AN APPLICATION OF THE ULTRASONIC RANGING AND DATA SYSTEM (USRADS) AS A VERIFICATION TOOL POSTER SESSION*

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ABSTRACT

The Ultrasonic Ranging and Data System (USRADS) is a computerized data collection system that enables the correlation between geographic location and data gathered at that location. The USRADS employees ultrasonics, radio frequency transmission and microcomputers to gather data for site characterization. In the case of a radiological survey, radiation measurements are gathered to confirm that remedial action has successfully removed contamination to levels below applicable guidelines or standards. Chemrad Tennessee Corporation currently holds the license to manufacture or lease commercial versions of the USRADS.

The Pollutant Assessments Group of Oak Ridge National Laboratory, Grand Junction, Colorado, was directed by the Department of Energy to verify the adequacy of remedial action taken at various sites throughout the western United States. The USRADS was utilized at the Monticello Remedial Action Program, a National Priorities List site in Monticello, Utah following remedial action of approximately 15 cm of soil contaminated by wind-dispersed uranium mill tailings. The verification was conducted in a 15,300 square meter property that resides on the periphery of the mill site and was vacant land. Remedial action at this location was conducted to bring the site's radiation levels below those specified in 40 CFR 192.

The radiological verification survey was conducted following excavation of the contaminated material. The USRADS was configured with a Victoreen gamma scintillometer and was operated by a two-man survey team. There are several advantages to verifying with the USRADS over conventional gamma radiation survey methods. First, survey coverage can be instantly verified, allowing the survey team to confirm complete survey coverage. Second, the data may be analyzed on site, enabling the team to identify areas of elevated gamma radiation exposure rates and to selected biased sample location. Finally, the USRADS provides both high quality graphical illustrations for permanent documentation and data storage that can be easily retrieved for site certification.

INTRODUCTION

Independent verification (IV) on Environmental Restoration (ER) Program sites has become a formal requirement of the Department of Energy (DOE). The Oak Ridge National Laboratory/Pollutant Assessments Group (ORNL/PAG) is one independent verification contractor (IVC) for the DOE Southwestern Area Programs. ORNL/PAG was directed by DOE Headquarters in July 1988 to provide IV for vicinity properties associated with Monticello Remedial Action Project (MRAP), which entails the remediation of the former uranium millsite at Monticello, Utah. The site was placed on the National Priorities List in 1987 (1).

ORNL/PAG performed a radiological verification survey of a property on the periphery of the Monticello millsite to support the adequacy of remedial action and confirm the site's compliance with Environmental Protection Agency (EPA) criteria and DOE guidelines (2,3). The survey employed the Ultrasonic Ranging and Data System (USRADS) to gather gamma radiation exposure rate measurements as part of the verification. This state-of-the-art method proved to be advantageous over conventional gamma radiation survey methods. Results of the survey verified that the radiological condition of the site indeed met DOE's remedial action objectives.

USRADS is a patented, computerized data acquisition system developed by ORNL to correlate the radiological surveyor's location with instantaneous radiation data taken during walk-on surveys (4). The system patent is currently held by Chem-Rad, Inc. One major application of USRADS includes verification of remediated and uncontaminated areas. It is especially applicable to radiological verification as it provides documented proof that no surface areas were missed during the walking scans.

INDEPENDENT VERIFICATION PROCESS

The property that is the subject of this report consisted of an alfalfa field, containing no buildings and lying approximately .4 km (1500 feet) north of the Monticello millsite. The property encompasses over 15,000 m^2 (4 acres).

The process of independent verification was initiated with a document review of the characterization report and remedial action plan. This was followed by the site survey, which employed USRADS and soil sampling. A document review of the remedial action contractor's (RAC) post-remedial-action report (or completion report) and confirmatory analysis will follow the site survey. Finally, samples will be chosen and archived to support the site's certification. The RAC has not yet issued the completion report.

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Review of the remedial action design report on the subject property prepared by the RAC indicated the property was evaluated by DOE on the basis of EPA standards and that excess residual radioactive materials were present. Thus it was appropriate to designate this property for remedial action.

During May 1992, Chem-Nuclear Geotech, the RAC for MRAP, performed remedial action on the property. The remedial action plan required excavation of all exterior contamination, backfilling with uncontaminated material, and restoration to a condition comparable to that existing prior to remedial action. When the excavation stage was completed, the property was resurveyed; soil samples were collected by the IVC to verify the data supporting the adequacy of remedial action and to confirm the site's compliance with DOE guidelines.

INDEPENDENT VERIFICATION SURVEY

The radiological verification survey was conducted immediately following excavation of the contaminated material. Measurement and analytical procedures followed were from the PAG procedures manual (5). Gamma radiation exposure rates were measured by USRADS, which provided documented proof that no surface areas were missed during the walking scan.

USRADS is configured with a Victoreen gamma scintillometer and is operated by a two-man survey team. One person acts as the surveyor, traversing grid blocks on 1.5 m centers and wearing a special survey backpack containing the electronic-data-gathering and telemetry equipment. The other team member operates the host computer and master receiver. As the surveyor traverses the block, an ultrasonic signal is emitted from the surveyor's data pack each second. Simultaneously, radio frequency transmissions containing the field data are broadcast from the surveyor's data pack to the master receiver. Stationary receivers placed within the grid block contain ultrasonic receivers and radio frequency transmitters. The radio frequency signal is transmitted to the master receiver each time a stationary receiver hears and identifies an ultrasonic signal emitted from the data pack. The microcomputer then calculates the distance between the surveyor and each stationary receiver. By this method, the location of the surveyor and the gamma radiation exposure rate data are established and recorded each second.

The property was divided into grid blocks based on the areal extent of the excavations performed by the RAC. The USRADS coordinate system was determined prior to the survey with the 0,0 base point for all coordinates arbitrarily chosen as the southeast corner of the property.

Fieldwork was conducted in two phases. The first phase involved surveying blocks 1 to 3, and the second phase examined blocks 4 to 7. Each block consisted of 2 to 3 verification areas (V areas). The V areas are subdivided into 9 to 11 grids for the purpose of soil sampling by the large-area-protocol method. These sampling grid blocks are designated with a letter within their respective V areas (Fig 1).

Following the survey of each block, data was analyzed in the field to locate a biased sampling location that exhibited at least one of the highest outdoor gamma (HOG) radiation measurements. After data analysis, a field printout was produced to illustrate the HOG locations within the sampling grid blocks enabling the sampling team to pinpoint sampling locations based on the USRADS coordinate system (Fig. 2).

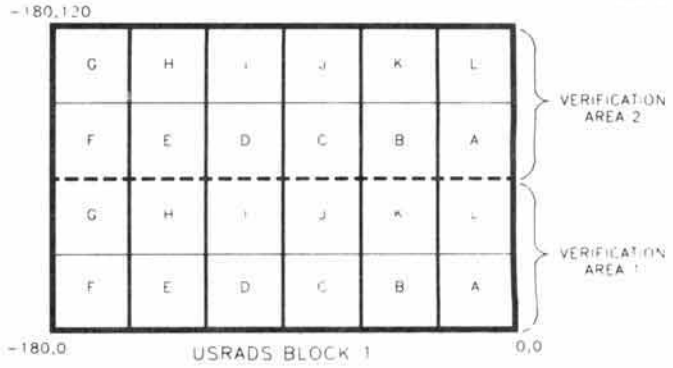

Fig. 1. Remedial action site location map and grid.

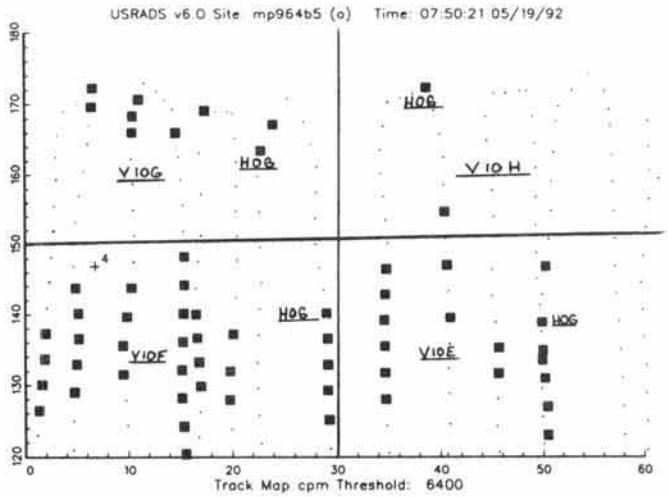

Fig. 2. Example of USRADS block.

Gamma radiation measurements taken by ORNL over the ground surface in each verification block prior to backfilling were tabulated for analysis. These data were extracted from the USRADS data files following completion of field activities and correlated with sample analysis data. When the entire verification survey was complete, a track map of the property verifying complete survey coverage was produced (Fig. 3), demonstrating the reproducibility of the USRADS method.

CONCLUSION

The results of the IVC analyses of this property showed that gamma radiation exposure rates and radionuclide concentrations were within applicable DOE guidelines. Currently, the RAC is preparing a completion report documenting the cleanup of the property in compliance with DOE guidelines. The IVC has yet to examine the completion report to compare and confirm analytical results, at which point an IV statement and report will be issued.

USRADS as a verification tool has a number of advantages over conventional survey methods. First, survey coverage is instantly verified by viewing the track map, allowing the survey team to confirm that the entire property was surveyed and that no areas were missed. Second, the data is analyzed on site, enabling the team to identify areas of elevated gamma radiation exposure rates and to select biased sample locations. Finally, USRADS provides high-quality, graphical illustrations and data storage in a electronic format that

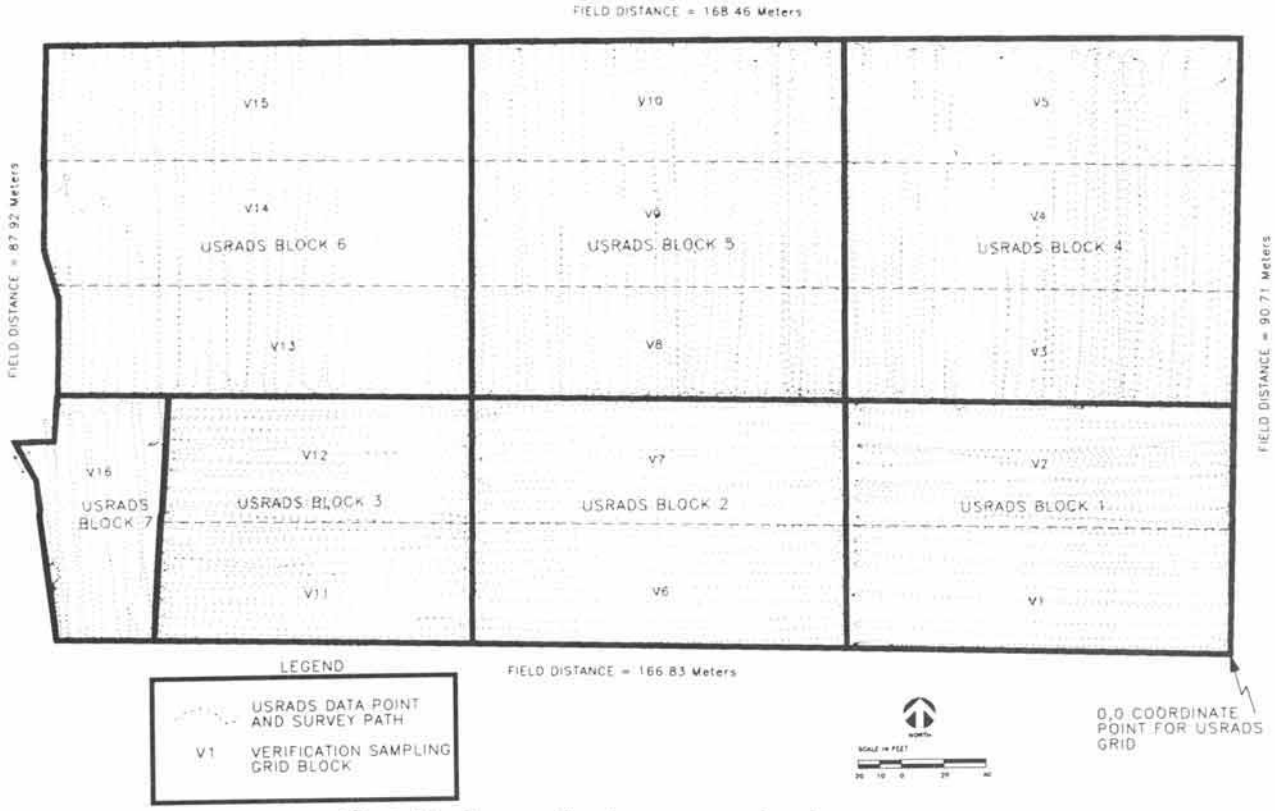

Fig. 3. Track map of entire property showing survey coverage.

provides easy retrieval and reproduction for IV and ultimate certification of the site.

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