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Revision 1

Use of the Aerial Measurement System Helicopter Emergency Response Acquisition Systems with Geographic Information System for Radioactive Soil Remediation - [11504]

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

U.S. DEPARTMENT OF ENERGY | Richland Operations Office

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Use of the Aerial Measurement System Helicopter Emergency Response Acquisition Systems with Geographic Information System for Radioactive Soil Remediation—[11504]

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ABSTRACT

The Aerial Measurement System (AMS) Helicopter Emergency Response Acquisition System provides a thorough and economical means to identify and characterize the contaminants for large area radiological surveys. The helicopter system can provide a 100-percent survey of an area that qualifies as a scoping survey under the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) methodology. If the sensitivity is adequate when compared to the clean up values, it may also be used for the characterization survey. The data from the helicopter survey can be displayed and manipulated to provide invaluable data during remediation activities.

BACKGROUND

The CH2M Hill Plateau Remediation Company (CHPRC) is currently contracted to the U.S. Department of Energy (DOE) to remediate contaminated waste sites on the Hanford Site. One of the sites scheduled for cleanup is the 11,256-acre Burial Cribs (BC)-Controlled Area. During the 1950s, the BC-Controlled Area, which includes six engineered soil waste disposal sites called "cribs" and 20 waste trenches, was used to absorb more than 30 million gallons of contaminated waste from the chemical separations plant. Before the cribs and trenches were capped with an intrusion barrier in 1969, contamination had been spread by wind dispersion and, to a lesser extent, by animals that had burrowed into the cribs and eaten the radioactive salts. The dispersion has resulted in shallow soil contamination within the BC-Controlled Area in which the primary isotope of concern is cesium-137.

The BC-Controlled Area is divided into separate regions based on past historical information and recent analytical sampling events. Within the northern part of the BC-Controlled Area is Zone A, which has the highest levels of contamination from cesium-137 and strontium-90. The remainder of the site contains some areas of contamination in an irregular pattern; however, these are generally considered to be of lower risk to human health and the environment. These regions are referred to as Zones B and C.

As part of the remediation design effort, a Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)-based approach was designed to determine the extent and magnitude of the contamination. The use of walking surveys to characterize the area would be costly, time-consuming, and has been proven to provide less than 100-percent coverage of an area of concern. Characterization of this area using vehicle surveys would be prohibited because of the nature of the terrain, fire hazards, and the possibility of inflicting unnecessary damage to the environment.

After the careful considerations of options, the Aerial Measurement System (AMS) using a Remote Sensing Laboratory (RLS) helicopter from Nellis Air Force Base in Nevada, equipped with a Geographic Information System (GIS) and an emergency response acquisition system, was chosen to perform the survey (Fig. 1). The survey performed by the AMS proved to be less than half the cost of a walking survey and was safer because no personnel were present on the ground in the area to risk contamination and there was no impact to the environment. The AMS provided 100 percent coverage, and the Minimum Detectable Activity (MDA) of the instrument allowed for the data to be used as both a scoping survey as well as a characterization survey under the MARSSIM methodology.

Fig. 1. Aerial Measurement System RLS Helicopter

Previous aerial surveys using an airplane instead of a helicopter have been performed on the Hanford Site (Fig. 2), but the altitude required for an airplane survey was too high to give the type of point source sensitivity needed to make remediation decisions. This was apparent when ground surveys of the same area showed activity where the aerial measurement showed none. To increase sensitivity to point sources, it was determined that the system had to fly at an altitude of 50 ft and at 80 mph. The increased point source sensitivity is acquired by averaging the activity detected by the instrumentation over a smaller field of view. The increased point source sensitivity greatly reduces the amount of statistically based ground surveys required to verify the cleanup level of the waste site area with the desired confidence interval (Table 1).

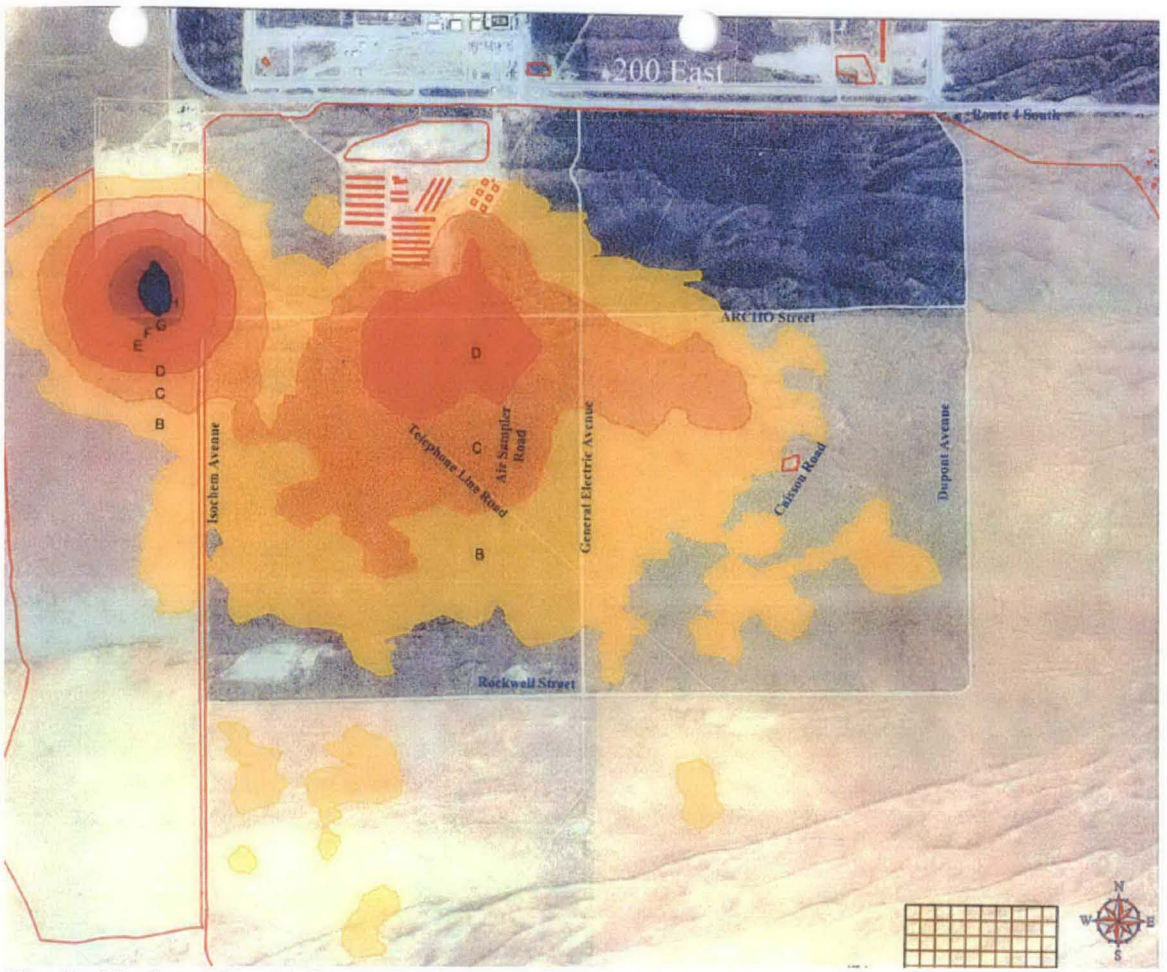

Fig. 2. Airplane Survey Data

Table 1. Instrument Detection Limits

Isotope	Pk Energy (keV)	Conversion Factor (unit/cps) at 50 ft	
		µCi/m2	pCi/g
Am-241	59.5	0.0794	1.16
Cs-137	661.6	0.0428	0.271
Co-60	1332.5	0.0149	0.072
Eu-152	121.8	0.129	1.52
I-131	364.5	0.0421	0.338
K-40	1460.8	0.531	2.41
Mn-54	834.8	0.0352	0.202

Table 1. Instrument Detection Limits

Isotope	Pk Energy	Conversion Factor (unit/cps) at 50 ft	
	(keV)	µCi/m2	pCi/g
Bi-214	1764.5	0.32	1.34
Pa-234m	1001	6.75	36
Pu-239	375.2	2270	18000
Tl-208	2614.5	0.101	0.354
U-235	185.7	0.0658	0.676

The lower altitude and increased point source sensitivity revealed a much larger and more complex deposition pattern than originally anticipated. The southern end of the area had been surveyed by ground survey teams that had not discovered any contamination. The 100-percent coverage of the helicopter survey showed that the terrain and physical obstructions prevented an effective ground survey of the area (Fig. 3).

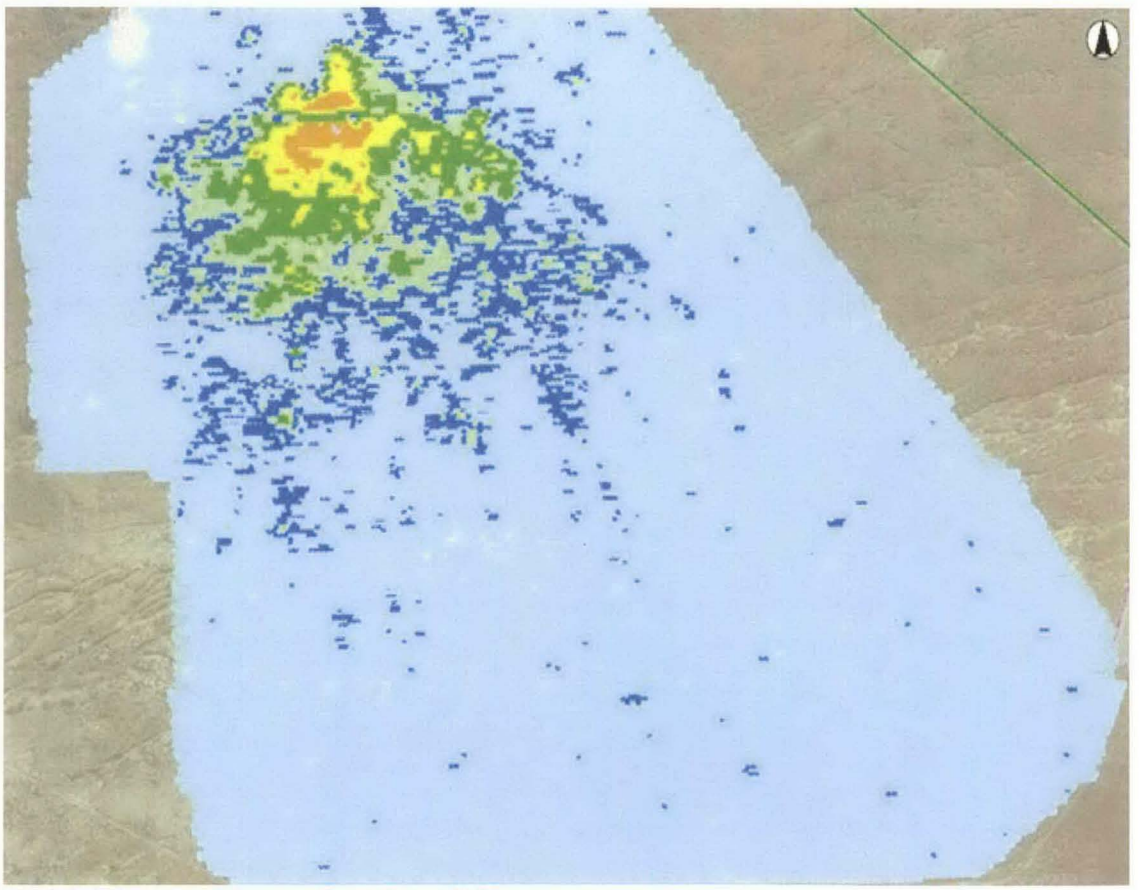

Fig. 3. Helicopter Flyover Survey at 50 Feet

INTEGRATION OF DATA

To effectively use the information for work planning and targeted remediation of areas, CHPRC collaborated with Lockheed Martin Services, Inc., to develop a web-based, geospatial data portal. The data portal allows use of the built-in tools such as Markup, Distance Measurements, Area Measurements, Layers, Imagery, Overlays, and Application Links. This web-based tool also displays latitudinal and longitudinal coordinates when the cursor is moved over a specific area. The data portal allows work planners to direct remediation teams to within one meter of an area requiring remediation. The data portal also provides valuable information about the magnitude of the contaminants in the area to allow for more effective safety analysis prior to starting work.

CONCLUSION

The use of the AMS Helicopter Emergency Response Acquisition System provides a cost-effective and efficient means of performing large-area radiological surveys. Surveys that provide 100-percent aerial coverage greatly enhance the ability to detect activity when physical or terrestrial obstructions exist. The use of the information in a format such as the web-based, geospatial data portal allows for easy viewing and adds additional features that enable work planning and safety analysis for the remediation project. These tools have proven invaluable to the successes in remediating the BC-Controlled Area.