Aquifer Exemption Data Release

EPA's Aquifer Exemption map allows users to view aquifers that have been approved for exemption by EPA under the Safe Drinking Water Act Underground Injection Control (UIC) regulations. This interactive map brings together data previously available only in paper form or at the Regional and state level. The map and accompanying data can be used by states, businesses, communities, and others to view exempted aquifers in the United States, see accompanying aquifer exemption data like depth of injection, local geology, and injected fluid characteristics, and can assist with UIC permit applications and approvals.

Background on Aquifer Exemptions

An aquifer is an underground body of rock that contains or can transmit groundwater. The UIC regulations allow EPA to exempt aquifers that do not currently serve as a source of drinking water and will not serve as a source of drinking water in the future, based on certain criteria. Aquifer exemptions allow these underground sources of water to be used by energy and mining companies for oil or mineral extraction or disposal purposes in compliance with EPA's UIC requirements under the Safe Drinking Water Act. Figure 1 shows simplified scenarios where a well owner/operator or a state might request EPA to approve an aquifer exemption

The process begins when EPA receives information about the aquifer proposed for exemption from a state agency or well owner or operator. EPA approves the aquifer exemption request if it meets the necessary criteria. Injection of fluids can begin only after EPA approves an aquifer exemption and an underground injection control permit is granted.

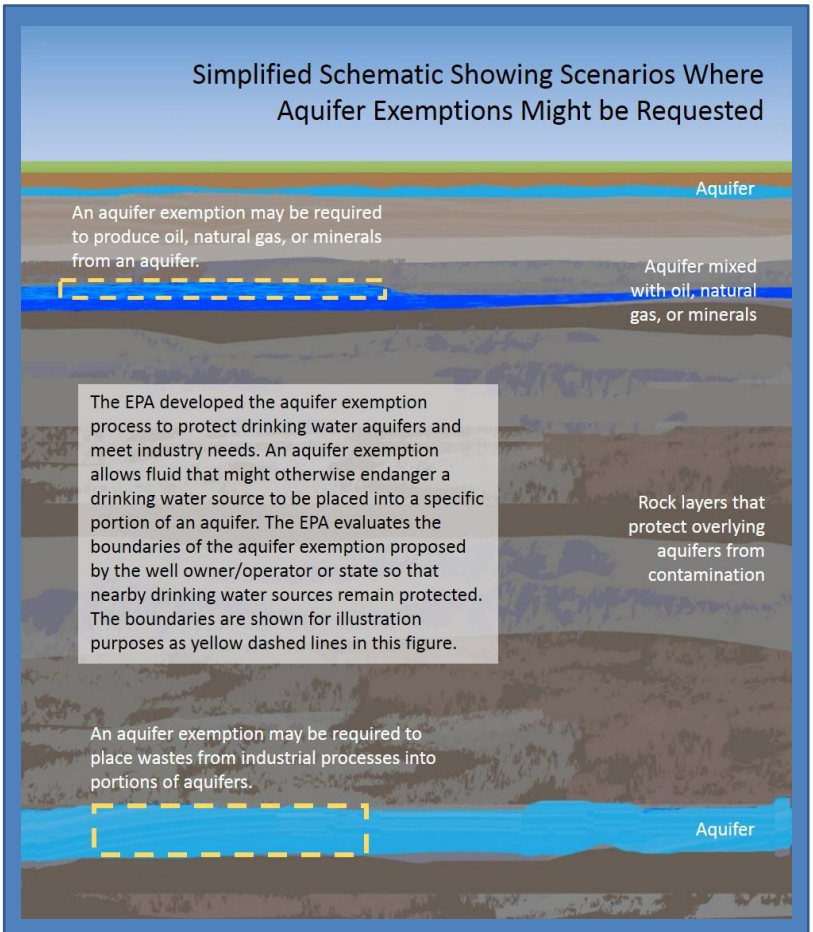

Figure 1. Simplified schematic showing scenarios where aquifer exemptions might be requested. The EPA evaluates proposed aquifer exemption boundaries where fluids may be injected while continuing to protect nearby drinking water sources. The boundaries are shown for illustration purposes as yellow dashed lines.

Aquifer Exemption Data Initiative

The EPA developed an interactive Aquifer Exemption Map that allows users to find locations of aquifers approved for exemption under the Safe Drinking Water Act. The website also provides geospatial files and Excel data with an accompanying user guide. The map shows the approved aquifer exemption boundaries, when available, in two dimensions, and information such as the depth of injection, local geology, and injected fluid characteristics. The Excel spreadsheet provides descriptive information from the geospatial file without geospatial data. Users may download the datasets, a fact sheet, and a user guide from the website.

The map and accompanying data can be used by states, businesses, communities, and others to

view exempted aquifers in the United States, see accompanying aquifer exemption data like depth of injection, local geology, and injected fluid characteristics, and can assist with Underground Injection Control (UIC) permit applications and approvals. The map consolidates information that was previously only available on paper and/or in databases at the Regional and state level and will assist EPA and states in maintaining consistent exemption data across the nation.

Aquifer exemption locations in California are not included in the current data. California is engaged in a process to digitize existing exemption locations and is also currently reviewing numerous requests for new or expanded aquifer exemptions that they expect to submit to the EPA Region 9 for review. As this work progresses, the aquifer exemptions in California will be added to the national dataset. The EPA is also working closely with Texas to better understand cases where Texas should have requested an exemption for Class II wells injecting oil and gas-related fluids.

How the EPA Developed the Aquifer Exemption Data

To develop the dataset of aquifer exemption information, the EPA gathered available information about approved aquifer exemptions from its Regional offices and some state agencies. The Agency collected the aquifer exemptions information from paper files, spreadsheets, and databases generated over the past 30 years. A new, national dataset was created with the collected information. The EPA assessed the quality of the new dataset by comparing it to the original documents to confirm the accuracy of the new data.

The EPA also developed a geospatial dataset that allows users to view or create a map of the aquifer exemption locations. The location of each exempted aquifer was converted from text descriptions to geospatial data. The text descriptions were recorded in multiple formats. A table of attributes associated with each aquifer exemption polygon includes information on the state, county, depth, geologic formation, lithology, approval date, and regulatory criteria met. More information on each attribute can be found in the data dictionary (Table 1).

Some gaps in information for each aquifer exemption exist. The EPA continues to gather additional information to enhance the coverage of aquifer exemptions information across the nation. The dataset will be periodically updated in the future with new information on existing exempted aquifers and newly approved exempted aquifers. Users who want specific local information on aquifer exemption locations or attributes should contact the EPA Regional Office that approved the aquifer exemption.

Both the geospatial data and the attribute data are shown in the Aquifer Exemptions Map on the EPA Geoplatform. Users can explore the data in the Aquifer Exemption Map or by downloading the files to create their own maps.

Aquifer Exemption Map

The Aquifer Exemption Map shows the locations and boundaries of aquifer exemptions with various descriptions of the exempted aquifers. The aquifer exemptions can be described in multiple ways, which can be viewed by clicking on the tabs at the top of the map, as shown in Figure 2.

Within the maps found on the Well Class, Depth, and Data Quality tabs, zooming in allows users to see individual aquifer exemptions or several aquifer exemptions within a small geographic area. The pop-up boxes on the Aquifer Exemption Map, as shown in Figure 3, describe certain attributes about the aquifer exemption. Locational information such as county, state, and tribe, are also found in the pop-up box.

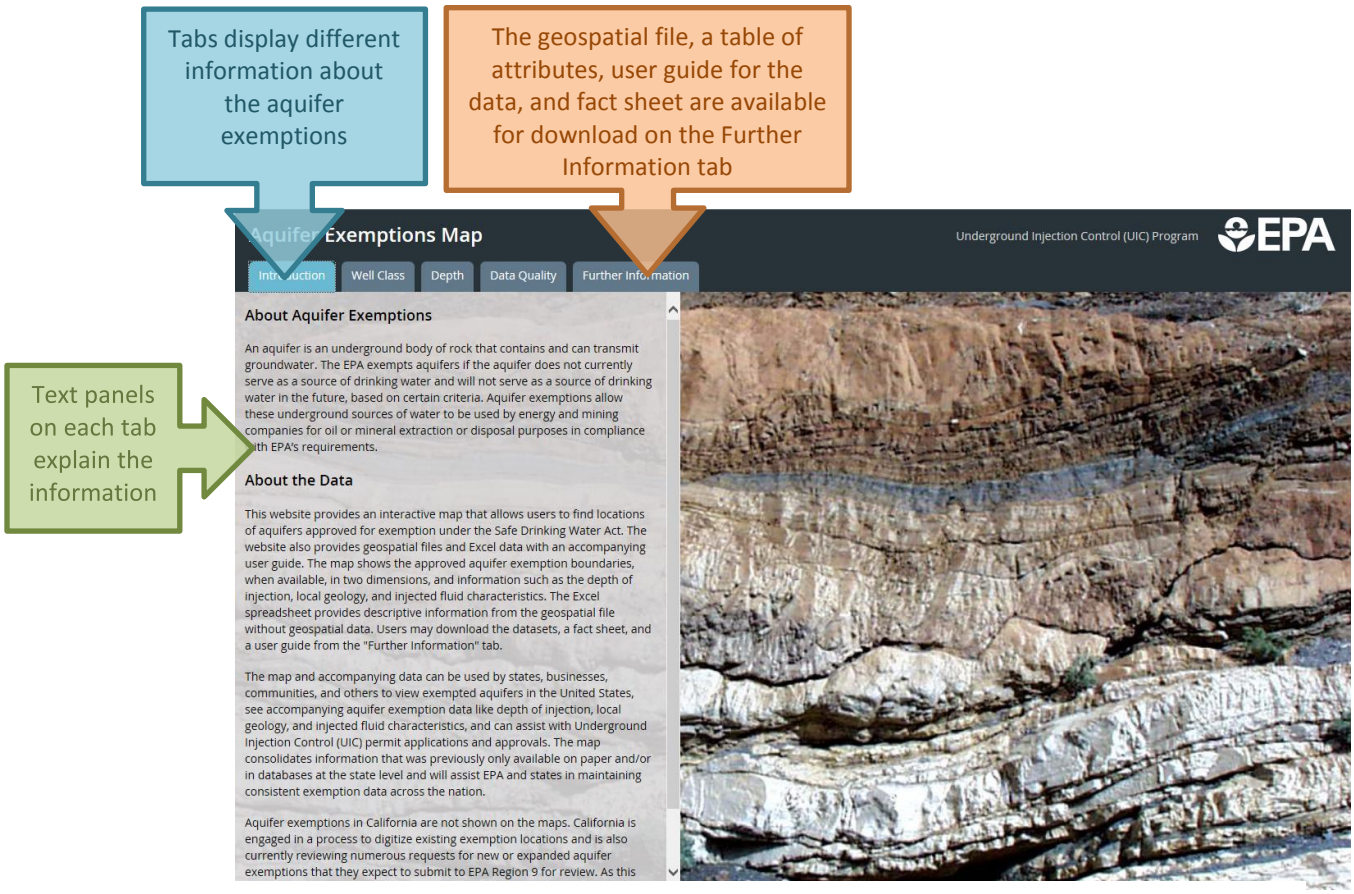

Figure 2. Tabs at the top of the Aquifer Exemption Map allow users to view different information about the exemptions. Users may download data, the user guide, and the fact sheet on the Further Information tab. Text panels on each tab give the user context about the data presented on each tab.

Aquifer Exemption Boundaries

When the user first visits the Aquifer Exemption map, the map scale is set to show the entire United States. Aquifer exemptions are indicated as points at such a small scale so that all the exemption locations are visible. As the user increases the map scale to show more detail, the aquifer exemption boundaries will begin to change from points to polygons. The polygons represent the two-dimensional aquifer exemption boundaries. For example, locations described by a radius around a specific latitude and longitude, as shown in Figure 3, appear as a circle. Some aquifer exemptions are defined by one or more grids in the Public Land Survey System and have a square or rectangular appearance, shown in Figure 3. The Public Land Survey System describes an area using a grid system with numbered townships, ranges, and sections. Map scale may be changed by clicking on the scale adjustment tool represented by the following image on the Aquifer Exemption Map,  .

Injection Well Classes Associated with Aquifer Exemptions

There are six classes of injection wells under the EPA's regulations. Class I wells are for the injection of industrial and municipal waste fluids. Class II wells are for the injection of fluids related to oil and gas operations, such as enhanced recovery (Class IIR) or disposal of production wastes (Class IID). Class III wells inject fluids that assist in extraction of minerals such as uranium and salts. Class IV wells for certain hazardous or radioactive waste injection are banned except under limited circumstances as part of an EPA or state-authorized ground water clean-up. Class V wells are for injection

activities not covered by the other well classes. Class VI wells inject carbon dioxide into deep rock formations for the purpose of long-term storage.

Operators or states typically describe the injection activity proposed for an aquifer when requesting an exemption from the EPA. Aquifer exemptions requested as of January 2016 are usually associated with three of the six classes of injection wells regulated by the EPA Underground Injection Control program. Most aquifer exemptions (about 95 percent) are associated with Class II wells. Almost two-thirds of aquifer exemptions associated with Class II wells are for enhanced oil or gas recovery (Class IIR) and one-third are for disposal of wastewater (Class IID). A small percentage of the aquifer exemptions are not associated with specific Class II activities such as enhanced recovery or disposal; those aquifer exemptions are designated as Class II rather than Class IID or Class IIR. About two percent are associated with Class III mining wells. The remainder are associated with Class I wells used to inject non-hazardous industrial wastes and others.

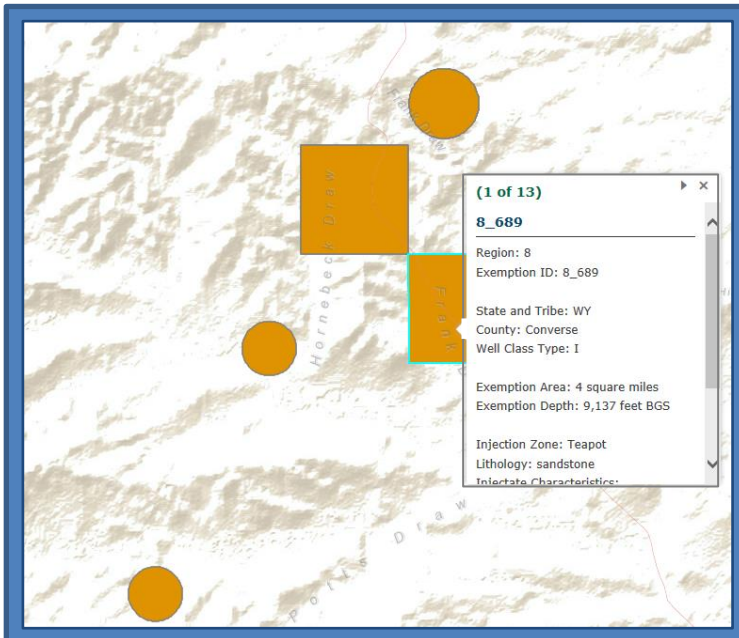

Figure 3. Aquifer exemption locations described by a radius around a specific latitude and longitude appear as a circle. Aquifer exemption locations described by one or more grids in the Public Land Survey System appear as square or rectangle shapes. Pop-up boxes identify attribute information for each aquifer exemption. Where there are overlapping polygons, the user can click on the left and right arrows at the top of the pop-up box to view information about each aquifer exemption.

Aquifer Exemption Depth Map

The aquifer exemptions depth map shows the depth, in feet, to the exempted aquifer from the land surface or its elevation below mean sea level. Some aquifer exemptions are shallow, while others are thousands of feet below the surface (far below drinking water aquifers). About one percent of aquifer exemptions are 500 feet or less below the surface; most are between 1,000 and 9,000 feet deep. Some are over 10,000 feet deep.

In some cases, there is more than one exempted aquifer at the same location, but at different depths and different geologic formations. The aquifer exemptions may have overlapping two-dimensional boundaries but they are separate aquifer exemptions. Information on overlapping aquifer exemption boundaries is listed in the pop-up boxes by clicking the left and right arrows at the top of the box, as shown in Figure 3.

Depth of the aquifer exemptions is measured as feet below ground surface in the majority of exemptions. In some aquifer exemptions located in Louisiana, Texas, and Oklahoma, depth is measured as feet mean sea level. The two scales for measuring depth are shown separately in the legend.

Data Quality Map

The EPA continues to assess the quality of the aquifer exemption records. Many of the records are relatively complete. Some aquifer exemption information is incomplete or aquifer locational information is imprecise. The incomplete or imprecise information is a result of different methods of documenting the data over the more than three decades that the EPA approved exemptions.

Because the EPA seeks to make as much information as possible available, the aquifer exemption polygons are color-coded to reflect the varying levels of certainty in the locational data. The EPA continues to collect information about these aquifer exemptions, and new information will be added to the geospatial file as it becomes available.

	Precise location: The EPA has a high level of confidence in the location of the aquifer exemption and the attribute table is complete for the exemption. In the current dataset, 863 aquifer exemptions, or 26%, have a precise location and complete attribute record.
	Less precise location and some attributes missing: The EPA has a moderate level of confidence in the location of the aquifer exemption and continues to collect information to improve aquifer exemption boundaries. In the current dataset, 1,981 aquifer exemptions, or 60%, fall into this category.
	Imprecise location or several attributes missing: The EPA has information that an aquifer exemption exists, but the location is imprecise or unclear. Locations with accuracy to the township-level, which is a six-square-mile area as defined by the Public Land Survey System (311 aquifer exemptions; 9%), are shown on the map.
	County locations available only: The current dataset contains 102 aquifer exemptions (3%) that have only county-level locations. While the EPA is unable to draw polygons for these aquifer exemptions, the counties containing these exemptions are outlined on the map. The EPA continues to collect information about these aquifer exemptions.
	Locations unavailable at this time: California is engaged in a process to digitize existing exemption locations and is also currently reviewing numerous requests for new or expanded aquifer exemptions that they expect to submit to EPA Region 9 for review. As this work progresses, the aquifer exemptions in California will be added to the national dataset.

A small number of aquifer exemptions are not included in the geospatial data (38 aquifer exemptions; 1%). The Excel spreadsheet available for download on the "Further Information" tab contains information on the aquifer exemptions found in the geospatial data as well as the aquifer exemptions without locational information.

Attribute Table

The EPA maintains a variety of information about the attributes of aquifer exemptions. Each row in the table describes the attributes of an individual aquifer exemption. For example, if two aquifers in the same area were exempted, the aquifers will be described in two separate rows. The polygons that represent the aquifer exemption boundaries on the Aquifer Exemption map may overlap in cases where there is more than one aquifer in an area. Users may also download the attribute table as a Microsoft Excel spreadsheet from the "Further Information" tab.

Data Dictionary

The data dictionary shown in Table 1 describes the column headings in the attribute table of the geospatial file and the Microsoft Excel spreadsheet.

For More Information

For additional information on aquifer exemptions, including the requirements at 40 CFR 146.4, see https://www.epa.gov/uic/aquifer-exemptions-underground-injection-control-program.

For additional information on the UIC program, see https://www.epa.gov/uic.

To download the geospatial file and related materials, visit https://www.epa.gov/uic/aquifer-exemptions-map.

Call the Safe Drinking Water Hotline at 1-800-426-4791 for questions on the aquifer exemptions data or map, or search the FAQ database at https://www.epa.gov/ground-water-and-drinking-water/safe-drinking-water-hotline

Table 1. Data dictionary for the attribute table of the geospatial file and the Microsoft Excel spreadsheet.

Attribute	Description
Region	EPA Regional Office that approved the aquifer exemption request
Number	A sequential number for each record within the EPA Regional records
ID	A unique identifier for each record that combines the data in the "Region" column and the "Number" attributes.
Well Class	The injection well class associated with the aquifer exemption at the time the exemption was approved.
State	The state in which the exempted aquifer (or the center point of the delineated exempted area) is located.
County	The county in which the exempted aquifer (or the center point of the delineated exempted area) is located.
Tribe	The name of the tribe in which the exempted aquifer (or the center point of the delineated exempted area) is located, if the aquifer is located on Indian country.
State or Tribe	A field used specifically for the pop-up boxes in the EPA Geoplatform to indicate either the state or tribe in which the exempted aquifer is located.
AE Centroid (Latitude)	The latitude of the center of the exempted area, in decimal degrees.
AE Centroid (Longitude)	The longitude of the center of the exempted area, in decimal degrees.
AE Area	The extent/boundary of the exempted aquifer (e.g., radius, acreage, etc.), along with the specific units (e.g., square feet, miles, acres) describing the exempted area.
AE Area Units	The specific units describing the exempted area. The units reported to EPA include acres and square miles.
Depth	The depth, in feet, to the top of the injection zone/exempted aquifer or its elevation below mean sea level.
Depth Units	The specific units describing the depth to the top of the exempted aquifer. The units reported to EPA include feet below ground surface (BGS), feet true vertical depth (TVD), feet mean sea level (MSL), and feet measured depth (MD).
Injection Zone	The name of the formation into which injection is planned (or the aquifer identified for exemption).
Lithology	A brief description of the type of rock that comprises the injection zone/exempted aquifer.
Injectate Characteristics	A narrative description or salinity of the fluid planned to be injected into the exempted formation. The units reported to EPA indicate the concentration of total dissolved solids (TDS) in milligrams per liter (mg/L) of fluid.
Approval Date	The date that EPA approved the aquifer exemption request.
Data Quality Category	A brief description of the data quality for each aquifer exemption. The categories include the following: • "Precise location": EPA has a high level of confidence in the location of the aquifer exemption and the attribute table is complete for the exemption. • "Less precise location and some attributes missing": EPA has a moderate level of confidence in the location of the aquifer exemption and continues to collect information to improve aquifer exemption boundaries. • "Imprecise location and several attributes missing": EPA has information that an aquifer exemption exists, but the location is imprecise/unclear. • "County locations available only": EPA is unable to draw actual boundaries for these aquifer exemptions because only county location information is available. The counties containing the exemptions are outlined on the map.