

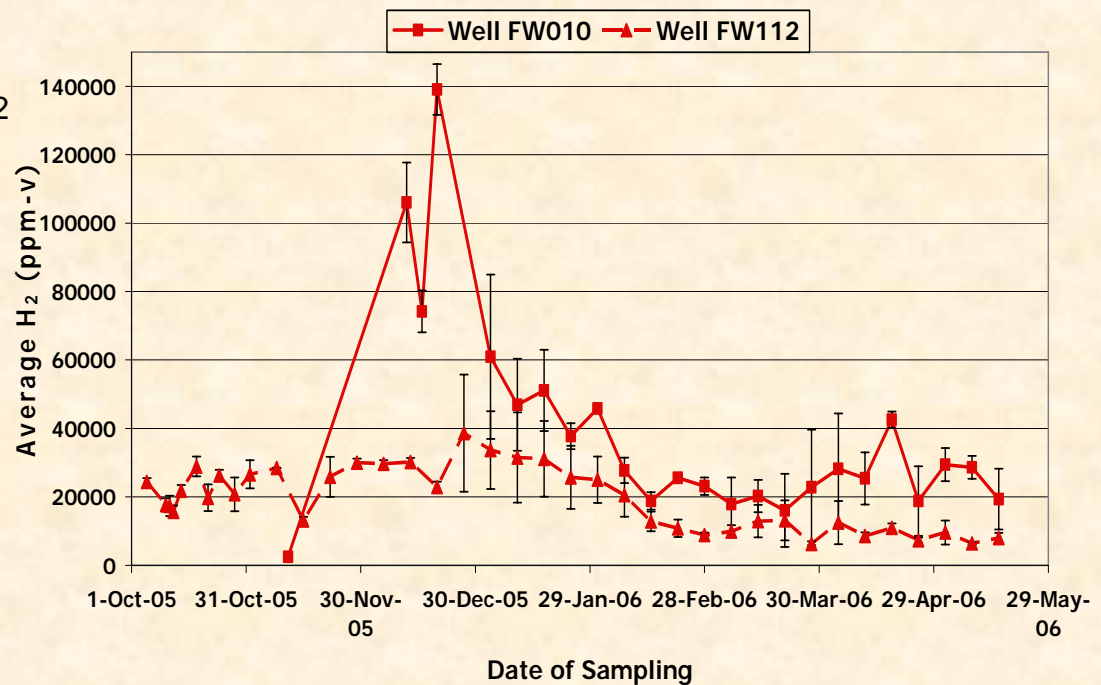
Passive Samplers for Chromatographic Analyses of Gases in Groundwater Reveal High Concentrations of Hydrogen

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Passive in situ gas samplers, made from silicone tubing and a syringe, have been demonstrated for collecting groundwater dissolved hydrogen and oxygen samples and exhibited facile advantage over presently-used active pumping methods such as bubble-stripping protocols.

Unusually high concentrations (up to 14% H₂ in equilibrium gas phase) were observed in monitoring wells around a group of former radioactive wastewater ponds.

Incubation of retrieved groundwater for up to eight weeks revealed unusually stable high hydrogen concentrations.



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Syringe/tubing dissolved gas sampler.

A simple in situ passive dissolved gas groundwater sampler, comprised of a short length of silicone tubing attached to a gastight or other syringe, was adapted and tested for in situ collection of equilibrium gas samples. Sampler retrieval after several days immersion in groundwater allowed the direct injection of the sample onto a gas chromatograph (GC), simplifying field collection and sample handling over the commonly used “bubble stripping” method for H₂ analyses. A GC was modified by sequencing a thermal conductivity (TC) detector followed by a reductive gas (RG) detector so that linear calibration of H₂ over the range 0.2 through 200,000 ppmv was attained using a 0.5 mL gas sample; inclusion of the TC detector allowed the simultaneous quantification of other fixed gases (O₂, CO₂, He, and Ne) to which the RG detector was not responsive. Uptake kinetics for H₂ and He indicated that the passive sampler reached equilibrium within 12 hours of immersion in water. Field testing of these passive samplers revealed unusually large equilibrium gas phase H₂ concentrations in groundwater, ranging from 0.1 to 13.9%, by volume, in eleven monitoring wells surrounding four former radiological wastewater disposal ponds at the Y-12 plant in Oak Ridge, Tennessee.

Spalding, B. P. and D. B. Watson. 2006. Measurement of Dissolved H₂, O₂, and CO₂ in Groundwater Using Passive Samplers for Gas Chromatographic Analyses. *Environmental Science & Technology Web* published 10/31/06 DOI: [10.1021/es0613310](https://doi.org/10.1021/es0613310)