

Chapter 3

Federal Institutional Framework To Protect Groundwater From Contamination

contents

	Page
Chapter Overview	63
Relevance of Federal Statutes to Groundwater Protection	64
Summary of Federal Statutes and Programs	64
Federal Legislation Passed Prior to the 1970s	64
Environmental Legislation: 1969 to the Present	73
Sources Addressed by Federal Statutes	75
Sources	75
Types of Programs.	77
Water Quality Standards	80
Mechanisms for Interagency Coordination.	81
USGS Coordinating Committees	82
Program-Related Agreements.	82
Water Data Coordination	83
Efforts To Improve Capabilities	83
Financial Assistance	83
Technical Assistance	84
Federal Research and Development Concerning Groundwater Quality	84
Chapter 3 References	86

TABLES

<i>Table No.</i>	<i>Page</i>
10. Summary of Federal Programs and Activities Related to the Protection of Groundwater Quality	65
11. Descriptions of Major Federal Statutes Relevant to the Protection of Groundwater Quality	66
12. Groundwater-Related Activities of Federal Agencies	72
13. Relationship Between Sources of Contamination and Federal Statutes	76
14. Committees for Program Coordination Between USGS and Other Federal Agencies	82
15. Federal Involvement in Groundwater Quality Research and Development	85

Federal Institutional Framework To Protect Groundwater From Contamination

CHAPTER OVERVIEW

OTA's assessment of Federal activities regarding groundwater contamination involved examination of 16 Federal statutes and discussions with representatives of 11 Federal agencies. The laws and programs selected for review relate to sources of contamination, the regulation of potential contaminants, and the use of groundwater for drinking water supplies. This chapter provides a summary of the existing Federal laws and programs that protect groundwater quality. In addition, aspects of the laws and programs are analyzed that define or support—and are thus shared in common by—detection, correction, and prevention activities.

The following topics are included:

- relevance of Federal laws to the protection of groundwater;
- summary of Federal laws and programs;
- sources of contamination addressed by Federal laws;
- water quality standards;
- existing mechanisms for interagency coordination with respect to implementation of legislative mandates; and
- efforts of the Federal Government to improve its own capabilities and those of the States to protect groundwater.

Federal detection, correction, and prevention activities are discussed in greater detail in chapters 6, 9, and 11, respectively.

The general conclusions drawn from this information follow.

There is no explicit, comprehensive national legislative mandate to protect groundwater from

contamination. Federal laws and programs do not address all sources known to contaminate groundwater, the vast majority of substances that have already been found or have the potential to be found in groundwater, or all uses of groundwater,

Specifically with respect to *sources*, different Federal laws and programs address different sources of groundwater contamination in different ways. The differences often have little relation to the potential for a source to cause contamination. In general, more stringent requirements are applied to selected point sources (especially those associated with hazardous wastes), rather than non-hazardous waste, non-waste, and non-point sources.

The Federal approach to *contaminants*, in terms of standards, is neither complete nor consistent. (The Federal regulation of potential contaminants for prevention is discussed in ch. 11.) Although drinking is the principal *use* addressed by Federal statutes, not all drinking water supplies are covered (see ch. 6).

There are many Federal laws and programs directed toward assisting the States and Federal agencies with groundwater contamination problems. These generally provide for financial and technical assistance and research and development. Several laws also authorize the States to implement federally mandated programs and establish minimum requirements for such programs. However, Federal efforts to protect groundwater quality are fragmented, and there is no single agency or organization responsible for all groundwater programs and activities; several coordination mechanisms are used.

RELEVANCE OF FEDERAL STATUTES TO GROUNDWATER PROTECTION

Protection of groundwater is not covered comprehensively by any one Federal law; nor is one Federal agency or office responsible for overseeing or coordinating all groundwater programs and activities.¹ Although the groundwater protection strategy of the U.S. Environmental Protection Agency acknowledges the need for comprehensive resource management, the details of the strategy do not fully provide for it (EPA, 1984).²

¹The EPA Office of Ground-Water Protection, established on Apr. 2, 1984, will be responsible for coordinating all EPA groundwater activities. The office will also "work with other Federal agencies . . . (and) convene an Interagency Committee on Ground Water . . . Other committees will be established as needed" (EPA, 1984).

²For example, the strategy depends on the *voluntary* participation of the States with financial assistance coming from *existing* grant programs and supporting program *development*. Existing grant programs are not deemed adequate by the States and funding is also required for program implementation, as discussed in chs. 4, 7, 10, and 12.

The strategy also singles out *three* inadequately addressed sources—underground gasoline storage tanks, surface impoundments, and landfills—for action, which is to emphasize *study* and *review* and, in addition for underground storage tanks, a Chemical Advisory and voluntary steps. Information about 33 sources (including these three) is presented in ch. 2 and app. A and analyzed throughout this report.

Further, the strategy states that current and potential drinking water supplies and water having other beneficial uses (Class II), which are the majority of usable groundwater in the United States, will receive levels of protection consistent with EPA's *existing* regulations. The adequacy of existing regulations is analyzed in ch. 3, 6, 9, and 11.

For a discussion of the history and a comparison of EPA's efforts to develop a groundwater strategy (EPA, 1980, 1983), see Feliciano, 1984.

OTA's analysis has identified 16 principal pieces of Federal legislation that authorize numerous programs and activities relevant to groundwater protection, and it develops a framework for determining how current laws and programs contribute to the detection, correction, and prevention of contamination. Groundwater protection per se is *not*, however, the primary objective of any of the statutes.

Table 10 summarizes the relationship between Federal legislation and groundwater protection activities including: detection/investigatory activities; corrective actions for contaminated groundwater; measures to prevent contamination; and standards for contaminants used in detection, correction, and prevention activities. Although table 10 presents an extensive array of programs and activities, Federal efforts overall are not fully protecting groundwater resources. For example, not all sources of groundwater contamination are included, and for the general source types that are, not all related facilities and/or activities may be covered; not all drinking water supplies are monitored routinely; and standards have not been developed for most contaminants that have already been detected in groundwater.

SUMMARY OF FEDERAL STATUTES AND PROGRAMS

Table 11 summarizes the objectives and major provisions of the statutes examined in this study, lists the Federal agencies responsible for their implementation, and indicates the relationship between the Federal laws and the States. (State programs are discussed in chs. 4, 7, 10, and 12.) Additional Federal activities undertaken to support or comply with these laws are summarized in table 12. Note that Federal statutes have not been ranked in terms of their relative importance to groundwater protection for many of the same reasons that sources were not prioritized in chapter 2—i.e., "import-

tance' depends on the ranking criteria chosen and site conditions.

Federal Legislation Passed Prior to the 1970s

Early Federal legislation regarding water quality in the United States focused primarily on surface waters. These statutes were the precursors of the more comprehensive water quality legislation passed in the 1970s.

Table 10.—Summary of Federal Programs and Activities Related to the Protection of Groundwater Quality

Statutes	Investigations/detection			Correction			Prevention			
	Inventories of sources ^a of groundwater monitoring	Groundwater monitoring		Federally funded remedial actions	Regulatory requirements for sources ^a	Regulate chemical production	Standards for new/existing sources ^a	Aquifer protection	Standards	Other ^b
		Ambient groundwater monitoring	related to sources ^a							
Atomic Energy Act.		X								
Clean Water Act.....	X	X		X			X		X	
Coastal Zone Management Act										
Comprehensive Environmental Response, Compensation, and Liability Act..... ^a	X			X						
Federal Insecticide, Fungicide, and Rodenticide Act.....			X			X				
Federal Land Policy and Management Act (and associated mining laws)...			X				X			
Hazardous Liquid Pipeline Safety Act.....	X									
Hazardous Materials Transportation Act.....	X									
National Environmental Policy Act...										X
Reclamation Act..... ^c				X						
Resource Conservation and Recovery Act.....	X						X			
Safe Drinking Water Act...	X								X	
Surface Mining Control and Reclamation Act.....			X			X				
Toxic Substances Control Act.			X							
Uranium Mill Tailings Radiation Control Act.....			X							
Water Research and Development Act			X							

^aPrograms and activities under this heading relate directly to specific sources of groundwater contamination. Table 13 summarizes the sources addressed by the statutes.

^bThis category includes activities such as research and development and grants to the States to develop groundwater-related programs.

SOURCE: Office of Technology Assessment.

Table II.— Descriptions of Major Federal Statutes Relevant to the Protection of Groundwater Quality

Statute	Objectives and provisions relevant to groundwater protection	Responsible Federal agencies	Relationship to the States
Atomic Energy Act of 1954, 42 U.S.C. 2011 ^a	<p>One purpose of the act is to encourage the development and use of atomic energy for peaceful purposes consistent with the common defense and security and the health and safety of the public.</p> <p>The act authorizes the regulation of the development and utilization of atomic energy, including the storage and disposal of radioactive wastes.</p>	Department of Energy Nuclear Regulatory Commission Environmental Protection Agency—Office of Radiation Programs	Regulation of certain radioactive materials is delegated by NRC to the States that participate in the Agreement States Program. Pursuant to the Low-Level Radioactive Waste Policy Act of 1980, States are currently engaged in regional and individual planning efforts to site new disposal facilities.
Clean Water Act of 1977, 33 U.S.C. 1251-1378 ^b	<p>The objective of the statute is to restore and maintain the physical, chemical, and biological integrity of the Nation's waters.</p> <p>Activities authorized by the act include:</p> <ul style="list-style-type: none"> — the construction of sewage treatment works and the use of alternative waste management techniques (Section 201); — the establishment of effluent standards and the regulation of point discharges of pollutants (Sections 302, 306, 307, and 402); — the development of ambient water quality criteria (Section 304); — regulation of the disposal of dredged or fill materials (Section 404); — establishment of State or regional water quality management plans, and the establishment of a program to develop Best Management Practices to control non-point source pollution in rural areas (Section 208); — responses to oil discharges into navigable water (Section 311). 	<p>Environmental Protection Agency—Office of Water Programs Operations, Office of Water Regulations and Standards, and Office of Water Enforcement and Permits</p> <p>Department of Agriculture—Soil Conservation Service and Agricultural Stabilization and Conservation Service (Section 208)</p> <p>Department of Transportation—U.S. Coast Guard (Section 311)</p>	<p>States (or local planning agencies) were required by Section 208 to submit area-wide water quality management plans to EPA that identified and proposed solutions to water quality problems (including point and non-point sources affecting surface water and groundwater). Funding for Section 208 activities was terminated in 1981. Grants under Sections 106 and 205(j) are now being used to support planning activities.</p> <p>State (or interstate agency) grants are authorized (Section 106) to assist with the administration of water pollution control activities required by the act. Funds are also available from Sections 205(g) and (j) which are reserves from State construction grant allotments. While Section 205(g) funds are used primarily to support construction grant programs (for sewage treatment works), Section 205(j) funds are authorized to support State water quality management planning.</p> <p>Regulatory authority for Section 402 is delegated to States for the point discharges of pollutants into navigable waters.^c Section 303 requires States to adopt water quality effluent standards for such discharges consistent with Federal standards.</p>
Coastal Zone Management Act of 1976, 16 U.S.C. 1451	<p>One policy specified in the statute is to preserve, protect, develop, and where possible, restore or enhance the resources of the Nation's coastal zone for this and succeeding generations.</p> <p>The act authorizes funding to encourage and assist the States in the development and</p>	Department of Commerce—National Oceanic and Atmospheric Administration	States are eligible to receive grants if a coastal zone management program is developed that meets minimum Federal requirements.

Table 11.—Descriptions of Major Federal Statutes Relevant to the Protection of Groundwater Quality—continued

Statute	Objectives and provisions relevant to groundwater protection	Responsible Federal agencies	Relationship to the States
<p>Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 U.S.C. 9601</p>	<p>implementation of management programs with respect to the use of land and water resources in the coastal zone, including efforts to mitigate salt-water intrusion. The statute does not contain an explicit policy statement. The act authorizes the Federal Government to respond whenever there is a release or threat of release of hazardous substances, pollutants, or contaminants into the environment which may present an imminent and substantial danger to public health or welfare. Responses are financed by excise taxes levied on petroleum and chemical feedstocks. The act also establishes liability for the cost of response actions on responsible parties and provides for compensation of expenses incurred by the government.⁸</p>	<p>Environmental Protection Agency—Office of Emergency and Remedial Response Department of Transportation — U.S. Coast Guard Department of the Interior</p>	<p>States may enter into a Cooperative Agreement with EPA and assume lead responsibility for remedial actions, or States may enter into a contract with EPA whereby EPA assumes lead responsibility. In either case, States are required to assure payment of 10 percent of the costs (or 50 percent if the site is publicly owned), assume responsibility for all future operation and maintenance required at the site, and assure the availability of an authorized hazardous waste disposal facility necessary for the disposal of wastes removed during remedial activities.</p>
<p>Federal Insecticide, Fungicide, and Rodenticide Act, as amended 7 U.S.C. 136⁶</p>	<p>The statute does not contain an explicit policy statement. The act requires the registration of all pesticides based on the submission of specified data (Section 3), the classification of pesticides for general or restricted uses (Section 3), and suspension and cancellation of pesticides causing unreasonable adverse effects on the environment (includes water, air, land, plants, man and other animals, and their interrelationships) (Section 6). The act also requires the establishment of procedures for the storage and disposal of pesticide containers and excess pesticides (Section 19), as well as formulation of a National Monitoring Plan for pesticides (Section 20).</p>	<p>Environmental Protection Agency—Office of Pesticide Programs</p>	<p>Authority is delegated to States for enforcement of FIFRA provisions (e.g., ensuring that pesticides are used in compliance with any Federal restrictions) if States adopt and implement adequate pesticide laws, regulations, and enforcement procedures.¹ States may also assume responsibility for the training and certification of pesticide applicators if Federal approval of a plan for such activities is obtained. Federal funding of State programs is available to those States that enter into cooperative agreements with EPA.</p>
<p>Federal Land Policy and Management Act of 1976, 43 U.S.C. 1701, and associated mining laws.⁹</p>	<p>The statute specifies that it is the policy of the United States that public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archaeological values. The act authorizes the regulation of the use of public lands, including mining operations.</p>	<p>Department of the Interior—Bureau of Land Management</p>	<p>Mining regulations may not preempt State laws and regulations regarding the conduct of mining operations or reclamation on Federal lands. States may enter into agreements with BLM to provide for joint administration and enforcement of regulatory programs</p>

Table 11.- Descriptions of Major Federal Statutes Relevant to the Protection of Groundwater Quality—continued

Statute	Objectives and provisions relevant to groundwater protection	Responsible Federal agencies	Relationship to the States
Hazardous Liquid Pipeline Safety Act of 1979, 49 U.S.C. 2001	<p>The statute does not contain an explicit policy statement.</p> <p>The act requires the establishment of Federal regulations for the movement of hazardous liquids by pipeline (and their storage incidental to such movement) and pipeline facilities in or affecting interstate or foreign commerce; such regulations must consider the extent to which they contribute to public safety.</p>	Department of Transportation— Office of Pipeline Safety Regulation	Federal regulations do not apply to intra-state pipelines and associated facilities for which there are applicable State regulations, provided that the State agency is certified annually by DOT.
Hazardous Materials Transportation Act of 1974, 49 U.S.C. 1801 ¹	<p>The policy underlying the statute is to protect the Nation adequately against the risks to life and property which are inherent in the transportation of hazardous materials in commerce.</p> <p>The act requires the establishment of Federal regulations for the transportation of hazardous materials (including hazardous wastes in commerce.</p>	Department of Transportation— Office of Hazardous Materials Regulation	State regulations that are inconsistent with Federal requirements are pre-empted. Although there is not a formal delegation of authority, States may enter into cooperative agreements with DOT to obtain technical and financial assistance. States may also establish requirements for certain activities not addressed by Federal regulations (e.g., routing the transport of hazardous materials).
National Environmental Policy Act of 1969, 42 U.S.C. 4371	<p>The purposes of the statute include: the declaration of a national policy to encourage productive and enjoyable harmony between people and the environment, and the promotion of efforts to prevent or eliminate damage to the environment and biosphere and to stimulate human health and welfare.</p> <p>The act directs Federal agencies to utilize a systematic, interdisciplinary approach in planning and decisionmaking that may have an impact on the environment and to prepare environmental impact statements for major Federal actions significantly affecting the quality of the human environment.</p>	All Federal agencies ¹	States have opportunity to review and comment on Federal actions under this and other programs under inter-governmental review provisions authorized by Executive Order 12372.
Reclamation Act of 1902, 43 U.S.C. 390(b)	<p>The policy underlying the statute supports the participation and cooperation of the Federal Government with States and local interests in developing water supplies for domestic, municipal, industrial, and other purposes.</p> <p>Some projects funded under the act are for the development of underground water supplies that are contaminated due to natural leaching (e.g., high salt concentrations) or human activities and thus require treatment prior to use.</p>	Department of the Interior— Bureau of Reclamation	Water rights for reclamation projects must be obtained through States' water rights systems. States are involved in project planning activities.

Table 11.—Descriptions of Major Federal Statutes Relevant to the Protection of Groundwater Quality—continued

Statute	Objectives and provisions relevant to groundwater protection	Responsible Federal agencies	Relationship to the States
Resource Conservation and Recovery Act of 1976, 42 U.S.C. 690	<p>The objective of the statute is to promote the protection of health and the environment and to conserve valuable material and energy resources.</p> <p>Subtitle C of the act requires the establishment of regulations for hazardous waste generators, transporters, and owners or operators of facilities who treat, store, or dispose of such wastes.</p> <p>Subtitle D requires the establishment of Federal guidelines for State solid waste management plans.</p>	Environmental Protection Agency—Office of Solid Waste	<p>Regulatory authority for Subtitle C is delegated to States that establish programs that incorporate minimum Federal requirements. Programs may be more stringent than Federal requirements. Financial assistance is authorized to the States for development and implementation of such programs.</p> <p>Although Subtitle D of the act does not mandate the development of State solid waste plans, States are required to meet certain minimum requirements to obtain EPA approval and qualify for Federal financial assistance. (Subtitle D State grants have not been available in 1982 and 1983.)</p>
Safe Drinking Water Act of 1974, 42 U.S.C. 300f	<p>The statute does not contain an explicit objective but is designed to assure that public water systems meet minimum standards for the protection of public health.</p> <p>The act requires the establishment of contaminant standards for drinking water (Part B), the establishment of regulations for underground injection (Part C), and the protection of sole source aquifers (Part C).</p>	Environmental Protection Agency—Office of Drinking Water	<p>States may assume primary enforcement responsibility for public water systems (PWS) to ensure compliance with national drinking water regulations if minimum Federal requirements are met. States may establish standards that are more stringent than Federal standards and may also set standards for substances not addressed by the Federal regulations.</p> <p>Regulatory authority for the Underground Injection Control (UIC) Program is also delegated to those States that establish programs that incorporate minimum Federal requirements. Programs may be more stringent than Federal requirements.</p> <p>Financial assistance is authorized to States for the development and implementation of both the PWS and UIC programs.</p> <p>States, municipalities, partnerships, associations, companies, corporations, or individuals may petition EPA to designate a sole source aquifer. Once an aquifer is so designated, any of these parties may petition EPA to review the potential of a project to contaminate the aquifer and create a significant hazard to public health.</p>

Table 11.—Descriptions of Major Federal Statutes Relevant to the Protection of Groundwater Quality-continued

Statute	Objectives and provisions relevant to groundwater protection	Responsible Federal agencies	Relationship to the States
Surface Mining Control and Reclamation Act of 1977, 30 U.S.C. 1201	<p>One purpose of the statute is to establish a nationwide program to protect society and the environment from the adverse effects of surface coal mining operations.</p> <p>The act requires the establishment of regulations for surface mining of coal (and the surface effects of underground coal mining) and authorizes reclamation of abandoned mine lands.</p>	<p>Department of the Interior— Office of Surface Mining</p> <p>Department of Agriculture— Soil Conservation Service</p>	<p>Regulatory authority is delegated to States that establish programs that incorporate minimum Federal requirements. Financial assistance is authorized to States for the development and implementation of such programs.</p>
Toxic Substances Control Act of 1976, 15 U.S.C. 2601	<p>The primary purpose of the act is to assure that chemical substances and mixtures do not present an unreasonable risk of injury to health or the environment.</p>	<p>Environmental Protection Agency—Office of Toxic Substances</p>	<p>Grants are available for States to establish programs to prevent or eliminate unreasonable risks to health or the environment in association with chemicals for which EPA is either unable or unlikely to take action under TSCA.</p>
Toxic Substances Control Act of 1976, 15 U.S.C. 2601 (continued)			<p>States may not establish or continue requirements (e.g., testing requirements or other regulatory actions) for chemicals for which EPA has prescribed rules or orders unless they are identical to the Federal requirements, prohibit the use of the chemical, or are adopted under the authority of other Federal laws. Exemptions may be approved by EPA under specified circumstances.</p>
Uranium Mill Tailings Radiation Control Act of 1978, 49 U.S.C. 7901i	<p>The purpose of the statute is to stabilize and control both inactive mill tailings in a safe and environmentally sound manner and to minimize or eliminate radiation hazards to the public.</p> <p>The act requires the establishment of regulations for mill tailings at uranium or thorium processing mills and authorizes remedial actions at inactive sites.</p>	<p>Department of Energy Nuclear Regulatory Commission</p> <p>Environmental Protection Agency—Office of Radiation Programs</p>	<p>Regulatory authority for active uranium mills is delegated by NRC to the States that participate in the Agreement States Program.</p> <p>States may enter into cooperative agreements with DOE for remedial action projects; the agreements define the responsibilities of the parties. States are required to pay 10 percent of the costs, concur with the remedial action plan, and acquire private lands, as necessary, to be used as a permanent disposal site for residual radioactive materials.</p>
Water Research and Development Act of 1978, 42 U.S.C. 7801	<p>The purpose of the statute is to assist the Nation and the States through water resources science and technology to address a variety of water quality and quantity concerns.</p> <p>The act authorizes the establishment of a water resources research and tech-</p>	<p>Department of the Interior</p>	<p>States are required to designate the college or university at which the institute is established if there is more than one land grant college within a State. Two or more States may cooperate in the establishment of a regional institute.</p>

Table 11.—Descriptions of Major Federal Statutes Relevant to the Protection of Groundwater Quality—continued

Statute	Objectives and provisions relevant to groundwater protection	Responsible Federal agencies	Relationship to the States
	nology institute at one college or university in each State, the support of a research and development effort for saline and other quality impaired water, and the establishment of a research assessment and technology transfer program.		Financial assistance for the institutes is available on a cost sharing basis, and matching grants are available for individual projects to supplement funds from non-Federal sources.

^a Legislation passed subsequent to the Atomic Energy Act also authorizes Federal agency activities with respect to radioactive material. *The Reorganization Plan No. 3 of 1970* established the Environmental Protection Agency; responsibility for establishing environmental standards for radioactive materials was transferred to EPA from the Atomic Energy Commission. *The Energy Reorganization Act of 1974* established the Nuclear Regulatory Commission; NRC is responsible for licensing (and related regulatory functions) of nuclear reactors and facilities used to receive, store, and dispose of radioactive waste. *The Energy Reorganization Act of 1977* established the Department of Energy; DOE is responsible for the safe handling of DOE generated waste (including the decommissioning of contaminated Federal property), the selection, acquisition, and development of high-level waste repositories (pursuant to the Nuclear Waste Policy Act of 1982, Public Law 97-425), and the coordination of a national planning effort for the selection of low-level disposal sites (pursuant to the Low Level Radioactive Waste Policy Act, Public Law 96-573).

^b This statute amends the Federal Water Pollution Control Act Amendments of 1972.

^c Despite conflicting Federal judicial decisions about authority under Section 402 to regulate discharges into groundwater, a number of States have established such programs.

^d The statute also creates a new Federal agency known as the Agency for Toxic Substances and Disease Registry within the U.S. Public Health Service of the Department of Health and Human Resources. In addition, CERCLA requires the promulgation of regulations for the assessment of damages from a release of oil or hazardous substances resulting in injury to, destruction of, or loss of natural resources. Executive Order 12316 delegates responsibility for the development of these regulations to the Department of the Interior. Advance notices of proposed rule-making were published by DOI in 1983 (43 FR 1084, Jan. 10, 1983 and 48 FR 34768, Aug. 1, 1983).

^e Federal Environmental Pesticide Control Act of 1972, Public Law 92-516; Public Law 94-140, Nov. 28, 1975; Public Law 95-396, Sept. 30, 1978; and Public Law 96-539, Dec. 17, 1980.

^f States may not authorize the sale or use of pesticides prohibited by EPA under FIFRA and may not impose or continue any requirements for pesticide labeling or packaging in addition to or different from those required by EPA. However, a State may provide registration for additional uses of federally registered pesticides formulated for distribution and use within the State to meet special local needs (if such use has not previously been prohibited by EPA).

^g Regulations promulgated by the Department of the Interior for mining operations are authorized by both the Federal Land Policy and Management Act and the following statutes: The Mineral Leasing Act of 1920 (30 U.S.C. 181-287) and Materials Act of 1947 (30 U.S.C. 601-604) authorize mining of minerals such as coal, phosphate, asphalt, sodium, potassium, sand, stone, gravel, and clay on Federal lands; The U.S. Mining Laws (30 U.S.C. 22) authorize mining of "locatable" minerals such as gold, silver, lead, iron, and copper on Federal lands; The Geothermal Steam Act of 1980 (30 U.S.C. 1001-10025) regulates the development of geothermal steam on Federal lands.

Regulations for onshore oil and gas production have been promulgated by DOI and are administered by BLM under the authority of 17 laws, Attorney General's Opinions, and Secretary's Orders (43 CFR 3160). Authority is primarily derived from the Mineral Leasing Act, as amended and supplemented (30 U.S.C. 181 et seq.), and the Mineral Leasing Act for Acquired Lands, as amended (30 U.S.C. 351-359). The regulations contain provisions for protection of environmental quality including the protection against contamination of freshwater-bearing and other usable water containing 5,000 ppm or less of dissolved solids (43 CFR 3162.5). While not explicit, these regulations provide authority for groundwater monitoring and corrective and preventive activities. BLM is in the process of developing additional guidance to lessees for the protection of groundwater (Spector, 1984).

^h As amended by Public Law 94-474, Oct. 11, 1976.

ⁱ The Council on Environmental Quality is responsible for issuing regulations regarding the preparation of environmental impact statements for use by Federal agencies.

^j Legislation listed in footnote a is also applicable to this statute in that it regulates radioactive substances.

SOURCE: Office of Technology Assessment.

Table 12.—Groundwater-Related Activities of Federal Agencies

<p>Department of Agriculture—Agriculture Research Service: ARS is conducting a limited number of research projects related to groundwater recharge and the impacts of agricultural activities on groundwater quality.</p>	<p>designing groundwater sampling programs). Other research activities related to source control, health effects, and treatment technologies are also being conducted at other EPA facilities.^a</p>
<p>Department of Agriculture—Forest Service: The Forest Service is conducting environmental research projects on the fate and transport of pesticides (under the National Agricultural Pesticide Impact Assessment Program).</p>	<p>Department of Energy: Programs have been established for identifying and decommissioning nuclear materials storage and processing facilities that have become contaminated. Hydrogeologic investigations are being conducted at some of these sites. These programs include the Formally Utilized Sites Remedial Action Program and the Surplus Facilities Management Program.</p>
<p>Department of Commerce—National Bureau of Standards: NBS is responsible for projects regarding the development of quality assurance standards that are used by other Federal agencies (e.g., EPA and DOE) to monitor the analytical performance of laboratories.</p>	<p>Department of Housing and Urban Development: Environmental assessments are conducted related to housing projects; groundwater impacts are considered.</p>
<p>Department of Defense: The Army, Navy, and Air Force are participating in a program to identify and evaluate hazardous waste disposal sites on military installations and to undertake remedial actions at certain sites to control the migration of wastes (Installation Restoration Program).</p>	<p>Department of the Interior—Bureau of Land Management: BLM is conducting inventories of hazardous waste sites on public lands.</p>
<p>The Army Toxic and Hazardous Materials Agency (USATHAMA), Air Force Occupational Environmental Health Laboratory, Air Force Engineering and Service Center, and Navy Energy and Environmental Support Activity provide technical support for the Installation Restoration Program and conduct research related to these efforts.</p>	<p>Department of the Interior—National Park Service: Groundwater monitoring studies are conducted at various national parks to develop baseline data and to determine the extent and impacts of groundwater contamination from sources such as septic tanks and agricultural activities.</p>
<p>The Army Medical Bioengineering Research and Development Laboratory develops water quality criteria for certain munitions compounds.</p>	<p>Department of the Interior—U.S. Geological Survey: The Water Resources Division of USGS is responsible for collection and analysis of hydrogeologic information (including groundwater data), maintaining computerized data bases, conducting research, and coordinating Federal activities with respect to the use and acquisition of water data.</p>
<p>The Army Corps of Engineers is working with EPA (under an interagency agreement) on design and construction of remedial action projects for CERCLA-designated sites. Research projects are also being conducted to support these activities.</p>	<p>Department of the Interior—Fish and Wildlife Service: FWS is conducting inventories of hazardous waste sites for all FWS lands and facilities.</p>
<p>Environmental Protection Agency—Office of Research and Development: EPA's Environmental Photographic Interpretation Center in Warrenton, VA, is responsible for acquiring and interpreting overhead imagery to support programs of EPA as well as other Federal agencies. Activities include conducting inventories of abandoned wells, mines, and hazardous waste sites, identifying failures in septic tank systems, and supporting emergency (e.g., oil spills) response activities.</p>	<p>Department of the Interior—Bureau of Indian Affairs: BIA is planning to conduct inventories of hazardous waste sites on or near Indian reservations.</p>
<p>EPA's Environmental Monitoring Systems Laboratory in Las Vegas, NV, the Robert S. Kerr Environmental Research Laboratory in Ada, OK, and the Environmental Research Laboratory in Athens, GA are conducting studies related to prediction (e.g., studies of those characteristics of aquifers that influence contaminant behavior) and monitoring (e.g., protocols for</p>	<p>National Science Foundation: The Division of Civil and Environmental Engineering, Directorate for Engineering (the Hydraulics, Hydrology, and Water Resources Program, and the Environmental and Water Quality Engineering Program) supports research projects on topics such as subsurface transport and wastewater treatment. Policy-related research is conducted by the Division of Research and Analysis, Directorate for Scientific, Technological and International Affairs.</p>
	<p>Nuclear Regulatory Commission: Research projects are conducted related to the fate and transport of radioactive substances in support of regulatory activities.</p>

^aEPA also supports several other types of activities related to groundwater. For example, EPA established a consortium called the National Center for Ground Water Research in September 1979. The consortium consists of the University of Oklahoma, Oklahoma State University, and Rice University; and the Ground Water Research Branch of the Kerr Laboratory serves as the center's immediate technical liaison. The primary objective of the center is to identify long-term problems and needs related to groundwater quality protection (e.g., transport and fate of contaminants and subsurface characterization) (Canter, 1982). EPA also provides funding to the GroundWater Clearinghouse at the Holcomb Research Institute. The clearinghouse contains an extensive file of groundwater models and assists the States in model selection and application (see OTA, 1982).

The Rivers and Harbors Act of 1899 prohibited discharge of refuse into navigable waters or their tributaries. In 1970, the statute was reactivated and became the basis for establishment of a permit program to regulate such discharges.³

The Water Pollution Control Act of 1948 and subsequent amendments in the 1950s and 1960s were concerned primarily with the establishment of surface water pollution abatement programs (e.g., construction of sewage treatment works).⁴ One section of the act, however, recognized the connection between surface water and groundwater in authorizing the development of programs for “eliminating or reducing the pollution of interstate waters and tributaries thereof and improving the sanitary condition of surface and *underground waters* [italics added].”⁵

Two additional statutes, basically development-oriented, provide the Federal Government with authority over certain sources of groundwater contamination; they are the Reclamation Act of 1902 (RA) and the Atomic Energy Act of 1954 (AEA). The primary purpose of the Reclamation Act is to provide Federal assistance to Western States and local governments in the development of water supplies for municipal, industrial, agricultural, or other purposes. Some recent projects funded under the act have involved the removal and treatment of groundwater containing high concentrations of salt. Other irrigation projects have focused on controlling nitrate levels in groundwater. The Atomic Energy Act authorizes regulation of the development and use of atomic energy and requires that these activities be accomplished consistent with the health and safety of the public to the maximum extent possible. Groundwater contamination has been addressed in the context of regulatory and remedial action programs developed by the Nuclear Regulatory Commission, the Environmental Protection Agency, and the Department of Energy within the

³33 U.S.C. 407. Executive Order No. 11574, Dec. 23, 1970, 33 FR 19627, authorized the permit program (administered by the Department of the Army). The program was merged with the Dredge and Fill Permit Program under Section 404 of the Federal Water Pollution Control Act Amendments of 1972. In at least one instance, the statute has been used successfully by the Department of Justice to require the owner of a landfill to undertake remedial measures.

⁴33 U.S.C. 466. For a discussion of the provisions of this statute, see U.S. House of Representatives, 1972 and U.S. Senate, 1971.

⁵62 Stat. 1155, as amended, 33 U.S.C. 466. For a discussion see Miller, 1980.

past 10 years for storage and disposal of radioactive substances.

Environmental Legislation: 1969 to the Present

The National Environmental Policy Act of 1969 (NEPA) was the first of many laws specifically enacted to protect the environment. It establishes a national policy on environmental quality and directs Federal agencies to use a systematic and interdisciplinary approach in decisionmaking and planning to ensure that environmental concerns are sufficiently considered. The act also requires Federal agencies to prepare environmental impact statements (EISs) for major Federal actions significantly affecting the environment. Although NEPA does not directly address groundwater, the EIS process provides a mechanism for evaluating the impacts of proposed projects (e.g., construction of a sewage treatment plant) and regulatory programs on groundwater.

Other environmental legislation passed in the early 1970s contains explicit wording for the protection of air, water, and oceans. “The objective of the Federal Water Pollution Control Act Amendments of 1972 (referred to as the Clean Water Act, CWA) is “to restore and maintain the chemical, physical, and biological integrity of the Nation’s waters.”⁷ However, because of ambiguous language contained in key regulatory provisions of the statute and conflicting judicial interpretations,⁸ its

⁶See the Federal Water Pollution Control Act Amendments of 1972, 33 U.S.C. 1251 et seq., as amended by the Clean Water Act of 1977; the Clean Air Act of 1970, 42 U.S.C. 1857 et seq., as amended; and the Marine Protection Research and Sanctuaries Act of 1972, 33 U.S.C. 1401 et seq., as amended.

⁷Section 10 1(a).

⁸Section 402 of the act establishes the National Pollutant Discharge Elimination System (NPDES), which requires that all point discharges into “navigable waters” be permitted. The legislative history of the statute suggests that the NPDES program is limited to surface water discharges. The permit program established by EPA is limited to surface water discharges. Federal courts have complicated the interpretation of the applicability of Section 402 to groundwater. The Seventh Circuit upheld EPA’s authority to regulate underground discharges (*United States Steel Corp. v. Train*, 556 F. 2d 822, 7th Cir., 1977); two other courts denied EPA such authority (*United States v. GAF Corp.*, 389 F. Supp. 1379, S. D. Tex., 1975, and *Exxon Corp. v. Train*, 554 F. 2d 1310, 5th Cir., 1977).

Section 303 of the act authorizes establishment of State water quality standards. Although the language used in Section 303 does not mention groundwater standards explicitly, one court has upheld the author-

application to groundwater has been limited. Nonetheless, provisions of the act are directly relevant to groundwater: Sections 208, 205(j), and 106 provide authorization and funding for State and regional monitoring and planning activities directed at both surface water and groundwater; Sections 201 and 311 authorize programs related to potential sources of groundwater contamination (land application of sewage treatment wastes and facilities used to store large quantities of oil, respectively); and Section 304 provides for development of water quality criteria.

In 1974, Congress enacted the Safe Drinking Water Act (SDWA) to "assure that water supply systems serving the public meet minimum national standards for protection of public health" (U.S. House of Representatives, 1974). To accomplish this goal, the act authorizes development and enforcement of drinking water standards for contaminants that may adversely affect human health, establishment of a program to regulate underground injection activities to protect drinking water sup-

ity of EPA to require States to develop such standards in cases where a 'clear hydrologic nexus' can be shown between surface water and groundwater (*Kentucky ex rel. Hancock v. Train*, 6 ELR 20689, E. D. Ky., 1976). For a more detailed discussion, see Wilson, 1976; Comments, 1978; and Tripp, et al., 1979.

plies, and designation of sole-source aquifers to protect aquifer recharge areas. The act does not establish a comprehensive program for protection of all groundwater resources.

Subsequent legislation, enacted between 1976 and 1980, authorizes preventive measures (e. g., design and operating requirements) and federally funded remedial action programs for specific sources of groundwater contamination. These statutes include: the Resource Conservation and Recovery Act (RCRA), the Surface Mining Control and Reclamation Act (SMCRA), the Uranium Mill Tailings Radiation Control Act (UMTRCA), the Hazardous Materials Transportation Act (HMTA), the Hazardous Liquid Pipeline Safety Act (HLPSA), and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, commonly known as "Superfund"). The objectives or purposes of these statutes focus more generally on protection of public health and the environment than on protection of groundwater per se; and the regulatory programs that followed are inconsistent regarding groundwater protection (see chs. 6, 9, and 11).

In addition to source-oriented statutes, two others regulate the production and use of pesticides and



Photo credit: State of Florida Department of Environmental Regulation

FIFRA addresses the improper storage and disposal of pesticides and **pesticide containers and residues.**

other chemical substances. The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) provides for registration and classification of pesticides (e. g., pesticides that may have unreasonable adverse environmental effects can be classified for ‘restricted use’ in specified areas) and authorizes development of procedures for storage and disposal of pesticides and pesticide containers and residues. The Toxic Substances Control Act (TSCA) authorizes the regulation of chemical substances or mixtures that may present an unreasonable risk of injury to human health and the environment. Regulations regarding the manufacture, processing, distribution in commerce, use, or disposal can be promulgated. To date, however, the application of these two statutes to groundwater has been limited.

Three additional statutes relate to groundwater protection. Two of them focus on natural resources management. The Coastal Zone Management Act of 1972 (CZMA) provides Federal funds to States for development and implementation of management programs for coastal areas. Some State management programs are concerned with salt-water intrusion, a source of groundwater contamination.

The Federal Land Policy and Management Act of 1976 (FLPMA) authorizes the Bureau of Land Management (BLM) to manage public lands on the basis of multiple use and sustained yield principles. Although the act does not discuss groundwater explicitly, it does authorize the management of public lands in a manner that protects the quality of ecological, environmental, and water resource values. The statute provides BLM with explicit authority to regulate the use and development of public lands through permits, leases, licenses, published

rules, and other instruments. ⁸One use of public lands with the potential to contaminate groundwater is mining.

The Water Research and Development Act of 1978 (WRDA)¹¹ authorizes the establishment of State Water Resources Research Institutes to conduct research and development relating to water resources, to disseminate information about these efforts, and to train scientists and engineers. Numerous projects funded under this program relate to groundwater quality.

⁸43 U.S.C. 1732.

¹¹ Prior to the passage of FLPMA, BLM had established or proposed regulations governing certain activities on Federal lands under the authority of several mining laws, including the U. S. Mining Laws of the 1860s and 1870s, the Mineral Leasing Act of 1920, and the Materials Act of 1947. With the enactment of FLPMA and the reallocation of responsibilities for mining operations (among DOI'S BLM, USGS, Minerals Management Service, and Conservation Division), BLM initiated efforts to revise the existing regulations so that they more clearly conformed with the objectives of the new legislation. Requirements for mining activities on Federal lands discussed in subsequent chapters reflect these changes; note that regulations for the Geothermal Steam Act were redesignated, with minor revisions, in 43 CFR 3260 on Sept. 30, 1983.

The U.S Mining Laws (see 30 U.S.C. 22 et seq.) include the Lode Law of July 26, 1866 (14 Stat. 251), the Placer Law of July 9, 1870 (16 Stat. 217), and the Mining Law of May 10, 1872 (17 Stat. 91), as amended. These laws address all ‘locatable’ mineral deposits such as gold, silver, uranium, lead, iron, and copper. The Mineral Leasing Act of 1920 (30 U.S. C. 181) and the Materials Act of 1947 (30 U.S. C. 601) address “leasable” minerals, including coal, phosphate, sodium, potassium, sand, gravel, and clay.

The Minerals Leasing Act and 16 other laws, Attorney General's Opinions, and Secretary's Orders address onshore oil and gas operations. Regulations for oil and gas production have been undergoing substantive revisions and were not analyzed *in* detail as part of this study. See table 11, footnote g, for a brief description of the relationship between the revised regulations and ground water.

¹¹ Section 410 of the act repealed the Water Resources Research Act of 1964 (Public Law 88-379, 78 Stat. 329, 42 U. S.C. 1961 et seq.), as amended, and the Saline Water Conversion Act of 1971 (Public Law 92-60, 85 Stat. 159, 42 U.S. C. 1959 et seq.), as amended.

SOURCES ADDRESSED BY FEDERAL STATUTES

This section focuses on current Federal programs and activities to address specific sources of groundwater contamination. It reviews the sources covered by each statute and the types of programs that each authorizes. Subsequent chapters describe in detail Federal investigatory activities (including monitoring), corrective actions, and preventive measures for specific sources.

Sources

Table 13 summarizes the relationship between sources known to contaminate groundwater and the Federal statutes, (The table is organized according to the OTA source categories described in ch. 2; see table 5.) Two significant points about sources and types of programs, based on table 13, are:

Table 13.—Relationship Between Sources of Contamination and Federal Statutes^a

Sources	Federal statutes															
	AEA	CWA	CZMA	CERCLA	FIFRA	FLPMA	HLPWA	HMTA	NEPA ^b	RA	RCRA	SDWA	SMCRA	TSCA	IIMTRCA	WRFDAC
Category I																
Subsurface percolation																
Injection wells (waste)		w		L								a				
Injection wells (non-waste)				L								a				
Land application		n		L							a	a				
Category II																
Landfills				L										A		
Open dumps (including illegal dumping)				L							m					
Residential (or local) disposal				L							m					
Surface impoundment				L	c)						a		4			
Waste tailings				L							a					
Waste piles				L							a					
Materials stockpiles				L	c)											
Graveyards																
Animal burial																
Aboveground storage tanks		Λ		L							A			A		
Underground storage tanks		Λ		L							A			A		
Containers				L	C						A			A		
Open burning/detonation sites				L	C						A					
Radioactive disposal sites				L	C											
Category III																
Pipelines				L						4						
Materials transport/transference operations				L												
Category IV																
Irrigation practices																
Pesticide applications		E														
Fertilizer applications		E														
Animal feeding operations		E														
Deicing salts applications		E														
Urban runoff		E														
Percolation of atmospheric pollutants		E														
Mining and mine drainage		E														
Category V																
Production wells																
Other wells (non-waste)																
Construction excavation		E														
Category VI																
Groundwater-surface water interactions		E														
Natural leaching		E														
Salt-water intrusion/brackish water upconing		E														

^aKey: A = Requires compliance with specified Federal requirements (some programs in this group may be implemented by States if they meet certain Federal criteria).
 B = Authorizes funding of optional State programs that address specific sources.
 C = Establishes Best Management Practices (BMPs) or recommended procedures for certain sources.
 D = Establishes Federal criteria that must be met in order to receive funds for specific projects related to a source of contamination.
 E = Establishes a grant program to States (funds may be used at the State or local level to address contaminants or sources).
 F = Funds Federal cleanup of contaminated groundwater and associated sources.
^bNEPA does not apply to any particular source. The environmental impacts of projects involving the use of Federal funds may be subject to Federal agency review.
^cWRDA does not apply to any particular source. The act provides research funds to States. Projects may focus on particular sources.
 SOURCE: Office of Technology Assessment

1. **existing Federal statutes do not cover all known sources of contamination discussed in this study; and**
2. **sources are not treated in a uniform manner by the programs authorized by Federal legislation.**

Table 13 indicates that most sources (all but 4) are covered by at least one statute and that 18 sources are covered by more than one statute.¹² But the coverage is not as comprehensive as it appears in the table. Most Federal statutes limit coverage by defining only subsets of facilities and/or activities of a given source type that are subject to their respective requirements. These definitions are based on various criteria, such as the presence of certain contaminants (e. g., hazardous wastes). Moreover, the statutory definition of sources is sometimes narrowed further by the regulations issued by the Federal agencies responsible for implementing the statutes.¹³ Descriptions of the sources covered by Federal programs is compiled in appendix B. 1, which also indicates whether detection, correction, or prevention provisions have been established for each source. These provisions are discussed in chapters 6, 9, and 11, respectively.

Based on the information in appendix B. 1 and the data on sources presented in chapter 2, a pre-

It is important to point out that the applicability of CERCLA to sources of contamination as presented in table 13 is based on the types of sources currently on the National Priorities List. It is certainly possible to use CERCLA to deal with other sources that release any hazardous substance, pollutant, or contaminant. Under CERCLA, hazardous substances are those designated by CWA (Sections 311(b)(2)(A) and 307(a)); RCRA (Section 3001); CERCLA (Section 102); the Clean Air Act (Section 112); and TSCA (Section 7). A pollutant or contaminant includes 'any element, substance, compound, or mixture that will, or may reasonably be anticipated to cause death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunctions, or physical deformations in organisms or their offspring' (Section 10). Petroleum (including crude oil and any fraction thereof) and natural gas, natural gas liquids, liquefied natural gas, and synthetic gas usable for fuel are explicitly excluded from the definition of hazardous wastes.

¹³ For example, Section 3001 of RCRA requires EPA to promulgate regulations identifying the characteristics of hazardous wastes and listing particular wastes. The statute explicitly defines hazardous wastes as solid wastes which may: '(A) cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible illness; or (B) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed [42 U.S. C. 6903(5)].' The listing criteria developed by EPA (see 40 CFR 261) have been subject to much discussion and criticism in that they limit the universe of hazardous wastes currently being regulated. See OTA, 1983.

liminary list of sources of groundwater contamination which are not currently being addressed by Federal statutes would include:

- surface impoundments used to contain non-hazardous wastes (e. g., impoundments used in agriculture);
- waste piles and materials stockpiles used to store non-hazardous wastes (except pesticides);
- tanks (aboveground and underground) used to contain non-hazardous wastes;
- non-coal mining activities on private lands; and
- pipelines not regulated by the Hazardous Liquid Pipeline Safety Act.

Given the limitations of OTA's information on sources, this list should not be viewed as either exhaustive or rigid. Further, some States are addressing some of these sources. Thus, a thorough assessment of source coverage necessitates examination of both Federal and State activities. (See ch. 4 for a discussion of State coverage of sources.)

Types of Programs

In addition to the sources that are covered by Federal statutes, it is also important to look at the types of programs authorized by the laws (table 13). These range from mandatory permit or licensing programs to such voluntary programs as development of Best Management Practices for new or existing sources of contamination. Other programs direct the Federal Government to undertake remedial action at inactive or abandoned sites that either have contaminated or have the potential to contaminate groundwater.

The Federal Government's general approach to prevention and control of contamination from sources with hazardous wastes and other toxic materials (e.g., mining operations and injection wells) differs from the one used for most non-hazardous waste sources (e. g., sanitary landfills in Category H) and non-waste sources (e. g., agriculture-related sources in Category IV and all sources in Category

¹⁴ Fifteen more sources not covered by Federal statute are: percolation of atmospheric pollutants, graveyards, animal burial grounds, deicing salts, and household disposal. The OTA analysis in ch. 2 did not identify these sources as major contributors to groundwater contamination nationwide.

VI). The major distinction is that the types of programs applicable to non-hazardous waste and non-waste sources rely on use of voluntary design or operating procedures (e. g., Best Management Practices), and those associated with hazardous or toxic substances establish mandatory requirements (e. g., permit programs). Significantly, programs with mandatory requirements focus on point sources of contamination, and voluntary approaches are generally used with non-point sources.

The types of programs authorized by Federal statutes that are relevant to sources of contamination can generally be described as follows (refer to table 13):

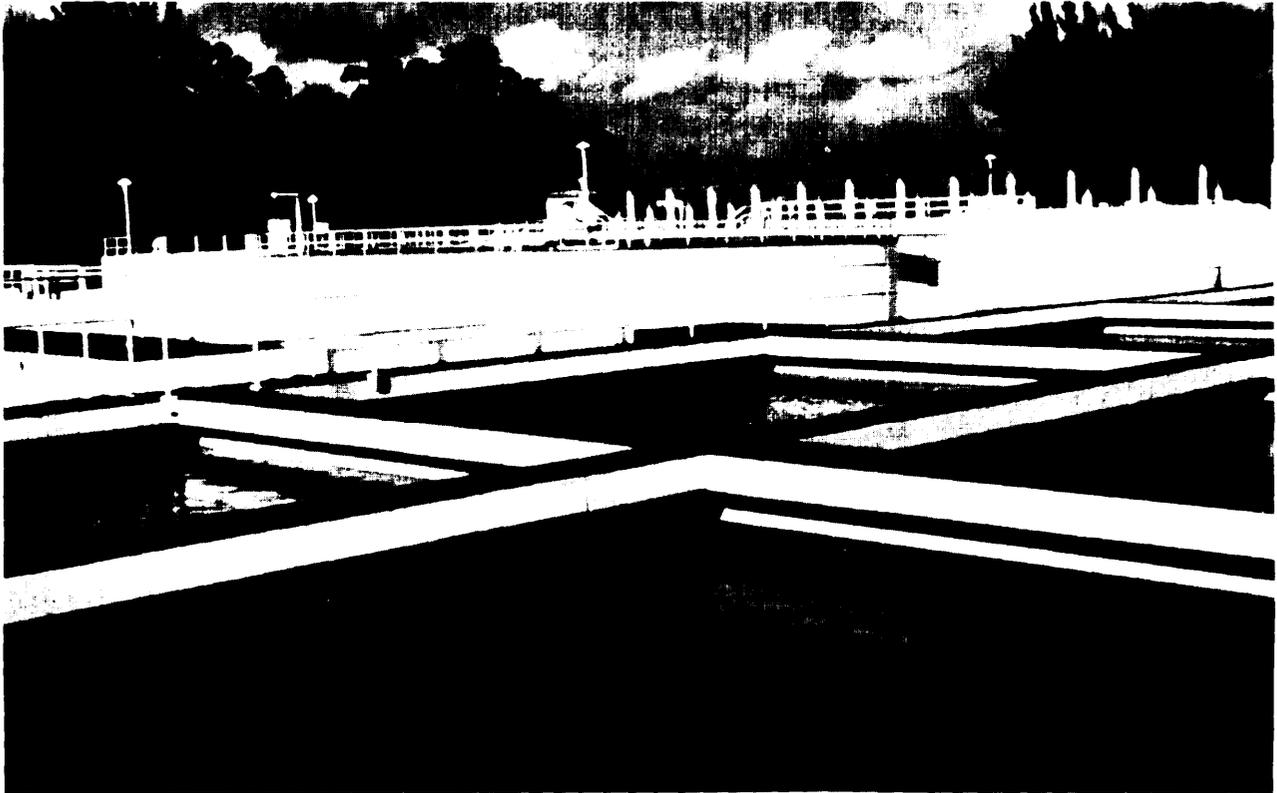
- *Programs that establish mandatory requirements (e.g., design, operation, monitoring, and/or corrective action requirements) for sources of groundwater contamination:* Table 13 indicates that 11 statutes authorize development and enforcement of such requirements. Site-specific permits or licenses are required by several of these laws (i.e., Subtitle C of the Resource Conservation and Recovery Act, the Safe Drinking Water Act, the Surface Mining Control and Reclamation Act, the Atomic Energy Act, and the Uranium Mill Tailings Radiation Control Act). In addition, some statutes specify that regulatory authority may be delegated to States that meet certain Federal criteria and/or enter into specific agreements with Federal agencies (table 10).
- *Programs that authorize Federal funding of optional State programs for specific sources:* Subtitle D of the Resource Conservation and Recovery Act is in this category. States are awarded grants to develop solid waste management plans if the plans meet specified criteria for sanitary landfills.
- *Programs that establish Best Management Practices (BMPs) or recommended procedures for design and operation of certain sources:* Best Management Practices for certain non-point sources have been developed under the Clean Water Act (e. g., agriculture-related sources in Category IV). Procedures are recommended for the storage of pesticides and disposal of pesticide residues under FIFRA (e.g., some Category II sources).



Photo credit: U.S. Geological Survey

The storage and disposal of radioactive substances is regulated under the Atomic Energy Act. This photograph shows vaults used to contain low-level radioactive wastes in shallow land burial sites.

- *Programs that establish Federal design and operating criteria that must be met by owners or operators in order to receive funds for specific projects (or project components) that are potential sources of contamination:* This category includes the Innovative and Alternative Technology provisions of Section 201 of the Clean Water Act for land application of sludge and wastewater from sewage treatment.
- *Programs that establish grant programs to States for water planning and management activities:* Under the Coastal Zone Management Act, grants are awarded to States for development and implementation of coastal zone management plans. Plans may provide for



minimizing impacts of salt-water intrusion by controlling land and water uses. Section 208 of the Clean Water Act also provides for State water planning and management activities. Funds may be used at the State or local level on non-point sources that cause groundwater quality problems.

- programs *that fund Federal remedial actions for sources of groundwater contamination*: These statutes include the Comprehensive Environmental Response, Compensation, and Liability Act, the Surface Mining Control and Reclamation Act, and the Uranium Mill Tailings Radiation Control Act. Some water development projects funded under the Recla-

mation Act also involve treatment of contaminated groundwater.

Two statutes not included above are the National Environmental Policy Act (NEPA) and the Water Resources Development Act (WRDA). Although NEPA is not directed at particular sources, environmental impact statements may be required for federally funded projects that are potential sources of groundwater contamination (e. g, construction of a highway or housing development). WRDA also does not address specific sources, but research projects funded under the act may relate to sources of contamination.

WATER QUALITY STANDARDS

Water quality standards specify the limits beyond which substances in the environment may cause adverse impacts. Standards may be developed strictly to protect public health, the environment, or uses of groundwater, or to balance the benefits and costs of achieving different levels of protection.

Water quality standards may be applied in programs to detect, correct, or prevent groundwater contamination. *Detection programs* may use water quality standards to determine whether there is a problem that warrants action. For example, under the Safe Drinking Water Act, public water supplies are monitored for contaminants specified by the National Interim Primary Drinking Water Regulations (NIPDWR); if concentrations exceed specified levels, certain steps must be taken, including public notification. Under the Resource Conservation and Recovery Act, hazardous waste landfills must be monitored for particular substances; if concentrations exceed specified levels, more intensive monitoring is required, possibly leading to corrective action. *Correction programs* may use water quality standards in determining cleanup goals (e. g., under RCRA, the NIPDWR may be used to set cleanup requirements; in the absence of drinking water standards, background levels or an alternative concentration limit may be used on a case-by-case basis). *Prevention programs* may use water quality standards in defining unacceptable levels of contamination (e. g., under the Clean Water Act, NIPDWR may be used to limit discharges to groundwater from the land application of wastewater, depending on the use of the groundwater).

In addition to standards that relate correction or prevention programs to the actual quality of water that may result from a particular activity, technology-based approaches such as design and operating requirements are also often used. In 1972, with passage of new water quality legislation, the Federal Government de-emphasized quality-based pollution control, given the difficulties in linking allowable releases of pollutants from point sources to the quality of surface waters.¹⁵

¹⁵For a more detailed discussion of the legislative history of the Federal transition to technology-based standards with respect to surface water, see Copeland, 1983; and Davis, et al., 1976.

Federal statutes require standards for drinking and surface water quality, but *not* specifically for groundwater (see also the section *Concentration and Frequency Data in Relation to Government Standards*, ch. 2). For drinking water, there are 22 Federal mandatory minimum standards for public drinking water supplies under the Safe Drinking Water Act National Interim Primary Drinking Water Regulations (Maximum Contaminant Levels, MCLs). Federal minimum standards are not set for surface water quality; rather, the Federal Government provides general guidance to the States on setting standards for specific water uses through Ambient Water Quality Criteria under the Clean Water Act. These criteria include numeric and narrative water quality standards to protect public health and welfare, aquatic life, and recreational use. If a State does not adopt as a minimum the NIPDWR or federally approved surface water quality standards, the the Federal Government is authorized to assume responsibilities for standards in the State.

The Federal Government also provides guidance on standards for selected substances in drinking water through National Secondary Drinking Water Regulations and Recommended Maximum Contaminant levels (RMCLs) under the Safe Drinking Water Act and Health Advisories (formerly, Suggested No Adverse Response Levels, SNARLS). National Secondary Drinking Water Regulations cover selected contaminants and concentrations that may adversely affect either odor, appearance, or the public welfare. RMCLs are non-enforceable *health goals* for public water supplies and are set at levels that would result in no known or anticipated health effects, including an adequate margin of safety.¹⁶ Health Advisories cover selected contaminants found in drinking water for which there are no Federal requirements.

As shown in appendix C.3, which lists the specific substances covered by Federal and/or State

¹⁶The first RMCLs were proposed for nine volatile synthetic organic chemicals (VOCs) in the Federal Register on June 12, 1984. MCLs for these chemicals will be proposed when the RMCLs are finalized. MCLs are to be set as close to the RMCLs as feasible but will also be based on a balancing of health protection with other factors including the availability and costs of treatment technologies.

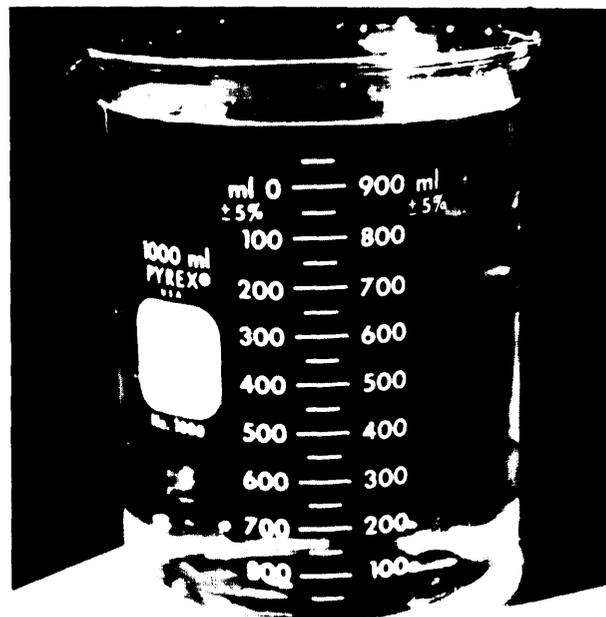
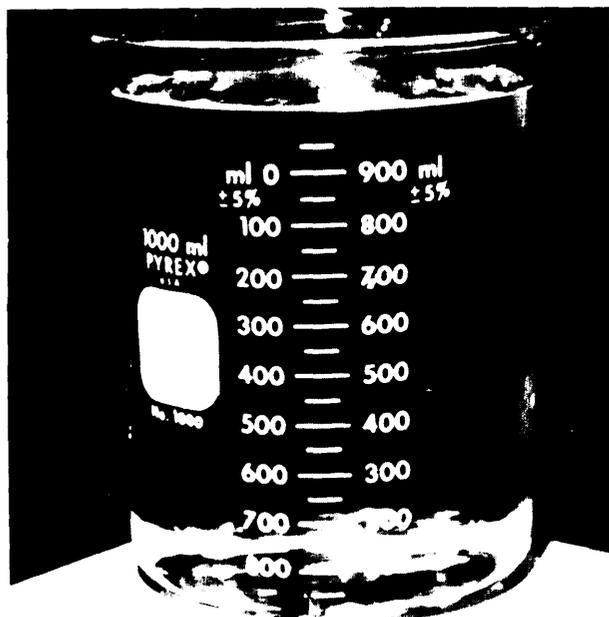


Photo credits" State of Florida Department of Environmental Regulation

An underground source of drinking water is in part defined under the Safe Drinking Water Act as containing fewer than 10,000 milligrams per liter (mg/l) of total dissolved solids (TDS) (left). Good tasting water has less than 1,500 mg/l of TDS (right).

water quality programs, different programs generally apply to different substances. When a substance is covered by more than one program, minimum requirements or suggested concentrations differ from program to program. Such differences arise because concentrations developed under the Safe Drinking Water Act reflect health

concerns as well as technology-related and economic factors, while Ambient Water Quality Criteria consider only health or environmental impacts. Further, health information from Ambient Water Quality Criteria includes the ingestion of aquatic life and not just adverse impacts from drinking water.

MECHANISMS FOR INTERAGENCY COORDINATION

The multiplicity of both groundwater-related laws and the agencies responsible for their implementation has fragmented Federal protection of groundwater quality. Further, within certain agencies, numerous offices are responsible for groundwater activities (refer to tables 11 and 12). Because no single agency or organization is responsible for

coordinating all groundwater programs and activities, three mechanisms for interagency coordination are used and are described below. Activities to be coordinated are both regulatory, primarily focusing on sources of contamination, and non-regulatory, including data collection, technical assistance, and research and development.

USGS Coordinating Committees

The U.S. Geological Survey and other Federal agencies have entered into Interagency Agreements (IAGs) or Memoranda of Understanding (MOUs), which establish coordinating committees comprised of representatives of each agency. The committees coordinate plans and activities of mutual interest, including water-related issues (e. g., hydrologic investigations), and exchange data and information. Table 14 lists the agencies with which USGS has established committees, their effective dates, and their purposes. As table 14 indicates, the scope of these committees extends beyond groundwater-related issues. Nonetheless, the committees provide a forum for raising groundwater concerns and have led to additional agreements that focus on groundwater quality.

Program-Related Agreements

IAGs and MOUs established between Federal agencies also relate to implementation of statute-specific programs or activities concerning groundwater protection, such as provision of technical assistance for hydrogeologic investigations (e. g., groundwater monitoring) or for corrective actions. Several agreements described below are examples of the types of programs that have been arranged:

- The Environmental Protection Agency and the Army Corps of Engineers have entered into an agreement whereby the Corps provides both management and technical assistance to EPA with respect to implementation of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

Table 14.—Committees for Program Coordination Between USGS and Other Federal Agencies

Federal agency	Effective date	Purpose
Department of Agriculture— Soil Conservation Service	5/12/73, revised 1/21/76	To exchange data and information, to cooperate in programs, and to coordinate fields of operation such as geologic, soil, chemistry, mineralogic erosion, watershed, river basin, flood, land resources, wetland, hydrologic, sediment, snow, topographic surveys, and mapping and resource analysis.
Department of Commerce— National Oceanic and Atmospheric Administration	2/20/72	To coordinate related programs including seismology, marine geology and geophysics, hydrology, mapping, and earth resource surveys from space.
Department of Energy— Office of Energy Research	11/8/78	To develop an exchange of information on research, to resolve issues of policy and responsibilities, to arrange cooperation in operation of programs, and to exchange budget information for cooperative programs.
Department of the Interior— Bureau of Land Management	3/6/74, revised 9/9/82	To coordinate related programs including lease management, environmental studies, land and resource classification, mapping and surveys, and water resource investigations.
Department of the Interior— Bureau of Mines	12/9/77	To clarify the primary roles of the agencies and to establish mechanisms for coordination, including resource classification, data storage, and data standards.
Department of the Interior— Bureau of Reclamation	4/15/83	To coordinate related programs including mapping, land and water resource planning, water resources investigations and research, geologic investigations and research, and information systems.
Department of the Interior— Office of Surface Mining	7/26/78	To coordinate data exchanges and related programs, including monitoring, hydrologic studies, land use, geologic mapping, data systems, and programs and budgets.
Environmental Protection Agency	8/5/81	To provide a mechanism to coordinate programs and plans, provide for technology transfer and data exchanges, arrange for cooperation and support of programs of mutual interest, arrange exchange of budget and planning information, act as a clearinghouse for EPA/USGS contacts, and provide information on existing and future MOUs and IAGs between the agencies.

SOURCE: USGS, 1983

Under the agreement, the Corps is responsible for managing the design, construction, and operation of remedial actions at hazardous waste sites for which EPA (as opposed to a State) assumes lead responsibility.

- An agreement between EPA and USGS specifies the cooperation and extent of assistance that USGS will provide EPA's Office of Waste Programs Enforcement in gathering information and assessing the hydrology and geology of hazardous waste sites. The types of assistance that USGS can provide include but are not limited to: provision of data from USGS files on groundwater systems near a hazardous waste site; technical assistance on the design or review of investigative studies; and comments on remedial action designs and the predicted effectiveness of such actions.
- Another agreement between EPA and USGS is for USGS assistance to EPA in fulfilling its responsibility to designate sole source aquifers under Section 1424(e) of the Safe Drinking Water Act. USGS provides EPA with the fol-

lowing: aquifer descriptions, evaluations of aquifer vulnerability to contamination, background information on drinking water sources and alternative water supply sources, and projections of water consumption,

Water Data Coordination

A 1964 directive issued by the Office of Management and Budget, Circular No. A-67, prescribes guidelines for "coordination of Federal activities in acquiring water data from streams, lakes, reservoirs, estuaries, and groundwater. The Department of the Interior was assigned lead responsibility. In October 1964, the Office of Water Data Coordination was established within the Water Resources Division of USGS to implement provisions of the directive. Two advisory committees, the Interagency Advisory Committee on Water Data and the Advisory Committee on Water Data for Public Use, were also established to assist USGS.

EFFORTS TO IMPROVE CAPABILITIES

Improving Federal and State capabilities to protect groundwater quality requires a variety of activities, including financial assistance, technical assistance, and research and development. The following discussions generally describe Federal activities and programs in these areas.

Financial Assistance

A number of Federal statutes examined in this study authorize grant programs for the States. None of the provisions, however, is earmarked exclusively for groundwater activities.

As indicated in table 11, the States may be delegated authority to implement certain regulatory programs, and grants are provided for these purposes. For example, Subtitle C of the Resource Conservation and Recovery Act, the Surface Mining Control and Reclamation Act, and the Underground Injection Control (UIC) Program of the Safe Drinking Water Act have such provisions.

Funds under these programs are not limited to groundwater-related activities.

Under other statutes, the States are awarded grants for planning and other water-related activities. For example, Section 208 of the Clean Water Act authorizes the States or regional planning agencies to prepare water quality management plans to identify and propose solutions to water quality problems; the plans, however, are not legally binding. Section 208 was designed explicitly to address non-point sources such as agriculturally and silviculturally related sources (e. g., irrigation return flows), mine-related sources, construction activities, and salt-water intrusion.¹⁷ Funding for Section 208 activities ended in 1981, but additional funding for State water quality activities is now available through Sections 106 and 205(j) of the Clean Water Act. Funding for other programs (e.g., the Coastal Zone Management Act, RCRA

¹⁷se.,irj., 208(b)(2)(F)—(K)

Subtitle D, and the Rural Abandoned Mine Program) has either been reduced or eliminated in recent years.

Technical Assistance

Programs within EPA, USGS, and the Soil Conservation Service (SCS) provide technical assistance on groundwater quality to the States, individuals, and other Federal agencies. For example, EPA's Office of Drinking Water advises the States and other authorities in determining the types of response appropriate to contamination incidents, Health Advisories for 22 contaminants have been developed; they suggest the level of a potential contaminant in drinking water at which adverse health effects would not be anticipated for the most sensitive members of the population. Other kinds of technical assistance activities at EPA include preparation of special guidance manuals for EPA program implementation (e. g., RCRA permit writer manuals) and guidance on laboratory testing.

USGS technical assistance to the States and other Federal agencies includes a variety of programs (e. g., the Hazardous-Waste Hydrology Program, the Assistance to Other Federal Agencies Program, and the State Cooperative Program) (Chase, et al., 1983). USGS assists in the development of both Federal and State regulations and standards for managing disposal of hazardous wastes and assists Federal agencies on toxic waste cleanup under RCRA and CERCLA programs. Through the National Water-Data Storage and Retrieval System (WATSTORE) and National Water Data Exchange (NAWDEX), USGS maintains and provides access to data on surface water and groundwater quality and quantity and to meteorological data. USGS study and research results are disseminated through numerous publications. USGS also provides training programs for Federal, State, and local agencies on hydrologic investigations. (Ch. 6 describes selected USGS activities in more detail.)

Although SCS programs are not directed specifically at groundwater, technical assistance to the States, counties, and individuals is provided through the Rural Clean Water Program and the development of Best Management Practices to minimize adverse impacts on water quality. Financial assistance to individuals may be provided through

the Agricultural Stabilization and Conservation Service (ASCS) to implement some Best Management Practices.

In compliance with Section 104 of CERCLA, the Agency for Toxic Substances and Disease Registry was established as part of the Centers for Disease Control (CDC) in April 1983.¹⁸ CDC is currently working with the National Governors' Association (NGA) to implement Section 104(i)(3). Under the section, the Agency for Toxic Substances and Disease Registry is required to maintain a complete list of areas closed to the public or otherwise restricted in use because of toxic substance contamination. A Memorandum of Understanding is currently being negotiated between CDC and EPA on the responsibilities of each for administering provisions of Section 104. CDC has also designated public health advisors in EPA's regional offices to assist in assessing health impacts at uncontrolled hazardous waste sites.

Other Federal agencies also have designated responsibilities under Section 104:

1. The Food and Drug Administration conducts field investigations and analyses of food chain crops affected by CERCLA sites (Section 104).
2. The National Library of Medicine is conducting an inventory of literature, research, and studies on health effects of toxic substances (Section 104).
3. The National Institute of Environmental Health Sciences analyzes compounds found at CERCLA sites (Section 104).

Federal Research and Development Concerning Groundwater Quality

At least 26 Federal organizations are conducting or are planning to conduct research and development (R&D) studies on groundwater quality. Table 15 lists the organizations and categorizes their major groundwater quality R&D activities. Most of the work that is done requires an understanding of groundwater flow systems.

¹⁸48 FR 17651-17652. The agency was established following settlement of a lawsuit brought by the Environmental Defense Fund (EDF) against the Department of Health and Human Services for their failure to comply with Section 104 of CERCLA. See Reisch, 1983.

Table 15.—Federal Involvement in Groundwater Quality Research and Development^a

Federal organization	Categories of groundwater quality R&D ^b									
	1	2	3	4	5	6	7	8	9	10
National Science Foundation.			x		x				x	
Department of Agriculture										
Agricultural Research Service.			x			x				
Forest Service.			x							
Soil Conservation Service.					x	x			x	
Department of Commerce										
National Bureau of Standards.	x									
Department of Defense										
Army Corps of Engineers.		x			x	x			x	x
Army Medical Bioengineering R&D Laboratory.	x									
Army Toxic and Hazardous Materials Agency.	x								x	
Department of Energy.			x							
Department of the Interior										
Bureau of Indian Affairs.						x				
Bureau of Land Management.						x				
Bureau of Reclamation.						x	x			
Fish and Wildlife Service.						x				
Geological Survey.		X	x	x	x	x	x	x		
National Park Service.				x	x					
Office of Surface Mining.					x		x			
Office of Water Policy.		x	x						x	x
Environmental Protection Agency										
Environmental Monitoring Systems Laboratory.	x		x							
R.S. Kerr Environmental Research Laboratory.			x							
Environmental Research Laboratory.			x							
Office of Pesticide Programs.			x							
Office of Radiation Programs.	x				x					
Office of Research and Development.		x	x		x				x	x
Office of Solid Waste.					x					
Office of Water.									x	
Nuclear Regulatory Commission.		x	x							

^aThe listing is not exhaustive but covers principal programs and activities related to groundwater quality R&D. Examples of other Federal R&D activities omitted here address quantity estimates, use patterns, source inventories, recharge, information exchange, socioeconomic effects of alternative supplies, and environmental effects of contamination.

^bKey for categories of groundwater research and development:
 1—Standards certification, quality assurance, and water quality criteria.
 2—Hydrogeologic investigations and dynamics of groundwater flow.
 3—Subsurface fate and transport of contaminants.
 4—Background monitoring of groundwater quality.
 5—Detection of groundwater contamination from various sources.
 6—Salt-water intrusion and salinity problems.
 7—Surface water-groundwater interactions.
 8—Control of groundwater contamination from various sources
 9—Treatment technologies.
 10—Evaluation of alternatives.

SOURCE: Office of Technology Assessment.

The most diverse research programs—in terms of the number of R&D categories involved—are those of the Environmental Protection Agency (the Office of Research and Development is most active), the U.S. Geological Survey, and the Army Corps of Engineers. Information made available for this study does not allow a detailed breakdown of projects within all the agencies.

Institutional involvement is highest—in terms of the number of organizations conducting research in a particular category—in the detection of groundwater contamination and in subsurface fate

and transport of contaminants. Detection efforts generally involve point sources (e. g., waste piles, landfills, mine drainage, underground *injection* wells, surface impoundments, and septic tanks), but some efforts are also being directed toward non-point sources (e. g., salt-water intrusion, farm runoff, and pesticide applications). Several organizations are also involved in standards certification and quality assurance, hydrogeologic investigations, and treatment technologies.

As of 1978, the Federal budget for all water research was approximately \$225 million but only \$10

million to \$12 million was spent on groundwater R&D (U.S. House of Representatives, 1978). Data available for this study are not sufficient for estimating current Federal expenditures either on groundwater quality R&D overall or on specific cat-

egories of R&D. In general, groundwater R&D expenditures are not identified as such, and without detailed budget information, the extent and focus of Federal groundwater R&D activities cannot be assessed.

CHAPTER 3 REFERENCES

- Canter, L. W., "Groundwater Quality Management," *Journal of the American Water Works Association*, October 1982, pp. 521-527.
- Chase, E. G., J. E. Moore, and D. A. Rickert, "Water Resources Division in the 1980's—A Summary of Activities and Programs of the U.S. Geological Survey's Water Resources Division," USGS Circular 893, 1983.
- Comments in "Groundwater Pollution in South Dakota: A Survey of Federal and State Law," *South Dakota Law Review*, vol. 23, No. 2, pp. 734-798, summer 1978.
- Copeland, C., "Water Quality: Implementing the Clean Water Act," Congressional Research Service Issue Brief IB83030, 1983.
- Davis, J. C., and B. S. Davis, *The Politics of Pollution* (Indianapolis, IN: Pegasus-Bobbs-Merrill Co., 1976).
- Feliciano, D., "Comparison of the U.S. Environmental Protection Agency's Groundwater Protection Strategies," Congressional Research Service 84-528 ENR, Feb. 8, 1984.
- Miller, D. W. (ed.), *Waste Disposal Effects on Ground Water*, pp. 445-446 (Berkeley, CA: Premier Press, 1980).
- Office of Technology Assessment, *Technologies and Management Strategies for Hazardous Waste Control*, OTA-M-196 (Washington, DC: U.S. Government Printing Office, March 1983).
- Office of Technology Assessment, *Use of Models for Water Resources Management, Planning, and Policy*, OTA-O-159 (Washington, DC: U.S. Government Printing Office, August 1982).
- Reisch, M. E. A., "Superfund: Hazardous Waste Cleanup," Congressional Research Service Issue Brief IB 83064, 1983.
- Spector, S., Branch of Technical Support, Bureau of Land Management, personal communication, Sept. 11, 1984.
- Tripp, J. T. B., and A. Jaffe, "Preventing Groundwater Pollution: Towards a Coordinated Strategy To Protect Critical Recharge Zones," *Harvard Environmental Law Review*, vol. 3:1, pp. 364-410, 1979.
- U.S. Environmental Protection Agency, "Proposed Ground Water Protection Strategy," Office of Drinking Water, Nov. 1980.
- U.S. Environmental Protection Agency, "Proposed Ground Water Policy—Draft," Office of Drinking Water, Feb. 2, 1983.
- U.S. Environmental Protection Agency, "Ground-Water Protection Strategy," Office of Ground-Water Protection, August 1984.
- U.S. Geological Survey, "Annotated Bibliography of Water-Related MOUs and IAGs," Office of Water Data Coordination, December 1983.
- U.S. House of Representatives, Committee on Public Works, "Federal Water Pollution Control Act Amendments of 1972," Report No. 92-911. Mar. 11, 1972.
- U.S. House of Representatives, Committee on Interstate and Foreign Commerce, Report No. 93-1185, pp.1, July 10, 1974.
- U.S. House of Representatives, 95th Cong., 2d sess., "Groundwater Quality Research and Development," hearing (including report) before the Subcommittee on the Environment and the Atmosphere, Committee on Science and Technology, Apr. 8, 26, and 27, 1978.
- U.S. Senate Committee on Public Works, "Federal Water Pollution Control Act Amendments of 1971," Report No. 92-414, Oct. 28, 1971.
- Wilson, V. P., "Groundwaters: Are They Beneath the Reach of the Federal Water Pollution Control Act Amendments," *Environmental Affairs*, vol. 5, pp. 545-566, 1976.