

**GUIDANCE FOR THE DETERMINATION OF
UNDERGROUND SOURCES OF DRINKING WATER (USDWs)
REGIONAL GUIDANCE #3**

I. ISSUE

In accordance with the statutory requirements set forth in the Safe Drinking Water Act as well as the regulatory requirements set forth at 40 CFR § 144.1(g), the ultimate goal of the UIC program is to protect USDWs from contamination that may adversely effect human health. Information on the specific location of USDWs, as defined under 40 CFR § 144.3, is lacking for the EPA administered UIC Programs in the States of Michigan and Indiana. Therefore, Region V needs to collect and compile specific information on the location of USDWs in Michigan and Indiana.

II. PURPOSE OF GUIDANCE

In the interim of finalization of a specific USDW data base for Michigan and Indiana which is being developed by Region V, this guidance is to be utilized by the UIC Section in determining the location of USDWs. Its purpose will be to ensure consistent application of principles and procedures by the UIC Section as part of the permitting process for injection wells and any other UIC related activity requiring such a USDW determination. This Guidance is to be used in conjunction with Regional Guidance #1 (Casing and Cementing) which provides for the protection of USDW's by cement. It is important to note that application of Regional Guidance #3 is not needed where casing strings, penetrating USDWs, are cemented to the surface as adequate USDW protection is explicitly afforded already. However, for wells having non-cemented casing strings, then Regional Guidance #3 is to be followed in determining all USDWs locations, especially the lowermost USDWs location.

In Indiana, information collected thus far indicates the depth to the base of the lowermost USDW to be at approximately 300 feet or deeper. In Michigan, the base of the lowermost USDW is known to be located at least at the base of the Glacial Drift and in some cases deeper. Data must be provided to verify all USDW locations.

1. Well Specific Information - Well specific information should always be utilized first. If well specific information is not available, information from surrounding wells may be extrapolated from to determine a realistic estimate of the lowermost USDW locations. It should be noted that the reliability of an estimated USDW location becomes suspect when the information used to extrapolate a USDW depth is more than a mile away from the injection well of interest.
2. Hydrogeologic Atlas - The Michigan Hydrogeologic Atlas is a good quantitative tool for the determination of USDW locations in Michigan. On the other hand, the Indiana Atlas serves only as a qualitative tool, therefore, it is to be used with caution and supplemented

with other sources whenever possible.

3. Well Logs - Whenever possible, the applicant will be required to calculate the total dissolved solids (TDS) value of formations from well logs to determine the location of the lowest USDW.
4. Supplemental Literature - Some reference literature has been distributed to geologists and engineers involved in the determination of the lowermost USDW location. A more extensive list of pertinent publications is being compiled at this time. Those publications that are not in-house will be ordered. The maps and literature will be organized into a library, making them more accessible to the UIC staff.
5. Other Permit Writers - The USDW depths from wells which are being permitted now and in the future are being entered into the IBM PC along with other pertinent technical information on the injection well. A data sheet has been developed and distributed to all permit writers in order to collect USDW data for the injection wells they have already permitted. This information will be compiled and made available to the UIC staff.
6. Geoscience/Purdue University Brine Study - The final report will be received by the middle of 1987. Although this project concentrated mainly on the sampling and analysis of production well brines, some useful USDW information was found (i.e., general basin trends and how they may be used to estimate the $\pm 10,000$ TDS interface). This study will also produce a Lotus 1-2-3 spreadsheet containing sampling locations and analyses. Pertinent USDW data from this study will be merged with the USDW data files that are currently in the IBM PC.

III. **BACKGROUND INFORMATION**

A. Regulatory and Statutory Citations

Regulations for the identification of Underground Sources of Drinking Water are presented in 40 CFR § 144.7(a). In accordance with these regulations, "the Director may identify... and shall protect, except where exempted... , as an underground source of drinking water, all aquifers or parts of aquifers which meet the definition of an "underground source of drinking water" in § 144.3. Even if an aquifer has not been specifically identified by the Director, it is an underground source of drinking water if it meets the definition in § 144.3."

B. Impact on Various Classes of Injection Wells

For all classes of wells, information on the location of USDWs is required in order to determine:

1. Construction criteria;
2. Adequacy of confinement system;
3. Acceptable injection pressure;
4. Potential threat from temporarily abandoned or improperly plugged wells;
5. Procedures for plugging and abandonment; and
6. Mechanical integrity.

In addition, Class IV wells in which hazardous waste is injected into USDWs, have been banned, therefore, in order to ensure that all Class IV wells have been properly plugged and abandoned more detailed information on USDWs is needed.

IV. **DISCUSSION**

Traditionally, the field definition of fresh/potable water has not been as inclusive as that of a USDW. Fresh/potable water generally refers to TDS contents of less than 3000 ppm, whereas USDWs include water with < 10,000 mg/l total dissolved solids (TDS). Prior to the 40 CFR § 144.3 definition of a USDW in 1984, ground water resource studies did not necessarily involve the 3,000-10,000 mg/l TDS aquifers and as a result, USDW information is lacking. Since promulgation of the 1984 UIC Regulations two studies have been conducted to determine the base of the lowest USDW in Region V. These studies resulted in the "Hydrogeologic Atlas of Michigan" and the "Hydrogeologic Atlas of Indiana". Although information provided in these studies is useful in a general sense, it becomes less valuable when site specific information is needed. The general data cannot be accurately extrapolated to specific sites, the reason being that facies changes due to varying depositional environment and changes in formation orientation in space, as well as location within a basin contribute to lateral and vertical water quality variations within the formations.

Glacial drift blankets the entire Michigan Basin. Therefore, in Michigan the bases of USDWs are at least at the base of glacial drift. At the basin flanks where formations outcrop or are near the surface, USDWs may be well below glacial drift. In Indiana, the glacial drift is thinner, becoming non-existent to the south. As a result, even broad generalizations are difficult to make. In order to ensure that injection wells are properly constructed to prevent contamination of USDWs, a detailed knowledge of local conditions is necessary.

V. **CONCLUSION**

It is recommended that Region V's, "Guidance for the Determination of USDWs" be followed. This guidance stresses the importance of site specific information and outlines acceptable alternatives when specific information is not available.

The determination of USDW locations is an ongoing project that will result in continuous updates of Region V's USDW data base. The depth to and name of the lowermost USDW which are penetrated by an injection well will be entered into the computer along with the other pertinent technical information on that injection well after either a permit review or file review has occurred.