[Form 2 (to be reported to Committee on Countermeasures for Contaminated Water Treatment and to be disclosed to public)

| Technology Information | |
|---|---|
| Area | 6 Understanding the groundwater flow |
| Title | Annular Beta Spectrometer System (ABSS) for Subsurface Monitoring |
| Submitted by | Douglas Akers Idaho National Laboratory |

1. Overview of Technologies (features, specification, functions, owners, etc.)

The INL's ABSS was developed for use in subsurface environments like the vadose zone at the Department Of Energy's Hanford Reservation in Richland, WA. Specific radionuclides for which direct measurements can be performed include technetium ($^{99}$Tc) and other beta, alpha, and low-energy gamma emitters such as strontium-yttrium ($^{90}$Sr-Y), Carbon 14 ($^{14}$C), tritium ($^{3}$H) and Iodine 129 ($^{129}$I). Tests were conducted with a number of alpha and beta-emitting radionuclides and with soils containing varying concentrations of $^{99}$Tc and other radionuclides. For example, detection of $^{99}$Tc at concentrations of < 0.04 Bq/g in soil was performed in less than one minute using a prototype ABSS. This system is suitable for direct characterization of air, water, and soils as part of a direct continuous monitoring or sampling program that is suitable for both contaminated water and facility monitoring at Fukushima. Just as important, the ABSS is not significantly affected by background radiation effects and can easily discriminate among beta emitters such as $^{99}$Tc from background concentrations of $^{40}$K and other natural beta/gamma emitters present in the environment. The ABSS system is highly automated with interface software based on other monitoring systems developed at the INL such as the Multi Detector Probe (MDP) system that was used at Hanford and the Rapid Transuranic Monitoring System that is currently in use at the INL's Radioactive Waste Management Complex.

ABSS offers a long list of practical applications, including the monitoring of radionuclide industrial production facilities or hospitals where $^{99}$Tc is used and where residual $^{99}$Tc amounts are expected to remain undetected under normal facility inspection procedures. Other applications where this technology can be used without any preprocessing or dissolution of samples include contaminated water process monitoring, monitoring of nuclear power plants, decommissioned nuclear fuel processing facilities, and environmental research laboratories.

2. Notes (Please provide following information if possible.)

- Technology readiness level (including cases of application, not limited to nuclear industry, time line for application). The ABSS technology has been demonstrated for a range of beta-emitting radionuclides in a subsurface environment using prototype detector systems. For specific applications and improved sensitivity for specific radionuclides, system design, hardware implementation, and software modifications will be required as changes to the prototype design. However, none of these modifications present significant challenges to the technology and can be addressed in the short term for specific applications.

- Challenges

The ABSS technology was has been well demonstrated for standard subsurface environments and can be used directly for air water and soil environments. The only primary challenge would be the use of the ABSS in high radiation field environments, which has not been demonstrated.

- Others (referential information on patent if any)

The ABSS is the subject of an issued US patent and several peer-reviewed technical reports. The ABSS US patent number, dated September 25, 2012 is US 8,274,056 B2.

【Areas of Technologies Requested】

(1) Accumulation of contaminated water (Storage Tanks, etc.)
(2) Treatment of contaminated water (Tritium, etc.)
(3) Removal of radioactive materials from the seawater in the harbor
(4) Management of contaminated water inside the buildings
(5) Management measures to block groundwater from flowing into the site
(6) Understanding the groundwater flow