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THE
REMOTE
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OF THE UNITED STATES
DEPARTMENT OF ENERGY

AN AERIAL RADIOLOGICAL SURVEY OF THE AREA SURROUNDING THE

UNC RECOVERY SYSTEMS FACILITY

WOOD RIVER JUNCTION, RHODE ISLAND DATE OF SURVEY: AUGUST 1979

DISCLAIMER

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This Document is UNCLASSIFIED

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Classification Officer

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ABSTRACT

An aerial radiological survey to measure terrestrial gamma radiation was carried out over the UNC Recovery Systems facility located near Wood River Junction, Rhode Island. At the time of the survey (August 1979) materials were being processed at the facility.

Gamma ray data were collected over a 3.28 km^2 area centered on the facility by flying north-south lines spaced 60 m apart. Processed data indicated that detected radioisotopes and their associated gamma ray exposure rates were consistent with those expected from normal background emitters, except directly over the UNC Facility.

Average exposure rates 1 m above the ground, as calculated from the aerial data, are presented in the form of an isopleth map. No ground sample data were taken at the time of the aerial survey.

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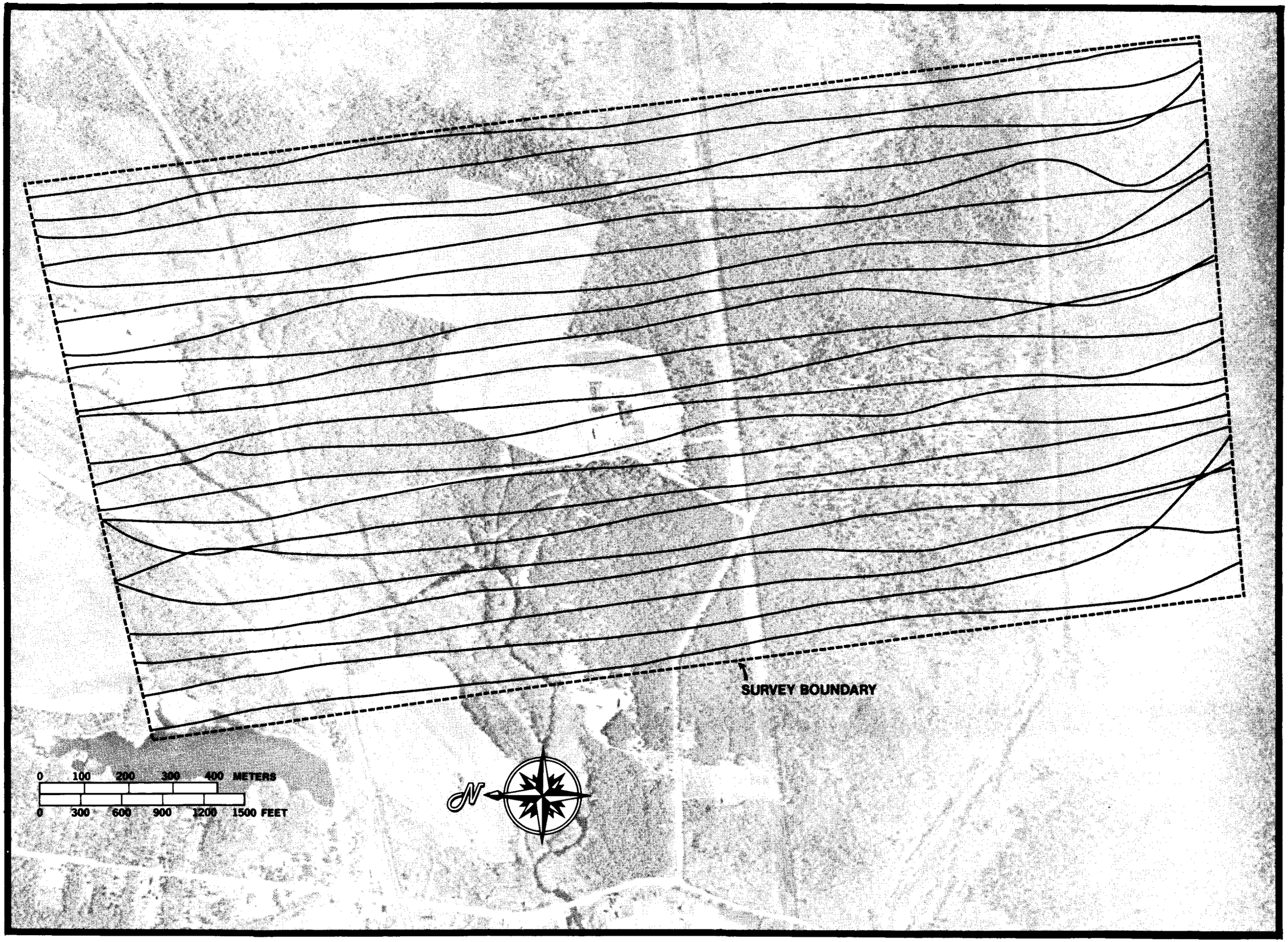


Figure 1. *FLIGHT LINES OVER THE UNC RECOVERY SYSTEMS FACILITY*

1.0 INTRODUCTION

The purpose of this aerial survey was to document, at a given point in time, the natural background radiation levels existing in the area and to aid local personnel in evaluating the magnitude and spatial extent of any radioactive contaminants existing in the environment. This survey was conducted by Aerial Measuring Systems (AMS).

AMS is maintained by the United States Department of Energy (DOE) and operated by EG&G. Begun in 1958, AMS is a continuing nationwide program involving surveys to monitor radiation levels in and around facilities producing, utilizing, or storing radioactive materials. AMS is deployed for various aerial survey operations at the request of DOE, other federal agencies (such as the United States Nuclear Regulatory Commission), and state agencies.

On 1 August 1979 this survey was conducted from a base of operations at Quonset Point Naval Air Station, Rhode Island. The facility surveyed was the UNC Recovery Systems facility.

At the time of the survey, the facility was receiving highly enriched uranium, which was processed to yield fuel for various uses in test reactor operations.

2.0 SURVEY AREA LOCATION

An area 3.28 km^2 was surveyed. This area was centered on the UNC Recovery Systems facility, located 1.2 km southeast of Wood River Junction and 1 km north of Indian Cedar Swamp.

3.0 SURVEY METHOD AND AIRBORNE EQUIPMENT

An enlarged aerial photograph of the site was used to lay out the survey flight lines. The survey pattern consisted of 21 parallel lines spaced at 60 m intervals, 2.6 km in length. The flight lines were oriented in a north-south direction (Figure 1). Flight altitude was 45 meters.

A BO-105 helicopter was utilized for the survey (Figure 2). The BO-105 carried a crew of two: pilot and navigator. It employed a lightweight version

Figure 2. *BO-105 HELICOPTER*
This aircraft contains the REDAR system.

of the Radiation and Environmental Data Acquisition and Recorder system (REDAR). Twenty NaI (Tl) detectors were contained in an aluminum box extended from the rear of the helicopter. Each detector was 12.7 cm in diameter and 5.1 cm thick. Gamma ray signals from the 20 detectors were summed and routed through an analog-to-digital converter into a pulse height analyzer. Gamma spectra were accumulated in 1 second intervals and recorded on 1/2 inch magnetic tape.

The helicopter position was established with two systems: a Trisponder/202A Microwave Ranging System (MRS) and an AL-101 radio altimeter. The Trisponder master station mounted in the helicopter interrogated two remote transceivers mounted on towers outside the survey area. By measuring the round trip propagation time between the master and remote stations the master computed the distance to each. These distances were recorded on magnetic tape each second. In subsequent computer processing they were converted to positon coordinates.

In like manner the radio altimeter measured the time lag for the return of a pulsed signal and converted this to aircraft altitude. For altitudes up to 150 m, the accuracy was ± 0.6 m or $\pm 2\%$, whichever was greater. These data were also recorded on magnetic tape so that any variations in gamma signal strength caused by altitude fluctuation could be compensated accurately.

The detectors and electronic systems which accumulate and record the data are described briefly here. They are described in more detail in a previous report.*

4.0 DATA PROCESSING

Data processing was done with the Radiation and Environmental Data Analyzer and Computer system (REDAC). This computer analysis laboratory was mounted in a mobile van for this survey (Figure 3). The van and aircraft were based at the Quonset Point Naval Air Station.

The REDAC consisted primarily of two Cipher Data tape drives, a Data General NOVA 840 computer, two Calcomp plotters, and a Tektronics CRT display screen. The computer had a 32 k-word core memory and an additional 1.2×10^6-word disc memory. An extensive collection of software routines was available for data processing.

The gross count data (integral counts between 50 keV and 3000 keV) were corrected for system dead time and altitude deviation. Corrections to the gross count rates were also made for contributions from airborne radon daughters, aircraft background, and cosmic rays. Flights over a lake near Wood River Junction were used to determine these contributions.

The corrected gross count rates were converted to exposure rates at 1 m altitude, using the factor 1100 counts per second (cps) per μR/h obtained from calibration data over a Nevada test range.

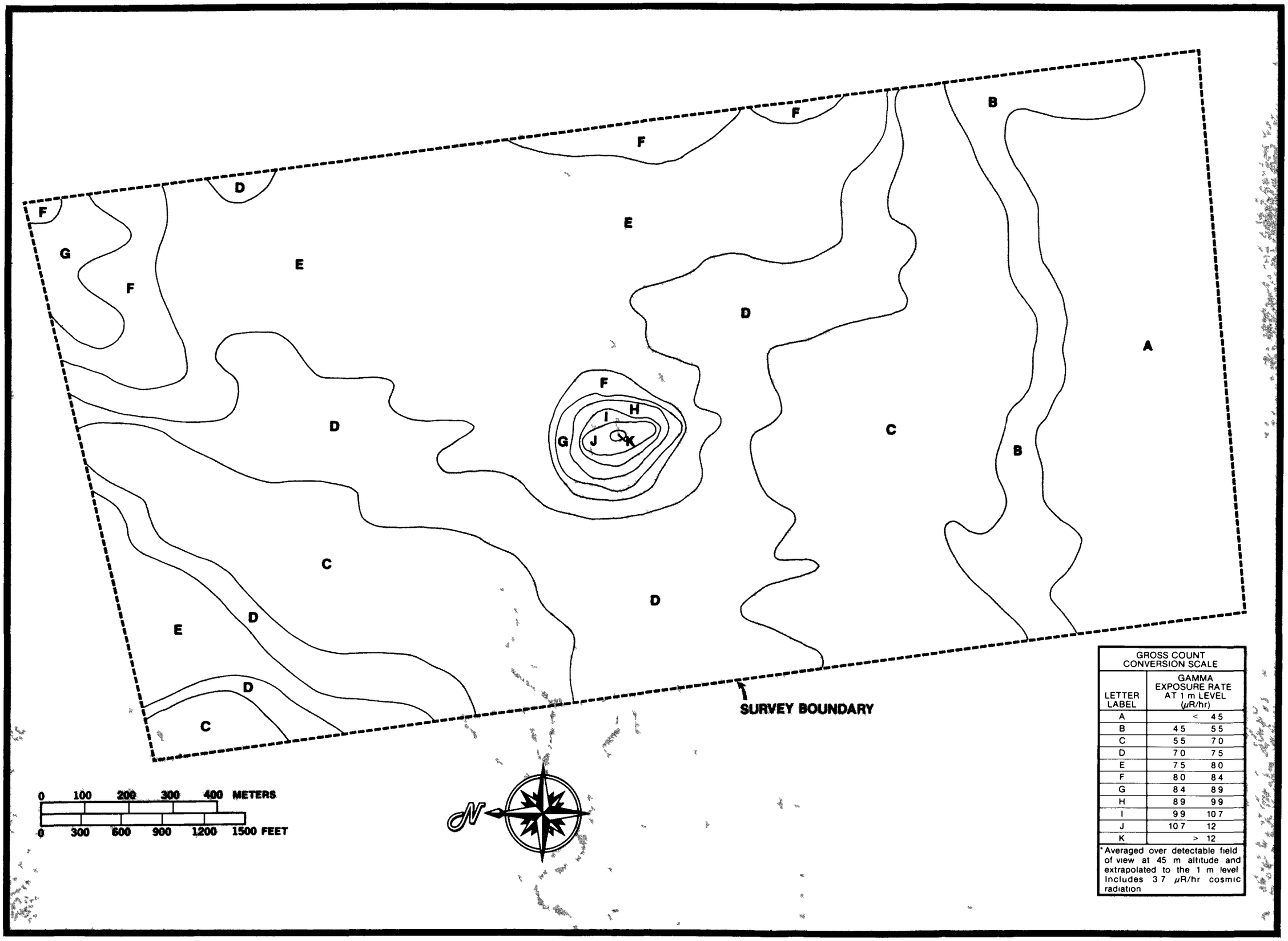
5.0 DISCUSSION AND RESULTS

Analysis of the radiological data taken over the area surrounding the UNC Recovery Systems facility indicated that the terrestrial radioisotopes and associated gamma ray exposure rates were consistent with the natural background normally found within areas having similar geological bases, except directly over the UNC Facility.

Figure 4 presents exposure rate isopleths superimposed on an aerial photograph of the site. The background in the area is in the range of 5-8 μR/h (including cosmic ray contributions).

* Boyns, P.K. July 1976. *The Aerial Radiological Measuring System (ARMS): Systems, Procedures, and Sensitivity (1976).* Report No. EGG-1183-1691. Las Vegas, NV: EG&G.

Figure 3. *MOBILE COMPUTER PROCESSING LABORATORY*



GROSS COUNT CONVERSION SCALE

LETTER LABEL	GAMMA EXPOSURE RATE AT 1 m LEVEL (μR/hr)
A	< 45
B	45 55
C	55 70
D	70 75
E	75 80
F	80 84
G	84 89
H	89 99
I	99 107
J	107 12
K	> 12

*Averaged over detectable field of view at 45 m altitude and extrapolated to the 1 m level Includes 3 7 μR/hr cosmic radiation

Figure 4 *GROSS COUNT EXPOSURE RATE ISOPLETH MAP*

Aerial radiological detection systems average the radiation levels due to gamma-emitting radionuclides existing over an area of several acres. The systems are capable of detecting anomalous gamma count rates and determining the specific radionuclides causing the anomalies; however, because of averaging, they tend to underestimate the magnitude of localized sources as compared with ground-based readings. Therefore, the ground level radiation levels in the vicinity of the UNC facility are likely to be higher than the 12μR/h as given in Figure 4.

Figure 5 presents the energy spectrum of the high radiation level observed over the UNC site due to contributions from enriched uranium.

Figure 6 shows a spectrum over the northeast corner of the site due to a slight increase in naturally occurring radioisotopes.

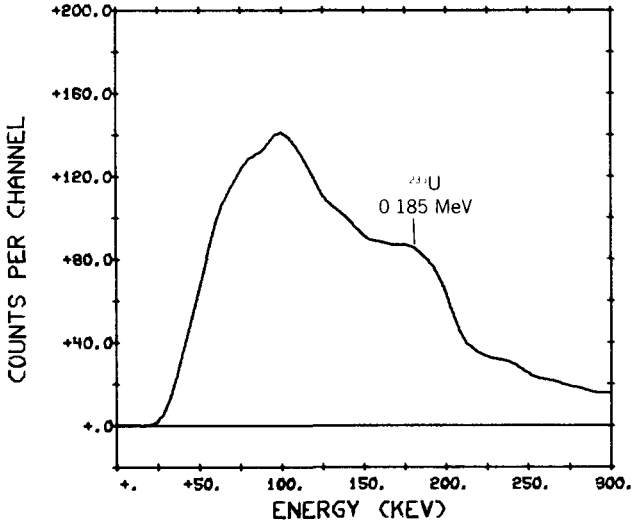


Figure 5. *GAMMA PHOTON ENERGY SPECTRUM OBSERVED OVER THE UNC SITE IDENTIFYING THE 185 keV PEAKS OF URANIUM-235*

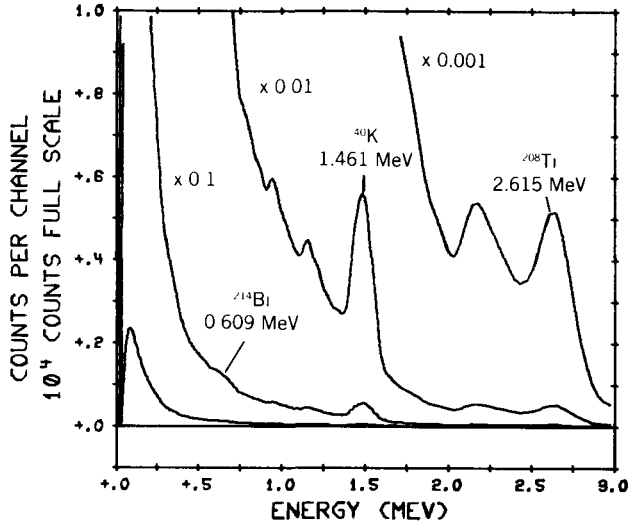


Figure 6. *GAMMA PHOTON ENERGY SPECTRUM OBSERVED OVER THE NORTHEAST CORNER OF THE SURVEY AREA*