, its characteristics, and its anticipated uses.[218] To use a differential protection policy, a state must be able to distinguish between aquifers or ground water regions on the basis of geologic characteristics, depth, and vulnerability to con-

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[218] Ibid, p. 60.

tamination. The state must also be able to distinguish between high quality, high yield drinking water aquifers from those ground water regions not possessing these qualities. With this information a state employing this policy will be able to develop a program to protect the high quality aquifers for present and future drinking water use, and allow some contamination of the poorer quality ground water by other uses such as agriculture or industry.

The most appealing argument for a differential protection policy is its flexibility. It not only allows protection of pristine ground water where appropriate, but it also makes allowance for economic development and growth. It is a realistic policy in that is recognizes that ground water is used for purposes other than drinking water. It would be attractive for states with a large amount of localized industry since it would allow for the designation of areas where controls can be relaxed and waste disposal permitted.

The most readily apparent problem with a differential protection policy is that aquifers are not always clearly separated. Without impermeable boundaries, lower quality water from less protected aquifers may spread to high quality aquifers. States without clearly defined aquifers, and states that presently have uniformly high quality ground water with few threats of contamination problems, would be less likely to choose this policy. Due to the difficulty in predicting future population patterns and ground water needs, choices made now may prove to be restrictive of future options.

B. Management Strategies For Controlling Entry of Contaminants Into Ground Water

The program each state uses to manage agricultural contamination of ground water will be greatly influenced by the political environment in the state and the ability of the state to manage the program. Thus the program chosen to persuade the farmer to reduce or cease his contamination of ground water can be based on one strategy or composed of a number of strategies. After selecting a policy defining its ground water protection goal, a state must chose a strategy for prevention of ground water contamination beyond the levels specified by its policy. The management strategies available to control entry of contaminants into ground water fall into four categories: 1) regulation, 2) imposition of liability, 3) economic incentives, and 4) education. The individual strategies can be used separately or in various combinations. Each is evaluated in the following sections in term of its positive and negative features. The practicality of applying each strategy to agricultural sources of ground water contamination will also be discussed.

1. Regulation

The power to regulate is an essential aspect of government. Every level of government has attempted to create rules and regulations to create what they believe will be the highest state of human welfare achievable. In the area of environmental protection, numerous statutes have been written and enforced when risk to the present or future population can be shown. The federal government has adopted a variety of legislation to provide guidelines and regulations that can provide protection for the environment. Some of these acts were adopted to provide protection for a specific environmental resource. Similarly, the states have adopted a variety of regulatory programs, which currently are often administered in coordination with related federal programs.

This section will present five options which are available as regulatory strategies for state governments to provide protection for the water resources, and will conclude with a discussion of the legal constraints which are imposed on these strategies.

a. Forms of regulatory strategies

A regulatory management strategy can be applied in several forms. The following sections will discuss five forms of regulatory strategies and their applicability or potential applicability for providing ground water protection: 1) enforcement of ground water quality standards, 2) imposition of effluent limitations on activities discharging potential contaminants, 3) imposition of requirements for facility design and operation, 4) banning or restricting use of specified chemicals, and 5) land use controls.

(1). Enforcement of ground water quality standards

Ground water quality standards specify the maximum concentration of contaminants allowed in ground water, or it could be said that they define the level of permissible ground water degradation. These standards traditionally are set by EPA or a state agency to protect ground water that is or will be used by the public as a drinking water supply or other productive purposes. However, health standards for many agricultural pesticides and other chemicals have not been set by EPA.[219] The sheer number of existing and new chemicals makes this task difficult for the agency to accomplish. Part of the problem stems from the fact that evidence linking human health effects to ground water contaminated by chemicals is limited, and interpreting existing evidence is in some cases a subject of controversy.[220] Some states have not waited on EPA to set health standards and have set their own for given chemicals they believe to cause public harm.

Ground water standards alone do not serve to prevent contamination or hold polluters accountable; these standards must be enforced against activities responsible for quality degradation. Ground water monitoring is an integral element in enforcing the standards that have been set (monitoring will be covered later in this report). Once monitoring indicates that the standard has

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[219] John M. Halstead, *supra* note 10, p. 6.

[220] Ibid.

been attained or exceeded, the state regulatory agency can act to achieve compliance with the standard. Unfortunately, once the standard has been attained or exceeded, prevention of contamination is impossible. An alternative measure to waiting until the standard has been met would be to create a second standard somewhat higher than the enforced standard. In Wisconsin a second set of standards called "preventative action limits" (PAL's) has been developed. In the event a PAL is attained or exceeded, the regulatory agency is required to assess the cause of the exceedence and implement responses designed to: 1) minimize the concentration of the substance in the ground water where practicable, 2) regain and maintain compliance with the PAL where practicable, and 3) ensure that the enforcement standard is not attained or exceeded. The agency may not prohibit the activity or chemical contaminating the ground water at the PAL level unless it is able to show that no other alternative is available to prevent exceedence of the enforcement standard.[221]

Development and enforcement of ground water standards involve several difficulties. A political battle has been waging for many years between chemical companies and those wanting to regulate use of their chemicals. For example, disagreements continue as to the standard to be set for nitrates in ground water. Other problems will arise in establishing and maintaining ground water monitoring due to the cost involved. Problems will also arise when attempting to enforce ground water standards that have been set. Ground water standards theoretically add certainty for ground water users and dischargers; the dischargers know to what extent they can contaminate ground water, and the users believe they will be protected from harm. However, in the agricultural context, the farmer does not know the relationship between the amount of pesticides or fertilizers applied to the fields and the amount of contaminant reaching the ground water. Unless this relationship can be determined for each hydrogeology and crop combination, it would appear that ground water standards would not be an effective management strategy to control agricultural nonpoint source contamination of ground water. Even if the relationship between application and contamination were known, identifying the party responsible for ground water contamination may be difficult. Given the numbers of farmers above and around a body of ground water, finding the responsible

[221] Thomas J. Dawson, "Wisconsin Programs on Ground Water Pollution Liability," Proceedings of a National Symposium on Liability Issues and Ground Water Pollution Control, May 22-23, 1986, pp. 117-118.

party would require extensive monitoring and chemical analysis, along with knowledge of the hydrogeology of the region and knowledge of which farmers were applying the chemicals that could have caused the contamination.

The difficulty of enforcing water quality standards has already been discovered in using this policy for dealing with surface water contamination. Due to the large number of dischargers into some bodies of water, the enforcement of ambient standards has been difficult. Locating the party responsible for causing the ambient level to be greater than the standard requires a large amount of personnel and resources, and at times has been impossible.[222]

(2). Imposition of effluent limitations

Effluent limitations restrict the type and amount of contaminants allowed in a facility's discharge into a water body. While effluent limitations can be correlated with the requirements of stream standards, they also can be based on administratively simpler approaches such as a requirement for achievement of wasteload reductions compatible with use of the best technology. Under CWA, for example, EPA has established effluent limitations for specific types of dischargers based on technological capabilities.

Effluent limitations appear to have limited applicability to agricultural non-point source pollution. Agricultural chemical contamination of ground water usually does not occur at a distinguishable source but rather over substantial land areas. The amount of discharge to ground water that will occur is generally unknown at the time chemicals are applied. This conditions also exists in the case of spreading of manure for fertilization. Although this operation would probably take place over a smaller acreage, the effect on ground water would still be difficult to determine. This difficulty in assessing impact stems from the fact that agricultural fertilizers and pesticides are placed on different crops, which are located in various types of soils, at various elevations above the

[222] Roger W. Findley and Daniel A. Farber, Environmental Law in a nutshell, West Pub. Co., St. Paul, Minn., 1983, p. 102.

water table, and in different hydrologic conditions. Each of these factors would have to be taken into account by the state to determine a proper effluent limitation (or chemical application rate) for each crop each farmer is raising. If an effluent limitation were set for each crop condition, another difficulty would arise when the state attempted to enforce these standards. If a farmer was not concerned with meeting the applicable effluent standards, he could easily apply more chemicals to his land since widespread monitoring of actual application would be difficult. The farmer could reduce the rate of application during inspections. From this discussion imposition of effluent limitation on many agricultural activities appears impractical.

(3). Imposition of requirements for facility design and operation

Regulation of facilities discharging or handling potential contaminants can go beyond specifying results to be obtained to include direct requirements for the design and operation of the facilities themselves. Rather than simply impose a no-discharge requirement, for example, the regulatory authority may specify steps to be taken to ensure that discharge does not occur. This approach can operate at two levels. First, minimum criteria for design and operation can be established that leave the owner flexibility regarding choice of equipment and operating procedures. Second, installation of specific equipment and processes can be mandated, with the owner's discretion substantially limited.

Regulations under the Resource Conservation and Recovery Act[223] for disposal of hazardous wastes illustrate the use of detailed facility design criteria. These regulations address such issues as use of liners for containment,[224] use of leak detection systems,[225] and installation of monitoring facilities.[226]

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[223] 7 U.S.C.A. sections 6901 et seq.

[224] 7 U.S.C.A. section 6924 (o)(1)(A)(i) (1986).

[225] 7 U.S.C.A. section 6924 (o)(4)(A) (1986).

[226] 7 U.S.C.A. section 6924 (o)(1)(A)(i) (1986).

On the farm, besides normal household wastes, at least five sources of ground water contamination may exist that may be subjected to design and operation criteria: 1) manure storage, 2) chemical storage, 3) empty chemical container storage and disposal, 4) transference of chemicals to application equipment, and 5) manure and chemical application. If the manure is used as a supplement to chemical fertilizer and applied to the land only at times when it is needed, with a large amount of manure collected between applications, a storage facility is probably warranted. A concrete lined storage tank, with a concrete or an impermeable soil bottom could store the manure and provide adequate safety against ground water contamination. Since virtually all farmers use agricultural chemicals, each farm will have chemicals stored on the land. Prevention of leaching requires that they be placed in a location inaccessible to precipitation. Full containers would need to be placed in an area which could contain any spill so it would not leach to the ground water. Empty containers must also be handled and stored to prevent leaching prior to final disposal in an approved manner. Spills may also occur when transferring chemicals from their containers to the equipment used to apply them to the fields. This transference should be done in an area that would contain any spill. Finally, selection and use of equipment used to break up the earth (i.e. chisel plowing or disking) and equipment used to apply manure or chemicals can be controlled to reduce ground water contamination and still provide the desired results.

The design and operating requirements for these facilities, and the process through which farming equipment is chosen, must have standard requirements, while allowing as much freedom of action as is possible. The one-time cost of constructing the necessary facilities may appear to be an unnecessary expenditure, although in the long term the manure storage tank should produce returns because of reduced fertilizer expenditures. The farmer may also be hesitant to apply different land preparation and chemical application techniques since he probably has a history of satisfactory results with his present practice. Thus, regulations will require strict enforcement and may need support from other strategies such as education (to be considered later).

(4). *Banning or restricting use of specified chemicals*

One alternative for protecting ground water from agricultural chemicals is to restrict the types of chemicals to be applied. At the national level this restriction occurs with respect to pesticides under FIFRA. Each state may review the data concerning a chemical registered by EPA to decide whether to grant a registration for that state.[227] The states may also regulate the use of agricultural chemicals, giving approval for its use statewide or in specified localities.[228] The state of California is one example where pesticide registration is denied if the state believes it to be hazardous, or registration is made only for restricted use, with the local government overseeing the place of its application.[229] A method which would reduce the amount of chemicals reaching ground water is to put restrictions on the use of leachable chemicals near drinking water wells and restricting their use during rainy seasons. Provisions for this method are given in SDWA under the discussion of the wellhead protection program.[230]

(5). *Land use controls*

Ground water is recharged directly from surface water bodies or by the infiltration of precipitation. The connection between land use and ground water quality is obvious. Congress has acknowledged the value of land use regulation in protecting ground water by requiring the states to identify agriculturally related nonpoint sources of pollution and to "set forth procedures and methods (including land use requirements) to control to the extent feasible such sources."[231] Land use regulations are needed since ground water and nonpoint source pollution are difficult, if not

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[227] 7 U.S.C.A. section 136v(a) (1986).

[228] 7 U.S.C.A. section 136v(c)(1) (1986).

[229] *See* Chapter 3.D.2. for a more complete discussion of pesticide registration in California.

[230] 42 U.S.C.A. section 300h-7 (1986): *See* SDWA in previous chapter for a discussion of this and other programs the states are to use to regulate the application of agricultural chemicals.

[231] 33 U.S.C.A. section 1288 (b)(2)(F) (1986).

impossible, to regulate through the traditional methods of effluent and ambient standards used to regulate point-source dischargers.

There is widespread agreement that land use controls are most suited for restricting activities on identifiable, sensitive areas.[232] Once the decision has been made to protect an aquifer, the state must identify the critical recharge areas[233] of the aquifer. Once a critical recharge area is designated, the local authorities could use their planning and regulatory powers to restrict activities within this zone to maintain the level of ground water quality desired.

Zoning is the primary mechanism for controlling land use. Zoning limits the uses that can be made of specified land areas. Zoning regulations have been used to protect sole source aquifers from the threat of contamination from land uses.[234] In Dade County, Florida, a local government uses a plan involving zoning regulations to protect both surface and ground water. Lot sizes and land usage is severely restricted, and agriculture is prohibited in certain critical recharge zones.[235]

Another form of land use control effects the area where the farmer is allowed to apply agricultural chemicals. In California, to use a restricted pesticide, the applicant must obtain a permit from the local County Agricultural Commissioner. If the Commissioner issues the permit, he may put restrictions on the permit specifying the location and conditions present at the time of application.[236] In Nebraska nitrogen fertilizer application is regulated at given locations in the state by local Natural Resource Districts. Through ground water monitoring the average nitrate/nitrogen concentration is determined, and based on the level of concentration, application of commercial nitrogen fertilizer may be banned on certain soils at specific times of the year, or application is simply permitted only at a given time of the year and only with approved inhibitor,[237] or permitted

[232] Timothy R. Henderson et al., *supra* note 104, p. 115.

[233] An aquifer source of large volumes of recharge with long residence time.

[234] *Moviematic Indus. Corp. v. Board of County Comm'rs*, 349 So2d 667 (Fla 1977).

[235] Robert L. Farrett et al., *supra* note 31, p. 37.

[236] Mary Brown, *supra* note 12, p. 284.

[237] An inhibitor allows nitrogen in commercial nitrogen fertilizer to be released over a period of time after application.

only if it is applied either in split (preplant/sidedress)[238] applications, with no more that 50% applied as preplant or with an inhibitor at a rate approved by the district.[239]

The one sure way to control all activity in a critical recharge area, and avoid any legal battles, is to buy the land of interest. Only that part of the ownership rights needed to protect ground water from contamination needs to be purchased. In this manner the full price of the land need not be given. However, public acquisition of even partial property rights imposes high costs to government.

b. Limits on regulation strategies

A state can impose regulations to protect the environment by using its police power -- the inherent right of government to protect the public safety, morals, health, and general welfare.[240] However, some constitutional constraints affect the ability of the states to exercise the police power to protect the natural environment within their borders. This section will discuss limitations on the police power of the states, focusing on the principles the courts will likely use to determine whether the state action under question is within the state's power. It will conclude with a summary showing variation in severity of restrictions among the regulatory strategies.

Although the courts have never been able definitely to circumscribe the police power,[241] general requirements can be stated: the subject matter of the regulation must fall within the scope of the police power, the regulatory measure must be a reasonable means to achieve the purpose of regulation, the measure must not violate constitutional requirements for equal protection under the law, and the impact of regulation must not be so great as to constitute a taking of property.

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[238] Sidedress application is the application of fertilizer part-way through the plant's growth.

[239] Annette Kovar, Natural Resources Districts and Groundwater Quality Protection: An Evolving Role, Paper presented to the 23rd Annual AWRA Conference, Nov. 1-6, 1987, Table 4, p. 17.

[240] *Chicago B. & Q. R., Co. v. Illinois*, 200 US 561 (1906); *Berman v. Parker*, 348 US 26 (1954).

[241] *People v. Brazee*, 149 NW 1053 (Mich 1914), affd. 241 US 340 (1916); *Pope v. City of Atlanta*, 249 SE 2d 16 (Ga. 1978).

The scope of the state police power is wide. A state is not limited to protection of the public health, morals, and safety but is free to comprehend its duty, within constitutional limitations, to protect the well being and tranquility of its communities.[242] The police power is one of the most essential powers, at times the most insistent, and always one of the least limitable of the powers of government.[243]

In exercising the police power, a state has wide discretion in determining its own public policy to safeguard the vital interests and protect the general welfare of its people.[244] In general, it may be said that the police power extends to all the great public needs. It may be put forth in aid of what is sanctioned by use, or held by the prevailing morality or strong and preponderant opinion to be greatly and immediately necessary to the public welfare.[245] Finally, "There is no federal constitutional requirement that a state exercise its police power to the fullest extent at any given time; nor that a state law, from the point of view of equal protection necessity, have a uniform application."[246] Problems occurring in a state in the same field may be perceived by the legislature to be of different dimensions and proportions, requiring different remedies. If there are different problem fields, the legislature may select one phase of one field and apply a remedy there, neglecting the others while addressing itself to the phase of the problem which seems most acute to the legislative mind.[247]

A state cannot, under the guise of protecting the public interest, interfere with the personal rights and liberty of the individual citizen through legislative action which is arbitrary or without reasonable relation to some purpose within the competency of the state to effect.[248] For example, in the state of Nebraska in 1919 a state act was approved which denied the teaching of any language

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[242] *Breard v. City of Alexandria*, 341 US 622 (1951).

[243] *District of Columbia v. Brooke*, 214 US 138 (1909).

[244] *East N.Y. Sav. Bank v. Hahn*, 326 US 230 (1945).

[245] *Noble State Bank v. Haskell*, 219 US 104 (1911).

[246] *Alkire v. Cashman*, 350 F. Supp. 360, 364 (1972), affirmed 477 F2d 598 (1973).

[247] *Williamson v. Lee Optical of Oklahoma*, 348 US 483 (1955); *Hilton v. City of Toledo*, 405 NE2d 1047 (Ohio 1980).

[248] *Meyer v. Nebraska*, 262 US 390 (1923).

other than English to any person who had not successfully passed the eighth grade. The purpose of this act was to cause children of foreign emigrants to learn English; so they would not be educated in their own language so they must always think in that language, "...and, as a consequence, naturally inculcate in them the ideas and sentiments foreign to the best interests of this country." The court counted the act unconstitutional, stating the learning of a foreign language at an early age "... is not injurious to the health, morals, or understanding of the ordinary child."[249] Legislators may not use the police power to impose restrictions that are unnecessary and unreasonable against the use of private property or the pursuit of useful activities.[250] A statute should be declared unconstitutional if it invades personal rights to liberty and is not directed to the promotion of the general welfare.[251]

After seeing that the subject to which a proposed statute relates is within the scope of the police power, it must then be determined whether the regulations prescribed are a reasonable means to achieve the stated purpose,[252] for a statute created through the police power can be made void if it is not reasonable.[253] No all-encompassing test could be used for all regulations as applied in the various situations is possible. The reasonable exercise of the police power will depend upon the social, economic, and political conditions at the time of application;[254] it cannot be measured by past precedents. The test must be based on present-day conditions.[255] It does not necessarily have to be the best regulation, but what is fairly appropriate to its purpose considering all circumstances.[256] Reasonableness will also depend upon the character or nature of the condition

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249 Ibid, p. 398, 403.

250 *State of Washington v. Roberg*, 278 US 116 (1928).

251 *Com. v. Pear*, 66 NE 719 (Mass 1903), affd. 197 US 11 (1905).

252 *Nashville, C. & St. L. Railway v. Walters*, 294 US 405 (1935).

253 *McCoy v. York*, 8 SE2d 905 (SC 1940).

254 *Raleigh v. Norfolk S.R. Co.*, 165 SE2d 745 (NC 1969).

255 *Wholesale Tobacco Dealers Bureau, Inc. v. National Candy & Tobacco Co.*, 82 P2d 3 (Cal 1938).

256 *Doyle v. State*, 511 P2d 1133 (Okl 1973).

to be met or overcome[257] and must take the surrounding facts and circumstances into consideration.[258] The courts may also look to see what has been done in similar cases in determining the reasonableness of a police power regulation.[259]

The test of the reasonableness of an exercise of the police power requires balancing the effects on private interests and the public good to be achieved.[260] It has been settled that the individual's right of liberty is subject to reasonable regulation and restraint under the state's police power in order to preserve the health, safety, morals, and welfare of the community.[261] Moreover, it has been settled that all property is held subject to the right of the state to reasonably regulate its use under the police power, based on the concept that all property within the jurisdiction of the state is held on the implied condition or obligation that its use will not be harmful or deprive the equal right of others to the use and benefit of their own property.[262] A statute may be sustained as a proper exercise of the police power even if the activity constrained is natural and otherwise right or lawful,[263] or if some of the activities not sought to be regulated are found to be constrained by the statute.[264] An individual cannot complain of incidental injury if the police power is exercised for a proper purpose (i.e. protecting public health, safety, or welfare), provided there is no arbitrary and unreasonable application in the particular case.[265] An action through the police power may not be justified if the restraint imposed upon the exercise of a private right is disproportionate to the amount of evil that will be corrected.[266]

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[257] *Sandstrom v. California Horse Racing Board*, 189 P2d 17 (Cal 1948), cert. den. 335 US 814 (1948).

[258] *Board of Zoning Appeals v. Decatur Co. of Jehovah's Witnesses*, 117 NE2d 115 (Ind 1954).

[259] *Wholesale Tobacco Dealers, supra* note 255.

[260] *Communist Party of US v. Subversive Activities Control Board*, 367 US 1 (1961).

[261] *West Coast Hotel Co. v. Parrish*, 300 US 379 (1937).

[262] *Nebbia v. New York*, 291 US 502 (1934).

[263] *Temple Baptist Church, Inc. v. City of Albuquerque*, 646 P2d 565 (N.M. 1982), affd. 468 US 641 (1984).

[264] *Purity Extract & Tonic Company v. C.C. Lynch*, 226 US 192 (1912).

[265] *McClain v. City of South Pasadena*, 318 P2d 199 (Cal 1957).

[266] *City of Russellville v. Vulcan Materials Co.*, 382 So2d 525 (Ala 1980).

The "equal protection of the laws" required by the Fourteenth Amendment of the U. S. Constitution established limitations on discriminatory regulation but does not prevent the states from resorting to classification for the purposes of regulation.[267] A state may draw distinctions between groups and legislate differently for the various groups so designated.[268] Numerous and familiar decisions of the U. S. Supreme Court establish that the states have a wide range of discretion in that regard. However, "...the classification must be reasonable, not arbitrary, and must rest upon some ground of difference having a fair and substantial relation to the object of the legislation, so that all persons similarly circumstanced shall be treated alike."[269] The test of the equal protection clause is whether the difference in treatment is invidious discrimination,[270] which occurs when members of a group, which are intrinsically the same, are treated differently, such as when a particular race or nationality has been selected for oppressive treatment.[271] In this respect a regulation on one type of agricultural chemical and not another is a permitable classification, if a distinction can be made between them, such as between those likely to leach to ground water and those which are not. A particular classification or category cannot be created to discriminate against others. The distinction which makes one subject part of a group, leaving out all others, cannot be made arbitrarily.

Delineation between legitimate application of the police power and unconstitutional taking of property is a complex issue. The fact that a valid exercise of the police power deprives property of its most beneficial use and therefore imposes an economic loss does not render it unconstitutional.[272] The fact that regulations created through the police power prevent the enjoyment of certain individual rights in property without compensation does not constitute a taking.[273] Acts done in the proper exercise of the police power, which merely impair the use of property, do not con-

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[267] *F.S. Royster Guano C. v. Commonwealth of Virginia*, 253 US 412 (1920).

[268] *Alkire v. Cashman*, 350 F. Supp. 360 (1972).

[269] *F.S. Royster Guano Co., supra* note 267, p. 415.

[270] *Williamson v. Lee Optical of Oklahoma*, 348 US 483 (1955).

[271] Words and Phrases, "Invidious Discrimination," Vol. 22A, West Publishing Co., 1958, p. 279.

[272] *Goldblatt v. Town of Hempstead*, 369 US 590 (1962).

[273] *New Orleans Public Service, Inc. v. New Orleans*, 281 US 682 (1930).

stitute a taking, and accordingly do not entitle the owner of such property to compensation from the state or its agents or give him any right of action for the injuries sustained.[274] For example, a realty company in Ohio[275] lost three-fourths of the future value of the acreages they owned when a village rezoned the area including that land from industrial to residential. This action was held constitutional.

A prohibition simply upon the use of property which would be injurious to the health, morals, or safety of a community, cannot, in any just sense, be deemed a taking or an appropriation of property for the public benefit.[276] The question of when or if there is a fifth amendment taking cannot turn simply on general principles of law; it must be based on the particular circumstances of each case.[277] However, the cost of complying with state regulations is an element properly to be taken into account in determining whether such laws are unconstitutional.[278] But cost and inconvenience would have to be very great before they could become an element in the consideration of the right of a state to exert its police power.[279] When considering when a taking would occur, it is certain that a person cannot be compelled under the police power to devote his property to any particular use; however the individual may be compelled to refrain from any use which is detrimental to the public,[280] provided that all right to make a beneficial use is not destroyed.

Determination of whether regulation is a taking of property requires balancing the effect on private interests and the public good to be achieved.[281] The exercise of police power almost inevitably involves the limitation (or perhaps even destruction) of property rights, but there is no vi-

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[274] *Atlantic C.L.R. Co. v. Goldsboro*, 232 US 548 (1914).

[275] *Village of Euclid, Ohio v. Ambler Realty Co.*, 272 US 365 (1926).

[276] *Mulger v. Kansas*, 123 US 623 (1887).

[277] *Aris Gloves, Inc. v. United States*, 420 F2d 1386 (1970).

[278] *Missouri P.R. Co. v. Norwood*, 283 US 249 (1931).

[279] *Erie R. Co. v. Williams*, 233 US 685 (1914).

[280] *Bowes v. Aberdeen*, 109 P 369 (Wash 1910).

[281] *Communist Party of U.S., supra* note 260.

olation of the constitution if the police power is properly exercised.[282] Legislation is a proper exercise of the police power when the collective benefit to the general public outweighs the restraint imposed.[283] In this manner a statute enacted to promote the public health, safety, morals, or general welfare may diminish in value or totally destroy an individual's right because of retroactive application or otherwise.[284] For instance, food, personal property, and even a person's house may be destroyed to halt an epidemic or a threat of a dangerous infection to the public health.

> That a state in a bona fide exercise of its police power may interfere with private property, and even order its destruction, is as well settled as any legislative power can be which has for its objects the welfare and comfort of the citizens.[285]

All the options available as management strategies utilizing regulation must comply with the constraints placed on the state police power. All the options can be (and have been) used by the states for the protection of water resources and be held to be constitutional under the police power, although an action can be held unconstitutional depending on the program details. Sepcifying facility design and operation would probably face the greatest obstacle from the police power if a state were to require the use specific farming equipment, such as a particular fertilizer applicator. The primary burden would be on the state to prove that such requirement is necessary to protect ground water. Use of effluent limetations and water quality standards is well established and should withstand challenge provided that restrictions imposed are reasonable. Precedent also exists for the banning and restriction of the use of specified chemicals within programs under legislation such as FIFRA and TSCA. Use of land use controls is also well established but can constitute a taking if impacts on property rights becomes severe enough.

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[282] *Stephens v. Bonding Ass'n of Kentucky*, 538 SW2d 580 (1976), affd. 625 F2d 737 (1980).

[283] *Foreman v. State ex res. Dept. of Natural Resources*, 387 NE2d 455 (Ind 1979).

[284] *Rothman v. Rothman*, 320 A2d 496 (N.J. 1974)

[285] *McGlone v. Womack*, 111 SW 688, 690 (Ky 1908).

2. Imposition of liability

Activities that impose adverse impacts on others can be controlled by privately initiated legal actions based on individual rights as well as by governmental programs implemented by administrative agencies. Private rights are based primarily on common law. There are no administrative regulations or standards to violate under common law; the issue is potential accountability for harm that may occur as a result of an action. The expectation of liability acts as a deterrent on the activity causing the harm. The extent of the deterrent effect depends directly on the probability that liability will be imposed. To evaluate this issue, consideration must be given to four theories of liability employed: 1) trespass, 2) nuisance, 3) negligence, and 4) strict liability. Consideration must also be given to causation - the evidence the plaintiff must produce showing the defendant caused the harm. Without proof of causation, the plaintiff cannot recover damages. The following sections discuss these two issues, after which consideration is given to financial arrangements for compensating victims where liability is imposed.

a. Theories of liability

The common law theory of trespass is intended to be applied in cases involving injuries resulting from affirmative acts;[286] trespass cannot be based on a mere omission to perform a duty.[287] Liability for trespass will be imposed for trespass which is intentional, the result of recklessness, or the result of an extra hazardous activity.[288] To be liable for trespass for an intentional act, a person must intentionally cause some substance or thing to enter upon another's land.[289] Conduct is in-

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[286] *Steyer v. Westvaco Corp.*, 450 F. Supp. 389 (1978).

[287] *Meredith v. McClendon*, 111 SW2d 1062 (Tex 1938).

[288] *Wilson v. Interlake Steel Co.*, 649 P2d 922 (Cal 1982).

[289] *Born v. Exxon Corp.*, 388 So2d 933 (Ala 1980); *Nissan Motor Corporation in U.S.A. v. Maryland Shipbuilding, Etc.*, 544 F. Supp. 1104 (1982), affd. 742 F2d 1449 (1984).

tentional if the actor realizes (or should realize) that his conduct involves serious risk or likelihood of causing such invasion, and either acts for the purpose of causing it or knows that it is resulting or is substantially certain to result from his conduct.[290] A party who does not realize (but should have realized) the possible consequences of his act may be held liable in trespass even though acting under a mistaken belief of law or fact, however reasonable.[291] The intent to do the act which leads to the trespass is the requirement, not the intent to actually trespass[292]; an unlawful intent is not necessary in order to constitute trespass.[293] An unintended trespass (i.e. the results of an honest mistake) is not excusable in law.[294] The actor, while intending to do the very act which results in the immediate damage, may not even know that his act will constitute a trespass and may be acting in good faith and through honest mistake, and yet be liable in trespass.[295] The trespass need not be in person but may be by the projection of force beyond the boundary of the land where the projecting instrument is employed. Thus, the trespass may be committed by casting earth, discharging water, or other substances upon another's land, or by projecting anything into, over, or upon the land. The foreign matter need not be thrown directly and immediately upon the other's land; it is enough that an act is done with knowledge that it will to a substantial certainty result in the entry of the foreign matter.[296] In order to constitute a trespass, the damage or injury must be the immediate result of the act committed.[297] It is immediate only when it is directly occasioned by, and is not merely a consequence resulting from, the acts complained of.[298] An actor can be liable for trespass if he acts recklessly, when he disregards a substantial risk of danger that either is known

[290] *Wright v. Masonite Corp.*, 237 F. Supp. 129 (1965), affirmed 368 F2d 661 (1966), cert. den. 386 US 934 (1967).

[291] *Baker v. Newcomb*, 621 SW2d 535 (Mo 1981).

[292] *W.T. Ratliff Co. Inc. v. Henley*, 405 So2d 141 (Ala 1981).

[293] *Dial v. City of O'Fallon*, 394 NE2d 84 (Ill 1979).

[294] *Cole v. Eastern Gas and Fuel Associates*, 322 F2d 506 (1963).

[295] *Cover v. Phillips Pipe Line Company*, 454 SW2d 507 (Mo 1970).

[296] *Rushing v. Hooper-McDonald, Ind.*, 300 So2d 94 (Ala 1974).

[297] *Alabama Power Co. v. Thompson*, 178 So2d 525 (Ala 1965).

[298] *Herlihy Mid-Continent Co. v. Bay City*, 293 F2d 383 (1961).

to him or would be apparent to a reasonable person in his position.[299] Recklessness exists where the actor knows that his actions are harmful but fails to realize that is will produce the extreme harm which it did produce; it is in such respect that recklessness and intentional conduct differ in degree.[300]

An actor can be guilty of trespass if he carries on an ultra hazardous activity. An ultra hazardous activity is one necessarily involving a risk of serious harm that cannot be eliminated by the exercise of the utmost care. Six factors may be considered to determine if an activity is ultra hazardous: 1) the existence of a high degree of risk of harm to the person or property of others, 2) likelihood the harm will be great, 3) inability to eliminate the risk by the exercise of reasonable care, 4) the extent to which the activity is not a matter of common usage, 5) the inappropriateness of the activity to the place where it is carried on, and 6) the extent to which the value to the community is outweighed by dangerous attributes.[301] One who carries on an ultra hazardous activity is liable to another whose person or property the actor should recognize as likely to be harmed by the activity, although the utmost care is exercised to prevent the harm.[302]

The common law theory of trespass has recently been applied to ground water contamination. In *Citizens Coordinating Committee v. WMATA*,[303] the defendant allowed its underground fuel storage tank system to leak large quantities of diesel fuel, creating an underground plume of fuel. This plume eventually reached the plaintiff's ground water collection system and also entered the basement of their building. It was held by the court that the pollution of ground water by the defendant which caused harm to the plaintiff was a trespass, actionable at common law.

The elements of a claim based on the common law theory of nuisance are that the defendant is carrying on an activity that is causing an injury or significant threat of injury to some

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[299] *Simpson v. Broglin*, 612 F. Supp. 1162 (1985); *Saaybe v. Penn Cent. Transp. Co.*, 438 F. Supp. 65 (1977).

[300] *Hackbart v. Cincinnati Bengals, Inc.*, 601 F2d 516 (1979).

[301] *Ind. Harbor Belt R. Co. v. Am. Cyanamid Co.*, 517 F. Supp. 314 (1981).

[302] *Ozark Industries, Inc. v. Stubbs Transports, Inc.*, 351 F. Supp. 351 (1972).

[303] 765 F2d 1169 (1985).

interest of the complaintant.[304] The term "nuisance" is incapable of a definition which will fit all cases. It is very comprehensive, including everything that endangers life or health, gives offense to the senses, violates the laws of decency, or obstructs the reasonable and comfortable use of property.[305] No hard and fast rules exist for determining when a nuisance exists; rather, the court must look to the totality of circumstances and attempt to balance the interests of both parties as well as those of the public.[306] Nuisance is based on the maxim that a person shall not use his property so as to harm another and traditionally requires that harm to a plaintiff be found to outweigh social usefulness of the defendant's activity.[307] Liability under a theory of nuisance for the invasion of another's interest in the use and enjoyment of land may result when the invasion is either intentional or unintentional. A person is subject to liability for an intentional invasion when his conduct is unreasonable under the circumstances of the particular case; a person is subject to liability for an unintentional invasion when his conduct is negligent, reckless, or ultrahazardous.[308] Intentional conduct is unreasonable if the gravity of the harm it causes outweighs the utility of the actor's conduct or if the harm is greater than the injured parties should be required to bear without compensation.[309]

The theory of nuisance also has recently been applied to ground water contamination. Pollution of ground water may constitute a nuisance if the polluted water under a property comes into direct contact with and harms the owner or his property.[310] In *Miller v. Cudahy Co.*[311] the defendant, through the operation of its salt plant, created salt pollution of a freshwater aquifer beneath the plaintiff's lands. By this contamination the plaintiffs suffered loss of crop profits, damage to a

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[304] *People of State of Ill. v. City of Milwaukee*, 599 F2d 151 (1979).

[305] *U.S. v. County Bd. of Arlington County*, 487 F. Supp. 137 (1979).

[306] *Boccardo v. U.S.*, 341 F. Supp. 858 (1972).

[307] *Little Joseph Realty, Inc. v. Town of Babylon*, 363 NE2d 1163 (NY 1977).

[308] *Wright v. Masonite Corp.*, 237 F. Supp. 129 (1965), affirmed 368 F2d 661 (1966), cert. den. 386 US 934 (1967).

[309] *McQuilken v. A & R Development Corp.*, 567 F. Supp. 1023 (1983), affirmed 742 F2d 1449 (1984).

[310] *Anderson v. W.R. Grace & Co.*, 628 F. Supp. 1219 (1986).

[311] 592 F. Supp. 976 (1984).

dairy operation, and were forced to replace domestic water wells. The court held the salt plant to be a nuisance where the escape of great quantities of salt from the plant and the invasion of the fresh ground water by the salt annoys the surrounding landowners, endangers their health and their businesses, violates the laws of decency, and unreasonably obstructs their lawful and reasonable use and enjoyment of their lands for agricultural purposes.

Negligence is the omission to do something which a reasonable person, guided by those considerations which ordinarily regulate the conduct of human affairs, would do, or doing something which a prudent and reasonable person would not do, with reference to attendant circumstance;[312] a finding of negligence does not require failure to take extraordinary measures which hindsight demonstrates would have been helpful.[313] Four elements of a cause of action for negligence are 1) a duty or obligation recognized by the law requiring the actor to conform to a certain standard or conduct for the protection of others against unreasonable risks, 2) a failure on the actor's part to conform to the standard required, 3) a reasonable close causal relation between the conduct and the resulting injury, and 4) actual loss or damages resulting to the interests of another.[314] To bring a case of negligence, the act which leads to injury, even though injury may have been unintended, must be an intentional act, a product of the actor's will.[315] Generally, anyone who does an affirmative act is under a duty to others to exercise the care of a reasonable man to protect them against unreasonable risk of harm arising out of the act.[316] Under negligence theory the actor is held accountable only on the basis of the knowledge he could, or should have had at the time he acted; negligence is measured from the actor's perspective and the then foreseeable fu-

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[312] *Ryder Truck Lines, Ind. v. Brennan*, 497 F2d 230 (1974); *Bibler v. Young*, 492 F2d 1351 (1974), cert. den. 419 U.S. 996 (1974); *Massachusetts Lobstermen's Ass'n, Inc. v. US*, 544 F. Supp. 740 (1982).

[313] *Bibler*, ibid.

[314] *U.S. v. M/V Big Sam*, 454 F. Supp. 1144 (1978), affirmed in part, reversed in part 681 F2d 432 (1982), cert. den. 462 US 1132 (1983); *Spurlin v. General Motors Corp.*, 528 F2d 612 (1976); *Ward v. Hobart Mfg. Co.*, 450 F2d 1176 (1971).

[315] *Jones v. Wittenberg University*, 534 F2d 1203 (1976).

[316] *Suchomajcz v. Hummel Chemical Co., Newark, New Jersy*, 524 F2d 19 (1975); *Arnold's Hofbrau, Inc. v. George Hyman Const. Co., Inc.*, 480 F2d 1145 (1973).

ture;[317] negligence will not be found if the relevant conditions or risk of a given action could not reasonably have been anticipated at the time of the alleged negligent conduct.[318] The cornerstone of the doctrine of negligence is behavior which should be recognized as involving unreasonable danger to others; there must be a foreseeable risk that the injury will occur, sufficiently great to lead a reasonable person to anticipate and guard against it. In the absence of such foreseeability, there is no negligence.[319] Requirement of reasonable foreseeability does not mean that the exact occurrence or the precise injury need be foreseen; all that is necessary is that the defendant should have been able to foresee that some injury to some person might result from the negligent act.[320] Failure to use ordinary care, which is that degree of care that a person of reasonable prudence would exercise under the same or similar circumstances, is negligence.[321] In negligence cases the duty is always the same: namely, to conform to reasonable conduct in light of the apparent risk.[322] A party is not relieved of a charge of negligence merely because he has done what is customarily done, if what is customarily done amounts to failure to exercise reasonable care under the circumstances of the particular case.[323] Compliance with customs and practices of an industry is not in itself due care;[324] custom and usage do not justify negligence.[325]

The common law theory of negligence has been extensively used in cases involving the aerial application of agricultural chemicals. Several courts have held the farmer and/or chemical applicator to be liable when the chemical was applied negligently so that neighboring landowners

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[317] *Jackson v. Firestone Tire & Rubber Co.*, 778 F2d 1070 (1986); *Rodregue v. Dixilyn Corp.*, 620 F2d 537 (1980), cert. den. 449 US 1113 (1981).

[318] *Dunz v. Utah Power & Light Co.*, 526 F2d 500 (1975).

[319] *Mayfield v. Wall Shipyard, Inc.*, 510 F. Supp. 605 (1981); *Boles v. La Quinta Motor Inns*, 680 F2d 1077 (1982).

[320] *Horstein v. General Motors Corp.*, 391 F. Supp. 1274, (1975); *Suchomajcz, supra*, note 319.

[321] *Duckworth v. Greyhound Lines, Inc.*, 469 F2d 424 (1972).

[322] *Livingston v. Gribetz*, 594 F. Supp. 238 (1982).

[323] *United Barge Co. v. Notre Dame Fleeting & Towing Service, Inc.*, 568 F2d 599 (1978).

[324] *Schlichter v. Port Arthur Towing Co.*, 288 F2d 801 (1961), cert. den. 368 US 828 (1961).

[325] *Tug Ocean Prince, Inc. v. U.S.*, 584 F2d 1151 (1978), cert. den. 440 US 959 (1979).

were harmed. In *J.L. Wilson Farms, Inc. v. Wallace,*[326] farmers suffered damage to their crops after a crop duster sprayed an adjoining farmer's fields. The farmers sued the operator of the adjoining field, the airplane owner, and pilot for damages to their fields. Evidence was presented showing the defendants failed to follow procedure and notify the proper board of the intended spraying of 2-4-D, which was known to drift from the area of application. The airplane owner and pilot also failed to have the pilot authorized for applying this chemical, and the owner failed to have the airplane and equipment inspected for this type of application. The action was therefore negligent, and the defendants were held accountable for damages, with the cost pro-rated among them.

The common law theory of strict liability is based on the assumption that some activities are so dangerous and harmful that their conduct by a defendant which results in injury subjects the actor to automatic liability. The modern doctrine of strict liability for this type of activity arose from *Rylands v. Fletcher,*[327] a nineteenth-century English case. In this case Justice Blackburn wrote:

> the true rule of law is that the person who for his own purposes brings on his lands and collects and keeps there anything likely to do mischief if it escapes, must keep it in at his peril, and, if he does not do so, is prima facie answerable for all the damage which is the natural consequence of its escape.[328]

The opinion also stated that one

> who has brought something on his property which was not naturally there, harmless to others so long as it is confined on his own property, but which he knows to be mischievous if it gets on his neighbor's, should be obliged to make good the damage which ensues if he does not succeed in confining it to his own property.[329]

The California Supreme Court in 1928 brought a broad principle of strict liability into the 20th century in a case which involved the "blowing out" of an oil well during drilling operations, resulting in an eruption of oil, gas, mud, and rocks which poured onto the plaintiffs dwelling and property.[330] The court stated:

> Where one, in the conduct and maintenance of an enterprise lawful and proper in itself, deliberately does an act under known conditions, and, with knowledge that injury may result to another, proceeds, and injury is done to the other as the direct and proximate consequence of the act, however carefully

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326 590 SW2d 42 (1979).

327 3 L.R.-E. & I. App. 330 (1868).

328 Virginia E. Nolan and Edmund Ursin, "The Revitalization of Hazardous Activity Strict Liability," North Carolina Law Review, Vol. 65, 1987, p. 260. (Quotation from *Rylands*, ibid).

329 Ibid.

330 *Green v. General Petroleum Corp.*, 270 P 952, 955 (Cal. 1928).

done, the one who does the act and causes the injury should, in all fairness, be required to compensate the other for the injury.

This broad principle of strict liability has recently been applied to hazardous substances discharged into surface water.[331] In this case the appellant was discharging industrial waste into a creek known to cross plaintiff's land. The court stated that the appellant,

> by intentionally discharging its effluent into the stream, became liable for all of the foreseeable damages resulting from the harm caused by the effluent. In other words, one who intentionally discharges potentially hazardous effluent into a stream does so at his peril and is liable for the foreseeable injuries and damages that may result therefrom.

A decision of the Oregon Supreme Court in 1982 assists in refining this concept.[332] The court stated that "whether the danger is so great as to give rise to strict liability depends both on the probability and on the magnitude of the threatened harm." Thus, if "the consequences of a mishap are potentially lethal or highly destructive of health or property, a slight likelihood that they will occur suffices."[333]

The theory of strict liability has already been applied to ground water contamination. In *Mowrer v. Ashland Oil & Refining Co., Inc.*,[334] the theory of strict liability was applied in a case involving damages sustained when oil seeped from the defendants capped oil well and leaked into and contaminated the fresh water well that supplied plaintiff's domestic water. The "abnormally dangerous activity" rendered the oil company strictly liable for damages sustained. Also, in *Branch v. Western Petroleum, Inc.*[335] the theory of strict liability was used against the defendant who ponded water containing a toxic substances in an area adjacent to the plaintiff's water wells, which constituted an inappropriate use of the land in light of its proximity to the plaintiff's property and was unduly dangerous to the plaintiff's use of well water. It was of no consequence that the business was a lawful business.

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331 *Atlas Chemical Industries, Inc. v. Anderson*, 514 SW2d 309, 315 (Tex 1974), affd. 524 SW2d 681 (1975).

332 *Koos v. Roth*, 652 P2d 1255, 1260 (Or 1982).

333 Ibid.

334 518 F2d 659 (1975).

335 657 P2d 267 (Utah 1982).

Is strict liability an appropriate legal theory to apply to agricultural ground water contamination? Although agriculture in general is not an abnormally dangerous activity for which strict liability is usually reserved, the hazardous nature of agricultural chemicals is clear, as the courts have shown in the previous cases involving negligent aerial application of agricultural chemicals. The fact that agriculture is common or engaged in by many people in a community does not preclude strict liability. Farming, regardless of the number of people who engage in it, creates risks of harm unlike the risks of harm routinely created by individual members of the public who pursue their everyday activities (i.e. driving an automobile from place to place). "Moreover, the strict liability rule applies even if these hazardous enterprises themselves create such risks as a part of *their* common everyday business practices."[336] Another factor that influences application of strict liability is whether the activity is taking place in an area that is uncommon or unsafe for that practice. The use of agricultural chemicals above karst topography or in sandy soils is recognized to be a considerable hazard to ground water. Thus, strict liability may be especially appropriate in such areas if precluded for general application. The courts have even found strict liability despite the fact that a practice is quite appropriate in an area and its use by farmers is prevalent.[337] The court in *Koos v. Roth*, a case involving a farmer burning off his field as an agricultural technique, recognized that the potential for harm would be different depending on the place where the activity is conducted. "A danger that is only ordinary in an appropriate location may be abnormal where it exposes others to an extraordinary risk or magnitude of harm... ." Thus "an activity is not otherwise immune from strict liability because it is 'appropriate' in its place."[338]

Comparison of these four theories of common law liability indicates many similarities between the different theories. However, major differences exist between the theories. In determining whether an invasion of a property interest is a trespass or a nuisance, reliance should not be placed on whether the intruding agent is "tangible" or "intangible." Instead, an analysis must be made to determine the interest interfered with: if the intrusion interferes with the right to exclusive pos-

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[336] Virginia E. Nolan et al., *supra* note 328, p300.

[337] *Langan v. Valicopters, Inc.*, 567 P2d 218 (Wash 1977).

[338] *Koos v. Roth*, *supra* note 332, p. 1263.

session of property, the law of trespass applies; if the intrusion is to the interest in the use and enjoyment of property, the law of nuisance applies. However, the remedies of trespass and nuisance are not necessarily mutually exclusive.[339] The common law theories of nuisance and negligence are completely distinct concepts, where the actor's failure to act reasonably, which is an essential element in deciding negligence, is simply not relevant in deciding nuisance. Negligence of the actor is not ordinarily an essential element in an action for damages sustained by reason of a nuisance.[340] Negligence and strict liability can be distinguished in that negligence requires the plaintiff to show a breach of duty of due care by the defendant, while in strict liability degree of care is unimportant: here, the plaintiff must show that the product or activity was unreasonably dangerous.[341]

Of the four theories of liability, the probability that liability will be imposed is greatest if the theory of strict liability is used. With the theory of trespass or nuisance, not only must causation be shown, but the plaintiff must show that their harm is not reasonable when compared to the utility of the defendant's business. The least probability that liability will be imposed occurs when the theory of negligence is used. This theory faces the same obstacles as trespass and nuisance, and also requires proving the action leading to the harm was a negligent act. Under this theory, even with the other parts proven, if negligence cannot be proven, the defendant will not be held accountable.

b. Causation

A primary stumbling block when applying a theory of liability to impose accountability on the source of an injury is proving the defendant is the party responsible for the harm. When a plaintiff brings action for harm against the party he believes to be responsible, the burden of fur-

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339 *Cloud v. Loin Corp.*, 553 F. Supp. 528 (1982); *Borland v. Sanders Lead Co., Inc.*, 369 So2d 523 (Ala 1979).

340 *State v. Lloyd A. Fry Roofing Co.*, 246 NW2d 692 (Minn 1976).

341 *Werner v. Upjohn Co., Inc.*, 628 F2d 848 (1980), cert. den. 449 US 1080 (1981).

nishing proof of a causal relationship is on the plaintiff.[342] An injury or damage is proximately caused by an act, or a failure to act, whenever it appears from the evidence in the case that the act or omission played a substantial part in bringing about the injury or damage, and that the injury or damage was either a direct result or a natural or probable consequence of the act or omission.[343] "Proximate cause" has also been defined as any cause which in a natural and continuous sequence, unbroken by any efficient intervening cause, produces the result complained of and without which the result would not have occurred.[344] The plaintiff's complaint to the court must contain a statement of the acts of the defendant that constitute the liable action.[345] There can be no recovery by plaintiff except on the case made by his pleading.[346] The degree of proof required in a liability case, and the weight and sufficiency of the evidence offered in support thereof, must be such that the plaintiff can show by a preponderance of the evidence that the injury or loss was the proximate result of the defendant's action.[347] It is not sufficient for the plaintiff to show the defendant might have been guilty of the injurious act; the evidence must point to the fact that the defendant is guilty, and where testimony leaves the question unanswered and shows one of several things may have brought about the plaintiff's condition, there can be no action taken against the defendant.[348] While the decision of the court cannot be made against the defendant upon a bare preponderance of evidence which leaves the issue in doubt,[349] the plaintiff does not need to prove his case beyond a reasonable doubt. He is required to persuade by a substantial margin, to come forward with more that a bare preponderance of the evidence to prevail.[350]

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[342] *Flansberg v. Montana Power Company*, 460 P2d 263 (Mont 1969).

[343] *Leistra v. Bucyrus-Erie Company*, 443 F2d 157 (1971).

[344] *Kopriva v. Union Pac. R. Co.*, 592 P2d 711 (Wyo 1979).

[345] *Matthews v. Forrest*, 69 SE2d 553 (NC 1952).

[346] *Vickers v. Russell*, 117 SE2d 45 (NC 1960).

[347] *Clark v. Hodges*, 39 SE2d 252 (Va 1946).

[348] *Indianapolis Transit System, Inc. v. Williams*, 269 NE2d 543 (Ind 1971).

[349] *Schneiderman v. U.S.*, 320 US 118 (1943).

[350] *United Mine Workers of America v. Gibbs*, 383 US 715 (1966).

An example of the necessity of proving causation is given in *Branch v. Western Petroleum, Inc.*.,[351] In this case the plaintiff sued adjoining owners for pollution of plaintiffs' drinking water wells caused by percolation of oil well formation waters which defendant had ponded on its property. The court stated that the major issue was whether and how the defendant's formation waters caused the pollution of the plaintiff's wells. A private geologist and a state geologist were brought into the case by the two parties, and the geologists agreed on the hydrogeology of the area in question, but disagreed as to whether the polluted waters had percolated down into the water formation from which the plaintiffs obtained their water. After much testimony, the court found that the defendant was responsible for 66% of the pollution in the plaintiff's old well and 52% of the pollution in their new well. Thus showing causation will not only determine whether the defendant will be held liable but can also provide to what extent he must pay for damages.

c. *Financial arrangements for paying damages when liability is imposed*

The final question raised in imposing liability for ground water contamination is who should pay for the harm inflicted. The principles of liability apportion accountability between the injured party and those responsible for the harm. The court in *Atlas Chemical Industries, Inc. v. Anderson*[352] stated the owner of the property to which the damage occurred certainly should not be expected to pay: "We know of no acceptable rule of jurisprudence which permits those engaged in important and desirable enterprises to injure with impunity those who are engaged in enterprises of lesser economic significance." Also in *Koos v. Roth*[353] the court stated "to say that when the activity has great economic value the cost should be borne by others is no more or less logical than to say that when the costs of an activity are borne by others it gains in value."

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351 657 P2d 267 (Utah 1982).

352 *Atlas, supra* note 331, p. 316.

353 *Koos v. Roth, supra* note 332, p. 1262.

Where multiple parties are associated with the injury-causing activity, the judicial process also must apportion a damage award to the injured party among the various parties involved. In the case of agricultural contamination of ground water, potentially liable parties include the owner of the farmland, the applicator of agricultural chemicals, and the manufacturer of chemicals. In a case involving a farmer employing a crop duster to apply pesticides on his fields which damaged adjoining property[354] the court stated, in holding the farmer liable, that he was within his

> legal rights in depositing the insecticide on [his] lettuce field for the purpose of ridding it of the worms with which it was infested, and [he] could do this work [himself] or [he] would contract it, but, because of the very great likelihood of the poisonous dust or spray spreading to adjoining or nearby premises and damaging or destroying valuable property thereon, [he] could not delegate the work to an independent contractor and thus avoid liability ... .

However, if the harm occurs due to the negligent act of the independent contractor, the contractor is liable.

Another party which can and has been liable for damage from chemicals is the chemical manufacturer. Chemical manufacturers have been held liable for damages under two circumstances: when the contents of the chemical used were not true to the label,[355] and in at least one special case when the chemical responsible for the damage has not been tested in that state before being put on the market.[356] But, if negligence on the part of the manufacturer could not be shown (i.e. through faulty labeling or possible lack of testing), then the chemical manufacturer could not be held liable for damage.[357]

The fairness of imposing liability on the farmer who is contaminating ground water is apparent when one recognizes the economic benefits the farmer enjoys from employing this hazardous activity. It would appear that requiring the farmer to pay for damages rendered would give him economic incentive to look for other methods to raise his crops other than using large amounts of chemicals. However, if the farmer continues these present practices and is held to be liable, he will need to be able to endure the payment of damages.

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[354] *Gerrard v. Fickler*, 27 P2d 678, 680 (Ariz. 1933).

[355] *Wist v. Hayes*, 361 P2d 171 (Wash 1961).

[356] *Ebers v. General Chemical Co.*, 17 NW2d 176 (Mich 1945).

[357] *Walton v. Sherwin-Williams*, 191 F2d 277 (1951); *McKennon v. Jones*, 244 SW2d 138 (Ark 1951).

Because of the financial burden that can be imposed by liability, creation of an insurance or other compensation program may be desirable. Since ground water contamination mitigation measures have the potential to cost far more than the individual can pay, an insurance pool created by multiple contamination sources would be more likely to have the funds for the mitigation. The funds from this insurance pool, to which those covered would be required to contribute, would be available to any member of the pool to pay the cost for mitigating ground water contamination they have caused. By belonging to such a pool, the members are acknowledging that they are accountable, or will be held accountable, for the mitigation of any ground water contamination contributed to by their farming practices.

In order for voluntary participation to occur, the farmer must first realize that he will be held accountable for the contamination of ground water by the chemicals he applies to his fields, and he must be made aware of the great costs he would encounter in mitigating the contamination. The insurance rate the farmer would pay could be based on the amount and the type of pesticide or fertilizer applied to his fields, the amount of acreage he has in production utilizing agricultural chemicals, the hydrology of the land used, the yield he receives from land using agricultural chemicals, and any other related characteristics. Relating the insurance rate to the amount and type of chemicals used on the land creates a disincentive for use of dangerous chemicals. However, a difficulty in implementing such a policy arises in monitoring chemical use. One approach would involve each farmer reporting what type of cropping is to be carried out for each season, and what chemicals are to be used. The records from the businesses selling chemicals could be checked to confirm the chemical purchase. However, stockpiling could still be possible, so random checks at the farms may be necessary.

An easier policy to administer would be use of acreage to determine rates. However, this policy may encourage reliance on agricultural chemicals since the farmer may get better yields without being penalized for the additional usage, leading to increased ground water contamination.

3. Economic incentives

Using economic incentives as a management strategy employs the inherent tendency to maximize gain to encourage the individual to alter behavior in a socially desirable manner. Economic incentives can come in two forms: subsidies or penalties. A subsidy is a payment by the government (or another party) to a person, company, or another government to encourage behavior that advances some public policy goal. Conversely, threat of a penalty can be used by the government to discourage behavior that causes public harm.

The potential for economic incentives employed to achieve one set of objectives to produce unintended adverse effects in other areas is an important factor in ground water quality protection. Since the 1930's, the federal government has employed economic incentives through programs that have sought to assure the farmer a reasonable income while concurrently protecting the nation as a whole from the effects of a farm crisis by seeking to maintain an abundant and reasonably priced supply of food and fiber for the consumer. The aims of these programs have been to stabilize farm prices, reduce input costs, make more efficient use of farm resources, expand the scale of farming operations, and (more recently) to promote soil conservation.[358] Unfortunately, these incentive programs may actually encourage practices that contribute to agricultural ground water contamination. A first consideration concerning incentives therefore is to evaluate existing farm programs to identify provisions that may lead to increased ground water contamination.

The following section considers potential restructuring of existing incentives in farm programs to reduce their effect of stimulating practices leading to ground water contamination. The next two sections discuss economic incentives that may be applied for protection of ground water from agricultural nonpoint-source contamination: 1) taxation of contaminants and 2) public cost sharing of ground water protective measures.

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[358] James B. Wadley, *supra* note 7, p311.

a. Restructuring of incentives encouraging contaminating practices

Federal subsidy programs are quite common in agriculture. These subsidy programs can have unintended and undesirable effects on ground water quality. As discussed in an earlier section,[359] price support programs have encouraged large-scale monoculture[360] - the continued planting of one crop on a given section of land - since support is provided for a narrow range of crops. The types of crops supported by this program depend on chemical fertilizers and pesticides.[361] Thus, an unintended effect of this subsidy is an increased threat of ground water contamination by agricultural chemicals. One possible way to remedy this problem would be to incorporate "cross-compliance" into farm programs, making price and income support available only if crop rotation, or some other less chemical reliant approach to supplying nutrients and provide pesticide protection, is employed.

Another type of subsidy is the set-aside programs used to induce farmers to take land out of production in exchange for other farm program benefits. When set-sides are needed to reduce production, farmers have historically set aside their poorest land. However, either slippage occurs, where more land outside the area of supply control is brought into production, or the application of pesticides and fertilizers is increased on the land remaining in production to help offset production losses on the land set aside. When slippage occurs the amount of contaminants reaching ground water may not significantly decline but may simply change location. The amount of contaminants may increase if more poor land is brought into production if more fertilizer is applied in attempting to make up for the poor quality soil. When production is increased on the remaining land with the increased use of chemicals, the amount of contaminants reaching ground water gen-

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[359] Chapter 1A.

[360] Harold F. Breimyer, "The Institutional Setting for a Resource-Conserving Agriculture," Proposed 1985 Farm Bill Changes: Taking the Bias Out of Farm Policy, Institute for Alternative Agriculture, Inc., 1985, p. 14.

[361] Government availability of price support is mandatory for corn, wheat and cotton. (*See* Cochrane and Ryan, American Farm Policy, Univ. of Minnesota Press, Minneapolis, 1976, p. x). USDA estimates that about 90 percent of all herbicides and insecticides are applied to only 4 crops: corn, wheat, cotton and soybeans. Corn by itself accounted for 54 percent of all herbicides and 43 percent of all insecticides. (*See* Sandra S. Batie, *supra* note 11, p. 28).

erally would also increase. As an alternative to acreage controls to reduce excess supply, controls on agricultural production could take the form of quantity controls (bushels or pounds).[362] Controls of this type would not allow increased production by slippage or increased use of chemicals. Poundage quotas are currently used in the tobacco and peanut programs.[363]

In addition to the incentives created by farming assistance programs, ground water is also affected by governmental incentives that focus on other objectives. Protection of surface water quality is an example. To help reduce nonpoint source pollution of surface waters, the federal government has created incentives for farmers to employ practices that reduce soil erosion and resulting pollution of surface waters. Some of these programs can increase ground water contamination. One such program has just recently been developed in the Food Security Act of 1985.[364] A major provision in the Act[365] creates a voluntary program which allows farmers to contract with the government to switch highly erodible cropland to grass or trees. As already noted, any type of acreage restriction carries the possibility of the farmer increasing the chemical loading on remaining cropland to make up for the acreage lost to planting. Other provisions of the Act[366] also provide for acreage limitations, land diversion (land use changed from cropping to conservation, wildlife, or public use), or set-asides (crop land used only for hay or grazing). The Act does not address ground water contamination.

A special practice designed to protect surface waters that may lead to increased ground water contamination is conservation tillage. Although conservation tillage is being heavily promoted by USDA and the agrichemical industry,[367] concerns are being raised. While there are differing views about whether conservation tillage requires a greater fertilizer application as compared

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[362] James E. Anderson, *supra* note 22, p. 8.

[363] 7 U.S.C.A. sections 1314c, 1358(m) (1985).

[364] 7 U.S.C.A. sections 1281 et seq.

[365] 7 U.S.C.A. section 3831 (1985).

[366] 7 U.S.C.A. sections 1441-(1)(f), 1444-1(f), 1444e(f)(1), 1445b-3(f)(1) (1985).

[367] Randall A. Kramer, "Soil Conservation Policy and Alternative Agriculture," Proposed 1985 Farm Bill Changes: Taking the Bias Out of Farm Policy, Institute for Alternative Agriculture, Inc., March, 1987, p. 42.

to conventional tillage, a large amount of literature and case studies supports the fact that conservation tillage requires more fertilizer per acre.[368] In addition, "conservation tillage typically uses more pesticides, particularly herbicides, than conventional tillage."[369] With these increased loadings associated with conservation tillage, ground water contamination may increase.[370]

These problems demonstrate the importance of coordinating federal policies and programs if ground water is to be effectively protected. Close coordination is needed between EPA and USDA so that trade-offs may be made explicitly and not by default. The bias written into the subsidies and incentives need to be removed so that farmers who wish to use alternative forms of farming practices (some of which are discussed in the next section) will not be discouraged from adopting such practices. Certain subsidies that encourage farmers to farm more intensively could be reduced or eliminated, while subsidies and incentives promoting alternative forms of farming known to be effective in protecting the environment could be established. Research could be done continually to discover or improve alternative agricultural methods that do not rely primarily on chemicals.

b. Taxation of contaminants

Leading scholars in law, economics, finance, biology, environmental science, and tax policy have recommended increased reliance upon taxation or imposition of other fees as a means of reducing environmental costs.[371] Environmental damage is often external to the party responsible for the problem. Imposing a tax on generation of pollution can internalize the impact of the environmental contamination to the party responsible for the contamination. In this way activities causing environmental degradation are forced to consider environmental impacts in their decision making

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[368] Pierre Crosson, *supra* note 14, pp. 7-9, 27.

[369] Ibid, p. 27.

[370] Randall A. Kramer, *supra* note 367, p. 43.

[371] Richard J. Pierce, Jr., "The Constitutionality of State Environmental Taxes," Tulane Law Review, Vol 58, 1983, p. 171.

process, that is businesses would be expected to engage in a contaminating activity to the extent that the associated costs (including any applicable taxes) are less than the costs of an alternative. As the cost of the contaminating activity increases, alternatives become relatively more attractive and the amount of contamination decreases. The level at which the tax is set will determine the level of protection provided the environment.

The implementation of a tax on agricultural chemicals has advantages over other methods such as regulations for reduction of agricultural nonpoint source contamination of ground water. Use of taxes provides greater flexibility than the other methods. The farmer is still free to persist with his present farming practice, paying the additional cost associated with harming the environment, or he can change his present practice and reduce chemical use. Moreover, since the farmer is in a better position to know the costs and benefits he acquires from any cropping practice than regulators, the solution chosen should be more cost effective. A tax "can be relatively simple and easy to enforce."[372] A primary burden to a taxation incentive is realized in determining the tax level. It should be set high enough to discourage excessive use of the chemical, but not so high where a farmer facing this tax would be drawn to move to another state where costs would be lower.

Since the purpose of a tax on agricultural chemicals would be to limit the amount of chemicals applied rather than to raise revenue, the tax would technically be an exercise of the state's police power and not its taxing power, provided the revenue collected from the tax went into the general fund. In this situation, the validity of the tax would be determined by the principles defining the scope of the police power.[373] If, however, the revenue collected were earmarked for a special purpose, such as mitigation of ground water contamination, the taxation would constitute a mixture of the state's police power and its taxing power, and the tax would have to conform to the limitations under the taxing power.[374] One challenge which would be faced in exercising the taxing power is that it must be evident that the purpose of the tax is for a public good. Since the adoption of

[372] Ibid, p. 172.

[373] *See* Chapter 3.B.1.b. for an overview of the state police power.

[374] *San Francisco v. Liverpool, L. & G. Ins. Co.*, 15 P 380 (Cal 1887).

the 14th Amendment to the federal constitution, state taxing power can be exerted only to effect a public purpose.[375]

A further limitation to using the taxing power could be faced in the states' constitutions and laws since they may set their own limits upon their taxing and spending power.[376] For example, at one time California's constitution[377] placed limitations on the state's taxing power:

> The legislature shall have no power to impose taxes upon counties, cities, towns, or other public or municipal corporations, or upon the inhabitants or property thereof, for county, city, town, or other municipal purposes, but may, by general laws, vest in the corporate authorities thereof the power to assess and collect taxes for such purposes.[378]

A taxation scheme is also potentially subject to challenge under three clauses of the United States Constitution - the commerce clause,[379] the import-export clause,[380] and the supremacy clause.[381] The commerce clause states "The Congress shall have power...to regulate commerce with foreign nations, and among the several states, and with Indian tribes." The Supreme Court has held that a state tax does not offend the commerce clause "when the tax is applied to an activity with a substantial nexus with the taxing State, is fairly apportioned, does not discriminate against interstate commerce, and is fairly related to services provided by the State."[382] The import-export clause states "No state shall, without the consent of the Congress, lay any imposts or duties on imports or exports, except what may be absolutely necessary for executing it's inspection laws... ." Concerning the import-export clause, which would be applied to make certain that the tax is not biased against goods imported into the state, the Supreme Court has determined that the test to determine the constitutionality of a state tax under this clause is identical to the commerce clause test.[383] Finally,

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[375] *Carmichael v. Southern Coal & Coke Co.*, 301 US 495 (1937).

[376] Ibid.

[377] Article 11, section 12.

[378] *San Francisco, supra* note 374, p. 381.

[379] Article I, Section 8, Clause 3.

[380] Article I, Section 10, Clause 2.

[381] Article VI, Clause 2.

[382] *Complete Auto Transit, Inc. v. Brady*, 430 US 274, 279 (1977).

[383] Richard J. Pierce, Jr., *supra* note 371, p. 203.

the supremacy clause states "This constitution, and the laws of the United States which shall be made in pursuance thereof; and all treaties made, or which shall be made, under the authority of the United States, shall be the supreme law of the land; and the judges in every state shall be bound thereby; any thing in the Constitution or laws of any state to the contrary notwithstanding." So long as the state has a valid basis for imposing the tax - an issue resolved through analysis similar to that under the commerce clause - the Supreme Court will not hold a tax invalid under the supremacy clause unless it finds a direct conflict between the tax statute and specific provisions of federal statutes.[384] Such a conflict could happen in one of two ways. First, the state could go beyond its role as a taxing authority and purposes to interfere with a regulatory function which Congress has placed within the exclusive jurisdiction of federal authorities.[385] Under some federal acts (such as FIFRA,[386] TSCA,[387] and SDWA[388]), however, the states are given significant authority to exercise regulatory authority beyond minimum federal requirements. The second way a conflict could occur is if Congress specifically limits the level of state taxation of agricultural chemicals, although no such limitation currently exists.

Federal constitutional limitations are not likely to prevent state taxation schemes for controlling excessive use of agricultural chemicals simply because they impose hardship. The U. S. Supreme Court has held that the cost and inconvenience would have to be very great before these factors would become elements in considering whether the exercise of the police power to tax agricultural chemicals is proper.[389] In *Missouri Pac. Ry. Co. v. Humes*[390] the Court stated

> It is hardly necessary to say that the hardship, impolicy, or injustice of state laws is not necessarily an objection to their constitutional validity; and that the remedy for evils of that character is to be sought from state legislatures. Our jurisdiction cannot be invoked unless some right claimed under the constitution, laws, or treaties of the United States is invaded.

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384 *Commonwealth Edison Co. v. Montana*, 453 US 609 (1981).

385 Richard J. Pierce, Jr., *supra* note 371, p205.

386 7 U.S.C.A. sections 136v, 136w-1 (1986).

387 15 U.S.C.A. section 2627 (1986).

388 42 U.S.C.A. section 300g-2 (1986).

389 D.L. Uchtmann et al., *supra* note 212, p. 608 [citing *Erie R. Co. v. Williams*, 233 US 685 (1913)].

390 115 US 512, 520 (1885).

c. *Public cost sharing of protective measures*

Farmers, like other business groups, focus on profit maximization as a primary objective. Just as avoidance of cost can be used to encourage socially desirable behavior, provision of financial rewards can also be employed to achieve desirable actions. In the field of environmental protection, public cost sharing of protective measures has become a standard tool of the federal government where the regulatory approach is not viewed as practical or desirable and where voluntary programs are not effective. Any program developed for the protection of the environment and dependent upon the voluntary acceptance of the farmer will probably have to provide the farmer an economic incentive to change or modify his present operating policy. Where a new practice involves a loss, or where gains can be realized only in the distant future, voluntary adoption will be limited. In such cases, public cost sharing programs may have to be implemented to encourage adoption.

Public cost can be provided for actual changes in chemical usage, for adopting certain land use or cropping practices, or for making pollution abatement investments. The subsidy should be such that it would offset costs (or a portion of the costs) the farmer will experience in adopting the new practice, including such reductions in other subsidy payments as may occur. Each state (or other administering party) would have to determine the level of the subsidy necessary to achieve adequate participation.

4. Education

Ground water contamination may occur because of a lack of awareness of the problem or a lack of knowledge of ways to prevent contamination; therefore, education should be viewed as a component of a state management strategy.

Although an approach based on education has the advantages of few legal constraints and general political acceptability, an approach relying solely on education has its limitations. This policy must rely completely on the attitude of the individual farmer. If he does not wish to change his proven methods, he does not have to, and ground water gains no protection. If he does choose to change his methods, without proper coordination among the farmers, the policy one farmer chooses to incorporate could be negated by the adopted policy of a neighboring farmer. Examples of the small effect of this approach include the voluntary collection of paper for recycling, which attracted 4 to 8 percent of the wastepaper in several cities, compared with a response of 80 percent or more in cities that mandated wastepaper separation for collection.[391] An education policy is certainly necessary, but because of its unpredictability, it should be looked upon as an element of a larger management strategy, not as the sole solution.

The following sections will discuss two major elements of an education program designed to influence farmers to change from their present practice. First, the farmer needs to know that a problem exists which requires his attention. Second, he needs to know what methods are available to mitigate the problem, what will be required of him to implement these methods, and what effect the implementation of these methods will have on his business.

a. Increasing awareness of problem

A major component of an education program to change behaviour is to show why change is necessary. Farmers would have to be very trusting to change his practices simply because a change is proposed. Ideally, the educational program will display a relatively unbiased presentation of fact to provide a rational justification for future changes.

Farmers will first need to be shown that a ground water quality problem exists or can occur if present practices continue. They need to be shown that the problem exists in their own area, with serious private and public consequences if the problem is not resolved. Data should be presented from the farmer's area (and wider area as necessary) showing the number of public and pri-

[391] Donald J. Epp and James S. Shotle, "Agricultural nonpoint pollution control: Voluntary or mandatory?", Journal of Soil and Water Conservation, J-F, 1985, p. 112.

vate wells that have been closed due to contamination and the problems arising in obtaining an alternative drinking water source.

After farmer's have been given information documenting an existing or potential ground water contamination problem, they must be shown that this problem has identifiable causes associated with the farmers' current behavior. To the extent possible, he needs to be given information concerning hydrogeologic conditions and how they affect the leaching of fertilizers and pesticides applied to the land. Then supporting evidence can be given to show how this contamination of ground water creates health concerns to those using it as a drinking water source, possibly leading to the closing of drinking water wells.

Accomplishing these objectives requires substantial information and application of effective presentation techniques. Knowing that traditional farming methods and agrarian ideologies still play an important role in today's farming communities should lead those who wish to use an educational policy to use the various media available to present the farming communities with supported data showing that existing practices are producing an intolerable situation.

b. Increasing knowledge of protective measures

The second major element of an education program is to make economically and agronomically feasible solutions to the problem available. The most practicable process to reduce ground water contamination by agricultural chemicals is to reduce the amount of chemicals reaching ground water. This reduction can be achieved in three ways: 1) modifications in agricultural practice, application equipment, and changes in the formulation and use pattern of a chemical to reduce the likelihood it will leach, 2) replacement of leachable chemicals with materials that are less mobile, persistent, and toxic, and 3) implementation of alternate crop production patterns and techniques that require less chemical application.[392]

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[392] Committee on Ground Water, *supra* note 3, p. 140.

More careful attention to the timing of chemical application and the ensuing infiltration of water (either from rainfall or irrigation) makes possible reductions in the use and leaching of agricultural chemicals. Many pesticides will degrade when they are above the soil or near the surface, while the degradation rate generally decreases as the pesticide leaches deeper in the ground.[393] Hence, by improving timing of chemical application with respect to irrigation or a predicted rainfall occurrence, the chemicals will be able to stay on or near the soil surface longer to fulfill their purpose, thus requiring less application while reducing the amount of contaminants that leach to the ground water. Another factor to take into account when applying chemicals is the equipment used for the application. Recent surveys indicate that as many as 60% of farmers are applying pesticides at incorrect rates, either higher or lower than desired, simply because equipment has not been maintained and calibrated properly.[394]

Another way to reduce contamination of ground water is to replace currently used chemicals with substitutes that are either less toxic or are less likely to leach to the ground water. New pesticides have been developed that are less persistent and/or less toxic to the public, while other pesticides are being designed to be applied at very low dosages.

Considerable potential exists for achieving reductions in chemical fertilizer application rates by more precise accounting of the nutrient value of manure applied to the land and the actual requirements of the soil at the location in question. In areas with a large density of cattle or poultry, supplementing chemical fertilizer with manure has significant potential. State government could develop a program to analyze manures for nutrient value. Supplementing chemicals with manures could help reduce the cost of agricultural chemicals to the farmer and decrease the amount of leachate reaching the ground water, while making use of what would otherwise be treated as a waste. The state of Virginia has developed such a program to encourage supplementing commercial fertilizer with manure. Under the state's Nutrient Management Program, which is funded by the state's Division of Soil and Water Conservation, farmers can contact the local extension agent to come to their farm and take a proper sample (or be present during the sampling) of the manure

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393 Ibid, p. 143.

394 Kenneth Ostlie, *supra* note 9, p. 326.

on the farm which will then be sent to Virginia Polytechnic Institute & State University to be analyzed for its nitrogen content. The results are sent back to the farmer for his consideration in supplementing commercial nitrogen fertilizer with manure.

Along with this program, another program has been developed whereby subsidies can be provided for construction of storage tanks where manure can be stored for up to six months, to be placed on the fields at the desirable time. Unfortunately, it appears that some of those making use of these programs are not taking advantage of the nitrogen content of the manure but are still using chemical fertilizers as in the past while spreading the manure on the fields. Thus education is still needed even for those utilizing these programs. The key role of education in this program is to increase awareness of the nutrient testing program to encourage its use, and to convince the farmer that the tested manure can be used to replace the equivalent amount of chemical nitrogen fertilizer.

Another protective measure available to the farmer is an alternate cropping technique. This alternative technique would involve some degree of organic farming, which seeks to significantly reduce, or avoid entirely, the use of agricultural chemicals. This objective is pursued by making more effective use of organic materials, crop rotations, and biological methods to supply plant nutrients and pest control for the crops being raised. Two major alternative cropping techniques are crop rotation and integrated pest management.

Before agricultural chemical use became a key part of the farm operation, crop rotation was standard practice. The benefits received from crop rotation include the ability of one crop to provide nitrogen for the following crop; improved insect, weed, and disease control; and improved soil structure and tilth.[395] In addition, the farmer has the potential to save on the cost of fertilizers and pesticides. "In many cases, even the cost of rootworm control can be eliminated if corn is simply rotated with another crop every other year."[396] Crop yields may drop in some cases when compared to yields using chemicals, but reductions are not inevitable;[397] on the contrary, yield in-

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[395] "Crop rotation: Wise management or outdated concept?", Farm Forum, Vol 14, Spring 1987, p. 10.

[396] Ibid, p. 12.

[397] Dick and Sharon Thompson, *supra* note 8, p. 33.

creases have been experienced.[398] Therefore, from the prospective of the farmer, a program involving crop rotation should not be viewed as a losing proposition. Certainly ground water quality will be enhanced due to the greatly reduced amount of chemicals required by this program. While re-educating the farmers to the possibilities of crop rotation, the state needs to be prepared to provide information to the farmers for the best procedures to use in their particular areas. Lack of information has proven to be an important barrier to the adoption of some organic methods.[399]

Integrated Pest Management (IPM) combines biological, mechanical, and agronomic methods in the best combination available to manage and control all pests - insects, weeds, diseases, nematodes, and rodents. IPM, unlike pure organic farming, does not completely disassociate itself from pesticide use. However, it is unlike common pesticide use today, for rather than being used in a programmed, periodic manner, chemical pesticides are sprayed only if an application seems warranted. By using sophisticated measures such as computer analysis of an insect's life cycle and field investigations to see how the insect population is progressing, IPM specialists keep a careful watch on pest species throughout the season. By tallying the number and types of pests present and matching that information against movement and mortality patterns, the specialists can determine the balance between pests and their predators.[400] With this information the specialist can decide which pests are likely to cause problems and the time of likely occurrence, recommending a pesticide strike only when the infestation reaches a proven danger point.[401] A natural effect of IPM is that the contaminants available to leach to ground water are greatly reduced.

The objective of pest control is not to eradicate all harmful pests: the pests are allowed to destroy a portion of the crop if it would cost more to get rid of the pests. Because IPM promotes the use of nonchemical means of pest control and improves the effectiveness of pesticides by im-

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[398] Crop rotation, *supra* note 395, p. 11.

[399] Roger Blobaum, "Barriers to Adoption of Organic Farming Methods," Alternative Agriculture: An Introduction and Overview, Institute for Alternative Agriculture, Inc., 1984, p. 32.

[400] Joseph A. Krivak, "Best management practices to control nonpoint-source pollution from agriculture," Journal of Soil and Water Conservation, July-August 1978, p. 164.

[401] William Jordan, "Pest Management: Pursuing an Environmental Dream," EPA Journal, July/August '85, p. 12.

proving the timing and placement of application, pesticide use (and therefore costs) can be substantially reduced,[402] and overall production costs can also be reduced as well.[403] A key example illustrating the effectiveness of IPM is cotton farming in California's San Joaquin Valley, where cotton is the biggest cash crop in the state. At one time farmers commonly sprayed 10 to 12 times a season, giving them the distinction of being the largest consumer of pesticides. By using IPM, they may spray as little as once a season.[404]

C. Program Support and Mechanics

Tremendous diversity exists in the nature and magnitude of ground water problems among the states and within individual states. Thus, no uniformly applicable standard exists to determine whether a government is dealing with ground water contamination problems in an "acceptable" or "good" manner. However, a number of conditions appear to be necessary to provide the proper program mechanics and support. This section will discuss ten issues related to program mechanics and support: 1) political support, 2) public support and participation, 3) program financing, 4) data collection and management, 5) inspection and enforcement, 6) incorporation of social and economic considerations, 7) flexibility to respond to variation in local conditions, 8) provisions for continuing evaluation of program impacts and effectiveness, 9) intergovernmental coordination, and 10) institutional compatibility with legal, political, and financial constraints.

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[402] Ibid.

[403] Committee on Ground Water, *supra* note 3, p. 140.

[404] William Jordan, *supra* note 401.

1. Political support

Political support is a necessary condition for the development of an adequate institutional response to ground water contamination problems and is the most fundamental concept related to capacity-building, affecting virtually every other element of institutional capacity.[405] With the establishment of political support, the way has been provided through which political pressure can be exerted.

Four factors or conditions have been present in the early stages of policymaking in states that have successfully dealt with ground water problems and appear to be necessary to establish and maintain political support: 1) awareness, 2) executive influence, 3) legislative support, and 4) external pressure.[406]

State politicians must be made aware that a problem exists and that it requires a public sector response. This awareness can originate with private sector concerns about events or crises, from reports supplied by researchers, or from news media attention. Political awareness includes not only knowledge that a problem exists but also information concerning the extent of the general public concern about the problem.

Political support for a new program (or change in an existing program) must usually involve the state executive officer. Since the executive branch carries out programs for ground water pollution control,[407] successful implementation of a ground water policy requires strong executive support. The administrative agency or agencies to be responsible for implementing the new policy must support the policy and provide pressure to the other agencies to gain their support also. Recent experience in Arizona provides an example. Since 1982 Arizona's Governor Bruce Babbitt had been calling for comprehensive ground water protection for the state. As the public's concern over ground water contamination continued to increase, comprehensive legislation to address

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[405] Tom James, et al., *supra* note 36, p. 4.

[406] Ibid, p. 5.

[407] Ibid.

ground water quality issues were introduced into the state legislature, but were not passed initially. The governor then saw the right ingredients for a ground water management process and invested his political capital in an effort to orchestrate comprehensive legislation. His commitment to the process lead to the production of the Arizona Environmental Quality Act,[408] which has been called "the nation's toughest law to protect underground water."[409]

Support for a policy must also occur within the legislative branch of state government. Legislative support includes actions of special committees created to investigate the need for a new policy and the activities of individual legislators who are particularly concerned about the problem. Certain individual legislators stood out as key figures in the creation and passage of the Arizona Environmental Quality Act.[410] Their interest in developing legislation to provide ground water quality protection allowed the governor to take direct measures and be personally involved in committees for the act's drafting. The legislators divided into specialized committees and subgroups to resolve specific problems in the issues, with six legislators making up a subgroup to work on the pesticide issue, so that a compromise was developed that ultimately had the support of both the agricultural and the United Farm Workers representatives. Another work of the legislative branch is the appropriation of funds to implement an act or policy. While some funds might be appropriated for the initial implementation of a policy the legislators must keep up with the progress and effectiveness of a policy to know how much or whether money needs to be appropriated for the policy in the future.

Finally, political support often involves pressure from sources external to the state government. "While outside pressure is seldom sufficient for change, it often serves as a catalyst."[411] Outside pressure can be provided from the same sources which provide awareness to the political sector. The public in general, or special interest groups, can bring pressure against the local legislator and the governor to bring about a desired action. The power of the people to elect public

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408 House Bill 2518, or Chapter 368.

409 *Arizona Waterline*, Athia L. Hardt, Editor, Salt River Project, Winter 1987, pp. 1-11.

410 Ibid.

411 Ibid, p. 6.

officials, including the provision of funding and other support can have a great effect on governmental attention given to an issue. A significant source of outside pressure in ground water policy is the federal programs that require states to develop ground water protection programs and provide funding of protective measures.

The barriers encountered in the development of political support for ground water protection policies can be physical, economic, and legal/political barriers. The physical barriers include the fact that ground water is out-of-sight, and on a nationwide basis an abundant supply exists. Perhaps the largest economic barrier is the need for economic growth. Unwillingness to impose major economic burdens on the agricultural sector has been a major limitation in environmental protection programs. A second economic barrier is the high cost of monitoring and evaluating ground water. A major legal/political barrier arises from the high value put on individual property rights. Options for the prevention of ground water contamination such as land use control often raise significant legal and political problems.

The lack of political support for ground water quality protection programs can prevent such programs from being implemented and can render even good laws ineffective. Political support is a necessary element in bringing ground water programs into effect and maintaining the desire to continue the protection of the resource.

2. Public support and participation

Public support is a key component of a successful state ground water protection program. Unless the public is convinced of the importance of the ground water resource, that those being charged with the contamination of ground water are actually responsible, and that the steps proposed to protect ground water from contamination are necessary, it is not likely to support a ground water protection program.

The extent to which the public is allowed to participate in the development of a ground water protection program can vary greatly. Too little participation may cause the program to go unsupported. With too much participation, the development of a program can take an unacceptable amount of time. Initially, the public must be informed of the existence and extent of a ground water contamination problem, and the need for current action to confront the problem. After the public becomes informed as to the problem, the means must be made available by which the public can express its concerns toward the development of a ground water protection program. When the program development has advanced to where choices among alternatives are necessary, public input must be allowed and the basis of selection fully explained. Through this process the program that is finally approved by the government should enjoy the greatest acceptance from the public in general and the least resistance from adversely affected groups.

Public participation cannot cease once the program has been established. The success of any program depends on continuing acceptance and voluntary compliance. It will be necessary to continue educating the public to the reasons for compliance. The public and, most importantly, those being directly affected by the program's policies must continue to be able to communicate with those overseeing the program to provide information concerning difficulties faced in complying with the program, or any parts of the program they feel are ineffective or unnecessarily burdensome. If the public feels that the program authorities are continually trying to make improvements, the public will be more likely to comply with the program to meet its goals.

3. Program financing

Ground water quality protection programs will consist of a variety of costly activities such as the identification of pollution sources; monitoring for ground water quality; enforcement; and coordination among state, local, and federal agencies. If a ground water protection program does not have adequate financial resources, some of these activities may not be implemented at a level necessary for effectiveness.

Obtaining funding is a primary obstacle a government must overcome in establishing a ground water protection program.[412] Just as there are multiple elements in a comprehensive ground water protection program, multiple sources of potential funding exist from which financial resources can be drawn. Most state governments finance ground water protection programs from general revenue supplemented by from federal funds.[413] Federal funding exists for states implementing federal programs to protect ground water under such statutes as SDWA.

Because of limitations on conventional funding from state and federal revenues, greater reliance on innovative funding arrangements will likely become necessary. Potential funding sources include a special tax on products or activities associated with ground water contamination, a tax on ground water users, and penalties imposed on parties in violation of applicable program requirements. Sources contributing to ground water contamination could be taxed or charged a set fee for the express purpose of providing funds to aid in the protection of ground water or mitigation of ground water contamination. Another taxation scheme would be to tax certain agricultural products known to contribute to ground water contamination in an effort to encourage alternate farming procedures or product usage. Again, these funds could be earmarked to be put back into the program for program financing. The water use tax could be applied per quantity of water used by each household and business, to be paid as part of the regular water bill. This tax would be one way to expand the financial burden to reach those who would benefit from the protected ground water. Finally, a state could impose fines for persons not complying with program regulations to be put back into the program for program financing. Choosing from among these unconventional funding arrangements requires an assessment of their revenue potential and a policy determination of where the funding border should rest.

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[412] Timothy R. Henderson et al., *supra* note 104, p. 164.

[413] Ibid.

4. Data collection and management

In order for a state government to develop a comprehensive ground water protection program, information relating to the characteristics of ground water must be collected and made available to those who are responsible for designing ground water protection strategies. Hydrogeologic characteristics and ground water quality are key elements that must be known to determine the extent to which ground water protection is needed for an area.

Data on ground water are expensive to collect. If new wells have to be drilled to collect needed information, costs will be high. However, ground water data can be collected from other sources. The water well drilling industry can be required to provide a detailed geologic log of every hole drilled. Reports can also be required from those diverting ground water for nondomestic purposes, as well as from those who have done ground water tests for proposed resource or subdivision development. This information could be further supplemented by data from energy resource exploration (i.e., gas, oil, coal) and ground water analysis done by state and university laboratories. When making use of people other than trained government personnel for the gathering of ground water data, special precautions to insure accuracy and standardization are necessary.

Whether ground water monitoring data are collected by the government, private businesses, or through a combination of these sources, a comprehensive monitoring program needs to be developed to initially determine the hydrology of the state, with provisions for the continuing assessment of ground water quality conditions and the land use practices which are known or believed to lead to ground water contamination. There are three different methods by which ground water monitoring can be conducted: 1) monitoring ground water near potential sources of pollution, 2) monitoring ground water near or at the point of water withdrawal, such as at drinking water wells, and 3) general monitoring of ambient ground water quality.[414] The first approach is used to detect any leaching that may occur from a specific facility before it migrates from the source. The second approach is used to identify any potential health risk in the drinking water being withdrawn before

[414] Ibid, p. 144.

the contaminant reaches a water supply well. The third approach does not focus on any specific source of contamination or individual water supply location, but is used to determine ambient or background water quality for a large area, such as an aquifer, and to determine any changes which may occur in the ground water over time.

To determine the entry of contaminants into ground water from agricultural nonpoint sources, ground water monitoring must be done at the point of application, i.e. the farmers' fields. If the area involved is relatively small, necessary monitoring would approximate the first approach. Due to the widespread occurrence of agriculture, however, the third approach listed above, monitoring ambient ground water quality on an areawide basis, is a more effective way to ascertain when contaminants have entered ground water. Due to the long travel times experienced in ground water movement in most cases, monitoring at the location where drinking water is taken from the ground would prove futile, since if ground water contamination is discovered here, ground water would likely be more contaminated up gradient, so it would be too late to provide protection. Locating monitoring sites in the farmers' fields would catch the contamination at its infancy. By controlling the source immediately, contamination levels could be held down, limiting the threat to the drinking water source.

Although ambient monitoring is necessary, it is difficult and expensive. Due to the complexities of hydrogeology, location of monitoring sites is difficult. In addition, careful attention may have to be given to depth of monitoring. A monitoring well located at one level might completely miss contamination at another level and allow ground water to carry contaminants to a drinking water source undetected. Even when the contaminant is detected, prediction of where and how far the contamination will travel may be difficult. However, the most serious obstacle to implementing a ground water monitoring system is the cost.[415]

A basic question is who should pay for monitoring -- the public, the farmers, or other parties related to potential contaminants? The New York State Department of Environmental Conservation has recommended that pesticide companies bear the cost of monitoring for pesticides

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[415] Robert L. Farrett et al., *supra* note 31, p. 37.

that have the potential to contaminate ground water. A California bill had originally required pesticide manufacturers to pay for monitoring, but due to pressure from these manufacturers, the bill was amended so the monitoring cost is borne by the state rather than by the pesticide manufacturer.[416] The ground water quality protection program in Wisconsin presently is being financed by general tax revenue and funds collected directly from the pesticide industry. Companies that produce active ingredients are charged $4,100 to do business in the state, from which $2,000 goes into a multi-agency ground water program fund to monitor ground water contamination from all sources and fund other program activities. Another $2,000 stays with the Department of Agriculture, Trade, and Consumer Protection for monitoring and research. Other companies pay $400 to do business in the state, $300 of which goes into the multi-agency program fund. An exception is made for companies that market only one product, which, instead of paying $400, pay $200, with $100 going into the multi-purpose fund.[417] Rhode Island and Vermont utilize annual pesticide registration fees to fund pesticide monitoring programs.[418]

Data received from ground water monitoring are of little value if they are not readily accessible. Alabama provides an illustration. Data collected by various agencies but kept in their department are not compiled with the data from other agencies; thus it has not formed an accessible data base.[419] Through a central office, activities of the agencies involved in data collection could be coordinated to prevent overlap and waste of funds which result from duplicated efforts. The agency which would be selected to act as the central office must be given a clear mandate for this role and given adequate funding to create a comprehensive system for collecting, compiling, storing, and retrieving ground water data. With the constructive leadership of a single agency and the participation of the other state agencies in contributing their data and ideas, a state can develop a data

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[416] Committee on Ground Water, *supra* note 3, p. 140.

[417] Orlo Ehart, "Wisconsin's Groundwater Law: Public Health Impacts and Enforcement," Pesticides and Groundwater: A Health Concern for the Midwest, The Freshwater Foundation, October 16-17, 1986, p. 279.

[418] State Program Brief/Pesticides in Ground Water, Office of Ground-Water Protection, EPA, Washington, D.C., May 1986, pp. 11, 16.

[419] Tola B. Moffett, "Where Have All the Ground-Water Data Gone - Into the Files Never to Return?", Proceedings of the Sixth National Ground-Water Quality Symposium, Sept. 22-24, 1982, p. 125.

base that supports the development of effective ground water contamination control programs while facilitation maximum use of this natural resource.[420]

5. Inspection and enforcement

The need for inspection and enforcement will depend on the choice of management strategy. Although a need exists in all approaches to determine program impact and effectiveness, inspection and enforcement are particularly significant where a regulatory strategy is employed. The benefits of regulation cannot be achieved unless compliance is determined and timely enforcement actions taken whenever noncompliance is discovered. This vital role of inspection points to the need for an adequate staff of trained inspectors to inspect both the installation of related equipment and operational practices. After inspection the inspectors must be able to provide a concise description of the situation(s) contributing noncompliance with program requirements. Proper enforcement action can then be taken from this inspection report.

Required farming practices, techniques, and equipment may require site visits. Wisconsin has realized that calibration of pesticide application equipment, which is always a difficult procedure and subject to individual error, will need more critical attention.[421] Farming practices such as strip cropping or crop rotation can also be easily checked by site visits, as can techniques for storage and disposal of chemical containers. However, since it can be impracticable to oversee the application practices of each farmer, direct inspection must be supplemented by monitoring. Through monitoring, it could be shown that a farmer was not complying with a program designed to protect the quality of ground water if the ground water was contaminated.

When a ground water contamination incident has been discovered, the ground water protection program must ensure timely restoration of compliance through adequate enforcement

[420] Ibid, p. 126.

[421] Orlo Ehart, *supra* note 417.

action. Such an enforcement program must contain clear legal and technical definitions of what constitutes compliance and noncompliance and should also contain penalties strict enough to encourage compliance.

Standard remedies that can be used to address contamination of ground water include monetary penalties and injunctions. Penalties can be imposed through criminal and civil actions. In general, a fine is a penalty imposed by the court for violation of the criminal law of the state. Civil penalties are also commonly used in environmental protection programs.[422] The greater the fine or penalty, the more likely it will act as an incentive to comply with the regulations. And certainly the possibility of placing an injunction against a farmer to cease his practice would create an incentive for compliance. Another, and probably greater, incentive for avoiding contamination would be to force the farmer to pay for clean up of the contamination he has caused and to compensate injured parties. Requiring the responsible farmer(s) to pay for clean up of ground water and to compensate victims forces the farmer to internalize the costs of the damage he has caused. This approach serves both to remedy the contamination problem and to establish an economic disincentive for future contamination.[423]

Finally, allowing private citizen suits aids enforcement. Allowing persons potentially affected by agricultural ground water contamination to bring suits to enforce statutory requirements against the suspected responsible farmers creates in effect another inspection or monitoring force. Giving these persons the chance to take an active role in protecting their drinking water supply could make them more conscious of what their farming neighbor is doing.

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[422] *State v. Rumfelt*, 85 SE2d 398 (NC 195).

[423] Timothy R. Henderson et al., *supra* note 104, p. 151.

6. Incorporation of social and economic considerations

Implementation of ground water protection programs involves a complex array of technical considerations such as hydrology, the biological impacts of chemical substances, and the fate of chemical substances in the environment, but such programs must also take into account the social and economic dimensions of the problem and the management program.

Development and operation of such programs must recognize society's values and the costs and benefits of actions to the general public, to special groups, and to the individual citizen.[424] Whatever policymakers decide to do, the decision will yield some degree of benefit and harm to some element of society and the economy. The factors to be weighed when considering society's views are, on the one hand, the belief that the farmer should be allowed to conduct a private business to support himself and his household. On the other hand, the value of clean drinking water is important to the farmer and the rest of society alike. In communities with little linkage to farmers, the general population may not be very concerned with the impact a clean water program will have on the farmer. In farming communities, however, the population may place a high value on protecting the economic status of the farmer while still wanting a clean water supply, thus providing conflicting signals to the policy makers.

In any decision making process, whether formal or informal, the benefits must be weighed against the costs before a decision is made. In addition, the distribution of benefits and costs must be considered. The benefits of an uncontaminated drinking water supply are realized by the farmer and society as a whole. Depending on the choice of policy and management strategy, the costs of achieving this condition may be less equally distributed. Under certain approaches, the farmer may lose income through reduced subsidies, reduced crop yields, or increased expenditures on control measures. However, if some farmers are forced to discontinue their livelihood, or at least reduce spending, some farming communities, and those business associated with the farming profession,

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[424] Sandra S. Batie, "Economics of Nonpoint Source Pollution," Perspectives on Nonpoint Source Pollution, Proceedings of a National Conference, EPA, May 19-22, 1985, p. 229.

may face financial difficulties. Through considering the economic condition of the farmers and local communities, the policy makers will have the chance to develop a protection program with the knowledge of all the consequences.

7. Scope of control measures

Regardless of the type of control measure adopted, an important consideration is the scope of the measure's coverage. Two basic dimensions of scope are type of activities covered and geographical extent of application.

a. Type of activities covered

Due to the wide range of sources of ground water pollution and the existing diversity of controls, management programs are likely to continue to consist of a combination of controls, each of which has somewhat limited scope. In each state a management program for the protection of ground water quality will have to consider two sources of ground water pollution: point and non-point sources. Point sources include such diverse sources as underground storage tanks, injection wells, landfills, storage lagoons, and possibly feedlots. Nonpoint sources include agricultural fields, residential lawns, and interstate-highway and airport runoff. While coverage of this broad range within a single program is theoretically possible, a program of such scope appears unlikely. First, the necessary size and degree of centralization of power do not recommend this approach. Such centralization is opposed by the traditional diversion of responsibilities between differing levels of government. Establishment of a single program is also opposed by the fact that different sources of contamination are amenable to different management strategies, which may require different management entities for implementation.

b. *Geographical extent*

The geographical extent to which a state applies its control measures to manage the agricultural contamination of ground water can vary substantially. If a state chooses to implement its control measures uniformly throughout the state, no special allowance is made for variation in ground water quality or in other factors such as economic activity. A second approach is to allow flexibility to respond to variation in local conditions by using an aquifer classification system to permit different levels of protection for ground water at different levels of purity, or by using a wellhead protection strategy, which represents a special classification system focusing on drinking water supplies. Each of these approaches is discussed in the following sections.

(1). Uniform statewide application

A uniform statewide application of the control measure accepted by the state government can be employed to furnish all of the state's usable ground water resource an equal level of protection or could be implemented to provide a consistent approach to more directly manage the sources of ground water contamination. A uniform statewide approach eliminates significant problems of overregulation or underregulation that could be created at the local level if the local governments were not incorporated into a central approach.

Any management strategy discussed in this paper to control agricultural contamination of ground water can be applied uniformly throughout a state. In this manner the state government will know to what level and in what manner its ground water resource is being protected from agricultural contamination, so if a problem should arise at any point in the state, the state officials will have a common base with which to address the problem.

The primary disadvantages of a uniform statewide application of a policy generally noted is that such an approach is unrealistic and uneconomical.[425] It does not allow for flexibility to

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[425] Timothy R. Henderson, *supra* note 104, p. 79.

consider differences in local conditions. A uniform protective policy of nondegradation will not allow contamination of already poor quality ground water or water not used for or likely to be needed for drinking water. With such a policy, economic growth could be stagnated since ground water degradation would not be allowed at any location, even in industrial centers.

(2). Flexibility to respond to variation in local conditions

A structured ground water protection program is necessary to ensure systematic coverage of the various sources of contamination; if the program is too structured, however, special conditions affecting ground water contamination in one area may not match program categorizations and management activities.

Ground water protection programs must provide flexibility to accommodate variation in local conditions. Ground water problems are highly site-specific, depending upon unique local conditions.[426] In any program, even those incorporating uniform state standards, provisions should be made that allow the consideration of unique conditions contributing to ground water contamination. In a given location variances could be allowed on chemical application depending on the time of year, weather conditions, type of crop in production, or plant growth stage. In this manner chemicals which may leach under one condition could be used in another. Where special conditions exist a particular product or practice normally prohibited may be temporarily authorized. For example, a pesticide denied registration may be authorized for use under appropriate conditions. The Federal Insecticide, Fungicide, and Rodenticide Act allows the EPA Administrator, at his discretion, to permit a state, in an emergency, to use a pesticide for which he had denied registration.[427] In its long range plan to control the application of certain pesticides, California has incorporated the collection of localized information on factors that influence the movement of

[426] Thomas W. Curtis, *supra* note 20, p. 3.

[427] 7 U.S.C.A. section 136 (1986).

pesticides in soil to enable more precise regulation at the local level.[428] In this manner over- or underregulation can be reduced. Two approaches which are designed to allow for separate consideration of local conditions are an aquifer classification system, and a wellhead protection program.

(a). Differential application of controls through an aquifer classification system

Ground water classification can be used by the states to provide a systematic approach to implement a state ground water policy by formally designating the uses of, and water quality goals for, individual components of the ground water resource. Through this system, ground water is identified and classified, providing a way of balancing conflicting societal demands for clean ground water and activities contributing to ground water contamination.

The criteria used to distinguish classes of ground water vary greatly due to differences in natural conditions and social and economic interests. A major consideration is existing water quality, which determines potential for future use. The yield of an aquifer is another condition that should be considered, since the importance of protecting an aquifer, regardless of its quality, may be minimal if it cannot be economically developed to yield a usable quantity of water, but it may be of primary importance to protect such an aquifer if it is the sole source of drinking water. The consideration of the hydrogeology of the state is also of major importance, not only for the determination of the boundaries of the aquifers, but also to determine the vulnerability of the aquifer - the effects various land uses will have on ground water quality.

Social and economic considerations also influence decisions to locate areas for waste disposal or other industrial land uses, while protecting other areas to provide drinking water. Thus in areas with large densities of industry, or where poor quality ground water already exists, use of ground water is permitted for what would seem to be a beneficial practice.

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[428] Mary Brown, *supra* note 12, p. 285.

A classification system provides flexibility for a state to set priorities. By creating areas where ground water contamination is allowed, the state can concentrate on the other areas where ground water quality is to be protected for a high quality water source. The state can also concentrate its powers of enforcement on those areas designated as a high quality water source, using its personnel and limited funds to a greater effectiveness by being able to concentrate directly on areas of known importance.

A classification system is not without drawbacks. In order to allow ground water degradation in some areas while maintaining or creating cleaner water in other areas, a large amount of technical data must be collected and analyzed. Defining aquifer boundaries can be a difficult task due to the complexity of ground water systems. Collection of needed data will be expensive. It may be difficult to develop a classification system that will adequately reflect the relationships between aquifers and contamination sources. Finally, public acceptability must be considered. Residents living in areas designated as suitable for degradation will probably take exception, while residents and businesses living in areas designated for a high degree of protection may complain because of anticipated reduction in economic growth of the area. The public will also be concerned about allowing contamination of water sources because of problems of predicting future water needs.

In areas where agricultural contamination of ground water poses a health threat to the populace, or other interference with ground water use, a classification system could be used to control such contamination while avoiding the placement of an unnecessary burden on other farmers or businesses that are not contributing to the contamination of a valuable resource. Since this program could impose a substantial burden on that part of the farming community put under its restrictions, public policy may dictate some type of subsidy to accompany this program.

(b). *Wellhead protection programs*

Wellhead protection involves identifying the areas that are particularly important in re-charging wells and protecting them to ensure the availability of fresh drinking water now and in the future. Both existing and projected wells should be considered in designating areas to be protected. The benefits of a wellhead protection program have been recognized by the federal government by creating within the Safe Drinking Water Act[429] a requirement that each state develop and implement a wellhead protection program.[430] Funding has been authorized to aid in the development and implementation of a state's plan.[431]

The area of primary concern for wellhead protection is the drawdown area of the well. Ground water within this area will flow to the well, carrying any contamination present. However, contaminants moving through an aquifer are reduced over time through such processes as dispersion, dilution, adsorption, chemical reaction, and biological degradation.[432] Therefore land uses around a well should be regulated as a function of hydraulic travel time to the well. The closer to the well, the more restrictive the land use regulation will be, and as the distance from the well increases, the restriction decreases (except for long-lived toxic substances). A major drawback with this program is that it will not restrict ground water contamination in areas unaffected by present or proposed future wells. Wells established in the future which are not planned during program design (or subsequently included) will have the chance of being drilled into contaminated ground water.

This program may be more acceptable to farmers as opposed to the other two approaches described since focus is placed on activities posing a direct threat to drinking water at the well.

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[429] 42 U.S.C.A. sections 300f et seq.

[430] 42 U.S.C.A. section 300h-7(a) (1986).

[431] *See* Chapter 2.A.1.

[432] Douglas Yoder, "The Biscayne Aquifer Project - A Local Wellfield Protection Program," Proceedings of the Sixth National Ground-Water Quality Symposium, September 22-24, 1982, p. 70.

With this program a farmer's total operation may not be restricted but only those operations within the zone of influence of a protected well.

8. Provisions for continuing evaluation of program impacts and effectiveness

The program which a state chooses will depend upon its own specific physical, economic, social, and political influences. A great amount of time, effort, and resources will be expended by the state to collect and utilize information in selecting the management program most suitable for its situation. Through the careful study the state will feel confident that the program selected is the best.

However, programs do not always work well in practice. A design which appears to be effective, especially one which is as complex as a ground water protection program, may be ineffective when put into practice. Provisions need to be made for the evaluation of program impacts and effectiveness after the program is put into effect. For a ground water protection program, this evaluation should not be limited to a one time check after the program is put into practice. Only through continuing evaluation of the program can the state be confident that it is effectively managing agricultural contamination of ground water in view of current information on the many dimensions of ground water contamination, its impacts, and control measures.

An example can be taken from the state of Florida. During the 1970's Florida passed major environmental laws which were broad enough to address a range of environmental issues.[433] However, most of these laws dealt with fairly evident problems, such as surface water pollution and visible air emissions. Evaluation revealed that the laws passed had created an incentive for ground water discharges. Thus, Florida's legislature created and adopted ground water-oriented rule

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[433] Wade L. Hopping and William D. Preston, "The Water Quality Assurance Act of 1983 - Florida's "Great Leap Forward" Into Groundwater Protection and Hazardous Waste Management," Florida State University Law Review, Vol. 11, 1983, p. 601.

amendments that took effect on January 1, 1983.[434] Upon evaluation of the effectiveness of these amendments, and in view of new information, the Florida Department of Health and Rehabilitative Services further revised some of its rules to provide better protection for the state's ground water resources.

9. Program coordination

The pervasiveness of sources of ground water pollution has resulted in a diverse range of protection programs administered at all levels of government. Therefore, a basic aspect of management is coordination among individual protection activities. This section will discuss three types of coordination necessary in the management of ground water contamination: 1) coordination among state components, 2) state/federal coordination, and 3) state/local coordination.

a. Coordination among state components

To bring better control over agricultural nonpoint source contamination, coordination is necessary among the departments of agriculture and health, water councils or water boards, and any other departments that address environmental research, protection, or enforcement or other areas effecting ground water. Since these numerous departments and agencies operate under the authority of equally numerous state and federal statutes, coordination is crucial to establishment of a comprehensive ground water program. The approach taken to bring about this coordination should provide more effective channels for the different departments and agencies to exchange information and resources, while at the same time providing avenues through which conflicts can be brought to the attention of the decision makers for resolution.

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[434] Florida Statutes, Title 29 - Public Health, Chapter 403 - Environmental Control, Part I - Pollution Control (1986).

One approach a state may choose is to establish a ground water coordinator at the state level. This person would not be allied with any of the state departments to reduce the possibility of bias. The success of this person would depend on personal skills, the amount of authority granted, and the willingness of the departments to cooperate. Apparently, this approach has not received significant acceptance.

Another approach is an interagency council comprised of a member from each of the departments with ground water protection responsibilities. The council would provide recommendations or make actual decisions and resolve conflicts. An important condition which must be met by each member of such a council is objective behavior to the extent possible. While subjective alliance to their departments will exist, this must be minimized to avoid negating the purpose of the council. The council could be made more effective if one of the members, or a representative of the governor's office, were to occupy a position of leadership and authority to resolve conflicts if the council is unable to. In the state of New Mexico, the Water Quality Control Commission has been created, comprised of members from eight state departments (or commissions) plus a representative of the public appointed by the governor. From within this Commission a chairman is elected, along with other officers as necessary. The authority of this Commission includes 1) the adoption of a comprehensive water quality program and the development of a continuing planning process, 2) the adoption and publication of regulations to prevent or abate water pollution in any specific geographic area in the state, and 3) assignment of responsibility for administering its regulations to constituent agencies so as to assure adequate coverage and prevent duplication of effort.[435]

A third approach is development of a new comprehensive agency (or expansion of an existing agency) so that it is responsible for all aspects of ground water management. With this approach ground water use and contamination would be handled in a unified manner. The drawbacks to this approach are that the reorganization may be time-consuming, costly, and unpopular with the agencies that would be effected.

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[435] New Mexico Statutes, Title 74, Environmental Improvement, Article 6 - Water Quality (1986).

In the state of Florida, the Department of Environmental Regulation is given the power and the duty to control and prohibit pollution of water in accordance with Florida's pollution control acts, and the rules and regulations adopted and promulgated by it. The Florida Groundwater Protection Task Force is created within the department, and consists of the following members: 1) the Secretary of Community Affairs, 2) the Secretary of Environmental Regulation, 3) the Secretary of Health and Rehabilitative Service, 4) the Commissioner of Agriculture, 5) the Secretary of Transportation, and 6) any additional state agency members as determined and appointed by the governor in order to properly implement the provisions of this act. The Secretary of Environmental Regulation, or his designee, shall chair the task force. The purpose of this task force includes 1) making recommendations to any person or governmental agency regarding ground water contamination affecting public or private wells and 2) ensure that a current inventory of all ground water contamination research activities by public and private universities in the state, public agencies, and private industries is developed and maintained. All state agencies shall be available to the Department of Environmental Regulation to perform, at its direction, the duties required of the department under this act.[436]

b. Coordination between the state and federal governments

In response to the recent awareness of the dangers associated with ground water contamination, Congress has passed legislation reflecting concern for the protection of the ground water. To date, however, no comprehensive protection program has been adopted, at least partly because of the impact of geographic diversity and the close interrelation between environmental controls and local land use decisions. Primary management responsibility continues to rest with state government. This situation necessitates close coordination between the state and federal governments.

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[436] Florida Statutes, Title 29 - Public Health, Chapter 403 - Environmental Control, Part I - Pollution Control (1987).

A primary mechanism of federal/state coordination is the provision in various acts for delegation of administrative responsibilities to the states. RCRA,[437] SDWA,[438] and FIFRA[439] all provide examples. It appears that all of the states, to various degrees or for various sections, have taken the administration and/or enforcement responsibilities for some of these programs.[440] States should aggressively capitalize on the technical and financial strengths of the federal government, while in turn the state governments can be responsible for the design and implementation of ground water protection programs.[441] In the past, some states have been unwilling or unable to accept delegation under federal programs,[442] but as agricultural ground water contamination becomes a greater issue, the states should take advantage of the federal programs by coordinating their own programs with them, so that technical data collected by the federal government and funding provided by them will not be unnecessarily duplicated or go unused.

Cooperative programs between the states and the U. S. Geological Survey (USGS) have long provided coordination in ground water data collection and analysis. For example, the state of Arizona has cooperated with USGS to collect ground water resource data to define the amount, location, and quality of its ground water resources and monitor the effects of large-scale development of the ground water supplies.[443] The state of Florida has also used the USGS to develop a set of maps of its aquifers showing the structure of Florida's aquifers and the locations of cities and communities in relation to ground water sources.[444] However, it appears that many states are relying on their own resources to construct ground water protection strategies.[445] However, these same

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[437] 42 U.S.C.A. sections 6926, 6947, 6991c (and others) (1986).

[438] 42 U.S.C.A. sections 300g-2, 300h-1 (and others) (1986).

[439] 7 U.S.C.A. sections 136c, 136v (and others) (1986).

[440] Overview, *supra* note 32, p. A-18.

[441] Thomas W. Curtis, *supra* note 20, p. 4.

[442] Joel H. Sachs, Environmental Law and Practice, Practicing Law Institute, New York, 1980, p. 323.

[443] U.S. GAO, *supra* note 1, p. 32.

[444] Ibid, p. 39.

[445] See short review of state ground water activities, ibid, pp. 26-79.

states have made use of available federal funding for ground water monitoring and data collection. The states have noted that they would like continued federal funding for program development and would like more technical assistance and ground water data provided from federal resources.[446]

c. *Coordination of state and local governments*

Local authorities can play a significant role in the management of ground water contamination through such measures as land use controls. Since land use control has been and will probably remain a local function,[447] local governments generally have a direct mechanism to protect the ground water in their area. Local governments throughout the states have used land use controls and other techniques to protect drinking water supplies for several years. For example, scores of towns within New England have relied upon zoning to protect water resources from both point and nonpoint source contamination.[448] Traditional zoning measures, such as large lot requirements (i.e. two or three-acre zoning) and preclusion of certain noxious uses (i.e. landfills), are two commonly used zoning tools to assure protection of water quality.[449] In Massachusetts, cities and towns (which have virtually complete control over local land use[450]) can delineate specially zoned districts for water supply protection, or purchase land outright, and enact by-laws to regulate certain activities with the potential for water supply contamination. However, the local governments do not

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[446] Ibid.

[447] James Murphy, "Ground Water Protection: A Planning Process for Local Government," Eastern Regional Ground Water Conference, July 28-30, 1986, p. 91.

[448] Scott W. Horsley and John D. Witten, "The Town of Duxbury, Massachusetts Aquifer Protection Plan: A Case Study In Innovative Water Quality Protection Strategies," Eastern Regional Ground Water Conference, July 28-30, 1986, p. 110.

[449] Ibid.

[450] Tara Gallagher and Susan Nickerson, "The Cape Cod Aquifer Management Project: A Multi-agency Approach to Ground Water Protection," Eastern Regional Ground Water Conference, July 28-30, 1986, p. 128.

always have available sufficient technical expertise to enact and implement protective measures as well as to engage in long-term planning.[451]

Although local authorities have considerable power and autonomy to control local land use,[452] they are likely to have limited resources and face other problems.[453] Two problems common at the local level are environmental spillovers and economic spillovers.

Environmental spillovers can occur due to underregulation or overregulation. Through underregulation, a local government may allow pollution-causing land uses by not giving full consideration to environmental factors because of a desire to attract taxable development projects,[454] from a reluctance to regulate politically influential land users,[455] or simply because it lacks the personnel and resources necessary to handle the complexities of environmental land use planning.[456] As a result, local land use controls may operate to promote local economic development at the expense of the environment. Through overregulation a local government can exclude pollution-causing activities from comparatively safe sites and displaces them into less safe areas. A local government may overregulate intentionally because it does not wish to deal with environmentally harmful land uses,[457] or, as in the case of underregulation, because it lacks the abilities to handle the complexities associated with environmental land use planning.

Economic spillovers can also occur due to underregulation or overregulation. Through underregulation one local government with less strict regulations, intentionally or unintentionally, can attract desirable development from another community with stricter environmental programs, thereby causing the loss of potential income to that community. Through overregulation a local government with strict regulatory programs can suffer economic harm if pollution control costs

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[451] Ibid, p. 129.

[452] Timothy R. Henderson, *supra* note 104, p. 160.

[453] James Murphy, *supra* note 447, p. 91.

[454] Developments in the Law - Zoning, 91 Harvard Law Review, 1978, p. 1590 [herein after cited as Developments.]

[455] James C. Buresh, *supra* note 35, p. 1440.

[456] Developments, *supra*, note 454, p. 1591.

[457] James C. Buresh, *supra* note 35, p. 1447.

discourage economic growth or create price differentials which have an adverse effect on demand for local products.

By coordinating with the state, local governments can take advantage of the resources and information available to the state and apply this information in program design and implementation. Also, through this coordination the state and local officials can clarify roles which each government level can perform, thus avoiding duplication of studies and unnecessary financial expenditures.

This potential is demonstrated by the experience of Connecticut. A recent review of the controls over a large group of Connecticut's communities revealed that of those towns that had adopted a town-wide ordinance to regulate hazardous materials, the regulations often overlaped existing state controls and in some cases were the only program through which the community attempted to provide ground water protection. To develop a more comprehensive ground water protection program, a unit of the Department of Environmental Protection developed a four stage planning process for community use, designed to guide local boards through review and decision making steps which will lead to selection of the controls most appropriate for that community. Through this process they will be able to seek state advice or assistance.[458]

> In its most simple form, Phase I consists of basic data collection and map making which will tell a group where their town is at the moment concerning land and water use. Phase II is an evaluation stage in which the town asks itself where it is going in regard to land and water. Phase III requires the identification of goals, or more simply, where do you want to go? Phase IV presents a mix of alternative management tools which enables a town to choose those they need to get where they want to go.[459]

This program is designed so that as the community learns procedures and techniques by completing one phase, they have the tools, confidence, and ability to work into the next phase.

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[458] Ibid, pp. 92-93.

[459] Ibid.

10. Institutional compatibility with legal, political, and financial constraints

As a state develops a ground water protection program to control agricultural contamination, it should consider different combinations of policies and management strategies for their effectiveness as a protection program. The state must compare its level of competence to administer the mechanics of each program considered, and the level of support which they consider to be present for each program, to the mechanics and support required for each program. Since there is virtually an unlimited number of programs which could be developed to control agricultural contamination, this discussion will be limited to special constraints on the management strategies which must be considered in program development. Three basic constraints that must be taken into account in the comparison are the legal, political, and financial constraints which are inherent in each management strategy. The remainder of this section will attempt to rank the management strategies presented in chapter three in order of the degree of institutional constraints present with their application.

The management strategy which would probably face the greatest constraint in its application is one utilizing land use controls. As discussed earlier in the "regulation" section,[460] land use controls are likely to undergo constitutional challenge if they impose substantial burdens on individual property interests. In addition to the constitutional issue, use of land use controls by state government involves modification of traditional divisions of responsibility between state and local governments and is a politically sensitive issue. Effective use of land use controls also requires a substantial information base concerning such factors as hydrogeology.

The next strategy that must be carefully constructed is an approach involving the imposition of detailed requirements for facility design and operation. Such action would probably face resistance if it significantly restricted freedom in the choice of equipment and operating practices. Such resistance may take the form of legal challenges and would likely result in substantial political

[460] Chapter 3.B.1.

opposition. Financial constraints must also be considered since research would be required to substantiate such action.

A state wishing to implement a program utilizing enforcement of ground water quality standards would face great financial constraints. Funds must be spent to improve information on the effects of various chemicals on health and the environment and the physical processes through which ground water contamination occurs. Once standards have been set, funds must still be expended to monitor ground water quality, and when standards have been exceeded, the state must pay to locate and prove which party is responsible for the contamination.

Public cost sharing of protective measures would be confronted primarily by financial constraints. This approach involves major funding and may require the development of new sources of state revenue. Costs can be controlled by limiting the applicability of the program geographically or by other means. Political constraints may also occur from those who oppose using state revenue to encourage individual actions.

A strategy imposing taxation of contaminants could face legal constraints either if the state designated the use of the funds collected for a specific purpose or if the funds went into the state general fund. In the first case, the state would have to comply with constitutional limitations on both the police power and the taxing power. A tax collected strictly as an incentive and placed in the general fund would be restricted only by limitation on the state police power. However, a taxation program can be designed to satisfy these legal constraints. This strategy could also come under political constraints by those who would not wish to oppress the farmer with any more costs.

A management strategy banning or restricting the use of chemicals would primarily face political constraints. Programs exist for implementing such actions; legal constraints therefore should be less significant of relative to adopting of an unprecidented strategy. Nevertheless, use of this strategy requires a great amount of data involving significant costs, a position of which can be shifted to the manufacturer. However, political constraints could develop from those who have come to depend on a chemical whose use has been disallowed at least in their area, and from those who believe a new chemical, whose use has been disallowed or restricted, would overcome problems that persist with present chemicals.

Several potential strategies considered face few serious obstacles, but those in this category tend to be limited in effectiveness and generally must be used in confirmation with other strategies. Use of effluent limitations is a well established approach to water quality protection, but application to agricultural operations has limited feasibility. Use of education will confront little resistance, but an effective education program requires substantial resources and has limited capability to effect change. Finally, the application of liability to require the source of contamination to compensate affected parties is compatible with existing institutional conditions, but this approach is affected by inherent weaknesses that limit its deterrent effect.

This attempted ranking is not intended to encourage or discourage the use of one strategy over another. The strategies with greatest potential tend to face the most serious constraints. Decision makers must be aware of these constraints to approach the development of a ground water protection program realistically.

D. Case Studies

In this paper a large amount of information has been provided concerning the alternatives that are available to be used, and the technical and political support that will be needed by the states as they develop or expand their ground water quality protection programs. While examples of state actions have been provided throughout this paper to show how individual states are addressing particular issues, the following section will provide a somewhat more detailed discussion of four state programs for providing ground water protection. The case studies were chosen not because their approach to protecting ground water is necessarily unique, but rather to represent particular approaches to addressing ground water contamination.

The first case study involves a state which has been subdivided into separate districts for natural resource management. The discussion will focus on one of these districts and the approach it is using to control agricultural contamination of ground water. The second case study will show

how a state utilizes its own pesticide registration process to protect its ground water from agriculture pesticide contamination. The third case study will show how a state utilizes ground water quality standards in a ground water protection program which requires dischargers to obtain an approved discharge plan if their effluent may contaminate ground water. The fourth case study involves a state utilizing a permit program to control agricultural activity.

1. Ground water protection in Nebraska using natural resource districts

Prior to 1972 there were over 500 resource-related special purpose districts in the state of Nebraska which had been created over the course of a half a century.[461] This multiplicity of special purpose districts resulted not only in overlapping responsibilities and jurisdictions but also left large cross-boundary projects without effective local sponsorship. The push for reorganization was undertaken by political leaders in the state, with the governor calling for a "functional realignment of local water agencies." The legislature responded to the challenge in 1969 by passing legislation which adopted new subdivisions of government established primarily along natural river basin boundaries to provide better management opportunities for resource-related problems. On July 1, 1972, approximately 154 of the old special purpose districts were merged into these newly created, multi-purpose Natural Resource Districts (NRD's).

The state of Nebraska is divided into 24 Natural Resources Districts to act as local subdivisions of government that can handle most any land, water, or natural resource program or project needed to be managed at the local level. These districts are given responsibilities and authorities in pollution control and ground water and surface water conservation and development. This discussion will be concerned with the Central Platte Natural Resources District in south central

[461] The information for this section is taken from; Annete Kovar, *supra* note 239; Ron Bishop, "Ground Water Nitrates - Source and Solutions," Proceedings of a National Symposium on Local Government Options for Ground Water Pollution Control, January 16-17, 1986 pp. 57-71.

Nebraska and how its programs combined with those of the state are used to reduce ground water contamination from agricultural chemicals.

In 1973, a base-line study of ground water quality was conducted in this District, giving results showing ground water to have nitrate concentrations at or above the U.S. Public Health Service's maximum safe level for human or animal consumption of 10 parts per million. Over the next ten years, in cooperation with various state and federal agencies, the District conducted a series of investigations, studies, and research projects to 1) research the effects various farming techniques have on the nitrate levels in ground water; 2) determine the source of the nitrate in ground water; 3) better define the location of the nitrates in the aquifer, both areally and vertically; and 4) identify interactions in the aquifer. During these studies the District used the services of the Conservation and Survey Division of the University of Nebraska, the Department of Agricultural Engineering of the University of Nebraska, the Nebraska Cooperative Extension Service, the County Agricultural Stabilization and Conservation Service, and the Soil Conservation Service.

In 1979, a major research and demonstration project was conducted within one of the counties in the District that had high nitrates and varying soil types.

> The objectives of the project were to study ways to impede the leaching of nitrates into the aquifer from fertilizer applications; to improve the water quality by mining the nitrates in the ground water; to improve the ground water quality for the purpose of domestic consumption; to demonstrate techniques that may be applied in other municipalities in the United States where agricultural nitrates are causing problems; and to demonstrate that nitrates may be managed efficiently and effectively while maintaining crop yields.[462]

As part of the project, 32 observation wells were used, not only to monitor the nitrates in the project area, but also to study the stratification of nitrate zones within the aquifer. The information from this project, along with data from other research projects and studies, began to answer some of the questions that had been raised earlier and pointed out several basic facts which apply to the problem areas in the District:[463]

- The major source of ground water nitrates in the District is commercial fertilizer applied to crops that has been leached through the soil profile and into the ground water aquifer.

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[462] Ibid, p. 61.

[463] Ibid, p. 62.

- The source of the water that leaches the fertilizers can be from flood waters, heavy rains, or over-application of irrigation water.
- The nitrates can be readily extracted from irrigation water by the corn crop.
- Even after crop uptake and leaching, there are levels of residual nitrates left in the root zone that are available for next years crop.
- The irrigation water contains 2.7 pounds of nitrogen per acre foot of water for each part per million of nitrate-nitrogen in the water, making 54 pounds of nitrogen per acre available from an irrigation well testing 20 ppm nitrate-nitrogen with a 12 inch annual application.
- An irrigation well, because of its higher production and resulting larger cone of depression, will have higher nitrate levels than will a domestic well assuming all other conditions being equal.

In 1977 the Nebraska Legislature passed the Nebraska Groundwater Management and Protection Act[464] that authorized the natural resource districts to establish "ground water control areas" where a ground water decline condition existed or was eminent, or in areas with ground water quality problems. The establishment of a control area is subject to the approval of the State of Nebraska, but after approval, a natural resources district can implement a number of regulations to control or manage the ground water decline or ground water quality problems. For a water quality problem, regulations in the law allow a natural resources district with a "control area" to impose any reasonable regulations that might be required to resolve the water quality problem. These regulations must also be approved by the State, while enforcement is left to the District. In 1982 the Nebraska Legislature passed legislation that authorized the districts to establish ground water "management" areas for quantity or quality problems. Ground water management areas do not need state approval, nor do any proposed regulations for the area.

With the necessary information already received from the past ten years studies, and the necessary legislation and authorization to carry out a management program, the District, in 1984, began developing a plan and program for ground water quality. The objectives of the program are to:[465]

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[464] Revised Statutes of Nebraska; Chapter 81, State Administrative Departments, Article 15 - Environmental Protection Act.

[465] Ibid, p. 65.

- Extract the nitrates in the ground water by utilizing them for the nitrogen needs of the crop.
- Fully utilize the residual nitrates in the soil profile for the nitrogen needs of the crop.
- Reduce fertilizer applications to account for nitrogen available in the soil and irrigation water.
- Reduce the "opportunity time" for fertilizer to leach below the root zone.
- Encourage farm practices, techniques, and the installation of equipment that have proven to be helpful in reducing ground water nitrate levels and nitrate leaching.
- Research new equipment and techniques that have potential for reducing ground water pollution from nitrates.

The District's program will establish management areas in those areas within its jurisdiction where ground water quality is a problem, with each problem area being placed in a "Phase" depending upon the level of nitrates or other contaminates within that area. Phase I quality management areas will be established when the average nitrate/nitrogen concentration is between 0 and 12.5 ppm. The District will coordinate with the Cooperative Extension Service and Soil Conservation Service and will provide information, education, and demonstration programs concerning preferred irrigation and fertilizer management, and will select those management and assistance programs they feel will be most appropriate for that given area. The installation of those techniques and equipment will be on a voluntary basis with the landowners, but fall/winter application of commercial nitrogen fertilizer will be banned on sandy soils. Phase II quality management areas will be established when the average nitrate/nitrogen concentration is between 12.6 and 20.0 ppm. The District will use the activities and techniques utilized in a Phase I area and will, in addition, implement mandatory regulations. Irrigators will be required to test their irrigation water for levels of nitrates and must also test for residual nitrates in the crop's root zone. Fertilizer applications will then be reduced by the amount already available. Fall/winter application of commercial nitrogen fertilizer on non-sandy soils will be permitted only after November 1 and only with an approved inhibitor.[466] Phase III quality management areas will be established when the average nitrate/nitrogen concentration is above 20.0 ppm. The District will carry out the same activities

[466] An inhibitor allows nitrogen in commercial nitrogen fertilizer to be released over a period of time when applied.

and techniques utilized in a Phase II area and can impose several additional regulations. These will include a requirement that all irrigators be certified by attending a class and training session on fertilizer management and irrigation water management. Fall/winter application of fertilizer will be banned on all soils until after March 1. Spring application of fertilizer will be either applied in preplant/sidedress application,[467] with no more than 50% applied as preplant, or applied with inhibitor.

The boundaries of the quality management areas will be set by the Board of Directors and will be based upon the water quality analysis report(s) and other information available at the time. The Board can adjust the boundaries from time to time as more information becomes available. The techniques used in the Central Platte Natural Resource District have been established through research and demonstration projects and have been shown to be effective in the District and other parts of the state.

2. Pesticide registration in California

In California, authority to regulate pesticides has been given to the California Department of Food and Agriculture (CDFA).[468] This Department is given assistance from five other state agencies who have regulatory authority over public health, water, air, fish and game, and industrial relations. These agencies have representatives who participate in formal pesticide regulatory committees. CDFA has the strictest and most comprehensive pesticide regulatory system in the world to control both sales and use of pesticides in a state where agriculture is the top state industry, and where pesticide use is the highest in the nation.[469] The two main components of CDFA's program are risk assessment (evaluation of data) and risk management (regulatory action).

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[467] Sidedress application is the application of fertilizer part-way through the plant's growth.

[468] The information for this section is taken from; Mary Brown, *supra* note 12, pp. 283-291.

[469] Ibid, p. 283.

When a request to register a new pesticide in California is made, the registrant must provide data to CDFA concerning the pesticide's health and environmental effects. If the pesticide is approved, it will be reevaluated after it has been used for some time, to determine whether the pesticide, when used legally, causes unanticipated adverse environmental or health effects. The registration may be denied or use of the pesticide restricted if it has been shown that the product may cause unreasonable adverse environmental or health effects. Risk management occurs at the local level with the County Agricultural Commissioner who is the primary enforcement officer for federal and state pesticide-use laws. A restricted pesticide can only be used if a permit is obtained from the County Agricultural Commissioner. Every time a permit for a restricted-use pesticide is requested, the Commissioner evaluates the risk associated with a restricted material's use, considering such local conditions as weather; threat to neighboring crops; and proximity of the application to schools, homes, parks, and other facilities. The Commissioner then decides what risk management measures to take and supervises these measures. The state also conducts ongoing reviews of registered pesticides and may re-evaluate a pesticide found to cause adverse health or environmental effects. Upon review, a pesticide may have its registration canceled, its use suspended, or it may be labeled for restricted use only.

The framework for collecting data on registered pesticides, and determining the status of their registration, is provided in California's Pesticide Contamination Prevention Act. The Act directs CDFA to collect and evaluate environmental fate data for each registered pesticide and maintain a statewide data base of wells sampled for pesticides to determine the extent of pesticide residues in ground water. Pesticides which are found by CDFA in well water are placed in the review process. Then the burden of proof is put on the registrants of these pesticides to show that these compounds will not pollute ground water.

The process by which data is collected and processed is provided in California's Ground Water Protection Plan developed by CDFA. This plan incorporates the results of laboratory studies, well sampling, soil coring, and computer modeling studies to develop "risk measures" indicating the potential for an agricultural chemical to reach ground water in designated areas. The state provides the County Agricultural Commissioners factors that influence the movement of pesticides in soil in their local area in standardized form to enable them to regulate more precisely at the local level.

The Ground Water Protection Plan has three objectives: 1) to provide the Commissioners with standardized information necessary to predict high risk uses of pesticides, 2) to identify areas with high risk of pesticides entering ground water due to agricultural use, and 3) to enable the Commissioners to regulate or otherwise manage pesticide use on a small or large scale. To accomplish these objectives CDFA has planned a series of coordinated activities that will occur over the next several years, including the identification of relevant data, collecting and processing the data, formatting and reporting the data to counties, formulating risk measures, and providing guidance to Commissioners on how to use the information they receive. To improve their knowledge of how agricultural pesticides move to ground water, CDFA uses a team of environmental hazards scientists to conduct studies monitoring the presence of pesticides in soil and ground water. At this time several factors are known that are associated with movement of pesticides through soil to ground water. These factors include previous history of contamination, use of pesticides in the area, chemical properties of the pesticide, depth to ground water, soil type and texture, irrigation method, geologic and climatic conditions, and agricultural practices. CDFA is still trying to discover which factors have the strongest influence on pesticide mobility in soil and how they interact to create high risk conditions.

To lay the groundwork for the Plan, CDFA is compiling data sets consisting of measures of the above factors classified geographically by township and section, to be made available to the Commissioners to use at their discretion. As the research improves understanding of how agricultural chemicals move through soils, the data sets will be used as variables in a mathematical model that will predict the possibility of a pesticide's contamination of ground water by geographical section. The first and most important data set provided was a statewide well inventory showing results of well sampling by public agencies for agricultural pesticide residues since 1975. In 1985 the well inventory contained over 10,000 samples taken by public agencies from an estimated 5,000 wells during the years 1975-1984. These samples represented 26 of California's 58 counties. In 1986, the well inventory will contain over 60,000 samples taken from wells in almost all counties in

California. This large increase is due to mandated sampling of large public water supply systems by the State Department of Health Services. In the coming years, CDFA expects to at least double the number of samples in the well inventory data base by further sampling of small community water systems by the State Department of Health Services, in addition to CDFA's own monitoring and that of other state and Federal agencies.

A second data set distributed to Commissioners under the Ground Water Protection Plan shows where certain potentially high-risk pesticides were used in California. The data set consists of records of all townships and sections where restricted pesticides with primary uses as soil applied compounds have been used in given years since to date all pesticides that have shown up in ground water are compounds that are applied to the soil, rather than crop foliage. The information in the data set, which will be updated yearly, comes from CDFA's annual Pesticide Use Reports, which summarize applications of restricted materials and materials applied by certified Pest Control Applicators.

The California Department of Food and Agriculture recognizes pesticides as important agricultural tools and encourages environmentally sound use of these chemicals through their Ground Water Protection Plan. This Plan stands on its own as a regulatory decision-making tool to be used at the discretion of the County Agricultural Commissioners. The Plan will also provide a state and county framework to document pesticide use, to guide monitoring, and to administer regulations.

3. New Mexico's regulation of subsurface discharge

The importance of ground water to the State of New Mexico is evident when one considers that 95 percent of the water supplied by public systems is from ground water sources, producing drinking water for three-fourths of the state's population.[470] To protect this vital resource, the state

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[470] The information for this section is taken from; Maxine S. Goad, "New Mexico's Experience in Setting and Using Ground-Water Quality Standards," Proceedings of the Sixth National Ground-Water Quality

legislature, in 1967, adopted the Water Quality Act[471] to address water pollution more specifically than earlier public health and public nuisance statutes. With this Act the Water Quality Control Commission (WQCC) was established and authorized to adopt standards and regulations to prevent and abate water (surface and subsurface) pollution from all types of activities.

Acceptance of the regulatory approach resulted from dissatisfaction with control based on common law measures. In the early 1970's, the state brought suit on the basis of public nuisance against a discharger who had created a serious ground water pollution problem. The state won the case, but the proceedings of the case demonstrated that public nuisance was a difficult and unwieldy means of addressing ground water pollution problems, and it did not prevent ground water pollution problems from arising. Thus in 1974 formal efforts were begun to develop ground water quality standards and regulations using the Water Quality Act.

The WQCC, which had already been established, consists of a delegate from eight state agencies, plus a representative of the public appointed by the governor. The agencies represented in the WQCC are:

- Environmental Improvement Division of the Health and Environment Department
- State Engineer and the Interstate Stream Commission
- Department of Game and Fish
- Oil Conservation Division
- State Park and Recreation Division
- New Mexico Department of Agriculture
- State Natural Resources Conservation Commission
- New Mexico Bureau of Mines

WQCC directed the Environmental Improvement Division (EID) to draft proposed regulations to protect the state's water resources. EID organized a technical advisory committee, consisting of representatives of industry (including mining and milling), agriculture, municipalities, and environ-

Symposium, September 22-24, 1982, pp. 42-48; New Mexico Statutes, Title 74, Environmental Improvement, Article 6 - Water Quality; New Mexico Water Quality Control Regulations (NMWQC Regulations).

[471] New Mexico Statutes, Title 74, Environmental Improvement, Article 6 - Water Quality.

mental organizations, to review the proposals created. This committee and WQCC reviewed EID's various proposals in numerous meetings from 1974 through 1976. Since both WQCC and the technical advisory committee had membership representing a wide variety of interests, EID had the benefit of hearing a variety of views and received much constructive criticism as it developed the standards and regulations. The final policy was presented in June 1976 in a four-day public hearing. The full WQCC was present to hear the extensive testimony and question witnesses. After suitable reworking in light of evidence presented at the hearing, the policy was adopted by WQCC on January 11, 1977, and became effective on February 18, 1977.

The primary source of ground water quality protection is provided in Part 3 of the New Mexico Water Quality Control Regulations, "Regulations for Discharges Onto or Below the Surface of the Ground." Its purpose as pertaining to ground water is to protect all ground water of the state of New Mexico which has an existing concentration of 10,000 mg/l or less total dissolved solids (TDS). Ground water having TDS greater than 10,000 mg/l is not protected, and may be degraded beyond the standards. The regulations of NMWQCR Part 3 apply to all types of discharges[472] of effluent or leachate onto or below the surface of the ground and any other discharge which may impact ground water, except for those discharges which are specifically exempted.[473]

The two basic aspects of the ground water protection program contained in this NMWQCR Part 3 are 1) setting ground water quality standards and 2) requiring by regulation that a discharger demonstrate he will not cause these standards to be violated at any place of present or foreseeable future use. The ground water quality standards are given in terms of human health standards, standards for domestic water supply, or standards for toxic pollutants.[474] Each of these

[472] "Discharge" means spilling, leaking, pumping, pouring, emitting, emptying, or dumping into water or in a location and manner where there is a reasonable probability that the discharged substance will reach surface or subsurface water; [taken from NMWQC Regulations, 1-203.C 1.]

[473] *See* NMWQC Regulations, *supra* note 470, section 3-105. Agricultural chemicals are not exempt.

[474] ""Toxic pollutant" means a water contaminant or combination of water contaminants in concentration(s) which, upon exposure, ingestion, or assimilation either directly from the environment or indirectly by ingestion through food chains, will unreasonably threaten to injure human health, or the health of animals of plants which are commonly hatched, bred, cultivated or protected for use by man for food or economic benefit.... In order to be considered a toxic pollutant a contaminant must be one or a combination of the potential pollutants each of these numerical standards listed [in this section] and be of a concentration shown by scientific information currently available to the public to have potential for causing one or more of the effects listed above. Any water contaminant or combination of the water contaminants in the list

numerical standards had to be supported by substantial evidence at a public hearing before adoption by the WQCC. Expert medical testimony was required for each of the human health standards. Many of the human health standards are identical to the maximum contaminant levels (MCLs) in the national drinking water regulations.[475] These standards do not apply to the effluent as it is discharged at the surface, but rather to the ground water itself where it is possible for leachate from the effluent to contaminate the ground water. If the existing concentration for a contaminant already exceeds the standard specified, the existing concentration becomes the standard.

A person must obtain an approved discharge plan to discharge onto or below the surface of the ground in a manner which may allow contaminants to reach ground water, unless the activity is exempted, as previously noted. The requirement for a discharge plan applies to all new or newly modified dischargers since June 1977 and to any older discharger where the Director of EID determines coverage to be necessary.[476] The burden is on the person desiring a discharge plan to have his plan approved. To accomplish this the person must show in the plan that either the discharge will not affect ground water with TDS of 10,000 mg/l or less, or that the discharge will not cause the standards to be violated or introduce any toxic pollutant at any place of present or foreseeable future use of the ground water. Private wells, as well as public water supplies are included in present or foreseeable future use, and almost any location in the state is considered a place of foreseeable use. Thus if a discharge is expected to contaminate ground water beyond the standards or regulations, the responsible party must demonstrate that he will be able to control any future use of the contaminated ground water for as long as the contamination remains there. This conceivably means that contamination on one's own property is allowed as long as they can prove the contaminated ground water will remain within their property boundaries and they will retain control

[in this section] creating a lifetime risk of more than one cancer per 100,000 exposed persons is a toxic pollutant." [taken from NMWQC Regulations 1-101.UU]. ""Water contaminant" means any substance which alters the physical, chemical or biological qualities of water." [taken from NMWQC Regulations 1-101.BBB.]

475 40 CFR part 141 subpart B.

476 This Act does not specifically address application of agricultural chemicals. However, it is not stated as being exempt. Agricultural chemicals are in the list of chemicals which are not permitted (at a given concentration) to contaminate an underground drinking water supply. It is concluded that this Act applies to agricultural chemical application.

over that property as long as the ground water is contaminated beyond the standards. Monitoring and reporting of discharge may also be required as part of the approved plan.

While the prospective discharger must meet this requirement, he has great flexibility under the regulations as to how he chooses to meet it. In formulating a discharge plan, a person may include such factors as 1) naturally occurring characteristics of the earth materials underlying the site (i.e. confining beds between the discharge and the aquifer), 2) dilution in the aquifer, or 3) any other factor that the discharger can demonstrate is relevant to the protection of ground water from his discharge at his site. By having the flexibility to determine how applicable ground water standards are to be met, both prospective dischargers and government regulators are permitted to take site-specific conditions into account. This consideration is especially important in New Mexico where geologic formations vary greatly and ground water depths range from less that one foot to more than one thousand feet.

Upon submission, EID reviews the discharge plan for conformance with regulations and holds a public hearing. When EID review staff raise questions about the adequacy of a discharge plan, the discharger must provide more information and/or amend his plan so is will conform to the regulations in order to have the plan approved. The records show that the WQCC ground water standards and regulations have proved extremely effective in preventing ground water pollution from new or newly modified discharges.[477] The only known cases of ground water contamination caused by new discharges since 1977 have been a few isolated cases when a discharger was in violation of the law and regulations by starting operation without informing EID and without obtaining an approved discharge plan. Discharge plans are being required one by one for older dischargers initiated prior to 1977 but still in operation. Each one requires a great deal of staff time: progress, though steady, has been slow.

The New Mexico system of enforcing numerical standards allows beneficial use of the ground water by permitting degradation of the ground water up to the standards. Although some degradation is allowed, this system clearly defines what is allowed both for the discharger who is

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[477] No specific mention is made of agriculturally applied chemicals.

preparing a discharge plan and for the governmental regulator who is reviewing a proposal or bringing an enforcement action. The drawback to using numerical standards is that they cannot be established for all possible contaminants. The process of conducting hearings and adopting standards for other problem chemicals requires substantial commitment of time and resources. However, New Mexico's experience using numerical standards has been positive. The standards are workable and enforceable, protecting ground water to drinking water quality.[478]

4. Arizona's permitting program for ground water protection

Arizona is a desert state where water is a precious and essential natural resource whose quality can be the determining factor in economic successes and failures.[479] Although concern over ground water has been evident from 1948, when the Governor proposed legislation to manage ground water resources, it wasn't until 1979 that the state began to seriously consider protecting ground water quality.[480] This occurred after U.S. Secretary of Interior Cecil Andrus threatened the state that, unless it undertook comprehensive ground water management (including quantity and quality), federal funding for the Central Arizona Project would be withheld. Although efforts were made to create ground water protection policies, the conflicting interests between the mining and agricultural industries and the environmentalists made it impossible to pass any proposed legislation.[481] Finally, concessions and compromises began to be made after 1984, when the city of Tucson, which gets all its water supply from ground water, discovered that its water supply wells

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[478] Maxine S. Goad, *supra* note 470.

[479] Gordon Meeks, Jr., "Arizona Groundwater: Negotiating an Environmental Quality Act," National Conference of State Legislatures, 1987, p. 15.

[480] Ibid.

[481] Ibid, p. 16.

were being contaminated. After complex negotiations, the Arizona Environmental Quality Act of 1986 was passed with major focus on ground water protection.[482]

It is the goal of Arizona to assess, manage, and maintain ground water quality at levels which 1) protect the public health, 2) acknowledge and accommodate current and projected uses, 3) support the long-term economic and environmental well-being of the state, and 4) recognize the current state of waste treatment and water treatment technology.[483] By June 30, 1987, the director[484] was to have inventoried and classified all aquifers, providing water quality standards to preserve and protect the quality of those water for all present and reasonably foreseeable future use. All aquifers were initially classified for drinking water use,[485] but the director may change the classification of an aquifer or part of an aquifer for a protected use other than drinking water on making all of the following findings:

> 1) the identified aquifer or part of an aquifer is or will be hydrologically isolated, 2) this water is not being used as drinking water, 3) the short-term and long-term benefits to the public that would result from the degradation of the quality of the water in the identified aquifer or part of an aquifer below established standards would significantly outweigh the short-term and long-term costs to the public of such degradation.

To uphold the standards set the director will require all persons (unless exempted) who discharge[486] or who own or operate a facility that discharges to obtain an aquifer protection permit.

One of three types of permits will be required of an agricultural activity: 1) agricultural general permit, 2) individual permit, or 3) general permit. The director shall adopt by rule agricultural general permits consisting of best management practices for regulated agricultural activities.[487] The terms and conditions of the permit issued will include agricultural best manage-

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482 Ibid, pp. 16, 1.

483 Arizona Administrative Rules and Regulations, Title 9 - Health Services, Chapter 21 - Water Quality Standards for Waters of the State, Article 1.R9-21-101.B. (1986).

484 "Director" means the director of environmental quality or the director's representative. [Unless otherwise stated the information for the rest of this section is taken from; Arizona Revised Statutes, Title 49 - The Environment; Chapter 2 - Water Quality Control; Articles 1-4.].

485 Gordon Meeks, Jr., *supra* note 479, p. 36.

486 "Discharge" means the direct or indirect addition of any pollutant to the waters of the state from a facility, where "pollutant" includes pesticides, herbicides, fertilizers and other agricultural chemicals, and "facility" means any land, building, installation, structure, equipment, device, conveyance, area, source, activity or practice form which there is, or with reasonable probability may be, a discharge.

487 "Best management practices" means those methods, measures or practices to prevent or reduce discharges

ment practices which have been determined by the director to be the most practical and effective means of reducing or preventing the discharge of pollutants by regulated agricultural activities. The director will consider differences in local conditions, economic and institutional aspects of alternative technologies, and the effect of the regulated activity on public health and the environment in adopting the agricultural best management practice for each activity.

In considering the issuance of an individual permit, the director will consider, and the applicant may have to furnish information, on the design, operation, discharge, impact, and any other relevant factors concerning the discharge facility. The director will issue a permit to a person for a facility only if either the first and second, or the first and third following conditions will be met: 1) the facility will be so designed, constructed and operated as to ensure the greatest degree of discharge reduction achievable through application of the best available demonstrated control technology, processes, operating methods or other alternatives; 2) the pollutants discharged will in no event cause or contribute to a violation of aquifer water quality standards at the applicable point of compliance for the facility; 3) no pollutants discharged will further degrade, at the applicable point of compliance, the quality of any aquifer that already violates the aquifer quality standard for that pollutant.

The director may issue by rule a general permit for a defined class of facilities if all of the following apply:

> 1) the permitted facilities, activities of practices are large in number and the cost of issuing individual permits cannot be justified by any environmental or public health benefit that may be gained from issuing individual permits, 2) the facilities, activities or practices in the class are substantially similar in nature, and 3) the director is satisfied that appropriate conditions under a general permit for operating the facilities or conducting the activity will meet the applicable requirements in [the section discussing individual permits].

If the director determines that a person is in violation of any provision relating to the permit they have received, the director may issue an order requiring compliance immediately or within a specified time period. He may also, through the attorney general, request a temporary restraining order, preliminary injunction, permanent injunction, or any other relief necessary to protect the

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and include structural and nonstructural controls and operation and maintenance procedures. "Regulated agricultural activity" means the application of nitrogen fertilizer of a concentrated animal feeding operation.

public health. Enforcement actions can also be taken against a party (unless exempted) if they 1) discharge without a permit or appropriate authority under this chapter; 2) fail to monitor, sample or report discharges as required by a permit; 3) violate a discharge limitation specified in a permit; or 4) violate a water quality standard. The party who commits one of these acts will be held guilty of a felony or misdemeanor, depending on whether the action was committed knowingly, negligently, recklessly, or otherwise.

Other provisions of this Act require the director to conduct ongoing monitoring of the waters of the state, including ground water. The director is also required to maintain a statewide data base of ground water and soils sampled for pollutants. All agencies shall submit the results of these samples to the director. The director is also required to establish certain values for pesticide characteristics that will allow him to determine whether individual pesticides are likely to get into Arizona ground water.[488] From this process the director will establish a "Groundwater Protection List" of highly mobile pesticides and will commence monitoring statewide to determine the actual environmental fate of these pesticides. If any of these pesticides are found in ground water, a procedure of to cancel its registration must begin. If the pesticide is carcinogenic, mutagenic, or teratogenic, its registration must be cancelled.[489] This Act also provides authority to the Commissioner of Agriculture and Horticulture to require the use of Integrated Pest Management[490] if there is an adequate scientific and economic basis to do so.[491] It is the belief of the state of Arizona that it is better to prevent ground water contamination than to have to clean it up after it has been contaminated.

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[488] James G. Derouin and Rep. David Bartlett, "New Arizona Act designed to assure water quality," *Arizona Waterline*, Athial L. Hardt, Editor, Salt River Project, Winter, 1987, p. 4.

[489] Ibid.

[490] *See* Chapter 3.B.4.b. for a discussion of this technique.

[491] James B. Derouin et al., *supra* note 488, p. 10.

IV. CONCLUSIONS AND RECOMMENDATIONS

Recent federal legislation has addressed specific sources of ground water contamination, placing restrictions on certain activities known to damage ground water. This legislation has come in a patchwork of federal acts, however, providing inadequate protection and failing to directly address the complex technical, economic, and political demands of ground water protection. Thus ground water protection, particularly protection from agricultural nonpoint source contamination, has been left to the states. Possibly in recognition of this, EPA has recently been encouraging a strong state role in local management of pesticide use to protect ground water resources.

The states are in a better position than the federal government for developing the programs necessary to protect the underground water resource. The physical variations which occur from state to state and within each state - the hydrogeology, water quality, water uses, and sources of contamination - can be directly considered in the development of an effective ground water protection program only by state and local governments. This paper has presented various strategies available to the states to be considered in their development of a protection program. Most states already have within their government structure the necessary programs to develop a ground water protection program. Many states have already begun to develop programs to provide ground water protection from agricultural nonpoint sources, and some states have already put such programs into effect. The experience gathered by the states in developing ground water protection programs has brought to light major obstacles to effective state ground water quality protection. The rest of this chapter will discuss certain of these obstacles and consider the strategies that can be incorporated into the design of a state ground water protection program.

A. Major Obstacles to Effective State Ground Water Quality Protection

Three major obstacles confront the state governments in their development of a ground water quality protection program against agricultural chemicals: 1) insufficient knowledge on the environmental and toxicological characteristics of each of the many agricultural chemicals in use, 2) lack of funds for adequate monitoring of ground water, and 3) inadequate institutional arrangements for making and implementing management decisions. The following sections address actions to remedy there problems.

1. Research

A major problem in the development of an effective state ground water quality protection program is the uncertainty about the fate, environmental degradation, and health risks due to chemicals in ground water. Tens of thousands of pesticide formulations, containing about 600 different active ingredients, are registered with EPA,[492] yet EPA does not know the environmental

[492] Ground Water Quality Protection: State and Local Strategies, National Academy Press, Washington D.C., 1986, p. 133.

and health effects each chemical can have. Knowing the characteristics of agricultural chemicals will allow state governments to decide which chemicals need to be reviewed and, for each chemical they determine to be a threat, decide what actions may be appropriate to control ground water contamination. Detailed knowledge about a chemical's effects and characteristics is essential to such actions as establishment of ground water quality standards and choice of strategies for controlling entry of pollutants into ground water. This knowledge will also provide aid for the creation of a proper enforcement program by providing more definitive boundaries at which action can be taken.

Expansion of research is especially needed in two areas: 1) the characteristics of agricultural chemicals and 2) alternative agricultural farming techniques. The characteristics of agricultural chemicals important to ground water protection are their tendency to leach, their fate during movement through the soil, and the concentrations that pose a threat to the environment and health. EPA has registered many chemicals without knowing what effects they will have on ground water. EPA is now trying to reevaluate the characteristics of these chemicals but is making slow progress. Improved information is essential so the use of likely contaminants can be restricted or eliminated to prevent the further contamination of underground drinking water in the future. Some states have taken it upon themselves to impose their own standards for many chemicals. Better coordination among the states is needed to ensure proper use of standard procedures in relating testing and analysis and to facilitate exchange of information.

Alternative farming techniques that show promise for reducing reliance on agricultural chemicals have been developed and are presently being used. More research should be conducted on these techniques to determine how they can be applied to a greater variety of crops in different geographic locations. If the state and local governments are knowledgeable concerning alternative crops and farming practices, they will be more likely to consider this option when developing a ground water protection program.

2. Increased federal support

For the states to provide more effective protection for ground water the federal government must provide more effective support. This support must come in three areas: chemical data, technical assistance, and financial assistance. States need information on how various agricultural chemicals affect ground water quality and the safe level of contamination for the various agricultural chemicals being used. They also need technical assistance to expand their own knowledge on various related matters such as ground water monitoring, laboratory analysis techniques, and proper techniques for the handling of data. If the federal government is not able to provide analysis on the various chemicals used, an alternative could be to provide the states with a uniform chemical analysis procedure so the states can conduct their own analysis of a given chemical. This information can then be placed in a national data center which can be accessed by every state, eliminating unnecessary reproduction of analyses.

The third type of federal support must come in the form of federal funding. Large costs are experienced with ground water investigations and monitoring. Ground water investigations and monitoring are necessary to determine hydrogeological conditions. Adequate hydrogeological information allows critical recharge areas and sole source aquifers to be defined and protected. Chemical application rates and types of agricultural chemicals applied can also be more effectively managed if adequate hydrogeological information is available. In the event of contamination from agricultural chemicals, this knowledge can be used to determine the reach of the contamination and to identify necessary mitigation measures. Unfortunately, because of the cost of conducting subsurface exploration, most aquifers are not thoroughly defined. Recharge areas, potential yields, and interconnections with other aquifers may not be known.

Better definition of existing ground water quality is also needed. Information on the quality of ground water is necessary for a state to determine which aquifers should be protected as drinking water sources and which can be used for other purposes. The state would then know whether it would be worth considering a differential protection policy to provide less protection for lower quality aquifers, placing its emphasis on creation of a protection program for those aquifers or wells producing higher quality ground water. With federal funding the states would be able to increase staff for ground water programs, increase monitoring of aquifer hydrogeology and water quality, expand research, expand educational programs, improve the management of ground water data, acquire necessary support equipment, and increase enforcement of regulations. The states already have some resources and knowledge to develop a ground water protection program, but with increased federal support they would have a better opportunity to develop a more effective protection program.

3 State program design

Many management strategies are available to state governments for managing agricultural contamination of ground water. Because of the diversity of contamination sources and other factors, a state program should combine these strategies into approaches tailored to the special conditions of that state.

Certain of the individual strategies posses weaknesses that generally require their joint application with other strategies. For example, establishment and enforcement of ground water quality standards is unlikely to provide adequate protection since this approach does not necessarily establish a means to control potential contamination before it occurs. A second strategy unlikely to be adequate as a role mechanism is imposition of liability. Primary weaknesses are its reactive nature and the need for proof of a cause and effect relationship between pollution injury and specific sources of pollution. A third strategy likely to be inadequate if used alone is education. While some degree of protection can be achieved by increasing awareness of the ground water quality issue and available means of protection, maintenance of an acceptable level of quality by this means is not ensured. Such strategies therefore can best be employed in a supporting role where they are supplemented with other measures.

To be effective, a ground water protection strategy must provide for continual assessment of chemicals to be used in agricultural practices and the imposition of restrictions on the use of those found to impose unacceptable impacts, including the total prohibition of use where necessary. Such programs are in place under FIFRA and TOSCA and similar state programs, but implementation to date has provided inadequate protection.

A somewhat unresolved issue is the appropriate balance between use of regulation and economic incentive in the overall effort to modify agricultural practices in such a way as to achieve a higher level of ground water quality protection. Environmental protection programs in the United States traditionally have emphasized the regulatory approach although financial incentives, primarily in the form of governmental subsidies, are not without precedent. Use of subsidy (in the form of public cost sharing for best management practices) has been a significant factor in nonpoint pollution control programs. The choice between the regulatory and incentive approaches, as well as the choice between the alternative incentive approaches (subsidy and taxation), is a policy decision. This decision requires the formulation of basic assumptions regarding the nature of private property rights and has important implications for the efficiency aspects of program operation.

Design of a state program also requires attention to a range of issues associated with program support and mechanics. The program must recognize that ground water protection involves a broad socio-cultural dimension and must reflect this scope.

The ground water protection program developed by a state will depend on how it perceives the problem, the alternatives available, and its capabilities to manage such a program. As the program becomes more complicated to address local or regional conditions, such as allowing limited degradation in one area but not in another, coordination becomes more essential. Many ground water protection strategies are available, and many of these have proven effective. Managing agricultural contamination of ground water is possible if state leaders will work together and with the public to develop ground water protection programs.

Selected Bibliography

Anderson, James E., "Farm Programs and Alternative Agriculture." Proposed 1985 Farm Bill Changes: Taking the Bias Out of Farm Policy, March 1985.

Batie, Sandra S., "Institutions and Ground Water Quality." Proceedings of a National Symposium on Agricultural Chemicals and Ground Water Pollution Control, March 26-27, 1987.

Batie, Sandra S., "Economics of Nonpoint Source Pollution." Proceedings of a National Conference, EPA, May 19-22, 1985.

Bishop, Ron, "Ground Water Nitrates - Source and Solutions." Proceedings of a National Symposium on Local Government Options for Ground Water Pollution Control, January 16-17, 1986.

Benbrook, Charles M., "Changing Responsibilities in the Agricultural Community." Pesticides and Groundwater: A Health Concern for the Midwest, The Freshwater Foundation, October 16-17, 1986.

Blobaum, Roger, "Barriers to Adoption of Organic Farming Methods." Alternative Agriculture: An Introduction and Overview, Institute for Alternative Agriculture, Inc., 1984.

Breimyer, Harold F., "The Institutional Setting for a Resource-Conserving Agriculture." Proposed 1985 Farm Bill Changes: Taking the Bias Out of Farm Policy, Institute for Alternative Agriculture, Inc., 1985.

Brown, Mary, "Reducing Agricultural Pesticide Residues in California Ground Water." Pesticides and Groundwater: A Health Concern for the Midwest, The Freshwater Foundation, October 16-17, 1986.

Buresh, James C., "State and Federal Land Use Regulation: An Application to Groundwater and Nonpoint Source Pollution Control." The Yale Law Journal, Vol. 95, 1986.

Cochrane, and Ryan, American Farm Policy, 1948-1973. University of Minnesota Press, Minneapolis, 1976.

Conservation Foundation, The, Groundwater Protection. The Conservation Foundation, Washington D.C., 1987.

Crosson, Pierre, "Implementation Policies and Strategies for Agricultural Non-Point Pollution." Conference on Agricultural Nonpoint Source Pollution Management, October 20-21, 1983.

Curtis, Thomas W., "Agricultural Chemicals and Groundwater Protection: The Need for New Federal/State Partnership." National Governors' Association, Washington D.C., 1986. Draft Manuscript.

Dawson, Thomas J., "Wisconsin Programs on Ground Water Pollution Liability." Proceedings of a National Symposium on Liability Issues and Ground Water Pollution Control, May 22-23, 1986.

Derouin, James G., and Bartlett, Rep. David, "New Arizona Act designed to assure water quality." Arizona Waterline, Athial L. Hardt, Editor, Salt River Project, Winter, 1987.

Edelman, Sidney, "Federal Air and Water Control: The Application of the Commerce Power to Abate Interstate and Intrastate Pollution." George Washington Law Review, Vol. 33, 1965.

Ehart, Orlo, "Wisconsin's Groundwater Law: Public Health Impacts and Enforcement." Pesticides and Groundwater: A Health Concern for the Midwest, The Freshwater Foundation, October 16-17, 1986.

Epp, Donald J., and Shotle, James S., "Agricultural nonpoint pollution control: Voluntary or mandatory?". Journal of Soil and Water Conservation, J-F, 1985.

Farrett, Robert L., and Ward, Robert M., "Agricultural Land Use Planning and Groundwater Quality." Growth and Change, Vol. 14, No. 1, January 1983.

Findley, Roger W., and Farber, Daniel A., Environmental Law in a Nutshell. West Pub. Co., St. Paul, Minn., 1983.

Gallagher, Tara, and Nickerson, Susan, "The Cape Cod Aquifer Management Project: A Multi-agency Approach to Ground Water Protection." Eastern Regional Ground Water Conference, July 28-10, 1986.

Goad, Maxine S., "New Mexico's Experience in Setting and Using Ground-Water Quality Standards." Proceedings of the Sixth National Ground-Water Quality Symposium, September 22-24, 1982.

Hallberg, George R., "From Hoes to Herbicides: Agriculture and groundwater quality." Journal of Soil and Water Conservation, November-December, 1986.

Halstead, John M., "Estimated Health Effects of Exposure to Agricultural Chemicals: Overview." Dept. of Agricultural Economics, Virginia Polytechnic Institute & State University, 1987.

Hardt, Athia L., Editor, Arizona Waterline., Salt River Project, Winter 1987.

Henderson, Timothy R., Groundwater: Strategies for State Action. Environmental Law Institute, 1984.

Hopping, Wade L., and Preston, William D., "The Water Quality Assurance Act of 1983 - Florida's "Great Leap Forward" Into Groundwater Protection and Hazardous Waste Management." Florida State University Law Review, Vol. 11, 1983.

Horsley, Scott W., and Witten, John D., "The Town of Duxbury, Massachusetts Aquifer Protection Plan: A Case Study In Innovative Water Quality Protection Strategies." Eastern Regional Ground Water Conference, July 28-30, 1986.

James, Tom, et al., "Elements of Institutional Capacity For Ground Water Pollution Control." National Symposium on Institutional Capacity for Ground Water Pollution Control, June 20-21, 1985.

Johnson, S.R., "Problems, Issues, and Control Options For Agricultural Chemicals." Proceedings of a National Symposium on Agricultural Chemicals and Ground Water Pollution Control, March 26-27, 1987.

Jordan, William, "Pest Management: Pursuing an Environmental Dream." EPA Journal, July/August '85.

Kovar, Annette, "Natural Resources District and Groundwater Quality Protection: An Evolving Role." Paper presented to the 23rd Annual AWRA Conference, Nov. 1-6, 1987.

Kramer, Randall A., "Soil Conservation Policy and Alternative Agriculture." Proposed 1985 Farm Bill Changes: Taking the Bias Out of Farm Policy, Institute for Alternative Agriculture, Inc., March 1987.

Krivak, Joseph A., "Best management practices to control nonpoint-source pollution from agriculture." Journal of Soil and Water Conservation, July-August, 1978.

Meeks, Gordon, Jr., "Arizona Groundwater: Negotiating an Environmental Quality Act." National Conference of State Legislatures, 1987.

Moffett, Tola B., "Where Have All the Ground-Water Data Gone - Into the Files Never to Return?". Proceedings of the Sixth National Ground-Water Quality Symposium, Sept. 22-24, 1982.

Murphy, James, "Ground Water Protection: A Planning Process for Local Government." Eastern Regional Ground Water Conference, July 28-30, 1986.

Nolan, Virginal E., and Ursin, Edmund, "The Revitalization of Hazardous Activity Strict Liability." North Carolina Law Review, Vol. 65, 1987.

O'Rourke, A. Desmond, The Changing Dimensions of U.S. Agricultural Policy. Prentice - Hall, Inc., Englewood Cliffs, N.J., 1978.

Ostlie, Kenneth, "Integrated Pest Management: A Tool to Manage the Risk of Ground Water Contamination." Pesticides and Groundwater: A Health Concern for the Midwest, The Freshwater Foundation, October 16-17, 1986.

Pierce, Richard J., "The Constitutionality of State Environmental Taxes." Tulane Law Review, Vol. 58, 1983.

Richardson, Len, "Striking a Balance - Protecting Endangered Species Means New Restraints." Agrichemical Age, July 1987.

Ruda, Stacy, "The Federal Water Pollution Control Act's Antidegradation Policy and its Application to Groundwater." University of San Francisco Law Review, Vol. 20, Spring 1986.

Sachs, Joel H., Environmental Law and Practice. Practicing Law Institute, New York, 1980.

Schlebecker, John T., A History of American Farming, 1609-1972. The Iowa State University Press, Ames, Iowa, 1975.

Thompson, Dick and Sharon, "Farming Without Chemicals." EPA Journal, June 1984.

Uchtmann, D.L., and Seitz, W.D., "Controlling Non-point Source Water Pollution: A Legal Perspective." Natural Resources Journal, Vol. 19, July '79.

U.S. EPA, Overview of State Ground Water Program Summaries. Vol. 1, U.S. EPA, March '85.

U.S. EPA, Report to Congress: Nonpoint Source Pollution in the U.S.. U.S. EPA, January 1984.

U.S. General Accounting Office, Federal and State Efforts to Protect Ground Water. U.S. GAO, February 21, 1984.

Wadely, James B., "The Future of Government Regulation of Agriculture: Biting the Hand That Feeds Us?". Northern Illinois University Law Review, Vol. 3, 1983.

Yoder, Douglas, "The Biscayne Aquifer Project - A Local Wellfield Protection Program." Proceedings of the Sixth National Ground-Water Quality Symposium, September 22-24, 1982.

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