United States
Environmental Protection Agency

Office of
Ground Water and
Drinking Water

CLASS V UIC STUDY FACT SHEET
HEAT PUMP/AIR CONDITIONING RETURN FLOW WELLS

What is a heat pump/air conditioning return flow well?	Heat pump/air conditioning return flow wells are Class V underground injection control (UIC) wells used to return ground water, which has been circulated through open-loop, heat pump/air condition (HAC) systems, to the subsurface. These HAC systems heat or cool buildings by extracting heat energy from ground water or using ground water as a heat sink when cooling.
What types of fluids are injected into heat pump/air conditioning return flow wells?	Ground water that usually has the same quality as the original source ground water, except that it may be cooler or warmer. Therefore, salts and other dissolved solids may either precipitate into suspension or dissolve into solution. HAC injectate can also contain: metals leached from the pipes and pumps; bacteria; precipitated ferric iron solids; and chemical additives.
Do injectate constituents exceed drinking water standards at the point of injection?	Available data indicate that HAC injectate has in some cases exceeded the primary drinking water standard for lead and copper and the secondary drinking water standard for chloride and total dissolved solids.
What are the characteristics of the injection zone of a heat pump/air conditioning return flow well?	HAC systems most commonly re-inject ground water into the same formation from which it is withdrawn. The aquifer must be relatively porous in order to provide adequate ground water flow to source wells and to accept fluids from return wells.
Are there any contamination incidents associated with heat pump/air conditioning return flow wells?	Relative to the number of HAC wells that exist in the United States, the number of documented contamination incidents is small. Due to a leaking well casing in one well in NY, chloride and total dissolved solid levels were found to be above secondary drinking water standards in one underground source of drinking water (USDW). In MN, two different water samples indicated high levels of lead and copper. This was attributed to leaching of metals from the HAC system pipes and pumps. In NC, well samples have been reported to contain high levels of iron and coliform attributed to poor HAC well construction and operation.
Are heat pump/air conditioning return flow wells vulnerable to spills or illicit discharges?	HAC return flow wells are generally part of systems that are completely closed above ground, and are generally located on private property. Therefore, the likelihood of USDW contamination by illicit discharges from HAC return flow wells is very low.
How many heat pump/air conditioning return flow wells exist in the United States?	There are 27,921 documented HAC return flow wells in 34 states and it is estimated that more than 32,804 wells (but probably not more than 35,000) exist in over 40 states.
Where are heat pump/air conditioning return flow wells located within the United States?	Approximately 88 percent of all documented wells are in four states: TX (46 percent), VA (28 percent), FL (11 percent), and TN (4 percent). Another 30 states collectively account for the remaining 11 percent of the total documented United States inventory.
How are heat pump/air conditioning return flow wells regulated in states with the largest number of this type of well?	*Permit by rule:* AZ, IL, KS, MI, MN, NE, ND, NY, OH, PA, SC, TN, TX, VA, WV, WY *General permit*: WI (for open-loop discharge to shallow subsurface soil absorption field in the unsaturated zone above the uppermost drinking water aquifer) *Individual permit*: DE, FL, MD, MO, NV, NC, OR (unless individually exempted), VT, WA *Banned*: WI (for open-loop discharge directly back into an aquifer)
Where can I obtain additional information on heat pump/air conditioning return flow wells?	For general information, contact the Safe Drinking Water Hotline, toll-free 800-426-4791. The Safe Drinking Water Hotline is open Monday through Friday, excluding federal holidays, from 9:00 a.m. to 5:30 p.m. Eastern Standard Time. For technical inquiries, contact Amber Moreen, Underground Injection Control Program, Office of Ground Water and Drinking Water (mail code 4606), EPA, 401 M Street, SW, Washington, D.C., 20460. Phone: 202-260-4891. E-mail: moreen.amber@epa.gov. The complete Class V UIC Study (EPA/816-R-99-014, September 1999), which includes a volume addressing heat pump/air conditioning return flow wells (Volume 19), can be found at http://www.epa.gov/OGWDW/uic/cl5study.html.