

Introduction to the Underground Injection Control Program



Some Reminders 2018

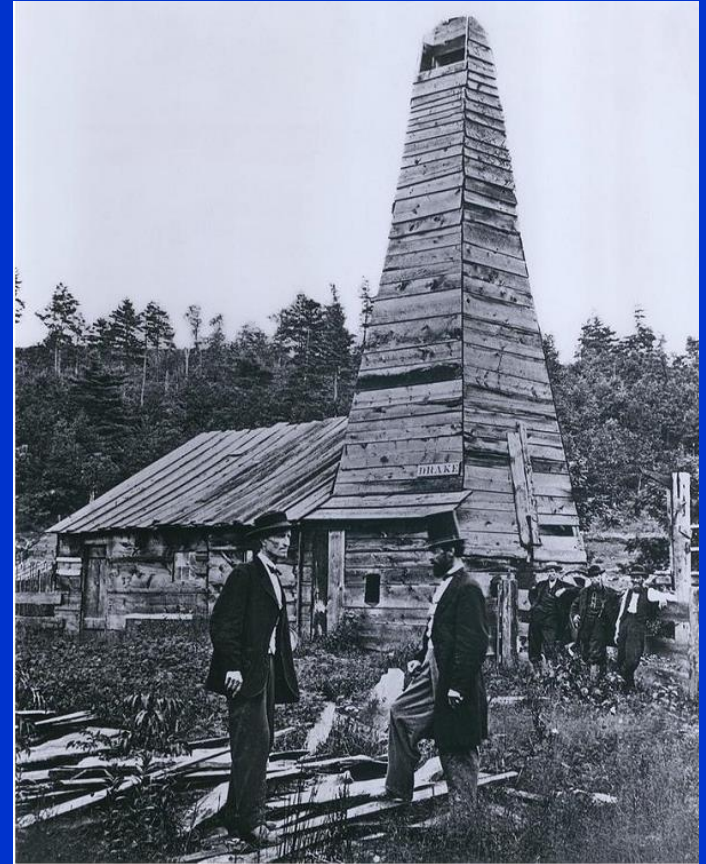
- If you seek a course certificate, you must take the exam after the course.
 - A certificate is required to obtain a federal inspection credential
- Exam will:
 - Be open book
 - Need to be completed within 90 days
 - Be passed with a score of at least 70%
- If you do NOT seek a course certificate, you do not need to take the exam.

Objective

- Describe the foundation of the Underground Injection Control (UIC) program
 - Historical uses of injection wells
 - EPA's mandate under SDWA (Safe Drinking Water Act)
 - Mission of the UIC program
 - Regulatory timeline
 - Basic terminology

History Leading to UIC

- The need for lighting: whale oil replaced by kerosene
- 1859: “Colonel” Drake drills first oil well in Titusville, PA (70 feet) to refine into kerosene
- Co-produced **brine waste** problems begin
- No regulations existed
- Brine dumping was the norm
- This was also the beginning of the use of a “barrel” of oil = 42 gallons



Source: <https://aoghs.org/petroleum-pioneers/american-oil-history/>

History Leading to UIC



- 1901: The center of oil and gas production moved to Texas
- Spindletop oilfield discovered near Beaumont, Texas
- Lucas gusher well: initial production was 100,000 barrels/day
- Started the petroleum era (according to Daniel Yergin)

Early Injection

The background of the slide features a silhouette of an oil pumpjack against a vibrant sunset sky with shades of orange, red, and purple. The pumpjack is positioned in the lower half of the frame, with its long arm extending towards the right. The sky is filled with soft, wispy clouds, and the overall atmosphere is dramatic and industrial.

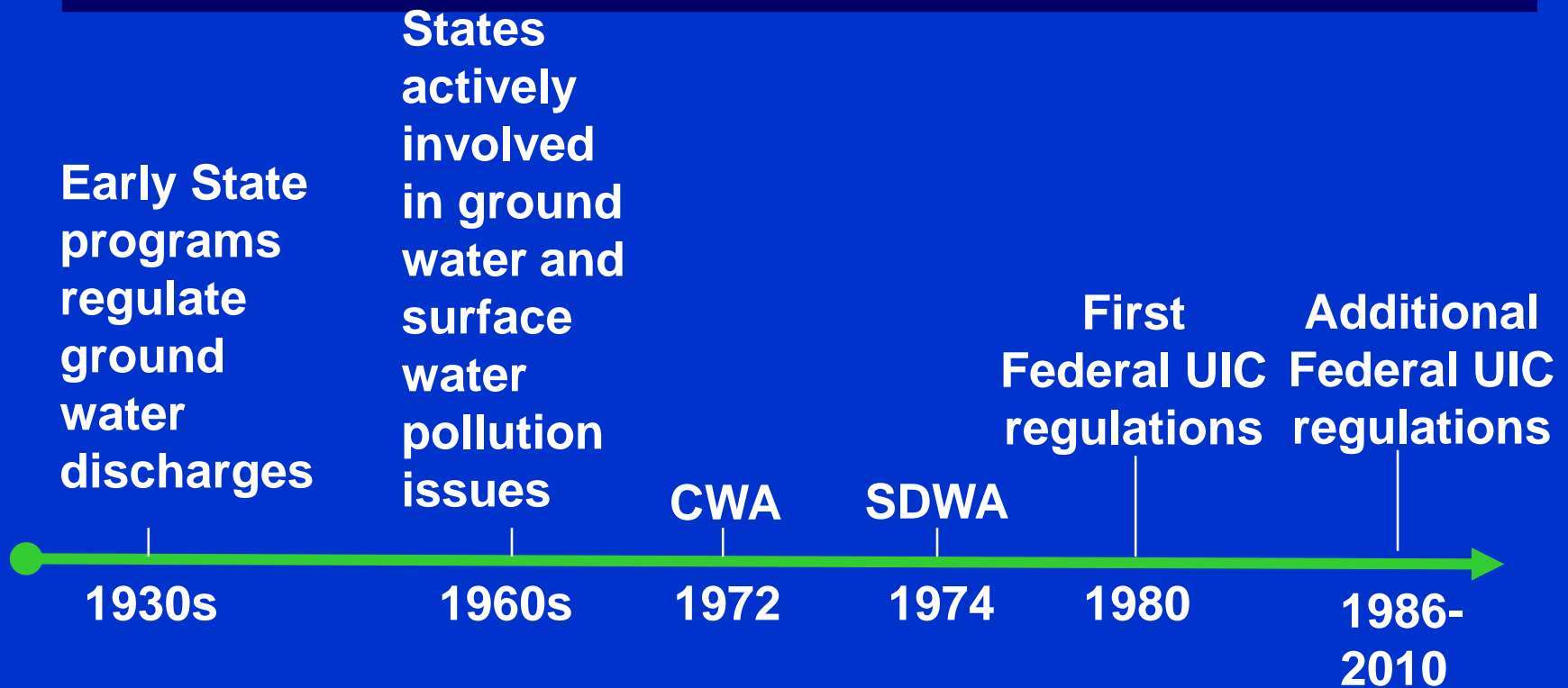
- **1930s:** Oil companies began injecting wastes into depleted reservoirs through converted oil production wells
- **1950s:** Injection of hazardous chemical and steel industry wastes began
- **1960s:** Injection practices increase sharply as the manufacturing of chemicals boomed

Cause for Concern

A scenic garden with a pond, a stone bridge, and many colorful flowers. The background is filled with tall trees and a person is visible in the distance.

- **1968:** PA - Hammermill Paper Company's leak suspected to cause contamination five miles away
- **1974-75:** TX - Velsicol Chemical Company injection well determined to have contaminated an underground source of drinking water

Basic Timeline



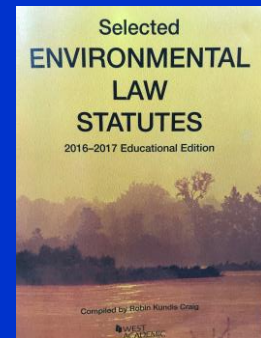
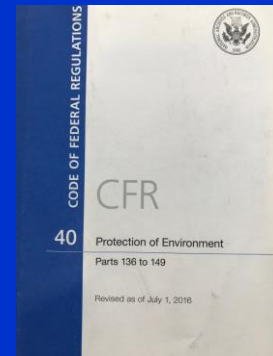
Mission of the UIC Program

- The UIC program's mission is to protect underground sources of drinking water (USDW) from the subsurface emplacement of fluids.

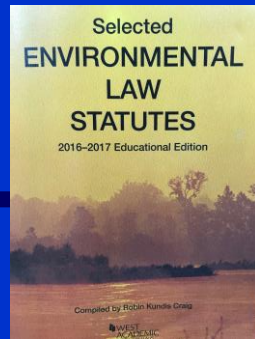
UIC Terminology



- Primacy and Direct Implementation
- Regs: Title 40 of the Code of Federal Regulations (40 CFR) – written by EPA
- Statute: Safe Drinking Water Act (SDWA) – written by the U.S. Congress

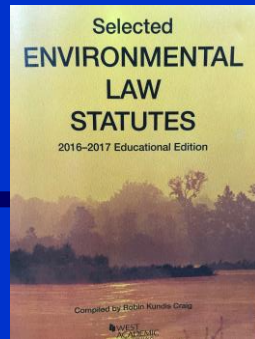


1974 SDWA - Basic UIC Concepts



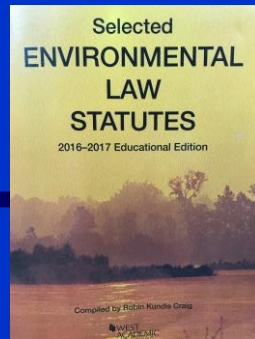
- SDWA requires EPA to promulgate regulations to protect drinking water sources from contamination by underground injection
- Defines:
 - Underground injection
 - Endangering drinking water sources
- Designed to be implemented by States

1974 SDWA - EPA Requirements



- Mandates that EPA:
 - Not unnecessarily interfere with oil and gas production
 - Consider varying geologic, hydrologic, or historical conditions
 - Avoid promulgating regulations that would unnecessarily disrupt existing State programs

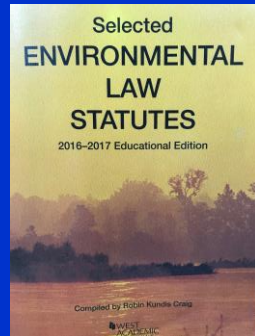
Minimum Statutory UIC Requirements



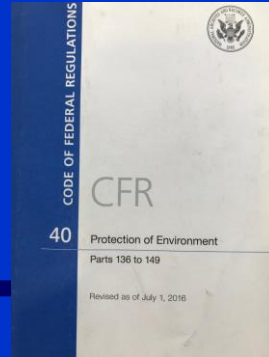
- The SDWA Part C requires EPA to develop a UIC program to prevent endangerment to USDWs. Minimum requirements must include
 - prohibition against endangering drinking water sources,
 - permitting,
 - inspection,
 - monitoring,
 - record-keeping,
 - reporting

Statutory Definition: Underground Injection

- The SDWA Sec. 1421 defines “Underground Injection” as follows
Subsurface emplacement of fluids through well injection.
- Excludes
 - Gas storage injection
 - Hydraulic fracturing unless diesel fuel is used

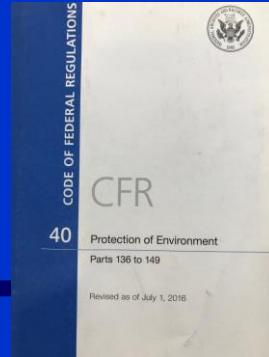


Regulatory Definition of Well Injection



- **Injection:** Subsurface emplacement of fluids
- **Well:** A bored, drilled, or driven shaft, or a dug well or dug hole where the depth is greater than the largest surface dimension; or an improved sinkhole; or a subsurface distribution system.

Define Aquifer and USDW

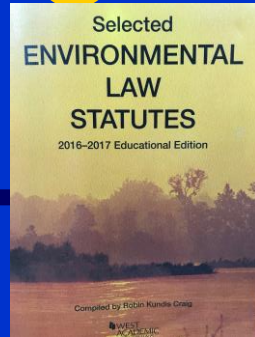


- **Aquifer:** Geologic formation that is capable of yielding a significant amount of water to a well or spring
- **Underground source of drinking water:** An *unexempted* aquifer or portion of an aquifer that
 - Supplies any public water system *or* contains a quantity of ground water sufficient to supply a public water system; *and either*
 - Currently supplies drinking water for human consumption, *or*
 - Contains fewer than 10,000 mg/L total dissolved solids

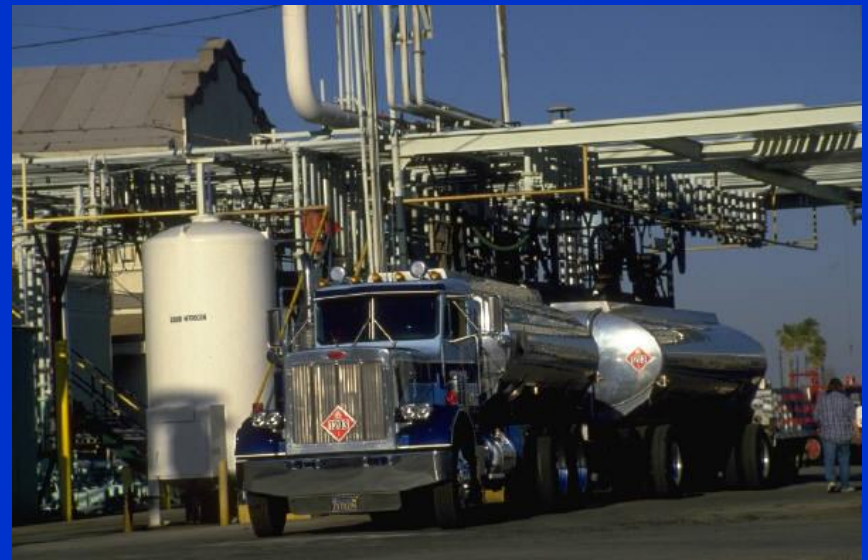
What's an Exempted Aquifer?

- It does not now serve as a drinking water (DW) source
- **And** it cannot now, and will not in the future serve as a DW source, because at least one of these four is true:
 1. It is mineral, hydrocarbon or geothermal energy bearing
 2. It is situated at a depth or location which makes recovery technically or economically impractical
 3. Is so contaminated and could not be treated economically for human consumption
 4. It is located above a Class III mining area subject to subsidence or collapse; **or**
- Its TDS content is between 3,000 and 10,000 mg/l and is not reasonably expected to supply a public water system.
- An aquifer exemption requires EPA concurrence

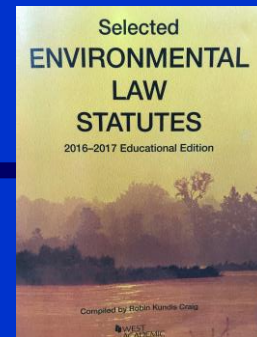
Changes From 1974 To Present



- SDWA: Addition of section 1425 applicable to oil and gas related wells in 1980
- Regs:
- Additional requirements for hazardous waste UIC wells in 1986 (Subpart G)
- Class V well regs added to Section 144 (Subpart G) in 1999.
- Class VI well regs added in 2010.

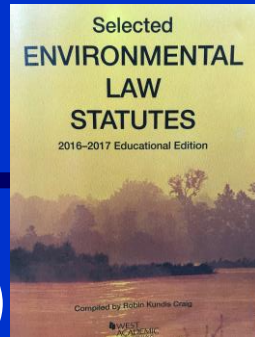


Structure of the Program: Primacy Requirements



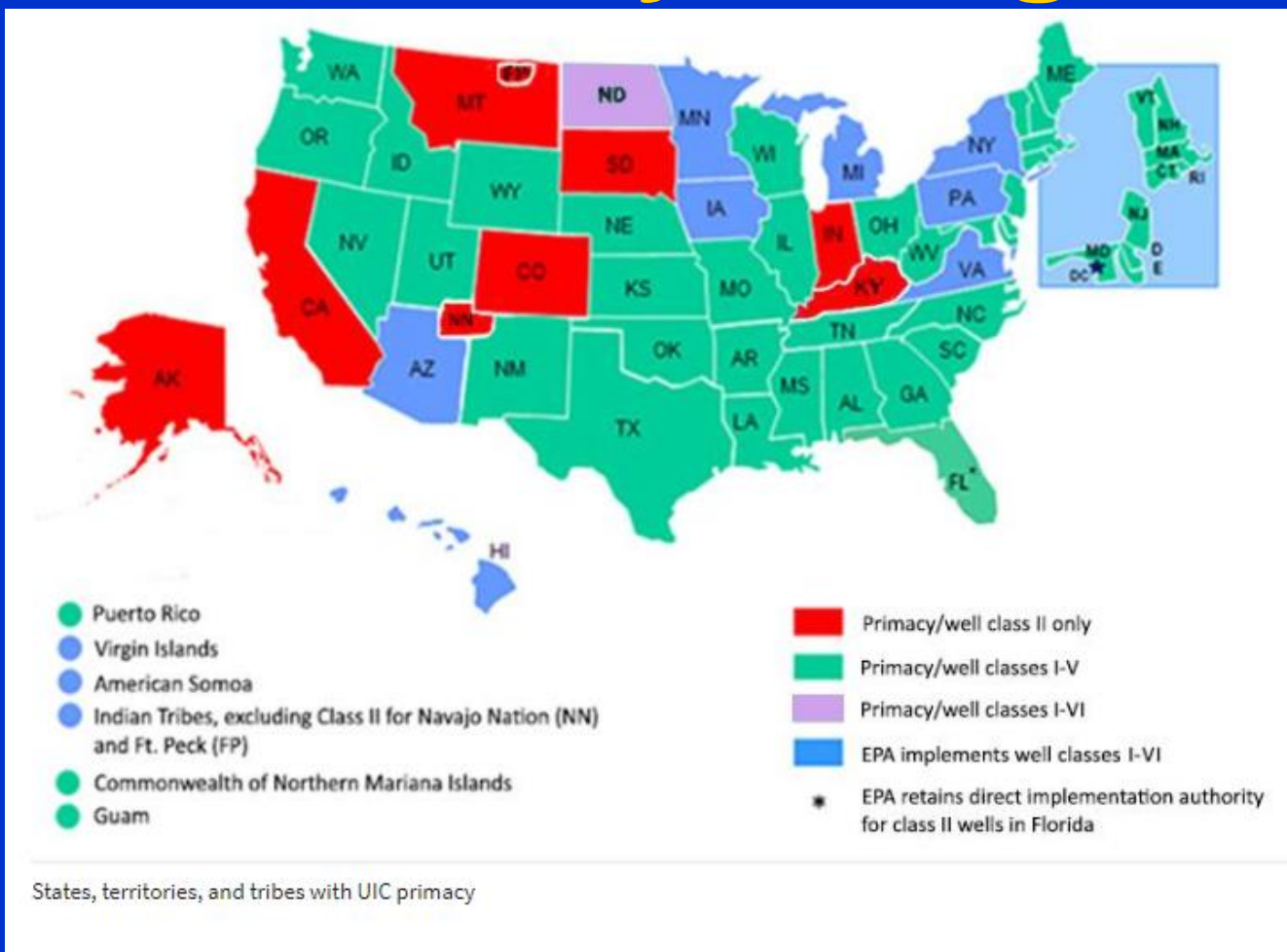
- SDWA Sec. 1422 approval – States/Tribes must promulgate requirements that are at least as stringent as EPA's:
- Must incorporate **all** the EPA regulatory requirements
- May be more stringent than EPA's regulations
- Primacy for Class VI wells must be under Sec. 1422

Structure of the Program: Primacy Requirements



- SDWA Sec. 1425 approval (oil and gas)
In lieu of the requirements of Sec. 1422
States must:
 - Demonstrate that the State UIC program is **effective** in preventing USDW endangerment
 - Requirements are typically similar to EPA requirement
 - Applies solely for Class II injection wells

Structure of the Program: UIC Primacy Delegation



https://www.epa.gov/uic/primary-enforcement-authority-underground-injection-control-program#primacy_states

Obtaining Primacy

State/Tribe promulgates injection well regulations under own authority

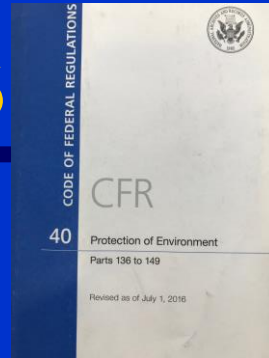
Per SDWA, EPA must have a Direct Implementation program everywhere unless Primacy is given

State/Tribe applies for Primacy

Primacy granted if State/Tribal program meets or exceeds SDWA 1422 or 1425 (Class II only)

Granting Primacy is an EPA rule-making, requiring public notice and comment

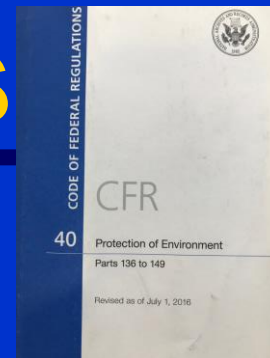
Structure of the Program: Federal UIC Regulations



- 40 CFR Part 22 – Enforcement Procedures
- 40 CFR Part 35 - State and Tribal Financial Assistance
- 40 CFR Part 124 - Public Participation Requirements for Permitting
- 40 CFR Part 144 - Permitting and Program Requirements

Structure of the Program: Federal UIC Regulations

- 40 CFR Part 145 - Requirements and Procedures for State/Tribal Program Approval
- 40 CFR Part 146 - UIC Criteria and Standards
- 40 CFR Part 147 – List of State/Tribal UIC Programs
- 40 CFR Part 148 - Hazardous Waste Injection Restrictions



Structure of the Program: Authorization by Rule and Permitting

- Some wells may be authorized by rule; permit not required if comply with basic requirements
- Some well owners or operators must apply for permits to drill and to operate
- All wells must submit inventory data
- All wells are subject to non-endangerment standard

Structure of the Program: Inspections

- EPA is authorized to inspect any facility subject to the UIC program (SDWA 1445)
- Types of inspections vary, based on status of wells and facility

Structure of the Program: Enforcement

- Enforcement tools available include:
 - Informal enforcement actions
 - Formal enforcement actions for UIC violations (SDWA 1423)
 - Others (emergency authority SDWA 1431)

Good inspections lead to good enforcement
Good inspections often help achieve
compliance

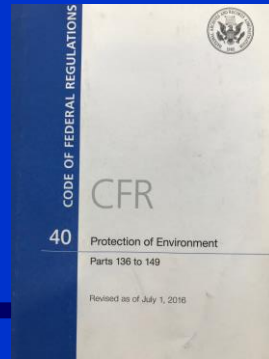
Structure of the Program: Public Involvement in UIC

- SDWA mandates public involvement
- Opportunities include
 - Any rule-making
 - Public hearings and/or public comment for Primacy program award or revisions, permitting decisions, aquifer exemptions, and formal federal enforcement actions
 - Public information meetings may be held for permitting decisions and other Agency actions

Classes of Wells

- Six classes of wells are addressed in UIC regulations
- Generally categorized based on well purpose and depth
- Degree of endangerment potential generally varies with depth, injected fluid quality, and geologic setting

Well Classes - Basic



- Class I – Industrial/Hazardous/Municipal
 - Class II – Oil and Gas
 - Class III – Subsurface Mining
 - Class IV – HW into/above USDW (banned*)
 - Class V – Other
 - Class VI – CO₂ geosequestration (new 2010)
-
- General: “Shallow” = Class IV, V; “Deep” = Class I, II, III, VI
 - *Exceptions to the ban for Superfund/RCRA clean up wells

Well Class Inventory

Well Class	2017 National Inventory
Class I (Industrial, Hazardous, Municipal)	~800
Class II (Oil and Gas)	~184,000
Class III (Subsurface Mining)	~25,000
Class IV (BANNED HW into/above USDW)	<20
Class V (Other)	~520,000
Class VI (CO ₂ Geosequestration)	<10
TOTAL	~730,000

Source: <https://www.epa.gov/uic/underground-injection-well-inventory/>



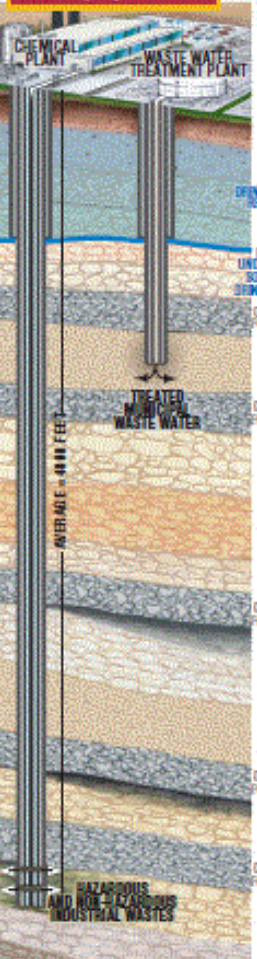
United States Environmental Protection Agency
 Office of Water (460C)
 Washington, DC 20460
 EPA 816-H-10-001
 November 2010
<http://water.epa.gov/drink>

Safe Drinking Water Act

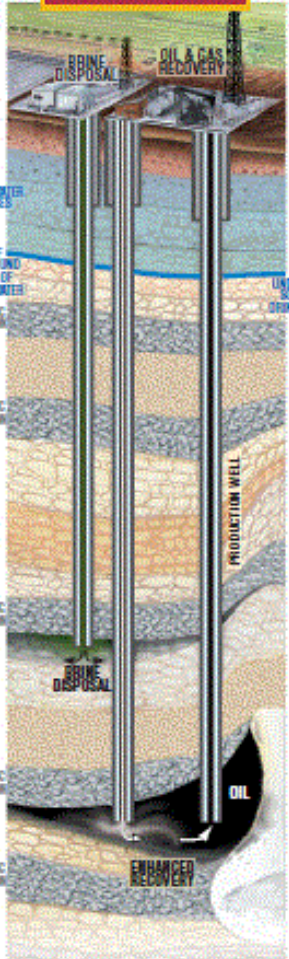
Underground Injection Control (UIC) Program

Protecting Public Health and Drinking Water Resources

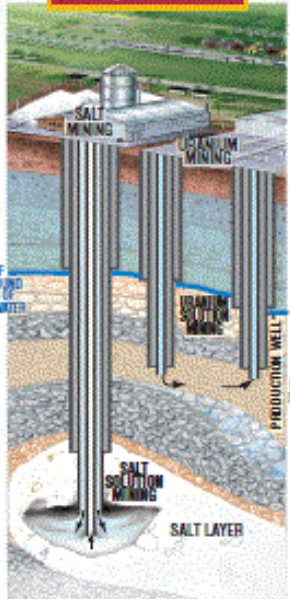
Class I wells-
Isolate hazardous industrial and municipal wastes through deep injection



Class II wells-
Inject oil and gas production fluids



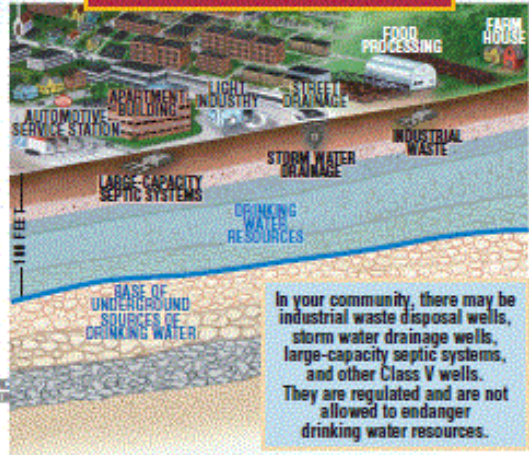
Class III wells-
Minimize environmental impacts from solution mining operations



Class IV wells-
Banned under all scenarios except as part of authorized hazardous waste cleanup activities

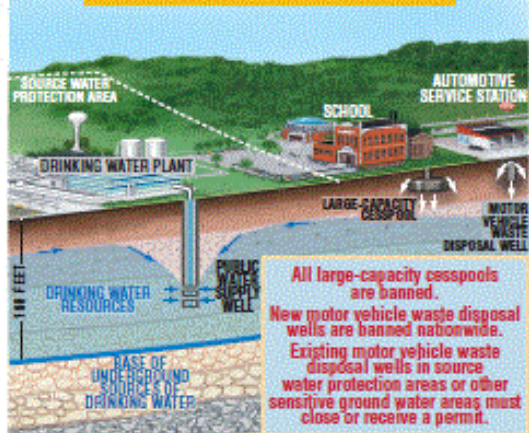


Class V wells-
Manage the shallow injection of all other fluids to prevent contamination of drinking water resources



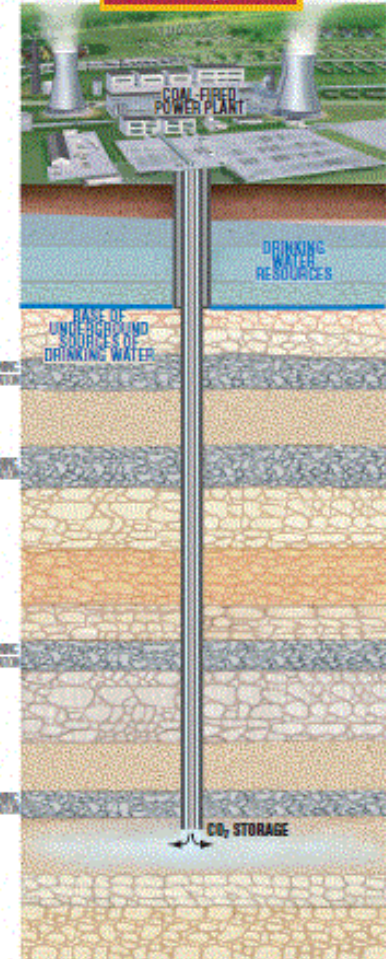
In your community, there may be industrial waste disposal wells, storm water drainage wells, large-capacity septic systems, and other Class V wells. They are regulated and are not allowed to endanger drinking water resources.

Class V wells continued



All large-capacity cesspools are banned. New motor vehicle waste disposal wells are banned nationwide. Existing motor vehicle waste disposal wells in source water protection areas or other sensitive ground water areas must close or receive a permit.

Class VI wells-
Inject CO₂ for long-term storage to reduce emissions to atmosphere



Not drawn to scale

Class I Wells



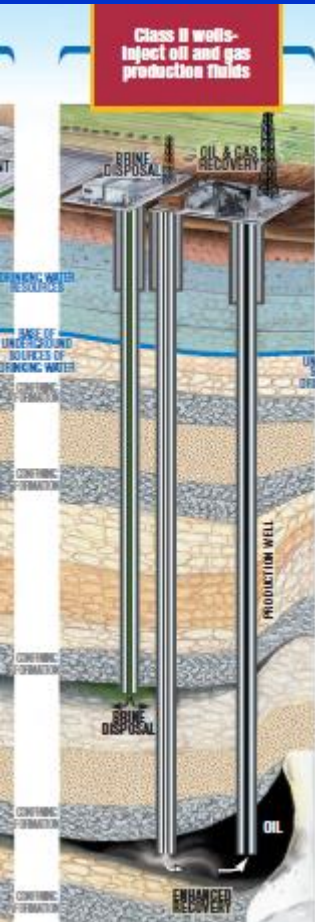
- Industrial (non-haz and haz), Municipal
- Extensive permitting requirements
- Cl. I Haz - No-migration demonstration – 10,000 year demonstration
- Continuous annulus monitoring (except municipal)
- Internal MIT:
 - Haz- every year
 - Nonhaz - every five years
- Frequent reporting (at least quarterly)

Class II Wells



- Dispose of salt water produced with oil or natural gas production (II-D)
- Inject fluids for enhanced oil or gas recovery (II-R)
- Inject liquid hydrocarbons for storage (II-H)
 - Must be liquid at Std Temp and Pressure

Class II Wells, cont'd



- Wells drilled prior to program approval may be rule-authorized until permitted
- May have multi-well area permits
- Wells must demonstrate mechanical integrity at least every 5 years
- Well owners and operators report well data annually

Class III wells



- Used for solution mining minerals, such as salt, sulphur, uranium and copper
- Inject chemical solutions, super-hot steam, or water into mineral formations
- Hot injectate or water dissolves and mixes with minerals underground; mineral-saturated solution pumped to surface for mineral extraction
- Injected fluids are frequently reused after some treatment

Class III Wells, cont'd



- May have multi-well area permits
- Wells drilled prior to program approval may be rule-authorized until permitted
- Salt solution wells must demonstrate MI at least every 5 years
- Well owners and operators report well data quarterly

Class IV Wells

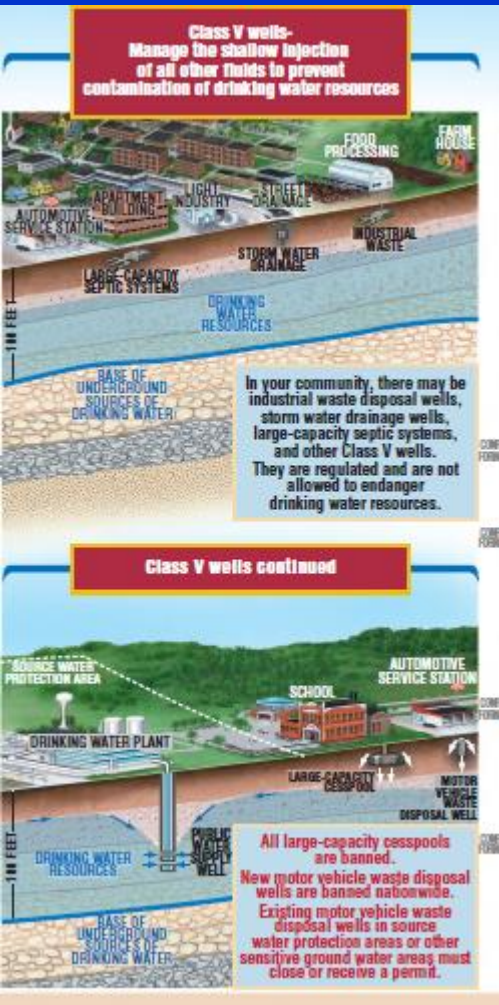
- Used to dispose of hazardous or radioactive waste into or above a formation which contains a USDW within 1/4 mile of the well
- Prohibited

Class IV wells-
Banned under all
scenarios except as part of
authorized hazardous
waste cleanup
activities



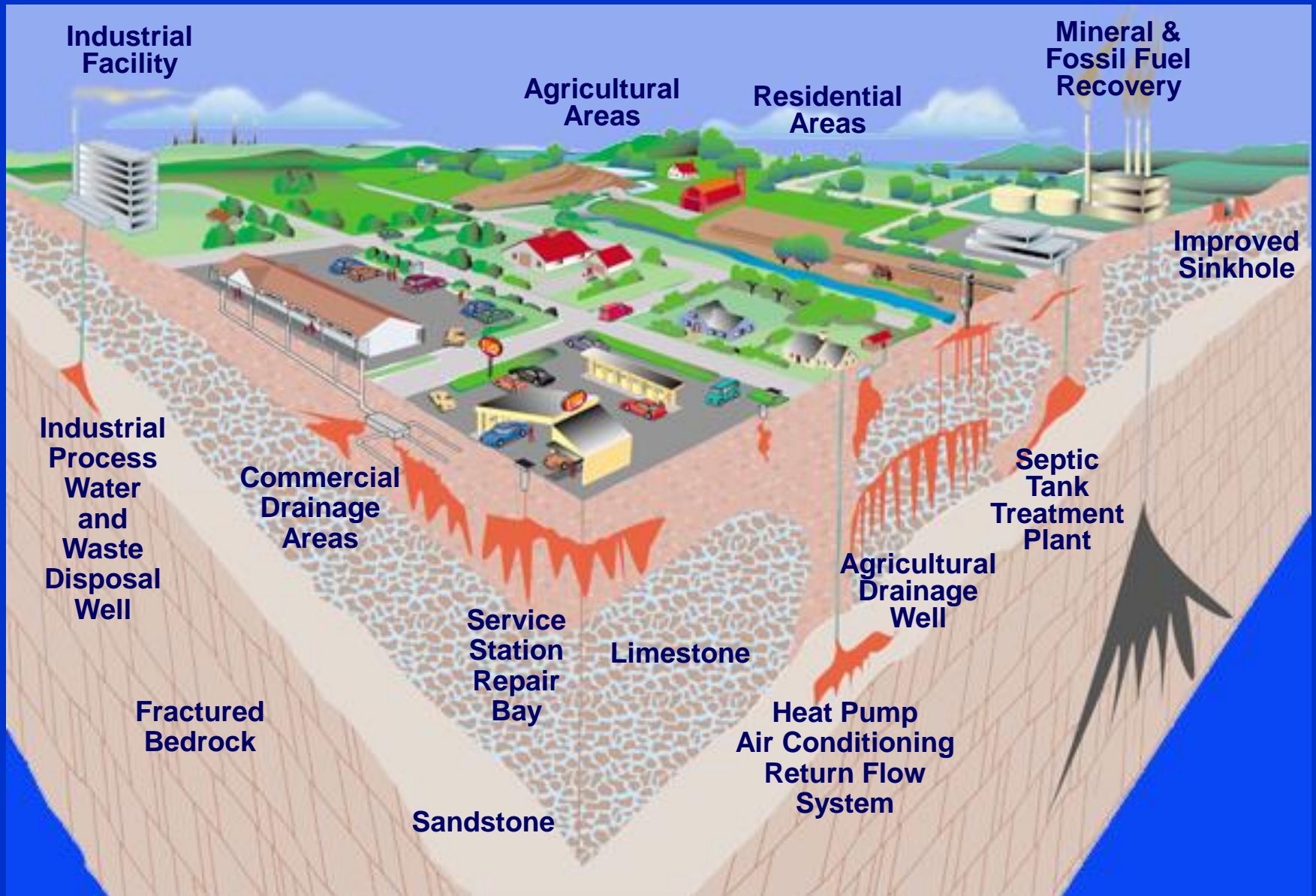
- One exception: wells that reinject into same formation treated ground water pursuant to approved CERCLA or RCRA clean-ups
- Voluntary site clean-ups not subject to exception

Class V Wells

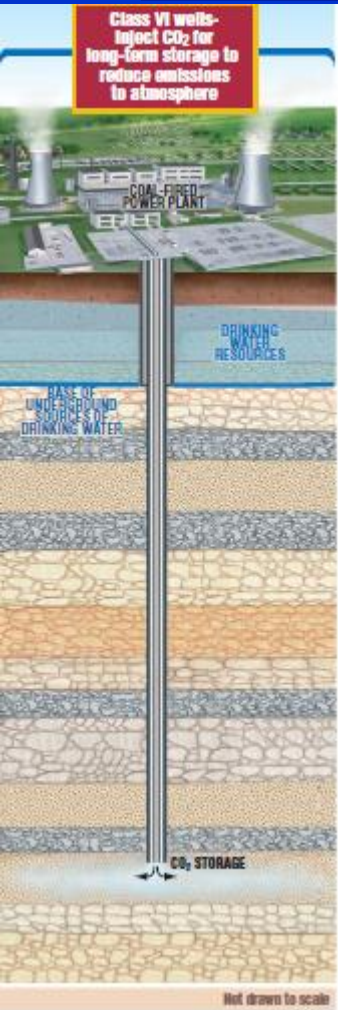


- Class V: All injection wells that do not meet the definitions of Classes I, II, III, IV or VI
- Most are shallow and low-tech
- Most inject into or above USDWs
- Operators must submit inventory information
- Must not endanger USDWs

Class V Wells - More



Class VI Wells



- Newest Well Class
- Regulations Promulgated 12/20/2010
- Regulates the Sequestration of Carbon Dioxide (CO₂)
- Requirements Similar to Class I Well Standards
- Not the same as Class II enhanced oil recovery CO₂ injection wells

Specific Exclusions

- Injection wells on drilling platforms or elsewhere beyond State's territorial waters
- Wells used for injection of gas hydrocarbons for storage
- Hydraulic fracturing related to oil, gas or geothermal production, unless using diesel fuels



Specific Exclusions

- Individual or single-family residential waste disposal systems (cesspools or septic systems)
- Non-residential cesspools or septic systems that receive only sanitary waste and serve fewer than 20 people per day
- Dug holes not used for subsurface fluid emplacement

Questions

Extra Slides

Other Federal Statutes Affecting UIC

- RCRA - site regulation divided into above ground and below ground surface
 - Hazardous waste sites
 - Underground storage tanks
- CERCLA - program overlap similar to RCRA

Other Federal Statutes Affecting UIC

- Toxic Substances Control Act - PCB issues
- Clean Water Act - storm water, antidegradation
- Emergency Planning and Community Right-to-Know Act - Toxic Release Inventory
- Federal Land Policy and Management Act - mining site requirements on Federal lands