Chapter 10

State Efforts To Correct Groundwater Contamination

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Chapter 10
State Efforts To Correct Groundwater Contamination

CHAPTER OVERVIEW

State responses. to survey questions about their efforts to correct groundwater contamination are presented in this chapter. (See the section *OTA State Survey* in ch. 4 for guidance in interpreting survey result s.) The following topics are discussed:

- Sources of groundwater contamination for which States have corrective action programs;
- priorities for selecting sites for action; and
- use of, preference for, and problems with corrective action techniques.

Additional information on State strengths, problems, and types of desired Federal assistance related to corrective action is found in chapter 4.

The conclusions that follow are drawn from this information.

Most States are working to correct contamination problems. But State efforts vary in terms of the sources that are addressed and the process for site selection, Further, State efforts to correct groundwater contamination are generally at *an early stage of development* in that relatively few States have formalized their approaches to corrective action.

The States are using a wide variety of techniques, and many techniques are used together. With the possible exception of source removal (for the cases where sources can be identified and removed), the States have few preferences among individual (or categories of) corrective techniques. In making decisions, the States are concerned about the costs of implementation and maintenance, the time required for implementation and achievement of desired results, and the degree of certainty about how well a technique will perform.

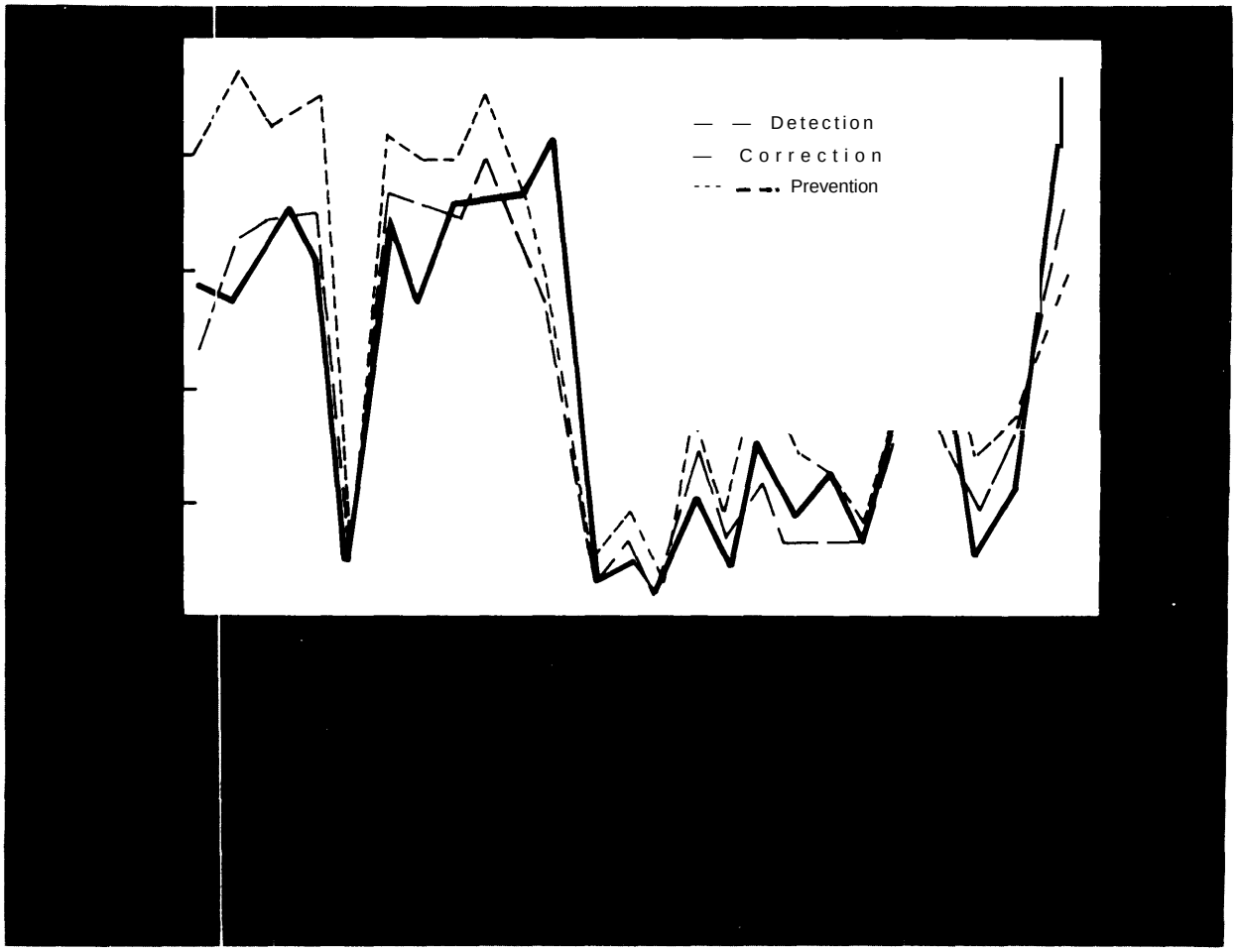
Most States have technical, legal, or institutional problems in undertaking corrective action. Although the States want Federal assistance in overcoming technical and institutional problems, most States do not want Federal assistance with their legal problems, particularly those involving water rights. Water rights issues often complicate the correction of groundwater contamination problems.

STATE CORRECTIVE ACTION PROGRAMS FOR SOURCES

Many States have programs to correct groundwater contamination from a variety of sources, as shown in figure 5. The highest number of States have programs to correct spills and accidents and leaks from storage facilities and pipelines. Overall, more States have programs to correct sources in OTA Categories 1, II, and 111 than to correct Categories IV-, V, and VI sources (refer to ch. ***2,*** table 5). There appears to be no correlation between the number of States with programs for a particular source and the pervasiveness of that source either nationally or regionally. (See ch. 2 for a discussion of the location of sources.)

In some States, correction programs *are* established for sources although there are no detection programs for those same sources, The implication is that the need for corrective action is often iden-

Figure 5.—OTA State Survey Responses: Number of States With Programs To Correct Groundwater Contamination From Selected Sources



See fig. 2 for footnotes a through g.

SOURCE: Office of Technology Assessment.

tified as a result of complaints or other reports of concern rather than from any kind of systematic investigation. Sources for which the highest number of States have correction but not specific detection programs include: spills and accidents, leaks from storage facilities and pipelines, feedlots, application of pesticides and herbicides, abandoned wells, waste piles, and subsurface percolation.

SELECTING SITES FOR CORRECTIVE ACTION

The States consider a variety of factors in their decisions to undertake corrective action at one contaminated site as opposed to another, as shown in table 37. Severity of the problem was identified by the highest number of States, but State definitions of severity vary. The States define severity in terms of: the characteristics of the aquifer, substances, or site; uses of the groundwater; impacts of contarnina-

Table 37.—OTA State Survey Responses: Factors Used By States To Determine Which Contaminated Sites To Address

Factors	Number of States
Formal criteria	24
Severity of the problem	45
Order in which contamination is detected	32
Public pressure	39
Availability of special funding	37
Sites where source and responsible party are identified	38

SOURCE: Off Ice of Technology Assessment

tion; reason for detection; and/or avail ability o f water supply alternatives.

Some States have developed formal criteria for determining the sites to consider. Some use ranking systems developed by the Federal Government (e. g., MITRE Hazard Ranking System); others have developed their own ranking systems. Some have no formal ranking systems but use State regulatory definitions (e. g., groundwater quality standards) to determine which sites warrant action.

Differences in selection criteria may result in very different corrective action decisions among the States—a site may qualify for corrective action in one State, but a similar site in another State may be of a lower priority. More detailed analysis of State decisionmaking and resources (e. g., funds and staff) is necessary to determine whether the differences in priorities and approaches to site selection result in different levels of groundwater protection among the States.

Most State efforts to correct groundwater contamination are in early stages of development. This point is apparent from a lack of formal criteria for selecting sites for corrective action in many States and from the lack of formal criteria, written guidelines, or procedures in a majority of States-to: 1) establish cleanup standards for corrective action (16 States have formalized approaches); 2) respond when quality standards are violated (19 States have formalized procedures, although the procedures do not cover all potential sources of contamination); and 3) respond when there is no quality standard for the substances found in groundwater(17 States have formalized procedures). Any formal criteria that have been established differ among the States.

STATE USE, PREFERENCES, AND PROBLEMS WITH CORRECTIVE ACTION ALTERNATIVES

Use and Preferences

The use of and preference for various techniques to correct contamination are summarized in table 38. The most notable point about the table is that the States are using or considering the use of a wide variety of techniques. That many techniques are used together is consistent with the technical limitations of these methods described in chapter 8. Most States are working to correct at least some of their identified groundwater contamination problems. OTA did not obtain information on either the extent to which all known incidents are being addressed or the effectiveness of the corrective actions that are being undertaken.

Preferences for specific techniques were noted by 40 States. Four States did not specify preferences for individual techniques, noting that preferences depend on such site conditions as source, substances, and aquifer characteristics. Two States said that it is too soon to know which techniques they prefer.

No individual technique is preferred by many States. Source removal (a management technique) is preferred by the highest number. The actual number of States preferring it may be higher because the OTA survey did not ask specificall, about the use of this option.

Preferences for techniques relate primaril, to the low cost and/or the expected effectiveness of a tech-

Table 38.-OTA State Survey Responses: Use and Preferences for Corrective Action Techniques

Technique	Number of States: Using	With preference for use[a]
Containment:		
Slurry wall	29	1
Sheet pile	10	0
Grouting	18	0
Geomembrane	NQ[b]	NQ
Clay Cutoff	NQ	NQ
Liner[c]	47	1
Natural containment	36	2
Surface sealing	35	1
Diversion ditches	41	0
Hydrodynamic control[d]	24	5
Technique not specified	2	7
Total number of States responding	48	15
Withdrawal:		
Pumping	**44**	5
Gravity drainage	31	1
Withdrawal enhancement	NQ	NQ
Gas venting[e]	29	0
Excavation	41	3
Technique not specified	3	11
Total number of States responding	47	17
Treatment:		
Skimming	**34**	0
Filtration	**28**	
Ultrafiltration	13	0
Reverse osmosis	17	1
Air stripping	34	2
Steam stripping	NQ	NQ
Precipitation/clarification/ coagulation	NQ	NQ
Treatment (cont'd):		
Ion exchange	25	0
Adsorption	34	0
Electrodialysis	NQ	NQ
Chemical transformation	NQ	NQ
Biological transformation	NQ	NQ
Incineration	NQ	NQ
Technique not specified	7	14
Total number of States responding	43	16
In-situ rehabilitation:		
Biological degradation	20	1
Chemical degradation	20	0
Water table adjustment	40	3
Natural process restoration	33	4
Technique not specified	3	2
Total number of States responding	47	10
Management:		
Limit/terminate aquifer use	38	5
Develop alternative water supply	44	6
Purchase alternative water supply	32	1
Municipal treatment	NQ	1[g]
Point of end-use treatment	32[h]	0
Source removal	NQ	11[g]
Monitoring	47	8
Health advisories	46	3
Accept increased risk	NQ	NQ
Technique not specified	1	1
Total number of States responding	**49**	21

[a] Nine States noted that they had few or no preferences for techniques—either because of having relatively little experience with implementing corrective actions or because preferences were site-specific. Four additional States had no preferences but did not provide an explanation, Some States listed more than one preference.
[b] NQ—OTA did not specifically question the States about this option.
[c] Responses primarily reflect the use of liners for prevention of groundwater contamination (e.g., in the design of new facilities), liners are rarely used for corrective action purposes,
[d] OTA used the term plume management in the questionnaire to the States rather than hydrodynamic control.
[e] OTA used the term gas migration control in the questionnaire to the States rather than gas venting.
[f] These treatment techniques are listed under Management to reflect who is responsible for the action and whether treatment occurs before or after water distribution,
[g] Although OTA did not specifically question the States about use of this option, some Stales noted a preference for it.
[h] Several States noted that this was a private option and not one that the State would implement.

SOURCE" Office of Technology Assessment.

nique or combination of techniques. These reasons were given for all categories of corrective action techniques. Other reasons given, mostly for preferring management options, relate to the lack of either resources or effective alternatives to clean up the contamination, the relatively short time usually available for implementation, and the absence of clear State authority to implement other techniques.

Agencies within a State may have different preferences for corrective action techniques. These differences may reflect agency missions, knowledge of technical options, and the problems that each confronts. For example, in one State, the health agency prefers to develop alternative sources, the water quality agency prefers withdrawal and treatment techniques, and the industry regulatory agency prefers containment options.

Problems With Corrective Action

Thirty-one States described problems with implementing corrective action techniques. Of the States that did not describe problems, five specifically noted that experience is too limited to evaluate the techniques. Other problems are more closely related to detection and hydrogeologic investigations (e. g., with contaminant transport models and identifying sources of contamination and responsible parties) and are discussed in chapter 7.

Table 39 classifies the problems associated with corrective action alternatives as technical, institutional, and legal and provides examples of each. General findings are:

- The States experience a variety of problems in implementing techniques for corrective action, and different States have different problems.
- More States noted technical problems than legal or institutional problems: This situation contrasts with the reported problems with hydrogeologic investimations, which are mostly institutional (see ch. 7). However, specific legal problems with water rights and general authority were also listed by a relatively large number of States regarding corrective action.

Photo credit State of Florida Department of Environmental Regulation

When contaminated drinking water wells are closed, water must be obtained from other sources.

Table 39.-OTA State Survey Responses: State Problems With Corrective Action Techniques

Number of States	Types of problems	Examples of problems
Technical problems:		
10	High cost of techniques	• Expense of treatment techniques for removing some organics • Expense of developing alternative water supplies • Expense of correcting salt-water contamination in agricultural areas
6	Site constraints associated with techniques	• Techniques unavailable for karst environments • Limitations on achievable withdrawal rates
1	Difficulties implementing techniques	• Difficulties in designing and installing liners
4	Lack of knowledge on setting standards for performance	• Lack of information on health and environmental impacts of many contaminants
4	Uncertainty over effectiveness of techniques	• Inability to predict technical performance
3	Adverse impacts of some techniques	• Increased contaminant migration caused by well closings and cessation of pumping • Impacts on air quality caused by air stripping
3	Intensive data and monitoring requirements	• Difficulties in identifying sources of contamination • Continued presence of contaminants after corrective action has been undertaken necessitates continued monitoring
21	Total States reporting technical problems	
Institutional problems:		
6	Lack of funds	• Scope of State activities constrained
3	Inadequate technical expertise	• Lack of staff with sufficient technical knowledge
3	Inadequate regulations and program implementation	• Lack of standards for determining cleanup objectives • Inadequate enforcement
3	Lack of interagency coordination	• Overlapping authority among agencies • Difficulties in coordinating with Federal agencies
1	Unavailability of equipment	• Shortage of drilling rigs and lack of geophysical equipment
2	Public resistance	• Public unwillingness to use water after cleanup
11	Total States reporting institutional problems	
Legal problems:		
10	Lack of authority—water rights	• Difficulties in obtaining information on water use and pumping schedules • Inability to control or restrict water uses that may influence alternatives involving pumping • Difficulties in obtaining alternative water supplies
8	Lack of authority—other	• Lack of regulatory jurisdiction over potential sources of contamination (e.g., underground storage tanks) • Difficulties in obtaining property access
2	Liability concerns	• Potential for damage suits if State supplies alternative water supply (e.g., bottled water) that turns out to be contaminated
16	Total States reporting legal problems	
31	Total number of States noting problems	

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Prevention


PESTICIDE
DRAIN Cleaner
PAINT
OVEN CLEANER
ACID
Charcoal Lighter
PAINT
Pool Chemicals
OIL
ANTI FREEZE