TECHNICAL PROGRAM OVERVIEW:

UNDERGROUND INJECTION CONTROL REGULATIONS

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DISCLAIMER: This document provides information to the States, tribes, underground injection well owners and operators, and the general public concerning how the United States Environmental Protection Agency (EPA) interprets the minimum federal requirements for the Underground Injection Control (UIC) program regulations authorized by the Safe Drinking Water Act. This document does not, however, substitute for the UIC regulations, nor is it a regulation itself. Thus, it cannot impose legally-binding requirements on EPA, States, tribes, or injection well owners or operators, and may not apply to a particular situation. This document is not intended, nor can it be relied upon, to create any rights enforceable by any party in litigation with the United States. EPA may decide to follow the interpretation provided in this document, or to act at variance with the interpretation based on its analysis of the specific facts present. This document may be revised without public notice to reflect EPA's revisions to existing UIC regulations, changes in EPA's approach to interpreting UIC regulations, or to clarify and update text.

Read the regulations thoroughly to ensure that you are in compliance. The UIC regulations are in the Code of Federal Regulations under Chapter 40, Parts 144, 145, 146, 147, and 148.

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Abbreviations

AOR	Area of Review
BLM	U.S. Bureau of Land Management
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CMA	Chemical Manufacturers Association
CWA	Clean Water Act
DI	Direct Implementation
EPA	U.S. Environmental Protection Agency
GAO	General Accounting Office
GWPC	Ground Water Protection Council
HSWA	Hazardous and Solid Waste Amendments
HWIR	Hazardous Waste Identification Rule
LDR	Land Disposal Restriction
LUST	Leaking Underground Storage Tank
MI	Mechanical Integrity
MIT	Mechanical Integrity Test
OAL	Oxygen Activation Log
OGWDW	Office of Ground Water and Drinking Water
OSWER	Office of Solid Waste and Emergency Response
PWS	Public Water System
RCRA	Resource Conservation and Recovery Act
RIA	Regulatory Impact Analysis
RTS	Radioactive Tracer Survey
SDWA	Safe Drinking Water Act
TDS	Total Dissolved Solids
UIC	Underground Injection Control
UIPC	Underground Injection Practices Council
USDW	Underground Source of Drinking Water
USFW	U.S. Fish and Wildlife Service
USFS	U.S. Forest Service
UST	Underground Storage Tank
UTS	Universal Treatment Standards

INTRODUCTION

This document provides an overview of the minimum regulations which are the basis of the U.S. Environmental Protection Agency's (EPA) Underground Injection Control (UIC) Program. Development of these minimum standards by EPA, was required by Federal statute (Safe Drinking Water Act, signed into law December 17, 1974). Congress intended for EPA to establish a Federal-State system of regulation to assure that drinking water sources, actual and potential, are not rendered unfit for such use by underground injection of contaminants[1].

The main text and Appendices describe the major classes of injection wells, important definitions, the associated technical and administrative requirements, and an extensive list of UIC Program related references. The intended audience includes operators, UIC program staff, Resource Conservation and Recovery Act (RCRA) and Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) program staff, and other individuals who are interested in an overview of the UIC Program requirements, without spending a great deal of time studying the regulations. However, it is necessary to read the applicable State or EPA regulations and, if available, the site specific UIC permit itself to fully understand the specific requirements for a given injection well facility. The general technical and regulatory requirements presented here represent the minimum Federal requirements that apply to UIC programs being implemented by States as well as those programs directly implemented (DI) by EPA.

This document is not a regulation. Thus, it cannot impose legally-binding requirements on EPA, States, Territories, authorized Tribes or the public. To the extent this document summarizes statutory or regulatory requirements, and anything in that summary is in conflict with the statutes or the regulations, the statutes and regulations control. The Reader of this Program Overview should remember that decision makers retain the discretion to adopt approaches on a case-by-case basis that differ from this document where appropriate. As necessary and appropriate, EPA may change this Program Overview in the future.

The Appendices contain supplemental information for those persons who want more details on the specific aspects of the regulations and technical criteria for individual well types. Appendix A, for instance, provides a broad list of specific references relating to the injection of fluids. These references range from general background information to reports on specific topics, such as mechanical integrity, well construction, Class V wells, etc. The remaining Appendices provide specific technical details regarding underground injection:

1. Appendix A - Provides a broad list of specific UIC related references and guidance;

2. Appendix B - Defines the major program definitions;
3. Appendix C - Describes classes of injection wells;

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[1] For more information on Congressional intent, see House Report No. 93-1185, July 10, 1974, Section 1421, in A Legislative History of the Safe Drinking Water Act, February 1982, Serial No. 97-9.

4. Appendix D - Describes the fluids that might be injected into Class II wells;

5. Appendix E - Describes the major technical requirements by injection well class;

6. Appendix F - Typical issues and questions that Permit applications must address; and

7. Appendix G - Lists the types of Class V wells identified by the 1987 Report to Congress.

PURPOSE AND COVERAGE OF THE UIC PROGRAM

Over the past 50 to 60 years, the practice of underground injection has become diverse in its many applications and is essential to many human activities, including petroleum production, chemical production, food production, manufacturing, mining, and many small specialty plants and related businesses. The use of underground injection has expanded from disposal of mainly produced brine from oil production 60 years ago to include more than 50 percent of the liquid hazardous waste and a large percentage of the non-hazardous industrial liquid waste generated in the United States (US). Facilities across the United States and in Indian Country discharge a variety of hazardous and nonhazardous fluids into more than 375,000 injection wells (FY 2000 National Injection Well inventory identifies about 375,000 known wells in all five categories, but experts believe there may be an additional 400,000 to 500,000 Class V wells not yet counted). While water and specific chemical treatment technologies exist, it would be very costly to treat and release to surface waters the billions and trillions of gallons of wastes that industries produce each year. Agribusiness and the chemical and petroleum industries all make use of underground injection for waste disposal. It is also a key component in the recovery of some natural resources, such as uranium (over 80% of the Nation's production) and salt (over 90% of the Nation's production), and in the remediation of shallow ground-water contamination at numerous mining, RCRA, CERCLA and leaking underground storage tank (LUST) sites.

Within the last few decades, the realization that subsurface placement of fluids could contaminate ground water prompted the Federal government, many States, and now Indian Tribes to develop programs and methods to protect underground sources of ground water being used for drinking water purposes. This threat to ground water is demonstrated by a 1968 incident associated with the over pressurization of the formation caused by an injection well at the Hammermill paper company. This incident may have resulted in ground-water contamination in an area about five miles from the injection well. In 1967, the U.S. Army Corps of Engineers and the U.S. Geological Survey (USGS) determined that a deep, hazardous waste disposal well at the Rocky Mountain Arsenal was causing significant seismic events in the vicinity of Denver, Colorado. In 1975, a deep injection well at an unnamed chemical company was closed because a casing leak resulted in contamination of an underground source of drinking water (USDW). More recently, contamination of shallow aquifers as a result of disposal of wastes into shallow injection systems, such as drain fields and drywells, has led to further concern and the development of regulations to attempt to address those identified problems. This was the case regarding the contamination in an unsewered residential area north of Boulder, Colorado, where a large area with a number of shallow drinking

water wells was found to have been contaminated. The contamination was linked to disposal of industrial wastes into a drainfield from a circuit board manufacturing plant. In the 1980s, drywells associated with runoff control for parking lots at several electronics plants in the Phoenix, Arizona were identified by State and Federal investigators as having received large quantities of spent solvent. This activity resulted in significant ground-water contamination of the shallow aquifer. Such problems can, however, be avoided. When wells are properly sited, constructed, and operated, underground injection is an effective and environmentally safe method to dispose of wastes.

Due to disparate levels of protection afforded ground water under the State injection well programs at the time, Congress passed the SDWA of 1974 (as amended in 1976, 1977, 1980, 1984, 1986 and most recently re-authorized and amended in 1996) requiring EPA to establish a Federal - State system of regulation of injection activities[2]. Several documents (see Appendix A, General Information) have been published that provide a general picture of the need, use, operation, and regulation of injection wells, including the **Statement of Basis and Purpose of Underground Injection Control Regulations** (1979)[3]. The regulations written by EPA to implement the statutory requirements of the SDWA establish minimum requirements for State, Tribal and Federal UIC programs[4] for controlling all injection activities and provide mechanisms for implementation and authorization of primary enforcement authority. State and Tribal governments can apply for primary enforcement authority (primacy) for the UIC Program under the procedures provided in Federal regulations (Title 40 Code of Federal Regulations (CFR) Part 145). For a State to assume primacy and receive implementation funding, the State must demonstrate (Section 1422 of the SDWA) that it has authority over injection activities on Federal lands (except for Indian Country[5]). Should States or Tribes decide not to seek primacy, EPA implements the program (See House Report No. 93-1185, July 10, 1974 and Section 1421 of the SDWA).

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[2] See Administrator's Statement #5 (**39FR12923, Tuesday, April 9, 1974**) that established the Agency's position on injection and described data operators must provide regulatory agencies and Section 1421 of the SDWA, December 16, 1974, as amended.

[3] This document was published as part of the effort for the 1979 reproposal of the UIC regulations. When the regulations were finalized in 1980 an expanded Statement of Basis and Purpose was published.

[4] In those areas where the Federal program is being Directly Implemented by EPA under applicable regulations, there also may be separate State, other Federal Agencies or Tribal regulations that establish additional requirements. Operators are required to comply with all the Federal, Tribal, State and Local requirements. On Federal leases administrated by the U.S. BLM and the U.S. Forest Service, Operators are required to comply with both sets of Federal regulations (See Appendix A, UIC Specific Regulations, items 9 and 10).

[5] "Indian Country" is defined at 18 U.S.C. 1151. The DI program regulates all wells within the external boundaries of the Reservation (Indian Country-See 40 CFR 144.3). This includes wells on private land and private mineral rights if the location is "Indian Country."

The goal of Federal regulations is to prevent contamination of "underground sources of drinking water" (USDW). A USDW is defined as an aquifer, or its portion, which serves as a source of drinking water for human consumption, or contains a sufficient quantity of water to supply a public water system, and contains fewer than 10,000 mg/liter of total dissolved solids. Appendix B, Item 25, provides the regulatory definition of a USDW[6]. The broad definition of a USDW was mandated by Congress in Section 1421 (d) (2) of SDWA (See House Report No. 93-1185, July 10, 1974) to ensure that future USDWs would be protected, even where those aquifers were not currently being utilized as a drinking water source or could not be used without some form of water treatment.[7]

Because some aquifers or parts of aquifers (which would otherwise meet the regulatory definition of a USDW) may not reasonably be expected to serve as a source of drinking water, the regulations are written to allow EPA to exempt portions of an aquifer from definition as a USDW and thus allow continued or future injection into them. These aquifers are generally associated with in-situ mining and enhanced recovery of oil. Appendix B, Item 2, provides the criteria for the exemption process. If an operator wishes to dispose of produced waters or inject for the purpose of enhanced recovery or for the recovery of minerals into a USDW, a demonstration must be made that the proposed aquifer meets at least one of the exemption criteria. EPA has issued two guidance (Ground-Water Protection Guidance #34 and an unnumbered guidance memo from the Director of the Office of Drinking Water to all Regional offices dated September 3, 1986) that provide details on the information which should be developed for an aquifer exemption request (See Appendix A, National UIC Program Guidance, section 1).

Regulations mandate the consideration of a variety of measures to assure that injection wells will not jeopardize (endanger) USDWs. The concept of endangerment is explicitly defined at 40 CFR 144.12 as the construction or operation of an injection activity that allows movement of fluid containing any contaminant[8] into USDWs if the presence of that contaminant may cause a violation of any primary drinking water regulation under 40 CFR Part 141or may otherwise adversely affect the health of persons. Part 141 establishes drinking water standards for various constituents (i.e., maximum contaminant levels [MCLs]) found in water.

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[6] The determination as to whether an aquifer meets the definition of a USDW as outlined in Appendix B, item 25 depends on the amount of water (significant) that can be produced. EPA has developed a policy for defining the term significant (See Appendix B, item 22).

[7] The use of advanced water treatment of ground water by existing and future water systems was discussed during the 1980 litigation of the UIC regulations. Information on some systems in use at the time of promulgation is provided in Desalination of Brackish Ground Water by Claire M. Gesalman: U.S. EPA, Office of Drinking Water, 4 pages; no date (Material prepared for the 1980 UIC Promulgation Litigation).

[8] Contaminant means any physical, chemical, biological, or radiological substance or matter in water.

Exceeding an MCL (See 40 CFR 141) at the point injected fluids enter a USDW would be cause for the Director[9] to determine if the prohibition of fluid movement has been violated. This is an especially critical issue for injection wells disposing of non-hazardous waste (fluids that contain contaminants not defined as hazardous under 40 CFR Part 261) directly into a USDW (See 40 CFR 144.12[c]). Operators of such wells could be required to obtain an injection well permit, modify the injection procedure to reduce contaminant levels, or cease injection and close the well.

The endangerment of USDWs can occur via any combination of at least six avenues - described here as "pathways of contamination" - ways in which fluids can escape the well or injection horizon and enter USDWs. These "pathways" are the following:

1. Migration of fluids through a faulty injection well casing (See Figure 3);
2. Migration of fluids upward through the annulus located between the casing and the drilled hole (See Figure 3);
3. Migration of fluids from an injection horizon through the confining zone (strata);
4. Vertical migration of fluids through improperly abandoned or completed wells (See Figure 2);
5. Lateral migration of fluids from within an injection zone into a protected portion of that stratum (a portion that is defined as a USDW); and
6. Direct injection of fluids into or above an underground source of drinking water (See Figure 1).

The extent to which a USDW is threatened will depend on the nature of the fluids being injected, the volume of the fluid being injected the hydraulics of the flow system (pressure in the injection zone and overlying USDWs), and the amount of fluid that may enter the USDW via one or more of the pathways. The injection of a hazardous waste into a poorly constructed well would pose a high potential threat of endangerment to USDWs, while the injection of high quality river water directly into a USDW using a recharge well may represent a low threat. Regardless, however, of the level of threat, all owners and operators of all injection wells fall under the regulatory control of the UIC Program, and are authorized either by rule (See appendix B,) or by Permit, except for those activities specifically excluded from regulation by 40 CFR 144.1 (g) (2), such as injection wells used for injection of hydrocarbons which are of pipeline quality and are gases at standard temperature and pressure for the purpose of storage [See 40 CFR 144.1(g)(1)(iv)]. Individual or single family residential waste disposal systems are also excluded from the UIC Program [See 40 CFR 144.1(g)(2)(ii) and House Report **No. 93-1185**, July 10, 1974].

UIC regulations separate injection wells into distinct categories to assure that wells with common design and operating technique are covered by similar or identical performance criteria. The sections of the CFR applicable to the UIC Program are listed in Appendix A, UIC Specific Regulations.

UIC PROGRAM WELL CLASSIFICATION

[9] Director means the Regional Administrator, the State Director as the context requires, or an authorized representative for the Primacy or DI UIC Program.

EPA's UIC Program creates five classes of injection wells each based principally on potential for the injection to (type of activity and the depth of injection) to result in endangerment of a USDW. Appendix C provides the regulatory definitions of all five classes of wells along with examples of each. The principal factor used to define each class is the type of activity and general nature of the fluids associated with that activity (except for Class V): a) injection of hazardous, industrial, and municipal waste; b) injection related to the production of oil and gas; c) injection related to the recovery of minerals; and d) other injection related to activities where data are insufficient to evaluate the threat to ground water (where fluids are not hazardous, but may still pose a threat). A secondary factor used in classification is the location (depth) of the injection relative to USDWs.

Class I wells, for example, inject hazardous, non-hazardous industrial or municipal waste, and radioactive waste, below the lowermost formation containing a USDW within one quarter mile of the wellbore. Class II wells inject, for the purpose of disposal, fluids produced from downhole that are associated with oil and gas production as well as fluids associated with the operation of natural gas storage operation, methane gas dehydration and sweetening plants. The Class II category also includes wells used for the enhanced recovery of oil and gas and the storage of hydrocarbons that are liquids at standard temperature and pressure. Class III wells are for in-situ extraction of minerals. Class IV wells inject hazardous or radioactive waste fluids into or above USDWs and are prohibited except in specific cases. The Class V category includes all other wells not covered in Classes I-IV.

As of 1999, the Class I category consisted of about 532 active wells which inject hazardous and nonhazardous industrial and municipal waste. This total included 406 non-hazardous Class I wells. Of the total number of Class I wells, 126 wells inject large volumes of hazardous fluids. For instance, in 1994, these Class I hazardous waste wells injected approximately 9 billion gallons of waste. As of 1999, there were 84 Class I wells injecting municipal waste at a rate of about 350 million gallons per day. These well numbers compare to a total of 485 Class I wells in 1991 (310 were non-hazardous).

A large number of injection wells are associated with disposal of fluids from oil and gas production and injection to enhance oil and gas production (secondary and tertiary recovery injection wells). These wells (See Appendix D) are defined as Class II wells. The injected fluids are either: waste fluids produced from downhole in connection with primary production of oil and gas, some fluids generated in the field in connection with oil and gas production (such as gas sweetening), or fluids used for enhanced recovery of oil or gas. Appendix D provides a list of the general categories

of Class II fluids. It should be emphasized that unused oil field chemicals, waste motor oil from field equipment or offsite waste fluids are not defined as oil field fluids that are produced from downhole and cannot be disposed of in a Class II well. The two largest injection well groups are the Class II (oil production related activities) and the Class V (shallow injection) activities. As of 1999, there were approximately 154,000 Class II wells in 32 states, including those wells on Tribal Lands. As a means of providing some sense of the fluctuation in Class II well numbers, the National inventory indicated 175, 464 wells in 1991, 166,771 in 1995, and about 148,000 in 2000.

Wells injecting fluids for mineral extraction are defined as Class III wells. This includes: solution mining of salts; in situ extraction of metals, such as uranium; and mining of sulphur by the Frasch process. Solution mining of metals within a conventional mine (such as stopes leaching) is not considered to be a Class III operation. Wells associated with mineral extraction within a conventional mine are regulated as Class V wells. At present, most active Class III facilities are associated with the solution mining of uranium, and the solution mining of salt. At this time, there has been a significant decline in the number of wells used for the extraction of sulphur. The Class III category included about 15,000 wells in 1999, at approximately 148 facilities. This increased slightly in 2000 with 16,577 wells at 164 sites, but is greatly reduced from 1991 when there were 30,027 wells at 207 facilities

An important factor for classifying wells is the source and chemical makeup of the fluid injected. A key factor is whether the fluid is hazardous. The definition of a hazardous waste is set forth in RCRA regulations under 40 CFR 261. A fluid may be hazardous if it exhibits one of four characteristics (corrosive, reactive, ignitable or toxic) or if it is a listed waste as defined in 40 CFR Part 261 Subpart D. If a well is injecting hazardous fluids into a USDW, it would be defined as Class IV and would be subject to immediate closure. Class IV wells used in remedial cleanups at EPA or State approved CERCLA and RCRA sites, however, are allowed as long as the final cleanup standards are protective of human health and the environment (See Appendix A, National Program Guidance-Section 3.g.).

According to the regulatory definition (See 40 CFR 144.80(e) and 144.81), Class V wells are any injection wells that: 1) emplace fluids into the subsurface; and 2) do not meet the definitions of a Class I-IV well (See 40 CFR 146.5). This category is predominantly shallow injection wells and includes infiltration galleries, drainfields and any other subsurface fluid distribution system or improved sinkhole. Class V does include a few deep wells (including one injecting at a depth of 14,000 feet). **Any septic system, cesspool, or other well used by a multiple dwelling, community, or regional system for the injection of wastes is covered by the UIC Program unless the system has the capacity to serve fewer than 20 persons a day and is used <u>solely for the disposal of sanitary wastes</u>** [See 40 CFR 144.1(g)(1)(iii) and 40 CFR 144.1(g)(2)(iii)].

Figure 1 illustrates the UIC well classification system by diagraming a situation at an old existing facility (constructed and commenced operation prior to implementation of EPA's UIC Program) involving Class I, and IV disposal wells. While the Class I well could be permitted under the UIC program, the disposal of a hazardous waste into or above a USDW is specifically prohibited by the regulations and by provisions of RCRA. Existing Class IV wells were required to cease operating and close within six months of implementation of the UIC Program. Failure to comply

with the operating, reporting, or closure requirements would subject the owner/operator to the enforcement and penalty stipulations of SDWA. Construction and operation of new Class IV wells is not allowed except for remedial cleanup wells associated with EPA or State approved CERCLA and RCRA cleanup activities (see Appendix E, Item 5).

If the shallow wells (described in the situation above) injecting into or above USDWs (as shown in Figure 1) are, however, injecting non-hazardous fluids, they would be defined as Class V. Class V wells are located in virtually every State, especially in unsewered areas where the population is likely to depend on onsite waste disposal for their wastewater and ground water for their drinking water. Frequently, these wells are designed as no more than shallow low-tech (gravity drainage) systems, such as dry wells (also referred to as vadose zone wells) or septic tank and leachfield combinations intended solely for sanitary waste disposal. Generally both large and small towns handle their storm runoff by the use of large numbers of drywells. This practice is not limited to unsewered areas. The drywells are used as a less costly alternative to the installation of storm water collection systems. While such designs may be adequate for disposal of general storm water or sanitary waste, they are not appropriate for the disposal of many other fluids, such as service station wastes or some industrial complex runoff. Sometimes these systems are inappropriately used for this purpose. Federal, State and local regulators have identified ground-water contamination that is linked to improper disposal of industrial wastes into drywells and drainfields around the country.

Under the Federal regulations, all Class V wells (with the exception of large capacity cesspools and motor vehicle waste disposal wells) are "authorized by rule" (40 CFR 144), which means they are allowed to inject if they comply with the minimum Federal requirements. The most important of these requirements is that Class V wells are not allowed to endanger USDWs. Existing and new Class V wells are allowed if the operator complies with the notification and inventory requirements, and the Director determines that injection will not endanger USDWs. The changes to the Class V regulations (See 40 CFR 144.88) published in **64FR68456, December 7, 1999**, require the closing of all large-capacity cesspools by April 5, 2005, and the closure or permitting of existing motor vehicle waste disposal wells no later than Jan. 2008. New construction of these two well types is prohibited.

The Class V injection well category includes drainfields and other subsurface distribution systems, except those disposing of sanitary waste that serve single family homes. The 2000 regulatory ban/phase-out of motor vehicle waste disposal wells applies to residential homes if vehicle maintenance waste is being discharged into a septic or other subsurface system. The drainfield is a single or multiple trench system filled with gravel that is covered at the surface. Water is introduced to the drainfield through a pipe system from the waste stream source. The Class V category is a catch-all for numerous types of allowable subsurface emplacement practices. The 1987 Report to Congress on Class V Injection Wells-Current Inventory, Effects on Ground Water and Technical Recommendations (See appendix A for specific references on Class V wells) identifies 32 different types of Class V injection wells found throughout the country. Appendix G is

Table 1
SUMMARY OF MINIMUM FEDERAL REGULATORY REQUIREMENTS BY CLASS OF INJECTION WELL

Class	Permit Required	Life of Permit	Area of Review	Mechanical Integrity Test required		Other Tests	Monitoring	Reporting
				Part I (Internal)	Part II (External)			
I H	Yes + Land Ban Petition (see 40 CFR 148)	Up to 10 years	2 mile minimum for hazardous waste wells.	Pressure test annually and after each workover	A temperature, noise or other approved log at least every five years	Yearly radioactive tracer survey, yearly Fall-off test, casing inspection log after each workover, continuous corrosion testing	Continuous injection pressure, flow rate, volume, temperature, and annulus pressure + fluid chemistry + ground-water Monitoring as needed	Quarterly
I NH	Yes	Up to 10 years	1/4 mile minimum	Pressure test or alternative at least once every five years	Each 5 yrs	Fall-off - Annually	Continuous injection pressure, flow rate, volume, and annulus pressure + fluid chemistry and yearly pressure falloff test	Quarterly
II	Yes except for existing EOR wells authorized by rule	Specific Period- may be for life of well	New wells- 1/4 mile fixed radius or radius of endangerment	Pressure test/at least once every five years	Adequate Cement records may be used in lieu of logs	annual fluid chemistry and other tests as needed/required by permit	Injection Pressure, flow rate and cumulative volume, observed weekly for disposal and monthly for enhanced recovery	Annual
III	Yes	Specific period- may be for life of project	Yes- either 1/4 mile fixed radius or radius of endangerment	initially and every five years for salt wells	Adequate cement records and RTS, noise, or Temperature unless limited by construction	As needed/required by permit	Continuous injection pressure, flow rate, volume, and fluid chemistry +Ground-water monitoring as required	Quarterly
IV	Banned except for those authorized under 40 CFR 144.13(c)	Closed upon identification unless authorized cleanup projects	No new wells are allowed except those that are part of an EPA or State approved RCRA or CERCLA cleanup and meets the criteria of Section 7010(b) of HWSA (1984). EPA must review and approve technical plans. Monitoring for system performance may be necessary. The cleanup plan must be designed to be protective of human health.					Closure or compliance report on schedule
V	Authorized by rule unless Permit required by 40 CFR 144.12(c) and (d) or 144.84, 144.88 and 144.89.	Following an assessment of Class V wells in 1987 (See Report to Congress Class V Injection Wells-Current Inventory, Effects on Ground Water and Technical Recommendations by Office of Water: September 1987, 435 pages (main text); EPA 570/9-87-006), EPA commenced an effort to develop regulations covering certain types of wells, such as large-capacity cess pools and motor vehicle waste disposal wells. This effort included a more detailed assessment of certain well types which was published in 1999 (See Class V Underground Injection Control Study, Office of Water: EPA/816-R-99-014, September 1999; 23 volumes and 5 Appendices [see **http://www.epa.gov/safewater/uic/cl5study.html**)] The new Class V regulations were published in the **Federal Register** on December 7, 1999, and were effective on April 5, 2000. The new rules include new definitions for wells; clarifies the Class V inventory requirements (40 CFR 144.83); moves a Class V subclass into another class; bans new large capacity cesspools and new motor vehicle waste disposal wells; and establishes a phase-out process for existing large capacity cesspools and motor vehicle waste disposal wells.						Required for permitted wells. All wells must be inventoried per 40 CFR 144.83

a list of these well types. This report was followed up by a 23 volume study of certain Class V wells completed in 1999. The subsequent regulations relating to Class V wells **(64FR68546, December 7, 1999)** was based in large part on the Report to Congress. The follow up

studies will be utilized to determine if further Class V Rules are needed.

The Class V group officially contained more than 200,000 wells in 1999. This is a far from complete number partially because of the shortage of funding to locate existing facilities. Experts familiar with inventory efforts believe that the Class V well numbers could approach 500,000 to1 million wells when the a consistent National inventory is completed.

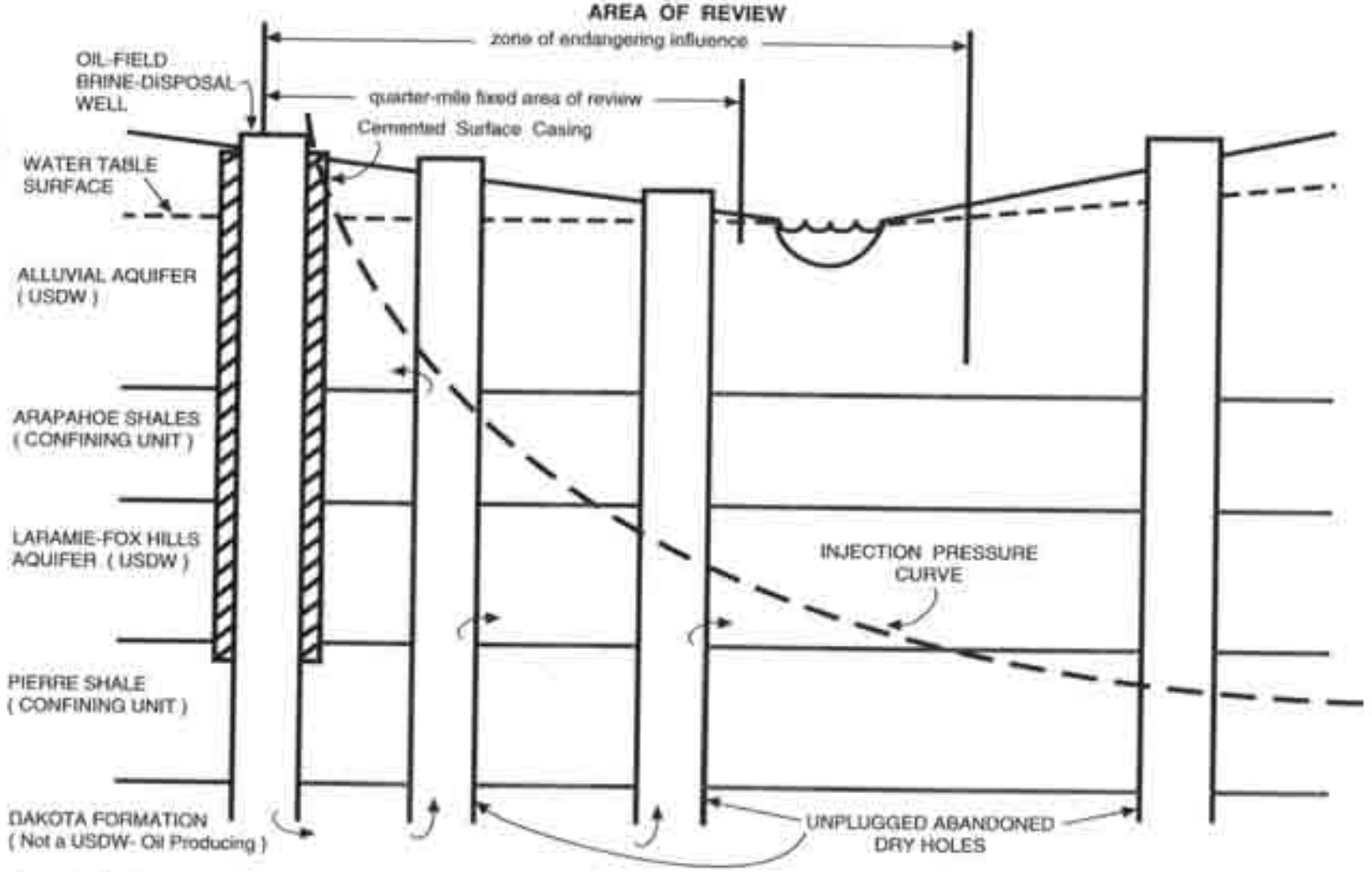
AUTHORIZATION OF INJECTION WELLS

The UIC regulations at 40 CFR Part 144 establish two methods for authorization to site, construct, operate, monitor and close an injection well - authorization by rule or by permit. Rule authorization is a regulatory mechanism established by 40 CFR 144.21 through 40 CFR 144.28 that provides a means of authorizing the operation of some injection wells. These sections cover Class I II and III injection wells existing when the UIC program was implemented by either a State or EPA and Class V wells for which there are no specific operational requirements other than a need to provide inventory information. Wells authorized by rule are subject to the specific requirements set by the regulations, but the operator is not subject to the public participation and other procedures that are necessary to obtain a Permit. Unless authorized by rule or by Permit, any underground injection is unlawful and is in violation of the Safe Drinking Water Act (SDWA). All wells existing on the effective date of State primacy or EPA implementation received authorization by rule; however, the UIC Director may revoke this authorization for failure to comply with any UIC regulation, including requests for information under 40 CFR 144.27. Appendix B, Item 6 provides specific details on the regulations relating to rule authorization.

All Class I wells, Class II disposal wells, and Class III wells existing on the effective date were required to apply for a permit during the first five years of UIC program implementation. Class II enhanced recovery wells existing at the effective date of implementation of the UIC Program maintain rule authorization for the life of the well, provided the owner/operator complies with regulations relating to rule authorization. Every new Class I well, Class II (including enhanced recovery) well, and Class III well is required to apply for and receive a Permit prior to construction or injection.

Although Class V wells have generally been authorized by rule, the owner/operator of a Class V well must notify the UIC Director of the proposed or existing activity and provide certain inventory information. This includes remedial cleanup wells being proposed for LUST, CERCLA, or RCRA sites. The Director may, based on this information, determine that a permit is needed to assure protection of USDWs (40 CFR 144.12[c]-[d]). Additional regulations specific to Class V wells became effective April 2000, and are presently being implemented. These additional rules require the phase-out of existing large capacity cesspools and existing motor vehicle wells and a ban on new large capacity cesspools and motor vehicle waste disposal wells.

Figure 2
AREA OF REVIEW



Note : The Figure illustrates how the zone of endangering influence can extend past the quarter-mile fixed area of review.
The zone of endangering influence is the region where injection pressures may force fluid out of the intended injection reservoir into a USDW.

UIC REGULATORY FRAMEWORK - TECHNICAL CRITERIA

The UIC regulations establish specific performance criteria for each well class to assure that drinking water sources, actual and potential, are not rendered unfit for such use by underground injection of the fluids common to that particular category. Table 1 summarizes the minimum Federal requirements for the five classes of wells. As shown on Table 1, Class I, II and III permitted wells have two major technical requirements that are similar: 1) a mechanical integrity testing requirement is established to assure that leaks do not result in significant movement of fluids into a USDW (pathways one and two, as defined previously); and 2) an area of review requirement is established for new wells to assure that existing, improperly completed, and abandoned wells or transmissive faults or fractures within that area [area of endangering influence] do not provide avenues for vertical migration into USDWs (pathways three and four).

Although the technical requirements for Class I, II, and III wells are similar, there are differences warranted by the nature of the waste, well design, and operational characteristics. The specific regulations which address each well class are found in 40 CFR 146, 147, and 148. Appendix E summarizes the major technical criteria for all classes of wells. This appendix covers requirements common to all permitted wells and those specific requirements associated with each of the five well classes.

Figure 2 is an illustration of the potential problems associated with improperly plugged wells or other well bores that penetrate the injection zone within the area of endangering influence (area of review) of the injection well[10] (See Appendix A, General Information and Appendix B, Item 3). The zone of endangering influence defines the area where the injection reservoir pressure under the influence of injection activity could cause fluid to move into a USDW. The radius of endangering influence is defined as the point where the injection pressure curve intersects the base of the lowermost USDW. The injection pressure curve represents the level to which fluids from the injection zone would rise in a hypothetical well at a given location. As shown on Figure 2, it is possible that the area of endangering influence may exceed the minimum fixed radius for the area of review established in the regulations. In such cases, the calculated zone of endangering influence becomes the area of review, within which all wells penetrating the confining zone must be identified.

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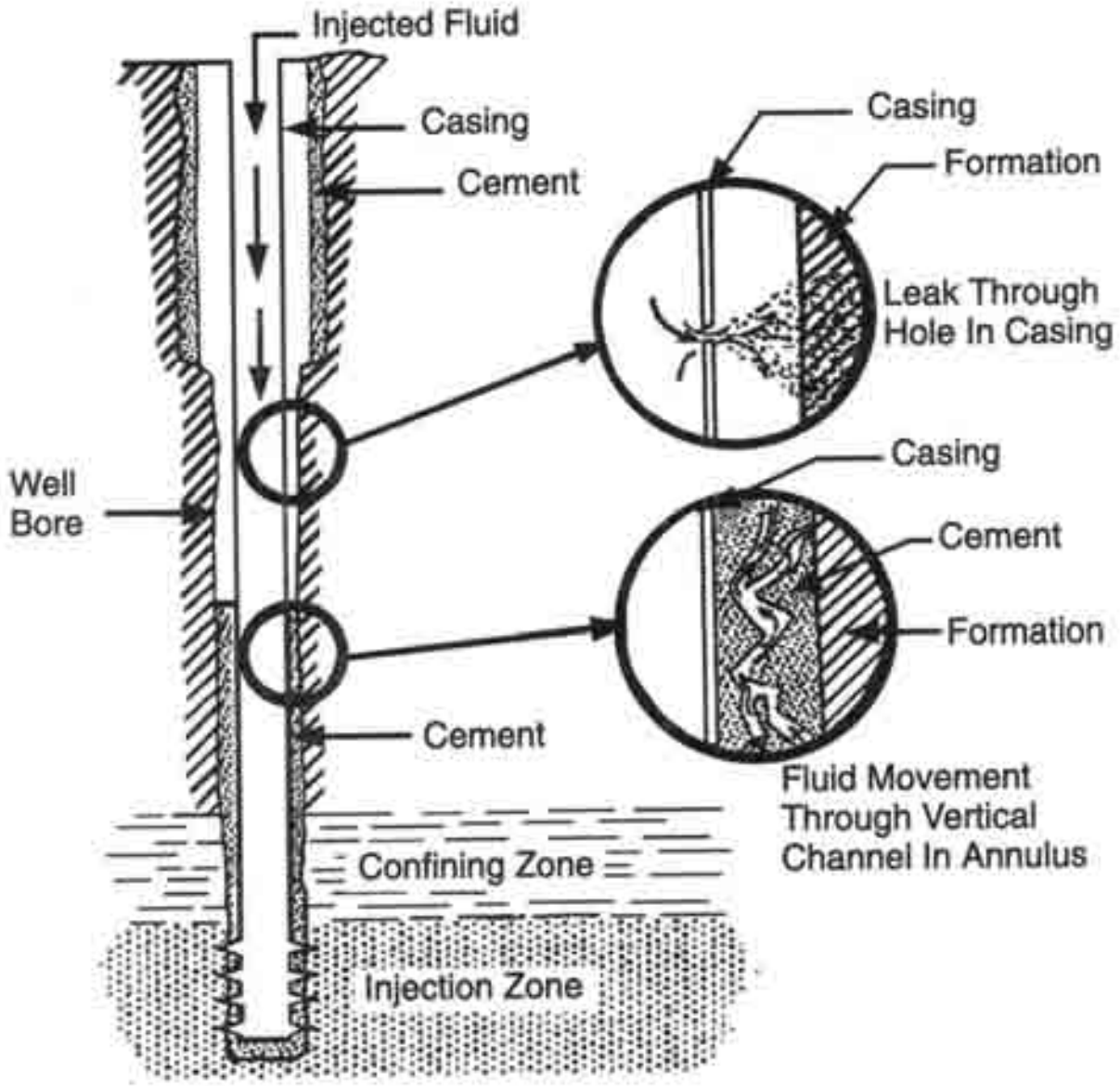
[10] The area of review concept as applied to Industrial disposal is discussed in an Master of Science Thesis: Determining the Area of Review for Industrial Waste Disposal Wells by Stephen Eugene Barker: The University of Texas at Austin, December 1981. The U.S. EPA also had a Guidance Document for the Area of Review prepared under the UIC Level of Effort contract: Guidance Document for the Area of Review Requirement by Engineering Enterprises: U.S. EPA, Drinking Water Branch, May 1985. This was followed by a compendium of memorandums and associated information on the development of the Area of Review concept: Area of Review Material assembled by A. Roger Anzzolin: U.S. EPA Drinking Water Branch, April 4, 1985.



Means by which injection wells may demonstrate
a lack of mechanical integrity.
Figure 3

Figure 3 illustrates the other principal pathways of contamination (pathways 1 and 2): failure of a well's mechanical integrity. A well does not have mechanical integrity if: 1) there are significant leaks in the casing; or 2) there is significant fluid movement into a USDW adjacent to the well casing. Item 15 of Appendix B provides a detailed discussion of the principles behind the mechanical integrity requirement. Figure 4 illustrates the typical design elements of a standard Class II injection well which are utilized to assure protection of USDWs. The absence of leaks in the tubing, casing, and packer can be determined by pressure testing the casing/tubing annulus while the well is shut-in. The references in Appendix A, Well Construction section and Mechanical Integrity and Formation Testing section, also provide extensive information on the topic.

UIC PERMITTING PROCESS

To obtain a permit for a new Class I, II or III well, the owner/operator must file an application with the UIC Director containing specific information listed in 40 CFR 146 or in the applicable State requirements. The information must provide sufficient data to demonstrate that USDWs will be protected. The key areas of information are: 1) geological considerations used in the well siting and design, especially information on all USDWs penetrated by the injection well; 2) the structural integrity of the well; 3) the specific operational considerations used in well design; 4) information on the status of wells in the area of review that penetrate the injection zone; and 5) the proposed monitoring of the facility. The monitoring program must consider quantity and quality of injected fluids and existing reservoir conditions. Operators must submit data on all existing and abandoned wells that penetrate the injection zone within the area of review of all newly drilled or converted injection wells. Information that would allow calculation of the injection pressure curve must be submitted. This submittal must detail the casing and cementing information for all wells in the area of review. The Director uses this information to determine if wells in the area of review require corrective action prior to commencement of injection. The applicant must also provide an appropriate demonstration of financial responsibility for operation and closure of the facility. Appendix F provides a list of typical issues and questions that must be addressed by the application for each of these four well categories. It should be noted that the Director may require the owner/operator of any existing or proposed Class V well to apply for a permit if injection might exceed any drinking water MCL or endanger human health.

Once the application has been reviewed, the applicant will be notified of the items needed for a complete application, if any. When the complete application is on hand, a draft permit decision to issue or deny the permit will be prepared and published with appropriate public notice and participation. The public notice period is a minimum of 30 days. Any one may request that the Director hold a public hearing to provide further opportunity for commentors to provide objections or information regarding the proposed permit. If the Director determines that there is sufficient reason for a hearing, a notice of the hearing must be issued for minimum period of 30 days. Any comments received during this period will be addressed in the final permit decision. When the Final Permit is prepared, it may be issued effective immediately if there have been no comments during the Public Comment period.

If there have been comments , including any from the applicant, the Permit will have an

effective date of 30 days after issuance. This provides time for an appeal to be filed. Only those parties commenting on the draft decision have legal standing to appeal the final decision, and must limit their grounds for appeal to those matters brought forth during the public comment period.

Owners/operators obtaining UIC permits from an EPA or state program for wells on Federal leases must obtain the necessary approval stipulated by the lease and by appropriate BLM on-shore oil and gas orders. Although the technical requirements of EPA's UIC Program (as implemented by the State, Indian tribe, or EPA) establish requirements for construction, operation, and abandonment of all injection wells, the BLM has authority to assure compliance with all lease restrictions and other requirements of its regulations relating to oil and gas production. The operator must, however, have an effective State or EPA UIC permit prior to actually drilling or converting a well which has BLM authorization. The BLM policy regarding the interaction of the UIC Program with its onshore oil and gas program is articulated by Instruction Memorandum No. 83-631 (Appendix A, National UIC Program Guidance), section 1 (f).

CLASS I LAND DISPOSAL RESTRICTIONS

In addition to the normal and customary UIC permitting process, which may be done by the Regional office for direct implementation programs, or by the States in Primacy programs, injection of hazardous waste into Class I injection wells requires a significant additional step implemented only at the Regional EPA level. The owner/operator must apply for both a UIC Class I Hazardous Permit and an exemption to the requirements of the 1984 Hazardous and Solid Waste Amendments (HSWA) to the Resource Conservation and Recovery Act (RCRA). This process, commonly referred to as "land ban" petition, is implemented under the 40 CFR Part 148 regulations promulgated in response to HSWA. The HSWA amendments imposed significant restrictions to land disposal of hazardous waste[11]. Under a public noticed procedure, EPA has and continues to place specific types of hazardous waste identified in Part 261 on a schedule for compliance with HSWA land ban restrictions. After the specific scheduled date, the continued land disposal of said hazardous waste is illegal (a so-called "ban date"), unless EPA grants an exemption to the "land ban." Injection is specifically included as a form of land disposal, so after a "ban date" is established for any given hazardous waste, the only manner in which that hazardous waste can be allowed to be injected is under a land ban exemption. To qualify for such an exemption, the owner/operator must demonstrate to a reasonable degree of certainty, that there will be no migration of hazardous constituents from the injection zone for as long as the waste remains hazardous.

For the UIC program, the additional Part 148 requirements specify that an operator must

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[11] Material defined as hazardous in 40 CFR Part 261 is either a characteristic waste or a specific listed waste. The four characteristic tests are: a) ignitability as defined by 261.21(a); b) corrosivity as defined by 40 CFR 261.22(a); c) reactivity as defined by 40 CFR 261.23(a); and d) toxicity as defined by 261.24(a). The listed hazardous wastes are described in 40 CFR 261, Subpart D as non-specific sources (F-codes), specific sources (K-codes), actively hazardous off-specification discarded product (P-codes), or toxic off-specification discarded product (U-codes).

submit a land ban petition (no-migration demonstration) to demonstrate, i.e., simulate through sophisticated computer models either (1) that the injected hazardous waste will not migrate to a USDW within at least 10,000 years, or (2) that the injected hazardous waste will be rendered non-hazardous through attenuation, transformation, or immobilization. The first of these demonstrations is what is popularly referred to as a "containment" demonstration, while the second is known as a "fate-of-waste" demonstration. As of this date, only one facility in the country has passed a "fate-of-waste" demonstration, while all other sites have relied on the "containment" demonstration. Across the country, there have been 47 successful demonstrations (Regional Approval) at deep Class I hazardous injection sites. In addition, there have been about 5 failed demonstrations.

Key factors that must be considered in the modeling demonstration include the pressure, permeability, and porosity of both the injection zone and confining layers, as well as mobility of hazardous constituents (e.g. their coefficients of dispersion and diffusion). For modeling the geochemical "fate-of-waste," an analysis of the chemical reaction(s) that will render the waste non-hazardous must be considered as well. Operators must conservatively estimate their projected injection volume, rate, and pressure, taking into consideration key factors, and produce an estimate of their plume dimensions forecast into the future, paying close attention to how much reduction in concentration is likely over both the operational period and any long-range non-operational period (e.g. 10,000 year "containment" demonstration).

For the purpose of public notice, EPA must publish its decision of whether to approve or deny a land ban no-migration demonstration in the Federal Register. Approvals of land ban demonstrations are not synonymous with UIC permit approval, nor do they necessarily carry the same approval duration that an accompanying permit might have. Much of this is dependent upon what geologic, hydrological, and operational assumptions were made in the computer modeling exercise. The authority to make a land ban determination is delegated to each Region's Water Program Division Director. Hence, an operator wishing to inject banned hazardous waste in a Primacy State needs to seek approval from the appropriate EPA Regional office with respect to the land ban determination.

SUMMARY OF REVISIONS TO UIC REGULATIONS

The December 1999 revisions to the UIC Regulations for Class V Injection Wells moves a subclass to another well class and adds new requirements for two categories of Class V wells to ensure protection of USDWs:

1. *Motor vehicle waste disposal wells.* These are generally floor drains and sinks connected to dry wells or septic tank and leachfield combinations that receive or have received fluids from vehicular repair or maintenance activities, such as an auto body repair shop, automotive repair shop, new and used car dealership, specialty repair shop (e.g., transmission and muffler repair shop), or any facility that does any vehicular repair work. Fluids disposed in these wells may contain organic and inorganic chemicals in concentrations that exceed the maximum contaminant levels (MCLs) established by the primary drinking water regulations (see 40 CFR Part 141). These fluids also may include waste petroleum products and may contain contaminants, such as heavy metals and volatile

organic compounds, which pose risks to human health.

2. *Large-capacity cesspools.* Cesspools are typically dry wells that receive untreated sanitary waste, and which sometimes have an open bottom and/or perforated sides. The UIC requirements do not apply to single-family residential cesspools or to non-residential cesspools that receive solely sanitary waste and have the capacity to serve fewer than 20 persons a day.

In particular, the Class V Rule bans new motor vehicle waste disposal wells and new and existing large-capacity cesspools nationwide. The Rule also bans existing motor vehicle waste disposal wells in ground water protection areas and other sensitive ground water areas but includes a waiver provision that will allow well owners and operators to seek a permit. The rule includes minimum Permit conditions. For the purpose of the Class V Rule, ground water protection areas are source water protection areas delineated in accordance with the 1996 SDWA Amendments for community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) that use ground water as a source. Other sensitive ground water areas include areas delineated by States that are critical for the protection of USDWs.

The new requirements for existing motor vehicle waste disposal wells will be phased-in over approximately seven years. The first wells to be affected will be those located in ground water protection areas. The effective date of the rule is April 2000.

Motor vehicle waste disposal wells in Ground Water Protection Areas

- Owners and operators in ground water protection areas must close their well or obtain a Permit within one year of completion of a local source water protection area assessment. States could grant a one year extension under certain conditions.

- States must complete all source water assessments by January 1, 2004. If they do not, three things could occur:

    1. The Class V rule (published December 7, 1999) would apply statewide**,** and owners and operators would have until January 1, 2005**,** to close their wells or obtain a permit;

    2. States could apply to EPA for a one year extension to complete their assessments. Owners and operators would have one year from the completion of their local source water protection area assessment to close their well or obtain a permit.

    3. If States get an extension and fail to complete their assessments**,** the rule would apply statewide and owners and operators would have until January 1, 2006**,** to close their wells or obtain a permit.

Motor vehicle waste disposal wells in Other Sensitive Ground Water Areas

- States must designate other sensitive ground water areas by January 1, 2004. Owners and operators of existing wells in these sensitive ground water areas have until January 1, 2007**,** to comply with the requirements.

- If States do not designate sensitive ground water areas by January 1, 2004**,** three things could occur:
  1. The rule would apply statewide and owners and operators would have until January 1, 2007**,** to close their wells or obtain a permit;

  2. States could apply to EPA for a one year extension to complete the designation. Owners and operators in designated sensitive ground water areas would have until January 2008 to close their well or obtain a permit; and

  3. If States get an extension and fail to complete their designation, the rule would then apply statewide and owners and operators would have until January 2008 to close their wells or obtain a permit.

UNDERGROUND INJECTION CONTROL PRIMACY STATUS

The UIC program is one of the major focal points of the EPA's ground water protection efforts. Authorized by the SDWA in 1974, the program is being implemented by various combinations of agencies at the state level and by the EPA for States and Indian Tribes that have not been granted primary enforcement authority (primacy)for the UIC Program. The latest regulatory revisions relating to Indian program implementation were promulgated in the Federal Register on November 25, 1988. These regulations established the EPA Direct Implementation (DI) Program for Indian Country[12] in primacy States.

Initially, EPA's UIC program emphasized assisting states to develop programs to enable them to qualify for primary enforcement authority (primacy). The first State program to achieve primacy did so in December of 1981 (Oklahoma). As of 2001, the last State to be approved for primary enforcement authority to regulate Class II wells on non-Indian country was Montana, on November 22, 1996. Nationwide, EPA has authorized primacy for all well classes on non-Indian

TABLE 2

AUTHORIZED UNDERGROUND INJECTION CONTROL PROGRAMS FOR STATES REGULATING

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[12] "Indian Country" is defined at 18 U.S.C. 1151. EPA regulates all wells within the external boundaries of the Reservation (Indian Country-See 40 CFR 144.3). This includes wells on private land and private mineral rights if the location is considered as "Indian Country."

ALL CLASSES OF WELLS

State or Territory	Class II Program		Class I, III, IV, and V Program	
	Agency	**Effective Date**	**Agency**	**Effective Date**
Alabama	State Oil and Gas Board of Alabama	Aug. 2, 1982 40 CFR 147.50	Alabama Dept. of Environmental Management	Aug. 25, 1983 40 CFR 147.51
Arkansas	Reserved		Arkansas Dept. of Pollution Control and Ecology	July 6, 1982 40 CFR 147.200
Connecticut	Class I Agency Administers all Classes		Conn. Dept. of Environ. Protection	Mar. 26, 1984 40 CFR 147.350
Delaware	Class I Agency Administers all Classes		Del. Dept. of Nat. Res. and Environ. Control	May 7. 1984 40 CFR 147.400
Georgia	Class I Agency Administers all Classes		Georgia Dept. of Nat. Resources, Environmental Protect. Div	May 21, 1984 40 CFR 147.550
Idaho	Class I Agency Administers all Classes		Idaho Dept. of Water Resources	July 22, 1985 40 CFR 147.650
Illinois	Class I Agency Administers all Classes	40 CFR 147.701	Illinois Environmental Protection Agen.	Mar. 3, 1984 40 CFR 147.700
Kansas	Kansas Corp. Comm.	Feb. 8, 1984 40 CFR 147.851	Kansas Dept. of Health and Environment	Dec. 2, 1983 40 CFR 147.850
Louisiana	Class I Agency Administers all Classes		Louisiana Dept. of Nat. Resources	Mar. 23, 1982 40 CFR 147.950
State or Territory	**Class II Program**		**Class I, III, IV, and V Program**	
	Agency	**Effective Date**	**Agency**	**Effective Date**

Maine	Class I Agency Administers all Classes		Maine Dept. of Environmental Protection	Sept. 26, 1983 40 CFR 147.1000
Maryland	Class I Agency Administers all Classes		Maryland Department of the Environment	June 4, 1984 40 CFR 147.1050
Massachusetts	Class I Agency Administers all Classes		Mass. Department of Environmental Protection	Dec. 23, 1982 40 CFR 147.1100
Mississippi	State Oil and Gas Board of Miss.	Mar. 2, 1989 40 CFR 147.1251	Miss. Dept. of Nat Resources	Sept. 26, 1983 40 CFR 147.1250
Missouri	Class I Agency Administers all Classes		Missouri Dept. of Nat. Resources	Dec. 2, 1983 40 CFR 147.1300
Nebraska	Nebraska Oil and Gas Conservation Comm.	June 25, 1984 40 CFR 147.1400	Nebraska Department of Environmental Protection	June 26, 1984 40 CFR 147.1401
Nevada	Class I Agency Administers all Classes		Nevada Division of Environmental Protection	Oct. 5, 1988 40 CFR 147.1450
New Hampshire	Class I Agency Administers all Classes		New Hampshire Department of Environmental Protection	Oct. 21, 1982 40 CFR 147.1500
New Jersey	Class I Agency Administers all Classes		New Jersey Department of Environmental Protection	Aug. 15, 1983 40 CFR 147.1550
State or Territory	**Class II Program**		**Class I, III, IV, and V Program**	
	Agency	**Effective Date**	**Agency**	**Effective Date**

Oklahoma	Oklahoma Corp. Comm.	Dec 2, 1981 40 CFR 147.1851	Oklahoma State Dept. of Health	July 24, 1982 40 CFR 147.1850
Oregon	Class I Agency Administers all Classes		Oregon Dept. of Environmental Quality	Oct. 9, 1984 40 CFR 147.1900
So. Carolina	Class I Agency Administers all Classes		So. Carolina Dept. of Health and Environmental Control	July 24, 1984 40 CFR 147.2050
Texas	Texas Railroad Commission	May 23, 1982 40 CFR 147.2201	Texas Department of Water Resources and the Texas Railroad Commission	Feb. 7, 1982 40 CFR 147.2200
Utah	Utah Dept of Natural Resources, Division of Oil Gas and Mining	Nov. 7, 1982 40 CFR 147.2251	Utah Dept. of Environmental Quality	Feb. 10, 1983 40 CFR 147.2250
Vermont	Class I Agency Administers all Classes		Vermont Dept. of Environmental Quality	July 6, 1984 40 CFR 147.2300
Washington	Class I Agency Administers all Classes		Washington Dept. of Ecology	Sept. 24, 1984 40 CFR 147.2400
West Virginia	West Virginia Office of Oil and Gas	Dec. 9, 1983 No CFR reference	West Virg. Dept. of Natural Resources	Dec 9, 1983 No CFR reference
State or Territory	**Class II Program**		**Class I, III, IV, and V Program**	
	Agency	**Effective Date**	**Agency**	**Effective Date**
Wisconsin	Class I Agency Administers all Classes		Wisconsin Dept. of Nat. Resources	Nov. 30, 1983 40 CFR 147.2500

Wyoming	Wyoming Oil and Gas Conservation Comm.	Dec. 23, 1983 40 CFR 147.2551	Wyoming Dept. of Environmental Quality	Aug. 17, 1983 40 CFR 147.2550
Commonwealth of the No. Marianna Islands	Class I Agency Administers all Classes		Commonwealth of the No. Marianna Islands Div. of Environmental Quality	Aug. 30, 1985 40 CFR 147.2800
Guam	Class I Agency Administers all Classes		Guam Environmental Protection Agency	June 1, 1983 40 CFR 147.2600
Puerto Rico	Class I Agency Administers all Classes		Puerto Rico Environmental Quality Board	July 29, 1992 40 CFR 147.2650

Country to 33 States and shares responsibility for certain well classes in 7 States. EPA implements a program for all well classes in 10 states and all Indian Lands. The Agency has also authorized primacy to 3 territories and implements a DI Program in 4 U.S. jurisdictions. Table 2 provides information (name of Agency, effective date of Program, and CFR citations) for those States that are authorized to regulate all classes of wells. Table 3 provides information on those jurisdictions where EPA and States share jurisdiction. EPA regulates all Classes of wells in the following states and U.S. Jurisdictions: Arizona, Hawaii, Iowa, Kentucky, Michigan, Minnesota, New York, Pennsylvania, Tennessee, Virginia, Indian Country, American Samoa, District of Columbia, and Virgin Islands. For more information regarding the various State and DI programs, please refer to the OGWDW Web page at: http://www.epa.gov/safewater/uic.html.

TABLE 3
STATUS OF UNDERGROUND INJECTION CONTROL PROGRAMS
IN STATES WITH
PARTIAL AUTHORIZATION

STATE	Classes I, III, IV, AND V WELLS	CLASS II WELLS

Alaska	EPA has implemented a direct implementation program for all lands (See 40 CFR 147.101)	Primary enforcement authority was granted to Alaska Oil and Gas Conservation Commission (See 40 CFR 147.100) for Non-Indian Lands, effective on June 19, 1986.
California	EPA has implemented a direct implementation program for all lands (See 40 CFR 147.251)	.Primary enforcement authority was granted to California Division of Oil and Gas (See 40 CFR 147.250) for Non-Indian Lands, effective on June 25, 1984.
Colorado	EPA has implemented a direct implementation program for all lands (See 40 CFR 147.301)	Primary enforcement authority was granted to Colorado Oil and Gas Conservation Commission (See 40 CFR 147.300) for Non-Indian Lands, effective on April 2, 1984.
Florida	Primary enforcement authority was granted to the Florida Dept. of Environmental Regulations (See 40 CFR 147.500) for Non-Indian Lands, effective on March 9, 1983.	EPA has implemented a direct implementation program for all lands (See 40 CFR 147.501)
Indiana	EPA has implemented a direct implementation program for all lands (See 40 CFR 147.751)	Primary enforcement authority was granted to Indiana Dept. of Nat. Resources (See 40 CFR 147.750) for Non-Indian Lands, effective on August 19, 1991.
Montana	EPA has implemented a direct implementation program for all lands (See 40 CFR 144.1351), including Indian Lands..	Primary enforcement authority was granted to the Montana Board of Oil and Gas Conservation (See 40 CFR 147.300) for Non-Indian Lands, effective on November 22, 1996
South Dakota	EPA has implemented a direct implementation program for all lands (See 40 CFR 147.2101)	Primary enforcement authority was granted to the South Dakota Department of Water and Natural Resources (See 40 CFR 147.2100) for Non-Indian Lands, effective on October 24, 1984.

Primacy for Class II wells is possible in those states where oil and gas production and injection operations are regulated by a separate state agency, and that agency chooses to make a statutory showing of equivalency under Section 1425 of the SDWA[13]. Partial primacy can also be

[13] As part of the demonstration for primacy under Section 1425 of the SDWA, the State Agency must show that their program meets the requirements of subparagraphs (A) through (D) of section 1421(b)(1) and represents an effective program.

established when a State can demonstrate that no underground injection exists or can exist within the State for any class of injection wells subject to the SDWA that is not covered by the State program. The State must demonstrate that such injections cannot legally occur in that State (40 CFR 145.21(e)). EPA may then approve a partial primacy program.

EPA began to focus on DI activity in states which did not assume primacy by promulgation in 1984 of 40 CFR 147, which implemented the provisions of 40 CFR 124, 144, and 146 for states without primacy. The DI UIC regulations were promulgated by EPA for 22 States and Territories (including most Indian Country, except for some areas, such as lands controlled by the Navajo Nation within those jurisdictions) on May 11, 1984 with an effective date of June 25, 1984. Promulgation of the UIC program by EPA for additional States, including Indian Country in some States with Primacy for all Classes of wells of wells (except on Indian Country), such Kansas, Minnesota and the Osage Mineral Reserve was effective on December 30, 1984. The remaining Indian Country within State jurisdictions not covered in the 1984 actions was promulgated October 25, 1988. The effective date of these programs was November 25, 1988. As of 2001, EPA implements Programs for all well classes on Indian lands although several Tribal Governments are working on obtaining primary enforcement responsibility. The Agency is currently viewing applications requesting primacy authorization of the Class II program on the Ft. Peck Indian Reservation and on the Navajo Reservation by their respective Tribal Governments.

OVERVIEW SUMMARY

It should be obvious after reading this Technical Overview, Part C of the SDWA, and the associated UIC Regulations that the program has many facets. The UIC program has interfaces with many other EPA programs, such as the Source Water Protection program, the RCRA program, the Drinking Water program, the Sole Source Aquifer program, the Emergency Powers section (1431) of the SDWA, etc. There are also links with other Federal programs, such as the oil and gas programs operated by the BLM and the USFS. Additionally, the UIC Regulations were written with significant latitude that has been addressed, where necessary, with guidance and/or policy documents.

For the individual who is planning on day-to-day involvement with the UIC program from either the regulatory program side or from the well operations side, additional reading is recommended. In addition to the SDWA and the UIC regulations, the following documents (listed in Appendix A) are recommended: 1) House Report (93rd Congress, 2nd Session) **No. 93-1185**, dated July 10, 1974. and House Report (96th Congress, 2nd session) **No. 96-1348**, dated September 19, 1980, in A Legislative History of the Safe Drinking Water Act, February 1982, Serial No. 97-9; 2) the UIC program specific guidance listed in Appendix A, National UIC Program Guidance and those additional guidance deemed relevant after a review of the web page of the Office of Water: http://www.epa.gov/safewater/uic//uicguid.html; 3) the Preambles to the proposed and final UIC rules (See Appendix A, U.S. EPA UIC Regulatory Citations); and 4) any of the many technical references listed in Appendix A. Copies of these references should be requested from either the HQ or Regional UIC staff or from the GWPC library. If there are questions as a result of the recommended reading, it is recommended that questions be raised to experienced Regional and/or State UIC and Source Water staff.

APPENDIX A

REFERENCES RELATING TO THE UNDERGROUND INJECTION CONTROL PROGRAM

A very basic reference for the UIC Program and associated regulations is House Report (93rd Congress, 2nd Session) **No. 93-1185**, dated July 10, 1974. This document details Congressional intent in establishing the UIC Program as part of the SDWA. Also important to an understanding of changes to the SDWA and subsequent UIC rule making is House Report (96th Congress, 2nd session) **No. 96-1348**, dated September 19, 1980. This report provides Congressional intent regarding the modifications to the SDWA to allow State Oil and Gas Programs to apply for primacy for regulation of Class II injection wells under Section 1425 of the SDWA. It also explains the rationale for removing the injection of hydrocarbon gas (at standard temperature and pressure) for underground storage from regulation under the SDWA. Both of these reports are reproduced in A Legislative History of the Safe Drinking Water Act, February 1982, Serial No. 97-9.

A very important EPA document that established the Agency's initial position on injection and described data that operators must provide regulatory agencies is: Administrator's Statement #5, **39FR12923, April 9, 1974**. This document was developed and published prior to finalization of the SDWA under the authority of the Federal Water Pollution Control Act, as amended.

General Information

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2. "Underground Waste Management and Environmental Implications." Memoir 18 , Proceedings of the Symposium on Underground Waste Management and Environmental Implications by The American Association of Petroleum Geologists, T.D. Cook, ed.: Houston, Texas, December 6-9, 1971. AAPG. 1972.

3. "Underground Waste Management and Environmental Implications." Papers Presented at the Second International Symposium on Underground Waste Management and Artificial Recharge by The American Association of Petroleum Geologists, Jules Braunstein, ed.: New Orleans, Louisiana, September 26-30, 1973. Vol. 1 and Vol. 2, AAPG. 1973.

4. Feasibility of Microbial Decomposition of Organic Wastes Under Conditions Existing in Deep Wells by M.M. Grula and E.A. Grula: Final Report. U.S. Bureau of Mines. December 31, 1975.

5. Potential Environmental Consequences of Tertiary Oil Recovery by Energy Resources Co. Inc.: 229 pages; U.S. EPA, Office of Planning and Evaluation, Contract No. 68-01-1912, July 1976.
6. The Report to Congress-Waste Disposal Practices and Their Effects on Ground Water by Office of Water Supply and Office of Solid Waste Management Program: 512 pages; U.S.

EPA, Jan. 1977.

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8. Class I Deep Subsurface Injection - An Option for Responsible Disposal of Liquid Wastes: Underground Injection Practices Council (no date).

9. The Shallow Injection Well Program - A Ground Water Protection Approach: Underground Injection Practices Council (no date).

10. An Introduction to the Technology of Subsurface Waste Water Injections by Don L. Warner and Jay H. Lehr: 345 pages; U.S. EPA, Robert S. Kerr Research Center, EPA 600/2-77-240, Dec. 1977.

11. Active Waste-Injection Systems in Florida, 1976 by John Vecchioli, D.J. McKenzie, C.A. Pascale, and W.E. Wilson: Open-File Report 79-1296; U.S. Department of the Interior, Geological Survey, 1979.

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13. Radius of Pressure Influence of Injection Wells by Don L. Warner, et al.: 204 pp, U.S. EPA, Robert S. Kerr Research Laboratory, Office of Research and Development; EPA-600/2-79-170, August 1979.

14. Statement of Basis and Purpose of Underground Injection Control Regulations by U.S. EPA, Office of Drinking Water: 42 pages, June 1980.

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National UIC Program Guidance

The following is a partial list of the important UIC guidance that are not generally part of the numbered series put out by the National UIC Program Office. There are a large number of official, numbered Ground-Water Program Guidance documents not listed in this document. The titles of these documents can be accessed by going to the web page of the Office of Water: http://www.epa.gov/safewater/uic//uicguid.html. Copies of any of the listed guidance can be obtained from the Office of Ground Water and Drinking Water.

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c. Applicability of Land Disposal Restrictions to RCRA and CERCLA Ground Water Treatment Reinjection Superfund Management Review: December 27, 1989, 6 pages; OSWER Directive 9234.1-06.

d. Definition of a Class II Fluid: Letter to C. V. Chatterton, Director, Alaska Oil and Gas Conservation Commission from Region X Water Division Director (approved by ODW), February 26, 1990.

e. Classification of Injection Fluid from a National Gas Processing Plant: Memorandum to Edward P. Watters, Region V from UIC Branch Chief (ODW), Francoise Brasier, March 8, 1990.

f. Classification of Waste Fluids Associated with Clean up of Crude Oil Leaks in Active Oil Fields: Memorandum from the Director of the Office of Solid Waste U.S. EPA to the Region VIII, Water Management Division Director, May 21, 1991.

g. Classification of Septic System Drain Fields and Infiltration Galleries as Underground Injection Wells: Memorandum from Susan G. Lepow, Associate General Counsel U.S. EPA to Wendell Ray Cunningham, Director, Water Management Division Region IV. January 23, 1992.

h. Classification of Infiltration Galleries under the UIC and RCRA Programs: Memorandum fro James R. Elder, Director Office of Ground Water and Drinking Water and Sylvia K. Lowrance, Director Office of Solid Waste to all Regional Water Management and Hazardous Waste Division Directors, February 4, 1992.

i. Clarification of the Regulatory Determination for Wastes from the Exploration, Development, and Production of Crude Oil, Natural Gas and Geothermal Energy: U.S. EPA, Office of Solid Waste and Emergency Response; **58FR15284**, March 22, 1993.

j. Marysvaille Underground Storage Terminal Request for Exclusion from UIC Regulations: Memorandum from Francoise M. Brasier, Chief UIC Branch, OGWDW to Richard J. Zdanowicz, Chief UIC Section, Region V, February 2, 1994.

k. Crude Oil and Natural Gas Exploration and Production Wastes: Exemption from RCRA Subtitle C Regulation: U.S. EPA, Office of Solid Waste and Emergency Response, 30 pages; EPA530-K-95-003, May 1995.

UIC Specific Regulations[14]

1. 40 CFR Part 124 -- Outlines the procedures for issuing, modifying, revoking and reissuing, terminating or appealing UIC permits.

2. 40 CFR Part 144 -- Sets the regulatory framework for the program.

3. 40 CFR Part 145 -- Defines the elements for an approvable state program and the processes for EPA approval and subsequent modification of a state program (referred to as a "primacy program" after approval).

4. 40 CFR Part 146 -- Establishes the technical standards to be used by the State or EPA in implementing the program.

5. 40 CFR Part 146 Subpart G -- Establishes the technical standards for Class I hazardous waste injection wells.

6. 40 CFR Part 147 -- Establishes state specific requirements.

7. 40 CFR Part 148 -- Establishes regulatory framework for restricted wastes and criteria for demonstrating "no migration" out of the injection zone per land disposal ban (HSWA Section 3004[f-h]).

8. 40 CFR Part 261 -- Establishes definitions for hazardous waste.

9. 36 CFR Parts 228 and 261--Contains procedures and requirements for managing oil and gas leasing, including bonding and reclamation on lands under U.S. Forest Service jurisdiction.

10. 43 CFR Parts 3160 through 3487–Contains procedures and requirements for managing oil and gas leasing, including bonding and reclamation on lands under the jurisdiction of the U.S. Bureau of Land Management.

U.S. EPA UIC Regulatory Citations

A key element to developing an understanding of the UIC rules themselves is the Preamble of the various UIC rule proposals and final actions. The Preambles provide some insight into the Agency's intent behind some of the regulations. The interested reader should consult the following:

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[14] The Code of Federal Regulations (CFR) is updated on a yearly basis to incorporate new changes but the CFR does not contain the preambles which are published when regulations are proposed and implemented. The CFR does, however, give the Federal Register date for each specific rule. Individuals desiring information on the intent of EPA regarding specific regulations should consult the specific Federal Register and review the related preamble.

1. Grants for State Underground Water Source Protection Programs; State Underground Injection Control Program; Proposed Regulations, 40 CFR Parts 35 and 146 (**41FR36730, August 31, 1976**);

2. National Pollutant Discharge Elimination System; Proposed Revision of Existing Regulations, 40 CFR Parts 6, 122, 123, 124, and 125 (**43FR37078, Aug. 21, 1978**);

3. Water Programs; State Underground Injection Control Programs; Reproposal of rules, 40 CFR Part 146 (**44FR23738, April 20, 1979**);

4. Underground Injection Control; List of States Requiring Programs (**45FR17632, March 19, 1980**);

5. Consolidated Permit Regulations: RCRA Hazardous Waste; SDWA Underground Injection Control; CAA Prevention of Significant Deterioration; CWA National Discharge Elimination System; and Section 404 Dredge or Fill Programs; Proposed Rule, 40 CFR Parts 122, 123, and 124 (**44FR34244, June 14, 1979**);

6. Consolidated Permit Regulations: RCRA Hazardous Waste; SDWA Underground Injection Control; CWA National Pollutant Discharge Elimination System; CWA Section 404 Dredge or Fill Programs; and CAA Prevention of Significant Deterioration: Final Rule, codified at 40 CFR Parts 122, 123, 124, and 125 (**45FR33290, May 19, 1980**);

7. Water Programs; Consolidated Permit Regulations and Technical Criteria and Standards; State Underground Injection Control Programs; Final Rule, Final codified as 40 CFR Part 146 and amendments to Part 122 (**45FR42472, June 24, 1980**);

8. Hazardous Waste Management System; Standards Applicable to Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities and EPA Administered Permit Programs; Reproposal of Proposed Rule and Proposed Amendments to Rule, 40 CFR Parts 122, 260, and 264 (**46 FR11126, February 5, 1981**);

9. Interim Final Rule and Request for Comment; Interim Standards for Owners and Operators of New Hazardous Waste Land Disposal Facilities and EPA Administered Permit Programs: The Hazardous Waste Permit Program, 40 CFR Parts 122 and 267 (**46FR12414, February 13, 1981**);

10. Interim Final Guidance and Request for Public Comment; State Underground Injection Control, SDWA Section 1425 Class II Programs, 40 CFR Ch. I (**46FR27333, May 19, 1981**);

11. Underground Injection Control Program Criteria and Standards; Technical amendments to final regulations, 40 CFR Parts 122 and 146 (**46FR43156, August 27, 1981**);

12. Underground Injection Control Program Criteria and Standards, Proposed amendments, 40 CFR Parts 122 and 146 (**46FR48243, October 1, 1981**);

13. Underground Injection Control Program Criteria and Standards; Final rule, codified at 40 CFR Parts 122 and 146 (**47FR4992, February 3, 1982**);

14. Underground Injection Control Program, Final rule, effective date for information collection requirements (**47FR32129, July 26, 1982**);

15. Hazardous Waste Management System; Standards Applicable to Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities; and EPA Administered Permit Programs; Interim Final Rule With Request for Comments, 40 CFR Parts 122, 260, 264, and 265 (**47FR32274, July 26, 1982**);

16. Environmental Permit Regulations: RCRA Hazardous Waste; SDWA Underground Injection Control; CWA National Pollutant Discharge Elimination System; CWA Section 404 Dredge or Fill Programs; and CAA Prevention of Significant Deterioration; Final rule, 40 CFR Parts 122, 123, 124, 125, 144, 145, 146, 233, 260, 261, 262, 263, 264, 265, 270, and 271 (**48FR14146, April 1, 1983**);

17. State Underground Injection Control Program: Permitting Procedures, Technical Criteria and Standards; Availability of Guidance Documents (**48FR27039, June 13, 1983**);

18. Permit Revisions; Revision in Accordance with Settlement; Final rule, 40CFR Parts 122, 123, 124, 144, 145, 233, 270, and 271 (**48FR39611, September 1, 1983**);

19. Underground Injection Control Program: Federally Administered Programs; Proposed rule, 40 CFR Parts 124, 144, 146, and 147 (**48FR40098, September 2, 1983**);

20. Underground Injection Control Program: Federally Administered Programs; Final rule, codified at 40 CFR Parts 124, 144, 146, and 147 (**49FR20138, May 11, 1984**);

21. Underground Injection Control Program: Federally Administered Programs; Final rule, codified at 40 CFR Parts 124, 144, 146, and 147 (**49FR45292, November 15, 1984**);

22. Hazardous Waste Management System; Final Codification Rule; Final Rule, 40 C.F.R. Parts 260, 261, 262, 264, 265, 266, 270, 271, and 280 (**50FR28702, July 15, 1985**);

23. Notice Requirements for Citizen Suits Under the Safe Drinking Water Act; Proposed Rule, 40 C.F.R. Part 135 (**51 Fed. Reg. 29426, August 15, 1986**);

24. Hazardous Waste Management System; Land Disposal Restrictions; Final Rule, 40 C.F.R. Parts 260, 261, 262, 264, 265, 268, 270, and 271 (**51FR40572, November 7, 1986**);

25. Technical Amendment, Underground Injection Control Programs on Indian Lands in Direct Implementation States; Final Rule (**52FR17680, May 11, 1987**);

26. Water Pollution Control; Underground Injection Control Programs on Indian Lands; Proposed Rule, 40 C.F.R. Part 147 (**52FR17684, May 11, 1987**);

27. Underground Injection Control Programs-for Certain Indian Lands; Proposed Rule, 40 CFR Part 147 (**52 FR17696, May 11, 1987**;

28. Water Pollution Control; National Primary Drinking Water Regulations; Final Rule, codified at 40 C.F.R. Parts 141, 142, and 144 (**52FR20672, June 2, 1987**);

29. Underground Injection Control Program; Extension of Water-in-Annulus Mechanical Integrity Test; Interim Approval, 40 C.F.R. Part 146 (**52FR26342, July 14, 1987**);

30. Indian Lands; National Primary Drinking Water and Underground Injection Control Regulations; Proposed Rule, 40 C.F.R. Parts 35, 124, 141, 142, 143, 144, and 146 (**52FR28112, July 27, 1987**);

31. Underground Injection Control Program; Hazardous Waste Disposal Injection Restrictions; Amendments to Technical Requirements for Class I Hazardous Waste Injection Wells; and Additional Monitoring Requirements Applicable to All Class I Wells; Proposed Rule, 40 C.F.R. Parts 124, 144, 146, and 148 (**52FR32446, August 27, 1987**);

32. Codification Rule for 1984 RCRA Amendments; Final Rule, 40 C.F.R. Parts 144, 264, 265, 270, and 271 (**52FR45788, December 1, 1987**);

33. Underground Injection Control Program; Radioactive Tracer Survey; Final Approval, Notice of Final Approval and Response to Comments, 40 CFR 146 (**52FR46837, December 10, 1987**);

34. Hazardous Waste Miscellaneous Units; Standard; Applicable to Owners and operators; Final Rule, codified at 40 C.F.R. Parts 144, 260, 264 and 270 (**52FR46946, December 10, 1987**);

35. Underground Injection Control Program; Hazardous Waste Disposal Injection Restrictions, Phase Two; Proposed Rule, 40 C.F.R. Part 148 (**53FR14892, April 26, 1988**);

36. Regulatory Determination for Oil and Gas and Geothermal Exploration, Development and Production Wastes; RCRA Regulatory Determination (**53FR25446, July 6, 1988**);

37. Underground Injection Control Program: Hazardous Waste Disposal Injection Restrictions; Amendments to Technical Requirements for Class I Hazardous Waste Injection Wells; and Additional Monitoring Requirements Applicable to All Class I Wells; Final Rule, codified at 40 CFR Parts 124, 144, 146, and 148 (**53FR28118, July 26, 1988**);

38. Underground Injection Control Program; Hazardous Waste Disposal Injection Restrictions, Phase Two; California List and Certain "First Third" Wastes; Final Rule, codified at 40 C.F.R. Part 148 (**53FR30908 (Aug. 16, 1988**);

39. Interim Approval With Request for Comments; Underground Injection Control Program: Oxygen Activation Method Mechanical Integrity Test for Injection Well Classes I-V; Notice of Alternative Method, 40 CFR Part 146 (**52FR37294, September 26, 1988**);

40 Notice of Alternative Method; Extension of Interim Approval; Underground Injection Control Program; Extension of Water-In-Annulus Mechanical Integrity Test, 40 CFR 146 (**53FR37296, September. 26, 1988**);

41. Underground Injection Control Program: Hazardous Waste Disposal Injection Restrictions; Phase Two; California List and Certain "First Third" Wastes; Final Rule; Correction, codified at 40 CFR Part 148 (**53FR41601,October 24, 1988**);

42. Underground Injection Control Programs on Indian Lands; Final Rule, codified at 40 CFR Part 147 (**53FR43084, October 25, 1988**;

43. Underground Injection Control Program; Hazardous Waste Disposal Injection Restrictions; Additional Effective Dates; First Third Wastes; Proposed Rule, 40 CFR Part 148 (**53FR43400, October 26, 1988**);

44. Land Disposal Restrictions for Second Third Scheduled-Wastes; Proposed Rule, 40 C.F.R. Parts 148, 268, and 271 (**54FR1056, January 11, 1989**);

45. Request for Comments; Underground Injection Control Program; Casing Cementing Pressure/Single Point Resistivity Log Mechanical Integrity Test for Class III In-Situ Uranium Injection Wells; Notice of Alternative Method, 40 CFR Part 146 (**54FR4903, January 31, 1989**);

40. Revisions to the Safe Drinking Water Act Underground Injection Control Regulations; Proposed Rule, 40 CFR Parts 144 and 146 (55FR26462, June 28, 1990); **47**) Safe Drinking Water Act; Administrative Enforcement Regulations; Final Rule, 40 CFR Parts 22 and 142 (**56FR3752, January 30, 1991**);

48. Underground Injection Control Program; Approval of Oxygen Activation Method Mechanical Integrity Test for Injection Well Classes I-V: Notice of Alternative Method, 40 CFR Part 146 (56FR4063, February 1, 1991);

49. Underground Injection Control Program; State Administered Programs; Incorporation by Reference Update; Final Rule, codified at 40 CFR Part 147 (**56FR9408, March 6, 1991**);

50. Non-APA, Consolidated Rules of Practice for Administrative Assessment of Civil Penalties; Proposed Rule, 40 CFR Part 28 (**56FR29996, July 1, 1991**);

51. Underground Injection Control Program; Hazardous Waste Disposal Injection Restrictions; Notice of Intent to Grant a Case-by-Case Extension, (**56FR33288, July 19, 1991**);

52. Final Approval; Underground Injection Control Program; Water-Brine Interface Mechanical Integrity-Test for Class III Salt Solution Mining Injection Wells; Notice of Alternative Method, 40 CFR Part 146 (**57FR1109, January 10, 1992**);

53. Final Approval; Underground Injection Control Program; Approval of Oxygen Activation Method for Mechanical Integrity Testing of Injection Well Classes I-V: Notice of Alternative Method, 40 CFR Part 146 (**57FR1176, January 10, 1992**);

54. Hazardous Waste Management System; Land Disposal Restrictions (LDR); DOE Mixed Wastes Extension application; Notice of Proposed Decision on Request for an Extension of the LDR Effective Date for Certain Mixed Wastes, 40 CFR Part 268 (**57FR22024, May 26, 1992**);

55. Underground Injection Control Program; Hazardous Waste Disposal Injection Restrictions and Requirements for Class I Wells; Revision of Testing and Monitoring Requirements; Final Rule, codified at 40 CFR Part 146 (**57FR46292, October 7, 1992**);

56. Environmental Radiation Protection Standards for the Management and Disposal of Spent Nuclear Fuel, High Level and Transuranic Radioactive Wastes, Proposed Rule, 40 CFR Parts 141 and 191 (**58FR7924, February 10, 1993**);

57. Revisions to the Safe Drinking Water Act Underground Injection Control Regulations; Final and interim rule and request for comments, codified at 40 CFR Parts 144 and 146 (**58FR63890, December 3, 1993**);

58. Standards Applicable to Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, Underground Storage Tanks and Underground Injection Control Systems; Financial Assurance; Letter of Credit; Final rule; amendment, codified at 40 CFR Parts 144, 264, and 280 (**59FR29958, June 10, 1994**);

59. Indian Tribes; Eligibility for Program Authorization; Final rule, codified at 40 CFR Parts 123, 124, 131, 142, 144, 145, 253, and 501 (**59FR64339, December 14, 1994**);

60. Class V Wells – Regulatory Determination and Minor Revisions to the Underground Injection Control Regulations; Technical Corrections to the Regulations for Class I Wells; Proposed rule, 40 CFR Parts 144 and 146 (**60FR44652, August 28, 1995**);

61. Revisions to the Underground Injection Control Regulations for Class V Injection Wells; Proposed Rule, 40 CFR Part 146 (**63FR40586, July 29, 1998**);

62. Revisions to the Underground Injection Control Regulations for Class V Injection Wells; Final

Rule, codified at 40 CFR Part 146 **(64FR68546, December 7, 1999**)

APPENDIX B

MAJOR UIC PROGRAM DEFINITIONS

The following definitions are some of the more important utilized by the UIC Program. The regulations themselves should be referred to for a more complete understanding of the program definitions.

1. Aquifer (40 CFR 144.3)

   An aquifer is a geological "formation," group of formations, or part of a formation that is capable of yielding a **significant** amount of water to a well or spring.

2. Aquifer Exemption (40 CFR 146.4)

   Injection into a USDW for the purpose of industrial waste disposal (Class I), oil and gas related activity (Class II), or in situ recovery of metals or salt (Class III) is not allowed. In order for Class II and III activities to be permitted for injection, it is necessary for the reservoir in question to be exempted from classification as a USDW. An exemption for the purpose of injection of hazardous waste disposal is not feasible because of siting restrictions. An aquifer exemption does not relieve the owner/operator from any construction or permitting requirements established by 40 CFR Part 144 and 146.

   In reading the preamble to the original UIC technical regulations and other documents, it can be interpreted that the purpose for creating the aquifer exemption process was to allow for the production of oil, gas and other minerals contained in the formation by injection of various fluids.[15] It was also to allow for disposal of wastes into formations which are determined to be unlikely future sources of drinking water. These pages of the preambles point out that the exemption process was created to allow for the development and production (and possible

[15] For more insight into the intent of aquifer exemptions, the reader should review the appropriate FR preambles and a HQ guidance Memorandum that provides some information on the Agency's intent to restrict the granting of exemptions to the injection zone: Comments on UIC Issues: Memo to all Water Division Directors from Office of Drinking Water Director, Vic Kimm: April 1983. The relevant preambles are: 1) 44FR23743 part of the preamble for the proposal of part 146 (4/20/79); 2) 45FR42481 part of the final publication of part 146 (6/24/80); and 3) 46FR48245 part of the settlement agreement conditions to resolve the litigation issues on the publication of the UIC program.

degradation) of the formations that contain minerals[16]; even though the formations are classified as USDWs. There is no mention of intent to allow an exemption from the definition of a USDW solely to decrease the requirements of a well operator. The inclusion of the exemption criteria in 40 CFR 144.7 for USDWs overlying a Frasch sulphur mining project provides important insight into the intended purpose of an exemption. This criterion is the only allowance in the regulations that specifically provides for exemptions of zones into which injection is not intended. The inclusion of the Frasch exclusion combined with the absence of criteria for other non-injection zones points to a general policy for not exempting zones into which there is not injection. The injection reservoir itself can be exempted if certain conditions are met.

An aquifer or portion thereof, meeting the definition of a USDW, can be exempted for the **purpose of injection** into the zone in question if it meets the following criteria:

a) It does not currently serve as a source of drinking water; and

b) It cannot now and will not in the future serve as a source of drinking water because:

   1) It is mineral, hydrocarbon, or geothermal energy producing;

   2) It is situated at a depth or location which makes recovery of water economically or technologically impractical;

   3) It is so contaminated that it would be impractical to make the water fit for consumption;

   4) It is located over a Class III well mining area subject to subsidence or catastrophic collapse; or

c) The total dissolved solids content of the ground water is more than 3000 mg/liter and less than 10,000 mg/liter and it is not reasonably expected to serve a public water system.

3. Area of Review (40 CFR 146.6).

This is a specific radial distance around an injection well, or in the case of an area permit, the project area plus a circumscribing area (See references in Appendix A, General Information,

[16] In the case of mining by the Frasch process, exemptions for overlying formations were allowed since the possibility of subsidence of overlying formations exists even if the operator complies with all technical requirements for the well. The Agency discussed the impact of exemptions associated with Frasch sulphur mining in Ground Water Program Guidance No. 27, Requirements applicable to wells injecting into or through or above an aquifer which has been exempted pursuant to 40 CFR 146.04 (b) (4).

Items 13, 15, 19, and 20). At present, wells that were rule authorized at the start of Program implementation are not routinely subject to the area of review requirement. A recent review of data on area of review activities relating to existing Class II wells indicates that there are cases where the Director is warranted in requiring an area of review analysis due to the presence of wells adjacent to rule authorized wells that may require corrective action[17]. The area of review is defined by either of the following criteria:

a) Fixed radius - a radius of not less than 1/4 mile around the well or project area for all wells other than Class I hazardous waste injection wells, which have a minimum radius of 2 miles;

b) Zone of endangering influence - that area, the radius of which is a lateral distance from the wellbore in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into a USDW. The concepts of area of review and zone of endangering influence are illustrated by Figure 2. The zone of endangering influence may be computed using various analytical hydrologic models[18], such as the Theis equation (See 40 CFR Part 146.6[a][2]). If the zone of endangering influence is computed to be greater than the fixed area of review, the applicant must supply information on all wells penetrating the injection reservoir within the computed zone of influence.

4. Authorization by Rule (40 CFR 144.21, 144.22, 144.23, 144.24, 144.26, 144.27 and 144.28).

The UIC Program regulates all injection wells used for the subsurface emplacement of fluids, except those specifically excluded under 40 CFR 144.1 (g) (2). Although most new wells are required to obtain permits prior to construction, some new wells and some existing wells (those in use when either the State received primacy or EPA promulgated a program) may not be covered by a specific permit. Authorization-by-rule is permissible with nearly equal protection as permits. The UIC regulations (40 CFR 144.28) contain the operating requirements for wells authorized by rule, and the only other type of authorization requires a permit. The rules which authorize certain types of existing and new wells, are as follows:

a) Injection into existing Class I, II (except existing enhanced recovery and hydrocarbon

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[17] There is some discussion relating to the area of review/corrective action requirements in Mid-Course Evaluation of the Class II Underground Injection Control Program: Final Report of the Mid-Course Evaluation Workgroup: U.S. EPA, Office of Drinking Water UIC Branch, August 22, 1989.

[18] Using information on the reservoir properties, the future pressure buildup curves associated with a well can be estimated using a number of models. An example of a simple pressure model is provided in: Radius of Pressure Influence of Injection Wells by Don L. Warner, et al.: 204 pp, U.S. EPA, Robert S. Kerr Research Laboratory, Office of Research and Development; EPA-600/2-79-170, August 1979.

storage) and Class III wells is authorized (40 CFR 144.21[a]-[c]) for up to five years after the effective date of primacy or DI. Except for the recently implemented DI program on some Indian Country, the five year period has long since expired. Owners or operators of such wells were required to comply with the applicable requirements of 40 CFR 144.28 and 40 CFR Part 147 no later than one year after implementation of a program in a specific state. These requirements establish financial responsibility, monitoring, reporting, plugging and abandonment, and other technical requirements;

b) Injection into existing Class II enhanced recovery and hydrocarbon storage wells may be authorized for the life of the well or project (40 CFR 144.22[a]-[b]). Owners and operators of a well authorized under this rule must comply with the applicable stipulations of 40 CFR 144.28 and Part 147; and

c) Injection into most Class V wells is authorized by rule until additional requirements under future regulations become applicable, unless the Director determines that a permit is necessary to prevent endangerment of USDWs (See 40 CFR 144.12 and 40 CFR 144 Subpart G).

The Director may require any Class I, II, III, or V injection well, authorized by rule, to apply for and obtain an individual or area UIC permit. (See 40 CFR 144.25[a] and [b] for cases where UIC permits may be required).

5. Cesspool (40 CFR 144.3)

A drywell that receives untreated sanitary waste containing human excreta, and which sometimes has an open bottom and/or perforated sides.

6. Considerations under Federal law (40 CFR 144.4)

There are other Federal laws that may apply to the issuance of UIC Permits. If applicable, the procedures or requirements in these laws must be followed: a) The Wild and Scenic Rivers Act; b) The National Historic Preservation Act of 1966; c)The Endangered Species Act, d) The Coastal Zone Management Act; and e) The Fish and Wildlife Coordination Act.

7. Director (40 CFR 144.3)

The UIC Director is the Regional Administrator, the State Director or the Tribal Director, as the context requires, or an authorized representative. When there is no approved State or Tribal program, and there is an EPA administered program, "Director" means the Regional Administrator. When there is an approved program, "Director" normally means the State or Tribal director. In some circumstances, however, EPA retains the authority to take certain actions even when there is an approved State or Tribal program. In such cases, the term "Director" means the Regional Administrator and not the State or Tribal Director.

8. Drywell (40 CFR 144.3)

A well other than an improved sinkhole or subsurface fluid distribution system, completed above the water table so that its bottom and sides are typically dry except when receiving fluids (often referred to as a vadose zone well).

9. Endangerment [Section 1421 (d)(2)]

Underground injection endangers drinking water sources if such injection may result in the presence in underground water which supplies or can reasonably be expected to supply any public water system of any contaminant, and if the presence of such contaminant may result in the system's not complying with any national primary drinking water regulation or may otherwise adversely affect the health of persons.

10. Existing injection well (40 CFR 144.3)

An "injection well" other than a "new injection well." This term is generally applied to wells which were in existence prior to the effective date of an authorized program.

11. Fluid (40 CFR 144.3)

Any material or substance which flows or moves whether in a semisolid, liquid, sludge, gas, or any other form or state.

12. Hazardous waste.

Material defined as hazardous in 40 CFR Part 261 is either a characteristic waste or a specific listed waste. The four characteristic tests are: a) ignitability as defined by 261.21(a); b) corrosivity as defined by 40 CFR 261.22(a); c) reactivity as defined by 40 CFR 261.23(a); and d) toxicity as defined by 261.24(a). The listed hazardous wastes are described in 40 CFR 261, Subpart D as non-specific sources (F-codes), specific sources (K-codes), actively hazardous off-specification discarded product (P-codes), or toxic off-specification discarded product (U-codes).

13. Improved sinkhole (40 CFR 144.3)

A naturally occurring karst depression or other natural crevice found in volcanic terrain and other geologic settings which have been modified by man for the purpose of directing and emplacing fluids into the subsurface.

14. Indian Country (40 CFR 144.3)

Indian lands as defined in 18 U.S.C. 1151. That section defines Indian Country as:

> (a) All land within the limits of any Indian reservation under the jurisdiction of the United States government, notwithstanding the issuance of any patent and, including rights of way running through the reservation;

(b) All dependent Indian communities within the borders of the U.S. whether within the original or subsequently aquired territory therof, and whether within or without the limits of a State; and

(c) All Indian allotments, the Indian titles to which have not been extinguished, including rights-of-way through the same.

15. Injection well (40 CFR 144.3)

A well into which fluids are being injected.

16. Injection Zone (40 CFR 144.3)

A geological "formation", group of formations, or part of a formation receiving fluids through a "well."

17. Mechanical Integrity (40 CFR 146.8).[19]

One means of measuring the adequacy of the construction of an injection well is by requiring a demonstration that a well has mechanical integrity. A well is deemed to have mechanical integrity if:

a) There is no significant leak in the casing, tubing, or packer; and

b) There is no significant fluid movement into a USDW through vertical channels adjacent to the injection wellbore.

Figures 3 and 4 illustrate the basic design elements of an injection well and the problems which may interfere with mechanical integrity (i.e. leaks in the casing and fluid movement through vertical channels in the casing/wellbore annulus as shown in the two circular sections on the right). It should be noted that interformational flow into or between USDWs where there is no connection with the injection zone may result in significant contamination of a USDW. Guidance indicates that the potential for such movement must be addressed when a demonstration of mechanical integrity is made.

The absence of leaks may be determined by:

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[19] For a more detailed insight regarding discussion of the various technical issues and methods involved in demonstrating mechanical integrity, the MIT references in Appendix A should be consulted. MIT reference Nos. 1, 2, 3, 20, and 21 are especially noteworthy for outlining the technical aspects of mechanical integrity. Information on field experience with MIT in the field can be obtained from MIT reference Nos. 6, 7, 8, and 9.

1. Monitoring the annulus pressure while maintaining a positive pressure on the annulus, after an initial pressure test;

2. Pressure testing with liquid or gas;

3. Radioactive tracer testing in cases where the procedure is valid for leak detection; or

4. Alternative testing approved by the permitting agency after EPA approval (40 CFR 146.8[d]).

The absence of vertical movement may be determined by using:

1. A temperature log, noise log, radioactive tracer survey in certain cases; and an oxygen activation survey[20](also known as a water flow log).

2. An alternative test or combination of tests approved by the permitting agency and concurred on by EPA (40 CFR 146.8[d]).

3. Cementing records or cement evaluation logs which show the existence of adequate cement to prevent fluid migration (only for Class II wells and Class III wells with plastic casing). For Class II wells, the use of a valid cement bond log is essential as a means of verifying the cement record. At a minimum, the cement record must contain the job tickets from the contractor verifying the number of sacks used and the method of placement.

18. New injection well (40 CFR 144.3)

An "injection well" which began injection after a UIC program for the State applicable to the well is approved or prescribed (effective date). The effective date of most of the approved program is 30 days after the date of approval.

19. Point of Injection (40 CFR 144.3)

The last accessible sampling point prior to waste fluids being released into the subsurface environment through a Class V injection well. For example, the point of injection of a Class V

[20] A proposal for the approval of the oxygen activation log and a request for comment was authorized for use on a nationwide basis by publication in the Federal Register in the Federal Register on February 1, 1991 (**56FR4063**). The final approval was issued in the Federal Register on January 10, 1992 **57FR1176**.

septic system might be the distribution box - the last accessible sampling point before the waste fluids drain into the underlying soils. For a dry well, it is likely to be the well bore itself.

20. Sanitary waste (40 CFR 144.3)

Liquid or solid wastes originating **solely** from humans and human activities, such as wastes collected from toilets, showers, wash basins, sinks used for cleaning domestic areas, sinks used for food preparation, clothes washing operations, and sinks or washing machines where food and beverage serving dishes, glasses, and utensils are cleaned. Sources of these wastes may include single or multiple residences, hotels and motels, restaurants, bunkhouses, schools, ranger stations, crew quarters, guard stations, campgrounds, picnic grounds, day-use recreation areas, other commercial facilities and industrial facilities **provided the waste is not mixed with industrial waste.**

21. Septic system (40 CFR 144.3)

A well that is used to emplace sanitary waste below the surface and is typically comprised of a septic tank and subsurface fluid distribution system or disposal system.

22. Significant amount of water

For the purpose of defining a USDW, the Office of Ground Water and Drinking Water uses 1 gallon per minute as the threshold value for determining if an aquifer produces a significant amount of water[21].

23. Subsurface fluid distribution system (40 CFR 144.3)

An assemblage of perforated pipes, drain tiles, or other similar mechanisms intended to distribute fluids below the surface of the ground.

24. Total dissolved solids (40CFR 144.3)

The total dissolved (filtrated) solids as determined by use of the method specified in 40 CFR 136.

25. Underground Source of Drinking Water (USDW) (40 CFR 146.3).[22]

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[21] The definition of a USDW and EPA's present policy for determining if an aquifer produces a significant amount of water is discussed in: Assistance on Compliance of 40 CFR Part 191 with Ground water Protection Standards, from James R. Elder, Director OGWDW to Margo T. Oge, Director Office of Radiation and Indoor Air: June 4, 1993.

[22] The broadness of the definition of a USDW was based on Congressional intent (See House Report (93rd Congress, 2nd Session) **No. 93-1185**, dated July 10, 1974) that the definition

An aquifer or portion of an aquifer which:

a) Supplies any Public Water System; or

b) Contains a sufficient quantity of ground water (See definition number 20 and footnote number 15) to supply a Public Water System; and

1) currently supplies drinking water for human consumption; or

2) contains fewer than 10,000 mg/l total dissolved solids unless exempted by the following provisions.

26. Well (40 CFR 144.3)

A bored, drilled or driven shaft whose depth is greater than the largest surface dimension; or, a dug hole whose depth is greater than the largest surface dimension; or, an approved sinkhole;, or, a subsurface distribution system.

27. Well Injection (40 CFR 144.3)

The subsurface emplacement of fluids through a well.

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use 10,000 mg/liter as an upper limit. Congress also indicated that EPA develop a program that provided protection to existing and **future** sources of drinking water (Also see Section 1421 (d) (2) of the SDWA). Further, EPA has followed a policy assuming that for the purpose of defining a USDW, the term significant amount of water is any amount over 1 gallon per minute (See Assistance on Compliance of 40 CFR Part 191 with Ground water Protection Standards, from James R. Elder, Director OGWDW to Margo T. Oge, Director Office of Radiation and Indoor Air: June 4, 1993.)

APPENDIX C

UNDERGROUND INJECTION CONTROL PROGRAM
WELL CLASSES

CLASS	DEFINITION	EXAMPLE
I	a) Injection of industrial and municipal waste below the lowermost formation containing, within 1/4 mile of the wellbore an underground source of drinking water (USDW); b) Injection of hazardous waste, as defined by 40 CFR 261 below the lowermost formation containing, within 1/4 mile of the wellbore a USDW; and c) Injection of radioactive waste below lowermost aquifer containing, within 1/4 mile of the wellbore a USDW.	-Chemical Company disposal of nonhazardous fertilizer below lowermost USDW. -Disposal of secondary treated municipal waste below lowermost USDW. -Rocky Mtn. Arsenal deep disposal of pesticide and nerve gas waste (hazardous) at a depth of 12,000+ ft.. Plugged and abandoned after induced seismic events.
II	a) disposal of fluids brought to the surface in connection with natural gas storage operations or conventional production of oil and gas which may be commingled with waste waters from gas plants that are an integral part of production operations; b) Injection of fluids for enhanced recovery of oil or gas; and c) Injection for storage of hydrocarbons that are liquid at standard temperature and pressure.	-Disposal of produced water, drilling waste, spent well workover fluids, gathering line pigging fluid, etc., often commingled with gas plant wastes that are not defined as hazardous at the point of injection. -Injection of gas for pressure maintenance. -Secondary water flood in a depressurized reservoir. -Micellar Polymer tertiary flood in a depleted oil reservoir. -Injection of oil into a salt dome for storage.
III	Injection of fluids for extraction of minerals including: a) solution mining of copper and uranium from areas which have not been conventionally mined; b)solution mining of potash, or salts; and c) steam injection using the Frasch Process for recovery of sulphur.	-Uranium solution mining of a shallow “rollfront” deposit in a potable water aquifer using multiple injection and extraction wells.. -In-situ potash recovery using multiple injection and extraction wells. -Steam injection using the Frasch process to recover sulphur from bedded deposits in the gulf coast region.
CLASS	**DEFINITION**	**EXAMPLE**

IV	a) Disposal of hazardous or radioactive waste into or above a formation which contains an underground source of drinking water. Construction and maintenance is banned unless approved under provisions of 40 CFR 144.13(c); and b) Injection of waste water containing hazardous waste into or above a USDW, as part of an EPA or State approved CERCLA or RCRA cleanup which meets the criteria outline in Section 7010(b) of HSWA.[23]	-Release of solvents (a listed hazardous waste) from the electronics manufacturing process into a runoff control well for a parking lot. (Banned) -Regular disposal of wastes from an industrial process into shallow disposal wells where wastes are defined as hazardous because they exhibit one of the characteristics at 40 CFR 261.21, 261.22, 261.23, or 261.24. (Banned) -Injection of wastewater pumped from cleanup of railroad tie treatment facility back into the contaminated area as part of RCRA approved cleanup.
V	All other types of injection wells. This well class may include, but is not limited to: irrigation return flow wells, cesspools, non-hazardous industrial disposal systems into USDWs, storm water control wells, mining sand backfill wells, recharge wells, brine extraction wells, etc. A national study identified 32 different types of wells. Most of these wells are shallow and penetrate only the surficial aquifer	-Dry wells in parking lots or areas of towns and cities with no storm sewers for runoff control, where runoff is not hazardous. -Recharge of treated sewage to prevent subsidence or sea water intrusion. -Drainfields associated with multi-family dwellings, serving more than 20 people per day. -Recharge wells associated with reinjection of treated water at LUST, RCRA, and CERCLA sites* where fluid is not hazardous under 40 CFR 261.
***NOTE:**	LUST - Leaking Underground Storage Tank (The LUST Program mandates cleanup of sites where leaks have occurred). RCRA - Resource Conservation and Recovery Act (This law sets requirements for programs regulating the generation, treatment, and disposal of solid and hazardous waste and the installation and cleanup of underground storage tanks). CERCLA - Comprehensive Environmental Response, Compensation and Liability Act (This law establishes the criteria for listing, investigating and cleaning up sites using a fund set up by law [Superfund]).	

[23] Additional detail is available in OSWER Directive 9234.1-06: Applicability of Land Disposal Restrictions to RCRA and CERCLA Ground-Water Treatment Reinjection Superfund Management Review: Recommendation No. 26: U.S. EPA, Office of Solid Waste and Emergency Response; Memo from Don R. Clay, Assistant Administrator Office of Solid Waste and Emergency Response, December 27, 1989. Information on the interface between CERCLA and the CWA and SDWA can be found in the fact sheet, CERCLA Compliance with the CWA and SDWA by U.S. EPA, Office of Solid Waste and Emergency Response: EPA 9234 2-06, FS, February 1990.

APPENDIX D

DESCRIPTION OF COMMON CLASS II FLUIDS

Class II Injection Wells Include:

1) Salt Water Disposal (SWD) wells are those disposing of fluids brought to the surface that may be commingled with waste streams from natural gas (methane) sweetening and dehydration plants as long as the fluid is not hazardous at the point of injection.[24] These wells also receive fluids produced during the recovery of methane stored in underground reservoirs, such as salt domes.

2) Enhanced Recovery (ER) wells, including wells used for maintenance of reservoir pressure and for tertiary recovery of oil and gas.

3) Hydrocarbon Storage (HC) wells inject hydrocarbon product that are liquid at standard temperature and pressure.

The above type wells are authorized to inject under the Underground Injection Control (UIC) Program, either by rule or by permit. The general categories considered to be Class II fluids are[25]**:**

1) Produced water from oil and gas production;
2) Waste fluids from the actual drilling operation;
3) Pigging fluids from the cleaning of collection and injection lines within the field;
4) Used workover and stimulation fluids recovered from production, injection, and exploratory wells;
5) Gas, such as methane, CO_2 or nitrogen used for enhanced recovery/pressure maintenance of production reservoirs;
6) Brine reject from water softeners associated with enhanced recovery;

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[24] Only certain fluids can be injected into Class II wells as discussed in Classification of Wells Used to Inject a Scrubber Waste or Water Softener Regeneration Brine Associated With Oil Field Operations: Memo to Water Supply Branch Chiefs from Mike Cook, Director, Office of Drinking Water, July 31, 1987.

[25] Additional Clarification regarding the scope of fluids acceptable for disposal into a Class II SWD well is provided in the following documents: 1) Definition of a Class II Fluid: Letter to C. V. Chatterton, Director, Alaska Oil and Gas Conservation Commission from Region X Water Division Director (approved by ODW), February 26, 1990; 2) Classification of Injection Fluid from a National Gas Processing Plant: Memo to Edward P. Watters, Region V from UIC Branch Chief (ODW), Francoise Brasier, March 8, 1990; and 3) Classification of Waste Fluids Associated with Clean up of Crude Oil Leaks in Active Oil Fields: Memo from the Director of the Office of Solid Waste to the Region VIII, Water Management Division Director, May 21, 1991.

7) Waste fluids from methane sweetening and dehydration, which is blended with produced water, as long as it is not hazardous at the point of injection;
8) Waste sour gas from the methane sweetening process;
9) Waste fluids from circulation during well cementing;
10) Waste oil and fluids from cleanup associated with primary production (but not the transportation) of oil within the oil field;
11) Fresh water used for enhanced recovery makeup;
12) Water containing chemicals such as polymers for the purpose of enhanced recovery; and
13) Drill cuttings from wells associated with oil and gas production.

It should be emphasized that unused chemicals (such as stimulation fluids, acid, paint, solvents, etc.), used motor oil, and field-generated sanitary waste are not exempt for Subtitle C of RCRA[26] and also are not Class II wastes. They do not fall in either the produced at the surface or the gas plant waste category. This waste (be it hazardous RCRA waste or non-hazardous waste) must be disposed of in an approved facility, probably off-site. The UIC Program Director should be consulted regarding the eligibility of specific waste streams.

[26] The exemption of oil and gas production waste from Subtitle C of RCRA is explained in the following notice published in the Federal Register: Regulatory Determination for Oil and Gas and Geothermal Exploration, Development and Production Wastes, U.S. EPA, Office of Solid Waste and Emergency Response: **53FR25446,** July 6, 1988. This determination was clarified to include the status of gas plant wastes with a Federal Register Notice: Clarification of the Regulatory Determination for Wastes from the Exploration, Development, and Production of Crude Oil, Natural Gas and Geothermal Energy: U.S. EPA, Office of Solid Waste and Emergency Response; **58FR15284**, March 22, 1993. A question and answer document which provides additional information regarding the determination is: Crude Oil and Natural Gas Exploration and Production Wastes: Exemption from RCRA Subtitle C Regulation: U.S. EPA, Office of Solid Waste and Emergency Response report, 30 pages; EPA530-K-95-003, May 1995.

APPENDIX E

MINIMUM FEDERAL TECHNICAL REQUIREMENTS FOR STATE UIC PROGRAMS

The following discussion summarizes the major program requirements stipulated in the UIC regulations. The regulations themselves describe all the legal requirements that apply to each well class and should be consulted for the definitive version of applicable requirements.

PERMITTING REQUIREMENTS common to Class I, II and III WELLS.

All Permits will contain the following elements:

- Demonstration that casing and cementing are adequate to prevent movement of fluid into or between USDWs. Cement bond logs are often needed to evaluate the adequacy of the cementing records, especially for Class II wells[27].

- Financial assurances (bond, letter of credit, or other adequate assurance) that the owner or operator will maintain financial responsibility to properly plug and abandon the wells.

- A maximum operating pressure calculated to avoid initiating and/or propagating fractures that would allow fluid movement into a USDW.

- Monitoring and reporting requirements.

- Requirement that all permitted (and rule authorized) wells which fail mechanical integrity be shut in immediately. The well may not resume injection until mechanical integrity has been demonstrated.

- Schedule for demonstrating mechanical integrity (at least every 5 years for Class I non-hazardous[28], II, and Class III salt recovery wells).

- All permitted injection wells, which have had the tubing disturbed, must have a

[27] To determine if the cement has been placed to adequately isolate the injection zone, an adequate cement bond or other evaluation log must be run as a means of verifying the cementing records. Cement records by themselves give no information on the condition or location of the actual cement. There are numerous references relating to cement evaluation, but Cement Evaluation Notes Compiled for the MIT Workgroup by Jerry T. Thornhill: U.S. EPA, Robert S. Kerr Research Center; Edited by Paul S. Osborne, U.S. EPA, Region VIII, 13 pages, January 17, 2001, is a good, concise field guide.

[28] Class I hazardous wells must demonstrate mechanical integrity once a year.

pressure test to demonstrate mechanical integrity.

- Plans for plugging and abandonment. All Class I to III wells shall be plugged with cement.

1. CLASS I WELLS. Those that involve: a) disposal of non-hazardous industrial or municipal waste below an underground source of drinking water (USDW); and b) disposal of hazardous waste, as defined by 40 CFR Part 261, below an underground source of drinking water (See Figure 3). The reservoir in the case of hazardous waste must be separated from the lowermost USDW by two confining zones an intervening porous zone containing fluids in excess of 10,000 mg/liter (See 40 CFR 146.62 for minimum siting criteria).

Conditions for Operation

- All new injection wells require a Permit prior to construction.
- Area of review for non-hazardous injection wells is a minimum of 1/4 mile, except for some Indian Country.
- Area of review for hazardous waste injection wells is a minimum of 2 miles.
- Injection between the outermost casing and the wellbore is prohibited.
- All injection wells must be tested for mechanical integrity prior to operation. This includes both a pressure test to demonstrate the absence of casing, tubing, or packer leaks and a valid temperature, oxygen activation or noise log or approved alternative log to demonstrate the absence of vertical fluid movement.
- Hazardous waste injection wells must have surface casing set through all USDWs. This casing must be cemented to the surface.
- Permit issued for up to ten years.
- Injection pressure must be limited such that no fracturing of the injection zone occurs during operation.
- Hazardous waste injection wells must have an annual Radioactive Tracer Survey to demonstrate integrity of bottom-hole cement.
- Hazardous waste injection wells are subject to the land disposal restrictions of 40 CFR 148. Submittal of a petition demonstrating there will be "no migration out of the injection zone" as required by Sections 3004(f)-(h) of HSWA (1984), must either precede the permitting process or run concurrently with the permit application review process. This demonstration must show, through computer modeling, that the hazardous constituents injected will not migrate out of the injection zone for as long as

they remain hazardous.

- Area Permits are allowed only for non-hazardous injection wells.

Monitoring Requirements.

- Continuous monitoring of annulus pressure, injection pressure, flow rate, and volume is required.

- An annual pressure falloff test of the injection reservoir must be performed in each Class I injection well. The results must be analyzed, including a comparison with previous tests, for major reservoir characteristics to determine if significant changes are occurring within the reservoir, especially immediately adjacent to the wellbore.

- Class I hazardous waste injection wells require a written waste analysis plan.

- The UIC Director may require Class I wells to obtain, interpret and submit seismic data for the site.[29]

- The UIC Director may require Class I wells to have ground-water monitoring in the 1st aquifer overlying the injection zone with quarterly sampling.

- Class I hazardous waste injection wells must have an annual RTS to test the adequacy of the bottom hole cement.

- Class I hazardous waste injection wells must have a casing inspection log whenever there is a well workover.

- Non-hazardous waste injection wells must demonstrate mechanical integrity at least once every five years unless the Director waives the requirement.

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[29] The following reports provide information on situations where seismic activity has been associated with injection operations: 1) Earthquake Hazard Associated with Deep Well Injection by Robert L. Weisen and Craig Nicholson, US Geological Survey: 100 pages; Open File Report 87-331, Report for U.S. EPA, Office of Drinking Water, June 1987; 2) 1999 Status Report-Paradox Valley Seismic Network Paradox Valley Project (Paradox Injection Well No.1) Southwestern Colorado by Jon Ake, Ken Mahrer, and Lisa Block: U.S. Bureau of Reclamation, Technical Service Center; Technical Memorandum No. D8330-2000-012, April 2000; and 3) 2000 Status Report-Paradox Valley Seismic Network Paradox Valley Project (Paradox Injection Well No.1) Southwestern Colorado by Ken Mahrer, Lisa Block, and Jon Ake: U.S. Bureau of Reclamation, Technical Service Center; Technical Memorandum No. D8330-2001-007, April 2001.

- Hazardous waste injection wells must demonstrate internal mechanical integrity (pressure test to demonstrate no leaks in casing, tubing, or packer) once per year.

- Class I hazardous wells are subject to post-closure monitoring requirements.

Reporting Requirements

- Any noncompliance with UIC regulations must be reported orally to EPA within 24 hours of discovery and in writing within five (5) days.

- For all hazardous waste injection wells, the Director must be notified within 24 hours of any well alarm or well shutdown.

- Submit Quarterly Report (EPA Form 7520-11 is suggested) containing: 1) the physical, chemical and other relevant characteristics of injected fluid: 2) observations of monthly average, maximum and minimum values for injection pressure, flow volume and rate and the pressure on the casing/tubing annulus; and 3) the results of any on-site ground-water monitoring.

- The first quarterly report after completion shall contain the results of periodic MIT, any well workover, and any other tests required by the Director.

3. CLASS II WELLS. Those wells are utilized for injection for the purpose of: a) enhanced recovery of oil and gas; b) injection for storage of hydrocarbons liquid, at standard temperature and pressure; and c) the disposal of fluids which are brought to the surface in connection with natural gas storage operations or conventional production of oil and gas. Produced water may be commingled with waste waters from gas plants that are an integral part of production operation, unless those waters are classified as a hazardous waste at the point of injection. This does not include waste fluids from CO_2 production plants.

Conditions for Operation:

- New injection wells require a Permit for construction or conversion.

- An existing hydrocarbon storage or enhanced recovery well may be authorized by rule for the life of the well.

- Permits are issued for a limited period of time, that may be up to the operating life of the facility.

- New injection wells must be tested for mechanical integrity prior to operation.

- Once in operation, injection wells must have a mechanical integrity test at least once every five years.

- o Existing rule authorized injection wells, which have had the tubing disturbed (workover), must have a pressure test to demonstrate mechanical integrity.
- o Injection pressure shall not exceed that which would initiate and/or propagate fractures in the confining zone adjacent to a USDW.

- o A review of the Permit is required at least once every five years, including review of the most recent mechanical integrity test.

- o Area Permits are allowed for wells within the same well field, project or reservoir operated by a single owner or operator..

- o Area of review for newly permitted injection wells is a minimum of 1/4 mile radius. This radius will be greater if the radius of endangering influence is found to exceed the fixed radius.

- o Authorization by rule is granted for existing enhanced recovery wells subject to applicable construction, operating, reporting, monitoring, plugging, and financial assurance requirements listed in 40 CFR 144.28. Successful mechanical integrity tests must be conducted at least once every five years[30].

- o Emergency Permits are allowed if they meet the stipulations of 40 CFR 144.34..

- o Operator must conduct monitoring of injection pressure, flow rate, and volume. Continuous monitoring may, in specific situations, be required.

Monitoring Requirements:

- o The operator must obtain a sample of the injection fluid and analyze it for specified parameters at least once within the first year of authorization, and thereafter when changes are made to the injection fluid.

- o The operator shall observe the injection pressure, flow rate, and cumulative volume at least weekly for SWD wells; monthly for ER wells; and daily for HC and cyclic steam wells. At least one observation of each of the above parameters is to be recorded at intervals no greater than 30 days.

- o The operator must perform a mechanical integrity test (MIT) on the well at least once every five (5) years during the life of the well, and following any workover operation.

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[30] Generally, wells which are authorized by Permit (i.e., new wells, conversion wells, and some formerly rule-authorized SWD wells) have monitoring requirements that differ from those listed in 40 CFR 144.28 for rule-authorized wells. Monitoring requirements for permitted wells are established on a case-by-case basis; therefore, the permittee should be guided by the specific monitoring conditions stated in each Permit.

Reporting Requirements

- o If a well is temporarily abandoned (TA), the operator must notify the UIC Director notification within 30 days. A well may remain TA for a period of two (2) years, after which the operator must plug and abandon the well unless an extension is requested and subsequently granted by the UIC Director. An extension will only be granted if the operator can demonstrate that no endangerment to USDWs will take place during the period of the TA.

- o The operator must report any noncompliance with UIC regulations orally to EPA within 24 hours of discovery and in writing within five (5) days.

- o Submit an Annual Disposal/Injection Well Monitoring Report (EPA Form 7520-11 or State equivalent) summarizing observations of injection pressure and cumulative volume. Submit the report to the UIC Director by January 31 of each year covering the observations for the previous year. This requirement may be different for permitted wells; refer to the permit for appropriate date and requirements.

- o If a change of ownership occurs for rule-authorized wells, the operator must notify EPA within 30 days of such transfer. Permitted wells require 30 days notice in advance of the proposed transfer date. An Application to Transfer Permit (EPA Form 7520-7or State equivalent).

- o Notify the UIC Director of company change of address at least 15 days prior to the effective date.

- o Submit Well Rework Record (EPA Form 7520-12 or State equivalent) within 60 days of any well workover.

- o Notify EPA at least 30 days prior to performing a mechanical integrity test (MIT). A shorter notice is permissible if sufficient time is allotted for EPA to witness the test. The operator must provide the UIC Director with test results within 30 days, unless a MIT failure occurs (pressure change of 10% or greater within 30 minutes), in which case notification must be within 5 days.

- o Notify the UIC Director at least 45 days prior to initiating plugging and abandonment of a well. A shorter notice is permissible if sufficient time is allotted for the UIC Director to witness the operation.

- o Submit a Plugging Record (EPA Form 7520-13 or State equivalent) within 60 days of plugging and abandonment of a well, specifying the manner in which the well was plugged.

4. CLASS III WELLS. Injection of fluids for extraction of minerals including solution mining of

copper and uranium, solution mining of salts, evaporites, or potash, and Frasch sulfur process.

Operating Conditions:

- All new operations require a permit.
- Existing operations may be authorized by rule for up to five years after approval of a UIC program. (1 year for EPA administered programs).
- Permit may be for up to the life of the well or project.
- The UIC Director must review the Permit at least once every five years.
- Area permits may be issued for multi-well projects.
- Area of review is a minimum of 1/4 mile from the boundary of the permitted project area or wellbore if this is not an area permit.
- The operator must monitor overlying or underlying underground sources of drinking water, if injection occurs into a formation containing water with a TDS of less than 10,000 mg/liter (See 40 CFR 146.32(e)).
- New injection wells must demonstrate mechanical integrity.
- Injection wells constructed with PVC casing (used primarily for shallow uranium solution mining) may demonstrate part II of mechanical integrity, the absence of significant flow adjacent to the casing, by circulating cement to the surface.
- Salt/Evaporite solution mining injection wells must demonstrate mechanical integrity every five years.
- Injection wells utilized for salt extraction that are constructed with metal casing must demonstrate Part II of mechanical integrity (the absence of significant flow adjacent to the casing) by use of a temperature or noise log or oxygen activation log every five years. All Class III wells so constructed must demonstrate Part II of MI when initially constructed.

Monitoring Requirements:

- The operator must obtain a sample of the injection fluid and analyze it for specified parameters with sufficient frequency to yield representative data on its characteristics, and thereafter when changes are made to the injection fluid.

- The operator shall observe the injection pressure and flow rate or volume, semi-monthly or metering and daily recording of injected and produced fluid volumes as appropriate.

- The operator must perform a mechanical integrity test (MIT) on the well at least once every five (5) years during the life of the well for salt solution mining wells..

- The operator must monitor any required ground-water monitoring wells quarterly.

Reporting Requirements

- The operator must report any noncompliance with UIC regulations orally to EPA within 24 hours of discovery and in writing within five (5) days.

- Submit quarterly Monitoring Report (EPA Form 7520-11 or State equivalent) on required monitoring to the UIC Director.

- If a change of ownership occurs for rule-authorized wells, the operator must notify EPA within 30 days of such transfer. Permitted wells require 30 days notice in advance of the proposed transfer date. An Application to Transfer Permit (EPA Form 7520-7or State equivalent).

- Notify the UIC Director of company change of address at least 15 days prior to the effective date.

- Submit Well Rework Record (EPA Form 7520-12 or State equivalent) within 60 days of any well workover.

- Notify EPA at least 30 days prior to performing a mechanical integrity test (MIT). A shorter notice is permissible if sufficient time is allotted for EPA to witness the test. The operator must provide the UIC Director with test results within 30 days, unless a MIT failure occurs (pressure change of 10% or greater within 30 minutes), in which case notification must be within 5 days.

- Notify the UIC Director at least 45 days prior to initiating plugging and abandonment of a well. A shorter notice is permissible if sufficient time is allotted for the UIC Director to witness the operation.

- Submit a Plugging Record (EPA Form 7520-13 or State equivalent) within 60 days of plugging and abandonment of a well, specifying the manner in which the well was plugged.

5. CLASS IV WELLS. Injection of hazardous or radioactive waste into or above a formation which is a USDW (See Figure 1).

Conditions for Operation:

- o Construction and operation of these injection wells, for the purpose of hazardous waste disposal, is prohibited (HSWA, 1984 and 40 CFR 144.13).

- o Wells used to inject contaminated ground water that has been treated back into the same formation as a part of an EPA or State approved RCRA or CERCLA project may be constructed and may continue to operate for the life of the project. Once approved, these wells are authorized by rule for the life of the project (See 40 CFR 144.23(c)). In evaluating the proposal the State or EPA would determine if the following conditions are met: 1) reinjected ground water is treated to substantially reduce hazardous constituents prior to reinjection; and 2) the final response action or corrective action will, upon completion, be sufficient to protect human health and the environment.

- o Existing injection wells not included as part of an approved RCRA or CERCLA project must be closed within 6 months of promulgation of a state program (for EPA administered programs, that is December 25, 1984).

- o Class IV injection wells which are part of a CERCLA or RCRA cleanup must be approved by EPA or the State prior to operation and are subject to necessary Applicable or Relevant and Appropriate Standards, Limitations, Criteria, and Requirements (ARARs) to ensure that such wells meet the criteria of Section 3020 of RCRA.[31]

6. CLASS V WELLS. All other types of injection wells including, but not limited to: injection of geothermal water produced for heating; heat pumps; service station sumps; cooling return flow wells; dry wells (such as French drains along highways); drainage wells and irrigation return flow wells; in-situ oil shale; wells for leaching of existing underground mines for the recovery of minerals, such as copper; mine backfill wells to emplace tailing or other material for the purpose of either disposal and/or the control of mine subsidence; large-capacity cesspools; motor vehicle waste disposal wells; and non-hazardous industrial or municipal wells injecting into or above a USDW. The formal definition includes any injection wells which emplace fluids into the subsurface that do not meet the definitions of a class I-IV well per 40 CFR 146.5. As can be noted from the examples Class V wells have a variety of uses including disposal, recharge, subsidence control and mineral recovery. Although Class V wells are mainly shallow injection wells, they range in complexity from shallow drainage to sophisticated deep reinjection wells.

   A report to Congress dated September 1987, identified 32 types of Class V wells. Subsequent

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[31] Such projects must be approved by the applicable State or EPA program with jurisdiction. The project must meet the criteria outlined in Applicability of Land Disposal Restrictions to RCRA and CERCLA Ground Water Treatment Reinjection Superfund Management Review: December 27, 1989, 6 pages; OSWER Directive 9234.1-06.

to the report to Congress, EPA commenced an effort to develop regulations for certain types of Class V wells which have been identified as having a significant threat to shallow ground water. The actual promulgation of new rules covering certain well categories was preceded by a study of Class V well types. This study was released in September 1999: Class V Underground Injection Control Study, Office of Water: EPA/816-R-99-014, September 1999; 23 volumes and 5 Appendices. This study can be accessed on-line (as of March 2001) by going to the following web page: http://www.epa.gov/safewater/uic/cl5study.html. The new additions to the Class V rules were published on December 7, 1999.

Conditions for Operation:

- Operators of existing wells are required to notify primacy or direct implementation (DI) program of location and type of well (See 40 CFR 144.83 and 144.84).

- Construction and operation of Class V wells will be authorized by rule unless a permit is determined to be necessary to protect USDWs or is required for specific categories.

- State or EPA may permit or close Class V wells deemed to threaten the ground water if injection will result in violating a primary drinking water Maximum Contaminant Level (MCL) (as defined by 40 CFR 141) or will result in a threat to human health. The quality of fluids at the point of injection is used to assess whether endangerment is a potential problem.

- No new large-capacity cesspools or motor vehicle waste disposal wells are allowed as of April 5, 2000 and existing large-capacity cesspools and motor vehicle waste disposal wells must be closed by April 5, 2005 (Operators of motor vehicle waste disposal wells may apply for a waiver from the ban and obtain a permit).

Failure to comply with any of the monitoring and reporting UIC requirements constitutes a violation of the Safe Drinking Water Act (SDWA) and is grounds for enforcement action. Under the SDWA, operators are liable for administratively assessed penalties of up to $137,500.00, or judicially imposed penalties of up to $25,000.00/day of violation, with no penalty cap.

Reports and requests for information should be directed to the appropriate State or EPA contacts.

APPENDIX F

Typical Issues and Questions That Permit Applications Must Address

1. GEOLOGICAL CONSIDERATIONS.

   - What is the stratigraphy?
   - What are the potential injection formation characteristics, such as water quality, initial pressure, permeability, porosity, thickness, areal extent, etc?
   - What are the geologic and hydrologic characteristics of the confining zone (lithology, permeability, porosity, etc)?
   - What is the potential for fluid movement out of the injection zone?
   - Are there other wells penetrating the injection zone within the area of review?
   - What is the potential for fracturing injection or confining formations?
   - Are there major faults or shear zones in the area which may be influenced by pressure changes in the reservoir? Will the faults be transmissive or sealing faults?
   - What are the corrosive characteristics of the formation fluids?
   - What is the formation water quality of all water bearing zones above and immediately below the injection zone?
   - What are the current uses of all USDWs?
   - What are the potential uses of all USDWs?
   - Are native reservoir fluids and reservoir rock compatible with proposed injected fluids?

2. STRUCTURAL INTEGRITY OF AN INJECTION WELL.

   - What forces (burst, collapse, and tension) will the injection well be subjected to?
   - What casing size and characteristics (weight, composition, surface coating, and strength) are needed?
   - What type and placement of cement is needed to assure isolation of the injection zone and USDWs?
   - What hole deviation is acceptable?

- What type of tubing and packer (size, composition, burst strength, and coating) will be needed.

- What special design considerations are needed to assure that the injection well works as expected?[32]

EPA or primacy agency performs its review to assure that environmental considerations are properly addressed.

3. OPERATIONAL CONSIDERATIONS

- Is the injected fluid consistent with well design and authorization?

- Does the injection well have mechanical integrity?

- Are injection fluid volumes within established limits?

- Can the injection well cause contamination through nearby wells?

- Is the plugging and abandonment plan complete?

- Has the operator made a satisfactory demonstration of financial responsibility?

- Will injection pressures initiate new fractures and/or propagate existing fractures thereby providing potential pathways for fluid migration?

- Will injection pressures be limited so as to prevent contamination of USDWs?

4. MONITORING CONSIDERATIONS

- QUALITY OF INJECTED FLUIDS

    o Monitor often enough to indicate change in quality.

    o Waste stream must be analyzed to adequately define its nature.

- FLUID QUANTITY

    o Injection pressure, volume, rate, and annulus pressure must be monitored

[32] The operator will usually design the injection well to assure that these considerations are resolved relative to the expected use of the injection well.

continuously for Class I wells.

- o Injection pressure, cumulative volume and rate must be monitored at least weekly for Class II disposal wells and monthly for Class II enhanced recovery wells.

- RESERVOIR CONDITIONS

  - o Class I wells must perform a yearly reservoir pressure falloff test to determine if abnormal buildup is occurring.

  - o Operation of a Class I well must be limited so pressures do not exceed that which would initiate fractures in the injection zone.

APPENDIX G

CLASS V INJECTION WELL TYPES IDENTIFIED IN THE 1987 REPORT TO CONGRESS

WELL CODE	NAME OF WELL TYPE AND DESCRIPTION
	DRAINAGE WELLS (a.k.a. DRY WELLS)
5F1	Agricultural Drainage Wells - receive irrigation tailwaters, other field drainage, animal yard, feedlot, or dairy runoff, etc.
5D2	Storm Water Drainage Wells - receive storm water runoff from paved areas, including parking lots, streets, residential subdivisions, building roofs, highways, etc.
5D3	Improved Sinkholes - receive storm water runoff from developments located in karst topographic areas.
5D4	Industrial Drainage Wells - wells located in industrial areas which primarily receive storm water runoff but are susceptible to spills, leaks, or other chemical discharges.
5G30	Special Drainage Wells - used for disposing water from sources other than direct precipitation. Four types were reported: landslide control drainage wells (Montana), potable water tank overflow drainage wells (Idaho), swimming pool drainage wells (Florida), and lake level control drainage wells (Florida).
WELL CODE	**GEOTHERMAL REINJECTION WELLS**
5A5	Electric Power Reinjection Wells - reinject geothermal fluids used to generate electric power - deep wells.
5A6	Direct Heat Reinjection Wells - reinject geothermal fluids used to provide heat for large buildings or developments - deep wells.
5A7	Heat Pump/Air Conditioning Return Flow Wells - reinject groundwater used to heat or cool a building in a heat pump system - shallow wells.
5A8	Groundwater Aquaculture Return Flow Wells - reinject groundwater or geothermal fluids used to support aquaculture. Non-geothermal aquaculture disposal wells are also included in this category (e.g. Marine aquariums in Hawaii use relatively cool sea water).

WELL CODE	DOMESTIC WASTEWATER DISPOSAL WELLS
5W9	Untreated Sewage Waste Disposal Wells - receive raw sewage wastes from pumping trucks or other vehicles which collect such wastes from single or multiple sources. (No treatment)
5W10	Cesspools[33] - including multiple dwelling, community or regional cesspools, or other devices that receive wastes and which must have an open bottom and sometimes have perforated sides. Must serve greater than 20 persons per day if receiving solely sanitary wastes. (Settling of solids)
5W11	Septic Systems (Undifferentiated disposal method) - used to inject the waste or effluent from a multiple dwelling, business establishment, community, or regional business establishment septic tank. Must serve greater than 20 persons per day if receiving solely sanitary wastes. (Primary Treatment)
5W31	Septic Systems (Well Disposal Method) - examples of wells include actual wells, seepage pits, cavitettes, etc. The largest surface dimension is less than or equal to the depth dimension. Must serve greater than 20 persons per day if receiving solely sanitary wastes. (Less treatment per square area than 5W32)
5W32	Septic Systems (Drainfield Disposal Method) - examples of drainfields include drain or tile lines, and trenches. Must serve more than 20 persons per day if receiving solely sanitary wastes. (More treatment per square area than 5W31)
5W12	Domestic Wastewater Treatment Plant Effluent Disposal Wells - dispose of treated sewage or domestic effluent from small package plants up to large municipal treatment plants. (Secondary or further treatment)

WELL CODE	MINERAL AND FOSSIL FUEL RECOVERY RELATED WELLS
5X13	Mining, Sand, or Other Backfill Wells - used to inject a mixture of water and sand, mill tailings, and other solids into mined out portions of subsurface mines whether what is injected is a radioactive waste or not. Also includes special wells used to control mine fires and acid mine drainage wells.
5X14	Solution Mining Wells - used for in situ solution mining in conventional mines, such as slopes leaching.

[33] This well name has been modified by Class V rule making, **64FR68546, December 7, 1999** [See 40 CFR 144.81 (2)].

5X15 In situ Fossil Fuel Recovery Wells - used for in situ recovery of coal, lignite, oil shale, and tar sands.

5X16 Spent-Brine Return Flow Wells - used to reinject spent brine into the same formation from which it was withdrawn after extraction of halogens or their salts.

WELL CODE **OIL FIELD PRODUCTION WASTE DISPOSAL WELLS**

5X17 Air Scrubber Waste Disposal Wells - inject waste from air scrubbers used to remove sulfur from crude oil which is burned in steam generation for thermal oil recovery projects. (If injection is used directly for enhanced recovery and not just disposal it is a Class II well.)

5X18 Water Softener Regeneration Brine Disposal Wells - inject regeneration waste from water softeners which are used to improve the quality of brines used for enhanced recovery. (If injection is used directly for enhanced recovery and not just disposal it is a Class II well.)

WELL CODE **INDUSTRIAL/COMMERCIAL/UTILITY DISPOSAL WELLS**

5A19 Cooling Water Return Flow Wells - used to inject water which was used in a cooling process, both open and closed loop processes.

5W20 Industrial Process Water and Waste Disposal Wells - used to dispose of a wide variety of wastes and wastewater from industrial, commercial, or utility processes. Industries include refineries, chemical plants, smelters, pharmaceutical plants, Laundromats and dry cleaners, tanneries, carwashes, laboratories, etc. Industry and Waste stream must be specified (e.g. Petroleum Storage Facility - storage tank condensation waste; Electric Power Generation Plant - mixed waste stream of laboratory drainage, fireside water, and boiler blowdown; Car Wash - Mixed waste stream of detergent, oil and grease, and paved area wash down; Electroplating Industry - spent solvent wastes; etc.)

5X28 Automobile Service Station Disposal Wells - repair bay drains connected to a disposal well. Suspected of disposal of dangerous or toxic wastes[34].

[34] The name of this category has been modified to motor vehicle waste disposal well by rulemaking, 64FR68546, December 7, 1999 (See 144.81 (16).

WELL CODE	RECHARGE WELLS
5R21	Aquifer Recharge Wells - used to recharge depleted aquifers and may inject fluids from a variety of sources such as lakes, streams, domestic wastewater treatment plants, other aquifers, etc.
5B22	Saline Water Intrusion Barrier Wells - used to inject water into fresh water aquifers to prevent intrusion of salt water into fresh water aquifers.
5S23	Subsidence Control Wells - used to inject fluids into a non-oil or gas producing zone to reduce or eliminate subsidence associated with overdraft of fresh water and not used for the purpose of oil or natural gas production.

WELL CODE	MISCELLANEOUS WELLS
5N24	Radioactive Waste Disposal Wells - all radioactive waste disposal wells other than Class IV wells[35].
5X25	Experimental Technology Wells - wells used in experimental or unproven technologies such as pilot scale in situ solution mining wells in previously unmined areas.
5X26	Aquifer Remediation Related Wells - wells used to prevent, control, or remediate aquifer pollution, including but not limited to Superfund sites.
5X29	Abandoned Drinking Water Wells - used for disposal of waste.
5X27	Other Wells - any other unspecified Class V wells. Well type/purpose and injected fluids must be specified.

[35] Radioactive disposal wells injecting below the lowermost USDW are no longer Class V wells. These wells have been moved to the Class I category (**64FR68546, December 7, 1999**).