ABANDONED URANIUM MINES PROJECT ATLAS

APPENDIX A.3

USDOE AERIAL MEASURING SYSTEM SUMMARY

Personnel and equipment provided by the U.S. Department of Energy (USDOE) Aerial Measuring System (AMS) were used in support of the U.S. Environmental Protection Agency (USEPA) Abandoned Uranium Mines Project. AMS equipment allowed USEPA to rapidly measure and map radiation sources over the large areas known or suspected to have had uranium mining activities. An Interagency Agreement between USDOE and USEPA was established and initial surveys were undertaken in 1994 in the Four Corners Area. Additional surveys were conducted in five other areas in 1997, 1998 and 1999. A total of 41 surveys covering 1,144 square miles were conducted within six areas shown on the Project Atlas maps. An overview map (Aerial Radiation Survey Area Map, page 1.13) provides a summary of the survey locations. The table presented on the following page provides a complete listing of the aerial surveys.

When the project began field operations in 1994 there were few records documenting the locations of the abandoned uranium mines. The locations of the mining areas or general districts of mining were known from old maps, publications, and oral history. The scientific and engineering resources of maps showing the locations of the old mines were on paper, in various scales and in a wide range of accuracy. Compiling the many paper records would have been an enormous undertaking, requiring considerable financial resources and many months, possibly even years of effort. Work efforts to compile these records are currently underway by several agencies. However, their work has not been published, nor was it available in the mid-1990s.

The benefits of using an aerial survey approach for this project were threefold:

1) To help focus the field investigations in areas of current rather than historic radiation; the Navajo Abandoned Mines Land Reclamation Program had already been working on the reclamation of old mines.

2) To locate and record the mining activities that were sources of radiation using a method that could be applied to large, regional areas, much faster than conventional scouting and measuring at ground level. Many of the survey areas involved rugged terrain and mining sites not readily accessible by roads.

3) To measure the levels of total radiation as well as the individual isotopes, such as Bismuth^{214} that could be extracted through data processing and used as an indicator of mining activity.

The radiation was measured with sensitive detectors mounted on a helicopter. The helicopter was initially flown along flight lines placed 250 feet apart, at a nominal altitude of 150 feet above ground level. At this altitude, the sensor footprint, or ground area being measured, was determined to be approximately 300 feet in diameter. After analysis of data collected using this protocol, the line spacing was increased to 300 feet to increase operational data collection efficiency. There was no apparent loss of data resolution due to this increase.

Radiation sensor measurements were integrated and recorded at one-second intervals. Each measurement provides an average radiation level for the entire ground sample area. This means the data does not pinpoint the radiation levels within the ground sample area, (i.e., the 300 feet diameter footprint under the helicopter). For each ground sample area, the radiation source could be evenly distributed or it could be made up of a combination of radiation sources, like a higher-level mine waste debris pile sitting on soil that had lower regional radiation levels. Obtaining finer detail measurements of an individual radiation source requires additional ground level measurements.

The aerial survey used real-time differential Global Position System (GPS) equipment for both navigation and establishing the precise location of aerial measurements. The GPS locations provide accurate records of where to go during field investigations to find and detail any aspect of the radiation sources measured by the helicopter borne equipment. Field investigations involving ground level measurements were necessary to determine the specific nature of the source of radiation, for example, whether a large mine, several small mines, or mine waste were involved.

The Project Atlas presents the radiation data in two forms: gross count and excess Bismuth^{214}. The gross count data is indicative of the total radiation in an area. The Bismuth^{214} radiation is indicative of the presence of uranium, making it a good indicator of old mines and mining related activities. The Bismuth^{214} response, rather than a uranium response, is used because its unique photopeak can be readily distinguished from other radiation sources.

The calculation of potential exposure to radiation is evaluated through knowing both the location of the radiation source and its specific proximity to people and the land use. The specific proximity to people and the land use had not been determined when the field activities ended as of January 31, 2000.

For the USDOE Survey Report, contact the USEPA Region 9 Records Center after January 2001.