ANALYTICAL LABORATORY and MOBILE SAMPLING PLATFORM

PROGRESS REPORT

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Vapor Tracers

Three compounds, trifluoromethane (CHF_3), 1,1,1,2-tetrafluoroethane (TFA), and octafluoropropane (C_3H_8), were compared to sulfur hexafluoride (SF_6) for use as vapor phase tracers. Dichlorodifluoromethane (CCl_2F_2 , F-12) was also used in one set of experiments, but only for comparison purposes. This compound will not be used because of its ozone depletion potential.

Experiments:

The experiments were set up to test the sorption and/or degradation of these compounds with respect to SF_6 . This was done because of problems with leakage in the test vials due to poor sealing of the containers as well as leakage through the septa from repeated sampling. The assumption is made that all components, including SF_6 , would be affected equally.

Experiments were set up to test sorption/degradation in a medium colored tuff with and without water. In the water with tuff experiment, enough water was added to the tuff so that it was near saturation. The tuff was obtained from outcroppings south of Yucca Mountain and is being used in our ground water tracer testing program. A blank containing only tracer was also analyzed. Two sets of experiments were performed.

In the first experiment CHF_3 , TFA and F-12 were compared to SF_6 (tables 1-3). The concentrations of all three start to decrease after about 14 days in the water and tuff sample. In the tuff only sample F-12 shows a decline after 21 days and CHF_3 after 3 days. The TFA remained stable for 30 days. Since F-12 is assumed to be a stable lightly sorbing tracer it was felt that the experimental design needed to be improved. C_3H_8 and CHF_3 were used in this experiment (all the TFA had been used in the first experiment). In this experiment the compounds compared favorably with sulfur hexafluoride and no reduction in concentration was seen for 33 days (tables 4-6). They did not sorb to soil any differently (if at all) than sulfur hexafluoride.

Detection limits were also determined for the octafluoropropane and trifluoromethane. Our detection limit for sulfur hexafluoride is listed for reference. The work was performed on a Hewelett-Packard 5890 gas chromatograph with an electron capture detector. The minimum detection limit (MDL) was calculated using:

$$\text{MDL} = t_{(n-1, \alpha=0.99)} * s$$

where:

t = the Student t value with n-1 degrees of freedom at the 99% confidence level

s = standard deviation of replicate analyses

Octafluoropropane	2.40 ppq (parts per quadrillion)
Trifluoromethane	24.27 ppt (parts per trillion)
Sulfur hexafluoride	23.71 ppt

The results of the detection limit tests for TFA will be available next quarter. We are also planning to test perfluoromethylcyclohexane (PMCH) and perfluoromethylcyclopentane (PMCP) as possible tracers. PMCP is a liquid and PMCH is a solid but their vapor pressure is high enough warrant testing. However experimental details must be worked out.

Environmental Field Activity Plan

We have also been working with DOE and SAIC personnel to rewrite the environmental field activity plan (EFAP) for water quality. This document should be completed during the next quarter and will specify locations, types of analyses and frequencies for a ground water quality monitoring program for the site characterization project.

Analysis of rock samples

We have obtained a microwave digestion system for rapid and complete digestion of rock samples. This system will be operational in a few weeks and we will begin analyzing crushed rock samples obtained from Zell Peterman of the USGS.

Medium Tuff and Water

TABLE 1

Medium Tuff, No Water

TABLE 2

No Medium Tuff, No Water (Blank)

TABLE 3

Medium Tuff and Water

TABLE 4

Medium Tuff Only, No Water

TABLE 5

No Medium Tuff, No Water
(Blank)

TABLE 6

END

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