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Aquifer Exemptions: Program Overview and Emerging Concerns

THE AQUIFER EXEMPTION PROGRAM WAS CREATED BY THE US ENVIRONMENTAL PROTECTION AGENCY IN 1980 AS PART OF THE SAFE DRINKING WATER ACT'S UNDERGROUND INJECTION CONTROL PROGRAM. CONCERNS ABOUT THE ABILITY OF THE EXEMPTION PROCESS TO PROTECT UNDERGROUND SOURCES OF DRINKING WATER HAVE BROUGHT THE PROGRAM BACK INTO THE LIMELIGHT.

When the United States Congress first passed the Safe Drinking Water Act (SDWA) in 1974, it authorized the US Environmental Protection Agency (USEPA) to develop a program to protect vital underground drinking water resources from risks of industrial activities in which fluid is injected into the ground. However, Congress also included language mandating that USEPA not “interfere with or impede” oil and gas production unless it is “absolutely essential” in order to protect underground sources of drinking water (SDWA §1421(b)(2)). One result of these mandates is the Aquifer Exemption program, which, until recently, was a little-known part of the SDWA Underground Injection Control (UIC) program.

As USEPA was developing the SDWA UIC program, it became clear that certain oil and gas activities would conflict with the prohibition of injection into drinking water sources (Tiemann & Vann 2013). The regulatory solution was to exempt certain aquifers from the definition of “underground sources of drinking water” in order to allow certain activities, including some enhanced recovery practices and wastewater disposal directly into aquifers.

USEPA published the first UIC regulations in 1980. These regulations included requirements for permitting UIC Class II wells, the first definition of underground sources of drinking water (USDWs), and provisions for the Aquifer Exemption program. The Aquifer Exemption program allows water that would otherwise be defined as a source of drinking water to be exempted from the prohibition on injection. The American Petroleum Institute sued

USEPA over the 1980 UIC regulations, claiming that both the USDW definition and the aquifer exemption requirements were overly restrictive and did not reflect congressional intent. USEPA settled this lawsuit

supplies drinking water for human consumption or contains fewer than 10,000 milligrams/liter of Total Dissolved Solids (TDS); and b. is not an exempted aquifer (USC 40 CFR §146.3).

Injection wells are often drilled through aquifers in order to reach the injection zone below the usable water, but the Safe Drinking Water Act prohibits injection directly into an aquifer.

and published revised final UIC regulations in 1982 (Freeman et al. 1995). These regulations include the USDW definition, which remains in place today, as well as criteria and process requirements for granting aquifer exemptions.

Revelations of major shortcomings in implementation and oversight of the Aquifer Exemption program in California, several controversial exemption cases, and the dramatic rise in oil and gas activity have brought concerns about the program to light. These include lack of a full national inventory of exemptions granted, lack of consistency in the process for granting exemptions, and questions about prioritizing oil and gas activities over protection of water resources in light of water stress and scarcity concerns.

CRITERIA FOR GRANTING AQUIFER EXEMPTIONS

According to USEPA, an aquifer is a geological formation or group of formations or part of a formation that is capable of yielding a significant amount of water to a drinking water well or spring (USEPA 2012a). The definition of a USDW in the UIC regulations is

... an aquifer or part of an aquifer which: a. supplies any public water system, or contains a sufficient quantity of ground water to supply a public water system and currently

The definition of USDW is important because it outlines those aquifers that are outside the concern of the UIC program. For example, an aquifer with more than 10,000 mg/L of TDS is not considered a potential drinking water source, does not require protection under the UIC program, and an aquifer exemption is not required for injection activities directly into the formation.

The criteria for granting aquifer exemptions are also contained in the UIC regulations (see sidebar on page 56). Aquifers with less than 3,000 mg/L of TDS must not serve as a source of drinking water and must meet one of the four sub-criteria in §146.4 (b). The USDW is eligible for an exemption if it

- contains hydrocarbons or minerals in producible quantities and the applicant can prove its viability,
- is at a depth deemed economically or technically unreachable for drinking water purposes,
- is contaminated to a point at which it is too expensive to treat, or
- is above a Class III mining operation.

Aquifers containing between 3,000 and 10,000 mg/L of TDS are eligible for an exemption if they are not “reasonably expected to supply a public water system” (USC 40 CFR §146.4). In a July 2014 memorandum to USEPA regional water directors, Office of Ground Water and

Drinking Water director Peter Grevatt noted that USEPA will be addressing both sets of criteria at the conclusion of ongoing discussions with state representatives through the Ground Water Protection Council (Grevatt 2014). Clarification of the criteria and the documentation required in the exemption process is critical in light of an increase in applications; this increase has been cited by USEPA in public presentations (USEPA 2013).

ACTIVITIES RECEIVING AQUIFER EXEMPTIONS

Injection wells are often drilled through aquifers in order to reach the injection zone below the usable water, but SDWA prohibits injection directly into an aquifer. The Aquifer Exemption program waives this prohibition on direct injection for energy extraction-related activities and allows wastewater injection directly into USDWs. Table 1 shows data from a USEPA presentation indicating that disposal (Class II D) and enhanced recovery wells (Class II R) account for the majority of exemptions.

Wastewater disposal. The most common and least expensive option for disposing of oil and gas wastewater is underground injection (NPR 2015, Marks 2014). Because capacity for the billions of gallons of wastewater is finite and disposal can be an onerous process, the oil and gas industry looks to existing freshwater aquifers as areas in which to inject its waste. If the target formation includes a USDW, operators apply for an exemption to inject directly into the once-protected aquifer. Around 4% of the more than 30,000 Class II disposal wells are injecting directly into exempted aquifers. Of 30,200 Class II D wells, 1,251 have exemptions (so far) equal to 4.14%. Of 137,00 Class II R wells, 3,037 have exemptions equaling 2.2% (USEPA 2014). According to a report by the US Government Accountability Office, approximately 80% of 172,000 Class II



wells are for enhanced recovery, equaling 137,000 (USGAO 2014).

Enhanced recovery. Enhanced recovery is the most common activity associated with aquifer exemptions. As oil production from existing wells plateaus, the oil and gas industry seeks ways to increase production. In order to recover the remaining oil, in the enhanced-recovery process, injection wells are used to pump water, steam, polymers, or carbon dioxide into already-tapped oil-bearing formations occasionally located in USDWs or in formations with aquifer connectivity. The newly introduced fluids help free the residual oil, and the surrounding production wells pump it to the surface (USEPA 2012b). Enhanced recovery is critical to extending the life of wells and responsible for a great deal of current production. For example, in California, 75% of oil production is from this practice (Bohlen & Bishop 2015). Hydraulic fracturing is a form of enhanced recovery because water, sand, and chemicals are injected at high pressures to fracture the source rock and free the remaining oil. However, USEPA regulates this process only if diesel fuels are used as part of the fracture fluid. It is unclear whether any aquifers have been granted exemptions for hydraulic fracturing activities.

Uranium mining. Aquifer exemptions are also commonly sought for in situ uranium mining. Conventional uranium mining involves extracting rock from the ground and then separating uranium from the mined rock. However, the majority of uranium mining in the United States uses in situ leach mining (ISL). During the ISL process, a sulfuric acid solution is pumped underground via injection wells into uranium-bearing sandstone and rock formations. There the solution oxidizes and mobilizes the uranium. The solution, now containing oxidized uranium, is then pumped to the surface through production wells and sent through additional refining processes. An aquifer exemption is

almost always required for this process because the native groundwater contained in the uranium orebody is used (and polluted as a result) to leech the chemical solution to the uranium (World Nuclear Association 2014). Waste from this process is then usually disposed of by returning the wastewater back underground via Class I nonhazardous wells.

THE AQUIFER EXEMPTION PROCESS

When an energy production, uranium mining, or waste disposal company recognizes the need for an exemption in order to begin injection activity, they submit the required information to the appropriate primacy agency. In states with primacy for the relevant UIC well class, the state agency reviews the initial application. In cases in which USEPA is the primacy agency, the company submits an application directly to the regional USEPA office.

UIC regulations outline two types of aquifer exemptions: substantial and nonsubstantial. Some aquifers with less than 3,000 mg/L of TDS are substantial exemptions and require final approval by the USEPA administrator after a process led by the USEPA region that includes public comment, a public hearing, and notice of a substantial program revision in the *Federal Register*. However, based on UIC Guidance #34 published in 1984 (USEPA 2015a), few Class II activities actually require substantial exemptions. The majority of exemptions are designated as nonsubstantial. The state primacy agency works with the applicant and runs a public comment and hearing process, and the USEPA region approves the exemption application. When USEPA is the primacy agency, the USEPA region conducts a public comment and hearing process and works with the company requesting the exemption.

The public notification and comment process for the UIC program, including the aquifer exemption process, requires notifying potentially interested and affected parties, though

they do not specifically refer to public water systems or private well users. States that have received primacy under the SDWA §1425 (Optional Demonstration by States Relating to Oil or Natural Gas) process are not required to follow the UIC regulations as long as they have demonstrated that they have an effective program in place to prevent endangerment of USDWs from injection activities (USEPA 2015b). Therefore, actual procedures for public comment and hearings may not exactly mirror the UIC regulation requirements.

Information submitted as part of the exemption application must demonstrate that the aquifer is not currently a source of drinking water and must prove that it will not serve as a source of drinking water in the future. The regulations do not elaborate on the data and analysis necessary to evaluate an exemption request. Instead, USEPA published Guidance #34 (USEPA 2015a), outlining information that should be included in the application in order to make an exemption determination. This information includes a topographic map of the proposed exempted area with the boundaries clearly indicated, subsurface depth of the aquifer and its vertical distance from other USDWs, area of the proposed exempted aquifer (in acres or feet), and a water quality analysis.

TABLE 1 USEPA exemption data as of May 29, 2014

Well Class	Aquifer Exemptions
I	140
II	4,614 D: 1,251 R: 3,037 Other: 326
III	120
V	2
Unknown	61
Total	4,937

In order to demonstrate that the aquifer does not currently serve as a source of drinking water, the company must survey the area to make sure no water supply wells exist in

USEPA suggests specific information for documenting exemptions under the criteria in section 146.4(b). This information varies for each subcategory but includes production

needs, costs of treatment, and cost of developing the water supply from the proposed exemption area. This Statement of Basis is essential for approving any exemption.

After an exemption is approved, the operator may begin injection activity into the once-protected USDW. If the exemption request is only for a portion of an aquifer, the company must submit similar documentation but is not required to submit migration modeling data to prove that the injected waste will not migrate out of the injection zone into nonexempt parts of the aquifer. USEPA Guidance #34 states that “a demonstration must be made that the waste will remain in the exempted aquifer.” The factors considered for this are pressure and volumes of injected fluid, but modeling the behavior of the injected fluids is not required.

It is unclear whether there is sufficient documentation to determine whether all aquifer exemptions were granted legally and to ensure that inappropriate injection is not permitted.

or around the proposed exempted area. The survey should include a buffer zone of at least ¼ mi from the boundary of the exemption zone.

history of wells in the vicinity of the aquifer, availability of alternative water supplies, ability of current supplies in the area to meet future

Criteria for Aquifer Exemptions

An aquifer can be exempted from pollution protection if

- 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
 - i) it contains hydrocarbons or it can produce geothermal energy, or it can be shown by a permit applicant as part of a permit application for a Class II or III operation to contain minerals or hydrocarbons that exist in a large enough quantity to be expected to be commercially producible,
 - ii) it is situated at a depth or location that makes recovery of water for drinking water purposes economically or technologically impractical,
 - iii) it is so contaminated that it would be economically or technologically impractical to render that water fit for human consumption, or
 - iv) 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 groundwater is more than 3,000 and less than 10,000 mg/l and it is not reasonably expected to supply a public water system.
- d) the areal extent of an aquifer exemption for a Class II enhanced oil recovery or enhanced gas recovery well may be expanded for the exclusive purpose of Class VI injection for geologic sequestration under §144.7(d) of this chapter if it meets the following criteria:
 - i) it does not currently serve as a source of drinking water; and
 - ii) the total dissolved solids content of the ground water is more than 3,000 mg/L and less than 10,000 mg/L; and
 - iii) it is not reasonably expected to supply a public water system.

Source: USC 40 CFR §146.4

EMERGING CONTROVERSY

Revelations of implementation problems in California and controversial exemption have focused attention on the Aquifer Exemption program.

California. Recent events in California have exposed serious problems in the state’s UIC program, including lack of appropriate oversight, poor recordkeeping, and permitting of injection into nonexempt aquifers. In 2011, a USEPA critique of the state’s Class II program (Walker 2011) led the Department of Conservation to review the entire program. The California USEPA has recently revealed that in 2011, staff at the Department of Oil, Gas & Geothermal Resources (DOGGR) discovered, investigated, and eventually reported to USEPA that there were discrepancies in the records regarding aquifer exemptions granted in the 1980s. Meanwhile, in 2014 the Central Valley Regional Water Board discovered that injection had been allowed in high-quality (less than 3,000 mg/L TDS) aquifers, prompting the state to work with USEPA to review most of the state’s injection wells. Since 2014, 24 wells have been



shut down by the state, and an additional 11 permits have been voluntarily relinquished. An analysis by the state's DOGGR and the State Water Resources Control Board in cooperation with USEPA had determined that approximately 2,500 enhanced oil recovery and wastewater disposal wells have injected into potentially nonexempt aquifers, with 2,100 of these wells still active (Rodriguez 2015). UIC program issues in California have led to high-level staff changes in at least one agency, to involvement by numerous state agencies in various aspects of the investigations, and to hearings in the state Senate.

Controversial exemptions. Several aquifer exemption applications have drawn attention to lack of clarity in the approval process. For example, in 2009 in Texas, Goliad County filed a lawsuit against Uranium Energy Corp. (UEC) under the SDWA citizen suit provisions, arguing that the Texas Commission on Environmental Quality (TCEQ) should deny UEC's pending aquifer exemption application because the company's previous operations polluted the aquifer that had been proposed for exemption. Goliad County alleged that UEC was taking samples of the aquifer it had already contaminated in order to demonstrate the aquifer was unsuitable as a USDW (*Goliad County, Texas, Plaintiff, v. Uranium Energy Corp., Defendant*. Civil Action No. V-08-18. US District Court, S.D. Texas, Victoria Division).

The court eventually dismissed the lawsuit, but USEPA Region 6 agreed that further analysis of the aquifer was necessary before an exemption could be granted. Communications between USEPA Region 6 and TCEQ showed that USEPA believed that "the criteria for exempting an aquifer had not yet been met," namely because UEC failed to demonstrate that the fluid would not migrate out of the exemption zone and because the groundwater well survey identified a number of wells that were likely to draw drinking water from

the aquifer (Honker 2012). Eventually officials from USEPA headquarters intervened in the case after intense industry lobbying. In December 2012, USEPA relaxed the type of monitoring and analysis necessary for the mining company to prove it was eligible for an exemption and approved the application (Lustgarten 2013). In 2013, local opposition led USEPA to revisit the application. The agency eventually reduced the size of the exempted area and approved the exemption (Sneath 2014).

CONCERNS ABOUT INVENTORY AND PROCESS

In light of controversial cases like that in Goliad County and the record-keeping and oversight problems in California, federal officials have recently acknowledged the need for a full accounting of exemptions granted and for improvement in the review and determination process. Many aquifer exemptions were granted during the primacy approval process in the early 1980s, when states were granted authority to run the UIC program through the SDWA §1425 primacy approval process. USEPA headquarters does not have complete records of exemptions granted or the Statement of Basis for those exemptions (USEPA 2013). Our own experience indicates that

4,937 exemptions (USEPA 2014b). In a July 2014 memorandum to regional water directors (Grevatt 2014), Grevatt stated that USEPA regions need to maintain data on all existing exemptions to ensure that potentially affected parties can be made aware of exemptions and to assist with a national tracking mechanism. The memorandum also clarifies the roles and responsibilities of state primacy agencies, USEPA regions, and the administrator in the aquifer exemption process.

In two January 2015 reports, Clean Water Action identified overarching concerns with aquifer exemptions and with the UIC Class II program (Clean Water Action 2015a, b). They are listed here.

Serious documentation problems. It is unclear whether there is sufficient documentation to determine whether all aquifer exemptions were granted legally and to ensure that inappropriate injection is not permitted.

Outdated and ambiguous criteria for granting exemptions. There is little documentation of how the 3,000- and 10,000-mg/L TDS bright lines were drawn during statutory and

Information submitted as part of the exemption application must demonstrate that the aquifer is not currently a source of drinking water and must prove that it will not serve as a source of drinking water in the future.

even the number of exemptions nationwide has been difficult to determine. A May 2013 USEPA presentation at a uranium recovery workshop estimated that there are 1,400 aquifer exemptions (USEPA 2013), but a May 2014 presentation to the Association of Public Health Laboratories stated that there are

regulatory development in the 1970s and 1980s. Three decades later, the depth and quality of water that could potentially serve as a drinking water source have changed in light of advances in technology and growing concerns over water scarcity. For exemptions of aquifers in the 3,000- to 10,000-mg/L TDS

range, it is not clear that there are consistent requirements for determining that an aquifer “is not reasonably expected to supply a public water system.” For exemptions of aquifers with less than 3,000 mg/L of TDS, the lack of a national inventory or apparent centralization of Statements of Basis for exemptions makes it difficult to determine whether the criteria have been and are being applied consistently.

Industry influence on UIC program development. This influence has contributed to a regulatory environment that risks prioritizing energy extraction over protection of USDWs. Significant extraction-industry influence on development of §1425 primacy approval and the Aquifer Exemption program appear to have contributed to the program’s lack of transparency and to potential endangerment of USDWs that should remain protected (Clean Water Action 2015a, b).

Continued underfunding of the UIC program. A 2014 USGAO report found that federal funding for the UIC program has been flat since the 1990s. The president’s 2016 federal budget does not remedy this problem, with the UIC program remaining at \$10.5 million in the USEPA budget proposal (USEPA 2015c). More effective oversight of the Aquifer Exemption program alone demands a higher level of effort by USEPA headquarters and regions (Clean Water Action 2015a, b).

In a presentation at the February 2015 Ground Water Protection Council Underground Injection Control Conference, Clean Water Action noted that the statutory language presents a challenge in that the UIC program must not “interfere with or impede” oil and gas activities “unless essential” to protecting USDWs (Thorp 2015). Determining exactly where that balance lies can be difficult, but for a decision as important as exempting some water sources from UIC protections, the public expects consistent application, transparent process, rigorous oversight, and public

access to information. Clean Water Action argued that currently the Aquifer Exemption program warrants scrutiny in these areas.

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