United States
Environmental Protection
Agency

Office of
Drinking Water
Washington DC 20460

June 1980

Water

EPA

Planning Workshops to Develop Recommendations for

A Ground Water Protection Strategy

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MAY 15 1980

THE ADMINISTRATOR

Dear Workshop Participant:

Welcome to this workshop on Ground Water Protection Strategy. As EPA looks into the 1980s the protection of the nation's ground water resources rates as a high priority in the Agency's mission.

The purpose of this week's workshops is twofold:

- To examine the issues of ground water protection with a diverse group of experts representing government, industry, environmentalists, public interest groups, and others: and
- To recommend for consideration by EPA policy makers your preferred strategies for ground water protection.

Further elaboration of the workshop scope and purpose is provided in Chapter I of the enclosed document.

To the end of fulfilling these purposes, we've invited many knowledgeable people to attend and participate in the workshops. Each of you will play an important role in helping EPA develop an effective and workable approach to dealing with the formidable challenge of protecting our ground water resources. All the EPA representatives here are anxious to listen to your views. I can assure you that the workshop results will play an important role in helping EPA formulate its Ground Water Protection Strategy.

Again, welcome, and best wishes for a productive workshop.

Sincerely,

Douglas M. Costle

Enclosure

TOPICAL AGENDA*

EPA WORKSHOP ON DEVELOPING A GROUND WATER PROTECTION STRATEGY

Sunday:	Evening	Reception, Dinner, Welcome, Orientation
Monday:	Morning	Plenary Session I The Ground Water Problem, Elements of a Strategy for Ground Water Protection, Possible Goals Work Groups The Goal for a National Ground Water Protection Program
	Lunch	Open
	Afternoon	Plenary Session II Work Group Reports (5 minutes each) Presentation/Discussion: Mechanisms to Achieve the Goal--Management, Control, and Other Work Groups Management, Control, and Other Mechanisms
	Dinner	Open
	Evening	Work Group Rooms Available for Continued Discussions (optional)
Tuesday:	Morning	Plenary Session III Work Group Reports (10 minutes each) Presentation/Discussion: Federal, State, and Other Roles Work Groups Federal, State, and Other Roles
	Lunch	
	Afternoon	Plenary Session IV Work Group Reports (5 minutes each) Presentation/Discussion: R&D Implications, Goals (revisited), Pulling Together a Complete Strategy, and Priorities Work Groups Develop Recommendations for All Elements of a Ground Water Protection Strategy
	Dinner	Open
	Evening	Work Group Rooms Available for Continued Discussions (optional)
Wednesday:	Morning	Plenary Session V Work Group Presentations of Ground Water Protection Strategy Recommendations (one-half hour each) Discussion
	Lunch	Open
	Adjournment	

*The topical agenda for Workshop II will be identical, running from Wednesday evening to Saturday noon. A detailed agenda will be distributed at each workshop and will show specific times, coffee breaks, room locations, etc.

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I

INTRODUCTION TO THE WORKSHOP

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THE SETTING FOR STRATEGY DEVELOPMENT

The Environmental Protection Agency (EPA) is concerned about the growing evidence that ground water, a resource that has always been considered relatively pollution free, is widely contaminated and that the nature of its contamination poses potential major health problems. Since ground water contamination is often difficult to detect or control, its prevention, or at least its early detection, is a crucial environmental and public health responsibility for the future.

Although there are some existing ground water protection measures authorized by the Clean Water Act (CWA), an Underground Injection Control (UIC) program recently instituted under the Safe Drinking Water Act (SDWA), and a hazardous waste program developed under the Resource Conservation and Recovery Act (RCRA), fundamental policies concerning how this nation should ultimately address the broad issue of ground water protection have not yet been developed. In establishing a ground water protection strategy, EPA would like to build these new federal programs in a collaborative effort with state and local governments who have some ground water protection programs under way. The broad participation of affected industries, businesses, and public services; concerned environmentalists; groups with broad public interest and support; and professionals in related fields is also encouraged.

Because of the far-reaching effects of the problem, the ground water protection strategy is being developed based on broad public debate and participation. Rather than the usual EPA proposal of a draft strategy and request for public comment, this approach involves workshop discussions of the policy choices that appear critical to the formulation of a ground water protection strategy, after which EPA will propose a strategy (or set of alternative strategies) for public consideration and eventual implementation.

The problem at hand is immense and represents decades of neglect. Protecting ground water is a long-term effort. The strategy development represents an important step in a lengthy process which must involve the collaboration of all affected institutions. In addition, as the country begins to impose pollution requirements on the disposal of waste on or into the land, it is closing off the last unregulated medium for waste disposal. Simultaneously one must begin to identify and consider the most environmentally satisfactory disposal schemes for various residuals.

THE APPROACH TO DATE

The planning process began in the winter of 1979, when the EPA Administrator assigned the Office of Water and Waste Management (OWWM) responsibility for developing a ground water protection strategy under the direction of the Assistant Administrator for Water and Waste Management and the Deputy Assistant Administrator for Drinking Water. Administrator Costle stressed that a ground water strategy should:

- Look well into the future to assure that the quality of ground water is protected as a resource for future generations;
- Explore openly alternative approaches to ground water protection and not be bound by existing policy or law;
- Concentrate on broad policy issues rather than narrow regulatory or technical choices;
- Fully involve representative state officials as well as other concerned groups through direct participation;
- Stress cooperation and interaction with other affected institutions; and
- Stress the relationships between ground water and surface waters, including wetlands.

The strategy must also be focused on key issues that are critical to ground water quality in order to have the most impact. For example, it is not intended to deal directly with tap water issues, such as current or proposed drinking water standards or treatment technologies. Likewise, the ground water depletion issue is not a major focus. While depletion is a critical ground water issue in many sections of the country, this strategy will focus on issues related to ground water quality. It will be important to recognize the problem of ground water depletion because depletion can contribute to quality problems, and its management and control can affect the management of programs related to ground water quality. Nevertheless, it is not expected that this strategy will deal with ground water depletion as an independent issue.

To fulfill the requirements above, EPA outlined a three phase approach.

- Phase I, which has been completed, involved the assembling of current information on ground

water use and pollution, state laws and programs, and the state of the art in ground water protection. In addition, numerous groups and individuals were contacted to elicit ideas on issues and approaches and to identify knowledgeable participants for Phases II and III. Special emphasis was given to obtaining the suggestions of representative state officials.

- Phase II will consist of a pair of workshops to which a small, knowledgeable group of representative state, local, environmental, business and industry, public interest, and professional persons will be invited to explore and analyze the issues presented in the working papers and to recommend preferred policies. Out of the workshops should come a wide range of recommendations for EPA's consideration in the next phase.

- In Phase III a strategy (or alternative strategies) that reflects the views of the workshops will be published by EPA in the Federal Register and widely distributed. Public hearings on the subject will then be held in at least five locations throughout the nation.

WHAT THE STRATEGY SHOULD PROVIDE

The ground water protection strategy should provide:

- A clear enunciation of the problems and issues being addressed and the goals and objectives to be achieved;

- A greater national recognition and understanding of ground water problems;

- A national program with fully defined federal and state roles;

- A comprehensive Agency ground water protection policy that will apply to all programs affecting ground water from data collection to management;

- A stronger set of relationships among federal, state, and local governments; and

- A meaningful short-term action plan and a strategy for dealing with ground water problems over the long term.

THE PLAN OF THIS DOCUMENT

This document is organized into two parts. The first part--Chapters II and III--describes the nature of the ground water problem and outlines current EPA programs directed toward its resolution.

The second part--Chapters IV through VII--describes a decision process for arriving at a strategy and analyzes the major policy issues that must be considered in selecting the best strategy. The analysis sets forth decision options and briefly analyzes each. The options cover four sequential topics: goals; mechanisms to achieve the goals; federal, state, and other roles; and research and development and other implications for near-term programs.

A set of appendices containing further analyses of particular issues is also included for background reading by workshop participants.

PURPOSE OF THE OPTIONS PRESENTED

The options discussed in Chapters IV, V, and VI present a range of the points of view that were expressed by different people during the research for this workshop. These options provide a menu of choices that could be made in developing a ground water protection strategy. The options are neither exhaustive nor mutually exclusive. They are intended as starting points for discussions in the workshops and may be modified as participants feel it appropriate. Elements of separate options may be combined as the work groups identify and formulate the components of a ground water protection strategy.

WORKSHOP STRUCTURE

The conference will contain six key elements, as follows:

I. Full-Group Discussions--Review of the Working Papers

Full-group discussions will take place in the main meeting room at several points during the workshop. The purpose of these discussions will be to identify and discuss the principal issues as indicated in this document and other issues as raised by the workshop participants in preparation for the more detailed discussions that will occur among individual teams.

II. Team Discussions

At several points during the workshop, the participants will break into four teams. Each team will be expected to independently select options and develop a tentative position on the topic assigned.

III. Brief Team Progress Reports

At the conclusion of each of these team working sessions, each team will present to the full working group a five- to ten-minute report of its tentative position on the given issue. These reports will not be considered binding on any team. Their purpose will be to provide an indication of each team's progress and direction.

IV. Team Preparation of Integrated Recommendations

Starting in the afternoon of the second full day of the workshop, each team will be asked to draw upon its work of the preceding sessions to prepare an integrated set of recommendations related to the options defined in this document.

V. Team Presentations

On the last morning of the workshop the group will be joined by members of EPA's ground water policy committee. Each team will be expected to make a twenty- to thirty-minute presentation of its recommendations to the full group with appropriate visual aids. Following each presentation a brief question-and-answer period will be allowed to answer questions of substance and clarification.

VI. Final Discussion

After the team presentations, the participants will discuss the issues raised and the recommendations made. The workshop will not attempt to reach a consensus on individual issues. Its focus will be on obtaining a full discussion of issues and recommendations for EPA's subsequent use in drafting a proposed ground water protection strategy.

II

BACKGROUND ON GROUND WATER

II. BACKGROUND ON GROUND WATER

Ground water is the least understood of our major natural resources. In both science fiction and courts of law it traditionally has been erroneously described and treated as "underground streams." Despite the general lack of awareness and understanding surrounding it, ground water is an important source of the nation's water supply. Use of it has grown sharply over the years but its availability has decreased because of pollution and, in some areas, because of depletion.

This chapter, along with the appendices, presents a description of ground water as a resource, including past and future use projections. It also describes damage that has been done to ground water by various contaminants and pollution sources, discusses the difficulty of protecting and cleaning up ground waters, and outlines what federal and state programs exist that can address ground water pollution problems.

GROUND WATER USE

Ground water has become an increasingly valuable resource over the past thirty-five years. Ground water withdrawals in the United States quadrupled from 21 billion gallons per day in 1945 to 82 billion gallons per day in 1975. The increase from 68 to 82 billion gallons per day in the five-year period 1970-1975 was particularly pronounced.

Most of this increased use can be attributed to agricultural irrigation. In 1950, 21 billion gallons of ground water were used for irrigation purposes. In 1975, 57 billion gallons--or approximately 70 percent of the ground water withdrawn nationwide--were used for irrigation activities, and ground water constituted 41 percent of the total amount of water so used. Since ground water is withdrawn primarily for irrigation purposes, the total amount of it used is bound to be affected by changes in agricultural policy and practices.

Increased energy costs, as they increase the cost of pumping ground water for irrigation purposes, will affect this major sector of ground water use. Data indicate that for a 300-foot lift in the Central Valley of California pumping energy costs increased from $3.30 per acre-foot in 1970 to $12.00 per acre-foot in 1980. In the short run, such energy price impacts in the agricultural sector may manifest themselves as an increase

in the amount of dryland or unirrigated farming and as a shift in the type of crops grown. For example, along the Ogallala Aquifer in Texas, cotton, a water-intensive crop, is being replaced with sorghum and other crops that are less water intensive.

For the future, total ground water withdrawal projections range from 70 to 100 billion gallons per day in both 1985 and 2000.[1] The range is expected to remain the same during this fifteen-year period because the cost of pumping will serve as a constraint on the demand for ground water.

Additional background data on ground water and its uses are provided in Appendices I and II. Included there is information on the regional levels of ground water use as well as national statistics on patterns of use.

SOURCES OF GROUND WATER CONTAMINATION

Ground water can be contaminated by a variety of sources. The degree of threat depends on the nature (toxicity) and volume of the contaminant that is generated by a particular site or activity, the characteristics of the material underlying the site, and the particular geological and hydrological conditions of the area. For instance, a landfill that is underlain by 200 feet of impermeable clay would pose little threat to an artesian aquifer beneath the clay, but a landfill located on a permeable material with a shallow depth to water could pose a serious threat. Appendices III, IV, and V discuss ground water contamination in detail.

Contamination by Municipal and Industrial Waste Disposal Sites

Disposal of municipal and industrial wastes on the land is a source of serious concern because of the large volumes of waste, the large number of sites involved, the hazardous nature of much of the waste, and the inadequacy of the precautions taken to protect ground water at many of the sites. While estimates of the magnitude of this problem vary, the following data are illustrative:

- A 1979 study by an EPA contractor indicated that 32,000 to 50,000 disposal sites may contain hazardous waste, and that of these

[1] These projections are based on the Water Resource Council's First and Second National Assessments and ground water data generated by the United States Geological Survey. (See Appendix II for a more detailed analysis.)

1,200 to 2,000 could pose potential danger to public health or to the environment.

- EPA estimates that approximately 57 million of the 378 million tons of liquid and solid industrial waste generated in 1978 were hazardous and that this amount will grow by 3.5 percent each year. About 80 percent of these hazardous wastes are improperly disposed of in landfills or lagoons and pose a threat of ground water contamination.

- Very few land disposal sites are lined and few have leachate collection systems; studies have estimated that about 75 percent of all active and inactive sites leach. Unfortunately, there are no firm data on the total number of land disposal sites. Among existing estimates are these:

  --A 1978 Waste Age survey identified approximately 15,000 active municipal landfills, of which only 35 percent were in compliance with state regulations.

  --A Fred C. Hart Associates' report estimated the number of active industrial landfills to be 75,700 and the number of abandoned sites to be as high as 100,000.

  --Another Fred C. Hart Associates' report estimated that 19,365 sites, either landfills or lagoons, are needed to handle the current stream of hazardous waste and that 50,644 active and inactive sites contain potentially dangerous amounts of hazardous waste.

- The Surface Impoundment Assessment, funded by EPA and conducted by the states, has identified 24,500 industrial impoundments and 173,000 total impoundments. Because of the hazardous nature of much of the waste placed in industrial impoundments, states were asked to perform detailed assessments of industrial sites. Preliminary analyses of 8,200 industrial sites indicate the following:

  --Most--70 percent--are unlined and possibly allow contaminants to enter the ground.

--Moreover, 30 percent are not only unlined, but also overlie usable aquifers and are on permeable soil; of these, one third are within one mile of a water supply well.

--About 50 percent hold liquid wastes that may contain hazardous constituents.

--At 95 percent of the sites no ground water monitoring is done.

Contamination by On-lot Disposal Systems and Radioactive Disposal Sites

Domestic on-lot disposal systems also represent threats to public health. The primary concern in their case is the large number of sites and the potential for bacteriological and chemical contamination. Recent studies indicate that significant amounts of organic contaminants have been introduced into ground water through septic systems. Buried storage tanks are also of concern because of the nature of the contaminants (primarily gasoline) and the significant number of such sites in areas of high population density.

Radioactive waste disposal sites pose a potential long-term threat to public health. Some ground water contamination has been associated with leakage from the temporary storage areas in which wastes are held prior to transfer to permanent sites. Radioactivity is also associated with the wastes produced by sources such as uranium mines and mills and by the mining and milling of phosphates and metallic ores such as copper.

Other Threats

Some sources of contamination endanger public health by introducing into ground water potentially hazardous materials that would not normally be detected by a user. Other forms of contamination make ground water more obviously unusable. For example, salt water encroachment (often caused by overpumpage of adjacent fresh water), brine injection wells, and highway de-icing salts may cause localized problems in the continued use of ground water as drinking water and for irrigation. Abandoned wells can create problems, too, if constructed such that water in poor-quality aquifers can enter aquifers of good quality through uncemented well bores. While artificial recharge is considered a viable technique in some parts of the country for conserving ground water supplies that would otherwise be wasted through evaporation or runoff, there is concern

that recharge of ground water by some types of water (for example, treated industrial or municipal waste water) could preclude its use. Recharge using municipal waste water can also create bacteriological problems that might preclude domestic use.

Ground water contamination implies more than such threats to public health. It also involves economic and environmental costs. Water quality changes induced by major ground water withdrawals for agricultural activities, for example, can result in reductions in net economic benefits. For instance, irrigation can lead to an increase in the salinity of ground water which in turn can lower crop yields. Similarly caused changes in ground water quality can also increase the costs for users who need to treat the water to enable continued use.

Activities related to mining waste disposal and acid mine drainage pose a threat to ecosystems as well as to certain uses of ground water. For instance, mine drainage and waste piles can result in excessive heavy metals in ground water that would preclude its use as drinking water without major treatment.

A more detailed discussion of such threats to ground water can be found in Appendices III and IV.

Contamination by Organic Chemicals

Drinking water drawn from the ground has generally been viewed as a pristine resource, unspoiled by human activities. Recent information, however, has revealed that many ground waters are contaminated by organic chemicals. The data are particularly disturbing in that many of these chemicals are known or suspected carcinogens. Moreover, they have frequently been detected at levels that are orders of magnitude higher than those generally found in surface waters.

As a result of these discoveries, federal and state agencies have increased their monitoring efforts and new data are being produced continually. Most of this monitoring is concentrated in areas where contamination is suspected, making it difficult to generalize about ground waters. However, it is clear that a widespread problem exists and that many more cases will come to light as more monitoring is done.

As a result of these monitoring efforts, at least twenty communities in Massachusetts have discovered their public water supplies to be severely contaminated with one or more synthetic organic compounds: sixteen incidents have occurred in Connecticut, twenty-five in Pennsylvania, twelve in New York, and one or more in each of twenty other states. New Jersey and California have also detected large-scale contamination in ground water.

For example, the municipal landfill in Jackson Township, New Jersey, was licensed by the state to receive waste water sludge and septic tank wastes, but it now appears that dumping of chemicals has also occurred at the site. As a result, approximately 100 drinking water wells surrounding the landfill have been closed because of organic chemical contamination. Analysis of water samples has shown the presence of chloroform (33 μg/l), methylene chloride (3,000 μg/l), benzene (330 μg/l), toluene (6,400 μg/l), trichloroethylene (1,000 μg/l), ethylbenzene (2,000 μg/l), and acetone (3,000 μg/l).

As of March 1980 over 8,000 chemical determinations for volatile organic compounds had been performed on well water by state agencies. While a large number of compounds have been detected in these and other analyses, chlorinated organic solvents have been found most frequently, sometimes at very high levels. Several of these solvents have been shown to cause cancer in laboratory animals.

Most frequently found was trichloroethylene, an industrial solvent and degreaser which is also used as a septic tank cleaner. This compound was found in one third of the samples tested, with concentrations as high as 35,000 μg/l. (This should not, however, be interpreted to mean that one third of the nation's drinking water supplies contain measurable levels of trichloroethylene: the state monitoring was concentrated in areas where contamination was expected, and a representative sample would undoubtedly show lower levels. Such data, however, are not yet available.)

Other volatile organics frequently found in ground water include tetrachloroethylene; 1,1,1-trichloroethane; 1,1-dichloroethane, and dichloroethylenes. These data are described in more detail in Appendix IV.

THE DIFFICULTIES OF GROUND WATER PROTECTION

Strategies to control ground water contamination must take account of the major differences between ground water and surface water. Compared with surface water contamination, ground water contamination is much more difficult to detect in a timely manner and to clean up once discovered. For ground water, it is also harder to predict the movement of certain constituents with time. Further, it is extremely difficult, if not impossible at our current state of knowledge, to analyze changes in ground water quality as a result of a particular land-use activity. These difficulties are related both to the physical characteristics of ground water and to the diversity of means by which it can be contaminated.

Slow Movement of Ground Water

Although some ground waters have very rapid rates of movement in the feet-per-hour range, such as through limestone, most have velocities in the feet-per-year range. The slow movement of ground water can create difficulties because large amounts of contaminating material can enter the ground water without detection. For instance, if a monitoring well is located at or near the point of use and the actual source of contamination is a long distance away, contamination could continue for many years before detection.

Ground water flow characteristics are usually predictable in that a plume of contaminants is fairly narrow and may not extend through the entire thickness of the aquifer. If a basin-wide monitoring program, however, relies on randomly selected wells, detecting contamination in a timely manner will be almost impossible unless a well happens by chance to be located immediately down-gradient to a contamination source. This fact has important consequences for the design of a monitoring program, as discussed below. Even more importantly, new management techniques will have to be developed to avoid serious public health risks which may occur as these plumes enter the area of influence of drinking water wells.

Monitoring Difficulties

There is currently no data base from which the magnitude of the ground water contamination problem can be determined. The large amounts of data gathered by the states and the U.S. Geological Survey have generally not focused on the types of problems that have more recently become the object of concern, particularly hazardous waste disposal and contamination by synthetic organic chemicals. The data that are available are largely anecdotal, that is, based on investigation of particular instances of contamination, such as those described in Appendices III and IV, and it cannot be determined with confidence how representative these cases are. Increased attention to ground water contamination problems is likely to lead to efforts to improve this data base and, to some extent, to redirect current monitoring efforts.

Ground water monitoring is much more expensive than surface water monitoring, since it is necessary to drill a well in order to monitor a new location. In addition, the design of a monitoring system should be tailored to the kind of contamination problem that is being studied.

For example, localized sources of pollution such as landfills and surface impoundments produce plumes of contamination around the site. Because of the slow movement of ground water,

these plumes will frequently be limited in size (although continually growing). Therefore, any monitoring plan using wells scattered over a large area is likely to miss most of them, thus producing a misleading result. This suggests that the appropriate unit of sampling for such a plan is the potentially polluting site, rather than the aquifer. That is, monitoring wells should be located near the sites and positioned so that they can detect pollution if it is occurring.

Many such potentially polluting sites either currently have monitoring wells around them or will be required to drill monitoring wells by regulatory programs now being established. This will make it feasible to select a random sample of such sites and monitor the quality of ground water in their immediate vicinity. Such a survey would yield systematic and representative data which could validly be generalized to conclusions about the extent of pollution from such sources.

Areawide sources like fertilizer use can affect large ground water areas and they are more easily detected by the conventional aquifer surveys. Generally, basin-wide monitoring detects a problem only when contamination has reached a stage where water quality changes are regional in nature. This is especially true if the monitoring program relies on wells that are designed for water supply, particularly if they are of limited depth. Therefore, building monitoring networks to provide an accurate picture of changes in ground water quality is expensive and difficult to accomplish. This is a fundamentally different problem from monitoring surface waters where access is seldom difficult.

Diversity of Sources of Contamination

Protecting ground water from pollution is further complicated by the varying nature of the sources of pollution. These sources can be classified according to industry involved, type of waste, or regional distribution.

Localized sources, though numerous, are subject to control on a site-by-site basis. Generally, contamination from such sources occurs in a localized area around the site. Pollution from areawide sources, such as agricultural practices and highway de-icing, often covers a wide area and is less subject to site-specific controls. Controls may involve changes in operation (for example, a "best management practice" such as controlled use of fertilizer) rather than direct expenditures on control technology. See Appendix V for a discussion of the major sources of ground water contamination.

Restoration or Cleanup

If a large area of contamination is found, it may be extremely difficult and expensive to institute an aquifer cleanup program. Cleanup is difficult because of problems in defining the area of contamination; because of the large amounts of water that have to be removed, treated, and returned to the aquifer; or because of the difficulty of changing hydraulic gradients to control the direction in which the unwanted contaminants are moving. In contrast, surface waters move quite rapidly and generally flush an area clean in a relatively short time once the discharge of pollution has stopped.

EXISTING GROUND WATER PROTECTION EFFORTS

Numerous federal laws deal in some way with ground water management or protection, yet neither these laws nor existing state programs fully address the range of problems presented by ground water pollution. They are a patchwork of efforts that fail to cover some of the most serious problems. Appendices VI, VII, and IX document each of these federal laws and programs, and Appendix VIII discusses current state ground water management programs.

A brief summary of the major sources of ground water contamination and the current approaches to their control is presented in Table II-1. In most instances, for each major source of contamination, there is an individualized approach to control on the part of state, local, and federal agencies.

Federal Efforts

EPA has recently turned its attention to ground water protection. Despite several specific references to ground water in the Clean Water Act (CWA), Congress did not explicitly confer federally enforceable authority in the sections of that Act. Courts narrowly interpreted the Act's ground water provisions, and the Agency itself, for many reasons--lack of resources and pressures to deal with surface waters among them--deferred action that would protect ground waters. Ironically, in some situations Agency actions resulted in increases in ground water pollution by diverting pollution from surface waters to the ground.

In recent years some provisions of the Clean Water Act have been used to increase ground water protection. Most notable is the Water Quality Management program required by Section 208 of the CWA. It served as the catalyst that enabled many states to develop ground water management programs and particularly to

Table II-1

MAJOR SOURCES OF GROUND WATER CONTAMINATION AND CURRENT APPROACHES TO CONTROL

Sources of Contamination	Primary Basis of Current Control Efforts
Waste Disposal Sources	
Landfills, Dumps, and Surface Impoundments	Federal regulations and state delegation under RCRA
Mining Wastes	Previously BMPs for active mines and little for abandoned mines, 1977 Surface Mining Act initiated permit and reclamation program
On-lot Waste Water Disposal Systems	Generally local or county control under state health regulations, with evaluation of alternatives under 208 funding
Radioactive Wastes	NRC authority, sometimes delegated to states
Sludge Management via Land Spreading	BMPs developed at federal level
Underground Injection Wells	New UIC program of federal standards and state enforcement under the Safe Drinking Water Act
Abandoned Sites	Superfund (if enacted) would begin to provide federal assistance
Non-Disposal Sources	
Abandoned Wells	Limited state programs, some expansion of program under UIC
Accidental Spills	Federal advice available, sometimes assistance; RCRA and Section 311 of the CWA will extend authorities and funding
Agricultural Practices	Primarily recommended BMPs, with selected regulations under FIFRA and CWA
Artificial Recharge	BMPs under development by EPA and selected cities
Highway De-icing Compounds	BMPs at state levels
Petroleum Exploration and Development	State programs in past, now UIC and RCRA add federal standards for injection wells and lagoons
Underground Storage Tanks and Pipelines	Some local or state standards for construction, few inspection programs
Depletion	
Increased Salinity	State and local efforts
Salt Water Encroachment	State and local efforts

Source: Appendix V, "Analysis of State and Federal Programs by Pollutant Source."

experiment with innovative ways of dealing with non-point source problems. Grants to the states for pollution control programs provided under Section 106 of the CWA, and the creation of co-ordination mechanisms such as state/EPA agreements, have also strengthened state abilities in ground water protection.

Nonetheless the major elements of the CWA have not thus far been directed to ground water protection. For example, EPA has construed Section 303 (Water Quality Standards) to apply to ground water only in unique and narrow circumstances. Accordingly, it has not developed a program of nationally consistent ground water quality standards. Further, there are

conflicting judicial opinions as to EPA's authority to issue NPDES permits related to ground water protection.

Several provisions of the Safe Drinking Water Act (SDWA) relate to ground water protection. One of these creates the Underground Injection Control program which establishes minimum standards for injection well design and operation and state program requirements. The Act provides for regulation of injection wells by permit or by rule. EPA regulations specify procedural and technical requirements for the program, including construction, operating, and monitoring requirements for injection wells. The Act envisions state assumption of the primary responsibility for enforcement of the standards. A limiting factor with respect to this program is that it is intended to protect ground waters that are current or potential sources of drinking water, thus only restricting pollution in single-use sources and disregarding other uses and ecological needs.

Another provision of the SDWA is the sole-source Aquifer Protection Program (Section 1424.e.) which provides a mechanism for state, local, or regional agencies to petition EPA to protect recharge zones of special aquifers by designating them sole-source aquifers. A limiting factor of this provision is that it only protects recharge zones from the federally funded projects that might contaminate them. Non-federally funded projects are not regulated. Despite this and other limitations, it is the only EPA program that uses recharge zone protection as a ground water management tool.

The Resource Conservation and Recovery Act (RCRA) of 1976 provides for control of the land disposal of municipal waste and the generation, treatment, storage, and disposal of hazardous waste. EPA regulations provide for a manifest system to track hazardous wastes from the point of generation to the ultimate disposal site. They also provide for the permitting of hazardous waste management facilities, including technical requirements for disposal sites. This Act also provides for federal standards for disposal of nonhazardous waste, but these standards are not federally enforceable. Again, this Act provides for delegation of enforcement responsibility to the states.

The newly launched UIC and RCRA programs provide significant funds for state grants, which may greatly improve the ability of the states to fund ground water protection programs.

The Surface Mining Control and Reclamation Act of 1977 under the administration of the Department of the Interior provides authority to control surface mine pollution; protection of ground waters is explicitly included. The Uranium Mill Tailings Radiation Control Act of 1978 mandates EPA to establish radiation

standards for uranium mill tailings and the Nuclear Regulatory Commission to implement and enforce the standards.

Other EPA laws such as the Toxic Substances Control Act (TSCA) and the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) have the clear potential in certain circumstances to ban substances that are of particular danger. Finally, EPA has proposed Superfund legislation which is now under consideration in the Congress. This authority, when passed, will support the cleanup of abandoned hazardous waste sites. More discussion is included in the appendices.

Thus, federal programs provide for explicit, well-developed regulatory approaches for some threats to ground water quality and devote only incidental attention to others. Hazardous waste disposal and underground injection are well covered by mandatory federal programs that are now entering the implementation phase. Federally funded projects in the recharge zones of designated sole-source aquifers are regulated, but other projects in those areas are not. Potential ground water impacts of surface mining and the uranium fuel cycle are covered by programs designed to deal with those activities comprehensively. EPA has used Section 208 of the Clean Water Act to encourage states to develop ground water management programs. But the other sources of ground water pollution, discussed above and in Appendix V, are not subject to federal control programs.

State Efforts

The state governments have been faced with a difficult challenge for many years in the area of ground water quality management. The combination of the technical complexity of the problem, the competition within state governments for administrative and financial resources, and the lack of any central coordinating federal program have all made significant progress in the area difficult. Some states have been able to achieve notable progress, while others have not been able to win adequate support to make ground water protection a high priority.

Approximately 60 percent of the states rely on general laws as the basis for ground water protection. Laws specific to particular sources of ground water pollution or related activities exist only sporadically, are often not explicitly designed to protect ground water quality, and commonly include grandfather clauses that exempt existing pollution sources. Laws that do exist to protect ground water from specific sources of pollution are not generally applied in a coordinated program aimed at ground water protection but implemented by diverse agencies whose primary responsibilities are not directed at ground water protection.

Few if any states have a centralized program to protect ground water from all major sources of contamination. Typically, a public health agency has (or shares) authority over on-lot waste water treatment. An environmental agency will have authority over most other ground water pollution sources, although in several states the authority for individual sources of contamination belongs to more than one agency (that is, oil- and gas-related issues are under a separate authority from industrial waste sites). A third agency may have responsibility for ground water quantity issues. In addition to the state agencies possessing regulatory authority, other agencies such as a state geological survey or the state soil conservationist are involved in data collection or in providing technical assistance.

There are attempts in several states to coordinate efforts through multi-agency advisory committees or task forces. However, many relationships that exist among the personnel of various state agencies are informal, and subject to the traditional forces of turf, personalities, and available resources.

State staffing and budgetary limitations will, for the most part, determine the ultimate form and organization of ground water protection efforts. It appears that no state has the resources or funding it needs. For example, several states have septic tank regulations or regulations on oil-well drilling but insufficient manpower to adequately enforce them. A broad extrapolation from data collected regarding the number of person-years currently involved in state ground water protection programs indicates that about 525 person-years of professional/technical effort are expended each year by all states.

A state's efforts in the protection of its ground water and its commitment in resources is a function of whether it perceives a problem. The level of concern varies tremendously between states. In some instances a state may not, at this time, be a heavy ground water user and may be complacent concerning the issues. Other states--New Jersey and Washington, for example--are developing fairly large staffs devoted to ground water issues and appear to be in the forefront in developing innovative approaches to ground water protection.

In order to round out the general information needed to give a reasonable picture of existing state ground water protection programs, ground water standards were selected as one barometer of state programs. Five states have standards in effect, six are currently reviewing or processing proposed standards, and another seven are currently involved in drafting ground water quality standards. Thus, nearly 40 percent of all states are either taking or have taken steps to develop specific standards to protect ground water quality. However, ground water standards may be very different from state to state, with each

state emphasizing the parameters and levels needed to ensure its own protection. Further discussion can be found in Appendix VIII.

In addition, major sources of ground water pollution vary from state to state. For example, in Washington and Vermont, on-lot waste water treatment is considered the most severe problem, while in New Jersey, surface impoundments that are leaking toxic wastes are the greatest source of pollution. Programs also vary substantially between states. In regulating septic tanks, programs vary from requiring permits to inspecting construction to regulating system installers. Attitudes toward land-use controls also vary. In Washington, sensitive aquifers and recharge areas have been identified, and courts have held the right to deny permits for septic tanks on these aquifers based upon ground water contamination. In Vermont, land-use controls are seen as the last resort.

Information essential to proper management of the ground water resource is also lacking in many states. In a preliminary inventory, six states were identified as having substantial knowledge of their ground water resource. Nine states are in the process of inventorying. Five states have a particular inventory, and twenty-seven states have no systematic inventory.

In addition, there are growing political pressures in most states to limit expanding state bureaucracies. There is a trend toward establishing limits on budget and personnel increases, particularly in areas supported by federal funds. A more detailed discussion of state ground water management programs can be found in Appendix VIII.

Effect of Federal Programs

A number of federal programs are being delegated to the states for management over the next two to five years. Some of these directly deal with ground water management--the UIC and RCRA programs, for example. Other programs much more indirectly related include the construction grants program for the construction of secondary treatment plants. The delegation of existing environmental programs has tremendous implications for state governments. The principal impacts will be to impose minimum federal standards as established in the statutes and to promote significant new levels of federal grant assistance.

Thus it is clear that there is a growing interest in and concern about ground water management on the part of the states. Many state agencies are involved in ground water protection. Existing resources, data bases, and available expertise are extremely limited. As a result, there will be fierce competition for resources in state governments.

RESEARCH AND DEVELOPMENT EFFORTS

The establishment of the following research categories first took focus in the fall of 1976 on the advice of a group representing various EPA Offices, universities, the USGS, state agencies, consultants, and the National Water Well Association. These have subsequently been refined based on the views of the Agency's Science Advisory Board, the National Drinking Water Advisory Council, the Subcommittee on the Environment and Atmosphere of the House Committee on Science and Technology, and various continuing committees within EPA.

The research categories are:

Methods Development
Contaminant Transport and Fate
Subsurface Characterization
Specific Sources of Contamination
Aquifer Rehabilitation
Information Transfer
Technical Assistance

Funding levels for such research were highly restricted until recently but are now being expanded significantly. Each of the research categories is discussed in detail in Appendix X.

III

WHAT IS A STRATEGY?

III. WHAT IS A STRATEGY?

A national strategy is not wholly synonymous with a federal strategy. Rather, it implies a consensus on the part of all concerned--federal, state, and local governments; business; industry; and others--as to what problem is to be addressed; what objectives are to be achieved in alleviating the problem; and what constitutes the most effective, efficient, and feasible way of achieving those objectives. Central to the development of a national strategy is specification of the roles the participants are to play. The type and extent of these roles depend on many factors--history, current law, capacity to provide needed resources, and the degree to which the problems are being addressed through current efforts, among them.

For ground water protection, EPA has in mind both a national and a federal strategy. Obtaining a national perspective will ensure the development of a federal strategy that is relevant to and supportive of related efforts, most particularly the efforts of state and local governments. It will also serve as a response to the mandates of the President's June 6, 1978, Water Policy Message, which directed federal agencies to expand federal-state dialogue and cooperation on ground water issues. The strategy should clearly delineate the larger context in which EPA works--on the federal level and with state and local governments--and provide the framework within which EPA decision making on ground water protection can take place.

THE FRAMEWORK FOR DEVELOPING A STRATEGY

Strategies imply choices--from the broadest determination of goals and objectives and alternative courses of action to implementation of the chosen course through laws, regulations, and resource devices.

For the purposes of this workshop, this series of choices will be dealt with as follows. First, the major strategic issues that emerged in Phase I of the planning process will be identified, analyzed, and discussed. Then, the workshop participants, in four groups of ten persons each, will be asked to carefully look at the alternatives, add new ones, discard those thought unworkable, and recommend the strategy choices considered most appropriate.

A strategy for ground water protection must include definition of each of the following elements:

- A national goal for the protection of ground water;
- A management process for setting priorities for regulatory and other actions under the assumption of limited resources;
- An appropriate set of control mechanisms based on considerations such as cost effectiveness and technological and political feasibility;
- The roles federal, state, and local governments are to play in carrying out aspects of the strategy;
- The research and development needed to support these mechanisms and roles; and
- A set of action steps for the short term and one for the long term (recognizing that future actions are based on research), including resource requirements.

Each of these elements will be discussed during the workshop, approximately in the sequence in which they are listed above. Work groups will discuss them and make recommendations in each area. The final strategy recommended by each work group will represent a pulling together of the various recommendations into one overall statement.

Strategic options for each of these elements are detailed in subsequent chapters. Table III-1 summarizes those options in four columns, corresponding to the first four elements of a strategy as listed above. The various columns in the table reflect the sequence of steps that the workshop participants will follow to develop their recommendations. First, teams will discuss goals and select the one that they recommend as the goal for a national ground water protection strategy. Next, teams will address the two topics under the general heading "Mechanisms." They will be asked to select one or more of the options (or develop additional options) under both topics--management approach and technical requirements. Finally, participants will discuss federal, state, and local roles in implementing the strategy and will select one or more of the options provided (or develop an additional option).

As each team selects options in the columns across Table III-1, it will define a unique potential strategy for ground water protection. The choices in various columns must relate

Table III-1

SUMMARY OF INITIAL OPTIONS FOR DEVELOPING A GROUND WATER PROTECTION STRATEGY

Goals (select one)	Mechanisms		
	Management Approach (select one or more)*	Technical Requirements (select one or more)*	Federal/State/Local Roles (select one or more)*
• To protect all ground waters at their present levels of quality (i.e., nondegradation) (p. IV-2)	• Uniform Requirements Everywhere (p. V-3)	• Best Management Practices (BMPs) (p. V-9)	• States take primary responsibility for implementation of federally developed national standards (p. VI-3)
• To assure that all ground waters are protected everywhere up to some specified level (e.g., a drinking water standard) (p. IV-3)	• Classification of Ground Waters (p. V-4)	• Technology-Based or Effluent Standards (p. V-10)	• States prepare and submit program plans for federal approval in response to federal minimum requirements (p. VI-4)
• To protect ground waters to the levels necessary for projected future uses (p. IV-4)	• Classification of Contaminants (p. V-5)	• Ground Water Quality Standards (p. V-11)	• States prepare individual program plans consistent with broad federal guidelines, subject to federal approval primarily on procedural grounds (p. VI-5)
• To protect only those ground waters that are used as drinking water sources, and to rely on monitoring or treatment for use of unprotected ground waters (p. IV-6)	• Classification of Sources of Pollution (p. V-6)	• Economic Incentives and Other Approaches (p. V-12)	• State and local governments set and enforce standards consistent with broad federal goals; the federal government provides technical assistance and support (p. VI-7)
			• States develop plans and programs; the federal government provides support and technical assistance only (p. VI-8)

Note: Page numbers following each option indicate location of discussion in text.

*Select or develop one option, or select more for different categories of problems, etc.

to one another logically, in the context of the strategy, but there is no predetermined correspondence of options in one column to those in another; any management approach could at least theoretically be combined with any technical requirement, and so on. Any horizontal path through the table, from an option in one column to some other option in each of the other columns, will define a potential strategy.

For illustrative purposes two scenarios of potential strategies are described below. These can serve as examples of the ways different options from Table III-1 can be combined to develop strategies. Although these scenarios are purposefully sketchy, they can also serve as examples of the format in which teams might present their recommendations to the full workshop.

SCENARIO I: ILLUSTRATIVE GROUND WATER STRATEGY

I. Goal

- To assure that all ground waters are protected everywhere up to some specified level.

II. Management Approach

- Classify sources of pollution, with an emphasis on industrial sources.

III. Technical Requirements

- Technology-based standards for industrial sources of pollution (e.g., hazardous waste sites, landfills, injection wells).
- Strict requirements for new sources; requirements for existing sources constrained by feasibility.
- Opportunity for local case-by-case variation based on engineering and hydrogeological considerations.
- Limited exceptions allowed for some standards (for example, sole-source aquifers, exempted aquifers).

IV. Federal, State, and Local Roles

- The federal government sets uniform minimum technical standards for major sources and specifies conditions for exceptions.
- States that accept responsibility for the program apply standards to individual facilities, write permits, and undertake inspection and enforcement roles.
- States may adopt standards which are more stringent than federal standards.

V. Implications for the Near Term

- R&D is needed to support the technology-based standards for specific sources.
- Guidance from EPA to states is needed on how to administer variances.
- Personnel staffing and training is needed for writing permits, performing inspections, and conducting enforcement actions.

VI. Pros and Cons

Pros

- Straightforward to administer.
- Similar in concept to successful air and surface water pollution control programs.

Cons

- Average level of protection will be too little in some areas, too much in others.
- Does not take advantage of siting as a control measure.
- Neglects areawide sources.

SCENARIO II: ILLUSTRATIVE GROUND WATER STRATEGY

I. Goal

- To protect ground waters to the levels necessary for projected future uses (considering the economic and social value of use versus protection).

II. Management Approach

- Basic premise is that water quality degradation will be allowed in some areas while strict controls will be applied in other areas.
- The central element is classification of ground waters according to use. Ground waters would be classified into three or four use categories depending on their present quality, the availability of alternative water supplies, and the value of other uses.
- Each classification would have an associated regulatory framework that could vary from state to state.

III. Technical Requirements

- Best management practices, through siting, would be a major aspect of the control strategy for new sources. Nondegradation (no new sources) might be appropriate for the highest ground water classification category.
- This approach relies on the ground water planning process (including public participation) to arrive at and implement appropriate levels of control.
- This allows but does not require numerical ground water quality standards.

IV. Federal, State, and Local Roles

- States and local institutions must design and implement ground water classification schemes and associated regulatory frameworks.

- Control strategies will vary considerably from area to area, reflecting differences in the importance of ground water and its uses around the country.

- The federal government will provide technical assistance on ground water classification and other topics, and require and approve state plans largely on procedural grounds.

V. Implications for the Near Term

- R&D is needed to provide technical support for ground water classification systems by state and local governments.

- Guidance is needed from EPA to the states on current basis for classifying ground waters.

- Planning guidance and assistance is needed from EPA to the states.

- Personnel staffing and training in states for planning and program implementation is required.

VI. Pros and Cons

Pros

- Allows tailoring of programs to local conditions. Forces weighing of social values involved.

- Takes advantage of siting controls.

Cons

- Places much greater burden on both the resource and institutional capacities of states and localities.

- Many states presently lack the ability to carry out such a program.

- Previous programs along these lines have had mixed results.

IV

GOALS FOR A GROUND WATER PROTECTION STRATEGY

IV. GOALS FOR A GROUND WATER PROTECTION STRATEGY

Selection of a goal related to ground water protection is the necessary starting point for the determination of a national ground water strategy. The term "goal" is used here in the sense of a broad mission or an overall statement of purpose. The recommended goal should thus encompass the whole of what the ground water strategy aims to accomplish.

The goal statements described herein were variously advocated by those interviewed in Phase I of the strategy development. They should be evaluated in a discussion that is largely independent of considerations of how the goal is to be reached--that is, through what management and regulatory mechanisms, by whom, and in what time frame. These are subjects of following chapters.

In recommending a goal for the ground water strategy, it is important to be realistic. One must take into account, for example, the competing national interests that will be affected. There is always some cost, economic or other, to protecting any natural resource. There is also a social cost, perhaps long term, to not protecting such a basic natural resource as ground water. The recommended goal should thus reflect an appropriate balancing of such interests.

The four alternative statements of the national goal for ground water protection identified in Phase I are the following:

- Option 1--To protect all ground waters at their present levels of quality (i.e., nondegradation). Protect all ground water from any further degradation, and possibly attempt to restore some aquifers that are already contaminated.

- Option 2--To assure that all ground waters are protected everywhere up to some specified level (e.g., a drinking water standard). Limit ground water contamination to maintain this quality level, perhaps with reference to some desirable drinking water standard (drinking water presumably being the socially most important category of water use).

- Option 3--To protect ground waters to the levels necessary for projected future uses. Protect ground water based on use, and perhaps project

uses based on population forecasts, availability of surface water, and present ground water quality. This would include making some tradeoffs between ground water protection and other activities. Allow contamination to levels consistent with anticipated ground water uses.

- Option 4--To protect only those ground waters that are used as drinking water sources, and to rely on monitoring or treatment for use of unprotected ground waters. Do not protect waters that are not now, or will not in the near future be, drinking water sources. Allow their contamination and rely on monitoring or treatment technologies to render the water usable if and when it is needed.

These options, and others which could be proposed, should be measured against general standards of feasibility and adequacy before being endorsed. Some of these general criteria are suggested in the following list:

- Is the goal attainable?
- Will the goal assure reasonable availability of ground water for future uses?
- Is the goal generally feasible, from technical, economic, and political perspectives? (These will be dealt with in more specific terms in later chapters.)
- Is the goal consistent with the nation's other environmental goals?

Each of the major options for a goal and its supporting rationale are described below.

OPTION 1--TO PROTECT ALL GROUND WATERS AT THEIR PRESENT LEVELS OF QUALITY (I.E., NONDEGRADATION)

This goal represents the strongest view of protecting ground water as a valuable and irreplaceable asset. It focuses on total control of all sources of contamination and includes the possibility of restoring some polluted aquifers.

Advocates contend that only with such a strong goal will adequate ground water protection be accomplished. Representative comments in favor of this goal are the following:

"Water is essential to human life. With surface water being extensively used in many areas of the United States, protection of ground water may be essential to future populations."

"Ground water contamination is the most subtle and dangerous form of pollution. We can't see, smell, or sense it and we can barely monitor it. It lasts for decades, maybe centuries, and may prevent future generations from having a source of potable water."

Those opposing this goal typically comment:

"In many areas, ground water will never be needed because surface water supplies are abundant or the areas are uninhabited. Why force businesses to close or incur higher costs to protect something that will never be used?"

"In oil field areas, additional petroleum production is far more important than ground water quality. Besides, the water may already be unusable."

OPTION 2--TO ASSURE THAT ALL GROUND WATERS ARE PROTECTED EVERYWHERE UP TO SOME SPECIFIED LEVEL (E.G., A DRINKING WATER STANDARD)

This goal focuses on the fact that any individual area of ground water may be needed at some time. Although advocates concede that a particular aquifer may be used for many different purposes, they insist that aquifers should be protected to a specified quality level. That quality level would presumably be high enough that most, if not all, major water uses would be compatible with it.

Some supporters of this goal advocate using some appropriate drinking water standard as the basis for the uniform level of protection. Reference to such a standard might be based in part on the assumption that drinking water is the socially most important water use.

Typical comments in favor of this option are the following:

"We can't predict where population centers will be, or how adequate surface water quality and quantity will be, a hundred years from now. Since we cannot be sure of future ground water needs, we should ensure that all ground water is protected to a desirable quality level."

"Since we really don't know what our future pattern of ground water uses will be in the long term, we should protect ground waters to a single set of standards."

Those opposed to this statement of the goal tend to view maintaining a single quality level everywhere as unrealistic, especially in areas where future use of an aquifer is deemed unlikely. Examples of ground waters that are not expected to be used are those in the sulfur fields in southern Louisiana, and aquifers in areas with abundant high-quality surface water supplies.

Those opposed to this option cite views such as these:

"Water quality standards are changing every few years. How can we know now what we'll consider safe 50 or 100 years from now?"

"We see water treatment technology as changing rapidly. Rather than have to protect ground water everywhere, we may be able to rely on technology to treat water when and if we need it."

"We have to be discriminating. We can't afford to protect water everywhere. We have to single out the places where it's most important and focus our efforts there."

OPTION 3--TO PROTECT GROUND WATERS TO THE LEVELS NECESSARY FOR PROJECTED FUTURE USES

This goal relies on forecasts of anticipated water use and suggests that ground water quality be allowed to deteriorate to levels consistent with those anticipated uses. Forecasts logically consider population projections, land-use patterns, industrial expansion plans, and agricultural needs, which are then translated into anticipated ground water demands.

Different uses require varying levels of water quality. Therefore, the necessity for controls can depend significantly upon the intended uses. Examples of major use categories are these:

- Drinking water
- Irrigation
- Source for surface stream flow

- Livestock drinking water
- Industrial cooling water
- Industrial process and other water use
- Mining
- Other energy-related uses (e.g., coal slurry)

This option also implies that tradeoffs will have to be made between ground water protection and other activities. It acknowledges that certain industrial and other activities may be of higher priority than ground water protection and, though they may pollute aquifers, should perhaps be continued based on a societal judgment of priority. Frequently cited high-priority activities are energy production, highway de-icing, and agricultural practices related to irrigation return flow and fertilizer use.

This option also provides the opportunity to build in flexibility in the definition of ground water use and in defining hydrological, geological, and climatic conditions, etc., which will permit accommodation of regional variations.

Those favoring this option feel that since some uses require higher quality waters than other uses, and because expected uses can be forecast, ground water protection standards should be set according to predicted uses. In support of this option they comment:

> "This goal is flexible and responsive to local and regional needs. It strikes a good balance between protecting ground water and setting ground water quality goals that are unrealistically high."

> "We should enable some polluting activities to continue where it won't affect future uses, as long as we monitor and control those activities."

Those opposing this goal tend to rely on the arguments supporting Options 1 and 2 above. Others also cite such concerns as these:

> "Predictions of the future are almost always wrong. We may be endangering our only drinking water supplies in some areas when we permit degradation below drinking water standards."

"Twenty years ago you'd never have guessed there'd be a Lake Havasu City out in the desert in Arizona. That's where the London Bridge is now. How can you forecast where water will be used and where it won't?"

"We know so little about ground water. It would be impossible to set appropriate standards and to control and monitor polluting activities. It just wouldn't work."

OPTION 4--TO PROTECT ONLY THOSE GROUND WATERS THAT ARE USED AS DRINKING WATER SOURCES, AND TO RELY ON MONITORING OR TREATMENT FOR USE OF UNPROTECTED GROUND WATERS

The supporters of this goal prefer a limited governmental program and would restrict ground water protection to waters that are now, or in the near future will be, drinking water sources.

Under this goal contamination of non-drinking water sources would be allowed. Monitoring could be used to detect whether contamination has spread to any areas where it would affect uses. Treatment technologies would be utilized if ground waters became too contaminated for other desired uses. Typical views favoring this goal are the following:

"Economic activity is this country's lifeblood. To interrupt it where ground water protection is unnecessary would be counterproductive."

"Let's minimize federal red tape. Where industry is not damaging ground water that is needed for other purposes, why add requirements like monitoring to meet quality standards?"

"Let's not subsidize industries that want to use ground water. If they are going to use it, then they can bear the cost of treating it to the level that meets their needs, just like they would have to if they were on a major river."

"Why pay a substantial cost to treat all the water or waste we put into or onto the ground when we end up needing only a very small fraction of the ground water? Why not just pay to treat the much smaller quantity of ground water we use?"

Those opposing this goal favor one of the first three options and cite views such as those reported in support of them.

They also offer the following concern:

> "Allowing significant contamination of any ground water particularly with toxic and hazardous materials is an almost irrevocable decision since restoration or exotic treatment before use is economically or technically infeasible."

V

MECHANISMS TO ACHIEVE THE GOAL--
MANAGEMENT AND TECHNICAL REQUIREMENTS

V. MECHANISMS TO ACHIEVE THE GOAL- MANAGEMENT AND TECHNICAL REQUIREMENTS

This chapter deals with the range of governmental approaches available for protecting the nation's ground water resource. The range is considered in the broadest sense to cover all types of requirements, including recommended management practices, engineering or technological standards, waste disposal regulations, and even economic incentives.

The focus of this discussion is on the mechanisms that could be utilized to achieve the goal or goals that arise out of evaluation of the previous chapter. It is separate and distinct from any consideration of the roles of federal, state, and local agencies. Many of the mechanisms could be developed with either the federal or state government assuming primary authority for certain key aspects of the program. This chapter, however, is concerned solely with the management and technical approaches; potential federal, state, and other roles are dealt with in Chapter VI.

The management and technical mechanisms which establish the framework for protecting ground water can embody much flexibility. Different mechanisms could be used to deal with different sources of contamination, for example. These mechanisms could also provide flexibility in dealing with different hydrological, geological, and climatic conditions and thereby accommodate regional differences.

The discussion of mechanisms herein is divided into two major sections. Any strategy for ground water protection must include a position on each:

- Management Approach. A consideration of whether regulatory standards should be applied uniformly across all regions, industries, and types of contamination. If not, then how should variations be incorporated?

- Technical Requirements. A discussion of the range of approaches to encouraging or requiring technical controls.

The following options for each of these sections were identified in preconference discussions by EPA:

Section	Options
Management Approach	1. Uniform Requirements Everywhere 2. Classification of Ground Waters 3. Classification of Contaminants 4. Classification of Sources of Pollution
Technical Requirements	1. Best Management Practices (BMPs) 2. Technology-Based or Effluent Standards 3. Ground Water Quality Standards 4. Economic Incentives and Other Approaches

To facilitate work group discussion and evaluation of these options, they are further described below. It should be remembered that these options are neither mutually exclusive nor totally exhaustive.

MANAGEMENT APPROACH

There are wide-ranging opinions as to whether requirements for ground water protection ought to be uniformly applied throughout the country or varied to accommodate local conditions. The range of opinion comprises four major management options:

- Option 1--Uniform Requirements Everywhere. Ensure that the requirements, whatever they are, are uniformly applied everywhere, regardless of differences in geological conditions, uses, and alternative water sources.

- Option 2--Classification of Ground Waters. Differentiate control requirements on the basis of ground water classifications that reflect the intended use of ground water in a specific area. The classifications could be based on aquifer vulnerability (that is, geology and hydrology), quality, present and projected uses, and the availability of alternative sources of water.

- Option 3--Classification of Contaminants. Establish priorities for various types of contaminants. As with current distinctions between "conventional" and "priority" pollutants in effluent standards, the potential contaminants of ground water could be classified, for example, according to toxicity, adsorption in the soil, and long-term fate.

- Option 4--Classification of Sources of Pollution. Determine priorities for protection based on some classification of sources of contamination. Sources could be categorized by type of facility, such as surface impoundments, or by industry. Classifications of high- and low-priority sources could be based on expected volumes, chemical composition, and method of waste disposal.

Each of these options and its supporting rationale are described below.

Option 1--Uniform Requirements Everywhere

Supporters of this position tend to believe that control requirements ought to be applied uniformly everywhere in the country. To them, neither the present availability of adequate surface waters nor the lack of projected ground water uses in an area provides justification for controlling sources of pollution in some areas differently than in others.

Some advocates of this option voice concerns about equity, and do not want strict controls imposed on some plants in an industry and not on others.

Representative comments in support of this option include the following:

> "We are concerned about ground water protection as a critical environmental and public health issue for the future. We must protect this critical resource everywhere for future generations."

> "We cannot afford to allow variation in our program of ground water protection because the significant adverse effects of contamination often do not show up until ten or twenty years later. Also, once ground water becomes contaminated, it remains so almost indefinitely."

The principal arguments put forth against this option generally are that it is unrealistic and uneconomical. This option would require strong protective measures everywhere even though only some areas of the country warrant them. A typical comment of this type is:

> "It just doesn't make sense to protect ground waters that may already be polluted, to the same degree as fresh water is protected somewhere else."

Option 2--Classification of Ground Waters

This approach would establish priorities for ground water protection on the basis of local geological and hydrological conditions and the importance of specific ground waters. Its advocates contend that these characteristics are sufficient to distinguish between places where ground water protection should be strict and those places where it should be relaxed. Such priority designations could be the basis for restrictions on the types of activities, such as mining or waste disposal, that would be allowed in the vicinity of ground waters of certain classifications.

One input to the classification of a ground water zone could be the physical conditions that provide some degree of natural protection from contamination. These would identify particularly vulnerable situations as candidates for strict controls. Data could include rates of ground water movement and replenishment.

A second input to such classification could be the ground water's intrinsic value in terms of yield, water quality, and the availability of alternative water supplies in an area.

A third element of the classification process could be based on the uses that are or that will be made of the ground water. Use categories that would justify different levels of protection include drinking water, irrigation, livestock, surface stream base flow, industrial supply, and waste disposal. Some supporters of this option suggest relying on use designation as the primary basis of classification.

People who advocate this approach to applying controls contend that the highest levels of protection should be given to ground waters that are important sources of drinking water and have particularly vulnerable geology, yield, and quality. These people also feel that lower levels of protection are warranted in cases where there are ample supplies of surface water, where ground waters are already contaminated, where the ground water is of low yield, or where there is a high social value placed on the contaminating activity.

Representative comments in support of this option include the following:

> "We know at the local and state levels which areas of ground water are really critical to our region and which are highly susceptible to contamination. Those are the only ones for which we want to impose strict controls. For the others a much more modest program is all we need."

"This approach can give us the flexibility to address regional differences. By having explicit differentiation on the basis of geological, hydrological, and other conditions, we'll have a rational basis for regional variation in ground water protection efforts."

"We can't do everything at once. We need to keep our priorities straight and take action to protect the ground waters that really need it."

Opposition to this point of view comes primarily from two directions. One is that described in favor of broad protection under Option 1 above. The other questions both the technical and economic feasibility of ground water classification. Some representative comments in this area are these:

"There are real difficulties describing ground waters. Some people make it sound simple, but it's more complex: there isn't just one aquifer under most areas; there are usually many different soil strata; yields and water quality vary throughout an aquifer; the direction and speed of water movement must be considered; and we can't define exact boundaries to an aquifer."

"This is an expensive process and may not be needed for some states. How would you distinguish where it is and isn't to be required?"

"A classification process would create a demand for detailed mapping information which is not available now."

"The manpower needed to undertake classification of all the nation's aquifers is simply not available."

Option 3--Classification of Contaminants

This approach would establish priorities for ground water protection on the basis of the toxicity of the potential contaminants.

Its proponents contend that the previous option, classification of ground waters, would lead to unnecessarily strict requirements. In particular, they feel that less toxic contaminants, like the "conventional pollutants" under the Clean Water Act, would present little threat to most ground waters and would therefore require little regulation. In the absence

of such classifications, though, they expect that requirements would be geared to the most toxic substances and would impose unnecessary burdens on sources with "conventional" wastes.

The following are representative comments from supporters of this option:

> "All wastes are not equal. We should be singling out the 'bad actors' with respect to ground water in terms of adsorption in the soil, long-term fate, and effectiveness of current treatment technologies. Then we should focus our efforts on the worst categories."

> "It's more efficient to prioritize actions by the seriousness of the contaminants than by the type of plant or production process involved. After all, it's the contaminants we're really concerned about. It may also be simpler to classify these than to develop standards or regs for dozens or hundreds of industries."

> "This approach could be consistent with the current hazardous waste program and the government's carcinogen policies which rely on identifying serious chemicals."

Opponents to this option tend to feel that the scientific data required to implement it is difficult and costly to develop and maintain.

> "There are thousands of chemicals in existence, and just because one has been identified as serious under the toxics program or the hazardous waste regulations doesn't necessarily mean it is a problem for ground water."

> "We don't need to tie ground water protection to a massive database of chemicals. We can specify what constitutes adequate control in most situations just by looking at the geology and other local conditions."

Option 4--Classification of Sources of Pollution

This approach would set priorities for protection based on the type of contaminating facility (source) or industry involved. Its proponents contend that there are certain sources, such as industrial leach fields, which should be singled out for high-priority treatment. Likewise, some argue, there are certain industries that are more likely than others to dispose of large volumes of wastes that could threaten ground water.

Both the new hazardous waste program under the Resource Conservation and Recovery Act (RCRA) and the Underground Injection Control (UIC) program under the Safe Drinking Water Act set requirements applicable to different classes of facilities. Source-specific requirements represent the traditional approach to the control of air and water pollution. This approach is most often utilized in conjunction with technical requirements that are technology-based standards.

The major sources of pollution that are mentioned as threats to ground water are listed in Table II-1 of Chapter II and are described in Appendices III and V. There are various ways of listing the sources, with sixteen categories used in the unranked list in Chapter II. For purposes of developing a ground water protection strategy, one could recommend a different technical approach for each source category, or one could attempt to group sources in ways that would simplify the strategy.

Representative comments from supporters of this option include the following:

"We should adopt a national priority listing of ground water contamination sources as a way of focusing attention on the most serious threats to ground water."

"Some sources of contamination, such as surface impoundments in developed areas, consistently pose problems for ground water and we ought to be very tough on them."

"If we're going to make any progress in a national program, we have to assign some priorities to different sources of pollution so we can tell people where to devote their effort."

"I don't care who makes the choices, whether it's the feds or the states, but there has to be a difference between the way we control some sources versus others."

The opposition to this approach to an overall ground water strategy seems to focus on the administrative and technical burden of issuing separate requirements for numerous classes of sources and/or industries. Comments which represent this point of view include the following:

"The government can't afford the manpower and time to develop regulations for every source or industrial category. It should develop a broad program and treat everyone the same."

"The continued risk posed by any given facility is so largely a function of local factors like soil conditions and proximity to drinking water sources that controlling contaminant sources alone may distort the resulting priorities."

TECHNICAL REQUIREMENTS

There are several possible approaches to encouraging or requiring technical control measures that will prevent ground water contamination. Most of these could be used in conjunction with any of the management approaches described in the previous section. By pairing a specific management approach with an approach to technical requirements, one can define the core elements of a ground water protection program.

The four major options for technical requirements that arose from EPA's preliminary research for the workshop are presented below. Other approaches and variations or combinations of these should also be considered wherever participants feel it appropriate to do so.

- Option 1--Best Management Practices (BMPs). Utilize "rules" that specify the best management practices to follow in various situations. This would provide the flexibility to tailor requirements to individual situations. It could also relieve state and federal officials of the burdens of specifying strict standards and administering a permit program.

- Option 2--Technology-Based or Effluent Standards. Establish standards for allowable levels of pollutant "discharge" to ground waters based upon industry processes and available control technologies. These could include standards for three phases of a facility's life: (a) design and construction, (b) operation and maintenance, and (c) closure and post closure.

- Option 3--Ground Water Quality Standards. Establish ground water quality standards. These could be based upon present water quality criteria for certain uses such as drinking water. They could also specify maximum levels of contamination based on the ability of present water treatment technology to remove the contaminants prior to water use.

- Option 4--Economic Incentives and Other Approaches. Establish some set of discharge allocations, ground water contamination fees, noncompliance fees, or other mechanism to provide incentives to businesses and others to meet the national ground water protection goal. Most, if not all, such incentives must be utilized in conjunction with one of the three other options above to provide a means of deriving the appropriate levels for fees, allocations, and so on.

Each of these options and its supporting rationale are described below. It is entirely possible that a ground water protection strategy could employ one of these approaches for some polluting activities and another for different activities.

Option 1--Best Management Practices (BMPs)

This approach to control requirements offers the flexibility for dealing with individual cases on a site-specific basis. Rather than specifying mandatory standards, it encompasses "rules" which are guidelines for various situations. As a result, the rules can be specified by the government with somewhat greater ease than that involved in developing and implementing stricter standards.

Another significant feature of best management practices is that they can be publicized and required on a broad basis without necessarily mandating a permit program. It is possible, for example, to advise landfill operators of the best management practices to be followed in the construction and operation of a landfill in order to protect ground water without ever requiring the operator to file a permit application.

This option is intended to cover both operating practices and standards for the initial design, construction, and location of facilities. Often BMPs have been primarily focused on day-to-day operating practices in areas such as agriculture. The same approach, however, has also been applied to guidelines for the location and design of on-lot disposal systems, for example, and could be extended to other types of facilities. A phrase which is sometimes used to describe these facility-oriented standards, in contrast to operating practices, is "Best Engineering Judgments" (BEJs). In the discussion of this option, the term "BMP" is used broadly to include both.

Typical comments from those who favor this option for control requirements include:

"Ground water protection is basically a local problem, so we need to establish broad guidelines in the form of BMPs and then let local decision making take over to tailor requirements to the local situation."

"BMPs are the only thing you can do in some cases. How else are you going to handle these areawide problems? The only solution is to carefully manage their use."

Opponents of this approach seem to feel that BMPs aren't strict enough and won't lead to any real changes. Typical comments include:

"BMPs are only effective when dealing with an areawide problem. Otherwise, technology-based standards are probably more effective at getting new controls in place."

"BMPs are not effective unless they are part of a regulatory program that can follow up in the field and make sure they are followed."

Option 2--Technology-Based or Effluent Standards

This approach to control requirements is based on industry-specific or process-specific standards relating to the handling, storage, and disposal of substances that could contaminate ground water. Thus, this parallels the water pollution control program for surface waters under the NPDES program.

Proponents of this option contend that strict standards can and should be established for a number of key industries and/or sources of potential contamination. Representative comments include:

"The way to ensure consistent, adequate protection is to specify technology standards that are clear and precise. We should tell people, for example, exactly how to build surface impoundments--what liners to use, how deep the liners should be, etc. This is the best way to create enforceable programs."

"It's industrial and other processes that we have to control. We can't control specific chemicals because we don't know exactly where they are, but we sure can find and regulate plants and landfills."

"Tradeoffs have to be made between the ideal level of control possible in each industry and the actual technologies available. We have to make those decisions industry by industry because each one is different and adherence to a single uniform standard might shut down whole industries."

Opponents of this approach frequently cite the administrative workload involved in establishing specific standards for industries and sources. The following comments are typical:

"Look at the BAT (Best Available Technology) standards under the Clean Water Act. They're a technical nightmare--they require years of technical and regulatory development. They've been working four years on those and they're still far from finished."

"Why go to all the trouble to set up standards for every possible situation? Each state will have a different set of industries which is the problem there, and you'd never finish setting standards to cover them all."

Option 3--Ground Water Quality Standards

Rather than control the activities that might contaminate ground water, this approach focuses directly on the ultimate goal--ground water quality. Proponents point to the appropriateness of basing decisions directly on the parameters of concern rather than on an indirect measure. Typical comments in support of this position are these:

"Let's not beat around the bush. If we want water kept clean let's just say so and then leave it up to individual companies to decide how they want to do it."

"Hard as it may be to set ground water standards, that's a lot fairer way to set controls than any other method. Then the burden is on the operator to be sure he has a location or a process which is safe."

People who oppose this approach do so primarily because of the technical difficulties associated with monitoring ground water. The following is a typical view:

"Ground water standards sound great, but they're impractical. Monitoring is expensive and you never really know for sure that you haven't missed a plume. Where do you monitor--in which direction, how far from the activity, at what depth, with how many holes?"

Option 4--Economic Incentives and Other Approaches

The final approach to control requirements suggested during Phase I interviews was to utilize some form of economic incentives or other innovative approaches rather than one of the more traditional regulatory approaches described above.

Advocates of this option drew on the experience and literature of air and water pollution programs for ideas. Potential suggestions include:

- Discharge allocations, which would allow a plant a specific daily or other allocation of waste that could be disposed of. These could be marketable so that the most cost-efficient controls would likely be implemented first across a broad range of industries or sources.

- Ground water contamination fees or taxes which would be paid to a government body by sources causing contamination. The fees would raise the cost of doing business in a manner that causes contamination, thereby creating an incentive for prevention. The fees would also build up a fund to cover the costs of treatment if and when it was required in order to use the ground water.

- Noncompliance fees, which would be levied on any sources not in compliance with applicable standards. These would be computed to remove the economic advantage that each source obtains by failing to install treatments, alternative disposal systems, and the like.

Proponents of these approaches point to the flexibility they provide at local levels. Typical comments include:

"Pollution shouldn't pay. We should make it more expensive to pollute than to operate in compliance with the laws."

"Some plants aren't as able to reduce pollution as others, but why should the government have to figure that all out? Just assign everybody a target level of reduction and let them get it wherever they can negotiate it."

Opponents to this approach are skeptical. They say:

"Incentives sound great, but you have to do more work to set up the right fees or allocations than if you just set standards in the first place."

"Trading waste allocations for ground water is too complex. The chemical composition of two wastes will always differ, and two sites may have different hydrogeology."

"Economic incentives are especially difficult to administer, particularly because of the low level of knowledge on ground water."

ISSUES TO CONSIDER

While evaluating these options and selecting one or more (or variations) from each of the major groups as the core design for a ground water protection program, it is important to be pragmatic and to consider issues affecting feasibility and effectiveness. One should not attempt to address these issues in detail during the strategy development but must be confident that they will contribute to the success of the recommended strategy once it reaches the implementation stage. Some of these issues are:

- Effectiveness in meeting the selected goal
- Administrative feasibility
- Relative resource requirements (is one approach more or less expensive than another, and for whom?)
- Technological feasibility, for monitoring and treatment
- Modeling and analytical capabilities to link discharges to changes in ambient ground water quality
- The institutional framework needed for implementation and assuring that due process occurs where contamination will be allowed
- The likelihood of obtaining desired actions on the part of those causing the pollution

VI

FEDERAL, STATE AND OTHER ROLES

VI. FEDERAL, STATE, AND OTHER ROLES

This chapter deals with the range of approaches that is available for managing the implementation of a ground water protection strategy. The roles to be played by federal, state, and local governments and others must be considered within the context of the goals selected for a national ground water protection strategy. The definition of these roles requires balancing significant national interests on the one hand with the need for state and local flexibility in dealing with local and regional problems on the other hand. Clearly, these roles will differ for various elements of the strategy.

Existing programs which have ground water impacts encompass a broad range of federal and state roles. Under the Clean Water Act, the federal government specifies standards while responsibility resides with the states for issuing permits and instituting enforcement actions. Other programs provide more independent authority to the states. The more recent programs under the Safe Drinking Water Act, such as UIC, and under the Resource Conservation and Recovery Act require by statute that the federal government establish national standards. The states are then responsible for implementing approved programs.

There are varying opinions as to the appropriate level of involvement for federal, state, and local governments in carrying out various aspects of a ground water protection strategy. The range of opinion comprises five major administrative options:

- Option 1--States take primary responsibility for implementation of federally developed national standards. States would take responsibility for writing permits, conducting site inspections, instituting enforcement actions, and performing other steps necessary to implement the program. The federal Agency would design the program and establish minimum standards. The federal role would include specifying monitoring requirements, and, as appropriate, specific ambient standards or technology-based standards.

- Option 2--States prepare and submit program plans for federal approval in response to federal minimum requirements. These federal requirements could be based on ground water quality standards or on technology-based or other similar standards. State governments would have the responsibility

to design programs to meet them. Within that context, for example, a state's program could spell out how the classification scheme is to be implemented, how the minimum standards will be carried out, what standards will be set for other categories of pollutants or sources not covered by federal standards, and finally what the details of the state's enforcement program will be. Responsibility would reside with the state to define the role of local and other organizations, and the federal government could provide financial support and technical assistance to the states.

- Option 3--States prepare individual program plans consistent with broad federal guidelines, subject to federal approval primarily on procedural grounds. This approach delegates authority to state and local governments to develop implementation programs that are patterned specifically to meet local and regional needs. Federal approval of the plans would be mainly to ensure that consideration has been given to all appropriate issues, including the need for surveys and assessments; that required state statutes and implementing regulations have been developed; that broad public participation has been obtained; that the required agreements exist between involved state and local agencies and other government groups; that there is compliance with existing federal standards; and that the proposed plan meets certain broad objectives.

- Option 4--State and local governments set and enforce standards consistent with broad federal goals; the federal government provides technical assistance and support. This option places primary reliance on the state and local governments for the development, implementation, and enforcement of a ground water protection program. The federal EPA only conducts research, provides technical assistance, and assures that states meet the broad federal goals.

- Option 5--States develop plans and programs; the federal government provides support and technical assistance only. This approach places full responsibility on the states for determination of the goals and objectives of a ground water protection program. State and local governments

then develop, implement, and enforce the program while the federal government provides support as needed.

Each of these options and its supporting rationale are discussed below. However, one must remember that the federal, state, and local roles could vary for different elements of a ground water protection strategy.

OPTION 1--FEDERAL UNIFORM NATIONAL STANDARDS WITH STATE IMPLEMENTATION

Supporters of this position believe that the approach is consistent in concept with other successful environmental programs. In addition, it is easy to administer, particularly if limited exceptions to the uniform standards are allowed.

Supporters also favor the approach because it allows states to impose more stringent standards where they deem a local or regional need to be significant.

Some advocates express support because they believe that this approach encourages the broadest possible federal technical assistance, federally sponsored research and development projects, data gathering assistance, and active exchange of information across states.

Representative comments in support of this option include:

"Our society has become so complex and companies and people are so mobile that oftentimes federal standards for national programs appear to be unavoidable."

"Ground water supplies are so important to the national economy and ecology that federal intervention into state and local management programs is necessary. Uniform national standards would accomplish this needed protection."

"Only a national, uniform approach would yield effective coordination of the many laws, programs, and mechanisms needed to manage ground water resources."

"Congress has already initiated some programs in this area by statute--programs like NPDES and now RCRA and UIC. We have a good start; let's continue in the same direction."

Opponents of this approach argue that regional, state, and local differences make national standards inappropriate. Additionally, current state and local control programs might not be integrated appropriately in a centrally mandated approach.

Representative comments against this option include:

"Because ground water basins are almost exclusively internal state matters, the biggest role in a national ground water strategy should be left at the state level."

"Federal regulation should be held in abeyance and only used in regard to interstate, international, or state inaction situations that endanger public health, national defense, national energy programs, or something else clearly in the national interest."

"Considering where we stand nowadays, a set of uniform national standards can do little to lessen the present overlapping and confusing array of too many cooks stirring the broth. This approach would only add more overlap and confusion to the question of who has jurisdiction over what."

"Any kind of national approach just isn't appropriate. Ground water problems in the East are completely different than in the West--Colorado is concerned about problems associated with energy development, while New Jersey is worried about chemical dumps."

OPTION 2--FEDERAL SUBSTANTIVE APPROVAL OF STATE IMPLEMENTATION PLANS

This option puts a significant responsibility on the states to develop and implement appropriate ground water protection plans within a set of criteria developed by the federal government.

The federal role under this option is an active one. It could involve the federal EPA establishing technology-based standards for various sources and quality goals or standards for each state or ground water area. Furthermore, the federal Agency would have an active responsibility to perform a substantive review of each state's proposed plan to guarantee that it meets all applicable standards and will achieve the established goals. In states that choose not to assume primary responsibility for the program, the federal government could also take on the states' role.

The states under this option would have the opportunity to assess local and state priorities and to incorporate them into their proposed plans. Within the federal guidelines each state could then tailor its own program to focus efforts on certain sources, contaminants, and so on. After approval of their plans the states would have primary responsibility for implementation and enforcement.

Supporters claim that other environmental programs are developed and managed with this approach. Typical comments in support of it are the following:

> "Some states are doing a great job already, but others are doing nothing. The feds have to set standards and make sure every state is meeting at least some consistent minimum goals."

> "Look at the air pollution control program. There's a lot of flexibility to accommodate local and area-wide differences. Some plants may have standards very different from those at similar plants a few miles away because of local conditions."

> "The program should be basically a state and local one, but you need the federal involvement to get some consistency across states and, frankly, to get them all moving."

> "Over the next five years the role of the federal government should be to set minimum program expectations and time schedules for the states to develop proposed programs. State failure to meet such minimum expectations and time schedules should result in federal intervention where ground water pollution has become a serious public health problem or a threat to continued beneficial use of the ground water."

Comments in opposition to this option tend to parallel the statements given in support of Options 1 or 3, favoring either a stronger federal role or a more independent state role.

OPTION 3--FEDERAL PROCEDURAL APPROVAL OF STATE PLANS

This approach assigns substantive program responsibilities to the states and gives to the federal government a procedural role to ensure that the states are doing their job.

The federal role under this option is an important one, but it is not focused on standard-setting. EPA in this case

would establish guidelines for how states should develop their plans. These would presumably identify critical ground water problems to ensure that all states at least consider a consistent minimum range of issues. The guidelines would also include procedures for public participation, recommended or required timetables, and requirements for coordination of the various state and local agencies involved in activities significantly affecting ground water.

After establishing these guidelines, the federal government would ensure that the states meet the guidelines in preparing their plans, would see to it that adequate progress is made by the states in implementing these plans, and would provide technical and possibly financial assistance.

The state role under this option would be to work with the local governments and others (1) to develop ground water protection programs, including management and regulatory mechanisms as appropriate; (2) to implement the programs; and (3) to carry out the enforcement and oversight necessary under the programs.

An important distinction between this option and Option 2 concerns the regulatory and management mechanisms for ground water. Under Option 2 those mechanisms, for example a commitment to use ground water classification, would be decided nationally and implemented by every state nationwide. Under Option 3 it is possible that each state could reach its own decision on the approach it favors, with the potential result that half the states would utilize ground water classification schemes and half would not.

The supporters of this option favor state and local decision making for what they believe is a very local problem. Typical comments in support of this option include:

> "The types of problems affecting ground water, such as septic systems, may occur nationwide, but their significance is radically different from area to area. There's just no way you can set national standards that make sense in all of the different local situations you'll find."

> "I believe in a hands-off policy in decision making where states have ground water pollution under reasonable control, but the feds should be a catalyst or motivator to the strengthening of weak state programs and should help states with no viable programs get started."

"A lot of the decisions affecting ground water are essentially land-use decisions, such as where landfills will go. Those should primarily be local decisions, not made at the state level. It's up to the EPA to provide the tools, though, such as guidance in the classification of aquifers and maybe even in the provision of some nationwide ground water mapping."

Those opposing this option tend to feel that it would result in too fragmented an approach to ground water protection. Typical comments include:

"We'll end up with a patchwork of different programs across the country. Protection won't be consistent, and states in which agriculture and industry interests are strong may be unable to withstand the pressure to relax standards."

OPTION 4--INDEPENDENT STATE PROGRAMS CONSISTENT WITH BROAD FEDERAL GOALS

This option focuses on the desire of states and localities to continue to implement ground water programs according to their own schedules, designs, and capabilities. The federal role would only be one of identifying broad national goals, recommending voluntary guidelines, providing technical assistance, and perhaps providing financial assistance.

Supporters of this approach contend that states are acting and will continue to act in their self interests. They claim that states with serious ground water problems will take aggressive steps on their own to protect ground water. They point to present state programs and especially to actions taken in the recent past to support their claim.

Typical comments in favor of this option include:

"We don't need a federal 'stick' as long as we have access to a 'carrot.' The most important elements of federal support are general guidance, funding, basic data, and technical expertise. State programs will employ these resources appropriately."

"The federal government is best able to fund ground water research and to identify broad problem areas. It should stick to providing that kind of help and leave the regulatory and management functions to the states who are closer to the problem."

Opponents express many of the arguments presented in support of Options 1 and 2 above. They also comment:

"There are substantial reasons for a nonrigid, central theme in ground water programs. A national program with fully defined federal and state roles will give people something to react to along a meaningful time schedule."

"It's difficult enough to set up one ground water protection program, let alone fifty separate programs. Let's introduce some efficiency and do some things just once, such as develop a ground water classification system."

"If federal agencies are excluded from active participation in ground water management, and subsequent pollution problems arise, why should federal resources be used to rescue state and local government mismanagement?"

OPTION 5--INDEPENDENT STATE PROGRAMS

This option assigns program responsibility exclusively to the states. The federal role would only be one of providing support at the request of the states.

Supporters say that the examples of existing ground water protection programs are proof that states are acting responsibly on their own. Even states with weak programs, according to supporters, are doing as much as possible given existing resources. State and local governments, they contend, are setting priorities and proceeding in a responsible manner.

Supporters also point to the existence of numerous federal agencies that could aid states appropriately without single-agency coordination at the federal level.

Typical comments in favor of this option include:

"States are already doing a lot on their own. Over twenty states have ground water programs underway, and the states with the most serious problems are doing the most. We need to be left alone to use our limited resources where they'll get us the most benefit."

"Federal funding is essential and appreciated, but states are certainly capable of accepting block

grants and allocating the funds to state and local programs according to our own priorities."

Opponents generally favor the more active federal involvement presented in Options 1 and 2. Typical arguments offered by opponents of this option are the following:

"Sure, some states are moving ahead and implementing good ground water programs. But a lot aren't and without federal prodding we aren't going to see significant environmentally responsible progress in some states."

"Without federal involvement and federal requirements, states would never get any political or financial support from their state or local governments."

ISSUES TO CONSIDER

It is important to realistically evaluate the responsibilities for state and federal agencies implied by any given set of program recommendations. In particular one must consider the functions and related tasks that would be carried out and be assured that the tasks would be performed most appropriately and efficiently compared with other program designs and that the desired actions are likely to result from the recommended program design.

Many responsibilities for a ground water protection program could be carried out at the federal, state, or local level. However, the division of labor should be rational. There may be situations where the national interest is a dominant, overriding concern, as is likely in broad issues relating to public health and safety. For example, in the interest of public health, responsibility for setting a ground water standard for toxic substances could be more appropriately assigned to a federal agency than to states or localities.

Some tasks may require resources and capabilities that are only available, or at least most efficiently applied, at the federal level. An example could be the establishment of a classification scheme, in which case it may be more efficient for one federal system to be implemented than for fifty states to develop fifty different approaches to such programs.

Alternatively, some problems may be so unique to local and regional areas that they cannot be effectively resolved on a national level. An example of this may be highway de-icing programs.

In considering these issues one ought to contemplate the full range of tasks that would be required to fully design and implement a recommended ground water protection strategy. Tasks that may be required could relate to monitoring, ground water mapping, technical computer modeling, writing of regulations, inventorying of sources, permit writing, performance of inspections, and management of enforcement efforts.

It is neither appropriate nor necessary to identify all the tasks during strategy development. It is important, however, that one be confident that the kinds of tasks to be included in a ground water protection program can be feasibly and effectively accomplished if and when the recommended strategy is actually implemented.

VII

IMPLICATIONS FOR THE NEAR TERM-- RESEARCH AND DEVELOPMENT AND OTHER

VII. IMPLICATIONS FOR THE NEAR TERM– RESEARCH AND DEVELOPMENT AND OTHER

Once the broad outlines of the strategy are clear, it is important to identify implications for short-term actions. These can help identify what EPA should consider initiating in the coming months in order to make progress on significant elements of the strategy within the next two to five years.

Short-term potential actions to be considered by the work groups fall into the following categories:

- Research and Development
  - --Accelerate development of guidance on toxicological significance of unregulated contaminants of ground water.
  - --Expand research in fate and effect of ground water contaminants, and on predictive tools to link discharges to anticipated changes in ground water quality.
  - --Expand technology transfer.
  - --Expand ground water mapping efforts.
  - --Identify best practices for safe disposal.
- Monitoring
  - --Assess existing ground water monitoring efforts.
  - --Initiate a national study of organic contamination in drinking water derived from ground water.
  - --Add focus to existing programs to identify hot spots and gather other data.
  - --Mandate consistent practices and parameters for existing monitoring programs.
  - --Coordinate data collection efforts and make them compatible so that they can be aggregated to provide state and national trends and status.
- Guidelines
  - --Develop guidelines for states and others on ground water classification categories that integrate geology, hydrology, control technologies, and use categories.
  - --Expedite development of design standards for on-lot disposal systems, storage tanks, etc.

--Develop model state laws.

--Develop voluntary guidelines for development of state ground water plans.

- Hot Spots

  --Assert ground water authority in current legislation to deal with high-priority problems.

  --Review growing data on contamination incidents to help identify high-risk situations for added study.

- State Capacity

  --Develop and run training programs in ground water planning, monitoring, etc.

  --Require planning and initial ground water classification through existing legislation or programs.

  --Increase the availability of federal grant funds for state ground water protection programs.

- Personnel

  --Take steps to expand the training of professional personnel through universities for high-level staff, and through vocational education and retraining programs for technicians.

  --Assess the manpower needs of state, local, and federal agencies to implement a program.

- Coordination

  --Better coordinate existing and new ground water protection programs.

  --Improve mechanisms for positive federal/state cooperation on planning and implementing ground water programs, sharing successful experience and technical assistance on critical issues.