

Mobile Unit for Site Characterization in Environmental Remediation Projects

Streil, T. and Oeser V.
SARAD GmbH, Wiesbadener Straße 10
01159 Dresden, GERMANY
streil@sarad.de

As part of an environmental remediation plan to be applied to areas affected by past activities and accidents, characterization of the site is a mandatory step. This activity will determine the extent of the contamination, contaminants' distribution, etc. Traditionally, this activity involves the collection of different environmental samples and laboratory analysis of the relevant radio nuclides (and eventually other contaminants like heavy metals). When the results are available they are interpreted and then a decision is made. This process is normally very expensive and time consuming. In recent years many techniques have been made available for in-situ measurement that can provide reliable information on the contamination profile in radiological contaminated land. Such measurements tend to be less expensive, faster and with the aid of GPS/GIS systems decisions can be made on-site in real time. Mobile units may also be useful to states who do have laboratory analysis facilities, but are faced with large, unforeseen characterization challenge, such as following and accident or radiation emergency. To overcome this situation we developed the DACM (Data Acquisition and Control Module) technology. Instruments based on this technology can be modified anytime by the user without special knowledge and the claiming of the manufacturer.

The DACM based offers a set of components which can be configured, parameterized and controlled with respect to the requirements on site. Typical components are Radon/Thoron modules (soil gas, water, air, exhalation, contiguous flux measurement in different depths), signal inputs for sensors like Co₂, Methane, SO₂..., control outputs for instance for pumps, magnetic valves for exhalation measurements but also complex functional blocks like spectrometers, GPS receiver, PID regulators etc. A complex sampling schedule can be created within few minutes by a graphical software interface. With a dimension of 235mm x 140mm x 255mm and weight less than 6 kg the full system is very handy.

Definition of a local dose, detection of radioactive sources: The handy and robust 2" x 2" NaI(Tl) detector is connected to the unit via a 10m long cable, so that it can be positioned flexibly in relation to the source. Thanks to the big detector volume, even small sources can be detected. Further direct measurements in boreholes are possible.

Net activity of free definable nuclides in food and material probes: The NaI(Tl) detector is also used to analyze food and material probes regarding specific nuclides (e.g. radium, Uranium, Thorium, Iodine, Caesium, Americium). By means of the gamma spectrum, the net activity of six user definable nuclides is automatically calculated.

Measurement of radioactive aerosols in inhaled air: The aerosol sampling head with its spectroscopy filter and its silicon detector samples continuously and detects even small quantities of aerosol carried radioactivity. Both alpha and beta radiation are measured. The spectrometric analysis allows e.g. detecting Plutonium aerosols which cannot be detected by measuring gamma radiation.

Mop tests, surface contamination (clothes), electrochemical probes: Optionally, the DACM can be connected to a portable vacuum chamber with Ion-implanted Silicon detector up to 2000mm², to allow on-site analysis of mop tests and other samples under circumstances similar to those prevailing in a laboratory. The employed vacuum pumps can be connected to a 12V source (car battery)

All detectors can be operated simultaneously. The concept of the system allows an easy handling and a standardized data basis. The device offers predefined measurement procedures that can be easily modified by the user. Additional measurement programs can be created without any problem.

The Data transmission and device control can be done by GPRS or GSM modems, as well as via ZigBee adapter (Wi-Fi), if the device is operated in inaccessible or contaminated areas.

One new developed version of this system is the NucScout as a handy and robust 2" x 2" (optional 3"x3") NaI(Tl) Nuclide Identifier and quantifier. With less than 2 kg including GPS and ZigBee wireless connection he can be so calibrated by use in 1 m high from the soil, that he show direct the nuclide activity in Bq/kg from up to 6 nuclides, which can be chosen from a big nuclide library with more than 50 nuclides. So you can get with a time resolution of 10 sec and a speed of 1 m/s a local resolution of 10 m and you can detect a specific activity less than 200 Bq/kg soil activity on the surface.

The device is so small that it is possible to use on a small UAV like Quadro- or Octocopter