

APPENDIX A

State Report Summary Sheets

Region I State Report Summaries

**Connecticut
Maine
Massachusetts
New Hampshire
Rhode Island
Vermont**

Prepared: 5-15-87
Updated: 8-14-87

STATE REPORT SUMMARY
(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: Connecticut **STATUS:** Primacy **BIBLIOGRAPHY:** No
TITLE: State of Connecticut UIC Class V Assessment
AUTHOR: Water Compliance Unit of the Department of Environmental Protection
DATE: 4-87 **REPORT STATUS:** Final
RESPONSIBLE AGENCY(IES): Water Compliance Unit DEP
HYDROGEOLOGY: N/A
INVENTORY AND ASSESSMENT: 84 wells **FURS COMPATIBLE:** No (8-20-86)

Type	Number	Contamination Potential	Case Studies	Regulatory System
5A7	12	None	Yes	Permit
5W20	6	Moderate	Yes	Permit
5W11	62	High	Yes	Permit (75000 gpd)
5X28	1	High	Yes	Permit
5D2	3	N/A	No	Permit

Strategy	Rating/Response
N/A	N/A

RECOMMENDATIONS:

To address the concern about 5X28 wells, the following strategy will be used by the Connecticut DEP:

- Task I - Continue the existing program of inspection by existing field and engineering staff of facilities that could discharge to the groundwaters of the state with emphasis placed on facilities that could contaminate underground sources of drinking water.
- Task II - Contact the owners and/or operators if the facilities that discharge to the ground via letter informing them of the need to apply for and obtain a permit for these discharges and the Department's policy of not granting discharge permits in GA or GAA and GB groundwater classification areas.
- Task III- Contact the Directors of Health of each of the 169 towns in Connecticut informing them of:
1. The potential for groundwater contamination from unpermitted discharges to the groundwater from floor drains at gas stations and auto repair shops.

Connecticut
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2. The department's program of permitting and enforcement actions for groundwater discharges from floor drains under the Connecticut Water Pollution Control Statutes.

Prepared: 1-28-87
Updated:

STATE REPORT SUMMARY

(All information recorded as described in state report
additional correspondence, and verbal communication)

STATE: Maine **STATUS:** Primacy **BIBLIOGRAPHY:** No
TITLE: Revised Interim Report: Maine's UIC Program
AUTHOR: Maine Department of Environmental Protection
DATE: 12-86 **REPORT STATUS:** Draft
RESPONSIBLE AGENCY(IES):
Maine Department of Environmental Protection

HYDROGEOLOGY:

Areas with rocky outcrops tend to be characterized by highly or moderately fractured bedrock relatively near the surface. In most such instances, the fissures are saturated with groundwater. The pumping of liquid wastes into the ground requires the displacement of the groundwater in these fissures.

Other areas of Maine consist of sand and gravel aquifers, usually overlying marine clays or bedrock zone. In such areas, forcible injection is feasible, yet the costs are still high relative to other disposal techniques. Also, most of Maine's sand and gravel aquifers are in moderately to heavily populated areas and are valued water supplies. This has discouraged the development of injection facilities within those areas.

INVENTORY AND ASSESSMENT: 15 wells **FURS COMPATIBLE:** NO (8-20-86)

Type	Number	Contamination Potential	Case Studies	Regulatory System
5W20	15	Variable	9 facilities	N/A
Strategy				Rating/Response
N/A				N/A

RECOMMENDATIONS:

N/A

Prepared: 12-4-86
Updated:

STATE REPORT SUMMARY

(All information recorded as described in state report
additional correspondence, and verbal communication)

STATE: Massachusetts STATUS: Primacy BIBLIOGRAPHY: Yes

TITLE: Underground Injection Control in the Commonwealth of Massachusetts

AUTHOR: Division of Water Pollution Control

DATE: 7-86 REPORT STATUS: Draft

RESPONSIBLE AGENCY(IES): Division of Water Pollution Control (DWPC)

HYDROGEOLOGY: No overview of general hydrogeology of the state is
provided. However, site-specific hydrogeology is
addressed in case study assessments.

INVENTORY AND ASSESSMENT: 131 wells FURS COMPATIBLE: NO (8-20-86)

Type	Number	Contamination Potential	Case Studies *	Regulatory System
5D2	19	Low	Yes	Exempt from permit if area is separ- ated from industrial activities.
5A7	10	Low	Yes	Permit if discharge exceeds 15,000 GPD.
5W11	27	Low	No	Permit if discharge
5W12	72	Low	Yes	exceeds 15,000 GPD.
5A19	3	Low	Yes	Permit if discharge exceeds 2,000 GPD or temp. of inj. fluid exceeds 40°C.
5W20	1	Moderate	Yes	Discharge permit required.

* Those provided are very brief but well summarized.

Strategy (Date)

Rating/Response

N/A

N/A

RECOMMENDATIONS:

N/A

Prepared: 12-12-86

Updated:

STATE REPORT SUMMARY

(All information recorded as described in state report
additional correspondence, and verbal communication)

STATE: New Hampshire **STATUS:** Primacy **BIBLIOGRAPHY:** No

TITLE: Inventory of Class V Injection Wells in New Hampshire (Plus additional
correspondence)

AUTHOR: New Hampshire Water Supply and Pollution Control Commission

DATE: ? **REPORT STATUS:** Draft

RESPONSIBLE AGENCY(IES): New Hampshire Water Supply and Pollution Control
Commission

HYDROGEOLOGY: N/A

INVENTORY AND ASSESSMENT: 38 wells **FURS COMPATIBLE:** No (8-20-86)

Type	Number	Contamination Potential	Case Studies*	Regulatory System
5D3	3	N/A	Yes	N/A
5D4	16	N/A	Yes	N/A
5A7	2	N/A	Yes	N/A
5A19	3	N/A	Yes	N/A
5W20	13	Variable	Yes	N/A
5R21	1	Low	Yes	N/A

* Specific data are provided on each individual well but no studies were
conducted over any length of time. Perhaps these should be termed
"skeleton" case studies.

Strategy (Date)

Rating/Response

N/A

N/A

RECOMMENDATIONS:

N/A

Prepared: 5-15-87
Updated: 8-14-87

STATE REPORT SUMMARY

(All information recorded as described in state report
additional correspondence, and verbal communication)

STATE: Rhode Island

STATUS: Primacy

BIBLIOGRAPHY: No

TITLE: State of Rhode Island Underground Injection Control Program Class V Well Assessment

AUTHOR: Department of Environmental Management, Division of Water Resources

DATE: 7-87

REPORT STATUS: Final

RESPONSIBLE AGENCY(IES): Department of Environmental Management, Division of Water Resources, Groundwater Protection Program

HYDROGEOLOGY: Groundwater is utilized by 24% of the population and is derived from two formations: consolidated paleozoic bedrock and unconsolidated pleistocene glacial deposits. Three specific geographical regions were studied. (1) Block Island, a sole source aquifer, glacial washout and till. (2) Southern portion of state, similar to geohydrological formations as in Number 1. (3) Central portion of state, sand and gravel aquifer.

INVENTORY AND ASSESSMENT: 80 wells

FURS COMPATIBLE: No (8-20-86)

Type	Number*	Contamination Potential	Case Studies	Regulatory System
5A19	8	High	Yes	N/A
5W11	8	Low	Yes	N/A
5W20	59	Mod./High	Yes	N/A
5X28	3	Low	Yes	N/A
5X26	2	High	No	N/A

* Some facilities reported lagoons as Class V wells.

Strategy	Rating/Response
Task 1. Identify UIC Class V injection wells, review the chemical analysis of waste streams and register them with the state UIC program.	N/A
Task 2. Segregate specific Class V wells having highest potential for contamination which could impact groundwater aquifers supplying public and privately-owned wells.	N/A

Rhode Island
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Task 3. Eliminate or modify Class V well discharges which are impacting underground drinking water supplies to comply highest attainable groundwater quality. NOV's and order are issued against those facilities that are not in compliance. Fines issued with Administrators' Order are based upon established penalty matrix. N/A

RECOMMENDATIONS:

N/A

Prepared: 5-15-87
Updated: 8-14-87

STATE REPORT SUMMARY

(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: Vermont **STATUS:** Primacy **BIBLIOGRAPHY:** Yes
TITLE: Vermont Class V Injection Well Inventory and Assessment
AUTHOR: Ground Water Management Section, Dept. of Water Resources and
Environmental Engineering
DATE: N/A **REPORT STATUS:** Final
RESPONSIBLE AGENCY(IES): Vermont Agency of Environmental Conservation, Water
Quality Division, Groundwater Management Section
HYDROGEOLOGY: Shallow unconsolidated groundwater aquifers
INVENTORY AND ASSESSMENT: 15 wells **FURS COMPATIBLE:** No (8-20-86)

Type	Number	Contamination Potential	Case Studies	Regulatory System
5X28	10	Mod./High	Yes	N/A
5W20	5	Mod.	Yes	N/A

Strategy	Rating/Response
(All well types)	
-Contractor mailed over 1,000 surveys to town clerks, health officers, planning commissions, water well drillers, septic system contractors, consulting engineers, industrial and environmental groups.	28% response 1 well located
-Published public notice in 16 newspapers.	No response
-Conducted file reviews (storage, transport, treatment, and disposal facilities-hazardous waste).	5 wells located
-Act 250 Review (plans submitted for new or renovated developments-reviewed weekly).	No wells located
(Sewage related wells)	
-Surveyed 53 septage haulers	22 responses

-Conducted 450 file reviews (mobile home parks, public buildings, campgrounds, and subdivisions).	No wells located
(Agricultural drainage wells-5F1)	
-Contacted Public Facilities Division of the Agency of Environmental Conservation	No wells located
(Heat pump return flow-5A7)	
-Sent public notice to 20 heat pump installers	7 responses
(Auto service stations-5X28)	
-Contacted 68 automotive repair stations	10 wells located

RECOMMENDATIONS:

1. The database of injection wells is small, and updating the inventory can be accomplished by site visits coupled with a telephone survey of the injection well operators.
2. Other methods of updating and future surveying of injection wells will continue through the Act 250 inter-agency communications.
3. Methods of remedial action have not been specifically addressed as there are no contaminating injection wells.
4. The injection well location, nature of establishment, type of fluid being discharged, and volume of fluid may be of critical importance to the emergency response program in case of accidents.

Region II State Report Summaries

**New Jersey
New York
Puerto Rico
Virgin Islands**

Prepared: 4-28-87
Updated:

STATE REPORT SUMMARY

(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: New Jersey **STATUS:** Primacy **BIBLIOGRAPHY:** No
TITLE: Underground Injection Control (UIC) Program Inventory and Assessment
of Class V Wells Statewide
AUTHOR: New Jersey Department of Environmental Protection
DATE: ? **REPORT STATUS:** ?

HYDROGEOLOGY: New Jersey is divided into two distinct geographic provinces. The Appalachian Province consists of Paleozoic strata, Pre-Cambrian metamorphic rock, and Mesozoic sediments interbedded with intrusive igneous sills. This region is extensively folded and faulted and has two separate groundwater systems (consolidated bedrock and unconsolidated glacial sediments). The Atlantic Coastal Plain consists of unconsolidated, stratified and unstratified, Mesozoic and Cenozoic Sediments underlain by Pre-Cambrian basement-rock complex.

INVENTORY AND ASSESSMENT: 379 wells identified **FURS COMPATIBLE:** No (8-20-86)
(3000-6000 estimated)

Type	Number	Contamination Potential	Case Studies	Regulatory System
5D2	1	N/A	No	NJPDES Permit
5D4	1	N/A	No	NJPDES Permit
5A7	181	N/A	Yes	Rule/Permit
5W10	1	N/A	No	NJPDES Permit
5W11	143	N/A	No	NJPDES Permit
5A19	5	N/A	No	NJPDES Permit
5W20	20	Variable	Yes	NJPDES Permit
5R21	0	N/A	No	Rule/Permit
5B22	0	N/A	No	Rule/Permit
5X26	9	N/A	No	NJPDES Permit
5X28	18	N/A	Yes	NJPDES Permit

Strategy (date)	Response/Rating
(12-86) File search of NJPDES permits.	N/A
(1981) Preliminary survey obtained from state records and questionnaires mailed to various institutions and organizations	1224 facilities identified
(?) Mailed permit application to 339 facilities (from preliminary survey).	31%

RECOMMENDATIONS

1. More NJPDES/DGW-UIC permits need to be issued to existing facilities to determine any impact on existing groundwater quality;
2. All new or proposed facilities desiring to utilize subsurface disposal as their primary means of waste management must provide adequate pretreatment of effluent sufficient to meet the State's groundwater quality standards at a pre-determined point of compliance;
3. All existing or abandoned Class V wells which cannot meet the groundwater quality standards must implement a detection monitoring program, pursuant to an order to permit, and enter into remedial mitigation concerning groundwater quality enhancement;
4. Funding from U.S. Environmental Protection Agency must be significantly increased from its present level (\$81,800) just to fulfill the minimum reporting requirements of the UIC program. Additional resources are currently needed by NJDEP if it is to perform the required enforcement and permit administration activities to meet EPA's expectations.
5. In terms of groundwater quality, protection and preservation, increased emphasis needs to be placed on creating new treatment facilities, in addition to upgrading existing ones, which are capable of achieving current drinking water or surface water standards.

Prepared: 1-28-87
Updated: 5-05-87

STATE REPORT SUMMARY

(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: New York **STATUS:** DI **BIBLIOGRAPHY:** Yes
TITLE: Class V Injection Well Inventory and Assessment: State of New York
AUTHOR: SMC Martin
DATE: 9-83 **REPORT STATUS:** ?

RESPONSIBLE AGENCY(IES):

New York Department of Environmental Conservation

HYDROGEOLOGY:

New York consists of several different provinces controlled by bedrock geology. Each province is blanketed by unconsolidated deposits in the form of glacial drift or coastal plain sediments underlain by consolidated bedrock. Unconsolidated deposits concentrating in stream valleys and Long Island have the highest permeabilities and serve as the principal aquifers but also serve as efficient zones for injection.

INVENTORY AND ASSESSMENT: 7,172 wells **FURS COMPATIBLE:** NO (8-20-86)

Type	Number*	Contamination Potential	Case Studies	Regulatory System
5F1	150**	Variable	No	SPDES permit
5D2	2,500	Positive	No	SPDES permit (>1000 gpd)
5D4	1,100	N/A	No	SPDES permit (industrial)
5A6	X	N/A	No	N/A
5A7	X	Low	No	Permit
5W10	X	Significant	No	Permit (>1000 gpd)
5W11	X	Significant	No	Permit (>1000 gpd)
5W12	21	N/A	No	SPDES permit
5X14,16	48	N/A	No	Permit
5W20	350	Significant	Yes	SPDES permit
5R21	3,000 basins	N/A	No	N/A
5S23	X	N/A	No	N/A
5X28	3	Highest	No	Permit
5W31	X	N/A	No	Permit (>1000 gpd)
5W32	X	N/A	No	Permit (>1000 gpd)

* "X" indicates well type is believed to exist; no numbers available

** May discharge to either surface or groundwater

Strategy	Rating/Response
1. Review preliminary report completed by the NYSHD on Class V injection wells.	Incomplete
2. Contact state and federal agencies and conduct library research to obtain information on geology, contamination from Class V wells, and regulations.	N/A
3. Contact county health officials with a letter of introduction and a questionnaire concerning the inventory, contamination, and local aquifers.	Limited
4. Contact county health officials and New York Department of Environmental Conservation with a follow-up telephone survey.	100%

RECOMMENDATIONS:

1. Further regulatory control of Class V injection wells.
 - a. Type and degree of regulation would most efficiently be developed and implemented by local agencies with respect to specific and potential contamination problems, geology, and pre-existing injection well concentrations.
 - b. Such regulation should inventory and classify existing and proposed Class V injection wells for further site specific contamination assessment and permitting.
2. Further study into Class V wells covered by the SPDES program since several county health officials felt the SPDES permit file was not complete or up to date.
3. Further study into the assessment of area of high contamination potential rather than an assessment covering the whole state. Such areas should be chosen with respect to known contamination from Class V injection wells, high injection well concentrations, and geology.
4. Further study into the Smithtown, Suffolk County area, and continuation of the preliminary report.
5. Investigation of other areas of high Class V well contamination potential using a methodology similar to the Smithtown study.

Prepared: 1-30-87
Updated:

STATE REPORT SUMMARY
(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: Puerto Rico **STATUS:** DI **BIBLIOGRAPHY:** No

TITLE: Report on Inventory and Assessment of Class V Injection Wells in Puerto Rico

AUTHOR: Engineering Enterprises, Inc.

DATE: 12-86 **REPORT STATUS:** Draft

RESPONSIBLE AGENCIES:

Puerto Rican Environmental Quality Board (EQB) -- the agency expected to assume "primacy" for continuation of the UIC program.

HYDROGEOLOGY:

Limestones and overlying alluvial deposits make up the most productive aquifers of Puerto Rico. The most extensive and thickest ones underlie the northern coastal area. While the high permeabilities developed in the limestone (due to development of solution cavities) have produced highly productive aquifers, they have also rendered the more shallow aquifers vulnerable to pollution. An additional threat to productive aquifers along the north coast is the intrusion of sea water.

INVENTORY & ASSESSMENT: 1,356 facilities **FURS COMPATIBLE:** No (8-20-86)

Type	Number*	Contamination Potential	Case Studies**	Regulatory System
5F1	-X-	-	No	-
5D2	3	-	2	-
5D3	10	Mod./High	Yes	Permit
5D4	15	-	13	-
5W9	5	-	No	-
5W10	67	-	1	-
5W11	1073	-	No	N/A
5W12	1	High	2	Permit
5A19	1	-	3	-
5W20	28	-	7	-
5X26	1	-	1	-
5X27	4	-	5	-
5W31	85	-	No	-
5W32	63	-	9	-

* "X" indicates well type is known to exist; no numbers available

** Number of inspection reports included in appendix

Strategy (Date)	Response/ Rating
Not addressed directly. There is evidence in the state report that an initial inventory was conducted and later updated.	N/A

RECOMMENDATIONS:

1. Future work:
 - a. Look for 5X28's - service stations
 - b. Look for 5X29's - probably present
2. Use revised form for pre-inspection mailing and for inventory.
3. Hire inspection personnel with training and experience in engineering geology, or groundwater, or equivalent; or train present employees in those subjects.
4. Set up system of periodic (or continuous) updating of inventory.
5. Inspect remaining industrial UIF's (not inspected in 1986 assessment).
6. Provide training for industrial personnel with responsibility for protecting the environment: geology; hydrogeology; groundwater occurrence and movement; groundwater protection; hydraulics of wells and aquifers; governmental (state and federal) agencies involved in groundwater development and protection.
7. Conduct groundwater studies to define better the direction and rate of groundwater movement in the principal aquifers; and to establish baseline values for key water quality parameters.
8. Training for engineers and drillers in the proper construction of water wells, with special emphasis on sanitary sealing and protection against corrosion. Training to be slanted toward construction in Karst or limestone formations.
9. Training for EQB personnel in those seminars provided by EPA and applicable to Puerto Rico.
10. Priority: study the Florida area to determine the seriousness of the existing threat to the groundwater-using communities in the vicinity.
11. Provide adequate financing for EQB's UIC staff--sufficient to permit routine and emergency field inspections.
12. Agricultural drainage wells--follow up on this, get the information from the Puerto Land Authority.

Puerto Rico

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13. Follow up on the UIF's that have not provided the information requested of them -- Glamourette Fashion Mills in particular.
14. Continue the search for unreported industrial UIF's.
15. Follow up on the school districts that have not responded to the CFO letter requests for information on the schools and their septic tanks.
16. Request all industries to conduct a monitoring program of their injectate. Results should be provided to EPA or to EQB in case Puerto Rico assumes "primacy."
17. Study, in more detail, Sterling, RCA Del Caribe, Lotus, Digital, Upjohn and Flor Quim, (1) to assess the impact each one of these discharges has on the quality of groundwater and on its present and future uses; (2) to delineate remedial actions, including costs and benefits of each alternative.
18. USGS reports existence of numerous water wells that are not within the PRASA water supply network. These should be checked to see if any are supplying water for human consumption.
19. Get injectate analyses with parameters selected according to kind of industries, chemicals or substances used, and the probability or possibility of accidental releases of given materials.
20. Tighten up sampling/monitoring requirements to assure their being representative of materials reaching the injection well. (First part of rain, last part, after a release, etc.)
21. Pre-treatment facilities on industrial plant grounds should be examined critically to see if they may be leaking. The potential for groundwater contamination from these facilities may be much more serious than storm water runoff to sinkholes.
22. Inspection teams should be reinforced by chemical or industrial engineers whose familiarity with the industrial processes would permit a more independent assessment of the impact the industry might have on the environment.

Prepared: 10-2-86
Updated: 1-30-87

STATE REPORT SUMMARY

(All information recorded as described in state report
additional correspondence, and verbal communication)

STATE: Virgin Islands STATUS: DI BIBLIOGRAPHY: Yes

TITLE: Class V Well Inspection Program: U.S. Virgin Islands

AUTHOR: Geraghty and Miller

DATE: 9-86 REPORT STATUS: Draft

RESPONSIBLE AGENCY(IES):

DFW: as part of the well permitting process, collects geologic and well construction data, installs and reads water meters, and requires submission of regular pumpage information from ground water consumers.

DCCA: responsible for collecting ground water quality data.

HYDROGEOLOGY:

Extensive geologic descriptions resulting from Geraghty and Miller's 1983 study of groundwater conditions in the U.S. Virgin Islands for the U.S. Virgin Islands Department of Conservation and cultural affairs are included in the state report.

INVENTORY AND ASSESSMENT: 47 wells FURS COMPATIBLE: NO (8-20-86)

Type	Number	Contamination Potential	Case Studies	Regulatory System
5W11	44	N/A	24 facility investigations	N/A
5W20	3	N/A		N/A

Strategy (Date)

Rating/Response

1. DCCA personnel in charge of the UIC program were contacted to determine if any records or previous reports were available for each facility on the FURS inventory. N/A
2. An attempt was made to contact each facility listed on the FURS inventory by telephone to check the accuracy of the information on the inventory. N/A
3. 24 facilities were selected for site inspections based on their proximity to public supply wells and the type of waste generated. N/A

Virgin Islands
Page Two

RECOMMENDATIONS:

1. A waste oil management program should be developed, and all existing underground fuel storage tanks should be inventoried and tested for leaks.
2. To evaluate the extent of septic tank usage on the islands, the DFW records should be inspected to determine which facilities are hooked to the public sanitary sewer system.
3. Records of the companies that clean and install septic systems on the islands should be inspected in order to determine which facilities still utilize septic tanks for waste disposal.
4. Expansion and upgrading of existing public domestic waste collection and disposal systems on St. Croix and St. Thomas would greatly reduce the potential for ground water contamination.
5. More manpower and equipment should be committed to DFW and DCCA in order to implement data-collection programs, coordinate the data-collecting functions of the two organizations, and store the data so that they can be easily retrieved.
6. The three 5X (5W20 above) wells should be investigated in more detail.

Region III State Report Summaries

**Delaware
Maryland
Pennsylvania
Virginia
West Virginia**

Prepared: 1-30-87
Updated: 5-15-87

STATE REPORT SUMMARY
(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: Delaware **STATUS:** Primacy **BIBLIOGRAPHY:** Yes

TITLE: Underground Injection Control Program Class V Well Assessment

AUTHOR: Philip J. Cherry

DATE: 12-86 **REPORT STATUS:** Final

RESPONSIBLE AGENCY: Department of Natural Resources and Environmental Control,
Water Supply Branch

HYDROGEOLOGY: Delaware is divided into two physiographic provinces: (1) Piedmont Province underlain by crystalline bedrock; and (2) Coastal Plain underlain by unconsolidated sedimentary deposits (most important aquifers in the state). Groundwater is the primary source of public, rural, and industrial water supply in 94% of the state; 60% of the population is served by groundwater.

INVENTORY & ASSESSMENT: 164 Wells **FURS COMPATIBLE:** No (8-20-86)

Type	Number	Contamination Potential	Case Studies	Regulatory System
5A7	164	Little to None	No	Permit

Strategy (Date)	Response/ Rating
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All Class V wells must be permitted; records are kept in a powerful computer system. Compilation of inventory information requires listing all permitted Class V wells on the system

N/A

RECOMMENDATIONS:

1. The UIC database inventory, as well as Delaware's well and water allocation database, should be transferred to a more interactive in-house computer-based data system for better data accessibility and reduction in cost.
2. The regulations governing installation of Class V injection facilities, while adequate at the present time, should be updated as the need occurs.
3. The mandatory injection well construction inspections should continue and be supplemented by annual inspections for continued adherence to appropriate regulations.

Prepared: 1-30-87
Updated: 4-2-87

STATE REPORT SUMMARY
(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: Maryland **STATUS:** Primacy **BIBLIOGRAPHY:** Yes

TITLE: State of Maryland Class V Injection Well Inventory
and Assessment

AUTHOR: N/A

DATE: 12-86 **REPORT STATUS:** Draft

RESPONSIBLE AGENCY(IES): Department of Health and Mental Hygiene (DHMH), Office
of Environmental Programs

HYDROGEOLOGY: Maryland is divided into five ground water provinces: (1) unconfined aquifers of the eastern portion of the Coastal Plain Physiographic Province; (2) confined aquifers of the western portion of the Coastal Plain; (3) crystalline rock aquifers of the Piedmont and Blue Ridge Provinces; (4) sedimentary rock aquifers, exclusive of the carbonate rocks, of the Valley and Ridge and the Appalachian Plateau Provinces; and (5) carbonate rocks of the Appalachian Plateau, the Great Valley in the Valley and Ridge Province, and the Frederick Valley in the Piedmont Province.

INVENTORY & ASSESSMENT: 1,271 wells **FURS COMPATIBLE:** No (8-20-86)

Type	Number*	Contamination Potential**	Case Studies	Regulatory System
5D4	3	N/A	1 facility	Individual Permit
5A7	368	(3) Low	No	General Permit
5W31	890	(2) Minimal	No	Individual Permit
5X13	1	N/A	No	Individual Permit
5W20	9	(1)	3 facilities	Individual Permit

* "X" indicates well type is known to exist; no numbers available.

** Well types are ranked according to contamination potential;
1 = highest, 3 = lowest.

Strategy (Date)	Response/ Rating
1. Well owners listed on the FURS printout provided 8/85 were surveyed by mail.	39% (poor)
2. Files of state and county records were searched.	N/A
3. Telephone inquiries were made of state agencies that kept records of Class V wells.	N/A

RECOMMENDATIONS:

1. Continue an active program of monitoring well drilling and sampling at industrial Class V well facilities.
2. Maintain an active monitoring presence at those industrial sites where groundwater quality is threatened. If groundwater quality is threatened due to a State permitted Class V discharge, actions should be taken to alleviate the contamination potential.
3. Maintain communications with Local Health Departments in order to disseminate information on current State actions and to solicit comments for future recommendations.
4. Develop a training and guidance program to be made available to local health departments in order to assist in the future protection of groundwater supplies. This program should be supported by the State's UIC grant that is administered by the EPA through the Office of Environmental Programs.
5. Solicit EPA to set aside additional monies in future grant years to assist the State in developing the training and guidance program.
6. Develop a factsheet of standard information to be obtained and guidelines to follow when drafting Class V industrial drainage and waste disposal wells.
7. Maintain an accurate UIC Class V data base. The Class V data base has been accommodated for in the Waste Management Administration's Consolidated Waste Management Information System (OWMIS). This effort has already been partially funded by EPA using State UIC carry over money.

Prepared: 1-30-87
Updated: 5-15-87

STATE REPORT SUMMARY

(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: Pennsylvania **STATUS:** DI **BILIOGRAPHY:** Yes
TITLE: Underground Injection Control Program Class V Well Assessment
AUTHOR: U.S. EPA Region III
DATE: 1-87 **REPORT STATUS:** Draft

RESPONSIBLE AGENCY: Pennsylvania Department of Environmental Resources (DER),
Bureau of Water Quality Management (BWQM)

HYDROGEOLOGY: There are two major types of groundwater flow or aquifer systems within the Commonwealth of Pennsylvania: (1) unconsolidated alluvial fluvial deposits from which most ground waters used for public water supplies are derived due to their high transmissivities and geographic relationship to high population density areas; and (2) fractured sedimentary bedrock which often serve as the only source of water for individual domestic needs in rural Pennsylvania. Most Class V operations inject directly into or above underground sources of drinking water.

INVENTORY & ASSESSMENT: 1,026 wells **FURS COMPATIBLE:** No(8-20-86)

Type	Number*	Contamination Potential**	Case Studies	Regulatory Systems
5D2	155	(2) High	No	
5A7	24	(6) Low	No	
5W9	X	N/A	No	
5W12	4	(4) Unknown	No	N/A
5X13	811	(5) Low	Yes	Mine Operation
5A19	X	N/A	No	
5W20	19	(1) Deleterious	4 facilities	Permit
5W31	13	(3) Pending	No	

* "X" indicates well types known to exist; no number available

** Well types are ranked according to contamination potential
(1 = highest, 6 = lowest)

Strategy (Date)	Rating/ Response
(1979-81)	
1. Manual search of the ground water file at BWQM	N/A
2. Review of industrial waste files ("case files")	N/A
3. Review of solid waste files	N/A
4. Review of mine permit files	N/A

Strategy (cont.)	Rating/ Response
5. Personal contacts and telephone interviews with government agencies	not significant
6. Survey questionnaire sent to Mayors or Borough Council Presidents, Township Chairmen or Commission Presidents, County Commissioners, County Health Departments, and water well drillers	50%
7. Department of Transportation survey (4 offices)	30 sites located
8. RCRA hazardous waste notification survey	2 located of 77 inquiries
9. Survey of heat pump manufacturers and distributors	14 responses of 26 inquiries
(1983) 1. EPA sent questionnaires requesting verification of and updates to the database to each Class V well operator on the previous inventory	N/A
2. Placed public notices of UIC requirements in each of Pennsylvania's major newspapers	N/A
3. (5A7) Responses were reviewed for completeness and cross-checked against existing inventory	N/A
4. (5D2) Each of the 11 Department of Transportation offices were surveyed	N/A
5. (5X13) Personal visits made to Bureau of Abandoned Mine Reclamation (3 offices), Penn. Dept. of the Interior (Office of Surface Mining (2 offices)	N/A
6. (5W11 & 5W20) Contacted personally or by phone: state and regional DER, BWQB offices; state DER office; all owners/operators of commercial or industrial waste facilities and some owners/operators of sanitary sewage disposal systems with wells; and county health departments	N/A

RECOMMENDATIONS:

Specifics as to recommended future federal action is premature at this time.

Prepared: 11-26-86
Updated: 5-15-87

STATE REPORT SUMMARY
(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: Virginia

STATUS: DI

BIBLIOGRAPHY: No

TITLE: 1. Assessment of Selected Class V Wells in the State of Virginia
2. Assessment of Class IV Wells in Saltville, VA
3. Virginia Class V UIC Assessment

AUTHOR: 1. CH2M Hill
2. SMC Martin
3. USEPA Region III

DATE: 1. 4-83
2. 12-84
3. 5-86

REPORT STATUS: 1. Final
2. Final
3. Final

RESPONSIBLE AGENCY(IES): USEPA Region III

HYDROGEOLOGY: Five physiographic regions (from east to west) are recognized: Coastal Plain, Piedmont, Blue Ridge, Valley and Ridge, and Appalachian (Cumberland) Plateau. Almost half of the state's groundwater occurs in the Coastal Plain. Eighty percent of the population relies either partly or entirely on groundwater for their water supply. Approximately 400 million gallons of groundwater are used every day.

INVENTORY AND ASSESSMENT: 1,864 Wells **FURS COMPATIBLE:** NO(8-20-86)

Type	Number	Contamination Potential	Case Studies	Regulatory System
5D2	116	Low	Yes	N/A
5D3	X**		No	N/A
5D4	3		No	N/A
5A7/19	1735	N/A	Yes	N/A
5W11	6		No	N/A
5W12	1		No	N/A
5W20	2	Variable	Yes	N/A
5X27*	8		No	N/A
5X28	1		No	N/A

* Propane storage wells (should be Class II)

** "X" indicates well type is believed to exist; no numbers available

Strategy (Date):
N/A

Response/Rating
N/A

RECOMMENDATIONS:
N/A

Prepared: 1-28-87

Updated: 5-15-87

STATE REPORT SUMMARY

(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: West Virginia **STATUS:** Primacy **BIBLIOGRAPHY:** Yes

TITLE: State of West Virginia Underground Injection Control Program,
Class V Injection Well Inventory and Assessment

AUTHOR: D.W. Long, J.M. King, K.W. Ellison

DATE: 1/87 **REPORT STATUS:** Draft

RESPONSIBLE AGENCY(IES): West Virginia Division of Water Resources (DWR),
Department of Natural Resources (DNR).

HYDROGEOLOGY: West Virginia is divided into 3 physiographic provinces: Appalachian plateaus, Blue Ridge, and Valley and Ridge. Precipitation is the main source of recharge to groundwater systems. The two principle types of aquifers are unconsolidated alluvial deposits and sedimentary bedrock aquifers (Pennsylvanian and Mississippian). Pennsylvanian rocks are likely to host mining activities while Mississippian rocks are susceptible to contamination due to sinkholes and large solution openings. Abandoned underground mines are an important source of ground water for public supply and industrial use.

INVENTORY AND ASSESSMENT: 83 wells **FURS COMPATIBLE:** NO (8-20-86)

Type	Number*	Contamination Potential	Case Studies	Regulatory System
5F1	X	High	No	.
5D2	2+	High	No	.
5D3	X	High	No	.
5D4	X	High	No	N/A
5W11	2	N/A	No	.
5X13	268	Low	No	Mine Operation
5X16	2	N/A	No	.

* "X" indicates well type is known to exist; no numbers available.

Strategy

5D2-4: Prepared news release announcing DNR's intent to assess this well type.

5W11: Ground water discharge survey conducted by State Water Resources Division Inspectors.

Strategy (cont.)

- 5X13: In-depth study by graduate student including permit file reviews, questionnaires, memos, letters of inquiry, and telephone contacts.
- 5X16: Information was submitted along with applications for Class III permits for solution mining operations.

RECOMMENDATIONS:

- (5X13) 1. In instances where Coal Slurry Disposal and Acid Mine Drainage Precipitate Wells may have detrimental effects on USDWs, it would seem prudent to regulate injection fluid composition, quantity, injection rate, injection well construction and operation, hydrogeologic transport, and exposure risk, among other factors, as needed.
2. Regulation of AMWT injection wells is not warranted at this time.
- (5W11) If contamination potential were to be detected and more information on these wells cannot be produced to facilitate regulation and/or remedial action, then the wells should be plugged, and alternate sources of waste disposal should be found.
- (5D2-4) These wells should all be identified and plugged within the shortest possible time frame.
- (5X16) These types of wells could be incorporated into a Class III solution mining permit, or a new permit could be created which closely approximates the conditions set forth in a Class III permit, to initiate regulation.

Region IV State Report Summaries

Alabama
Florida
Georgia
Kentucky
Mississippi
North Carolina
South Carolina
Tennessee

Prepared: 7-28-86

Updated: 4-23-87

STATE REPORT SUMMARY

(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: Alabama

STATUS: Primacy

BIBLIOGRAPHY: Yes

TITLE:

1. Alabama Class V Injection Well Assessment Report
2. Evaluation of Storm Water Drainage (Class V) Wells, Muscle Shoals, Alabama
3. Response to Comments on Alabama's Class V Assessment

AUTHOR: 1. Alabama Department of Environmental Management (ADEM)
2. Geological Survey of Alabama, Water Resources Division
3. Laura E. Ming, ADEM

DATE: 1. 6-86
2. 8-86
3. 2-87

REPORT STATUS: 1. Draft
2. Final
3. Not Applicable

RESPONSIBLE AGENCY (IES): Alabama Department of Environmental Management

HYDROGEOLOGY:

Northern province: Consolidated rocks formed before and during the Appalachian orogeny. Resistant sandstones and metamorphic rocks form ridges and plateaus while valleys are cut into limestones. Water table depths range from 10 to 50 feet.

Southern province: Unconsolidated sediments deposited during coastal plain development. Abundant sand units provide shallow water table aquifers.

About 45-55% of the population of Alabama depend on groundwater as a source of drinking water; 85% of the public water supply systems use groundwater for part of their supply. The principal withdrawal areas for groundwater are the Coastal Plain and the Tennessee Valley areas. Industry also uses groundwater for their process needs, but these wells are not regulated.

INVENTORY AND ASSESSMENT: 144 facilities **FURS COMPATIBLE:** NO (8-20-86)

Type	Number*	Contamination Potential	Case Studies	Regulatory System
5D2	9	Varies according to site-specific details	Several cases presented.	Permits required for all Class V operations
5W11	1		More information needed	
5X13	X**		on each facility	
5A19	33			
5W20	98			
5X25	2			
5X26	1			

* These numbers represent facilities rather than wells
** Wells believed to exist; no numbers available

Strategy (Date)	Rating/Response
(6-82) Notice placed in newspaper informing owners of Class V wells that they were obligated to apply for a UIC permit	30%
(-85) Owners of facilities were notified to determine whether they were still in operation	?
(?) Notified State and County Health Departments and State funeral home licensing agency	?

RECOMMENDATIONS:

1. Facilities which operate Class V injection wells and are not a potential threat to the groundwater could be controlled without requiring a permit. Construction requirements could sufficiently protect the groundwater from contamination.
2. EPA should ensure that State programs will address the potential impact on groundwater by Class V operations. "One means of accomplishing this goal may be a revised formula for grant computation which assigns more weight to Class V wells."

Prepared: 1-28-87
Updated:

STATE REPORT SUMMARY
(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: Florida **STATUS:** Primacy **BIBLIOGRAPHY:** Yes
TITLE: Florida Underground Injection Control Class V Well Inventory and Assessment Report
AUTHOR: Bureau of Groundwater Protection, Florida Dept. of Environmental Regulation
DATE: 12/86 **REPORT STATUS:** Draft

RESPONSIBLE AGENCIES: Department of Environmental Regulation (DER): 1) Division of Environmental Programs; 2) Division of Environmental Permitting. Often a Class V well will be permitted by both DER and the appropriate water management district (of which there are five).

HYDROGEOLOGY: The Floridan (north & central) and Biscayne (southeast) aquifers are the primary aquifers receiving water injected through Class V wells in Florida. Because of high transmissivities, the sole hindrance to the volume of water a well receives in some areas is the physical size and condition of the well (possibilities range up to hundreds or thousands of gallons per minute into the receiving aquifer).

FURS

INVENTORY AND ASSESSMENT: 25,573 wells **COMPATIBLE:** No (8-20-86)

Type	Number*	Contamination Potential**	Case Studies	Regulatory System
5F1	X	N/A	No	A permit must
5D2	1539+	1	Yes	be obtained to
5D3	X	1	No	construct all
5D4	X	1	No	Class V wells
5A7	2671	7	No	with the except-
5W11	19000	N/A	No	ion of air con-
5W12	553	2	Yes	ditioning return
5A19	35	5	Yes	flow and swimming
5W20	20	4	Yes	pool drainage
5R21	349	3	Yes	wells which are
5B22	2	N/A	No	issued a general
5X25	3	N/A	No	permit.
5X27	16	N/A	No	
5X28	X	N/A	No	
5X29	X	N/A	No	
5G30	1385	6	Yes	

*"X" indicates well type is known to exist, no numbers available.

**Well types are ranked according to contamination potential; 1 = highest, 7 = lowest

STRATEGY (Date)

- (1970) First inventory conducted by Florida Dept. of Air and Water Pollution Control - obtained information from State Board of Health permit files which date back to 1937.
- (1977) Inventory updated by Florida DER - used permit files dated 1950 to 1976.
- (1980) Class V inventory was compiled for the UIC program - 1977 inventory was on wells drilled between 1977 and 1980. Telephone surveys and a mail survey were also conducted. 6,684 wells were identified.
- (1982-83) Owner notification program was conducted. 7,000 questionnaires were mailed out and 2,973 wells were identified (many duplicates of previous inventories).
- (1984) Inventory updated and duplications eliminated. 9,602 wells were identified.
- (1986) FDER Groundwater Management System (GMS) identifies 6,564 wells. Not all wells in 1984 inventory have been entered into the GMS.

RECOMMENDATIONS:

- (5W12) Should further monitoring show that the sewage treatment plant is, in fact, discharging effluent that results in drinking water standard violations in the effluent discharged to the drainage wells, some type of action will be required by FDER. Such corrective action will probably be directed toward modifying the sewage treatment plant.
- (5W11) Further study is required.
- (5R21)
 - 1. To minimize the occurrence of connector wells draining water with high levels of radionuclide parameters, ground water in the surficial aquifer should be thoroughly analyzed in advance of connector well construction and all new connector wells should be properly constructed and routinely sampled. More attention to well construction and maintenance would also improve well performance and prevent suspended solids from entering connector wells.
 - 2. Areas of shallow ground water contamination should be avoided in siting connector wells.
- (5D2-4)
 - 1. Monitoring wells located to specifically monitor certain of the injection wells should be constructed and sampled.

Recommendations (cont.)

2. Monitoring wells should be constructed using information on casing depth and permeable zones intercepted by the injection well.
 3. Monitoring wells should be constructed to monitor all the permeable zones that are suspected of being connected to the injection well.
 4. Ground water hydrographs and precipitation records should be used to demonstrate hydraulic connection between the monitor and injection wells before samples are collected.
- (5A7) The state permitting agency should insure that the wells be and are constructed and operated properly. This effort will entail a review of well construction data by the state, as well as probably requiring permit language that assures that any ground water heat pump system that is damaged or otherwise malfunctions will be promptly repaired.
- (5A19) The several systems which place additives in the cooling water should not be allowed to operate.
- (5W20) These wells should be permitted only when injection is into ground water containing greater than 10,000 mg/l TDS. If a USDW is present above the injection zone, on-site well monitoring should be required which is capable of detecting the migration of effluent in the direction of the USDW. This practice should be discouraged and these wastes should be routed to on-site treatment systems or municipal sanitary sewer systems if possible.
- (5W20) Class V reverse osmosis reject water wells should be permitted using extreme caution. The supply water should be analyzed for primary and secondary water quality parameters and a projection should be made as to the expected reject water quality before a well is permitted. If the projected reject water quality is as good or better than the ambient water quality in the injection zone, a Class V well may be permitted if the applicant can demonstrate that the injected fluids will remain in the injection zone.
- (Regs) 1. Change the regulations in order to exempt fluids being injected in a Class V aquifer remediation well (5X26) from having to satisfy the drinking water quality standards or be of a quality equal to, or better than, the natural unaffected background water quality. This requirement should be replaced with one that requires the injected fluid to be better than that in the contaminated aquifer undergoing remediation. The fluids injected would also have to be completely captured by the nearby withdrawal wells. A very stringent monitoring program would also be required.

Recommendations (cont.)

2. Changes should be made in the UIC regulations which would specifically require mechanical integrity testing for Class V wells which inject poor quality fluids, under pressure, into a non-USDW located between two USDW or below a USDW.

3. Construction requirements should be left as is due to the great variety of possible Class V well designs. More stringent construction requirements should be emphasized when poor quality effluent is injected into non-USDW zones located below a USDW or between two USDWs. There should be a range of requirements for these wells, determined by the quantity and quality of effluent injected and the quality of the USDWs below and/or above, with the most stringent requirement being the Class I injection well standards. The proximity of drinking water supply wells should also be taken into account when considering construction requirements for Class V wells.

Prepared: 1-13-87
Updated: 4-24-87

STATE REPORT SUMMARY

(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: Georgia **STATUS:** Primacy **BIBLIOGRAPHY:** No

TITLE: 1. Inventorying and Assessing Class V Injection Wells
2. An Assessment of Class V Injection Wells in Georgia

AUTHOR: 1. J.C. Adams, Ralph M. Lamade
2. Patricia Franzen

DATE: 1. 4-86 **REPORT STATUS:** 1. Draft
2. 12-86 2. Final

RESPONSIBLE AGENCY (IES): Geologic Survey Branch of the Environmental Protection Division (EPD) of the Georgia Department of Natural Resources

HYDROGEOLOGY: Georgia is characterized by the absence of oil and gas production, mineral resources that are not amenable to solution or well-slurry mining techniques, fresh water aquifers to depths of 2000 feet, thick clayey residual soils that protect the bedrock aquifers of north Georgia, and multiple confining units that protect the aquifers of south Georgia. Drainage wells represent the type of injection well most likely to adversely affect water quality in USDW. The geologic character of the state is not conducive to injection well technology.

INVENTORY AND ASSESSMENT: 163 wells **FURS COMPATIBLE:** NO (8-20-86)

Type	Number	Contamination Potential	Case Studies	Regulatory System
5F1	43	Low/Unknown	No	Banned
5D2	2	None (Plugged)	No	Banned
5D3	0	None	No	Banned
5D4	2	None (Plugged)	No	Banned
5A7	111	Low	No	Banned
5A19	5	Low	No	Permit

Strategy

Rating/Response

1. General Assessment--mail survey--Univ. of Ga.
contacted licensed well drillers, HVAC contractors,
county health and public work departments, U.S.
Soil Conservation Service field offices, city
engineers.

68%

Strategy (cont.)	Rating/Response
2. Specific Assessment--verification--GTRC	
a. mail survey: Phase 1, Phase 2	25%, 43%
b. telephone and personal interviews	N/A
c. verification of initial survey	N/A
3. Follow-up Assessment - EPD	
visited water well drillers, personal contacts	Best

RECOMMENDATIONS

1. Additional efforts should be made to identify agricultural drainage wells.
2. Wells identified should be plugged and water samples should be checked for contamination within the corresponding well region.
3. Suspend or revoke the license of any driller who constructs an illegal well. Loss of license represents loss of income to the well driller.
4. Prohibit new ground water heat pumps.

Prepared: 4-20-87
Updated:

STATE REPORT SUMMARY

(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: Kentucky STATUS: DI BIBLIOGRAPHY: Yes

TITLE: An Assessment of Class V Injection Wells in Kentucky

AUTHOR: USEPA Region IV

DATE: ? REPORT STATUS: Draft?

RESPONSIBLE AGENCY(IES): USEPA Region IV

HYDROGEOLOGY: Groundwater serves 31% of the population in Kentucky. Excluding withdrawals for thermoelectric power, groundwater use is 22% of total (water) use. Recharge is primarily from precipitation. Principal aquifers include the Alluvial, Tertiary and Cretaceous, Pennsylvanian Sandstone, and Mississippian and Ordovician Limestone Aquifers.

INVENTORY AND ASSESSMENT: 1360 wells FURS COMPATIBLE: No (8-20-86)

Type	Number*	Contamination Potential	Case Studies	Regulatory System
5F1	X	N/A	No	N/A
5D2	484+	Smallest °	Yes	Local/City/None
5D3	76	Smallest °	Yes	Local/City/None
5D4	X	Smallest °	No	KPDES Permit
5A7	X	N/A	No	N/A
5W12	3	Serious	No	To be eliminated
5X13	61	Serious	No	Permit
5W31	736	Unknown	No	Rule (Health Dept.)

- * "X" indicates well type may exist
- + Estimated additional 100 wells not inventoried
- ° Or dependent on land use in the drainage area

Strategy	Rating/Response
(1983) LOE Contract with SMC Martin (5D2,3)	Located 47 wells
(1984) Grant with Western Kentucky Univ. (5D2,3)	Located 560 wells
(?) Environmental Impact Study, Jefferson County (5W11)	Located 736 wells
(?) Region IV staff (5X13)	Located 61 wells

RECOMMENDATIONS:

- (5D2-4) 1. New wells should be investigated and added to FURS.
2. Identify wells draining contaminated runoff from commercial or industrial areas. Where possible, the contaminants should be prevented from entering the storm water.
3. Retention basins might be planned so runoff can be released slowly into the sanitary sewer or treated before entering the well.
4. Plug or cement deep wells which may cause mixing between aquifers.
5. Construct a stand pipe, several feet in height, at the opening of the well.
6. Add a sand and gravel filter to the well.
- (5W12) All three wells are scheduled to be plugged in 1988 when the regional treatment plant and interceptor sewer is completed.
- (5X13) Require owners/operators to submit permit applications.

Prepared: 4-22-87
Updated:

STATE REPORT SUMMARY

(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: Mississippi STATUS: Primacy BIBLIOGRAPHY: Yes
TITLE: State of Mississippi Class V Injection Well Inventory
AUTHOR: Mississippi Dept. of Natural Resources, Bureau of Pollution Control
DATE: 3-87 REPORT STATUS: Final
RESPONSIBLE AGENCY(IES): Mississippi Dept. of Natural Resources,
Bureau of Pollution Control

HYDROGEOLOGY: Geologic and hydrologic conditions and quality of groundwater vary throughout the state. The state is divided into six groundwater areas: 1) far northeast; 2) northeast; 3) north central and central; 4) northwest-Mississippi Delta; 5) central; and 6) south.

INVENTORY AND ASSESSMENT: 14 wells FURS COMPATIBLE: No (8-20-86)

Type	Number	Contamination Potential	Case Studies	Regulatory System
5A7	7	N/A	No	N/A
5W11	X+	N/A	No	N/A
5X25*	5	N/A	No	Rule
5X27**	2	N/A	No	Rule

* Groundwater solute transport studies

** Temporary injection of drlg. fluids at gas well sites

+ "X" indicates well type believed to exist; no numbers available

Strategy	Rating/Response
(?) Telephone survey conducted to determine which governmental agencies permit or keep records on Class V wells. Contacted MS district offices, water management district offices, local environmental programs, and county health departments.	Poor
(?) Mail survey conducted. Contacted all licensed well drillers in the state.	Poor

RECOMMENDATIONS:

N/A

Prepared: 1-16-87
Updated:

STATE REPORT SUMMARY

(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: North Carolina

STATUS: Primacy

BIBLIOGRAPHY: Yes

TITLE: North Carolina Class V Injection Well Inventory Assessment Report

AUTHOR: NC Department of Natural Resources and Community Development, Division
of Environmental Management, Groundwater Section

DATE: 12-86

REPORT STATUS: Draft

RESPONSIBLE AGENCY: Division of Environmental Management in the
Department of Natural Resources and
Community Development.

HYDROGEOLOGY: North Carolina can be divided into 7 major hydrogeologic units:
(1) Great Smokey Mountain Belt (2) Blue Ridge - Inner Piedmont Belt (3)
Charlotte Belt (4) Carolina Slate Belt (5) Triassic Basins (6) Sand Hills, and
(7) Coastal Plain Sediments. Known Class V injection wells are primarily
located in four of the most productive units: (2), (3), (4), and (7). Ground-
water usage within the state as a whole accounts for more than 60 percent of
total water required, and in the coastal plain, usage exceeds 90 percent of
total water required.

INVENTORY AND ASSESSMENT: 99 wells

FURS COMPATIBLE: No (8-20-86)

Type	Number	Contamination Potential	Case Studies	Regulatory System*
5A7	79	low	No	Monitoring & Permit Required
5X25	8	N/A	No	Permit Required
5X26	12	N/A	No	Permit Required

* "a permit shall be obtained from the director prior to constructing,
operating, or using any well for injection."

Strategy (Date)

Contacts made by phone, letter, or visit with:
Regional drilling contractors, heating and
air conditioning contractors
Building inspectors

Response/ Rating

least helpful
most helpful

Also: Realtors, housing developments, country clubs, funeral
homes, mortuaries, dry cleaners, county health departments,
local governmental departments, lending institutions,
individual well owners

RECOMMENDATIONS:

1. Every injection well contact must be covered and informed of state statutes and regulations. After the education is complete, inventory upkeep is relatively easy.

2. The FURS system should be implemented in North Carolina. Upkeep of the present system by sending in inventory forms is inadequate and not the most efficient method of inventory upkeep.

3. Regulating heat pump facilities is best accomplished by monitoring the effluent and system configuration. The permit allows UIC staff access to the facility and effluent sampling port. Thus, samplings and inspections are usually continued after permitting in North Carolina.

4. Should remedial action become necessary at an unpermitted site where ground water has become polluted, the recommended procedure would be to close down the facility, and take steps to neutralize the contaminant plume.

Prepared: 4-20-87
Updated:

STATE REPORT SUMMARY

(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: South Carolina STATUS: Primacy BIBLIOGRAPHY: Yes

TITLE: An Assessment of Class V Injection Wells in South Carolina

AUTHOR: Sofge, G.M., C.M. Livingston, and M.A. Williams

DATE: 12-86

REPORT STATUS: Final

RESPONSIBLE AGENCY(IES): South Carolina Dept. of Health and
Environmental Control (SCDHEC)

HYDROGEOLOGY: The SCDHEC has classified and designated the aquifers within
South Carolina into nine systems (briefly described in state report). All
Aquifers in South Carolina meet the definition for USDW.

INVENTORY AND ASSESSMENT: >493

FURS COMPATIBLE: No (8-20-86)

Type	Number	Contamination Potential*	Case Studies	Regulatory System
5D2	31	1 (high)	2 facilities	Permit
5A7	>60	2 (low)	3 wells	Rule
5A19	2 facilities	2 (low)	1 facility	Rule
5W20	>200 drainfields	3	4 facilities	Permit
5W32	>200 drainfields	3	No	Permit

* Contamination Potential is ranked from highest to lowest; 1=highest, 3=lowest

Strategy (Date)

Rating/Response

(?) Field inspections.

Mailed questionnaires to architects, engineers,
municipalities and well drillers.

Reviewed state project files.

Contacted State and Federal personnel.

Mailed news letters.

N/A

RECOMMENDATIONS:

- (5A7/19) 1) The policy prohibiting injection into an aquifer or zone
different from the source should be continued.
- 2) Proper distances between return and production wells should be
maintained.

Recommendations (cont.)

- 3) Extending the return line below water level and installing a back pressure valve at the end of the discharge line is necessary.
 - 4) Cavitation of the pump within the production well should be avoided.
 - 5) Temperature and pressure shut-off sensors within the heat pump units should remain in proper operation.
 - 6) Authorization by rule is appropriate for properly spaced and operated systems.
 - 7) Additional funding to support State evaluations of groundwater impact from high density situations involving 5A7 wells should be provided.
- (5W20)
- 1) Embalming fluid wastes (volatiles and base neutral and acid extractables) are inherently unsuitable for biological treatment and disposal via septic tanks and drain fields.
 - 2) The policy of prohibiting the installation of septic tank/drain field for treating embalming fluids (current practice requires holding facilities and periodic removal and proper disposal) should be continued.

Prepared: 4-20-87
Updated:

STATE REPORT SUMMARY

(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: Tennessee STATUS: D.I. BIBLIOGRAPHY: Yes

TITLE: An Assessment of Class V Injection Wells in Tennessee

AUTHOR: USEPA Region IV

DATE: ? REPORT STATUS: Draft?

RESPONSIBLE AGENCY(IES): USEPA Region IV

HYDROGEOLOGY: Groundwater serves 51% of the population in Tennessee. Excluding withdrawals for thermoelectric power, groundwater use is 21% of total (water) use. Recharge is primarily from precipitation. Principal aquifers include Alluvial, Tertiary, Cretaceous Sand, Pennsylvanian Sandstone, Mississippian and Ordovician Carbonate, Knox, Cambrian and Ordovician Carbonates, and Crystalline Rock Aquifers.

INVENTORY AND ASSESSMENT: 82 wells FURS COMPATIBLE: No (8-20-86)

Type	Number	Contamination Potential	Case Studies	Regulatory System
5D2	7	N/A	Yes	New wells require a permit.
5D3	5	N/A	Yes	
5A7	70*	Low	No	N/A
5X13	X	N/A	No	N/A

* Estimated 700 to 1000 wells

Strategy (Date)	Rating/Response
(1980-81) 1. Identified areas of Karst landscape.	N/A
2. Mailed letter requesting information to 300 organizations and individuals (mailing list obtained from telephone books).	45%
3. Interviewed landowners, residents of flood-prone areas, city officials, and people on the street.	Most Successful
4. Interviewed state government officials in Nashville, TN.	Helpful

	Strategy (Date) - cont.	Rating/Response
(1982)	1. Made contacts with several groups to locate wells: industries - 5A19 & 5X13; TN Dept. of Health - 5W9, 10, 11, & 12.	Poor
	2. Contacted 1/3 of the registered water well drillers in the state - 5A7.	Located 70 wells

RECOMMENDATIONS:

- (5D2,3)
1. Plug deeper wells which may cause mixing between aquifers.
 2. Direct runoff in commercial and industrial areas to sanitary sewers, or retain and treat storm water before releasing it to drainage wells.
 3. Construct a stand pipe, several feet in height, at the opening to the well.
 4. Add a sand and gravel filter to the well.
- (5A7)
1. Contamination can be prevented by requiring closed loop systems.
 2. Wells should be properly constructed, with cement behind the casing, to prevent surface runoff from running down the backside of the casing into USDW.

Region V State Report Summaries

**Illinois
Indiana
Michigan
Minnesota
Ohio
Wisconsin
Indian Lands**

Prepared: 11-24-86
Updated: 8-24-87

STATE REPORT SUMMARY

(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: Illinois

STATUS: Primacy

BIBLIOGRAPHY: Yes

TITLE:

1. Class IV and Class V Injection Well Inventory.
2. An Assessment of Class V Underground Injection in Illinois, Interim Report. Phase One: Assessment of Current Class V Activities in Illinois.
3. An Assessment of Class V Underground Injection in Illinois, Interim Report. Phase Two: Identification of Possible Action Options.
4. An Assessment of Class V Underground Injection in Illinois

AUTHOR:

1. Stephen Davis and Monte Nienkirk;
2. Stephen L. Burch, and Bruce R. Hensel, Illinois State Water Survey Division, Illinois State Geological Survey;
3. Same as 2.
4. Stephen L. Burch, Bruce R. Hensel, John S. Nealon, and Edward C. Smith

DATE:

1. 5-84
2. 7-86
3. 12-86
4. 6-87

REPORT STATUS:

1. Final
2. Draft
3. Draft
4. Final

RESPONSIBLE AGENCY(IES): Illinois Environmental Protection Agency (IEPA);
Illinois Pollution Control Board (IPCB)

HYDROGEOLOGY: Most groundwater in Illinois is obtained from unconsolidated sand and gravel, sandstone, or fractured limestone and dolomite. Brine and brackish aquifers are found below 2000 feet in the northern part and 100 feet in the southern part of the state. Injection is generally to zones with high hydraulic conductivity and to open caverns (both abandoned mines and sinkholes). Very good site-specific information is included in the state report.

INVENTORY AND ASSESSMENT: 1,766 wells

FURS COMPATIBLE: NO (8-20-86)

Type	Number*	Contamination Potential	Case Studies	Regulatory System
5F1	6	N/A	Yes	All Class V operations are authorized by rule until assessments are completed and recommendations are made.
5D2	697	High	Yes	
5D4	47	Moderate	Yes	
5A7	57	N/A	No	
5W9	916	Moderate	Yes (illegal)	
5W12	1	N/A	No	
5X13	5	N/A	No	
5A19	10	N/A	No	
5W20	16	Moderate	Yes	
5R21	1	N/A	No	
5N24	1	N/A	No	
5X25	2	N/A	No	
5X28	5	N/A	No	
Unknown	2	N/A	No	

* "X" indicates well types known to exist; no number available

	Strategy	Rating/Response
(1984)	1. Mailed questionnaire to well drillers, engineers, private companies, statewide associations, and U.S. Professional Services.	37%
	2. Telephone survey - 270 contacts made (cities and counties).	Invaluable
	3. Press release in state and local newspapers.	0

RECOMMENDATIONS:

1. Use of storm water drainage wells should be discouraged.
2. Location of storm water drainage wells should be emphasized.
3. UIC manager should use zoning ordinances to limit future construction of stormwater drainage wells to residential areas.
4. Use of detention ponds should be promoted.
5. Policies should prohibit injection wells near or in flow paths toward public water supply wells.

Prepared: 12-17-86
Updated:

STATE REPORT SUMMARY

(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: Indiana **STATUS:** DI **BIBLIOGRAPHY:** Yes
TITLE: Inventory and Assessment of Class V Injection Wells in Indiana
AUTHOR: Geraghty and Miller
DATE: 12/86 **REPORT STATUS:** Draft

RESPONSIBLE AGENCY(IES):

Department of Natural Resources (DNR)
Department of Environmental Management (DEM)

HYDROGEOLOGY: Indiana has been divided into four regions on the basis of the principal source of water supplies used in each region. With the exception of several areas in the southern part of the state, surficial deposits consisting of Pleistocene-aged glacial drift, alluvium, and lake deposits blanket the State. Groundwater resources are derived from both surficial unconsolidated aquifers and bedrock aquifers.

INVENTORY AND ASSESSMENT: 3816 wells **FURS COMPATIBLE:** No (8-20-86)

Type	Number	Type	Number
5F1	72	5W11	895
5D2	2180	5W12	27
5D3	26	5X15	1
5D4	8	5X16	8
5A5*	1	5X18*	3
5A6*	3	5A19	22
5A7	236	5W20	30
5A8*	3	5X26	4
5W9	22	5X28	2
5W10	22	5X29	156
		5W31	105

No information was provided on contamination potential, case studies, or regulatory systems.

* Verification efforts proved these wells do not exist.

Strategy

Response/
Rating

1. Questionnaire packages containing a stamped, addressed return envelope, a cover letter describing the program, and a request for collect telephone calls to G&M concerning questions were mailed to:
 - a. county health department sanitarians..... 7%
 - b. county agricultural extension agents..... 39%
 - c. soil conservation service district representatives 31%
 - d. director of public works of all cities in the state..... 25%
 - e. drilling companies listed in the 1986 NWWA directory, and selected drilling companies from the listing of registered water well drillers in the state..... 17%
2. Telephone interviews..... ?
3. Personal interviews..... ?

Recommendations:

1. Additional resources must be allocated to this program in order to meet the UIC mandates.
2. Additional work is needed in order to expand and refine the assessment report by incorporating more specifics and case studies.
3. Additional work is needed in order to refine procedures for determining the degree-of-risk.
4. Additional work is needed to develop options for corrective actions and regulations of various well types.
5. Additional work is needed toward development of implementation steps.
6. The Class V inventory and assessment reports must be updated annually.

Prepared: 12-17-86
Updated:

STATE REPORT SUMMARY

(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: Michigan **STATUS:** DI **BIBLIOGRAPHY:** Yes
TITLE: Inventory and Assessment of Class V Injection Wells in Michigan
AUTHOR: Geraghty and Miller
DATE: 12/86 **REPORT STATUS:** Draft

RESPONSIBLE AGENCY(IES):

Department of Natural Resources (DNR)
Department of Public Health (DPH)

HYDROGEOLOGY: The state has been divided into seven hydrogeologic regions. Most of Michigan is blanketed by glacial drift composed of till, outwash, and morainal material. Groundwater resources are derived from both surficial unconsolidated aquifers and bedrock aquifers. Bedrock aquifers normally have the largest well yields and best water quality where they subcrop directly beneath and are hydraulically connected with the glacial drift.

INVENTORY AND ASSESSMENT: 7575 wells **FURS COMPATIBLE:** No (8-20-86)

Type	Number	Type	Number
5F1	15	5X15	1
5D2	623	5X16	33
5D3	103	5X17*	1
5D4	9	5A19	52
5A6*	3	5W20	9
5A7	760	5X25	4
5W9	11	5X26	59
5W10	18	5X28	27
5W11	2693	5X29	630
5W12	2	5W31	2511
5X14	15		

No information on contamination potential, case studies, or regulatory systems was provided.

* Verification efforts proved these wells do not exist.

Strategy

Response/
Rating

1. Questionnaire packages containing a stamped, addressed return envelope, a cover letter describing the program, and a request to call G&M collect with any questions were mailed to:
 - a. county health department sanitarians..... 77%
 - b. county agricultural extension agents..... 35%
 - c. soil conservation service district representatives 48%
 - d. director of public works in cities whose population is > 2000..... 29%
 - e. drilling companies listed in the 1986 NWWA directory, and selected drilling companies from the listing of registered water well drillers in the state..... 11%
2. Telephone interviews..... N/A
3. Personal interviews..... N/A

RECOMMENDATIONS:

1. Additional resources must be allocated to this program in order to meet the UIC mandates.
2. Additional work is needed in order to expand and refine the assessment report by incorporating more specifics and case studies.
3. Additional work is needed in order to refine procedures for determining the degree-of-risk.
4. Additional work is needed to develop options for corrective actions and regulations of various well types.
5. Additional work is needed toward development of implementation steps.
6. The Class V inventory and assessment reports must be updated annually.

Prepared: 12-17-86
Updated:

STATE REPORT SUMMARY

(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: Minnesota STATUS: DI BIBLIOGRAPHY: Yes

TITLE: Inventory and Assessment of Class V Injection Wells in Minnesota

AUTHOR: Geraghty and Miller

DATE: 12/86 REPORT STATUS: Draft

RESPONSIBLE AGENCY(IES):

Minnesota Pollution Control Agency (MPCA)

Minnesota Department of Health (MDH)

HYDROGEOLOGY: Most of the state is covered by varied thicknesses of glacial drift, lake deposits, peat, and alluvium. Groundwater resources are derived from both surficial unconsolidated aquifers and bedrock aquifers. The major aquifers, and the most favorable units for well injection in terms of permeability and porosity, are located in the southeastern part of the state. This part of the state also is the most heavily populated.

INVENTORY AND ASSESSMENT: 2107 wells FURS COMPATIBLE: No (8-20-86)

Type	Number	Contamination Potential	Case Studies	Regulatory System
5F1	54	N/A	N/A	N/A
5D2	30	N/A	N/A	N/A
5D3	6	N/A	N/A	N/A
5D4	8	N/A	N/A	N/A
5A7	34	N/A	N/A	Permit by MDH
5W9	10	N/A	N/A	N/A
5W10	25	N/A	N/A	N/A
5W11	588	N/A	N/A	MN Regulation Chp. 7080
5W12	11	N/A	N/A	N/A
5A19	4	N/A	N/A	N/A
5W20	1	N/A	N/A	N/A
5R21	1	N/A	N/A	N/A
5X25	2	N/A	N/A	N/A
5X26	7	N/A	N/A	N/A
5X27	1	N/A	N/A	N/A
5X29	1309	N/A	N/A	N/A
5W31	16	N/A	N/A	N/A

Strategy

Response/
Rating

1. Questionnaire packages containing a stamped, addressed return envelope, a cover letter describing the program, and a request to call G&M collect with any questions were mailed to various government agencies and private companies:
 - a. county health department sanitarians..... 51%
 - b. county agricultural extension agents..... 23%
 - c. soil conservation service district representatives 59%
 - d. director of public works in cities whose population is > 2000..... 48%
 - e. drilling companies listed in the 1986 NWWA directory..... 9%
 - f. selected drilling companies from the listing of registered water well drillers in the state N/A
2. Telephone interviews with state government personnel and selected city and county officials..... ?
3. Personal interviews..... ?

RECOMMENDATIONS

1. Additional resources must be allocated to this program in order to meet the UIC mandates.
2. Additional work is needed in order to expand and refine the assessment report by incorporating more specifics and case studies.
3. Additional work is needed in order to refine procedures for determining the degree-of-risk.
4. Additional work is needed to develop options for corrective actions and regulations of various well types.
5. Additional work is needed toward development of implementation steps.
6. The Class V inventory and assessment reports must be updated annually.

Prepared: 11-12-86
Updated:

STATE REPORT SUMMARY

(All information recorded as described in the state report,
additional correspondence, and verbal communication)

STATE: Ohio

STATUS: Primacy

BIBLIOGRAPHY: No

TITLE: Class IV and V Injection Well Inventory for Ohio Environmental
Protection Agency

AUTHOR: Malcolm Pirnie

DATE: 6-86

REPORT STATUS: Draft

RESPONSIBLE AGENCY(IES):

Ohio Department of Natural Resources (ODNR); Ohio Environmental Protection
Agency (OEPA).

HYDROGEOLOGY:

Groundwater sources (1) buried valleys of glacial outwash, and stream
valleys with thick alluvial deposits; (2) porous bedrock: open textured
limestones and dolomites; (3) sandstones, conglomerates, and well-sorted
glacial material beneath till. Confining units (1) Till and glacial lake
deposits; (2) dense shales and limestones.

INVENTORY AND ASSESSMENT: 2360 wells

FURS COMPATIBLE: NO (8-20-86)

Type	Number*	Contamination Potential	Case Studies	Regulatory System
5D2	1341	High	N/A	N/A
5D3	X	N/A	N/A	N/A
5D4	118	High	N/A	N/A
5A7	73	Low	N/A	N/A
5W11	361	High	N/A	N/A
5W12	X	N/A	N/A	N/A
5W20	467	High	N/A	N/A
5X27	X	N/A	N/A	N/A
5X29	X	N/A	N/A	N/A

* "X" indicates well types known to exist; no number available

Strategy

Rating/Response

Personal visits to County health or environmental departments; City, State agencies	+
Press release - newspapers and professional associations	?
Telephone interviews	?
General mailing	33%
Industry mailing	64%
Hazardous Materials Facility Mailing	72%
Field site visits	?

RECOMMENDATIONS:

1. Unverified wells should be verified.
2. All ODNR well logs be required to state the intended use of each well being drilled.
3. Further publicize legal requirement to register Class V wells with the OEPA.

Prepared: 1-5-87
Updated: 5-17-87

STATE REPORT SUMMARY

(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: Wisconsin **STATUS:** Primacy **BIBLIOGRAPHY:** No
TITLE: Wisconsin Class V Injection Well Inventory
AUTHOR: Wisconsin Department of Natural Resources (WDNR) Central Office
DATE: 9-86 **REPORT STATUS:** Final
RESPONSIBLE AGENCY (IES): Wisconsin Department of Natural Resources (WDNR)

HYDROGEOLOGY: Five ground water provinces are defined according to the principal aquifers: (1) valley alluvium, (2) central sand plain, (3) glacial, (4) western paleozoic, (5) eastern paleozoic. Seventy-five percent of the state is covered by permeable, glacial deposits. All areas, except the dense crystalline rocks in the northwest third of the state, are capable of accepting injected wastes.

INVENTORY AND ASSESSMENT: 151 Wells **FURS COMPATIBLE:** NO(6-10-86)

Type	Number	Contamination Potential	Case Studies	Regulatory System
5D2	116	in question	No	None
5D4	1	minimal	No	Bur. Waste Water Mgmt.
5A7	4	minimal	Yes	Bur. of Water Supply
5A19	2	N/A	No	Bur. Waste Water Mgmt.
5W20	4	unknown	No	WPDES permits
5S23	4	negligible	No	Bur. Water Supply
5X26	17	negligible	No	Bur. Water Supply
5W31	3	negligible	No	Bur. Waste Water Mgmt.

Strategy	Rating/Response
1. Examined state's hydrogeologic factors to identify areas favorable for injection	---
2. Recorded field observations and investigated complaints from the public	N/A
3. Reviewed WPDES permit files; then facilities were contacted by phone	N/A
4. Sent questionnaires re: sanitary and stormwater collection systems to 695 municipalities. Followed up with phone contact for qualifying systems	82%

Strategy (cont.)	Rating/Response
5. Contacted DILHR, Division of Safety, Bureau of Plumbing - accessed facilities permitted since 1981.	N/A
6. Sent questionnaires re: "seepage pits" to county zoning administrators.	86%
7. Review Bureau of Water Supply and Bureau of Solid Waste Management Files.	N/A

RECOMMENDATIONS:

1. Further evaluation of industrial seepage pits and municipal storm drainage seepage pits is necessary.
2. Groundwater monitoring programs, in addition to current statewide monitoring, could be established for those nonpermitted Class V injection wells.
3. Increased effluent monitoring could be required in any permitting process for permitted Class V injection wells.

Prepared: 4-15-87
Updated:

STATE REPORT SUMMARY

(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: Region V - Indian Lands STATUS: DI BIBLIOGRAPHY: No

TITLE: Survey of Class V Injection Wells

AUTHOR: Larry W. Bailey, Minnesota Rural Water Association

DATE: 3-87 REPORT STATUS: Final

RESPONSIBLE AGENCY(IES): N/A

HYDROGEOLOGY: N/A

INVENTORY AND ASSESSMENT: 45 wells FURS COMPATIBLE: N/A

Type	Number	Contamination Potential	Case Studies	Regulatory System
5W32	39	N/A	N/A	N/A
5X28	2	N/A	N/A	N/A

Strategy	Rating/Response
Interviewed water system operators, Tribal officials, Tribal and Indian Health Service (IHS) Sanitarians, IHS Engineers, Tribal Housing Authority personnel, and Tribal Environmentalists.	N/A
Interviews confirmed by personal inspection of all Reservations.	N/A
Telephone follow-ups conducted to determine existence of septic systems.	N/A

RECOMMENDATIONS:

1. Follow-up is needed to secure additional maps of reservations.
2. Follow-up will be needed if more detail is required on the wells located to date.
3. Inventory activity should continue to determine whether the data gathered to date is all-inclusive.

Region VI State Report Summaries

**Arkansas
Louisiana
New Mexico
Oklahoma
Texas**

Prepared: 9-18-86
Updated:

STATE REPORT SUMMARY

(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: Arkansas **STATUS:** Primacy **BIBLIOGRAPHY:** No
TITLE: Final Design for Arkansas' Class V Injection Well Inventory and Assessment
AUTHOR: Arkansas Dept. of Pollution Control and Ecology
DATE: 9-85 **REPORT STATUS:** Draft

RESPONSIBLE AGENCY(IES):

The Arkansas Oil and Gas Commission (AO & GC) regulates the subsurface portion, and the Arkansas Department of Pollution Control and Ecology (ADPCE) has regulatory authority over the above ground portion of Class V brine disposal injection wells. The APDCE has complete regulatory authority over all other types of Class V injection wells in Arkansas.

HYDROGEOLOGY:

The principal Class V brine disposal injection formation is the Smackover Limestone which ranges from 7000 to 9000 feet in South Arkansas. Other formations used include: the James Member (limestone) of the Glen Rose Formation, the Tokio Formation (sandstone), the Blossom Formation (sandstone lateral equivalent of the Brownstone Marl), and the Graves Member (sandstone) of the Ozan Formation.

INVENTORY AND ASSESSMENT: 71 wells **FURS COMPATIBLE:** NO (8-20-86)

Type	Number	Contamination Potential	Case Studies	Regulatory System
5X16	70	Mod-Low	Yes	AO & GC (permits)
5A19	1	Low	N/A	none
Strategy (Date)				Rating/Response
N/A				

RECOMMENDATIONS:

(5X16)

1. The proposed injection formation must be separated from USDW's by one or more confining zones which meet the approval of the Director
2. Casing and cement must be designed to protect USDWs (see state report for detailed considerations).

Recommendations: (cont.)

3. The casing above the injection zone shall be sufficiently cemented by circulating cement with returns to the surface. Good quality cement is imperative to assure against fluid migration into untargeted zones. The quality should be sufficient to withstand the maximum operating pressure and should be resistant to degradation by native formation fluids and the injection fluids.
4. On all newly drilled or converted, and all existing Class V brine disposal wells, injection must be through tubing set on a packer unless exception is granted by the Director. Packers shall be set no higher than 100 feet above the top of the injection zone.
5. Well use may not begin until an appropriate permit is issued. After permit issuance, any proposed change or alteration to construction plan and specifications described in the application must be approved by the Director before being incorporated.
6. All phases of well construction and testing must, if possible, be supervised by a qualified person who is knowledgeable and experienced in practical drilling engineering and who is familiar with the special conditions and requirements of injection well construction.
7. During the drilling and completion of Class V brine disposal injection wells, appropriate logs will be obtained and tests conducted as set forth in the mechanical integrity guidelines.
8. The operation of a new as well as existing Class V brine disposal injection wells should be regulated according to the same operating requirements by which Class II injection wells are regulated.

(5A19)

Because of the shallow depths of these wells (only fresh water bearing formations are penetrated) and the simpleness of the system in which the water is being used, the Department sees no need for complicated regulations governing this type well except to maintain that no intermingling of the system's water with foreign substances occurs between the supply well and the return well. Specifically, all Class V cooling water return flow wells shall be constructed using the following construction requirements:

1. Both the supply well(s) and the return well(s) shall be cased at least from the surface down through the top of the uppermost supply and injection formation.
2. The casing shall be cemented in place from the top of the uppermost supply and injection formation to the surface.
3. A cooling water return flow well system shall, at a minimum, consist of two wells, a supply well and a return well.
4. The supply and return well system shall be constructed so that the formation from which the cooling water was extracted is the same formation into which the cooling water is reinjected.
5. There shall be no "open-loop" cooling water return flow wells.
6. All cooling water return flow system wells shall be plugged upon abandonment by filling the well with cement.
7. Cooling water return wells shall receive nothing other than the used cooling water which originated at the cooling water supply well(s).

Prepared: 10-16-86
Updated:

STATE REPORT SUMMARY

(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: Louisiana **STATUS:** Primacy **BIBLIOGRAPHY:** Yes

TITLE: Louisiana Class V Assessment Reports

AUTHOR: Louisiana Department of Natural Resources (DNR), Office of
Conservation (OC), and Louisiana Geological Survey

DATE: 3-85 **REPORT STATUS:** Final

RESPONSIBLE AGENCY(IES): Louisiana Department of Natural Resources (DNR),
Office of Conservation (OC)

HYDROGEOLOGY: N/A

INVENTORY AND ASSESSMENT: 11 wells **FURS COMPATIBLE:** NO (8-20-86)

Type	Number ⁺	Contamination Potential	Case Studies	Regulatory* System
5D4	5	N/A	N/A	Class II regulations
5A7	5	Low	N/A	Permitted by OC, DNR
5W11	X	N/A	N/A	Regulated by Dept. Health and Human Resources
5G30	1	N/A	N/A	Class II regulations

+ "X" indicates that well type is known to exist; no number available

* Presently Louisiana does not require the registration of any Class V wells

Strategy

Rating/Response

1. Louisiana Geological survey mailed letters to all the
well water contractors in the state requesting
information on heat pumps and associated problems 10%
2. Department of Health and Human Resources helped
Geological Survey in mailing letters to parish
sanitarians requesting information about septic
systems 10%
3. Letters were sent to each state requesting
information on heat pumps 80%

RECOMMENDATIONS: (Concerning heat pump systems only)

1. Discharge should be to the surface rather than to an injection well.
2. The waste product from ground-water source heat pumps for a single family residence should be returned or injected into or above the supply aquifer without prior review by the State and without a State permit. The installation shall conform with Section 20.03E and 20.04C of Statewide Order 29-N-1, with the following provisions.
 - A. The ground water/heat pump installation or system shall be limited to a single family residence.
 - B. The owner of an injection/return well, or the licensed water well contractor who installs it, shall be required to register the injection/return well with the Office of Conservation, DNR, within 30 days after the well's completion. The supply well should be registered with the Office of Public Works DOTD. The Office of Public Works Water-Well Registration Form (GW-1) can be used to register the wells. This form has been in use by water-well contractors since 1976.
 - C. If pollution of ground water should occur, the well owner or land leasee is responsible for immediately informing the appropriate State and local officials so that the "spread" of polluted water can be prevented and the cause of pollution eliminated. The owner should be made aware that he may be liable for any damage to the property and water of others.
 - D. The waste product shall contain no additives, such as chlorine, etc.
 - E. A licensed water-well contractor should be employed to install the return/injection well, to rework the well, whenever necessary, and to provide the necessary maintenance.
 - F. If the injection/return well becomes inoperative and must be abandoned, a licensed water-well contractor shall be employed to plug and seal the well. When a well is plugged and sealed this action should be reported to the Office of Conservation, DNR and Department of Transportation and Development using Louisiana Office of Public Works Plugging and Abandonment Form (GW-2).
3. The Office of Conservation, DNR, should establish a permit system for an injection well used by an installation for a multiple dwelling, office building, commercial and industrial establishment, or institution. The permit review process should include rules and/or guidelines to provide for the review of plans.

Prepared: 2-13-87
Updated: 8-24-87

STATE REPORT SUMMARY

(All information recorded as described in the state report,
additional correspondence, and verbal communication)

STATE: New Mexico **STATUS:** Primacy **BIBLIOGRAPHY:** Yes

TITLE: Underground Injection Control Class V Inventory

AUTHOR: G. Koschal, K. Lambert, S. Sares

DATE: 3-87 **REPORT STATUS:** Final

RESPONSIBLE AGENCY(IES): (1) New Mexico Environmental Improvement Division, (2) Environmental Improvement Division, (3) Ground Water/Hazardous Waste Bureau

HYDROGEOLOGY: Wide variety of geologic settings. Eastern plains are sedimentary sequences; western areas are mountainous. The state is divided into four physiographic provinces: Colorado Plateau, Great Plains, Basin and Range, and Southern Rocky Mountains. Major aquifers are in Tertiary and Quaternary alluvium, Mesozoic sandstones, and Paleozoic limestones.

INVENTORY AND ASSESSMENT: 1237 wells **FURS COMPATIBLE:** NO (8-20-86)

Type	Number*	Contamination Potential	Case Studies	Regulatory System
5D2	5	Low	No	Registration/Rule
5A6	2	Low	No	Permit
5A7	27	Low	No	Registration/Rule
5W10	14	Moderate	No	ILLEGAL
5W11	10	Moderate	No	Registration/Rule
5X13	11	Low	Yes	N/A
5X14	1073	Low	Yes	Permit
5A19	6	Low	No	Registration/Rule
5W20	2	Moderate	Yes	N/A
5R21	30	Low	No	Registration/Rule
5N24	1 (abd)	Low	Yes	ILLEGAL
5X25	6	Low	Yes	Permit
5X26	50	Mod-Low	No	N/A

Strategy

Rating/Response

1. Preliminary assessment of Class V wells prioritizing subclasses.
2. Assemblage of potential well owner/operators using permit database, notice of intent database, and knowledge of city, county, and state offices, well drillers, and the general public.
3. Target surveys mailed.
4. Follow up letters and telephone calls.

RECOMMENDATIONS:

1. Need some control over agricultural drainage wells (not in inventory; specifically exempted from WQCC control).
2. Regulations needed to control abandoned injection wells.
3. If abandoned wells have contaminated groundwater, procedure is needed for remediation.
4. Existing notification requirements should be improved (rewrite portions of regulations).
5. Definitions for well type classes and subclasses should be provided in the regions.

Prepared: 9-18-86
Updated:

STATE REPORT SUMMARY

(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: Oklahoma **STATUS:** Primacy **BIBLIOGRAPHY:** Yes
TITLE: Oklahoma Class V Well Study and Assessment
AUTHOR: Oklahoma Industrial Waste Division, State Department of Health
DATE: 7-85 **REPORT STATUS:** Draft
RESPONSIBLE AGENCY(IES):
Oklahoma Industrial Waste Division
HYDROGEOLOGY:
N/A
INVENTORY AND ASSESSMENT: 167 wells **FURS COMPATIBLE:** NO (8-20-86)

Type	Number*	Contamination Potential	Case Studies	Regulatory System
5F1	X	N/A	N/A	All Class V facilities are required to register with the Division
5D2	X	N/A	N/A	
5A7	100's	Low	N/A	
5W11	X	N/A	N/A	
5X16	7	N/A	N/A	
5N24 (Plugged)	X	N/A	N/A	
5X26	60	N/A	N/A	

*"X" indicates this well type is known to exist; no number available

Strategy (Date)	Rating/Response
(1980) 1.a. Department sent questionnaire with a cover letter explaining the purpose of the survey to all County Health Departments, rural water districts, and county/district sanitarians.	0%
b. Press releases were placed in local newspapers requesting public assistance	0%
2. Second mailing and follow-up phone calls to county sanitarians	0%
(1982) Pilot study of Class V wells in Cleveland Co., OK by University of Oklahoma	poor

RECOMMENDATIONS:

1. Oklahoma needs a cooperative system among state agencies to record all drilling activity that exactly defines what each well is intended to be used for.
2. (5X26)
 - a) During drilling, machinery capable of producing heat or a spark that could ignite flammable vapors should be kept up-wind and as far removed from the wellsite as possible.
 - b) Air rotary drilling should be avoided since the injection of air into the hydrocarbons can produce an extremely flammable mixture.
 - c) Registration of wells and a description of construction features and well locations should be mandatory.
 - d) The Division should have an opportunity to examine well proposals and set permit conditions as they see fit, including the quality of fluid to be reinjected.
 - e) Federal or State regulatory standards and limitations would be extremely difficult to enforce as well as hinder activity. Permit conditions should be defined on a case by case basis.
3. (5A7)
 - a) Any new regulatory program for air conditioning/heat pump return flow wells should mainly be directed at large scale systems designed for commercial buildings, such as office complexes and manufacturing facilities.
 - b) A system is needed to register, inventory, and maintain opportunity for review of air conditioning/heat pump return flow wells.
 - c) Renewable permits and periodic inspections would help prevent groundwater contamination problems due to these return-flow wells.
4. With a registration and tracking mechanism the Division would have the opportunity to review well site conditions and construction, set permit standards where needed, and better assess possible groundwater contamination from Class V wells.
5. Before stringent state and federal regulation is imposed, further study of Class V wells is advisable.
6. Recommendations from the Cleveland County pilot study:
 - a) A public awareness, public relations program should be instituted concerning these wells. The program should be conducted using a sound, positive approach which emphasizes that while most of these wells probably pose no pollution problems, they must be reported in an ongoing effort to assess their significance to possible groundwater contamination.
 - b) Since the state already has an effective working network of Professional Sanitarians and Environmental Specialists at the city and county levels, this group should have the primary responsibility for data gathering and inspection of Class V wells.
 - c) The Class V well inventory and permitting information should be compiled and stored in a databank which has capability for future expansion.

Prepared: 11-13-86
Updated:

STATE REPORT SUMMARY

(All Information is recorded as described in state report,
additional correspondence, and verbal communication)

STATE: Texas **STATUS:** Primacy **BIBLIOGRAPHY:** Yes

TITLE: Underground Injection Operations in Texas: A Classification and
Assessment of Underground Injection Activities, Report 291

AUTHOR: Texas Department of Water Resources, Ben K.Knape

DATE: 12-84 **REPORT STATUS:** Final

RESPONSIBLE AGENCY(IES): Texas Department of Water Resources (now Texas Water
Commission); Texas Railroad Commission

HYDROGEOLOGY: Most significant structures: (1) fault zones of central Texas,
(2) salt domes and growth faults of Gulf Coast, (3) salt
dissolution structures of High Plains, (4) impermeable rocks of
Llano Uplift. Very good list of major and minor aquifers in
state report.

INVENTORY AND ASSESSMENT: 2356 wells **FURS COMPATIBLE:** NO (8-20-86)

Type	Number*	Contamination Potential	Case Studies	Regulatory System
5F1	108	High	Yes	N/A
5D2	52	Low	No	N/A
5A5	X	?	No	TX Railroad Comm.
5A6	1	?	No	TX Railroad Comm.
5A7	1014	Low	Yes	Authorized by rule
5W9	10	?	No	N/A
5W10	16	?	No	N/A
5W11	56	?	No	Differs locally
5X13	65	Low	No	TX Railroad Comm.
5X15	X	?	No	TX Railroad Comm.
5W20	2	N/A	No	Class I
5R21	44	Low	Yes	Local Authority
5X25	6	Low	No	N/A
5X26	37	N/A	No	N/A
5X29	945	N/A	No	P&A Rules

* "X" indicates well types known to exist; no numbers available.

Strategy

Rating

No inventory strategies discussed in state report.

Recommendations (cont.):

1. New regulatory programs for heat pump system wells should be directed at large-scale systems rather than at systems for single-family dwellings. The Department should continue to inventory the wells, and maintain opportunity for review of project proposals for the purpose of issuing permits as necessary.
- 2.a. Regulatory orders for private sewage facilities should be adopted in areas which are not already protected. Orders should be based on current minimum standards for sewage disposal as published by the Department of Health and appropriate site-specific considerations.
- 2.b. Sewage disposal wells for private facilities are not acceptable under Texas Dept. of Health standards and should be phased out and replaced by alternate methods of sewage treatment and disposal.
- 2.c. Each proposed sewage disposal well, excluding single-family residence sewage facilities, should be authorized by site-specific permit rather than by rule, and existing wells should be individually reviewed for contamination potential with appropriate action taken in each case.

Region VII State Report Summaries

**Iowa
Kansas
Missouri
Nebraska**

Prepared: 1-30-87
Updated:

STATE REPORT SUMMARY

(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: Iowa STATUS: DI BIBLIOGRAPHY: Yes

TITLE: Class V Injection Well Assessment Report for Direct Implementation,
State of Iowa

AUTHOR: U.S. EPA, UIC Section, Drinking Water Branch, Region VII

DATE: 11-86 REPORT STATUS: Final

RESPONSIBLE AGENCY: Iowa Conservation Commission, Dept. of Natural Resources

HYDROGEOLOGY: There are five major bedrock aquifers in Iowa which are separated
by aquicludes. A sixth aquifer system consists of alluvial aquifers
associated with stream systems and glacial drift. These aquifers provide
75 percent of the state's domestically used water.

INVENTORY & ASSESSMENT: 262 wells FURS COMPATIBLE: No (8-20-86)

Type	Number	Contamination Potential	Case Studies	Regulatory System
5F1	230 (est 700)	High	Yes	Diversion Permit
5D2	6	?	No	N/A
5A7	17 (est 250)	Low	No	N/A
5W11	3	None*	No	N/A
5A19	5	N/A	No	4 permitted 1 monitored
5X28	1	High	No	N/A

* if "properly constructed and maintained"

Strategy	Response/ Rating
1. Sent letters to well drillers and heat pump installers	N/A
2. Ran public notices in thirteen Iowa newspapers	N/A
3. Compiled a list of ADW owners through well tax reporting cards	N/A
4. Used infrared and aerial photography to locate ADWs.	N/A

RECOMMENDATIONS:

(5F1)

Close highway surface inlets to ADWs. Provide alternate drainage or impoundments when necessary. Permits should be required to ensure compliance.

Raise inlets above maximum ponding levels. Abandoned wells are to be properly plugged. Nitrates should not be applied where subsurface tiles are present. Any other appropriate best management practices should be used. Perhaps water going down hole should be required to meet drinking water standards.

Elimination of ADWs could be accomplished gradually through attrition. A more rapid phase out could be accompanied by cost sharing plans like a onetime payment for plugging followed by annual tax incentives. The land could be bought by the government who would then plug ADWs on government lands.

(5A19)

Require permit stating type and volume of injected fluids, construction features, depth, date drilled, and driller. New wells would require grouted surface casing, and a concrete pad at top. EPA to be informed on any change of conditions, source and injected aquifer to be the same. Five year inspection.

(5A7)

Same as (5A19)

(5X28)

Require permit showing: Construction features and a plan to utilize separator and holding tank and a plan to sample and analyze injected fluid. Five year inspection.

(5D2)

Require permit showing locations, construction features; and plan to affix cover to tops of casings should a spill occur. Also show plan for emergency cleanup operations. Five year inspection.

(5W11)

Require permit giving construction features and stating that only sewage goes into tank. Five year inspection.

Prepared: 11-17-86
Updated:

STATE REPORT SUMMARY

(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: Kansas **STATUS:** Primacy **BIBLIOGRAPHY:** Yes

TITLE: Class V Well Assessment of Kansas

AUTHOR: Kansas Department of Health and Environment
Susan Hargadine

DATE: 11-86 **REPORT STATUS:** Draft

RESPONSIBLE AGENCY: Kansas Department of Health and Environment

HYDROGEOLOGY: Class V well records were found in many areas with surface geology consisting of Tertiary and Pleistocene alluvial deposits (especially in the western and south-central parts of Kansas). In Butler, Cowley, and parts of Sedgwick Counties, the surface rocks are of Permian age and the wells penetrate rocks in the Chase and Sumner groups which are also used for supply purposes. A few wells are drilled into the Dakota formation in Barton, Cloud, Ellsworth, Hodgeman, and Pawnee counties.

INVENTORY AND ASSESSMENT: 419 wells **FURS COMPATIBLE:** NO (8-20-86)

Type	Number	Contamination Potential	Case Studies	Regulatory System
5D2	3	Positive	N/A	N/A
5A7	394	Low	N/A	N/A
5A19	3	Possible	N/A	N/A
5R21	4	Possible	N/A	N/A
5X26	15	Low	N/A	N/A
5X27	758*	Low	N/A	N/A

* Hydrocarbon storage wells (should be Class II)

Strategy	Rating/Response
1. Used FURS printout for wells entered 1981-84.	N/A
2. Questionnaires were sent to well owners.	N/A
3. A printout was made of water wells with well types that would include most Class V wells.	N/A
4. Water well record files were checked manually to eliminate wells on the printout that were not Class V's.	N/A
5. Some data were acquired from discussion with field staff.	N/A
6. Phone contacts and letters were written to owners on questionable wells.	N/A

RECOMMENDATIONS:

(Database)

1. It is possible that additional wells exist. The current inventory will have to be accepted until much time and manpower can be devoted to searching all possible avenues.
2. The computer inventory system is good and workable.
3. The inventory on the FURS system is not correct: the state system is correct and contains all information called for on the FURS system.
4. It would be desirable to get the state Class V inventory on a computer with capabilities to plot distribution, make graphs and maps, summarize, etc.

(Additional Information)

1. Public notices asking for voluntary information on Class V type wells could be printed in newspapers and trade journals.
2. Yellow pages could be checked for businesses advertising for construction or maintenance of Class V type wells; then businesses could be contacted for information.
3. Contact to personnel in county health departments, extension services, or public works could be helpful.
4. If field personnel of various agencies requiring field work (Board of Agriculture, Department of Health and Environment, etc.) are advised on the types of data needed, they may be able to supply information discovered during field investigations.

(5D2, 5W11, 5W20, 5X26)

1. These well types should be more closely monitored.
2. Inspections should be made to investigate construction of the wells.
3. The surrounding drainage areas should be studied and all possible pollution sources noted.
4. Samples should be taken of the waste stream to be analyzed.

(5A7)

1. Require all groundwater heat pump systems to have properly designed and maintained fresh water disposal wells (and reduce the number of systems discharging to surface).

2. Establish construction standards
 - a. for specific site and hydrogeologic conditions
 - b. for necessary volumes of water
 - c. with back-check valves and disposal lines immersed below water level
 - d. with spacing of 50-100 feet between disposal and supply wells
 - e. with disposal well located down-gradient from supply well
 - f. for proper grouting of vertical holes
 - g. for line connectors
3. Establish formal requirements for reporting heat pump installations to the appropriate state agency.
4. Specify approved antifreeze solutions.
5. Monitor Class V well systems on a systematic basis particularly in areas of the state with high concentrations of wells.

Prepared: 1-16-87
Updated:

STATE REPORT SUMMARY

(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: Missouri STATUS: Primacy BIBLIOGRAPHY: Yes

TITLE: Missouri Underground Injection Control Program Class V Assessment

AUTHOR: N/A

DATE: 12-86 REPORT STATUS: Draft

RESPONSIBLE AGENCIES: Department of Natural Resources, Division of Geology and
Land Survey

HYDROGEOLOGY: Rocks ranging from PreCambrian to recent are exposed. They include volcanic and intrusive rocks, marine and continental sedimentary rocks, glacial deposits and wind blown soils. Table 4-1 in the state report contains a summary of geologic and hydrologic characteristics and locations of the surficial materials and bedrock in Missouri.

INVENTORY AND ASSESSMENT: 5324 wells FURS COMPATIBLE: No (8-20-86)

Type	Number*	Contamination Potential	Case Studies	Regulatory System
5F1	x	High	No	None
5D3	250	Possible	Yes	None
5A7	741	Low	No	Registration
5W11	2	Low	No	Permit
5X13	4326 (abd)	Low	Yes	None
5X26	x	N/A	No	N/A
5X28	5 (abd)	Unknown	No	N/A

*"x" indicates well type is known to exist; no numbers available

Strategy	Response/ Rating
1. State and Federal agencies that may have information of Class V wells were contacted.	N/A
2. A telephone survey was made covering the manufacturing industry, disposal industry, heating and cooling contractors, installers, utilities, and the general public.	N/A
3. A field search was made to locate and determine type of injections and the rates of injection as required in 40 CFR 144.26.	N/A

RECOMMENDATIONS:

- (5F1) 1. More careful N management could be used to reduce the amount of $\text{NO}_3\text{-N}$ leaked and transported to an ADW.
2. Pesticide incorporation at application and the use of soil conservation practices, along with more strongly adsorbed pesticides could decrease pesticide losses.
3. For bacteria, moderately or strongly adsorbed pesticides, and sediment itself, closing the surface inlets and forcing surface water to infiltrate through soil would decrease their transport into the aquifer.
4. Transport of the slightly adsorbed anoxic herbicides with subsurface flow, or the even lesser movement of other pesticides would have to be solved by banning the pesticides of concern or closing the ADW's if this transport was deemed a problem.
- (5D3) 1. Further dye tracing will be necessary to better define the boundaries of the spring recharge areas.
2. It is suggested that a careful dye trace study be run on any existing or planned improved sink hole drainage systems and that occasional monitoring of both entering and exiting fluids be run after the system is in operation.
- (5A7) Areas that need addressing include:
1. Regional meetings with drillers and installers so that information can be distributed and exchanged.
2. More energy directed toward public awareness of the rules and regulations regarding heat pumps.
3. More detailed research about the theoretical environmental effects of heat pumps.
4. Standards set for the construction of supply and return wells so that the problems associated with them can be reduced.
- (5W11) Proper construction and installation guidelines should be considered before and during construction of a sewage disposal system.
- (5X13) Water supplies having a known or suspected close connection to mining activities should be tested prior to use to insure against contamination from such sources.

Prepared: 11-13-86
Updated:

STATE REPORT SUMMARY

(All information is recorded as described in state report,
additional correspondence, and verbal communication)

STATE: Nebraska STATUS: Primacy BIBLIOGRAPHY: Yes
TITLE: Inventory and Assessment of Class V Injection Wells and Related Sources
AUTHOR: N/A
DATE: 8-86 REPORT STATUS: Final
RESPONSIBLE AGENCIES: Nebraska Department of Environmental Control

HYDROGEOLOGY: Much of Nebraska is underlain at shallow depth by a thick, moderately to highly permeable unconsolidated rock of Cenozoic and/or Tertiary age. This is the principal aquifer, Ogallala, and it supplies large quantities of good quality water. In northwest Nebraska there is a group of secondary aquifers which are generally deeper and provide low to moderate quantities of acceptable quality water. These aquifers include the Arikaree Group, Brule Formation, and Chadron Formation. Another secondary aquifer in eastern Nebraska is the Dakota aquifer, which is currently utilized.

INVENTORY AND ASSESSMENT: 672 wells FURS COMPATIBLE: NO (8-20-86)

Type	Number*	Contamination Potential	Case Studies	Regulatory System
5F1	5	High	No	Rule
5D2	1	Low	No	Rule
5A7	650	Low	No	Rule
5W10	X	N/A	No	Rule
5W11	X	High	No	Rule
5A19	8	Variable	No	Rule
5R21	4	Variable	No	Rule
5X25	2	N/A	No	Rule
5X27	2	Low	No	Rule
5X29	X	N/A	No	Rule

* "X" indicates well type is known to exist; no numbers available.

Strategy	Response/Rating
Review of DEC files and records	?
Mailing to each member of the Nebraska Well Drillers Association	39%
Mailing to Natural Resource District Managers and follow-up phone call	100%
Remote sensing techniques	-
Mailing to Residential Groundwater Heat Pump Contractors and Installers	65%

RECOMMENDATIONS:

Based upon information gained from the Class V injection well technical review, inventory, and assessment, the following recommendations will aid in prevention of groundwater contamination from Class V injection wells in Nebraska.

All Class V Injection Wells

1. The injection well should not be located in any depressions where it would be subject to influence from surface runoff or flooding (not including ADWs).
2. The injection well should be located at least 50 feet from any septic tank, cesspool, or other surface or subsurface waste disposal area.
3. A continuous inventory program for Class V injection wells should be established. This program should include:
 - i) the filling out of Class V injection well application forms. These forms would be distributed to well drillers and heat pump contractors and installers to in turn be distributed to owners of Class V injection wells. These forms would then be sent back to the Department as each well is installed;
 - ii) data on all existing and future Class V injection wells should be stored in a computer data base for easy access.
4. On all Class V injection well applications (if applicable), details should be included on well depth, well casing type, screen locations, gravel pack depths, static and injection water levels, and a well log.
5. The definition of Class V Injection Wells under Title 122 Rules and Regulations for Underground Injection and Mineral Production Wells should be modified to include closed loop heat pump systems and single family septic systems.

Agricultural Drainage Wells

1. All ADWs would require a permit from DEC. The permit requirements would include the following:
 - i) a Gas Chromatography/Mass Spectrophotometry (GC/MS) analysis be done on injection water on at least a quarterly basis to determine the presence of any pesticides. Parameters to be monitored for pesticide concentrations would be later determined by DEC;
 - ii) water should be monitored and meet standards for nitrate-nitrogen (10 mg/l).

Recommendations (cont.)

2. A Class V injection well application form specifically for ADWs which would require:
 - i) a detailed map of the location of the injection well including the locations of all municipal, domestic, and stock wells within one mile of the injection well;
 - ii) a diagram of the drain tile (if applicable) and the injection well.
3. The drainage well should be located at least 2,000 feet from any stock, municipal, or domestic well.

Any ADW not meeting the above requirements would have a potential to adversely impact ground water quality and would not be allowed.

Cooling Water Return Flow Wells

1. Minimum design requirements for cooling water return flow wells including:
 - i) wells be grouted from a point at least 20 feet below land surface to the land surface or to the water table;
 - ii) wells be designed only for noncontact systems where injection water is not chemically altered.
2. A Class V injection well application form specifically for cooling water return flow wells which would require:
 - i) a detailed map of the location of the injection well including the locations of all municipal, domestic, and stock wells within one mile of the injection well;
 - ii) a diagram of the injection well including screen depths, gravel pack, and grout;
 - iii) a diagram of the injection well system.
3. Minimum locating requirements for the injection well relative to any nearby municipal supply wells.

Any cooling water return flow well not meeting requirements 1, 2, and 3 from above would require a permit.

Recommendations (cont.)

Residential Ground Water Heat Pump Systems

1. Minimum design criteria for the injection well in open loop systems which would include:
 - i) the well be grouted from a point at least 20 feet below land surface to the land surface or to the water table;
 - ii) wells be designed only for noncontact systems where injection water is not chemically altered.
2. Minimum design criteria for the underground loop in closed loop systems which would include:
 - i) the loop be built of flexible, stress resistant, high density, noncorroding pipe such as polyethylene, polybutylene, or other pipes approved by DEC;
 - ii) joints and links in the underground loop should be properly sealed as outlined in the National Standard Plumbing Code.
3. The underground loop or the injection well should be located at least 100 feet from any domestic and 500 feet from any municipal supply wells.
4. A Class V injection well application form specifically for residential ground water heat pump systems which would require:
 - i) a detailed map of the location of the injection well including the locations of all municipal, domestic, and stock wells within one half mile of the injection well or underground loop;
 - ii) if the system is closed loop, details on the design including the type of pipe and the type of antifreeze used.

Any residential groundwater heat pump system not meeting the above criteria would require a permit.

Commercial Ground Water Heat Pump Wells

1. Minimum design criteria for commercial ground water heat pump wells including:
 - i) wells be grouted from a point at least 20 feet below land surface to the land surface or to the water table;
 - ii) wells be designed only for noncontact systems where injection water is not chemically altered.

Recommendations (cont.)

2. A Class V injection well application form specifically for commercial ground water heat pump wells which would require:
 - i) a detailed map of the location of the injection well including the locations of all municipal, domestic, and stock wells within one mile of the injection well.
3. The injection well should be located at least 500 feet from any stock, municipal, or domestic supply well.

Any commercial ground water heat pump well not meeting the above requirements would require a permit.

Ground Water Recharge Wells

1. Water from streams, rivers, canals, lakes, or ground water which is to be used to recharge ground water should be monitored for and meet standards for the following limits:
 - i) nitrate-nitrogen (10 mg/l);
 - ii) fecal coliform (200 per 100 ml) as outlined in the 1976 EPA Quality Criteria for Water.
2. A GC/MS analysis should be done on any water source which will be used to recharge ground water to determine the presence of any pesticides. Parameters to be monitored for pesticide concentrations would be later determined by DEC.
3. Treated sewage water to be used to recharge ground water should be tested for and should meet standards for:
 - i) all parameters listed under Chapter 4, Title 118 Nebraska Ground Water Protection Standards (excluding radionuclides);
 - ii) biological oxygen demand (30 mg/l);
 - iii) fecal coliform (200 per 100 ml);
 - iv) chlorides (200 mg/l);
 - v) ammonia-nitrogen (5 mg/l);
 - vi) any other parameters determined by DEC.
4. The ground water recharge well should be located at least 2000 feet from any stock, domestic, or municipal supply well.

5. A Class V injection well application form specifically designed for ground water recharge wells which would include:
 - i) the exact location of the injection well including the location of any municipal, domestic, and stock wells within one mile of the recharge well;
 - ii) the type of water being used for recharge and its source;
 - iii) time of year which recharge will be done and expected injection rates to be used.
6. The injection well should be grouted from a point at least 20 feet below land surface to the land surface or to the water table.

Any ground water recharge well not meeting the above criteria would require a permit.

Septic Tank Systems

1. Local planning groups should be encouraged to examine establishing septic tank density limits. These limits would be based upon, among other things:
 - i) depth to ground water;
 - ii) soil permeabilities;
 - iii) potential for further septic tank installations; and
 - iv) quantities of wastes being discharged to individual systems.
2. Many industries discharge process wastes, in addition to sanitary wastes, to septic tank systems. Discharge of industrial process wastes should be restricted due to the fact that septic tank systems are not designed to adequately treat this waste type.

Region VIII State Report Summaries

**Colorado
Montana
Indian Lands
North Dakota
South Dakota
Utah
Wyoming**

Prepared: 12-15-86
Updated:

STATE REPORT SUMMARY

(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: Colorado **STATUS:** DI **BIBLIOGRAPHY:** Yes
TITLE: Inventory of Class V Injection Wells in the State of Colorado
AUTHOR: SMC Martin, Inc.
DATE: 3-85 **REPORT STATUS:** Final
RESPONSIBLE AGENCY(IES):
N/A

HYDROGEOLOGY:

Colorado can be broadly divided into 5 major groundwater regions: High Plains, Unglaciaded Central Region, Central Mountains, San Luis (alluvial) Valley, and Colorado Plateau. The geologic and hydrologic frameworks are not generally conducive to the utilization of injection wells.

INVENTORY AND ASSESSMENT: 115 wells **FURS COMPATIBLE:** No (8-20-86)

Type	Number*	Contamination Potential	Case Studies	Regulatory System
5F1	X	High	N/A	N/A
5D2	2	Low	N/A	N/A
5A6	2	Low	N/A	N/A
5A7	2	Low	N/A	N/A
5X13	2	?	N/A	Rule
5X15	23	?	N/A	Rule
5A19	1	Low	N/A	N/A
5X25	2	Low	N/A	N/A
5X26	81	Low	N/A	N/A
5X29	X	High	N/A	P&A Rules

* "X" indicates this well type is known to exist; no number available

Strategy (Date)	Rating/Response
1. (1984) Contacts were made with governmental and private sector sources of general information on Class V injection wells.	?
2. (1984) Mass mailings were made to individuals and organizations presumed to be knowledgeable about specific types of Class V wells.	Low

Strategy (Date) - cont.

Rating/Response

- | | | |
|----|---|------|
| 3. | (1984) Telephone contacts were made with specific individuals and organizations determined to have information on individual well, well types, or well facilities in Colorado | High |
| 4. | (1985) Lists of names and phone numbers compiled from phone books, directory assistance and preliminary inventory report (over 200 calls made). | High |
| a. | State agencies within the Board of Health, Department of Natural Resources and other public sector groups | |
| b. | Private sector individuals | |
| c. | Legal contacts for all inventoried wells in order to verify inventory information | |

RECOMMENDATIONS:

1. State of Colorado Division of Water Resources should alter its drilling permit form (WRJ-5-Rev.76) to categorize wells as "injection" or "extraction" wells.
2. State officials involved in developing new ground water regulations should provide a means in the legislation of maintaining the inventory.
3. Identify and inventory agricultural drainage wells and make further recommendations based on combined efforts of the State Department of Health and the EPA.

Prepared: 12-15-86
Updated:

STATE REPORT SUMMARY

(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: Montana STATUS: DI BIBLIOGRAPHY: No

TITLE: Inventory of Class V Wells in the State of Montana

AUTHOR: SMC Martin, Inc.

DATE: 3-85 REPORT STATUS: Final

RESPONSIBLE AGENCY(IES):
N/A

HYDROGEOLOGY:
N/A

INVENTORY AND ASSESSMENT: 4587 wells FURS COMPATIBLE: YES (8-20-86)

Type	Number	Contamination Potential	Case Studies	Regulatory System
5D2	4500	High	N/A	(private) permit: Building Dept. (municipal) Engi- neer's Dept.
5A7/19	20	Low	N/A	None
5W11	2	High	N/A	permit: County Sanitation Authority
5X13	10	?	N/A	permit: Bureau of Abd. Mines
5G30	55	Low	Yes	permit: Dept. of Highways

Strategy (Date)	Rating/Response
(1983) o Inventory compiled by telephone interviews and correspondence with various federal, state, county, and municipal agencies as well as industrial firms, drillers, pump sales and service companies, and private individuals.	N/A
o All county sanitation officers were initially contacted through letters stating the purpose of the survey and describing the types of Class V wells. The sanitarians were requested to list all Class V facilities in their counties. Telephone calls were subsequently made to verify information and obtain other sources of information.	N/A

Strategy (Date) - cont.

Rating/Response

- | | | |
|-------------|--|-----|
| o | All drillers listed in the Montana telephone directories were contacted. Information given by a driller concerning an injection well, if incomplete, was followed up with a telephone call to the owner of the well. | N/A |
| o | Pump sales and service companies were contacted. They were occasionally able to give the names of unlisted local well drillers, who were then contacted. | N/A |
| (Post-1983) | SMC Martin conducted an extensive series of telephone interviews to assess and evaluate the previously completed inventory. See the state report for the scope of this effort. | N/A |

RECOMMENDATIONS:

1. Site specific study is needed to determine the nature and extent of degradation from 5X13 wells.
2. EPA should contact county sanitation authorities concerning sanitary waste disposal wells: A more reasonable assessment of the number of these wells could be obtained by a review of permits in county sanitation files. Site specific study is needed to evaluate the impact and extent of this degradation.
3. An assessment of the effects of 5D2 wells should be conducted prior to completing a complete inventory because the inventory would be time consuming and costly. If found to be an actual source of significant contamination, this inventory should be completed immediately.

Prepared: 4-15-86
Updated:

STATE REPORT SUMMARY

(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: Region VIII - Indian Land **STATUS:**DI **BIBLIOGRAPHY:**No

TITLE: Inventory of Class V Injection Wells in the Indian Lands
of EPA Region VIII

AUTHOR: SMC Martic

DATE: 3-85

REPORT STATUS: Final

RESPONSIBLE AGENCIES: U.S. EPA Region VIII, Bureau of Indian Affairs, Bureau of
Land Management

HYDROGEOLOGY: N/A

INVENTORY AND ASSESSMENT: 2 wells **FURS COMPATIBLE:** No (8-20-86)

Type	Number	Contamination Potential	Case Studies	Regulatory System
5A7	1	Minor, localized	No	N/A
5W11	1	N/A	No	N/A

Strategy (Date)

Response/Rating

(Date N/A) Contacted government agencies on
several levels: federal, regional, state, and
reservation. BIA agencies were the most valua-
ble source of information. Very little specific
information was gathered from state agency contacts.

RECOMMENDATIONS:

This inventory can best be updated if individuals in local agencies who are familiar with the operations of individual reservations are periodically contacted to determine if any activity involving Class V injection wells has recently taken place on the reservation. Local BIA officials and/or tribal council members should be contacted. A knowledgeable person on each reservation could be empowered by the EPA to monitor Class V (and perhaps all) injection wells on that reservation. Periodic reporting by these people to EPA would ensure that the inventory remains current.

Prepared: 12-15-86

Updated:

STATE REPORT SUMMARY

(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: North Dakota

STATUS: Primacy

BIBLIOGRAPHY: No

TITLE: Evaluation of the Inventory and Assessment of Class V Injection
Wells in North Dakota

AUTHOR: SMC Martin, Inc.

DATE: 3-85

REPORT STATUS: Final

RESPONSIBLE AGENCY(IES):

N/A

HYDROGEOLOGY:

N/A

INVENTORY AND ASSESSMENT: 448 wells

FURS COMPATIBLE: NO (8-20-86)

Type	Number	Contamination Potential	Case Studies	Regulatory* System
5F1	1	N/A	No	N/A
5A7	135	Low	N/A	All water well drillers must submit a log of wells that have been completed Installation must be approved by the State Water Department
5X13	300	Positive	N/A	Rule
5X16	1	?	N/A	N/A
5A19	1	?	N/A	N/A
5X27	10	?	N/A	N/A

*Every individual well owner is required to register his injection well with
the State Department of Health.

Strategy (Date)

Rating/Response

Telephone survey conducted of:

N/A

- o Private residences
- o Industrial and commercial sites
- o Municipal and other governmental operations
- o Various public facilities including schools, churches, etc.
- o Industrial installers and dealers of heat pumps

RECOMMENDATIONS:

N/A

Prepared: 12-15-86
Updated:

STATE REPORT SUMMARY

(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: South Dakota

STATUS: DI

BIBLIOGRAPHY: No

TITLE: Evaluation of the Inventory and Assessment of Class V Injection Wells in
the State of South Dakota

AUTHOR: SMC Martin, Inc.

DATE: 3-85

REPORT STATUS: Final

RESPONSIBLE AGENCY (IES):
N/A

HYDROGEOLOGY:
N/A

INVENTORY AND ASSESSMENT: 49 Wells

FURS COMPATIBLE: NO (8-20-86)

Type	Number	Contamination Potential	Case Studies	Regulatory System
5A7	48	N/A	N/A	N/A
5A19	1	N/A	N/A	N/A

Strategy	Rating/Response
(1983) Telephone surveys soliciting information from: o Electric cooperative member service directories o Plumbing and heating contractors o Water well drillers o State agencies-limited effort	Thorough and accurate for heat pumps
(Post 1983) SMC Martin conducted a more extensive survey: See state report for details	N/A

RECOMMENDATIONS:

Water wells should be designated as "supply" or "injection" wells on drilling permits.

Prepared: 3-16-87
Updated: 4-27-87

STATE REPORT SUMMARY

(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: Utah STATUS: Primacy BIBLIOGRAPHY: Yes

TITLE: Draft Class V Well Inventory for the UIC Program

AUTHOR: Morton, Loren B. and James H. Martin

DATE: 2-87 REPORT STATUS: Draft

RESPONSIBLE AGENCY(IES): Utah Bureau of Water Pollution Control (BWPC)

HYDROGEOLOGY: The state of Utah is composed of three physiographic provinces which each contain distinct aquifer characteristics and vulnerabilities. In the Basin and Range Province, injection wells penetrating the confining layer or located in the recharge area pose the greatest threat to current public water supplies. In the Middle Rocky Mtn. Province the bedrock aquifer systems are at high risk for groundwater pollution while the alluvial and glacial aquifer systems are less vulnerable. No information is currently available on the Colorado Plateau Province.

INVENTORY AND ASSESSMENT: 3,088 wells FURS COMPATIBLE: No (8-20-86)

Type	Number	Contamination Potential ⁺	Case Studies	Regulatory System ^o
5D2	2743	2-5		Rule
5D4	321	3-7		Rule
5A6	1	5	No	Permit
5A7	7	4		Permit
5A19	3	4		Permit
5W20	4	5-7		(Prohibited)
5X28	2	6		(Prohibited)
5X29	7	2-7		(Illegal)
5W11	X*	N/A		N/A

* "drainfields are believed to exist and should be included

+ contamination potential is rated on a scale of 2 to 7,
(2=lowest, 7=highest)

o information concerning responsible agencies rather than system
(e.g. permit, rule, etc.)

Strategy

Rating/Response

City, State, and Federal Cooperation.....	Good
Public Education.....	To Be Implemented
Industry Response.....	Mixed
(5D2,4) Contacted city and county engineers, planning and zoning staff, building inspectors, public works directors, and local environmental health staff. Also conducted site inspections.	

Strategy (cont.)	Rating/Response
(5A5-7) Reviewed records of Utah Division of Water Rights (DWR). Some site inspections.	N/A
(5A19) Contacted DWR and potential well owners.	N/A
(5W20) Contacted BWPC personnel and local health department staff.	N/A
(5X28) Located during drainage well inventory.	N/A
(5X29) Contacted DWR and BWPC.	N/A

RECOMMENDATIONS:

(5D2,4)

- A. The most obvious alternative to these wells is the conventional storm sewer. In most Utah communities this would require extensive public works construction. A ban on drainage wells would force communities to construct and extend storm sewers for all public streets and some private property. This creation or augmentation would result in increased costs to the local taxpayer.
- B. Another alternative would be to provide environmental management.
1. Studies should first be undertaken to assess:
 - (a) organic parameters of urban runoff entering drainage wells from public streets (5D2 wells),
 - (b) total water chemistry, including organics, of runoff entering commercial/industrial drainage wells (5D4 wells).

Priority attention in the study should be given to wells located in the recharge area of the public water supply aquifers. In these areas ground water pollution problems should be addressed immediately upon discovery.
 2. Once armed with facts, efforts should be focused on prevention of pollution from drainage wells. This could best be accomplished by:
 - (a) Establishment of state and federal standards for drainage well water quality, and associated design, siting, and spill prevention requirements.
 - (b) Propagation of authority and implementation of state and federal standards to local government. Multiple point source nature of drainage wells will require highly labor intensive management which could best be accomplished at the local level.
 3. After prevention, cleanup of drainage well polluted sites should be emphasized. This would be accomplished through accepted aquifer cleanup practices.

- C. Additional regulation is needed in storage and loading areas which are vulnerable to hazardous product and spills.
 - 1. Increased attention could be provided in changes to local zoning and building code ordinances or environmental regulations.
 - 2. Plan review in the permit approval process could give opportunity for local government to assist the private sector in proper design and siting, including spill prevention.
- D. Little federal attention has been given to regulation of urban runoff to date. Even less attention has been given to urban runoff disposed in drainage wells. We recommend that drainage well studies be conducted, regulations as necessary be implemented, and coordination be accomplished between local government, and the UIC and NPDES programs. Today, the UIC program is ineffective at regulating these systems due to 1) lack of understanding of regulatory needs of drainage wells, and 2) the sheer numbers of wells to be managed by a limited staff. It must be noted that any increase in regulatory requirements for these wells, without an increase in program resources, will only result in even more diminished program effectiveness.

(5A6,7,19)

- A. The most practical corrective alternative is one that should already exist in these systems: non-contact use of the groundwater. System design should emphasize prevention of groundwater contact with any other fluids or soluble solids.
- B. If operation and maintenance inspections of these wells is required in the future, more resources will be necessary to match the increased workload.
- C. The federal government can be effective by providing information on necessary environmental regulations and encouraging states to adopt them. Currently the UIC program is ineffective in regular inspection and day-to-day management of these wells due to lack of resources. Increased requirements will have to be accompanied by increased resources to achieve better program effectiveness.

(5W20)

- A. The best corrective alternative for these wells is to connect the waste streams to the sanitary sewer, following any necessary pretreatment requirements. Direct discharge to a well or dry well does not provide the treatment necessary to render the waste water harmless to groundwater supplies. This treatment can be provided by local water reclamation plants.

- B. These wells can be detected and managed by local building code, environmental, or sewer pretreatment programs. However, the fact that some of these wells exist may be indicative of a lack of Class V well experience, and the high workloads and low funding levels that local government programs endure. Occurrence of these wells in rural areas may also be caused by a lack of community water reclamation systems.
- C. The low number of these wells found indicates local government is doing a good job of regulating industrial process water. However, the NPDES program can be more effective in helping the UIC program by requiring sewer improvement districts to inventory all industrial users of their system and to review details of each user's waste stream(s). This assistance will help locate these wells in urban areas of the state. The UIC program should then closely examine rural industry, in conjunction with state ground water protection staff and with the help of local government, to identify industrial dischargers to ground water. Such a study would locate discharges not only to wells but also to drainfields, sumps, dry wells, etc. Once again without increased resources this effort may never be accomplished.

(5X28)

- A. These wells can be corrected by providing underground holding tanks (total containment) for the waste oils/fluids. These tanks would require regular off-loading to waste oil reclaimers. In Utah, there is economic incentive for a service station to sell waste oil to a reclaimer. The management of these wells would best be accomplished at the local government level because they already enforce their building and sewer ordinances. Any inspections by state or federal staff would be a duplication of effort.
- B. Communities with a water reclamation system commonly prohibit oil and grease discharges to their sewer. Consequently, some operators opt to discharge to dry wells as a "loophole" to the environmental regulations. Local building code and sewer pretreatment inspection should be able to locate and manage these wells.
- C. The UIC program has not been effective in controlling this problem, but local government has. Considering the thousands of service stations in the state, to find only two of these wells thus far is encouraging. The UIC program can be more effective by educating those local government staff who conduct building and environmental inspections. This training will help locate these violators and hopefully solve the problem.

(5X29)

- A. The only corrective alternative for these wells is closure. This practice must be halted to prevent aquifer contamination. In the case of domestic waste, sanitary sewer hook-up should be required. Industrial wastes should receive any necessary pretreatment and should also be discharged to the sanitary sewer. Hazardous waste should be handled in accordance with RCRA regulations.

- B. Disposal practices are difficult to detect without inspecting each and every water well; a Herculean task. Perhaps a more practical way to find these problems is through inspections carried out by other existing state, local, and federal regulatory programs. Educating those who conduct building code, water appropriation, and environmental inspections on what to look for should be the most cost effective way to find these types of violations. Prevention of this problem would best be accomplished through public education, particularly of water well owners.
- C. It appears that the most practical way these wells can be located and closed is to educate the public and personnel in other government programs (i.e., RCRA, NPDES, local environmental and planning/building programs) in how to locate these wells, what they consist of, and the damage they can do to the ground water supply. Short of this, these wells could only be detected by an exhausting review of all existing water wells in the state; an impossible task considering current funding levels.

Prepared: 1-16-87
Updated:

STATE REPORT SUMMARY

(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: Wyoming STATUS: Primacy BIBLIOGRAPHY: Yes

TITLE: Assessment of Class V Injection Wells in the State of Wyoming

AUTHOR: Western Water Companies

DATE: 9-86 REPORT STATUS: Final

RESPONSIBLE AGENCY: Department of Environmental Quality (DEQ)

HYDROGEOLOGY: The formations most sensitive to Class V injection operations include those areas underlain by: 1. Quaternary-age alluvium; 2. Mountain glacial deposits; 3. Shallow bedrock aquifers; 4. Paleozoic-age aquifers; 5. Dune sand and loess. Less Vulnerable units include igneous, metamorphic, and volcanic rocks; Mesozoic sandstone aquifers; playa lake and other lacustrine deposits; landslides; and Mesozoic shales (aquitards).

INVENTORY AND ASSESSMENT: 738 wells FURS COMPATIBLE: No (8-20-86)

Type	Number	Contamination Potential*	Case Studies	Regulatory System
5D2	5	3	No	Any party who in-
5A7	7	8	No	tends to construct
5W10	3	5	No	or operate any fac-
5W11	420	5	No	ility which may
5X13	74	3,10	No	cause or contribute
5X14	14	1	No	to pollution of any
5X15	41	4,7	2 facilities	water of the
5W20	32	3	No	state is required
5R21	7	6	1 facility	to obtain a permit
5X25	135	1,9	3 facilities	from the WQD.

* Well types are ranked according to contamination potential (1 = highest, 10 = lowest). Some well types had different rankings for different facilities.

Wyoming
Page Two

Strategy (Date): see state report for individual strategies.		Rating/ Response
(1984)	1. Interviewed state and federal government agencies and reviewed available records.	N/A
	2. Local government offices were asked to provide information about Class V wells within their jurisdictions.	N/A
	3. Potential owners of and businesses likely to install or service Class V wells were identified and contacted.	N/A
	4. When potential well owners or information sources could not be reached, an extensive letter and telephone follow-up system was employed.	N/A

RECOMMENDATIONS:

1. Continue current regulatory efforts.
2. Investigate the environmental effects of dry wells within the state.
3. Obtain a computerized standard ground-water quality model to verify model results submitted by permit applicants and independently evaluate proposed projects.
4. Develop and use a standard data management system for routine monitoring data submitted by permittees.

Region IX. State Report Summaries

Arizona

California

Hawaii

Nevada

American Samoa

Trust Territories and Pacific Islands

Guam

CNMI

Prepared: 7-22-87
Updated:

STATE REPORT SUMMARY

(All information recorded as described in April 10, 1987 memorandum
from Richard A. Coddington to Michael B. Cook)

STATE: DI States - USEPA Region IX (AZ, CA, Guam, HI, NV, TTPI)

RESPONSIBLE AGENCY: U.S. Environmental Protection Agency

INVENTORY AND ASSESSMENT: 64,105 wells

Type	Number*	Contamination Potential	Case Studies	Regulatory System
5D2,4	59,323	See individual State Report Summaries		
5G30	1		"	
5A5	81		"	
5A6	7		"	
5A7	53		"	
5A8	25		"	
5W9	3		"	
5W10	120		"	
5W11	1,311		"	
5W31	73		"	
5W32	1,279		"	
5W12	358		"	
5X13	1		"	
5X14	875		"	
5X17	35		"	
5X18	22		"	
5A19	26		"	
5W20	209		"	
5R21	103		"	
5B22	155		"	
5X25	45		"	

Strategy (Date)

Rating/Response

See individual State Report Summaries

RECOMMENDATIONS:

1. Develop a system to consistently update and maintain the Class V inventory. This system should:

- * focus on obtaining inventory information and well specific data about high priority or high contamination potential wells prior to construction;

- * focus on obtaining data about wells in areas which have a high level of groundwater usage and a high density of wells which could endanger the USDW;
 - * coordinate with and utilize information from existing state programs;
 - * utilize authority under UIC or RCRA program to request information from operators of high contamination potential wells;
 - * contact and obtain information from well drillers, cities and other groups that maintain records on recent and new well construction and operation; and
 - * utilize information gathered by other Federal programs (e.g. through RCRA at hazardous waste generation facilities with stormwater drainage wells).
2. Develop and implement an effective inspection, compliance, and enforcement program. This should include:
- * review state specific Class V assessments, Class V inventory, state program reports, and local program reports, and identify specific facilities with high contamination potential wells which must be inspected;
 - * inspect high contamination potential well types in high risk areas (e.g., areas overlying sole source aquifers with a high density of high contamination potential wells);
 - * coordinate inspection and work in conjunction with existing state programs;
 - * sample waste streams when necessary to assess possible violations;
 - * bring enforcement actions against all Class IV wells which may be uncovered; and
 - * take appropriate enforcement actions against operators of Class V wells which are "endangering" an USDW.
3. Develop and implement an interim UIC Class V permit program. This interim permit program should contain proper siting, construction, monitoring, reporting, and closure requirements which will assure that a permitted Class V well will not endanger an USDW.

Prepared: 2-3-87
Updated: 6-1-87

STATE REPORT SUMMARY

(All information recorded as described in state reports,
additional correspondence, and verbal communication)

STATE: Arizona

STATUS: DI

BIBLIOGRAPHY: Yes

TITLE: Report on Class V Injection Well Inventory and Assessment in Arizona

AUTHOR: Engineering Enterprises, Inc.

DATE: 5-87

REPORT STATUS: Final Draft

RESPONSIBLE AGENCY(IES): USEPA, Region IX, UIC Section

HYDROGEOLOGY: The Upper Alluvian Unit of the basin-fill aquifer in the Salt River Valley groundwater area receives the majority of water injected through Class V wells in Arizona. This basin-fill aquifer is utilized for domestic, industrial, irrigation and public water supply. Groundwater withdrawals from this aquifer account for 25 percent of groundwater withdrawals in the state.

INVENTORY AND ASSESSMENT: 51,207 wells **FURS COMPATIBLE:** No (8-20-86)

Type	Number	Contamination Potential	Case Studies	Regulatory System
5D2	40,000 - 60,000	Moderate	Yes	Registration
5D4	Combined w/5D2	Moderate	Yes	Registration
5W20	72	High	Yes	Permit
5W10	17	High	No	Permit
5W11	143	High	No	Permit
5W12	1	High	No	Permit
5W31	18	High	No	Permit
5W32	3	High	No	Permit
5X14	870	Low to Mod.	Yes	Permit
5R21	51	Low	Yes	Permit
5X25	32	Low to Mod.	Yes	Permit
5A7	X	Low	No	None

Strategy

Rating/Response

Jan.-Feb., 1985	Inventory questionnaires mailed to various federal, state and local agencies.
April-May, 1985	A second inventory questionnaire was mailed to businesses and industries and potentially owning/operating Class V wells.

N/A

N/A

May-June, 1985	Inventory questionnaires were mailed to irrigation, drainage, and other water districts in Arizona.	N/A
August, 1986	A fourth questionnaire was mailed to county health departments and the Arizona Department of Health Services to increase the inventory of Class V sewage treatment/disposal systems.	N/A
July, August, Sept., 1986	A file investigation/site inspection study was conducted by EEI to obtain further data on solution mining wells and industrial disposal wells.	N/A

RECOMMENDATIONS:

Solution Mining Wells (5X14) and Experimental Technology Wells (5X25) Associated with Solution Mining:

1. Require operators currently grandfathered from having to obtain a permit to seek one through the appropriate state agency.
2. Additional study is needed to determine if post-closure requirements are sufficient to protect USDW.
3. Performance bonds may be necessary to insure compliance with permit conditions.

Aquifer Recharge Wells (5R21):

1. USEPA and Arizona regulators should agree on guidelines to address how water quality versus water quantity conflicts are resolved for projects using injection wells.

Heat Pump/Air Conditioning Return Flow Wells (5A7):

1. Well construction and choice of injection zone should be regulated.
2. Additional study on the impact of additives such as biocides, corrosion or scale inhibitors, and clay dispersal agents used to increase injection well performance is needed.

Sewage Waste Water Disposal Wells (5W10, 5W11, 5W31, 5W32):

1. Inventory may be improved by working with state and local agencies. Inventory efforts should focus upon systems receiving industrial/commercial wastes or process waters.

Arizona
Page Three

2. Groundwater Quality Protection Permit conditions should be tested to ensure protection of USDW by conducting site investigations, including groundwater monitoring.
3. Class V on-site systems should be reclassified in order that waste stream quality and quantity may be determined from the type of system indicated on the returned questionnaire.
4. The public should be educated on the appropriate use of on-site treatment systems.

Domestic Waste Water Treatment Plant Effluent Disposal (5W12):

1. Conduct additional inventory efforts.
2. Groundwater Quality Protection Permit conditions should be tested to ensure protection of USDW by conducting site investigations including groundwater monitoring.

Storm Water Drainage and Industrial Drainage (5D2 and 5D4):

1. Additional study of the water quality impacts to USDW are needed. These should involve sampling of sediments in settling basins of drainage wells, storm water run off, and groundwater within the saturated and unsaturated zone at selected sites. Also, use studies as a basis for establishing a minimum vertical separation distance between the water table and the bottom of the well.
2. Provide depth to water maps for drillers and planners especially in commercial areas.
3. Continue public information efforts on the newly instituted registration program.

Industrial Process Water and Waste Water Disposal Wells (5W20):

1. Conduct targeted questionnaire mailings, telephone follow-ups, and facility inspections. Also, review ADHS files for additional inventory.
2. Any operating permits which are granted should require water level data and a geologic description of sediments down to the regional water table.
3. Develop case studies at selected sites, including groundwater monitoring, to determine if permit conditions protect USDW.
4. Continue to require a complete waste stream analysis as part of the permit application.

5. In conjunction with (3) above, conduct studies on the attenuation of contaminants within the vadose zone in order to specify a minimum separation distance between completion depth and the water table.

Agricultural Drainage Wells (5F1):

If such wells are installed or discovered in the future, they should be regulated. Guidelines should include well construction standards, injectate quality standards, choice of injection zones and injection volume.

Prepared: 1-28-87

Updated: 5-7-87

STATE REPORT SUMMARY

(All information recorded as described in state report, additional correspondence, and verbal communication)

STATE: California

STATUS: DI

BIBLIOGRAPHY: Yes

TITLE: Reporting on Class V Injection Well Inventory & Assessment in California

AUTHOR: Engineering Enterprises, Inc.

DATE: 5-87

REPORT STATUS: Final Draft

RESPONSIBLE AGENCY(IES):

California Division of Oil & Gas (CDOG); Division of Water Resources (DWR); Regional Water Quality Control Boards (RWQCB); Bureau of Land Management (BLM)

HYDROGEOLOGY:

Groundwater withdrawals account for 40% of California's water use. Total storage capacity of all groundwater basins is 1.3 billion acre-feet. Principal aquifers are alluvium and older sediments in coastal regions. Basin-fill aquifers typify desert regions. Volcanic aquifers are found primarily in northern California, flanking the Cascade & Siskiyou Ranges, and along the eastern Sacramento Valley. Consolidated crystalline rocks and bedded sandstones are principal aquifers locally.

INVENTORY AND ASSESSMENT: 12,236 wells (Est) **FURS COMPATIBLE:** No (8-20-86)

Type	Number	Contamination Potential	Case Studies	Regulatory System
5D2 - 5D4	9175 (est)	MOD	1	NO PERMIT REQUIRED
5A5	65	LOW	4	PERMIT
5A6	1	LOW	1	PERMIT
5A7	53	LOW	NO	PERMIT
5W10	46	HIGH	NO	BANNED
5W11	1165	HIGH	NO	N/A
5W12	22	HIGH	NO	PERMIT
5X14	5	UNKNOWN	1	PERMIT
5X17	35	MOD-HIGH	5	PERMIT
5X18	22	MOD-HIGH	9	PERMIT
5A19	20	UNKNOWN	NO	PERMIT
5W20	93	HIGH	6	PERMIT
5R21	52	UNKNOWN	YES	PERMIT
5B22	155	LOW	YES	PERMIT
5X25	2	UNKNOWN	NO	PERMIT
5W31	48	HIGH	NO	PERMIT
5W32	1276	HIGH	NO	PERMIT

Strategy	Rating/Response
(1,2-1985) Questionnaires I & II mailed by EEI & EPA to: county health departments, public works departments, departments of transportation, department of agriculture, U.S. Soil Conservation Service, known geothermal operators, selected RCRA applicants	Moderate
(4-1985) Questionnaires mailed by EEI to: petroleum refiners and chemical plants, chemical manufacturers, industrial manufacturers, drilling service companies, campgrounds/RV discharge areas, mortuaries, refuse haulers, industrial disposal services, waste oil refiners, smelters, pumping contractors	Low
(6-1985) Similar questionnaires mailed by EEI to new operator	Low
(7-9-1986) Agency file reviews and site investigations for hi-tech facilities	Moderate
(9-12,1986) Contact regional boards and county health departments to increase the inventory of Class V sewage disposal systems.	Moderate

RECOMMENDATIONS:

A. STORMWATER AND INDUSTRIAL DRAINAGE WELLS (5D2 & 5D4)

Increased inventory efforts are needed to locate and identify wells of this type. In addition, the severity of contamination potential posed by these wells needs to be better defined by further field investigations. Factors to consider in establishing interim regulations for these wells include:

- 1) Prohibition of wells in areas served by storm water sewers.
- 2) Prohibition of well development into public supply aquifers.
- 3) Definition of minimum vertical separation requirements.
- 4) Definition of minimum horizontal setback requirements.

B. GEOTHERMAL ELECTRIC POWER GENERATION INJECTION WELLS (5A5)

It is recommended that all permit applications are accompanied by baseline hydrogeological studies, complete with maps showing all water supply wells in the area, detailed drilling and completion plans, and comprehensive injectate and injection formation fluid chemical analyses. Mechanical integrity tests and analysis of injection fluids should be required annually. In addition, continual monitoring of injection volumes and pressures should be required.

C. GEOTHERMAL DIRECT HEAT INJECTION WELLS (5A6)

Recommendations are generally the same as for electric power generation. In addition, further inventory efforts are needed to locate other low-temperature geothermal injection facilities in northern California.

D. HEAT PUMP/AIR CONDITIONING RETURN FLOW WELLS (5A7)

Potential for USDW contamination is lowest when the source and injection zones are the same aquifer. It is recommended that all injection of heat pump/air conditioning return flow water is into the source aquifer. In addition, increased inventory efforts are needed to identify new and existing wells, and to evaluate their potential for USDW contamination.

E. SEWAGE WASTEWATER DISPOSAL SYSTEMS (5W10, 5W11, 5W12, 5W31, 5W32)

Increased inventory efforts are needed. Inventory efforts should be concentrated on cesspools, septic systems with wells, and septic systems with drainfields receiving industrial/commercial wastes or process waters. Septic systems and cesspools should be classified according to the types of waste water disposed. Operators of cesspools should be required to develop alternate disposal systems. Sewage disposal systems should not be designed for areas with existing sewers. Owners of these disposal systems should submit waste discharge reports. Operators should be required to characterize their waste streams before discharging and at any time composition changes. Permitting for small facilities should be conducted at the local agency level.

F. SOLUTION MINING INJECTION WELLS (5X14)

A more thorough database for existing facilities should be developed. Monitoring well networks should be established down gradient to the mine and semi-annual sample analysis should be conducted for each well. Monthly volumetric analysis of injection and recovery fluids should be conducted to ensure balance. Mechanical integrity for all wells should be demonstrated periodically.

G. AIR SCRUBBER WASTE DISPOSAL WELLS (5X17)

It is recommended that a sampling program is developed to characterize waste streams at all facilities. Samples should be taken at the injection pumps or wellhead. Semi-annual waste stream analyses should be required, and standard sample parameters should be Total Organic Carbon (TOC), oil and grease, and total recoverable hydrocarbons. Injection into USDW that are not oil zones should be prohibited. Finally, consistency in permit requirements for each facility should be established.

H. WATER SOFTENER REGENERATION BRINE DISPOSAL WELLS (5X18)

For recommendations, see Air Scrubber Waste Disposal Well Summary.

I. COOLING WATER RETURN FLOW WELLS (5A19)

Increased inventory efforts are necessary to locate and identify all wells of this kind. Injection of contact cooling water into Class IIB aquifers should not be allowed, and all new systems should be of the closed loop variety. Spent cooling water should be injected back into the source aquifer to prevent aquifer degradation due to fluid incompatibility. Finally, permit applications should address the hydrogeology for a 1/4-mile radius around the facility.

J. INDUSTRIAL PROCESS WATER & WASTE DISPOSAL WELLS (5W20)

Monitoring well systems should be implemented at large facilities to trace the migration of contaminants. Injection of industrial waste and process water into USDW should be prohibited. Increased inventory efforts are needed to identify new and existing facilities. More in-depth hydrogeological background should be acquired prior to permit approval. Finally, all permits should require regular chemical analysis of injected fluids.

K. AQUIFER RECHARGE WELLS (5R21)

Agricultural chemicals and nutrients should be removed from return flows in agricultural areas where recharge is being conducted. Sewage wastewater should always be treated prior to use as recharge fluid. Water not meeting National Primary and Secondary Drinking Water Standards should not be injected into currently used USDW.

L. SALTWATER INTRUSION BARRIER WELLS (5B22)

Case studies should be conducted to assess the influence of this injection upon potential or present public drinking water supplies. Studies should also be conducted to further define the lithologic and hydrogeologic controls over salt water intrusion. Characterization of injectate and injection zone fluids should be conducted at all salt water intrusion barrier projects. Finally, increased inventory efforts are needed to ensure that all such projects have been identified.

M. EXPERIMENTAL TECHNOLOGY INJECTION WELLS (5X25)

Increased inventory efforts are necessary to locate other experimental facilities. Site-specific studies should be conducted for each facility located through continued inventory efforts.

Prepared: 2-3-87
Updated: 5-7-87

STATE REPORT SUMMARY

(All information recorded as described in state reports,
additional correspondence, and verbal communication)

STATE: Hawaii

STATUS: DI

BIBLIOGRAPHY: Yes

TITLE: (1) Draft Report, Inventory and Assessment of Class V Injection Wells
in Hawaii for US EPA Region IX
(2) Draft Report of Investigation Class V Injection Well Inspections,
Oahu and Hawaii Islands, Hawaii
(3) Letter with inventory updates from Hawaii Department of Health
and various correspondence

AUTHOR: (1), (2) Engineering Enterprises, Inc.

DATE: (1) April 1987
(2) November 1985
(3) August 1986

REPORT STATUS: Draft

RESPONSIBLE AGENCY (IES):

U.S. EPA Region IX, UIC Section
Hawaii Department of Health, Environmental Permits Branch

HYDROGEOLOGY: Primary water source is groundwater on major islands. Surface
water is locally important. Groundwater occurs primarily as (1) basal
lens, underlying all islands, comprising major groundwater source, (2)
water held in dike complexes, above basal lens and/or sea level, and (3)
perched water at high elevations above basal lens and/or sea level.
Specific information is contained in draft reports.

INVENTORY AND ASSESSMENT: 617 wells

FURS COMPATIBLE: No

Type	Number	Contamination Potential	Case Studies	Regulatory System
5D2	129*	Moderate	No	All Class V
5D4	4	Moderate	No	injection wells
5A8	25	Moderate	Yes	are regulated
5W9	3	High	Yes	under a permit
5W10	57	High	No	system by the
5W31	7	High	Yes	Hawaii Dept.
5W12	335	High	Yes	of Health,
5A19	6	Low	Yes	Environmental
5W20	44	High	Yes	Permits Branch.
5X25	6	Low	No	
5G30	1	Unknown	No	

* Many more wells thought to exist.

Strategy (Date)	Response/Rating
(1) Hawaii Dept. of Health obtained a list of injection well owners which USGS compiled and mailed request-for-permit application forms to people on list. The USGS list was based on: permit applications for privately owned treatment works; personal memories of regulatory officials; and well drilling permits. (pre-1985)	Good
(2) Hawaii Dept. of Health also mailed request-for-permit application forms to: businesses in the telephone book; potential sewage disposal well owners in non-sewered areas; and known industrial plants or operations. (pre-1985)	Good
(3) Follow-up letters were mailed to non-respondents of surveys listed in (1) and (2).	?
(4) EEI inspection program added three facilities (sewage related wells) during site inspection program. One facility was in a non-sewered area and was found to use well disposal. Two other facilities were state/county hospitals disposing of sewage waste for which the Health Dept. had not had manpower before inspections to obtain data needed to complete permit application. (August 1985)	Good

RECOMMENDATIONS

From EEI Draft Report "Inventory and Assessment of Class V Injection Wells in Hawaii" (April, 1987):

- Inventory efforts should continue.
- The public should be educated with regard to proper operation of Class V injection well systems and potential groundwater contamination which may result from unregulated Class V injection. The public should be made aware of regulations regarding Class V wells.
- In-depth hydrogeologic studies should be conducted by a qualified individual for active and proposed areas of Class V injection.
- Wells should be properly designed, constructed, and operated. Regulatory personnel should review proposed construction specifics and the submitted hydrogeologic report before granting permission to construct wells.

- Periodic sampling and analysis of injected fluids should be conducted. Receiving waters should also be sampled periodically for signs of degradation from injection practices.
- Mechanical integrity of selected well types should be maintained and verified through testing periodically. Appropriate mechanical integrity tests may need to be developed.
- Wells should be properly plugged and sealed when injection is terminated.
- The UIC Line may need to be relocated in some areas, as it is only a rough approximation of groundwater containing at least 5,000 mg/l TDS.
- Research should be conducted with regard to attenuation capabilities of basalts at various stages of weathering.
- An organized sample and core library could be formed to facilitate areal mapping and hydrogeologic evaluation. This proposal should be considered.

From EEI Draft Report of Investigations (November 1985):

SITE INVESTIGATIONS AND HAWAII UIC PROGRAM

- Site inspections should be conducted at facilities which submit permit applications to verify and augment submitted information.
- Appropriate chemical analyses should be done to characterize injected fluids at permitted facilities.
- Site hydrogeology at permitted facilities should be better documented, at least in the form of injection well boring logs.
- Water usage in the area of the permitted facilities should be considered during the permitting process.
- Abandoned wells should be properly plugged and abandoned.
- Efforts should be continued to locate facilities not currently under the regulatory process. This activity could entail substantial field work. This task could be aided by requiring and strictly enforcing a rule on well installation. This rule would require submittal of well logs, completion details, and other pertinent data to all appropriate state agencies.

Hawaii
Page Four

From Hawaii Department of Health Correspondence (May 1986)

ELEMENTS NEEDED FOR THE FUTURE

- Review and revision of existing state regulations to provide more prudent control of injection and monitoring requirements.
- Promote cooperation between regulatory agencies and the regulated community. Cooperation must be coupled with education of the regulated community and the public.
- Seek out and regulate injection facilities which have not yet been reported.

Prepared: 1-28-87
Updated: 5-4-87

STATE REPORT SUMMARY

(All information recorded as described in state reports,
additional correspondence and verbal communication)

STATE: Nevada **STATUS:** DI **BIBLIOGRAPHY:** Yes
TITLE: Report on Class V Injection Well Inventory and Assessment in Nevada
AUTHOR: Engineering Enterprises, Inc.
DATE: 5-87 **REPORT STATUS:** Final Draft

RESPONSIBLE AGENCY(IES):

Division of Environmental Protection (DEP); Division of Water Resources (DWR); Department of Minerals (DOM); Division of Health (DOH)

HYDROGEOLOGY:

Groundwater withdrawals account for about 20% of all water used in Nevada. Basin-fill (valley-fill) aquifers are currently supplying the majority of groundwater withdrawals. Carbonates (limestone and dolomite) and volcanic rocks also function as principle aquifers in certain parts of the state.

INVENTORY AND ASSESSMENT: 46 wells

FURS COMPATIBLE: NO (8-20-86)

Type	Number*	Contamination Potential	Case Studies	Regulatory System
5D2	15	Moderate	No	N/A
5D4	X	Moderate	No	N/A
5A5	16	High - Low	3 facilities	Permit
5A6	6	Low	5 facilities	Permit
5A7	X	Low	No	N/A
5W11	3+	Moderate	No	Permit
5W32	X			Permit
5X25	5+	Unknown	No	Permit
5X28	X	High	No	N/A
5X13	1	Unknown	No	N/A

* "x" indicates well type is believed to exist; no numbers available

Strategy	Rating/Response
(1981) "Feasibility Report of the Underground Injection Control Program for the State of Nevada"	N/A
(1983) Inventory of injection wells, compiled by SMC Martin	N/A
(1984) Assessment of injection wells, compiled by SMC Martin	N/A
(1,2-85) Questionnaires I & II mailed by EEI & EPA to: county health depts., public works depts., depts. of transportation, dept. of agriculture, Nev. Pollution Control Federation, U.S. Soil Conservation Service, various other state and federal agencies, known geothermal operators, selected RCRA Part A permit applicants, and others from previously constructed lists.	Moderate
(4,5-85) Questionnaires mailed by EPA to: petroleum refiners, petroleum chemical plants, chemical manufacturers, other industrial manufacturers, drilling service companies, campgrounds/ R.V. discharge areas, mortuaries, major refuse hauling and disposal services, industrial waste disposal services, waste oil re-refineries, smelters, and pumping contractors (sewage).	Low
(5,6-85) Questionnaires mailed by EPA to irrigation, drainage, and various water districts in Nevada.	Low
(9-86) Survey conducted by EEI/EPA to increase the inventory of sewage disposal well facilities.	Low

RECOMMENDATIONS:

Sewage Disposal Wells (5W11, 5W32):

1. Effluent limitations, periodic inspections and public education may alleviate problems of misuse through improper disposal.
2. Site investigations or case studies may provide information in order to ascertain whether siting guidance for individual systems is suitable for Class V systems.
3. State, county, and local agency files may be examined in order to improve inventory.
4. Site investigations may be desirable when the inventory is improved.

Experimental Technology Wells (5X25):

1. Additional inventory data should be obtained.
2. Additional study should be conducted on current regulatory jurisdiction.

2. Injection fluids should be sampled and analyzed for parameters of the National Primary Drinking Water Standards (NPDWS).
3. State should expand the scope and detail of baseline hydrologic investigations required in permit applications.

Geothermal Direct Heat Injection Wells (5A6):

1. A discussion should be held with state agencies in order to inventory domestic size systems.
2. Additional study is needed to determine appropriate MIT's and frequency of testing.
3. Injection fluids should be sampled and analyzed for parameters of the NPDWS.
4. State should expand the scope and detail of baseline hydrologic investigations required in commercial permit applications.

Storm Water and Industrial Drainage Wells (5D2, 5D4):

1. Likely present and future uses of drainage wells should be determined by asking state and local officials if ordinances requiring or banning drainage wells exist.
2. Consider public education as a means to control future use of this well type and on-site sewage waste water disposal systems. Periodic conferences and literature distributions for public officials or interested parties regarding the uses and abuses of such systems would provide education and promote awareness of the Federal UIC program. Regulatory approaches could also be discussed through such means.

Prepared: 2-3-87
Updated:

STATE REPORT SUMMARY

(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: American Samoa STATUS: DI BIBLIOGRAPHY: Yes

TITLE: Assessment Report - American Samoa

AUTHOR: UIC, Region IX

DATE: 1-87 REPORT STATUS: Draft

RESPONSIBLE AGENCY(IES): EPA Region IX, UIC

HYDROGEOLOGY: All of the groundwater occurs in either high-level aquifers or basal aquifers. Ground water in high level aquifers is either (1) prevented from migrating downward by flat-lying aquitards, or (2) impounded behind near vertical dikes that have intruded highly permeable basalt flows. Discharges range from 2 liters/sec. to 24 liters/sec. Basal aquifers drain directly to the sea without significant retention times. They are generally located near the coast. Discharge rates range from 2 liters/day to 21 liters/day. Inhabitants generally depend on surface water.

INVENTORY AND ASSESSMENT: 0 Wells FURS COMPATIBLE: N/A

Type	Number	Contamination Potential	Case Studies	Regulatory System
0	0	0	0	0
Strategy				Rating/Response
Not Applicable				

RECOMMENDATIONS:

Prior to the early 1970's, the inhabitants of American Samoa relied almost entirely on surface water sources to support their drinking water needs. With the installation of numerous water wells in the last decade, however, groundwater now represents the bulk of the drinking water consumed on the islands of American Samoa. Despite this element of progress, new groundwater sources must be developed to meet the needs of the growing population.

The islands of American Samoa will probably soon face the problem of large scale waste disposal as new industries are introduced. Due to the delicate water balance that exists on each island, the disposal of waste must be approached cautiously. At present, little recorded data exists on the distribution of high-level and basal aquifers on the islands. Because of this, it is difficult to assess hydrogeologic vulnerability. There are, however, numerous examples of locations that clearly should not be used as waste disposal sites such as the Tafuna-Leone Plaine and the upper Fagaalu Valley. These two areas are

American Samoa

Page Two

vulnerable because the local aquifers, which occur at or near the surface, are essentially unprotected from contamination due to the high level of hydraulic interconnection between the geologic units. Other areas characterized by highly permeable formations or deposits are likewise unsuitable as waste disposal sites for the reason given above.

In order to objectively identify areas of hydrogeologic vulnerability, a set of standard criteria must be developed that define in precise terms what constitutes vulnerability and what does not. Once these criteria have been established, it will be possible to isolate areas that are vulnerable to contamination, and to evaluate the potential for Class V well installation in a site-specific manner.

Prepared: 2-3-87
Updated:

STATE REPORT SUMMARY

(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: Trust Territories of the Pacific Island (TTPI) STATUS DI BIBLIOGRAPHY: NO

TITLE: Trust Territory of the Pacific Islands Underground Injection Control Program

AUTHOR: John Mink

DATE: 1-87 REPORT STATUS: Draft

RESPONSIBLE AGENCY(IES): EPA Region IX, UIC; Trust Territory Environmental Protection Board

HYDROGEOLOGY: Two island types are prevalent: volcanic and raised limestone. The people rely on a variety of sources for water supply including rain catchment, stream flow, and shallow hand dug wells.

INVENTORY AND ASSESSMENT: 0 Wells FURS COMPATIBLE: N/A

Type	Number	Contamination Potential	Case Studies	Regulatory System
0	0	0	0	0
Strategy				Rating/Response
Not Applicable				

RECOMMENDATIONS:

As mentioned previously, the completion of the 1985 EPA study reaffirmed the original assumption that there were no UIC wells in Micronesia. However, it should be noted that limestone aquifers are highly susceptible to dissolution by acidic solutions, i.e., disintegration by acidic injectates. Therefore, the pH of the injectate should be carefully monitored and assessed should consideration be given to allow future injection near these limestone formations. Unconsolidated and semi-consolidated rock types are highly permeable, and therefore if used as receiving formations, can pose a potential endangerment to nearby underground sources of drinking water (USDW's). Unweathered volcanic rocks, on the other hand, are considered highly consolidated units and should make very stable, impermeable confining zones. Efforts should be made to locate any future Class V wells in areas where aquifers or USDWs can be adequately protected from injection zones by such consolidated confining zones. Where injection must occur into a USDW, a detailed chemical analysis of the injectate should be first conducted to protect against any direct contamination of the USDW. At a minimum, total dissolved solids (TDS) and any constituents for which drinking water standards have been developed should be measured and evaluated. Also, because of the fragile nature of ground water resources, alternatives such as surface treatment facilities, should be considered prior to making the final decision.

Prepared: 12-1-86
Updated:

STATE REPORT SUMMARY

(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: Guam

STATUS: Primacy

BIBLIOGRAPHY: Yes

TITLE: Underground Injection Control Class V Assessment Report

AUTHOR: Guam Environmental Protection Agency

DATE: 9-86

REPORT STATUS: Final

RESPONSIBLE AGENCY (IES): Guam Environmental Protection Agency (GEPA),
Water Program Division, Safe Drinking Water Programs

HYDROGEOLOGY: Northern half: limestone plateau covered by Guam clay, contains three groups of ground water resources: (1) basal, (2) parabasal, and (3) perched limestone caps on hills of volcanic rock. The "Northern Lens" serves as a source of potable water for 95% of the population. Southern half: Volcanic uplands. Ground water occurs in limestone lenses, volcanic rocks, and noncalcareous sediments. Not adequate for large scale development (i.e., beyond local needs).

INVENTORY AND ASSESSMENT: 164 Wells **FURS COMPATIBLE:** YES(10-20-86)

Type	Number	Contamination Potential	Case Studies	Regulatory System
5D2	164	Low	N/A	Permit Required

Strategy

GEPA contacted all federal, state, and local
agencies in Guam

Response/Rating

+

RECOMMENDATIONS: (These practices are presently in effect in Guam)

1. GEPA has issued permits to all Class V wells and prohibits the construction and operation of new injection wells without a permit.
2. GEPA requires the operator to sample and monitor the injection fluids for MBAS, Oil and Grease, and NO₃-N.
3. GEPA staff conduct inspections of injection wells to ensure that only surface water runoff and storm water are disposed of into the wells and to ensure that no toxic or hazardous chemicals or other pollutants are injected.
4. Periodically, GEPA staff conduct surveillance, islandwide, for possible illegal activities concerning underground injection control.

Prepared: 12-1-86
Updated:

STATE REPORT SUMMARY

(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: CNMI **STATUS:** Primacy **BIBLIOGRAPHY:** No

TITLE: Underground Injection Control Class V Assessment Report

AUTHOR: Division of Environmental Quality

DATE: 9-86 **REPORT STATUS:** Final

RESPONSIBLE AGENCY (IES): Division of Environmental Quality (DEQ);

HYDROGEOLOGY: Primary water sources are basal, characteristic of coastal regimes. More specific information about Saipan, Rota, and Tinian is included in the state report.

INVENTORY AND ASSESSMENT: 2 Wells **FURS COMPATIBLE:** YES(8-20-86)

Type	Number	Contamination Potential	Case Studies	Regulatory System
	2	Low	N/A	None required

egy

Response/Rating

c was notified of requirement to notify DEQ
in one year) of ownership of Class V wells through

(1) publication of regulations in the Commonwealth
Register

0

(2) conduction of a public hearing

0

outine safe drinking water inspection

found 2 wells

COMMENDATIONS:

- DEQ should be on the look out for other Class V wells
- Interviews should be conducted with staff members of the Department of Public Works, who were aware of the above described wells, for information on other possible wells.

Region X State Report Summaries

Alaska
Idaho
Oregon
Washington

Prepared: 1-18-87
Updated:

STATE REPORT SUMMARY

(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: Alaska **STATUS:** DI **BIBLIOGRAPHY:** Yes
TITLE: Preliminary Class V Injection Well Inventory and Assessment Report-Alaska
AUTHOR: Engineering Enterprises, Inc., Zonge Engineering and Research Organization
DATE: 11/86 **REPORT STATUS:** Draft

RESPONSIBLE AGENCY(IES):

Alaska Department of Environmental Conservation (ADEC)

HYDROGEOLOGY:

Alaska's principal aquifers consist of unconsolidated alluvium and glacial deposits, and consolidated clastic and carbonate sedimentary rocks. They produce shallow, high-yield and deep, low-yield wells, respectively. Permafrost, a major factor in groundwater availability, and groundwater storage and recharge are also discussed in the state report.

INVENTORY AND ASSESSMENT: 2542 wells **FURS COMPATIBLE:** NO (8-20-86)

Type	Number	Contamination Potential	Case Studies	Regulatory System
5X29	3	High		
5D2	66	High		
5A5	4	Moderate	N/A	Require a permit to discharge
5A7	7	Moderate		
5A19	2	Moderate		
5W20	230	High		
5W9	3			Require plan review...in some cases permits to discharge
5W10	>79			
5W11	8	High	N/A	
5W12	4			
5W31	3			
5W32	2133			

Strategy (Date)

Response/Rating

Agency contact - seven days contacting state, federal and local (Anchorage) agencies reviewing files

95%

Written inquiry - four mailing programs conducted including - municipalities
industry (I)
service stations
industry (II)

12%

RECOMMENDATIONS:

Ongoing inventory - tailoring specific and concise questionnaire targeted for specific potential well owners rather than general mailing programs.

- Public awareness improvement of UIC regulations in Alaska
- Agency file search in Alaska

Hydrogeologic and jurisdictional - WATSTORE incorporation with UIC programs (to achieve hydrogeologic Database to accompany UIC Database)

- Identify jurisdictions best regulated by state and local agencies and incorporate into cooperative UIC program

Well site investigations -

(1) Review Alaskan inventory to identify high densities of industrial process water and waste disposal systems.

(2) Gather hydrogeologic information for these areas.

(3) Gather regulatory information from state, local, and/or federal agencies.

Carry out site inspections for 5W20 focusing and examining facility records, facility layout, industrial process, sampling of injected fluids.

Prepared: 3-11-87
Updated:

STATE REPORT SUMMARY

(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: Idaho STATUS: Primacy BIBLIOGRAPHY: Yes

TITLE: Idaho Assessment of Class V Injection Wells

AUTHOR: W.G. Graham, Linford J. Campbell, Ingrid Sather

DATE: 1-87 REPORT STATUS: Final Draft

RESPONSIBLE AGENCY(IES): Idaho Dept. of Water Resources

HYDROGEOLOGY: Ninety percent of all inventoried Class V injection wells, excluding mine tailings backfills, are located in areas overlying the Snake Plain, Boise Valley, and Rathdrum Prairie ground water systems. These three groundwater systems provide drinking water for 41 percent of the state population and supply large quantities of water for irrigation and industrial users. Mine backfills occur in formations that are effectively isolated from underground sources of drinking water.

INVENTORY AND ASSESSMENT: 2,533 wells **FURS COMPATIBLE:** No (8-20-86)

Type	Number	Contamination Potential ^o	Case Studies	Regulatory System
5F1	572	2	Yes	*
5D2	1,165	1	Yes	*, +
5A5	4	12	Yes	Permit
5A6	2	5	Yes	Permit
5A7	20	12	No	Permit
5W11	52	6	No	*, +
5W12	9	7	No	+
5X13	575	3	No	Rule
5A19	49	11	No	Permit
5W20	46	10	No	*, +
5R21	7	7	Yes	*
5N24	4	7	Yes	*
5X28	21	4	No	+
5G30	7	14	Yes	*, +

^o Well types are ranked according to contamination potential
(1=highest, 2=lowest)

* Deep wells (>18 feet) authorized by permit requiring compliance with discharge quality standards and locational criteria.

+ Shallow wells (<18 feet) authorized by rule provide that required inventory information is furnished and use of the well does not contaminate a drinking water source.

Strategy (Date)

Rating/Response

- (1974) Permit application reviews and regional office surveys.... N/A
- (?) 1. Remote sensing/high-altitude aerial photographs (5F1).
2. Mail-out surveys to city and county engineers, high-way district supervisors, airport managers, pesticide applicators, owners/operators of various automotive and implement service facilities (5D2) initial: 50-60% final: 2002/2248
3. Mail survey for mine backfill wells 100%
4. Follow-up mailings 85%
5. Follow-up phone calls 100%

RECOMMENDATIONS:

1. Shallow injection wells (less than or equal to 18 feet in depth) generally discharge small quantities of nonhazardous wastes into horizons well above the underlying drinking-water sources. Continued authorization of shallow injection wells by rule is recommended for Idaho where the quality of underground drinking-water sources are not endangered. This option should continue to be available to the States under the federal UIC program.
2. Deep injection wells (greater than 18 feet in depth), excluding mine backfills, may discharge large volumes of fluids into drinking-water sources, or into injection horizons that are generally close to drinking-water sources. Authorization of these practices should require submittal of data concerning well construction, quality of injected fluids and pertinent geologic and hydrologic features in addition to the required inventory information.
3. Continued authorization of mine backfill wells (Class 5X-13) without permit is recommended where the tailings are injected into formations that are effectively isolated from underground sources of drinking water.
4. With regard to the possible endangerment to underground drinking-water sources from fluids injected through service station waste disposal wells (Class 5X-28), a concerted effort should be undertaken to determine the nature of the injected fluids and to ensure that all such wells are inventoried. Subsequent permitting and abandonment may be required.

Prepared: 12-22-86
Updated:

STATE REPORT SUMMARY

(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: Oregon STATUS: Primacy BIBLIOGRAPHY: Yes

TITLE: Underground Injection Control Class V Inventory and Assessment in the
State of Oregon

AUTHOR: Oregon Department of Environmental Quality

DATE: 12-86

REPORT STATUS: Draft

RESPONSIBLE AGENCY(IES):

Department of Environmental Quality (DEQ), Water Quality Division
Department of Water Resources (DWR) - well construction standards; geothermal
fluids < 250°F
Department of Geology and Mineral Industries (DOGAMI) - oil & gas related;
geothermal fluids > 250°F

HYDROGEOLOGY: Highly permeable alluvial deposits (central Multnomah County) are generally used for disposal of storm water drainage and sewage. Fractured basalt and layers of volcanic pumice and scoria were used for sewage disposal before the installation of sewers and treatment plants. Geothermal resources are used for space heating, agriculture, and industrial process heating. In arid areas groundwater is used for irrigation.

INVENTORY AND ASSESSMENT: 7,120 wells **FURS COMPATIBLE:** No (8-20-86)

Type	Number+	Contamination Potential	Case Studies	Regulatory System*
5F1	16	2nd highest	No	N/A
5D2	4,162	3rd highest	Yes	Limited to depth of 100'.
5D4			No	
5A6	20	low	No	Permit required if water produced exceeds 5,000 gpd.
5A7		low	Yes	
5A8		N/A	No	
5A19		N/A	No	
5W9	6320	1st highest (5W9-12)	No	Rules resulting from the Mid-Multnomah Co. Plan & FWPCA Study. Individually permitted.
5W10			Yes	
5W11			Yes	
5W12		N/A	No	
5W20			No	

+Numbers were not reported according to the most recent breakdown of subclassifications.

Oregon
Page Two

*Permits are required for disposal of all wastes. Subsurface discharge requires a Water Pollution Control Facilities (WPSF) permit.

STRATEGY (DATE)	RESPONSE/ RATING
1. (1982) EPA contracted with the Dept. of Geology and Oregon State University to conduct an inventory and assessment.....	Incomplete
2. (?) Personal inquiries of employees of the DEQ and DWR were conducted.....	+
3. (?) Public notices were published in major newspapers throughout the state which informed the public of the necessity of reporting any underground injection activity.....	-
4. (?) Cities and counties involved with storm water disposal and sewage disposal were called upon to provide information.....	?
5. (?) Agricultural disposal well information was solicited from water masters located throughout the state.....	?

RECOMMENDATIONS:

(5W9-10-11) 1. The Department should continue to monitor the implementation of the order adopted by the Environmental Protection Quality Commission for the Mid-Multnomah County Area (see state report).

2. The Department should continue to implement its present control strategy for the communities of Central Oregon (see state report).

(5F1) 1. Inventory of disposal wells should be coordinated with the Dept. of Water Resources and Central Oregon Irrigation District.

2. Irrigation runoff quality data should be collected by the Department.

3. Guidelines for the construction and operation of irrigation disposal wells should be developed by DEQ and DWR.

4. The Central Oregon Irrigation district should encourage the use of pump back ponds and develop informational programs on proper irrigation practices.

(5D2-4) 1. Water quality data for storm runoff should be collected in the Bend area by either the Dept. or the city in lieu of a formal storm runoff study.

2. There should be guidelines and policies that will delineate the responsibilities of the Dept. and local governments for evaluating proposed storm drainage wells.
3. The City of Portland and Multnomah County should review their storm drainage well control program including usage, design, and siting of wells.
4. Guidelines should be developed for proposed drainage wells in newly developing industrial areas.
5. A monitoring program for both surface runoff and drainage wells should be implemented by the local authorities and coordinated with the Department.

Prepared: 2-17-87

Updated: 4-27-87

STATE REPORT SUMMARY

(All information recorded as described in state report,
additional correspondence, and verbal communication)

STATE: Washington STATUS: Primacy BIBLIOGRAPHY: Yes

TITLE: Class Five Injection Well Inventory

AUTHOR: Lawrence Goldstein, Washington Department of Ecology

DATE: 2-87 REPORT STATUS: Draft

RESPONSIBLE AGENCY(IES): Washington Department of Ecology

HYDROGEOLOGY: The occurrence, quantity, and quality of groundwater in Washington is closely tied to regional differences in climate, topography, surficial geology, and land uses. Descriptions of the geology and hydrology of Washington, which are provided in the state report, are based on approximately twenty principal aquifer regions.

INVENTORY AND ASSESSMENT: 14,242 wells FURS COMPATIBLE: No (8-20-86)

Type	Number	Contamination Potential	Case Studies	Regulatory System
5F1	66	Unknown (wells) High (chemigation)	No	Undecided
5D2	14,903	Mod to High	No	None
5D4	2,141	Mod to High	No	None
5A7/19	110	Low	No	Permit (county plan- ning codes) ^o
5W20	69	Unknown	No	N/A
5R21	7	Low	No	Permit
5N24	116	High	Yes	Permit
5X25	3	N/A	No	N/A
5G30	108	N/A	Yes	N/A
5W32	108**	Site-Specific	No	Permit ^o

^o Construction standards available

** Estimated total is 1,000

+ Natural Gas Storage & Municipal dewatering

Strategy (Date)

Rating/Response

(1981) Spokane Valley

1. In-house records search of county records N/A
2. City of Spokane records search.
3. Personal interviews with city and county utility design and maintenance personnel.
4. Field work using block by block, section by section, search method.

Washington
Page Two

(1981) Pierce County

1. Record search of county records.
2. Personal interviews with county engineers, technicians, public works employees, and field sanitarians.

(1981) Field Investigations

- (N/A) Public Notification of need to file construction and operation data, published in major daily newspapers and letter to Washington Well Drillers Association.

(1985) State Inventory

1. Public Notification - letter to county and city public works directors; follow up on phone calls.
2. Records searches of county and city records.
3. Personal interviews with public works directors and maintenance personnel, public utilities personnel, engineers, technicians, and private well owners.
4. Field Investigations.

RECOMMENDATIONS:

(5A7)

1. A concerted effort should be made to ensure proper construction of these wells and heat pump installations.
2. Permits for development of a commercial system should include requirements for water quality characterizations of both source and receiving water.
3. Records should be maintained by counties and periodically uploaded to the state water rights data management center in order to monitor well density.
4. Monitoring wells should be installed to track changes in water chemistry and temperature.
5. A policy of prohibiting new well installation in known or suspected contaminated aquifers should be developed and implemented by the state...This policy would be administered by local government, with the assistance of the department.

(5D2/4)

1. Further study is recommended in areas of (a) attenuation processes, (b) well design, (c) inventory of private wells, (d) specific industrial and commercial activities, and (e) land-use site characteristics.
2. Dry wells or other facilities discharging to the ground should not be allowed where they may be exposed to potentially contaminating industrial materials or discharges. Loading docks and material storage areas should be designed so that spilled materials cannot be washed, either deliberately or accidentally, into a drainage device discharging to the ground.
3. Commercial or industrial wastewaters containing chemicals should not be discharged to the ground without treatment. Current state waste discharge permits allowing this practice should be reevaluated.

4. Monitoring and regulatory activities should be increased, focusing on wells in areas of high contamination potential.

(5N24)

1. The department proposes to use the provisions of [the state waste discharge permit program (Chapter 173-216 WAC)] to authorize and take enforcement actions for discharges which do not satisfy the standard of all known available reasonable methods of treatment and control.
2. The disposal standard for cribs and french drains will be to treat the waste before discharge and not to rely solely on evaporation, the soils, and dilution to treat the wastes.
3. The number of permits issued and permit compliance and enforcement actions will be negotiated annually with Environmental Protection Agency through the State/EPA Agreement program planning process.

(5W32)

There is a critical need to establish a statewide monitoring system, inventory methodology, and database in order to evaluate design for existing systems, establish ambient water quality in vulnerable aquifer regions, and be able to quantify changes in critical parameters.

(5W20)

1. Until additional data is at hand to define the fate of industrial wastes in the saturated zone, it is prudent to taken extraordinary precautions to minimize the potential for aquifer degradation via injection of highly toxic substances.
2. Alternatives to land disposal such as recycling or resource recovery, reduction of wastes generated through process modification, and improved methods of hazardous waste neutralization should be actively pursued.