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PROOF-OF-CONCEPT TEST OF A UNIQUE GASEOUS PERFLUROCARBON TRACER SYSTEM FOR VERIFICATION AND LONG-TERM MONITORING OF CAPS AND COVER SYSTEMS CONDUCTED AT THE SAVANNAH RIVER SITE BENTONITE MAT TEST FACILITY*

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ABSTRACT

Engineered covers have been placed on top of buried/subsurface wastes to minimize water infiltration and therefore, release of hazardous contaminants. In order for the cover to protect the environment it must remain free of holes and breaches throughout its service life. Covers are subject to subsidence, erosion, animal intrusion, plant root infiltration, etc., all of which will affect the overall performance of the cover.

The U.S. Department of Energy Environmental Management (DOE-EM) Program 2006 Accelerated Cleanup Plan is pushing for rapid closure of many of the DOE facilities. This will require a great number of new cover systems. Some of these new covers are expected to maintain their performance for periods of up to 1000 years. Long-term stewardship will require monitoring/verification of cover performance over the course of the designed lifetime. Inaddition, many existing covers are approaching the end of their design life and will need validation of current performance (if continued use is desired) or replacement (if degraded). The need for a reliable method of verification and long-term monitoring is readily apparent.

Currently, failure is detected through monitoring wells downstream of the waste site. This is too late as the contaminants have already left the disposal area. The proposed approach is the use of gaseous Perfluorocarbon tracers (PFT) to verify and monitor cover performance . It is believed that PFTs will provide a technology that can verify a cover meets all performance objectives upon installation, be capable of predicting changes in cover performance and failure (defined as contaminants leaving the site) before it happens, and be cost-effective in supporting stewardship needs.

The PFTs are injected beneath the cover and air samples taken above (either air samples or soil gas samples) at the top of the cover. The location, concentrations, and time of arrival of the tracer(s) provide a direct measure of cover performance. PFT technology can be used as a non-invasive method (if injection ports are emplaced prior to cover emplacement) on new covers or a minimally invasive method on existing covers. PFT verification will be useful at all buried waste sites using a cover system (e.g., treated or untreated chemical waste landfills) including DOE, commercial, and private sector sites.

This paper discusses the initial field trial of the PFT cover monitoring system performed at the Savannah River Site (SRS) in FY01. The experiments provided a successful proof-of-principle test of the PFT technology in monitoring caps and covers. An injection and sampling array was installed in the Bentomat test cap at the SRS Caps Test Facility. This system contained 6 feet of sandy soil beneath a ½ inch geosynthetic clay liner covered by an HDPE liner which was covered by 2 feet of clayey top soil. PFTs were injected into the sandy soil through a pre-existing system of access pipes below the cap and soil gas samples were taken on top of the cap. Mid-way into the injection period a series of 1 ½ inch holes were punched into the cap (through the geomembrane) to provide a positive breach in the cap. Data will be presented that shows the initial cap was fairly tight and leak free and that the artificially induced leaks were detectable within two hours of occurrence.

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