National Uranium Resource Evaluation

AERIAL GAMMA RAY AND MAGNETIC SURVEY
HUNTINGTON QUADRANGLE
OHIO , WEST VIRGINIA AND KENTUCKY

FINAL REPORT

EG&G GEOMETRICS
Sunnyvale, California 94086

April 1981

PREPARED FOR U.S. DEPARTMENT OF ENERGY

Grand Junction Office, Colorado

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Under Contract No. DE-AC13-76GJ01664
and Bendix Field Engineering Corporation
Subcontract No. 80-479-L

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ABSTRACT

The Huntington quadrangle of Kentucky, Ohio, and West Virginia covers 7,250 square miles of the easternmost Midwestern Physiographic Province. Paleozoic exposures dominate the surface. These Paleozoics deepen toward the east from approximately 500 feet to a maximum depth of 8,000 feet. Precambrian basement is thought to underlie the entire area.

No known uranium deposits exist in the area.

One Hundred anomalies were found using the standard statistical analysis. Some high uranium concentration anomalies that may overlie the stratigraphic equivalent of the Devonian-Mississippian New Albany or Chattanooga Shales may represent significant levels of naturally-occurring uranium. Future studies should concentrate on this unit.

Magnetic data are largely in concurrence with existing structural interpretations but suggest some complexities in the underlying Precambrian.

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INTRODUCTION

General

The Huntington quadrangle covers 7,250 square miles of northeastern Kentucky, southern Ohio, and western West Virginia (See Figure 1).

The geologic map used in the interpretation was compiled in 1981 by Fremont Geologic Consultants at 1:250,000 scale. The scales of the maps used in the compilation are not listed in the Fremont map legend. Geologic map unit descriptions (Appendix C) were taken directly from the Fremont map legend. Supplementary geologic information was taken from Fairbridge (1972) and Cohee and others (1962). Cultural and physiographic information was taken from the 1:250,000 scale Huntington topographic map (1977 version).

Radiometric and magnetic data were acquired in December of 1980, and processed in February and March of 1981 (see Flight Summary in Appendix B). Appendix A contains a summary of data acquisition, processing, interpretation, and presentation methods.

Physiography

The Huntington quadrangle lies along the border between the Midwestern and Intermountain Plateau Physiographic Provinces. The region is largely covered by dissected plateau, though some small areas of more regular topography occur near the western edge. The region is largely rural, and most cultural activity is located along the Ohio River system.

The region is drained by the Ohio River (which meanders westward through the center of the quadrangle), and its tributaries. All the major rivers appear antecedent to the topography. The most obvious characteristic of these rivers is their entrenched meanders.

Elevations range from just below 500 feet at the base level of the Ohio River, to over 1,300 feet in several areas of the mountainous region.

The region is moderately developed culturally. The largest cities in the area are Huntington (69,000), and Ashland (pop. 20,100). These and all other large concentrations of population are along the Ohio River. The population centers are served by a few U.S. and interstate free-ways, but contains a very sparse network of smaller roads and railroads.

Drilling for oil and gas is common in the southern central region of the quadrangle. Coal mining is even more extensive, occurring throughout the central and eastern portions of the quadrangle, and in some cases, significantly altering the landscape.

GEOLOGY

Structure

Paleozoic cover deepens to the east from approximately 500 feet along the western edge (near the axis of the Cincinnati Arch). Sediments approach 8,000 feet in thickness along the eastern edge (Figure 2), and continue to deepen eastward into the Appalachian Basin.

Folding is common in the thicker (more easterly) sedimentary sequences. Axes of these anticlines and synclines strike northeasterly. Dip-slip faults of the Kentucky River Fault Zone displace rocks as young as Pennsylvanian along the southern edge of the quadrangle.

Surface Geology

As mapped by Fremont Geologic Consultants, the surface of the Huntington quadrangle is dominated by Paleozoic rocks. Quaternary deposits cover 10 percent of the quadrangle and consists of Recent alluvium in the major river flood plains, Illinoian till in the northwest, and small deposits of Wisconsinan outwash and lacustrine sediments.

In the Paleozoic section, Pennsylvanian rocks predominate, and account for 47 percent of the entire quadrangle. Formations of this age consist primarily of sandstone and shale, with some limestones, conglomerates, and significant seams of coal. These rocks cover almost the entire eastern half of the quadrangle, and represent a wide variety of marine, intermediate, and non-marine depositional environments.

Permian rocks cap some mountains in the extreme eastern area of the quadrangle. These rocks also contain sandstone, shale, limestone, and coal, and may be in part Pennsylvanian (see map legend - Appendix C). These rocks account for approximately 1 percent of the total surface area.

Mississippian age materials cover 25 percent of the quadrangle in a 20 mile wide belt striking southward through its western central portion. These rocks consist of shales, limestones, and sandstones. Silurian and Devonian rocks (covering 3 and 2 percent of the quadrangle respectively) largely duplicate this lithology, and border the Mississippian section on the west. Carbonaceous shale mapped in the Devonian may be the stratigraphic equivalent of the Chattanooga or New Albany Shales, which contain low grade uranium concentrations (Schnabel, 1955, and Butler and others, 1962). These rocks may be in part, of Mississippian age.

Ordovician rocks crop out along the western edge of the quadrangle. The formations of this age consist primarily of limestone, with some calcareous shale, dolomitic limestone, chert, sandstone, and metabentonite.

Uranium

No specific regions of uranium mineralization are known in the Huntington quadrangle. The carbonaceous shale of Devonian (?) age could be considered a uranium source material, but no specific localities of significant uranium concentrations are known in this unit.

INTERPRETATION OF GEOPHYSICAL DATA

Radiometric Data

A total of 100 groups of uranium (Bi214) samples meet the minimum statistical requirements set forth in the data interpretation section of Appendix A. These are displayed, along with all other anomalous samples and pertinent data, on Figure 3. The anomalies are summarized in a table in Appendix G. The potassium, uranium, thorium, and ratio pseudo-contour maps, which reflect radiometric responses for each quadrangle, are found in Appendix H. Discussion of the abundances of potassium, uranium, and thorium are in terms of apparent equivalent percent and apparent equivalent ppm. These equivalent units are derived from scaling of counts per second by the sensitivities calculated for the detection system and as such cannot be taken as directly determined geochemical values.

Apparent concentrations of potassium, uranium, and thorium, are low, though they are higher than areas to the north and west that have been surveyed previously. Uranium has a quadrangle-wide average concentration of 2.7 ppmeU. Potassium and thorium average 1.0 percent and 7.0 ppmeT respectively.

Thorium appears to vary in concentration somewhat randomly. No particular region of the quadrangle stands out as being particularly high or low in levels of thorium. Highest average thorium occurs in map unit PM (Pennsylvanian Monogahela Group) at 8.11 ppmeT. Map unit PC (Pennsylvanian Conemaugh Formation) has the highest peak thorium concentration at 11.45 ppmeT.

Potassium is clearly higher along the western edge. The rest of the quadrangle shows potassium levels near 0.9 percent. The potassium levels along the western edge, in apparent association with Ordovician rocks, reach concentrations of 1.25 to 2.00 percent. Highest average potassium is found in map unit OC (Ordovician Cynthiana Formation) at 1.61 percent. The highest peak potassium concentration (2.28 percent) occurs in map unit OE (Ordovician Eden Group).

Uranium is highest in a nearby north-south belt striking through the central western half of the quadrangle. Concentrations of uranium increase from a nearly uniform quadrangle-wide average of 2.25 ppmeU to

levels of 4.00 ppmeU or more within the belt. This high uranium belt appears to overlie the boundary between the Mississippian and Devonian units. Map unit DU (Devonian undifferentiated) has the highest average and peak uranium concentrations at 4.07 and 10.91 ppmeU respectively. The lithology of the Devonian here is described as primarily carbonaceous shale, which may be the stratigraphic equivalent of the New Albany or Chattanooga Shales. Both of these shales are known to contain high concentrations of uranium.

Examination of the gamma ray profiles (Appendix D) shows several lines that have significantly higher uranium and BiAir concentrations. These peculiar radiometric signatures have been encountered in previous surveys nearby, and seem to indicate some weather phenomenon that the present radon correction scheme (based upon the assumption of uniform, homogenous radon distribution) has some difficulty in correcting for. Assuming that the absolute ground uranium concentrations in these areas are actually similar to those of adjacent and crossing lines, an adjustment of the uranium and affected ratios was made. Statistical analysis were done using the corrected values.

Anomalies are scattered throughout the quadrangle. Most have peak concentrations of 3.5 to 4.5 ppmeU, and all are related to some cultural activity (roads, railroads, quarries, etc.). One well-defined group overlies the high-uranium region (anomalies 3, 6, 7, 11, 12, 18-21, 27, 28, 35, 46, 47, 58, 59, 60, 62-68, and 70-72) and has peak concentrations in the 4.4 to 10.8 ppmeU range. The high uranium anomalies primarily overlie map units DU and MU (Undivided Mississippian). Whatever the actual name of the geologic units involved and despite the cultural origins of the specific anomalies, the high uranium levels coupled with the geographic coherence of the anomaly group implies high uranium concentrations throughout the unit. Future studies of uranium resources should concentrate on this region and on the geologic units involved.

Magnetic Data

The structural picture of the region is one of a gradually deepening sedimentary basin toward the east. The picture is roughly reflected by the magnetic field (see Appendix H). Gradients become generally lower toward the east. However, the structure implied by the magnetics appears to be complicated by several isolated structures and short linear features that do not correspond to known structure in the Paleozoic. These structures may in fact represent lithologic and/or structural complexities in the Precambrian. The faults of the Kentucky River Fault Zone have no clear expression on the magnetic pseudo contour map.

Figure 3 - Uranium Anomaly/Interpretation Map - Huntington Quadrangle

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**APPENDIX A - Data Acquisition, Processing, and
Interpretation Methods**

INTRODUCTION

General

Under the U.S. Department of Energy's (DoE), National Uranium Resource Evaluation (NURE) Program, geoMetrics, Inc., conducted a high sensitivity airborne radiometric and magnetic survey. The data collection and processing were conducted under requirements set forth in Bendix Field Engineering Corporation specification 1200-C, dated February, 1979. The objectives of the (DoE)/NURE program, of which this project is a small part, may be summarized as follows:

"To develop and compile geologic and other information with which to assess the magnitude and distribution of uranium resources and to determine areas favorable for the occurrence of uranium in the United States." (DoE)

As an integral part of the DoE/NURE Program, the National Airborne Radiometric Program is designed to provide cost effective, semiquantitative reconnaissance radio element distribution information to aid in the assessment of regional distribution of uraniferous materials within the United States.

All Airborne data collected by geoMetrics during the course of this project were done so utilizing a Beechcraft B65 Queen Air Airplane (U.S. Registry No. N9AG) and a Rockwell Aero Commander (Registry No. N1213B). Both aircraft used 3584 cubic inches of NaI crystal and a high sensitivity proton magnetometer (0.25 gamma).

Each report contains a detailed geologic summary, interpretation report, reduced scale copies of all maps and profiles, histograms, and statistical tables for each quadrangle contained within the project. In addition, each report contains an appendix detailing the survey description, specifications, data collection and processing methods, and interpretation methods.

All data processing, statistical analyses, and interpretation were performed at the geoMetrics computer facility, Sunnyvale, California. After processing, the corrected data were statistically evaluated to define those areas which were radiometrically anomalous relative to other areas within each computer map unit. Standard deviation maps and radiometric and magnetic profile data were first evaluated individually and then integrated into a final interpretation map for each NTMS quadrangle.

Corrected profiles of all radiometric variables (total count, potassium, uranium, thorium, uranium/thorium, uranium/potassium, and thorium

/potassium, ratios), magnetic data, radar altimeter data, barometric altimeter data, air temperature, and airborne bismuth contributions are presented as profiles in this report. Single record and averaged data are presented on microfiche in report. These data are given at 1.0 second sample intervals, corrected for Compton Scatter, referenced to 400 foot mean terrain clearance as Standard Temperature and Pressure and corrected for atmospheric bismuth. Digital magnetic tapes are available containing raw spectral data, single record data, magnetic data, and statistical analysis results.

OPERATIONS

PRODUCTION SUMMARY

The production summary presented below describes the general procedures involved in gathering data for the entire project. The detailed daily production summary in Appendix B describes a portion of the total project.

Prior to the start of the survey operations, the airplanes were calibrated at the DoE test pads and Dynamic Test Range (the Queen Air in April 1980, and the Aero Commander in October 1980). Requirements for system calibrations are listed in the 1250-A specifications from BFEC.

Throughout the course of the overall project, the average ground speed maintained by the Queen Air was 140 mph. The Aero Commander averaged 150 mph.

Nearly 100% of the data collected were within the specification limits of 200-700 feet. Several deviations over short distances were required to meet military regulations, FAA safety requirements, and to ensure that livestock were not endangered due to low flying aircraft. A sample altitude statistical distribution is shown in Figure I.

DATA COLLECTION PROCEDURES

Operating Parameters/Sampling Procedures

This survey was conducted using data collection parameters summarized below:

1. Data sampling was performed by a time-base system using 1.0 second sample intervals. All sensor data with analog output were digitally sampled at each scan based upon the clock timing rate of 1.0 seconds. The data so collected are the instantaneous values of the altimeter, temperature, pressure, and magnetometer parameters determined at the time of the data scan, but represent a count time of 1.0 seconds for the gamma ray spectrometer data.
2. The airplanes' objective ground speeds, mentioned previously, were not exceeded unless dictated by safety.
3. The airplane's downward looking crystal volume was 3,072 cubic inches providing an objective V/V (crystal volume in cubic inches divided by ground speed in miles per hour) of 22.0 at 140 m.p.h.
4. The upward looking crystal volume was 512 cubic inches.

NUMBER OF OCCURRENCES

Navigation/Flight Path Recovery

For all of the quadrangles, profiles were flown east-west at 6 mile (9.6 km) spacing. North-south tie lines were flown at 18 mile (28.8 km) spacing.

Navigation was accomplished using visual navigation techniques. Flight lines were drawn on 1:250,000 quadrangles and the pilot/navigator utilized these maps to provide visual navigation features.

Simultaneously, a 35 mm tracking camera was used to record actual flight position. This camera's fiducial numbering system was directly synchronized to the digital recording system such that a one-to-one correlation between position and data could be made. Upon completion of a data collection flight, the 35 mm film was processed and actual flight path positions located on the appropriate scale map sheets.

Infield System Calibration

Due to the complex nature of both the system and the required data interpretation, much emphasis was placed on infield calibration of the data collection system. The objective of this calibration was to ensure continuous high quality of the data collected. The daily calibration procedures used are summarized below:

A. Pre Flight

1. Use cesium sources (same positioning on crystals every day), peak each Photomultiplier tube/crystal using the digital split-window detector of the GR-800. Then using thallium sources, repeat the tuning of the individual crystals.
2. Run full cesium spectrum on analog recorder for both down and up looking crystals. Calculate the cesium resolution (see sample in Figure II). Run spectrum out past the K40 peak on down crystals for evaluation of system tuning.
3. Finally run a full thorium analog spectrum of the down crystals and check for centering of K40 and Tl208 peaks in spectrum.
4. Repeat 1-3 until system is within contract specifications.

B. During Flight

1. Fly test line at survey altitude (400 ft), for approximately five miles, prior to production data collection (record both analog and digital).
2. Prior to production data collection, the above data are evaluated to ensure +20% limits on total count compared to average of all test flights from that base of operations.

FIGURE II
GR-800D ANALOG SPECTRUM PLOT
DET-1024 Crystal Detector (1,024 in³)
137Cs Source 11.81 Kev/Ch
20K c.p.s. Full Scale
Resolution Calculation
 $\% = \frac{100 \times \text{FWHM} \times \text{Kev/Ch}}{662 \text{ Kev}}$
 $\% = \frac{100 \times 4.79 \times 11.81}{662} = 8.5\%$

DATA COLLECTION SYSTEM

AIRCRAFT

Two aircraft were used for this survey: (1) a Beechcraft Queen Air - Model 65 (U.S. Reg. No. N9AG), and (2) a Rockwell Aero Commander 680F (U.S. Reg. No. N1213B). Both these aircraft, being medium size with twin engines, possess overall performance and safety features which make them ideal for low level, fixed-wing airborne geophysical surveys in areas of up to moderately high topographic relief. They can carry adequate payloads at low constant airspeeds, while maintaining economy and a wide envelope of safety. Performance data for the two craft in their present survey configuration are given below.

	<u>QUEEN AIR</u>	<u>AERO COMMANDER</u>
Maximum Aircraft Gross Weight	7,700 lbs.	8,500 lbs.
Aircraft Empty (dry)	4,640 lbs.	5,200 lbs.
Max. useful load including fuel	3,060 lbs.	3,300 lbs.
Geophysical Package	1,110 lbs.	1,110 lbs.
Navigation Equipment	125 lbs.	125 lbs.
Fuel Tanks Full	1,380 lbs.	1,338 lbs.
Pilot & Electronics Operator	350 lbs.	350 lbs.
Total	2,965 lbs.	2,923 lbs.
Min. Control Speed at G.W. (IAS)	95 mph	NG
Safe Single Eng. Speed @ G.W. (IAS)	105 mph	NG
Rate of Climb 2 engines @ gross (FPM)	1,300	1,500
Rate of climb 1 engine @ gross (FPM)	210	250
Avgas consumption (ga/hr) at 75% power	36	38
Endurance (75% power)	6 hrs/6 mins.	5 hrs/30 mins.
Range (75% power - 45 min. reserve)	1,200 miles	1,100 miles

Cruise Configuration stalling speed at gross weight (IAS)

0° bank	80 mph	80 mph
45° bank	95 mph	NG

- During production data collection, monitor radon analog data for unusual increases. Visually correlate these with temperature and barometric pressure.
- Upon completion of production data collection, re-fly test line at survey altitude (400 ft). Record both analog and digital.

C. Post Flight

- Verify test line total count within 20% of average for all test lines at that base of operations.
- Using cesium sources (same position as pre-flight), run full cesium spectrum for both down and up crystals (allow it to record through the K40 peak in the down crystals). Repeat the procedure using thallium sources and examine the Tl208 window.
- Calculate the resolution of down and up crystal pack.
- Determine shift, if any, in Tl208 peak position.

Field Digital Data Verification

At the completion of each flight, the raw digital data tapes were checked for data quality and completeness on geoMetrics' G-725. The G-725 system is a totally portable mini computer (and peripherals) consisting of; an Interdata 516, two 9 track tape drives, a CRT, a line printer, and two floppy discs. Any digital problems encountered were immediately evaluated by the electronics operator and data man, thus assuring optimum data quality. In addition, histogram information for each measured variable was generated. Thus a summary display of altitude, etc., is available for immediate evaluation.

Electronics

The major components of the airborne data collection system are summarized below (shown schematically in Figure III):

1. Gamma Ray Spectrometer, geoMetrics GR-800, utilizing a dual 256 channel capability to provide spectral data in the 0.4 to 3.0 MeV range for both the downward looking and the upward looking crystal packages and coverage in the 3.0 to 6.0 MeV range for cosmic background.
2. Crystal Detector, geoMetrics Model DET-3072/512R consisting of 3072 cubic inches in the downward looking configuration and 512 cubic inches appropriately shielded in an upward looking configuration.
3. A geoMetrics Digital Data Acquisition System, Model G-714 with "read-after-write" data verification, recording the following on magnetic tape:
 - a. 512 channels of gamma ray spectrometer data
 - b. Total magnetic intensity
 - c. Fiducial number from data system/camera
 - d. Manually inserted information, i.e. date, survey area, and flight line number
 - e. Altitude from radar altimeter and barometric altimeter (by analog-to-digital conversion)
 - f. Time in days, hours, minutes and seconds
 - g. Outside air temperature
4. Magnetometer, geoMetrics Airborne Model G-803, capable of 0.125 gamma sensitivity, but operated at 0.25 gamma sensitivity.
5. Radar Altimeter, Bonzer Model Mark 10 with recording output and display operating over an altitude range of 0 to 2,500 feet.
6. Rosemont Barometric Altimeter with recording output and display.
7. Recording Thermometer for monitoring outside air temperature.
8. Tracking Camera. Automax 35 mm framing camera with wide angle lens and 10 character fiducial/line number display to provide flight path recovery data.

FIGURE III

SYSTEM CALIBRATION

9. Analog Recorder geoMetrics (MARS 6) to record the following data:

- a. Bi214 using a window about the 1.76 MeV peak from the downward looking system.
- b. Bi air background from the upward looking system.
- c. Magnetometer
- d. Radar Altitude
- e. Total count for downward looking system (0.4 to 3.0 MeV)
- f. Barometric Altitude
- g. Time markers

10. HP 7155 single channel analog recorder during pre and post flight calibrations, this recorder is used to plot a full analog spectra for both the down and up crystal systems via the GR-800. Thus, a hard copy record of the data used for resolution, drift, etc., checks are available at all times. This approach provides instant verification of system parameters (refer to Figure II).

AIRCRAFT AND COSMIC BACKGROUND

Full spectral data are collected at five (5) altitudes over water (14,000 feet, 12,000 feet; 10,000 feet; 8,000 feet and 6,000 feet) in an area where the existence of no airborne Bi214 can be assured (off shore over the Pacific Ocean). This results in separate spectra as shown schematically in Figure 10. We define $S(12,000)$ to be the spectra at 12,000 feet from 0.4 MeV to 3.0 MeV with $S(8,000)$ the same spectra at a lower altitude (8,000) and $C_i(h)$ the total count between 3.0 and 6.0 MeV at respective altitudes. Since the aircraft background is constant, the difference between any two altitudes separated sufficiently - typically, 2,000 feet - yields the cosmic spectral curve shape as shown schematically in Figure VI. Thus

$$S(12,000) - S(8,000) = \Delta S$$

and

$$\sum C_{12}(h_i) - \sum C_8(h_i) = \Delta C$$

This cosmic spectral curve is scaled back to 12,000 feet as follows:

$$\frac{C_{12}(h_i)}{\Delta C} \times \Delta S = \Delta C(12,000) \text{ the Cosmic Spectrum (shape and magnitude at 12,000 feet)}$$

The aircraft background is derived as follows:

$$S(12,000) - C(12,000) = \text{A/C Background}$$

Since data were collected at five altitudes, this procedure was repeated for each combination of altitudes and results averaged. Typical aircraft and cosmic spectra are shown in Figures V, AND VI respectively.

SYSTEM CONSTANTS

System constants were determined by occupation of the DoE Walker Field Test Pads. (See Ward, 1978, and Stromswold, 1978, for complete descriptions of the building and monitoring of the pads). The five test pads contained varying concentrations of K, U, and T as presented by BFEC:

FIGURE IV - Multiple altitude spectra schematic.

PAD	K	U	T
Matrix	1.45%	2.19 ppm	6.26 ppm
K	5.14%	5.09 ppm	8.48 ppm
U	2.03%	30.29 ppm	9.19 ppm
T	2.01%	5.14 ppm	45.33 ppm
Mixed	4.11%	20.39 ppm	17.52 ppm

Since the measurements were taken over a relatively short time period (a few hours), it was assumed that the matrix pad measurements contain not only the effects of the matrix pad itself, but also aircraft background (which is a constant), cosmic background (constant over the time period of interest), and all other local background (e.g. BiAir, etc.) effects. (The matrix pad is constructed with only the basic concrete mix without the additional elemental minerals). Thus, by subtracting the matrix pad count rates from the count rates in the four pads, we have eliminated aircraft and cosmic background and BiAir effects for the four pads. The pad concentrations are then modified in a similar fashion by the subtraction of the matrix pad concentrations. The differential concentrations in the pads are given in the table below.

PAD	K	U	T
K-Matrix	3.7%	2.9 ppm	2.2 ppm
U-Matrix	0.6%	28.5 ppm	2.9 ppm
T-Matrix	0.6%	3.0 ppm	39.0 ppm
Mixed-Matrix	2.7%	18.8 ppm	11.3 ppm

Considering the above, we can define a functional relationship between the differential concentrations and the residual count rates which will provide a method of determining the calibration constants for the spectrometer system. These calibration constants are the six (6) stripping coefficients which account for the interactions occurring between the elemental channels in the system (Compton scatter coefficients, etc.).

On the basis of an ideal situation, one would anticipate that some of these interactions should be negligible. This is not totally the case, since we are dealing with a system which has less than infinite resolving power (i.e. the energies are smeared to some extent).

DERIVED AIRCRAFT BACKGROUND SPECTRUM FROM PACIFIC OCEAN DATA
DOWNWARD-LOOKING CRYSTAL SPECTRUM FOR LINE AC BGD, DATED 078577
TC (0-0 MEV) 184.07 TC (0.4-3.0 MEV) 141.17 COSMIC (3-6 MEV) 0.00
U (1.12 MEV) 9.91 K (1.46 MEV) 14.54 U (1.76 MEV) 4.36 T (2.62 MEV) 4.20

CH 0 (0.000 MEV)	0.000 CPS	1
CH 1 (0.012 MEV)	0.000 CPS	1
CH 2 (0.024 MEV)	0.000 CPS	1
CH 3 (0.035 MEV)	0.000 CPS	1
CH 4 (0.047 MEV)	0.000 CPS	1
CH 5 (0.059 MEV)	0.000 CPS	1
CH 6 (0.071 MEV)	0.000 CPS	1
CH 7 (0.083 MEV)	0.000 CPS	1
CH 8 (0.095 MEV)	0.000 CPS	1
CH 9 (0.106 MEV)	0.000 CPS	1
CH 10 (0.118 MEV)	0.000 CPS	1
CH 11 (0.130 MEV)	0.000 CPS	1
CH 12 (0.142 MEV)	0.000 CPS	1
CH 13 (0.154 MEV)	0.000 CPS	1
CH 14 (0.165 MEV)	0.000 CPS	1
CH 15 (0.177 MEV)	0.000 CPS	1
CH 16 (0.189 MEV)	0.000 CPS	1
CH 17 (0.201 MEV)	0.000 CPS	1
CH 18 (0.213 MEV)	-0.025 CPS	1
CH 19 (0.225 MEV)	-0.050 CPS	1
CH 20 (0.236 MEV)	0.000 CPS	1
CH 21 (0.248 MEV)	1.401 CPS	1
CH 22 (0.260 MEV)	3.790 CPS	1
CH 23 (0.272 MEV)	4.580 CPS	1
CH 24 (0.284 MEV)	4.324 CPS	1
CH 25 (0.295 MEV)	3.748 CPS	1
CH 26 (0.307 MEV)	3.897 CPS	1
CH 27 (0.319 MEV)	3.819 CPS	1
CH 28 (0.331 MEV)	4.236 CPS	1
CH 29 (0.343 MEV)	3.433 CPS	1
CH 30 (0.355 MEV)	3.996 CPS	1
CH 31 (0.366 MEV)	2.559 CPS	1
CH 32 (0.378 MEV)	2.268 CPS	1
CH 33 (0.388 MEV)	1.085 CPS	1
CH 34 (0.402 MEV)	2.081 CPS	1
CH 35 (0.414 MEV)	2.121 CPS	1
CH 36 (0.426 MEV)	1.144 CPS	1
CH 37 (0.437 MEV)	1.976 CPS	1
CH 38 (0.449 MEV)	2.890 CPS	1
CH 39 (0.461 MEV)	2.188 CPS	1
CH 40 (0.473 MEV)	2.226 CPS	1
CH 41 (0.485 MEV)	1.983 CPS	1
CH 42 (0.496 MEV)	2.165 CPS	1
CH 43 (0.508 MEV)	2.158 CPS	1
CH 44 (0.520 MEV)	2.267 CPS	1
CH 45 (0.532 MEV)	2.217 CPS	1
CH 46 (0.544 MEV)	1.997 CPS	1
CH 47 (0.556 MEV)	2.447 CPS	1
CH 48 (0.567 MEV)	2.540 CPS	1
CH 49 (0.579 MEV)	2.586 CPS	1
CH 50 (0.591 MEV)	2.708 CPS	1
CH 51 (0.603 MEV)	2.481 CPS	1
CH 52 (0.615 MEV)	2.372 CPS	1
CH 53 (0.626 MEV)	1.866 CPS	1
CH 54 (0.638 MEV)	1.682 CPS	1
CH 55 (0.650 MEV)	1.661 CPS	1
CH 56 (0.662 MEV)	1.480 CPS	1
CH 57 (0.674 MEV)	1.474 CPS	1
CH 58 (0.686 MEV)	1.447 CPS	1
CH 59 (0.697 MEV)	1.431 CPS	1
CH 60 (0.709 MEV)	1.476 CPS	1
CH 61 (0.721 MEV)	1.453 CPS	1
CH 62 (0.733 MEV)	1.467 CPS	1
CH 63 (0.745 MEV)	1.579 CPS	1
CH 64 (0.756 MEV)	1.497 CPS	1
CH 65 (0.768 MEV)	1.548 CPS	1
CH 66 (0.780 MEV)	1.421 CPS	1
CH 67 (0.792 MEV)	1.226 CPS	1
CH 68 (0.804 MEV)	1.155 CPS	1
CH 69 (0.816 MEV)	1.246 CPS	1
CH 70 (0.827 MEV)	1.245 CPS	1
CH 71 (0.839 MEV)	1.161 CPS	1
CH 72 (0.851 MEV)	1.253 CPS	1
CH 73 (0.863 MEV)	1.231 CPS	1
CH 74 (0.875 MEV)	1.425 CPS	1
CH 75 (0.887 MEV)	1.452 CPS	1
CH 76 (0.898 MEV)	1.543 CPS	1
CH 77 (0.910 MEV)	1.444 CPS	1
CH 78 (0.922 MEV)	1.364 CPS	1
CH 79 (0.934 MEV)	1.289 CPS	1
CH 80 (0.946 MEV)	1.150 CPS	1
CH 81 (0.957 MEV)	1.144 CPS	1
CH 82 (0.969 MEV)	1.005 CPS	1
CH 83 (0.981 MEV)	1.061 CPS	1
CH 84 (0.993 MEV)	0.941 CPS	1
CH 85 (1.005 MEV)	0.919 CPS	1
CH 86 (1.017 MEV)	0.822 CPS	1
CH 87 (1.028 MEV)	0.816 CPS	1
CH 88 (1.040 MEV)	0.853 CPS	1
CH 89 (1.052 MEV)	0.901 CPS	1
CH 90 (1.064 MEV)	0.825 CPS	1
CH 91 (1.076 MEV)	0.867 CPS	1
CH 92 (1.087 MEV)	0.969 CPS	1
CH 93 (1.099 MEV)	0.951 CPS	1
CH 94 (1.111 MEV)	0.905 CPS	1
CH 95 (1.123 MEV)	0.847 CPS	1
CH 96 (1.135 MEV)	0.861 CPS	1
CH 97 (1.147 MEV)	0.800 CPS	1
CH 98 (1.158 MEV)	0.727 CPS	1
CH 99 (1.170 MEV)	0.751 CPS	1
CH 100 (1.182 MEV)	0.607 CPS	1
CH 101 (1.194 MEV)	0.663 CPS	1
CH 102 (1.206 MEV)	0.657 CPS	1
CH 103 (1.217 MEV)	0.633 CPS	1
CH 104 (1.229 MEV)	0.710 CPS	1
CH 105 (1.241 MEV)	0.671 CPS	1
CH 106 (1.253 MEV)	0.475 CPS	1
CH 107 (1.265 MEV)	0.601 CPS	1
CH 108 (1.277 MEV)	0.661 CPS	1
CH 109 (1.288 MEV)	0.669 CPS	1
CH 110 (1.300 MEV)	0.606 CPS	1
CH 111 (1.312 MEV)	0.838 CPS	1
CH 112 (1.324 MEV)	0.656 CPS	1
CH 113 (1.336 MEV)	0.644 CPS	1
CH 114 (1.347 MEV)	0.652 CPS	1
CH 115 (1.359 MEV)	0.791 CPS	1
CH 116 (1.371 MEV)	0.787 CPS	1
CH 117 (1.383 MEV)	0.834 CPS	1
CH 118 (1.395 MEV)	0.884 CPS	1
CH 119 (1.407 MEV)	1.072 CPS	1
CH 120 (1.418 MEV)	1.124 CPS	1
CH 121 (1.430 MEV)	1.088 CPS	1
CH 122 (1.442 MEV)	1.210 CPS	1
CH 123 (1.454 MEV)	1.231 CPS	1
CH 124 (1.466 MEV)	1.207 CPS	1
CH 125 (1.477 MEV)	0.995 CPS	1
CH 126 (1.489 MEV)	0.967 CPS	1
CH 127 (1.501 MEV)	0.624 CPS	1
CH 128 (1.513 MEV)	0.635 CPS	1
CH 129 (1.525 MEV)	0.512 CPS	1
CH 130 (1.537 MEV)	0.488 CPS	1
CH 131 (1.548 MEV)	0.409 CPS	1
CH 132 (1.560 MEV)	0.369 CPS	1
CH 133 (1.572 MEV)	0.339 CPS	1
CH 134 (1.584 MEV)	0.438 CPS	1
CH 135 (1.596 MEV)	0.318 CPS	1
CH 136 (1.608 MEV)	0.259 CPS	1
CH 137 (1.619 MEV)	0.250 CPS	1
CH 138 (1.631 MEV)	0.353 CPS	1
CH 139 (1.643 MEV)	0.323 CPS	1
CH 140 (1.655 MEV)	0.332 CPS	1
CH 141 (1.667 MEV)	0.326 CPS	1
CH 142 (1.678 MEV)	0.267 CPS	1
CH 143 (1.690 MEV)	0.275 CPS	1
CH 144 (1.702 MEV)	0.245 CPS	1
CH 145 (1.714 MEV)	0.347 CPS	1
CH 146 (1.726 MEV)	0.352 CPS	1
CH 147 (1.738 MEV)	0.293 CPS	1
CH 148 (1.749 MEV)	0.359 CPS	1
CH 149 (1.761 MEV)	0.270 CPS	1
CH 150 (1.773 MEV)	0.334 CPS	1
CH 151 (1.785 MEV)	0.245 CPS	1
CH 152 (1.797 MEV)	0.255 CPS	1
CH 153 (1.808 MEV)	0.174 CPS	1
CH 154 (1.820 MEV)	0.228 CPS	1
CH 155 (1.832 MEV)	0.188 CPS	1
CH 156 (1.844 MEV)	0.115 CPS	1
CH 157 (1.856 MEV)	0.084 CPS	1
CH 158 (1.868 MEV)	0.147 CPS	1
CH 159 (1.879 MEV)	0.147 CPS	1
CH 160 (1.891 MEV)	0.139 CPS	1
CH 161 (1.903 MEV)	0.109 CPS	1
CH 162 (1.915 MEV)	0.091 CPS	1
CH 163 (1.927 MEV)	0.151 CPS	1
CH 164 (1.938 MEV)	0.088 CPS	1
CH 165 (1.950 MEV)	0.136 CPS	1
CH 166 (1.962 MEV)	0.157 CPS	1
CH 167 (1.974 MEV)	0.119 CPS	1
CH 168 (1.986 MEV)	0.100 CPS	1
CH 169 (1.998 MEV)	0.113 CPS	1
CH 170 (2.009 MEV)	0.106 CPS	1
CH 171 (2.021 MEV)	0.147 CPS	1
CH 172 (2.033 MEV)	0.137 CPS	1
CH 173 (2.045 MEV)	0.171 CPS	1
CH 174 (2.057 MEV)	0.154 CPS	1
CH 175 (2.068 MEV)	0.108 CPS	1
CH 176 (2.080 MEV)	0.162 CPS	1
CH 177 (2.092 MEV)	0.104 CPS	1
CH 178 (2.104 MEV)	0.138 CPS	1
CH 179 (2.116 MEV)	0.137 CPS	1
CH 180 (2.128 MEV)	0.119 CPS	1
CH 181 (2.139 MEV)	0.163 CPS	1
CH 182 (2.151 MEV)	0.148 CPS	1
CH 183 (2.163 MEV)	0.101 CPS	1
CH 184 (2.175 MEV)	0.114 CPS	1
CH 185 (2.187 MEV)	0.088 CPS	1
CH 186 (2.199 MEV)	0.101 CPS	1
CH 187 (2.210 MEV)	0.085 CPS	1
CH 188 (2.222 MEV)	0.130 CPS	1
CH 189 (2.234 MEV)	0.117 CPS	1
CH 190 (2.246 MEV)	0.113 CPS	1
CH 191 (2.258 MEV)	0.116 CPS	1
CH 192 (2.269 MEV)	0.088 CPS	1
CH 193 (2.281 MEV)	0.097 CPS	1
CH 194 (2.293 MEV)	0.095 CPS	1
CH 195 (2.305 MEV)	0.087 CPS	1
CH 196 (2.317 MEV)	0.059 CPS	1
CH 197 (2.329 MEV)	0.015 CPS	1
CH 198 (2.340 MEV)	0.041 CPS	1
CH 199 (2.352 MEV)	0.070 CPS	1
CH 200 (2.364 MEV)	0.087 CPS	1
CH 201 (2.376 MEV)	0.085 CPS	1
CH 202 (2.388 MEV)	0.084 CPS	1
CH 203 (2.399 MEV)	0.064 CPS	1
CH 204 (2.411 MEV)	0.123 CPS	1
CH 205 (2.423 MEV)	0.076 CPS	1
CH 206 (2.435 MEV)	0.116 CPS	1
CH 207 (2.447 MEV)	0.147 CPS	1
CH 208 (2.459 MEV)	0.108 CPS	1
CH 209 (2.470 MEV)	0.020 CPS	1
CH 210 (2.482 MEV)	0.092 CPS	1
CH 211 (2.494 MEV)	0.127 CPS	1
CH 212 (2.506 MEV)	0.139 CPS	1
CH 213 (2.518 MEV)	0.206 CPS	1
CH 214 (2.530 MEV)	0.262 CPS	1
CH 215 (2.541 MEV)	0.184 CPS	1
CH 216 (2.553 MEV)	0.208 CPS	1
CH 217 (2.565 MEV)	0.195 CPS	1
CH 218 (2.577 MEV)	0.173 CPS	1
CH 219 (2.589 MEV)	0.201 CPS	1
CH 220 (2.600 MEV)	0.329 CPS	1
CH 221 (2.612 MEV)	0.325 CPS	1
CH 222 (2.624 MEV)	0.187 CPS	1
CH 223 (2.636 MEV)	0.171 CPS	1
CH 224 (2.648 MEV)	0.171 CPS	1
CH 225 (2.660 MEV)	0.089 CPS	1
CH 226 (2.671 MEV)	0.122 CPS	1
CH 227 (2.683 MEV)	0.122 CPS	1
CH 228 (2.695 MEV)	0.131 CPS	1
CH 229 (2.707 MEV)	0.090 CPS	1
CH 230 (2.719 MEV)	0.027 CPS	1
CH 231 (2.730 MEV)	0.012 CPS	1
CH 232 (2.742 MEV)	-0.026 CPS	1
CH 233 (2.754 MEV)	-0.024 CPS	1
CH 234 (2.766 MEV)	0.038 CPS	1
CH 235 (2.778 MEV)	0.093 CPS	1
CH 236 (2.790 MEV)	0.060 CPS	1
CH 237 (2.801 MEV)	0.038 CPS	1
CH 238 (2.813 MEV)	0.023 CPS	1
CH 239 (2.825 MEV)	0.008 CPS	1
CH 240 (2.837 MEV)	0.078 CPS	1
CH 241 (2.849 MEV)	0.027 CPS	1
CH 242 (2.860 MEV)	0.047 CPS	1
CH 243 (2.872 MEV)	0.039 CPS	1
CH 244 (2.884 MEV)	0.084 CPS	1
CH 245 (2.896 MEV)	0.025 CPS	1
CH 246 (2.908 MEV)	0.025 CPS	1
CH 247 (2.920 MEV)	-0.015 CPS	1
CH 248 (2.931 MEV)	0.037 CPS	1
CH 249 (2.943 MEV)	-0.005 CPS	1
CH 250 (2.955 MEV)	0.042 CPS	1
CH 251 (2.967 MEV)	0.002 CPS	1
CH 252 (2.979 MEV)	-0.018 CPS	1
CH 253 (2.990 MEV)	0.031 CPS	1
CH 254 (3.002 MEV)	-0.106 CPS	1
CH 255 (3.014 MEV)	0.000 CPS	1

AIRCRAFT BACKGROUND
ROTARY WING AIRCRAFT
DOWNWARD LOOKING CRYSTAL
2048 CUBIC INCHES
DATE: 25 JULY 1977

Thus, energy peaks within a spectrum of a given element are Gaussian shaped rather than pure line spectra. Additionally, we are dealing with finite spectral windows, multiple peaked spectra, and pulse pileup; all tend to couple each window's response to the other.

Keeping in mind that we are dealing with the count rates corresponding to the concentrations presented in the last table, we define the following:

KC_i = uncorrected system count rate for the K channel

UC_i = uncorrected system count rate for the U channel

TC_i = uncorrected system count rate for the T channel

K_i = the percent differential concentration of potassium

U_i = ppm differential concentration of uranium

T_i = ppm differential concentration of thorium

where "i" refers to the ith pad.

We also define the following:

ζ_{kk} = sensitivity of KC_i to concentrations of K_i

ζ_{ku} = sensitivity of KC_i to concentrations of U_i

ζ_{kt} = sensitivity of KC_i to concentrations of T_i

ζ_{uk} = sensitivity of UC_i to concentrations of K_i

ζ_{uu} = sensitivity of UC_i to concentrations of U_i

ζ_{ut} = sensitivity of UC_i to concentrations of T_i

ζ_{tk} = sensitivity of TC_i to concentrations of K_i

ζ_{tu} = sensitivity of TC_i to concentrations of U_i

ζ_{tt} = sensitivity of TC_i to concentrations of T_i

Using the above definitions, we now construct the functional relationship by means of the following nine (9) equations in sets of three (3) per pad.

$$\text{K pad} \quad KC_k = \zeta_{kk}K + \zeta_{ku}U + \zeta_{kt}T$$

$$UC_k = \zeta_{uk}K + \zeta_{uu}U + \zeta_{ut}T$$

$$TC_k = \zeta_{tk}K + \zeta_{tu}U + \zeta_{tt}T$$

$$\text{U pad} \quad KC_u = \zeta_{kk}K + \zeta_{ku}U + \zeta_{kt}T$$

$$UC_u = \zeta_{uk}K + \zeta_{uu}U + \zeta_{ut}T$$

$$TC_u = \zeta_{tk}K + \zeta_{tu}U + \zeta_{tt}T$$

$$\text{T pad} \quad KC_t = \zeta_{kk}K + \zeta_{ku}U + \zeta_{kt}T$$

$$UC_t = \zeta_{uk}K + \zeta_{uu}U + \zeta_{ut}T$$

$$TC_t = \zeta_{tk}K + \zeta_{tu}U + \zeta_{tt}T$$

Separating these equation into consistent groups, we get for the uncorrected count rates in the K channel

$$(\text{K pad}) \quad KC_k = \zeta_{kk}K_k + \zeta_{ku}U_k + \zeta_{kt}T_k$$

$$(\text{U pad}) \quad KC_u = \zeta_{kk}K_u + \zeta_{ku}U_u + \zeta_{kt}T_u$$

$$(\text{T pad}) \quad KC_t = \zeta_{kk}K_t + \zeta_{ku}U_t + \zeta_{kt}T_t$$

The equations can be expressed in matrix notation

$$\begin{bmatrix} KC_k \\ KC_u \\ KC_t \end{bmatrix} = \begin{bmatrix} K_k & U_k & T_k \\ K_u & U_u & T_u \\ K_t & U_t & T_t \end{bmatrix} \cdot \begin{bmatrix} \zeta_{kk} \\ \zeta_{ku} \\ \zeta_{kt} \end{bmatrix}$$

Where the k, u and t subscripts represent the K, U and T pads.

In a similar manner we can write two other matrix equations for UC_i and TC_i respectively.

$$\begin{bmatrix} UC_k \\ UC_u \\ UC_t \end{bmatrix} = \begin{bmatrix} K_k & U_k & T_k \\ K_u & U_u & T_u \\ K_t & U_t & T_t \end{bmatrix} \cdot \begin{bmatrix} \zeta_{uk} \\ \zeta_{uu} \\ \zeta_{ut} \end{bmatrix}$$

$$\begin{bmatrix} TC_k \\ TC_u \\ TC_t \end{bmatrix} = \begin{bmatrix} K_k & U_k & T_k \\ K_u & U_u & T_u \\ K_t & U_t & T_t \end{bmatrix} \cdot \begin{bmatrix} \zeta_{tk} \\ \zeta_{tu} \\ \zeta_{tt} \end{bmatrix}$$

Collecting the above, these equations can be expressed in matrix form as

$$\begin{bmatrix} KC_k & UC_k & TC_k \\ KC_u & UC_u & TC_u \\ KC_t & UC_t & TC_t \end{bmatrix} = \begin{bmatrix} K_t & U_k & T_k \\ K_u & U_u & T_u \\ K_t & U_t & T_t \end{bmatrix} \cdot \begin{bmatrix} \zeta_{kk} & \zeta_{uk} & \zeta_{tk} \\ \zeta_{ku} & \zeta_{uu} & \zeta_{tu} \\ \zeta_{kt} & \zeta_{ut} & \zeta_{tt} \end{bmatrix}$$

or

$$\bar{A} = \bar{B} \cdot \bar{\zeta}$$

where $\bar{A}$ is the residual count rate matrix, $\bar{B}$ is the matrix of the known differential concentrations and $\bar{\zeta}$ the sensitivity matrix.

Rearranging the above equations we have

$$\bar{B} = \bar{A} \cdot \bar{\zeta}^{-1}$$

We now define

$$\bar{\zeta}^{-1} = \bar{\Delta}$$

Eliminating $\bar{\zeta}$, we get

$$\bar{B} = \bar{A} \cdot \bar{\Delta}$$

We can now solve for $\bar{\Delta}$ by matrix inversion.

Therefore, the differential concentrations in the mixed pad can be derived from the k,u,t pads to check the computed $\bar{\Delta}$.

$$\begin{bmatrix} K_m \\ U_m \\ T_m \end{bmatrix} = \begin{bmatrix} \Delta_{kk} & \Delta_{ku} & \Delta_{kt} \\ \Delta_{uk} & \Delta_{uu} & \Delta_{ut} \\ \Delta_{tk} & \Delta_{tu} & \Delta_{tt} \end{bmatrix} \cdot \begin{bmatrix} KC_m \\ UC_m \\ TC_m \end{bmatrix}$$

where the subscript m refers to the mixed pad. Expanding this in algebraic form we obtain the following set of equations:

$$K_m = \Delta_{kk}(KC_m) + \frac{\Delta_{ku}UC_m}{\Delta_{kk}} + \frac{\Delta_{kt}TC_m}{\Delta_{kk}}$$

$$U_m = \Delta_{uu}(UC_m) + \frac{\Delta_{ut}TC_m}{\Delta_{kk}} + \frac{\Delta_{uk}KC_m}{\Delta_{uu}}$$

$$T_m = \Delta_{tt}(TC_m) + \frac{\Delta_{tu}UC_m}{\Delta_{tt}} + \frac{\Delta_{tk}KC_m}{\Delta_{tt}}$$

The terms in parentheses in the above 3 equations are the "corrected stripped count rates" for the system, and the stripping coefficients are as follows:

$$S_{ku} = \frac{\Delta_{ku}}{\Delta_{kk}} \quad (\text{effect of uranium on potassium})$$

$$S_{kt} = \frac{\Delta_{kt}}{\Delta_{kk}} \quad (\text{effect of thorium on potassium})$$

$$S_{ut} = \frac{\Delta_{ut}}{\Delta_{uu}} \quad (\text{effect of thorium on uranium})$$

$$S_{uk} = \frac{\Delta_{uk}}{\Delta_{uu}} \quad (\text{effect of potassium on uranium})$$

$$S_{tu} = \frac{\Delta_{tu}}{\Delta_{tt}} \quad (\text{effect of uranium on thorium})$$

$$S_{tk} = \frac{\Delta_{tk}}{\Delta_{tt}} \quad (\text{effect of potassium on thorium})$$

These stripping coefficients are defined in terms of S_{ij} in order to eliminate confusion with α , β , and γ , which are sometimes defined slightly differently.

ATMOSPHERIC RADON CORRECTION

Consider the crystal configuration shown below:

Let 1 and 2 designate the down and up crystal respectively. The down crystal sees radiation rates of I_1 composed of the air signal I_a and the ground signal I_g plus aircraft and cosmic background.

$$\text{Therefore } I_1 = I_g + I_a + A_1 + C_1$$

Similarly, the up crystal sees the air signal and ground signal (both somewhat attenuated) plus an aircraft and cosmic background.

$$\text{Therefore } I_2 = \ell I_g + m I_a + A_2 + C_2$$

Where m is the response to the air signal and ℓ is the % of the ground signal getting through to the up detector.

Using the test pad data, the factor ℓ can be determined. Consider the two previous equations. When we subtract the matrix pad data from the K, U, and T pad data, we have essentially set A_1 , A_2 , C_1 , and C_2 and I_a equal to zero.

$$\begin{aligned} \text{Therefore } I_1 &= I_g \\ I_2 &= \ell I_g \\ &= \left(\frac{I_2}{I_1} \right) \end{aligned}$$

Instead of using the count rates we can use the resultant sensitivities $1/\Delta_{uu}$ to determine ℓ for the elemental channel U.

$$= \frac{1/\Delta_{uu} \text{ (up)}}{1/\Delta_{uu} \text{ (down)}}$$

It should be noted that due to "shine around" (since the shielding is not an infinite plane, the upward looking crystal responds to the surrounding terrain) on the test pads, as altitude increases, should decrease, thus $\ell = f(h)$.

Only the factor m remains to be determined. This unfortunately cannot be determined from test pad data. It can however be determined by flying over water (e.g. use of the Lake Mead over-water data).

Consider the equations for I_1 and I_2 again

$$I_1 = I_g + I_a + A_1 + C_1$$

$$I_2 = \ell I_g + m I_a + A_2 + C_2$$

Over water $I_g = 0$

We have A_1 , A_2 , C_1 , and C_2 defined.

Removing the aircraft and cosmic background from the over water data and we are left with

$$I_1 = I_a$$

$$I_2 = m I_a$$

Since m is the shielding factor response to the air signal, we should have an air signal to "shield". Thus m is best determined if there is radon present.

Both up and down counting rates are corrected for aircraft and cosmic background and so we can solve the following two equations for I_a :

$$I_1 = I_g + I_a$$

$$I_2 = \ell I_g + m I_a$$

$$m I_a = I_2 - \ell I_g$$

$$\text{but } I_g = I_1 - I_a$$

$$\text{then } I_a (m - \ell) = I_2 - \ell I_1$$

$$\text{or } I_a = \frac{I_2 - \ell I_1}{m - \ell} = \text{Bi Air}$$

and I_a is then the Bi Air contribution from the surrounding air. This is then subtracted from the down looking U count resulting in corrected data.

DATA PROCESSING

DATA PREPARATION

The following sections summarize the techniques used for reduction and processing of the airborne data collected by geoMetrics.

Field Tape Verification and Edit

The field data tapes containing the airborne data are read on a computer to verify the recording and data quality. Data recovery is essentially 100% from the field tapes. During this phase, statistics are generated summarizing all the variables recorded for each flight line. Simultaneously, the spectral peaks are evaluated for shifts using a centroid calculation and the particular window's peak channel. The data are also checked for correct scan lengths and proper justification of data fields within each scan and and live time calculations are made. During this process, the desired window data fields are extracted from each spectrum and rewritten as a reformatted copy tape. (Portions of this operation were performed in the field using the G-725 field computer system.)

The reformatted raw data for each flight line (with aborted or unnecessary flight line data edited out) are then checked for consistency, data spikes, gradients, etc. Every correction suggested by the computer is evaluated by the data processing personnel prior to implementation. Upon completion of the phase, the data on the output tape are "clean" and ready for subsequent correction of the radiometrics and tying of the magnetics.

Flight Line Location

A single frame 35 mm camera is used for obtaining position recovery information. The photo locations are spotted or transferred to a suitable base map and are digitized. The fiducial numbers of the spotted points along each line are entered during the digitizing process. A computer program is used to check the consistency of these data using calculated intersections from tie line to tie line and from traverse to traverse. This program allows easy detection of entry errors as well as potential flight path recovery errors.

A computer program then calculates the map location for each intersection and the beginning and end of each line based on the fiducial numbers and the control line/tie grid. A computer plot is made of these locations to check against the field plot and correct editing

information. These flight lines are then overlain on the geologic base map and each map unit is digitized such that each sample falls within a single unit. This resulting location information is then merged with the geophysical data using the fiducial numbers as common reference.

RADIOMETRIC DATA REDUCTION

Reduction of the raw window data was carried out utilizing system calibration constants as derived from high altitude over water flights, Lake Mead Dynamic Test Range, and the Walker Field Test Pads. The data reduction sequence used is summarized in Figure VII. Processing of the data was performed using the window energies given below:

- Total count - 0.4 to 3.0 MeV
- K - 1.37 to 1.57 MeV
- U - 1.66 to 1.87 MeV (downward looking system)
- U_{up} - 1.04 to 1.21 MeV and 1.65 to 2.42 MeV (upward looking system)
- T - 2.41 to 2.81 MeV
- Cosmic - 3 to 6 MeV (downward and upward looking system)

Aircraft and Cosmic background for the Queen Air/Aero Commander over these windows are as follows:

	QUEEN AIR		AERO COMMANDER	
	Aircraft	Cosmic*	Aircraft	Cosmic*
TC (cps)	152.04	2.3833	220.37	2.3915
K (cps)	16.06	0.1322	18.82	0.1334
U _{dn} (cps)	6.50	0.1098	10.85	0.1082
U _{up} (cps)	3.17	0.5540	5.35	0.5915
T (cps)	3.42	0.1503	4.35	0.1513

*Cosmic background values are in cps per 1.0 cps in the 3-6 MeV window.

DATA PROCESSING FLOW DIAGRAM

FIGURE VII

Compton corrections to the down data were made using the following constants:

<u>S_{ij}</u>	<u>QUEEN AIR</u>	<u>AERO COMMANDER</u>
S _{ku}	0.8437	0.8717
S _{kt}	0.1584	0.1408
S _{ut}	0.2703	0.2877
S _{uk}	0.0	0.0
S _{tu}	0.05614	0.09453
S _{tk}	0.0	0.0

The ij subscripts represent the influence of the jth window on the ith window.

All parameters except for S_{ut} are considered constants. S_{ut} was considered an altitude dependent parameter utilizing the following expression (after Grasty, 1975).

$$S_{ut} = S_{ut_0} + 0.0076h, \text{ where } h \text{ is the altitude in hundreds of feet.}$$

Altitude attenuation coefficients used are defined as follows:

ALTITUDE ATTENUATION COEFFICIENTS		
	<u>QUEEN AIR</u>	<u>AERO COMMANDER</u>
TC (per foot)	0.002011	0.001688
K (per foot)	0.002740	0.002800
U (per foot)	0.002479	0.002536
T (per foot)	0.002048	0.002102

All radiometric data presented in the strip charts have been normalized to 400 feet mean terrain clearance at STP using the expression:

$$\exp - u_i \frac{273.15}{760} \times \frac{P}{T} (h - 400)$$

where h is the height in feet, i is the appropriate altitude attenuation coefficient, P is in mm of Hg, and T is in degrees Kelvin. In cases where the altitude exceeds 1,000 feet, the correction coefficients were limited to the 1,000 foot value.

Bi Air calculations are made using the following expressions:

$$U_{up} = (R_{us} + \frac{C'_{uk}}{C'_{uu}} R_{ks} + \frac{C'_{ut}}{C'_{uu}} R_{ts}) \ell$$

$$Bi_{Air} = \frac{\quad}{m - \ell}$$

Where U_{up} = count rate from upward detectors

ℓ = crystal coupling constant

m = crystal geometric factor

C'_{uk}, C'_{ut}, C'_{uu}, = stripping coefficients relating down data to up data

R_{us} = stripped uranium count rate - down system

R_{ks} = stripped potassium count rate - down system

R_{ts} = stripped thorium count rate - down system

The numerical values for the constants ℓ, m, C'_{uk}, and C'_{uu} are given below:

	<u>QUEEN AIR</u>	<u>AERO COMMANDER</u>
ℓ	0.1101	0.0890
m	0.596	0.445
C' _{uk}	0.00947	0.00964
C' _{uu}	0.07136	0.08562
C' _{ut}	0.04636	0.05644
μℓ	-0.000032	-0.00019
μm	-0.000192	-0.000112

μ_l & μ_m are altitude dependent as follows:

$$l = l - \mu_l \times h, \text{ where } h \text{ is in feet}$$

$$m = m - \mu_m \times h, \text{ where } h \text{ is in feet}$$

These Bi Air data are filtered and the filtered results are then removed on a point by point basis from the corrected uranium window data.

The window data are then evaluated for statistical adequacy prior to altitude correction to ensure they are significant within the context of the anticipated errors in count statistics.

Statistical Adequacy Test

The statistical adequacy test is made to determine whether the corrected data sample is sufficiently greater than the "noise" to represent the "signal" of interest.

We can define three separate criteria for detection thresholds (ref. Currie, Analytical Chemistry, Volume 40, No. 3, March 1968) of which only one is directly applicable to our case; this is the "critical level". This is the level at which the decision is made that a signal is "detected". We thus define this critical level as that level at which the data are statistically adequate.

Setting the actual levels in counts per second, "a priori" for each elemental window is difficult at best since the full effect of all parameters affecting the counts is not known to a sufficient degree of certainty. If the corrections to the data are a significant portion of the count rate, most of the error (exclusive of systematic errors due to electronics, etc.) in the corrected data can be ascribed to random errors within the applied corrections. The corrections are basically the results of counting radioactive decay products (gamma rays) and are therefore assumed to follow the classical Poisson distribution. The following assumptions concerning these corrections are:

1. In the best case, the error in each correction is additive.
2. The sum of these corrections also follows a Poisson distribution.
3. The uncertainty in the correction itself is equal to the square root of the correction applied.
4. This uncertainty is directly reflected in the corrected single record count rate.

With these assumptions in mind, the criterion for determining the statistical adequacy of a given data sample is defined as follows:

"If a corrected single record data sample exceeds 1.5 times the square root of the summed correction applied to that data sample, then that data sample is statistically adequate."

Since any calculation using statistically inadequate data (such as ratios) is also inadequate, the adequacy of each element of the single sample record data is tested prior to the calculation. This is done during the course of the processing by retaining all corrections applied to each data sample and determining its adequacy as explained above.

Not only are the results of this statistical adequacy test used to insure that calculated ratios will be meaningful but they are also utilized to determine the optimum interval over which the data should be averaged (e.g. 5 seconds or 7 seconds, etc.) to improve the overall data statistical adequacy. In the case of this project, the resulting averaging sample interval was 7 seconds.

Conversion to Equivalent ppm and Percent

At this point the data are single record corrected samples in units of counts per second. These data are then converted to equivalent ppm (parts per million) uranium, thorium and percent potassium. The conversion factors are the sensitivities derived from the Lake Mead Dynamic Test Range data at 400 feet mean terrain clearance.

<u>Radioelement</u>	<u>Equivalent Percent/ppm</u>	<u>Queen Air Counts/Second</u>	<u>Aero Commander Counts/Second</u>
K	1%K	91.5	96.3
U	1 ppmeu	10.4	9.2
T	1 ppmeT	6.4	6.7

DATA PRESENTATION

MAGNETIC DATA REDUCTION

The magnetic data reduction processes are: correction for diurnal variation, tying to a common magnetic datum, and subtraction of the regional magnetic field as defined by the International Geomagnetic Reference Field (IGRF). During data acquisition, the magnetic field is monitored by a ground-based diurnal magnetometer that samples every four seconds at a sensitivity of one-quarter gamma. These data are recorded on magnetic tape along with the time for synchronization with the airborne data.

The diurnal data are edited to keep only samples taken during flight time and remove spikes and man-made magnetic events. After editing, these data are displayed in profile form to ensure that all corrections necessary have been made. Next, the data are synchronized in time with the airborne data, interpolated, and subtracted from the airborne magnetic data.

The diurnally corrected magnetic data are then processed by a tying program that compares the magnetic differences at intersections of flight lines and tie lines. This program calculates individual magnetic field biases for each flight tie line based on tie line intersections. This allows miss-ties to be minimized throughout the survey. These biases usually represent, after diurnal correction, systematic magnetic changes caused by such things as heading error, changes in location of the ground-based magnetometer, or changes in the airborne equipment. The biases are manually evaluated and selectively applied.

General

The majority of the data products are presented in this report. These include the uranium anomaly/interpretation maps and pseudo-contour maps of potassium, uranium, thorium, and magnetic data which are integrated as part of the text in the interpretation section. In addition to these data, this report contains data presented in the form of radiometric profiles, flight path recovery maps, standard deviation maps, and histograms. Microfiche data are contained in the back cover of each report. Data tapes are available separately.

Radiometric Profiles

Stacked profiles were prepared from the averaged data for each traverse and tie line. These stacked profiles, plotted at a linear scale of 1:250,000, contain the following parameters: corrected Total Count, percent potassium, equivalent ppm uranium, equivalent ppm thorium, eU/eT, eU/%K, and eT/%K ratios, equivalent ppm Bi Air, radar altimeter, and magnetometer data. Each of the stacked profile sheets contains a plot of the flight path superimposed on a geologic strip map. Included along these profiles are the fiducial numbers which correspond to flight path position as displayed on the flight path recovery maps. Each of the stacked profiles represents the data contained on the specific flight line within the boundaries of the specified NTMS Quadrangle sheet.

Radiometric traces on the stacked profiles contain an indicator showing those data which are statistically inadequate. These statistically inadequate data are marked by a small vertical tick at the sample location. The altitude profile has been limited in display to 1,000 feet. A dashed line at the 700 foot level is presented to show those data which do not meet the altitude specifications. The vertical scale of each variable remains constant on all stacked profiles. When overranging occurs, the trace is stepped and the step labeled showing the actual value. A pictorial representation of such a stepping profile is shown in Figure VIII. At the end of each stacked profile, a statistical summary of the minimum value, maximum value, mean, and standard deviation for that variable is presented.

This report contains an equivalent set of stacked profiles for each quadrangle, photographically reduced to an approximate scale of 1:500,000.

MAGNETIC PROFILES

A set of profiles containing the magnetic data (corrected, with IGRF removed), barometric altimeter data, radar altimeter data, diurnal monitor data, and temperature data are available at a linear scale of 1:250,000. Each of the stacked profiles contains a plot of the flight path superimposed on the geology over which the aircraft flew. Reduced scale (1:500,000) copies of these are presented in of this report.

FIGURE VIII Plotter Step Value Labeling

FLIGHT PATH MAPS

For each of the NTMS quadrangle sheets covered by this survey, a flight path position map is available at a scale of 1:250,000. The actual flight path has been superimposed on the geologic quadrangle maps. Flight lines and tie lines are annotated along with fiducial numbers of located positions. Reduced scale (1:500,000) copies of these can be found in this report.

STANDARD DEVIATION MAPS

Gamma ray standard deviation maps have been prepared for each NTMS quadrangle included in this survey. The six maps generated represent the following parameters: percent potassium, equivalent ppm uranium, equivalent ppm thorium, and eU/eT, eU/%K and eT/%K ratios. The data contained in each map represent only those data which are considered statistically adequate. This automatically excludes all data collected over water or data which falls outside of altitude specifications (i.e. altitude greater than 700 and less than 200 feet). The symbolism of each of the six maps is identical. The center of each circle represents the central averaged sample since the data had been averaged over a 7 second interval. The small boxes adjacent to each of the circles represents one standard deviation from the mean for that specific data sample. In order to determine whether the data shown are represented by positive or negative standard deviations, consider each map with north pointing away from the viewer. For east/west lines (traverse lines) positive standard deviations lie above or to the north of the traverse line with negative standard deviation below or to the south. On the north/south lines (tie lines) positive standard deviations are to the left of the viewer (west) with negative standard deviations to the right (east).

These maps were generated at a scale of 1:250,000 for each NTMS sheet and in addition, are presented in each report at a reduced scale of approximately 1:500,000.

HISTOGRAMS

Computer generated histograms, showing the equivalent ppm and percent distributions for the three gamma ray emitters and their ratios measured and calculated as a function of computer map unit are presented in this report (See Figure IX). Information contained on these histograms includes the standard deviation as calculated about the arithmetic mean (or median), and the total number of samples from which the statistics were derived.

FIGURE IX Sample Computer Map Unit Histogram

DATA LISTINGS

Single record reduced and averaged record (statistical analysis) data listings have been prepared on microfiche. The microfiche are contained in each report. Each of the single record and averaged record data listings are presented for the data contained in a single quadrangle. The data contained in the single record data listings are summarized below:

1. Fiducial number
2. System/Quality (SAKUT) - The first digit identifies the system used to collect the sample. The remaining digits define the results of statistical adequacy testing for altitude, potassium, uranium, and thorium. A value of 0 indicated that the data are statistically adequate. A value of 1 indicates that the data are statistically inadequate. All data collected in excess of 700 feet and less than 200 feet are considered statistically inadequate.
3. Time - time presented in hours, minutes, and seconds
4. Altitude - altitude presented in feet above terrain
5. LAT/LONG - Latitude and Longitude presented in terms of decimal degrees
6. Magnetic field expressed in residual gammas
7. Geology - code representing geologic units
8. %K, eU, eT - percent potassium, equivalent ppm of uranium and thorium
9. eU/eTH, eU/%K, eTH/%K - calculated ratios of the three parameters
10. Total count - corrected total count data (0.4 to 3.0 MeV)
11. COS - downward looking cosmic count rate in the 3-6 MeV channel
12. Uair - atmospheric Bi-214 equivalent ppm
13. Temperature - outside air temperature in degrees centigrade
14. Press - barometric pressure in mm of mercury

The averaged record (statistical analysis) data listings are summarized below:

1. Fiducial number
2. System/Quality (SAKUT) - The first digit identifies the system used to collect the sample. The remaining digits define the results of statistical adequacy testing for altitude, potassium, uranium, and thorium. A value of 0 indicated that the data are statistically adequate. A value of 1 indicates that the data are statistically inadequate. All data collected in excess of 700 feet and less than 200 feet are considered statistically inadequate.
3. LAT/LONG - Latitude and longitude presented in terms of decimal degrees
4. Magnetic field expressed in residual gammas
5. Geology - code representing geologic formations
6. %K, eU, eT - percent potassium, equivalent ppm of uranium and thorium data and the number of (+) standard deviations from the mean
7. eU/eTH, eU/%K, eTh/%K - calculated ratios of the three parameters, and the number of (+) standard deviations from the mean
8. Total count - corrected total count data (0.4 to 3.0 MeV)
9. COS - downward looking cosmic count rate in the 3-6 MeV channel
10. Uair - atmospheric Bi-214 in equivalent ppm

DATA TAPES

Data tape files have been generated for each of the 1:250,000 NTMS quadrangle sheets. The tapes are IBM compatible and recorded on 9 track EBCDIC at 800 bpi. Five separate types of data tapes are presented: raw spectral data tapes, single record reduced data tapes, statistical analysis tapes, magnetic data tapes and a statistical analysis summary tape. Detailed descriptions of the data tape formats follow this discussion.

DATA INTERPRETATION METHODS

General

The stated objective of the NURE Program is the evaluation of the uranium potential of the United States. In support of this goal, high sensitivity airborne radiometric and magnetic surveys have been implemented to obtain reconnaissance information pertaining to regional distribution of uraniferous materials. Within this context, data interpretation has been oriented toward regional detection and description of anomalously high concentrations of uranium.

By far the most significant natural sources of gamma radiation in the geologic environment are the radioactive decay series of potassium 40 (K40), thorium 232 (Th232) and uranium 238 (U238) of which 0.7% is uranium 235. Potassium 40 is the largest contributor to natural radioactivity, accounting for nearly 98%, as it is the most abundant gamma ray emitter-.012% of all potassium in nature. (Refer to GSA Memoir 97 for abundances of uranium, thorium, and potassium).

Potassium 40 is directly identified by the airborne spectrometer from a single clear peak at 1.46 mev (million electron volts) in its gamma ray spectrum. However, thorium 232 and uranium 238 do not have any clear, distinct peaks at sufficiently high energies to allow direct detection from airborne systems. Instead, daughter products which do have distinct peaks are measured as representing the abundance of the parent element. For thorium 232, the daughter nuclide thallium 208 (Tl208) has a distinct peak at 2.62 mev while uranium 238 has a daughter, bismuth 214 (Bi214) possessing a clear peak at 1.76 mev (see Figure 7 for a composite decay series spectrum). Consequently the fundamental assumption implicit to airborne uranium and thorium measurements is that the measured daughter products are in radioactive equilibrium - the number of atoms of disintegrating daughter nuclides are equal to the number being formed (see Adams and Gasparini, 1970).

An airborne gamma ray measurement is the sum of photons counted during a specified time interval from a multitude of gamma ray sources which include the three geologic emitters that are being sought plus other interfering sources. These others include, but are not limited to higher energy cosmic rays, aircraft and instruments, contributions from overlapping decay series and airborne radon 222. (See Burson, 1974 and McSharry, 1973 for a more complete discussion of airborne radiometric measurements, and Radiometric Data Reduction in this volume for a complete description of data correction procedures).

When correlating ground data (geochemical, geological, etc.) with the corrected data derived from raw airborne measurements, the interpreter must remember what an individual airborne gamma ray sample physically measures. First, the terrestrial component of the gamma radiation measured by the airborne detector emanated primarily from the upper 18 inches of material on the earth's surface (Gregory and

Horwood, 1963). The airborne measurement cannot "see" any deeper into the underlying rock material and is essentially a measurement of the soil's or exposed (weathered) rock's radioactivity. Secondly, since each airborne sample is an accumulation of gamma rays measured on a moving platform over a fixed period of time, the individual sample represents a large areal extent of surficial material. For this survey, with specifications of 400 feet mean terrain clearance and an average ground speed of 140 miles per hour, a one second sample corresponds to an oval approximately 750 feet long by 600 feet wide (assuming an infinite, uniformly distributed source). Accordingly, averaged samples represent tremendous volumes of surficial materials.

Methodology

As described previously, the gamma ray data were located by computer map units, histograms were produced and statistical analyses performed. The basic unit for interpretation then is the averaged sample and its attendant deviations about a particular map unit's mean.

The uranium anomaly/interpretation map displays each individual averaged sample that meets the following criteria:

1. The averaged uranium sample must be greater than or equal to 1 standard deviation above its map unit mean.
2. The sample must have a U/T ratio greater than or equal to 1 standard deviation above its unit mean.
3. Each U/T ratio defined in (2) must have a corresponding thorium value lying at least greater than minus one (-1) standard deviation below the mean. If the thorium sample is less than one standard deviation below the mean, the U/T ratio is considered questionable.

All the possible anomalies displayed on the map are then examined for clusters, trends, and comparisons with all other available data.

Minimum requirements in the subsequent interpretation discussions of each quadrangle for anomalies listed in the uranium anomaly summary are defined as follows:

Two (2) consecutive averaged U samples lying two or more standard deviations above the mean or three (3) consecutive averaged U samples, two of which are one (1) or more standard deviations and the third of which is two (2) or more standard deviations above the mean.

Statistical anomalies which meet the above criteria can result from several factors or circumstances including: (1) true concentration of uraniferous minerals, (2) differential surface cover (soils and/or

vegetation) within a lithologic unit, (3) local weather conditions such as rain and snow, (4) extreme facies variation within a mapped unit, and (5) differential weathering of rocks within mapped units. Obviously an averaged sample which lies on the boundary between two map units is not truly reflecting either one, but is rather an average of both. Thus, for two markedly different units, such a sample would be anomalous relative to one of the units and not be a true indication of radioactive differences within the unit.

The percent potassium, equivalent ppm thorium and uranium, the three ratios and residual magnetic data were plotted as separate pseudo-contour maps and overlain on the geologic base map and standard deviation maps. Regional trends of each variable and average values could thus be easily and quickly determined and compared with the associated geological, magnetic, and statistical trends. Only the long wavelengths within each variable would show any line-to-line continuity on the pseudo-contour maps and thus, only regional trends will appear.

Each quadrangle's stacked profiles were also overlain on the corresponding geologic and standard deviation maps and anomaly map to further delineate trends and to allow a more detailed analysis of individual anomalies. Since the interpretation was concentrated on detection of anomalous uranium, subtle trends present in the potassium and thorium channels and ratios were only examined in a cursory manner. Even during such a brief examination of the profiles, it was evident that the spectrometer system was highly sensitive to changes in surface materials even in areas of low counting rates such as glacial drift. Thus radiometrics have a real potential for performing general surficial mapping "geochemical analysis" on a geologic unit (or soils) basis in addition to merely radioactive mineral "anomaly hunting".

TAPE FORMATS

SINGLE RECORD REDUCED DATA TAPE

REFERENCE: Paragraphs 4.7.6 and 6.1.6, BFEC 1200-C

The Single Record Tape is an unlabeled, nine track, 800 BPI, NRZI. All data are recorded as EBCDIC characters. Each tape contains but one file of format, header, data, and trailer records for no more than one quadrangle. The tape is divided into 6900-character blocks containing the following information.

Block 1 - Format Data

This block contains 6768 characters in 94 consecutive lines of 72 characters containing the following literal description.

02 0978 (DATA TAPE TYPE AND FORMAT SPECIFICATION DATE CODES)

SINGLE RECORD REDUCED DATA TAPE

FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK)

ITEM	FORMAT	DESCRIPTION
1.	A40	QUADRANGLE NAME AS PROJECT IDENTIFICATION
2.	A20	NAME OF SUBCONTRACTOR
3.	I4	APPROXIMATE DATE OF SURVEY (MONTH, YEAR)
4.	I1	NUMBER OF AERIAL SYSTEMS USED TO COLLECT DATA FOR THIS QUADRANGLE
5.	I1	AERIAL SYSTEM IDENTIFICATION CODE FOR FIRST SYSTEM
6.	A20	AIRCRAFT IDENTIFICATION BY TYPE AND FAA NUMBER FOR FIRST SYSTEM
7.	F6.1	NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO TERRESTRIAL POTASSIUM (K-40) TO ONE DECIMAL PLACE IN CPS PER PERCENT K
8.	F6.1	NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO TERRESTRIAL URANIUM (BI-214) TO ONE DECIMAL PLACE IN CPS PER PPM EQUIVALENT U
9.	F6.1	NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO TERRESTRIAL THORIUM (TL-208) TO ONE DECIMAL PLACE IN CPS PER PPM EQUIVALENT TH

ITEM	FORMAT	DESCRIPTION
13	I3	NUMBER OF CHANNELS (0-3 MEV) IN 4PI SYSTEM FOR FIRST AERIAL SYSTEM
14	I3	NUMBER OF CHANNELS (0-3 MEV) IN 2PI SYSTEM FOR FIRST AERIAL SYSTEM
15-24	(SAME)	REPEAT OF ITEMS 5-14 FOR SECOND AERIAL SYSTEM
*	*	*
*	*	*
*	*	*
85-94	(SAME)	REPEAT OF ITEMS 5-14 FOR NINTH AERIAL SYSTEM
95	I3	NUMBER OF FLIGHT LINES ON THIS TAPE
96	I4	FIRST FLIGHT LINE NUMBER ON THIS TAPE
97	I6	FIRST RECORD NUMBER OF FIRST FLIGHT LINE
98	I3	JULIAN DATE (DAY OF YEAR) FIRST FLIGHT-LINE DATA WAS COLLECTED
99-101	I4,I6,I3	REPEAT OF ITEMS 96-98 FOR SECOND FLIGHT LINE ON THIS TAPE
*	*	*
*	*	*
*	*	*
390-392	I4,I6,I3	REPEAT OF ITEMS 96-98 FOR 99th FLIGHT LINE ON THIS TAPE

FORMAT FOR SINGLE RECORD REDUCED DATA RECORD (THIRD THRU LAST BLOCK)

ITEM	FORMAT	DESCRIPTION
1	I1	AERIAL SYSTEM IDENTIFICATION CODE
2	I4	FLIGHT LINE NUMBER
3	I6	RECORD IDENTIFICATION NUMBER
4	I6	GMT TIME OF DAY (HHMMSS)
5	F8.4	LATITUDE TO FOUR DECIMAL PLACES IN DEGREES
6	F8.4	LONGITUDE TO FOUR DECIMAL PLACES IN DEGREES
7	F6.1	TERRAIN CLEARANCE TO ONE DECIMAL PLACE IN METERS
8	F7.1	RESIDUAL (IGRF REMOVED) MAGNETIC FIELD INTENSITY TO ONE DECIMAL PLACE IN GAMMAS
9	A8	SURFACE GEOLOGIC MAP UNIT CODE
10	I4	QUALITY FLAG CODES
11	F6.1	APPARENT CONCENTRATION OF TERRESTRIAL POTASSIUM (K-40) TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
12	F4.1	UNCERTAINTY IN TERRESTRIAL POTASSIUM TO ONE DECIMAL PLACE IN PERCENT K
13	F6.1	APPARENT CONCENTRATION OF TERRESTRIAL URANIUM (BI-214) TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
14	F4.1	UNCERTAINTY IN TERRESTRIAL URANIUM TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
15	F6.1	APPARENT CONCENTRATION OF TERRESTRIAL THORIUM (TL-208) TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH
16	F4.1	UNCERTAINTY IN TERRESTRIAL THORIUM TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH

ITEM	FORMAT	DESCRIPTION
17	F6.1	URANIUM-TO-THORIUM RATIO TO ONE DECIMAL PLACE IN PPM EQUIVALENT U PER PPM EQUIVALENT TH
18	F6.1	URANIUM-TO-POTASSIUM RATIO TO ONE DECIMAL PLACE IN PPM EQUIVALENT U PER PERCENT K
19	F5.1	THORIUM-TO-POTASSIUM RATIO TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH PER PERCENT K
20	F8.1	GROSS GAMMA (0.4-3.0 MEV) COUNT RATE TO ONE DECIMAL PLACE IN COUNTS PER SECOND
21	F6.1	UNCERTAINTY IN GROSS GAMMA COUNT RATE TO ONE DECIMAL PLACE IN COUNTS PER SECOND
22	F5.1	ATMOSPHERIC BI-214 4PI CORRECTION TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
23	F4.1	UNCERTAINTY IN ATMOSPHERIC BI-214 4PI CORRECTION TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
24	F4.1	OUTSIDE AIR TEMPERATURE TO ONE DECIMAL PLACE IN DEGREES CELSIUS
25	F5.1	OUTSIDE AIR PRESSURE TO ONE DECIMAL PLACE IN MMHG

This description serves to identify the format of data on subsequent blocks on the tape. The remaining 132 characters on this block are blanks.

Block 2 - Single Record Reduced Identification Data

The second block contains the identifier information for the data contained in subsequent blocks. The identification information is written according to the format description in the first half of the first block. The remaining 4978 characters on this block are blanks.

Block 3 - Single Record Reduced Data

These blocks contain data written according to the format description in the second half of the first block. There will be 50 logical records per physical block. As of August 1979, the method for determining uncertainties specified in the data blocks remains undefined, and those values are filled with 9's under format control.

STATISTICAL ANALYSIS TAPE

REFERENCE: Paragraphs 4.7.7 and 6.1.6, BFEC 1200-C

The statistical analysis data tape is an unlabeled, nine track, 800 BPI, NRZI. All data is recorded as EBCDIC characters. The block length is 8000 characters long. Each tape contains one file of data for no more than one quadrangle.

Block 1 - Format Description Data

The first physical block on this tape contains a format description for data on subsequent blocks. The first 7560 characters on this block contains 105 lines of 72 characters exactly as written below:

03 0978 (DATA TAPE TYPE AND FORMAT SPECIFICATION DATE CODES)

STATISTICAL ANALYSIS DATA TAPE

FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK)

ITEM	FORMAT	DESCRIPTION
1	A40	QUADRANGLE NAME AS PROJECT IDENTIFICATION
2	A20	NAME OF SUBCONTRACTOR
3	I4	APPROXIMATE DATE OF SURVEY (MONTH, YEAR)
4	I1	NUMBER OF AERIAL SYSTEMS USED TO COLLECT DATA FOR THIS QUADRANGLE
5	I1	AERIAL SYSTEM IDENTIFICATION CODE FOR FIRST SYSTEM
6	A20	AIRCRAFT IDENTIFICATION BY TYPE AND FAA NUMBER FOR FIRST SYSTEM
7	F6.1	NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO TERRESTRIAL POTASSIUM (K-40) TO ONE DECIMAL PLACE IN CPS PER PERCENT K
8	F6.1	NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO TERRESTRIAL URANIUM (BI-214) TO ONE DECIMAL PLACE IN CPS PER PPM EQUIVALENT U
9	F6.1	NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO TERRESTRIAL THORIUM (TL-208) TO ONE DECIMAL PLACE IN CPS PER PPM EQUIVALENT TH
10	I6	BLANK FIELD (99999)
11	F6.3	4PI-SYSTEM DATA COLLECTION INTERVAL TO THREE DECIMAL PLACES IN SECONDS FOR FIRST SYSTEM
12	F6.3	2PI-SYSTEM DATA COLLECTION INTERVAL TO THREE DECIMAL PLACES IN SECONDS FOR FIRST SYSTEM
13	I3	NUMBER OF CHANNELS (0-3 MEV) IN 4PI SYSTEM FOR FIRST AERIAL SYSTEM
14	I3	NUMBER OF CHANNELS (0-3 MEV) IN 2PI SYSTEM FOR FIRST AERIAL SYSTEM

ITEM	FORMAT	DESCRIPTION
15-24	(SAME)	REPEAT OF ITEMS 5-14 FOR SECOND AERIAL SYSTEM
*	*	*
*	*	*
*	*	*
85-94	(SAME)	REPEAT OF ITEMS 5-14 FOR NINTH AERIAL SYSTEM
95	I3	NUMBER OF FLIGHT LINES ON THIS TAPE
96	I4	FIRST FLIGHT LINE NUMBER ON THIS TAPE
97	I6	FIRST RECORD NUMBER OF FIRST FLIGHT LINE
98	I3	JULIAN DATE (DAY OF YEAR) FIRST FLIGHT-LINE DATA WAS COLLECTED
99-101	I4,I6,I3	REPEAT OF ITEMS 96-98 FOR SECOND FLIGHT LINE ON THIS TAPE
*	*	*
*	*	*
*	*	*
390-392	I4,I6,I3	REPEAT OF ITEMS 96-98 FOR 99th FLIGHT LINE ON THIS TAPE

FORMAT FOR STATISTICAL ANALYSIS DATA RECORD (THIRD THRU LAST BLOCK)

ITEM	FORMAT	DESCRIPTION
1	I1	AERIAL SYSTEM IDENTIFICATION CODE
2	I4	FLIGHT LINE NUMBER
3	I6	RECORD IDENTIFICATION NUMBER
4	I6	GMT TIME OF DAY (HHMMSS)
5	F8.4	LATITUDE TO FOUR DECIMAL PLACES IN DEGREES
6	F8.4	LONGITUDE TO FOUR DECIMAL PLACES IN DEGREES
7	F6.1	TERRAIN CLEARANCE TO ONE DECIMAL PLACE IN METERS
8	F7.1	RESIDUAL (IGRF Removed) MAGNETIC FIELD INTENSITY TO ONE DECIMAL PLACE IN GAMMAS
9	A8	SURFACE GEOLOGIC MAP UNIT CODE
10	I4	QUALITY FLAG CODES
11	F6.1	APPARENT CONCENTRATION OF TERRESTRIAL POTASSIUM (K-40) TO ONE DECIMAL PLACE IN PERCENT K
12	F4.1	UNCERTAINTY IN TERRESTRIAL POTASSIUM TO ONE DECIMAL PLACE IN PERCENT K
13	F5.1	POTASSIUM STANDARD DEVIATION FROM THE MEAN TO ONE DECIMAL PLACE AND ALGEBRAICALLY SIGNED
14	F6.1	AVERAGED CONCENTRATION OF TERRESTRIAL URANIUM (BI-214) TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
15	F4.1	UNCERTAINTY IN TERRESTRIAL URANIUM TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
16	F5.1	URANIUM STANDARD DEVIATION FROM THE MEAN TO ONE DECIMAL PLACE AND ALGEBRAICALLY SIGNED
17	F6.1	AVERAGED CONCENTRATION OF TERRESTRIAL THORIUM (TL-208) TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH
18	F4.1	UNCERTAINTY IN TERRESTRIAL THORIUM TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH
19	F5.1	THORIUM STANDARD DEVIATION FROM THE MEAN TO ONE DECIMAL PLACE AND ALGEBRIACALLY SIGNED.

ITEM	FORMAT	DESCRIPTION
20	F8.1	GROSS GAMMA (0.4-3.0 MEV) COUNT RATE TO ONE DECIMAL PLACE IN COUNTS PER SECOND
21	F6.1	UNCERTAINTY IN GROSS GAMMA COUNT RATE TO ONE DECIMAL PLACE IN COUNTS PER SECOND
22	F5.1	ATMOSPHERIC BI-214 4PI CORRECTION TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
23	F4.1	UNCERTAINTY IN ATMOSPHERIC BI-214 4PI CORRECTION TO ONE DEICMAL PLACE IN PPM EQUIVALENT U
24	F4.1	AVERAGED URANIUM-TO-THORIUM RATIO TO ONE DECIMAL PLACE IN PPM EQUIVALENT U PER PPM EQUIVALENT TH
25	F5.1	URANIUM-TO-THORIUM RATIO STANDARD DEVIATION FROM THE MEAN TO ONE DECIMAL PLACE AND ALGEBRAICALLY SIGNED
26	F6.1	AVERAGED URANIUM-TO-POTASSIUM RATIO TO ONE DECIMAL PLACE IN PPM EQUIVALENT U PER PERCENT K
27	F5.1	THORIUM-TO-POTASSIUM RATIO STANDARD DEVIATION FROM THE MEAN TO ONE DECIMAL PLACE AND ALGEBRAICALLY SIGNED
D8	F6.1	AVERAGED THORIUM-TO-POTASSIUM RATIO TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH PER PERCENT K
29	F5.1	THORIUM-TO-POTASSIUM RATIO STANDARD DEVIATION FROM THE MEAN TO ONE DECIMAL PLACE AND ALGEBRAICALLY SIGNED

The remaining 440 characters in this block are blanks.

Block 2 - Statistical Analysis Identification Data

The second block contains the identifier information for the data contained in subsequent blocks according to the format specification in the first part of Block 1. The final 6078 characters on this block are blanks.

Block 3 - Statistical Analysis Data

The third and subsequent blocks contain statistical analysis data in the format specified by the second part of the Block 1. Fifty logical records are allowed per block. The method for determining uncertainty values shown, as of August 1979, remains undefined. These values are filled with 9's under format control.

MAGNETIC DATA TAPE

REFERENCE: Paragraphs 4.7.8 and 6.1.6, BFEC 1200-C

The Magentic Data Tape is an unlabeled, nine track, 800 BPI, NRZI. All data are recorded as EBCDIC characters. Each tape contains data for no more than one quadrangle and are divided into 8000-character blocks as described below.

Block 1 - Tape Format Description

The first block contains 3384 characters of format information in exactly the following format:

04 0978 (DATA TAPE TYPE AND FORMAT SPECIFICATION DATE CODES)

MAGNETIC DATA TAPE

FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK)

ITEM	FORMAT	DESCRIPTION
1	A40	QUADRANGLE NAME AS PROJECT IDENTIFICATION
2	A20	NAME OF SUBCONTRACTOR
3	I4	APPROXIMATE DATE OF SURVEY (MONTH., YEAR
4	I3	NUMBER OF FLIGHT LINES ON THIS TAPE
5	I4	FIRST FLIGHT LINE ON THIS TAPE
6	I6	FIRST RECORD NUMBER OF FIRST FLIGHT LINE
7	I3	JULIAN DATE (DAY OF YEAR) FIRST FLIGHT-LINE DATA WAS COLLECTED
8	F8.4	LATITUDE OF GROUND BASE STATION TO FOUR DECIMAL PLACES IN DEGREES FOR FIRST FLIGHT LINE
9	F8.4	LONGITUDE OF GROUND BASE STATION TO FOUR DECIMAL PLACES IN DEGREES FOR FIRST FLIGHT LINE
10-14	(SAME)	REPEAT OF ITEMS 5-9 FOR SECOND FLIGHT LINE ON THIS TAPE
*	*	*
*	*	*
*	*	*
495-499	(SAME)	REPEAT OF ITEMS 5-9 FOR 99th FLIGHT LINE ON THIS TAPE

FORMAT FOR MAGNETIC DATA RECORD (THIRD THRU LAST BLOCK)

ITEM	FORMAT	DESCRIPTION
1	I1	AERIAL SYSTEM IDENTIFICATION CODE
2	I4	FLIGHT LINE NUMBER
3	I6	RECORD IDENTIFICATION NUMBER
4	I6	GMT TIME OF DAY (HHMMSS)
5	F8.4	LATITUDE TO FOUR DECIMAL PLACES IN DEGREES

ITEM	FORMAT	DESCRIPTION
6	F8.4	LONGITUDE TO FOUR DECIMAL PLACES IN DEGREES
7	F6.1	TERRAIN CLEARANCE TO ONE DECIMAL PLACE IN METERS
8	F5.1	OUTSIDE AIR PRESSURE TO ONE DECIMAL PLACE IN MMHG
9	A8	SURFACE GEOLOGIC MAP UNIT CODE
10	F7.1	TOTAL MAGNETIC FIELD INTENSITY TO ONE DECIMAL PLACE IN GAMMAS
11	F7.1	RESIDUAL (IGRF REMOVED) MAGNETIC FIELD INTENSITY TO ONE DECIMAL PLACE IN GAMMAS
12	F7.1	DIURNAL MAGNETIC INTENSITY VARIATION TO ONE DECIMAL PLACE IN GAMMAS
13	F7.1	MAGNETIC DEPTH-TO-BASEMENT TO ONE DECIMAL PLACE IN METERS (IF REQUIRED)

The remaining 4616 characters in this block are blanks.

Block 2 - Magnetic Tape Identification Data

This block contains information about the data in subsequent blocks organized according to the format specification in the first half of Block 1.

Block 3 - Magnetic Data

This block and subsequent block contains magnetic data for the quadrangle organized according to the format specifications in the second half of Block 1. There will be 100 logical records per physical block.

STATISTIC ANALYSIS SUMMARY TAPE

REFERENCE: Paragraphs 4.7.9, BFEC 1200-C

The statistical analysis summary tape is an unlabeled, nine track, 800 BPI, NRZI. All data is recorded as EBCDIC characters. The block length is 700 characters long. Each tape contains one file of data for no more than one quadrangle.

Block 1 - Format Description Data

The first physical block on this tape contains a format description for data on subsequent blocks. The first 4320 characters on this block contains 60 lines of 72 characters exactly as written below:

05 0978 (DATA TAPE TYPE AND FORMAT SPECIFICATION DATE CODE)

STATISTICAL ANALYSIS SUMMARY TAPE (OR FILE)

FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK)

ITEM	FORMAT	DESCRIPTION
1	A40	QUADRANGLE NAME AS PROJECT IDENTIFICATION
2	A20	NAME OF SUBCONTRACTOR
3	I4	APPROXIMATE DATE OF SURVEY (MONTH, YEAR)
4	I6	NUMBER OF GEOLOGIC MAP UNITS USED FOR THIS QUADRANGLE

FORMAT FOR STATISTICAL ANALYSIS SUMMARY DATA RECORD (THIRD THRU LAST BLOCK)

ITEM	FORMAT	DESCRIPTION
1	A8	SURFACE GEOLOGIC MAP UNIT IDENTIFYING CODE
2	I6	TOTAL RECORDS FOR GEOLOGIC MAP UNIT
3	I6	NUMBER OF POTASSIUM RECORDS COMPUTED FOR GEOLOGIC UNIT
4	F6.1	POTASSIUM CONCENTRATION MEAN TO ONE DECIMAL PLACE IN PERCENT K
5	F6.1	POTASSIUM CONCENTRATION STANDARD DEVIATION TO ONE DECIMAL PLACE IN PERCENT K
6	A3	POTASSIUM CONCENTRATION DISTRIBUTION CODE
7	I6	NUMBER OF URANIUM RECORDS COMPUTED FOR GEOLOGIC UNIT
8	F6.1	URANIUM CONCENTRATION MEAN TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
9	F6.1	URANIUM CONCENTRATION STANDARD DEVIATION TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
10	A3	URANIUM CONCENTRATION DISTRIBUTION CODE
11	I6	NUMBER OF THORIUM RECORDS COMPUTED FOR GEOLOGIC UNIT
12	F6.1	THORIUM CONCENTRATION MEAN TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH
13	F6.1	THORIUM CONCENTRATION STANDARD DEVIATION TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH
14	A3	THORIUM CONCENTRATION DISTRIBUTION CODE
15	I6	NUMBER OF URANIUM-TO-THORIUM RATIO RECORDS COMPUTED FOR GEOLOGIC UNIT

16	F6.1	URANIUM-TO-THORIUM RATIO MEAN TO ONE DECIMAL PLACE IN PPM EQUIVALENT U PER PPM EQUIVALENT U PER PPM EQUIVALENT TH
17	F6.1	URANIUM-TO-THORIUM RATIO STANDARD DEVIATION TO ONE DECIMAL PLACE IN PPM EQUIVALENT U PER PPM EQUIVALENT TH
18	A3	URANIUM-TO-THORIUM RATIO DISTRIBUTION CODE
19	I6	NUMBER OF URANIUM-TO-POTASSIUM RATIO RECORDS COMPUTED FOR GEOLOGIC UNIT
20	F6.1	URANIUM -TO-POTASSIUM RATIO MEAN TO ONE DECIMAL PLACE IN PPM EQUIVALENT U PER PERCENT K
21	F6.1	URANIUM-TO-POTASSIUM RATIO STANDARD DEVIATION TO ONE DECIMAL PLACE IN PPM EQUIVALENT U PER PERCENT K
22	A3	URANIUM-TO-POTASSIUM RATIO DISTRIBUTION CODE
23	I6	NUMBER OF THORIUM-TO-POTASSIUM RATIO RECORDS COMPUTED FOR GEOLOGIC UNIT
24	F6.1	THORIUM-TO-POTASSIUM RATIO MEAN TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH PER PERCENT K
25	F6.1	THORIUM-TO-POTASSIUM RATIO STANDARD DEVIATION TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH PER PERCENT K
26	A3	THORIUM-TO-POTASSIUM RATIO DISTRIBUTION CODE

The remaining 2680 characters on this block shall be blanks.

Block 2 - Statistical Analysis Identification Data

The second block contains the identifier information for the data contained in subsequent blocks according to the format specification in the first part of Block 1. The final 6930 characters on this block are blanks.

Block 3 - Statistical Analysis Summary Data

The third and subsequent blocks contain statistical analysis data in the format specified by the second part of the Block 1. Fifty logical records are allowed per block.

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APPENDIX B - Flight Summary

APPENDIX B
DAILY PRODUCTION SUMMARY
NOVEMBER, DECEMBER, 1980
QUEEN AIR N9AG

Nov. 27-30	Aircraft Maintenance
Dec. 1-3	Base Mobilization
4	434 line miles Louisville, Huntington
5	434 " " " "
6	868 " " " "
7	Weather - nil production
8	848 line miles Louisville, Huntington
9	Weather - nil production
10	848 line miles Louisville, Huntington
11	Weather - nil production
12	630 line miles Marion
13	630 " " Marion
14	671 " " Marion, Toledo
15	Weather - nil production
16	" " " "
17	1055 line miles Cincinnati

AERO COMMANDER

Nov. 21	200 line miles Cincinnati
22	480 " " Vincennes
23-25	Weather - nil production
26	480 line miles Vincennes
27-30	Weather - nil production
Dec. 1	448 line miles Cincinnati, Vincennes
2	Weather - nil production
3	528 line miles Vincennes, Indianapolis
4	368 " " Indianapolis
5	206 " " "
6	206 " " "
7	Weather - nil production
8	Equipment problem
9	Weather - nil production
10	" " " "
11	" " " "
12	300 line miles Indianapolis
13	Weather - nil production
14	434 line miles Indianapolis
15	Weather - nil production
16	" " " "
17	399 line miles Cincinnati

Total miles for the above period = 10,467 line miles.
Total miles for the included quadrangles:

Louisville	1716.0
Huntington	1716.0
Indianapolis	1693.8
Cincinnati	1693.8
Vincennes	1716.0
Toledo	Unfinished
Marion	Unfinished

APPENDIX C - Flight Path and Geologic Map

SCALE 1:500,000

MILES 0 5 10 15

KILOMETRES 0 5 10 15 20

FLIGHT LINE SPACING 6.0 MILE(S)
FLIGHT ALTITUDE 400 FEET AMT
FLOWN AND COMPILED 1980-1981

LOCATION DIAGRAM

88° 78°

36°

INDIANA OHIO WEST VIRGINIA KENTUCKY TENNESSEE NORTH CAROLINA VIRGINIA

16-11 16-12 16-13 16-14 16-15 16-16 16-17 16-18 16-19 16-20 16-21 16-22 16-23 16-24 16-25 16-26

PIKE PIKE PIKE PIKE PIKE PIKE PIKE PIKE PIKE PIKE PIKE PIKE PIKE PIKE PIKE

U. S. DEPARTMENT OF ENERGY

HUNTINGTON QUADRANGLE
GEOLOGIC MAP EXPLANATION
(Martel Laboratories, 1981)

Cenozoic	Qal	Alluvium	Pleistocene & Holocene	Quaternary
	Qo	Outwash <i>Well sorted, layered sand & gravel, commonly crossbedded.</i>		
	Ql	Lacustrine deposits <i>Silt & clay, commonly laminated, with marl & peat in places.</i>		
	Qit	Hillolite till <i>Rolling, silty till with areas of deeply weathered gravel.</i>		
	Pd	Dunkard Group <i>Cyclic, non-marine sandstone, siltstone, shale, limestone, & coal. Lower part probably Pennsylvanian.</i>	Permian	
	Pm	Monongahela Group <i>Cyclic, non-marine sandstone, siltstone, shale, limestone, & coal.</i>		
	IPc	Conemaugh Formation <i>Cyclic sandstone, siltstone, & shale, with thin limestones & coals.</i>	Pennsylvanian	
	IPb IPap	IPb Breathitt Group <i>Siltstone, sandstone, & claystone, with some coal, ironstone, limestone, & chert.</i>		
	IPi	IPi Lee Formation <i>Sandstone, occasionally conglomeratic, & siltstone, with some claystone, coal, ironstone, & limestone. IPb & IPi in Kentucky are equivalent to IPap in Ohio.</i>		
	IPap	IPap Allegheny & Pottsville Groups undifferentiated <i>Sandstone with siltstone, shale, limestone, & coal</i>		
Paleozoic	Mu	Mississippian rocks undifferentiated <i>Silty claystone & argillaceous siltstone with some sandstone & limestone.</i>	Mississippian	
	Du	Devonian rocks undifferentiated <i>Carbonaceous shale with limestone & some sandstone & green shale.</i>		
	Su	Silurian rocks undifferentiated <i>Bluish-gray & green shale with thin layers of dolomitic limestone.</i>	Silurian	
	Or	Richmond Group <i>Limestone, mostly dolomitic or argillaceous, interbedded with shale, calcareous in part.</i>		
	Oma	Maysville Group <i>Interbedded limestone & shale with some fine sandstone & siltstone near base.</i>	Ordovician	
	Oe	Eden Group <i>Interbedded limestone & shale with some fine sandstone & siltstone near top.</i>		
	Oc	Cynthiana Formation <i>Crystalline limestone with thin shale beds increasing toward top.</i>		
	Oi Ot	Oi Lexington Formation <i>Limestone with some interbedded shale. Includes lower part of Cynthiana Fm.</i>		
	Ot	Ot Trenton Group <i>Crystalline, nodular, & argillaceous limestones with some metabentonite streaks.</i>		
		<i>Ot occurs in Kentucky, Oi in Ohio.</i>		

APPENDIX D - Profiles

LINE 730
HUNTINGTON QUADRANGLE - NTMS NJ 17-4
DATA ACQUIRED 80343

LINE 750
HUNTINGTON QUADRANGLE - NTMS NJ 17-4
DATA ACQUIRED 80339

BI AIR CORR
ED. PPM

RESID MAG
ED. PPM

RADAR ALTMTR
FEET

BI THALLIUM 208
ED. PPM

BI BISMUTH 214
ED. PPM

POTASSIUM 40
PERCENT

TOTAL COUNTS
CTS/SEC

BI/TL
BI/K

TL/K

TL/K	MIN .0000 MAX 13.98 MEAN 7.050 STD DEV 1.385
BI/K	MIN .0000 MAX 11.93 MEAN 2.745 STD DEV .8119
BI/TL	MIN .0000 MAX 1.914 MEAN .3922 STD DEV .1045
TOTAL COUNTS CTS/SEC	MIN 771.6 MAX 2319 MEAN 1758 STD DEV 208.5
POTASSIUM 40 PERCENT	MIN .1921 MAX 1.679 MEAN .9855 STD DEV .2125
BI BISMUTH 214 ED. PPM	MIN 1.097 MAX 5.194 MEAN 2.591 STD DEV .5053
BI THALLIUM 208 ED. PPM	MIN 1.079 MAX 10.54 MEAN 6.763 STD DEV 1.164
BI AIR CORR ED. PPM	MIN 1.053 MAX 2.233 MEAN 1.590 STD DEV .2041
RESID MAG ED. PPM	MIN -1655 MAX -125.0 MEAN -951.5 STD DEV 401.5
RADAR ALTMTR FEET	MIN 292.6 MAX 651.8 MEAN 428.0 STD DEV 59.18

LINE 770
HUNTINGTON QUADRANGLE - NTMS NJ 17-4
DATA ACQUIRED 80340

BI AIR CORR
EQ. PPM

RADAR ALTMT
FEET

THALLIUM 208
EQ. PPM

BISMUTH 214
EQ. PPM

POTASSIUM 40
PERCENT

TOTAL COUNTS
CTS/SEC

BI/TL
BI/TL

BI/K
BI/K

TL/K
TL/K

LINE 770

RADAR ALTMT
FEET
MIN 231.0
MAX 672.7
MEAN 403.9
STD DEV 67.11

RESID MAG
GAMMAS
MIN -1365
MAX 770.1
MEAN -725.0
STD DEV 350.2

BI AIR CORR
EQ. PPM
MIN .7823
MAX 2.676
MEAN 1.519
STD DEV .4342

THALLIUM 208
EQ. PPM
MIN 1.194
MAX 11.02
MEAN 7.659
STD DEV 1.278

BISMUTH 214
EQ. PPM
MIN 1.207
MAX 7.587
MEAN 3.452
STD DEV .9461

POTASSIUM 40
PERCENT
MIN .1520
MAX 2.184
MEAN 1.080
STD DEV .2602

TOTAL COUNTS
CTS/SEC
MIN 678.8
MAX 2822
MEAN 1902
STD DEV 281.7

BI/TL
MIN .0000
MAX 1.354
MEAN .4580
STD DEV .1331

BI/K
MIN .0000
MAX 14.16
MEAN 3.347
STD DEV 1.122

TL/K
MIN .0000
MAX 13.30
MEAN 7.340
STD DEV 1.535

LINE 790
HJNTINGTON QUADRANGLE - NTMS NJ 17-4
DATA ACQUIRED 80341

MIN	3.010
MAX	15.11
MEAN	7.033
STD DEV	1.383

MIN	.0000
MAX	9.701
MEAN	3.016
STD DEV	.9892

MIN	.0000
MAX	1.021
MEAN	.4267
STD DEV	.1072

MIN	840.5
MAX	2570
MEAN	1817
STD DEV	231.7

MIN	.2143
MAX	2.111
MEAN	1.008
STD DEV	.2693

MIN	1.151
MAX	6.684
MEAN	2.857
STD DEV	.6448

MIN	1.363
MAX	10.02
MEAN	6.821
STD DEV	1.141

MIN	1.179
MAX	2.350
MEAN	1.592
STD DEV	.2272

MIN	-934.3
MAX	83.02
MEAN	-451.9
STD DEV	233.0

MIN	275.3
MAX	673.5
MEAN	414.4
STD DEV	63.31

LINE 800 HUNTINGTON QUADRANGLE - NTMS NJ 17-4 DATA ACQUIRED 80341

BI AIR CORR
EQ. PPM

RADAR ALTMTR
FEET

THALLIUM 208
EQ. PPM

BISMUTH 214
EQ. PPM

POTASSIUM 40
PERCENT

TOTAL COUNTS
CTS/SEC

BI/TL

BI/K

TL/K

NETS
0 5 10 15 20 METERS

NETS
0 5 10 15 20 METERS

NETS
0 5 10 15 20 METERS

NETS
0 5 10 15 20 METERS

TL/K	MIN 3.119 MAX 12.13 MEAN 6.820 STD DEV 1.314
BI/K	MIN 1.011 MAX 7.894 MEAN 2.610 STD DEV .7379
BI/TL	MIN .1876 MAX 1.227 MEAN .3854 STD DEV .1016
TOTAL COUNTS CTS/SEC	MIN 1016 MAX 2748 MEAN 1869 STD DEV 258.4
POTASSIUM 40 PERCENT	MIN .3694 MAX 2.112 MEAN 1.112 STD DEV .2948
BISMUTH 214 EQ. PPM	MIN 1.230 MAX 7.275 MEAN 2.770 STD DEV .7065
THALLIUM 208 EQ. PPM	MIN 2.697 MAX 11.63 MEAN 7.205 STD DEV 1.214
BI AIR CORR EQ. PPM	MIN 1.174 MAX 2.022 MEAN 1.532 STD DEV .1877
RESID MAG GAMMAS	MIN -1124 MAX 457.9 MEAN -407.7 STD DEV 293.0
RADAR ALTMTR FEET	MIN 264.8 MAX 658.9 MEAN 395.1 STD DEV 60.07

LINE 810 HUNTINGTON QUADRANGLE - NTMS NJ 17-4 DATA ACQUIRED 80341

BI AIR CORR
EQ. PPM

TL/K	MIN 3.057 MAX 12.63 MEAN 6.793 STD DEV 1.298
BI/K	MIN 1.028 MAX 5.532 MEAN 2.458 STD DEV .6414
BI/TL	MIN .1231 MAX .9228 MEAN .3675 STD DEV .0974
TOTAL COUNTS CTS/SEC	MIN 1165 MAX 3162 MEAN 1812 STD DEV 267.4
POTASSIUM 40 PERCENT	MIN .5019 MAX 1.951 MEAN 1.075 STD DEV .2492
BISMUTH 214 EQ. PPM	MIN .8981 MAX 6.842 MEAN 2.575 STD DEV .7223
THALLIUM 208 EQ. PPM	MIN 3.848 MAX 10.91 MEAN 7.050 STD DEV 1.029
BI AIR CORR EQ. PPM	MIN 1.042 MAX 2.485 MEAN 1.499 STD DEV .3018
RESID MAG GAMMAS	MIN -1371 MAX 155.9 MEAN -435.4 STD DEV 279.9
RADAR ALTMTR FEET	MIN 272.5 MAX 644.3 MEAN 431.0 STD DEV 62.58

LINE 820
HUNTINGTON QUADRANGLE - NTMS NJ 17-4
DATA ACQUIRED 80345

LINE 840
HUNTINGTON QUADRANGLE - NTMS NJ 17-4
DATA ACQUIRED 80345

LINE 1150

LINE 1160
HUNTINGTON QUADRANGLE - NTMS NJ 17-4
DATA ACQUIRED 80343

BI AIR CORR 21
30. 10. 1961
10. 1961

[illegible]

LINE 1180

Parameter	Units	Min	Max	Mean	Std Dev
TL/K		.0000	10.75	7.589	.9681
BI/K		.0000	6.857	3.339	.5150
BI/TL		.2856	.7569	.4426	.0665
TOTAL COUNTS CTS/SEC		497.1	2371	1743	195.7
POTASSIUM 40 PERCENT		.1554	1.444	.9888	.1487
BISMUTH 214 EQ. PPM		.9476	4.905	3.254	.5085
THALLIUM 208 EQ. PPM		1.422	10.58	7.453	1.171
BI AIR CORR EQ. PPM		.4828	1.748	.9107	.2532
RESID MAG GAMMAS		-1244	-139.5	-661.4	331.6
RADAR ALTMTR FEET		237.4	586.1	380.0	60.57
LN F

LINE 730 HUNTINGTON QUADRANGLE - NTMS NJ 17-4 DATA ACQUIRED 80343

BARO PRESSURE
MM HG
MIN 713.0
MAX 736.1
MEAN 723.7
STD DEV 3.281

AIR TEMPERATURE
DEG C
MIN 13.00
MAX 16.00
MEAN 14.33
STD DEV .9810

RESIDUAL MAG
GAMMAS
MIN -1593
MAX 406.2
MEAN -873.6
STD DEV 471.6

DIURNAL
GAMMAS
MIN 55605
MAX 55616
MEAN 55604
STD DEV 6.932

RADAR ALTMTR
FEET
MIN 266.6
MAX 649.9
MEAN 418.3
STD DEV 56.43

LINF 730

LINE 740
HUNTINGTON QUADRANGLE - NTMS NJ 17-4
DATA ACQUIRED 80343

BARO PRESSURE
MM HG
MIN 711.1
MAX 738.3
MEAN 723.2
STD DEV 4.660

AIR TEMPERATURE
DEG C
MIN 15.00
MAX 18.00
MEAN 16.69
STD DEV 1.6394

RESIDUAL MAG
GAMMAS
MIN -1750
MAX 251.8
MEAN -885.1
STD DEV 467.1

DIURNAL
GAMMAS
MIN 55600
MAX 55625
MEAN 55604
STD DEV 9.090

RADAR ALTMTR
FEET
MIN 233.4
MAX 636.0
MEAN 379.3
STD DEV 57.12

LINE 750 HUNTINGTON QUADRANGLE - NTMS NJ 17-4 DATA ACQUIRED 80339

LINE 750

LINE 760
HUNTINGTON QUADRANGLE - NTMS NJ 17-4
DATA ACQUIRED 80339

LINE 760

LINE 770
HUNTINGTON QUADRANGLE - NTMS NJ 17-4
DATA ACQUIRED 80340

BARO PRESSURE
MM HG
MIN 720.2
MAX 749.0
MEAN 731.6
STD DEV 3.349

AIR TEMPERATURE
DEG C
MIN 5.000
MAX 9.000
MEAN 7.063
STD DEV 1.024

RESIDUAL MAG
GAMMAS
MIN -1365
MAX 770.1
MEAN -725.0
STD DEV 350.2

DIURNAL
GAMMAS
MIN 55616
MAX 55819
MEAN 55616
STD DEV 1.325

RADAR ALTMTR
FEET
MIN 231.0
MAX 672.7
MEAN 403.9
STD DEV 67.11

LINE 770

LINE 780 HUNTINGTON QUADRANGLE - NTMS NJ 17-4 DATA ACQUIRED 80340

BARO. PRESSURE
MM HG
MIN 721.0
MAX 740.2
MEAN 730.6
STD DEV 3.228

AIR TEMPERATURE
DEG C
MIN 6.000
MAX 11.00
MEAN 7.994
STD DEV 1.751

RESIDUAL MAG
GAMMAS
MIN -1258
MAX 431.4
MEAN -587.7
STD DEV 268.0

DIURNAL
GAMMAS
MIN 556.14
MAX 556.17
MEAN 556.06
STD DEV 7.271

RADAR ALTMTR
FEET
MIN 263.7
MAX 340.2
MEAN 304.8
STD DEV 52.55

LINE 780

LINE 790
HUNTINGTON QUADRANGLE - NTMS NJ 17-4
DATA ACQUIRED 80341

BARO PRESSURE
MM HG
MIN 717.8
MAX 743.8
MEAN 729.4
STD DEV 3.438

AIR TEMPERATURE
DEG C
MIN 10.00
MAX 13.00
MEAN 11.63
STD DEV .8576

RESIDUAL MAG
GAMMAS
MIN -934.3
MAX 83.02
MEAN -451.9
STD DEV 233.0

DIURNAL
GAMMAS
MIN 55621
MAX 55621
MEAN 55610
STD DEV 8.066

RADAR ALTMTR
FEET
MIN 275.3
MAX 673.5
MEAN 414.4
STD DEV 63.31

LINE 790

LINE 800
HUNTINGTON QUADRANGLE - NTMS NJ 17-4
DATA ACQUIRED 80341

BARO PRESSURE
MM HG

AIR TEMPERATURE
DEG C

RESIDUAL MAG
GAMMAS

DIURNAL
GAMMAS

RADAR ALTMTR
FEET

LINE 810
HUNTINGTON QUADRANGLE - NTMS NJ 17-4
DATA ACQUIRED 80341

LINE 820
HUNTINGTON QUADRANGLE - NTMS NJ 17-4
DATA ACQUIRED 80345

BARO PRESSURE
MM HG
MIN 715.6
MAX 740.4
MEAN 726.0
STD DEV 3.279

AIR TEMPERATURE
DEG C
MIN 2.000
MAX 17.00
MEAN 12.05
STD DEV 5.736

RESIDUAL MAG
GAMMAS
MIN -1260
MAX -100.2
MEAN -592.6
STD DEV 301.0

DIURNAL
GAMMAS
MIN 55606
MAX 55623
MEAN 55612
STD DEV 8.598

RADAR ALTMTR
FEET
MIN 251.6
MAX 403.7
MEAN 403.3
STD DEV 68.22

LINE 830
HUNTINGTON QUADRANGLE - NTMS NJ 17-4
DATA ACQUIRED 80345

BARO PRESSURE
MM HG
MIN 714.1
MAX 736.6
MEAN 723.9
STD DEV 3.308

AIR TEMPERATURE
DEG C
MIN .0000
MAX 3.000
MEAN 1.584
STD DEV .8387

RESIDUAL MAG
GAMMAS
MIN -1348
MAX 57.98
MEAN -558.4
STD DEV 231.8

DIURNAL
GAMMAS
MIN 5561.0
MAX 5561.5
MEAN 5560.4
STD DEV 9.343

RADAR ALTMTR
FEET
MIN 203.1
MAX 634.6
MEAN 411.8
STD DEV 64.62

LINE 840 HUNTINGTON QUADRANGLE - NTMS NJ 17-4 DATA ACQUIRED 80345

LINE 1150
HUNTINGTON QUADRANGLE - NTMS NJ 17-4
DATA ACQUIRED 80343

LINE 1160
HUNTINGTON QUADRANGLE - NTMS NJ 17-4
DATA ACQUIRED 80343

LINE 1170
HUNTINGTON QUADRANGLE - NTMS NJ 17-4
DATA ACQUIRED 80343

LINE 1190
HUNTINGTON QUADRANGLE - NTMS NJ 17-4
DATA ACQUIRED 80343

BARO. PRESSURE
MM HG
MIN 718.8
MAX 737.8
MEAN 726.2
STD DEV 2.059

AIR TEMPERATURE
DEG C
MIN 15.00
MAX 17.00
MEAN 16.38
STD DEV .5000

RESIDUAL MAG
GAMMAS
MIN -1244
MAX -139.5
MEAN -661.4
STD DEV 331.6

DIURNAL
GAMMAS
MIN 55600
MAX 55605
MEAN 55600
STD DEV 2.943

RADAR ALTMTR
FEET
MIN 237.4
MAX 586.1
MEAN 380.0
STD DEV 60.57

LINE 1190

LINE 1200
HUNTINGTON QUADRANGLE - NTMS NJ 17-4
DATA ACQUIRED 80343

APPENDIX E - Standard Deviation Maps

HUNTINGTON

SCALE 1:500,000

SURVEY AND
COMPILED BY:

EG&G GEOMETRICS

NOTE: ON E-W LINES, +σ TO NORTH, -σ TO SOUTH,
ON N-S LINES, +σ TO WEST, -σ TO EAST

LOCATION DIAGRAM

POTASSIUM STANDARD DEVIATION MAP

GREAT LAKES PROJECT

U. S. DEPARTMENT OF ENERGY

HUNTINGTON

SCALE 1:500,000

○ - DATA STATISTICALLY ADEQUATE
BLANK - DATA STATISTICALLY INADEQUATE
- - - - - 10' ABOUT MEASURE OF CENTRAL TENDENCY
NOTE: ON E-W LINES, +10 TO NORTH, -10 TO SOUTH.
ON N-S LINES, +10 WEST, -10 TO EAST.

1 SURVEY AND
COMPILED BY:

EG&G GEOMETRICS

URANIUM STANDARD DEVIATION MAP

GREAT LAKES PROJECT

U. S. DEPARTMENT OF ENERGY

HUNTINGTON

SCALE 1:600,000

○ - DATA STATISTICALLY ADEQUATE
 ○ - DATA STATISTICALLY INADEQUATE
 ⊕ - 1 σ ABOUT MEASURE OF CENTRAL TENDENCY
 NOTE: ON E-W LINES, ⊕ TO NORTH, ⊖ TO SOUTH.
 ON N-S LINES, ⊕ TO WEST, ⊖ TO EAST.

THORIUM STANDARD DEVIATION MAP

GHEAI LAKES PROJECT

U. S. DEPARTMENT OF ENERGY

SURVEY AND
 COMPILED BY:

EG&G GEOMETRICS

HUNTINGTON

SCALE 1:300,000

NOTE:
ON E-W LINES, +σ TO NORTH, -σ TO SOUTH.
ON N-S LINES, +σ TO WEST, -σ TO EAST.

THORIUM/POTASSIUM STANDARD DEVIATION MAP

GREAT LAKES PROJECT

U. S. DEPARTMENT OF ENERGY

SURVEY AND
COMPILED BY:
EG&G GEOMETRICS

HUNTINGTON

SCALE 1:500,000

NOTE: ON E-W LINES, +σ TO NORTH, -σ TO SOUTH.
ON N-S LINES, +σ TO WEST, -σ TO EAST.

LOCATION DIAGRAM

URANIUM/POTASSIUM STANDARD DEVIATION MAP

GREAT LAKES PROJECT

U. S. DEPARTMENT OF ENERGY

SURVEY AND
COMPILED BY:

EG&G GEOMETRICS

HUNTINGTON

SCALE 1:500,000

NOTE: ON E-W LINES, +σ TO NORTH, -σ TO SOUTH.
ON N-S LINES, +σ TO WEST, -σ TO EAST.

URANIUM/THORIUM STANDARD DEVIATION MAP.

GREAT LAKES PROJECT

U. S. DEPARTMENT OF ENERGY

SURVEY AND
COMPILED BY:
EG&G GEOMETRICS

**APPENDIX F - Histograms and Map Unit Conversion
Table**

THORIUM

URANIUM

POTASSIUM

U/K

U/TH

TH/K

THORIUM

URANIUM

POTASSIUM

U/K

U/TH

TH/K

NTMS NJ 17-4 HUNTINGTON

MAP UNIT : PAP

TOTAL NUMBER OF SAMPLES 2966

NTMS NJ 17-4 HUNTINGTON

MAP UNIT : 0E

TOTAL NUMBER OF SAMPLES 956

NTMS NJ 17-4 HUNTINGTON

MAP UNIT : OC

TOTAL NUMBER OF SAMPLES 106

HUNTINGTON QUADRANGLE

Computer Map Unit Symbol Conversion Table

<u>Computer Map Unit Symbol</u>	<u>Geologic Map Unit Symbol</u>
QAL	Qal
QO	Qo
QL	Ql
QIT	Qit
PD	Pd
PM	Pm
PC	Pc
PB	Pb
PL	Pl
PAP	Pap
MU	Mu
DU	Du
SU	Su
OR	Or
OMA	Oma
OE	Oe
OC	Oc
*OL	Ol
*OT	Ot

NOTES:

On the following pages, histograms for each computer map unit are included in the same order as they appear on the above list.

Geologic descriptions of original geologic map units are in Appendix A.

Areas over water or cultural features were assigned separate map unit symbols and were removed from the data block during processing.

*Statistical analysis was not performed on these units due to an insufficient number of samples.

**APPENDIX G - Uranium Anomaly Summary and
Statistical Tables**

ANOMALY SUMMARY TABLE						NUMBER OF SAMPLES WITH A STANDARD DEVIATION OF :										
AND FLIGHT	COMPUTER	MAP	UNIT	AND NO.	ANOMALOUS SAMPLES IN UNIT	PEAK PPM	1	2	3	4	5	6	7	GT7		
1 C	730	QIT	/ 5	/ 0	/ 0	3.1	4	1	0	0	0	0	0	0		
2 C	730	QIT	/ 1	/ 0	/ 0	3.2	0	0	1	0	0	0	0	0		
3 C	730	DU	/ 1MU	/ 3	/ 0	6.5	0	1	2	1	0	0	0	0		
4 C	730	PAP	/ 1	/ 0	/ 0	4.5	0	0	1	0	0	0	0	0		
5 C	730	PM	/ 1PC	/ 2	/ 0	3.7	1	2	0	0	0	0	0	0		
6 C	740	SU	/ 2	/ 0	/ 0	6.6	0	1	1	0	0	0	0	0		
7 C	740	MU	/ 1	/ 0	/ 0	4.9	0	0	0	1	0	0	0	0		
8 C	740	PC	/ 3	/ 0	/ 0	3.8	2	1	0	0	0	0	0	0		
9 C	750	PM	/ 1	/ 0	/ 0	4.1	0	0	1	0	0	0	0	0		
10 C	760	UMA	/ 30E	/ 1	/ 0	3.3	3	1	0	0	0	0	0	0		
11 C	760	UR	/ 1QAL	/ 1	/ 0	5.1	1	0	1	0	0	0	0	0		
12 C	760	MU	/ 2	/ 0	/ 0	4.4	1	0	1	0	0	0	0	0		
13 C	760	QAL	/ 2MU	/ 2	/ 0	4.5	1	3	0	0	0	0	0	0		
14 C	760	PAP	/ 2	/ 0	/ 0	3.8	0	2	0	0	0	0	0	0		
15 C	760	PAP	/ 2	/ 0	/ 0	4.1	0	1	1	0	0	0	0	0		
16 C	760	PC	/ 7	/ 0	/ 0	3.7	4	3	0	0	0	0	0	0		
17 C	760	PC	/ 2	/ 0	/ 0	4.1	1	0	1	0	0	0	0	0		
18 C	770	DU	/ 1SU	/ 5	/ 0	7.0	2	2	2	0	0	0	0	0		
19 C	770	SU	/ 3DU	/ 1	/ 0	6.3	3	1	0	0	0	0	0	0		
20 C	770	SU	/ 6	/ 0	/ 0	5.8	1	5	0	0	0	0	0	0		
21 C	770	SU	/ 4	/ 0	/ 0	6.2	1	3	0	0	0	0	0	0		
22 C	770	MU	/ 4PL	/ 2	/ 0	3.6	5	1	0	0	0	0	0	0		
23 C	770	GAL	/ 1MU	/ 1	/ 0	4.2	0	2	0	0	0	0	0	0		
24 C	770	PL	/ 1QAL	/ 1	/ 0	4.7	0	1	1	0	0	0	0	0		
25 C	770	PC	/ 1	/ 0	/ 0	4.3	0	0	1	0	0	0	0	0		
26 C	770	PM	/ 2	/ 0	/ 0	4.2	0	0	2	0	0	0	0	0		
27 C	780	SU	/ 3	/ 0	/ 0	6.8	0	1	2	0	0	0	0	0		
28 C	780	DU	/ 2SU	/ 1	/ 0	6.2	2	1	0	0	0	0	0	0		
29 C	780	PAP	/ 2	/ 0	/ 0	3.9	0	2	0	0	0	0	0	0		
30 C	780	PC	/ 4	/ 0	/ 0	4.5	0	2	2	0	0	0	0	0		
31 C	780	PC	/ 3PM	/ 2	/ 0	4.0	2	3	0	0	0	0	0	0		
32 C	790	UR	/ 3	/ 0	/ 0	3.4	2	1	0	0	0	0	0	0		
33 C	790	UR	/ 4	/ 0	/ 0	3.7	0	3	1	0	0	0	0	0		
34 C	790	UR	/ 1	/ 0	/ 0	4.1	0	0	1	0	0	0	0	0		
35 C	790	SU	/ 1DU	/ 1MU	/ 5	6.3	3	1	0	2	0	1	0	0		
36 C	790	MU	/ 3	/ 0	/ 0	4.4	1	1	1	0	0	0	0	0		
37 C	790	MU	/ 3	/ 0	/ 0	4.2	2	0	1	0	0	0	0	0		
38 C	790	PB	/ 3	/ 0	/ 0	3.8	1	2	0	0	0	0	0	0		
39 C	790	PB	/ 4	/ 0	/ 0	3.9	2	2	0	0	0	0	0	0		
40 C	790	PM	/ 5	/ 0	/ 0	3.9	2	3	0	0	0	0	0	0		
41 C	790	PM	/ 2PC	/ 2	/ 0	4.2	2	1	1	0	0	0	0	0		
42 C	790	PM	/ 1PC	/ 2	/ 0	3.8	1	2	0	0	0	0	0	0		
43 C	790	PM	/ 6	/ 0	/ 0	3.8	5	1	0	0	0	0	0	0		
44 C	800	UC	/ 1	/ 0	/ 0	3.7	0	0	1	0	0	0	0	0		
45 C	800	UR	/ 4	/ 0	/ 0	3.3	3	1	0	0	0	0	0	0		
46 C	800	SU	/ 1DU	/ 1MU	/ 1	5.8	1	1	1	0	0	0	0	0		
47 C	800	SU	/ 1	/ 0	/ 0	7.2	0	0	1	0	0	0	0	0		
48 C	800	QAL	/ 1PB	/ 2	/ 0	3.5	2	1	0	0	0	0	0	0		
49 C	800	PB	/ 5	/ 0	/ 0	3.6	1	4	0	0	0	0	0	0		
50 C	800	PB	/ 1PC	/ 2	/ 0	3.9	0	3	0	0	0	0	0	0		

ANOMALY SUMMARY TABLE														
ANOMALY	FLIGHT	COMPUTER MAP UNIT AND NO.	ANOMALOUS SAMPLES IN UNIT			PEAK PPM	NUMBER OF SAMPLES WITH A STANDARD DEVIATION OF :							
							1	2	3	4	5	6	7	GT7
51 C	800	PB	/ 1	/ 0	/ 0	3.9	0	0	1	0	0	0	0	0
52 C	800	PB	/ 1	/ 0	/ 0	4.2	0	0	1	0	0	0	0	0
53 C	800	PC	/ 1	/ 0	/ 0	4.0	2	3	1	0	0	0	0	0
54 C	800	PC	/ 1	/ 0	/ 0	4.3	0	0	1	0	0	0	0	0
55 C	800	PC	/ 1	/ 0	/ 0	4.0	0	0	1	0	0	0	0	0
56 C	800	PC	/ 3	/ 0	/ 0	3.9	2	1	0	0	0	0	0	0
57 C	810	OMA	/ 1	/ 0	/ 0	3.5	0	0	1	0	0	0	0	0
58 C	810	SU	/ 1PM	/ 1MU	/ 2DU	6.6	2	0	1	0	1	0	1	0
59 C	810	SU	/ 2	/ 0	/ 0	6.4	0	1	1	0	0	0	0	0
60 C	810	SU	/ 2	/ 0	/ 0	5.9	0	2	0	0	0	0	0	0
61 C	810	PB	/ 1	/ 0	/ 0	4.3	0	0	1	0	0	0	0	0
62 C	820	SU	/ 4DU	/ 1	/ 0	7.9	1	2	1	1	0	0	0	0
63 C	820	DU	/ 3MU	/ 3	/ 0	8.0	3	2	1	0	0	0	0	0
64 C	820	MU	/ 2	/ 0	/ 0	5.1	0	0	1	1	0	0	0	0
65 C	830	MU	/ 1	/ 0	/ 0	4.7	0	0	1	0	0	0	0	0
66 C	830	DU	/ 3SU	/ 1	/ 0	6.1	3	1	0	0	0	0	0	0
67 C	830	SU	/ 1QAL	/ 4DU	/ 2	6.9	4	0	2	0	1	0	0	0
68 C	830	MU	/ 2	/ 0	/ 0	5.0	1	0	0	1	0	0	0	0
69 C	830	PB	/ 2	/ 0	/ 0	3.4	0	2	0	0	0	0	0	0
70 C	840	DU	/ 5	/ 0	/ 0	7.2	2	3	0	0	0	0	0	0
71 C	1150	DU	/ 4SU	/ 2OR	/ 1	10.8	0	4	1	2	0	0	0	0
72 C	1150	OR	/ 2	/ 0	/ 0	3.7	0	1	1	0	0	0	0	0
73 C	1150	OMA	/ 4OE	/ 1	/ 0	3.3	3	2	0	0	0	0	0	0
74 C	1150	OMA	/ 3	/ 0	/ 0	3.1	2	1	0	0	0	0	0	0
75 C	1150	OR	/ 1OMA	/ 1	/ 0	3.4	0	2	0	0	0	0	0	0
76 C	1150	QIT	/ 3	/ 0	/ 0	3.2	2	0	1	0	0	0	0	0
77 C	1160	SU	/ 3DU	/ 1	/ 0	6.3	1	3	0	0	0	0	0	0
78 C	1160	SU	/ 5DU	/ 1MU	/ 2	6.3	2	4	1	0	0	1	0	0
79 C	1160	SU	/ 3DU	/ 1	/ 0	5.8	2	2	0	0	0	0	0	0
80 C	1170	GAL	/ 2PB	/ 1	/ 0	4.1	1	2	0	0	0	0	0	0
81 C	1170	PB	/ 3PL	/ 1MU	/ 1	4.0	3	1	1	0	0	0	0	0
82 C	1170	PL	/ 2PB	/ 1	/ 0	3.7	0	3	0	0	0	0	0	0
83 C	1170	PL	/ 4	/ 0	/ 0	3.6	2	2	0	0	0	0	0	0
84 C	1170	PL	/ 3PB	/ 1	/ 0	3.4	1	3	0	0	0	0	0	0
85 C	1170	PL	/ 1PB	/ 3	/ 0	3.4	3	1	0	0	0	0	0	0
86 C	1170	MU	/ 2PL	/ 1	/ 0	3.8	0	3	0	0	0	0	0	0
87 C	1170	MU	/ 4	/ 0	/ 0	3.6	3	1	0	0	0	0	0	0
88 C	1170	MU	/ 2	/ 0	/ 0	3.7	0	2	0	0	0	0	0	0
89 C	1180	PB	/ 1	/ 0	/ 0	5.0	0	0	0	1	0	0	0	0
90 C	1180	PB	/ 2	/ 0	/ 0	4.0	0	1	1	0	0	0	0	0
91 C	1180	PB	/ 3	/ 0	/ 0	3.4	2	1	0	0	0	0	0	0
92 C	1190	PC	/ 4	/ 0	/ 0	4.1	2	1	1	0	0	0	0	0
93 C	1190	PC	/ 3	/ 0	/ 0	3.8	2	1	0	0	0	0	0	0
94 C	1190	PAP	/ 1	/ 0	/ 0	4.1	0	0	1	0	0	0	0	0
95 C	1200	PC	/ 2PB	/ 1	/ 0	3.8	1	2	0	0	0	0	0	0
96 C	1200	PC	/ 3	/ 0	/ 0	4.2	1	0	2	0	0	0	0	0
97 C	1200	PC	/ 7	/ 0	/ 0	3.9	4	3	0	0	0	0	0	0
98 C	1200	PM	/ 2	/ 0	/ 0	4.0	0	2	0	0	0	0	0	0
99 C	1200	PC	/ 1	/ 0	/ 0	4.0	0	0	1	0	0	0	0	0
100 C	1200	PM	/ 1PC	/ 1	/ 0	3.8	0	2	0	0	0	0	0	0

			MAP UNIT QAL						
			-3	-2	-1	0	+1	+2	+3
POTASIMUM	DIST	NORMAL	0. 2445	0. 4889	0. 7333	0. 9777	1. 2221	1. 4665	1. 7109
URANIUM	DIST	NORMAL	0. 6312	1. 3403	2. 0494	2. 7585	3. 4676	4. 1767	4. 8858
THORIUM	DIST	NORMAL	2. 3827	3. 8384	5. 2941	6. 7498	8. 2055	9. 6612	11. 1169
U/K	DIST	NORMAL	0. 1239	1. 0713	2. 0187	2. 9661	3. 9135	4. 8609	5. 8083
U/TH	DIST	NORMAL	0. 0739	0. 1894	0. 3049	0. 4204	0. 5359	0. 6514	0. 7669
TH/K	DIST	NORMAL	2. 8120	4. 2443	5. 6766	7. 1089	8. 5412	9. 9735	11. 4058

			MAP UNIT QO						
			-3	-2	-1	0	+1	+2	+3
POTASIMUM	DIST	NORMAL	0. 6156	0. 7213	0. 8270	0. 9327	1. 0384	1. 1441	1. 2498
URANIUM	DIST	NORMAL	0. 7333	1. 4252	2. 1171	2. 8090	3. 5009	4. 1928	4. 8847
THORIUM	DIST	NORMAL	3. 0501	3. 8860	4. 7219	5. 5578	6. 3937	7. 2296	8. 0655
U/K	DIST	NORMAL	0. 9340	1. 6293	2. 3246	3. 0199	3. 7152	4. 4105	5. 1058
U/TH	DIST	NORMAL	-0. 0290	0. 1551	0. 3392	0. 5233	0. 7074	0. 8915	1. 0756
TH/K	DIST	NORMAL	2. 2706	3. 5266	4. 7826	6. 0386	7. 2946	8. 5506	9. 8066

			MAP UNIT QL						
			-3	-2	-1	0	+1	+2	+3
POTASIMUM	DIST	NORMAL	0. 3868	0. 5187	0. 6506	0. 7825	0. 9144	1. 0463	1. 1782
URANIUM	DIST	NORMAL	1. 6899	2. 0904	2. 4909	2. 8914	3. 2919	3. 6924	4. 0929
THORIUM	DIST	NORMAL	4. 3128	5. 1906	6. 0684	6. 9462	7. 8240	8. 7018	9. 5796
U/K	DIST	NORMAL	2. 0529	2. 6182	3. 1835	3. 7488	4. 3141	4. 8794	5. 4447
U/TH	DIST	NORMAL	0. 2366	0. 2977	0. 3588	0. 4199	0. 4810	0. 5421	0. 6032
TH/K	DIST	NORMAL	5. 3103	6. 5426	7. 7749	9. 0072	10. 2395	11. 4718	12. 7041

			MAP UNIT QIT						
			-3	-2	-1	0	+1	+2	+3
POTASIMUM	DIST	NORMAL	0. 3652	0. 5493	0. 7334	0. 9175	1. 1016	1. 2857	1. 4698
URANIUM	DIST	NORMAL	1. 2683	1. 6138	1. 9593	2. 3048	2. 6503	2. 9958	3. 3413
THORIUM	DIST	NORMAL	4. 3295	5. 0889	5. 8483	6. 6077	7. 3671	8. 1265	8. 8859
U/K	DIST	NORMAL	0. 8035	1. 4030	2. 0025	2. 6020	3. 2015	3. 8010	4. 4005
U/TH	DIST	NORMAL	0. 1701	0. 2308	0. 2915	0. 3522	0. 4129	0. 4736	0. 5343
TH/K	DIST	NORMAL	3. 3822	4. 7284	6. 0746	7. 4208	8. 7670	10. 1132	11. 4594

			MAP UNIT PD						
			-3	-2	-1	0	+1	+2	+3
POTASIMUM	DIST	NORMAL	0. 5742	0. 6825	0. 7908	0. 8991	1. 0074	1. 1157	1. 2240
URANIUM	DIST	NORMAL	1. 6022	1. 9717	2. 3412	2. 7107	3. 0802	3. 4497	3. 8192
THORIUM	DIST	NORMAL	5. 7427	6. 5005	7. 2583	8. 0161	8. 7739	9. 5317	10. 2895
U/K	DIST	NORMAL	1. 4173	1. 9641	2. 5109	3. 0577	3. 6045	4. 1513	4. 6981
U/TH	DIST	NORMAL	0. 1756	0. 2307	0. 2858	0. 3409	0. 3960	0. 4511	0. 5062
TH/K	DIST	NORMAL	5. 0993	6. 4119	7. 7245	9. 0371	10. 3497	11. 6623	12. 9749

			MAP UNIT PM						
			-3	-2	-1	0	+1	+2	+3
POTASIMUM	DIST	NORMAL	0. 6073	0. 7470	0. 8867	1. 0264	1. 1661	1. 3058	1. 4455
URANIUM	DIST	NORMAL	1. 4205	1. 9127	2. 4049	2. 8971	3. 3893	3. 8815	4. 3737
THORIUM	DIST	NORMAL	5. 5089	6. 3776	7. 2463	8. 1150	8. 9837	9. 8524	10. 7211
U/K	DIST	NORMAL	1. 3572	1. 8553	2. 3534	2. 8515	3. 3496	3. 8477	4. 3458
U/TH	DIST	NORMAL	0. 1659	0. 2304	0. 2949	0. 3594	0. 4239	0. 4884	0. 5529
TH/K	DIST	NORMAL	5. 1354	6. 0863	7. 0372	7. 9881	8. 9390	9. 8899	10. 8408

			MAP UNIT PC						
			-3	-2	-1	0	+1	+2	+3
POTASium	DIST	NORMAL	0. 5560	0. 7098	0. 8636	1. 0174	1. 1712	1. 3250	1. 4788
URANIUM	DIST	NORMAL	1. 1271	1. 6520	2. 1769	2. 7018	3. 2267	3. 7516	4. 2765
THORIUM	DIST	NORMAL	4. 2949	5. 3986	6. 5023	7. 6060	8. 7097	9. 8134	10. 9171
U/K	DIST	NORMAL	1. 0729	1. 6112	2. 1495	2. 6878	3. 2261	3. 7644	4. 3027
U/TH	DIST	NORMAL	0. 1778	0. 2376	0. 2974	0. 3572	0. 4170	0. 4768	0. 5366
TH/K	DIST	NORMAL	4. 5598	5. 5541	6. 5484	7. 5427	8. 5370	9. 5313	10. 5256

			MAP UNIT PB						
			-3	-2	-1	0	+1	+2	+3
POTASium	DIST	NORMAL	0. 4859	0. 6575	0. 8291	1. 0007	1. 1723	1. 3439	1. 5155
URANIUM	DIST	NORMAL	0. 6748	1. 2638	1. 8528	2. 4418	3. 0308	3. 6198	4. 2088
THORIUM	DIST	NORMAL	3. 0116	4. 2302	5. 4488	6. 6674	7. 8860	9. 1046	10. 3232
U/K	DIST	NORMAL	0. 6593	1. 2648	1. 8703	2. 4758	3. 0813	3. 6868	4. 2923
U/TH	DIST	NORMAL	0. 1488	0. 2221	0. 2954	0. 3687	0. 4420	0. 5153	0. 5886
TH/K	DIST	NORMAL	3. 7042	4. 7100	5. 7158	6. 7216	7. 7274	8. 7332	9. 7390

			MAP UNIT PL						
			-3	-2	-1	0	+1	+2	+3
POTASium	DIST	NORMAL	0. 2507	0. 4561	0. 6615	0. 8669	1. 0723	1. 2777	1. 4831
URANIUM	DIST	NORMAL	0. 7685	1. 3215	1. 8745	2. 4275	2. 9805	3. 5335	4. 0865
THORIUM	DIST	NORMAL	2. 8009	3. 9620	5. 1231	6. 2842	7. 4453	8. 6064	9. 7675
U/K	DIST	NORMAL	0. 3991	1. 2378	2. 0765	2. 9152	3. 7539	4. 5926	5. 4313
U/TH	DIST	NORMAL	0. 1450	0. 2270	0. 3090	0. 3910	0. 4730	0. 5550	0. 6370
TH/K	DIST	NORMAL	3. 6370	4. 9052	6. 1734	7. 4416	8. 7098	9. 9780	11. 2462

			MAP UNIT PAP						
			-3	-2	-1	0	+1	+2	+3
POTASIUM	DIST	NORMAL	0. 4164	0. 5986	0. 7808	0. 9630	1. 1452	1. 3274	1. 5096
URANIUM	DIST	NORMAL	1. 0500	1. 5851	2. 1202	2. 6553	3. 1904	3. 7255	4. 2606
THORIUM	DIST	NORMAL	3. 3657	4. 5442	5. 7227	6. 9012	8. 0797	9. 2582	10. 4367
U/K	DIST	NORMAL	1. 0988	1. 6688	2. 2388	2. 8088	3. 3788	3. 9488	4. 5188
U/TH	DIST	NORMAL	0. 1809	0. 2501	0. 3193	0. 3885	0. 4577	0. 5269	0. 5961
TH/K	DIST	NORMAL	3. 9585	5. 0628	6. 1671	7. 2714	8. 3757	9. 4800	10. 5843

			MAP UNIT MU						
			-3	-2	-1	0	+1	+2	+3
POTASIUM	DIST	NORMAL	0. 3335	0. 5055	0. 6775	0. 8495	1. 0215	1. 1935	1. 3655
URANIUM	DIST	NORMAL	0. 4785	1. 1416	1. 8047	2. 4678	3. 1309	3. 7940	4. 4571
THORIUM	DIST	NORMAL	3. 5732	4. 5181	5. 4630	6. 4079	7. 3528	8. 2977	9. 2426
U/K	DIST	NORMAL	0. 5485	1. 3543	2. 1601	2. 9659	3. 7717	4. 5775	5. 3833
U/TH	DIST	NORMAL	0. 1026	0. 1974	0. 2922	0. 3870	0. 4818	0. 5766	0. 6714
TH/K	DIST	NORMAL	4. 0631	5. 2776	6. 4921	7. 7066	8. 9211	10. 1356	11. 3501

			MAP UNIT DU						
			-3	-2	-1	0	+1	+2	+3
POTASium	DIST	NORMAL	0. 3394	0. 5728	0. 8062	1. 0396	1. 2730	1. 5064	1. 7398
URANIUM	DIST	NORMAL	-0. 4220	1. 0768	2. 5756	4. 0744	5. 5732	7. 0720	8. 5708
THORIUM	DIST	NORMAL	4. 3820	5. 2541	6. 1252	6. 9963	7. 8674	8. 7385	9. 6096
U/K	DIST	NORMAL	0. 8595	1. 8733	2. 8871	3. 9009	4. 9147	5. 9285	6. 9423
U/TH	DIST	NORMAL	-0. 0361	0. 1705	0. 3771	0. 5837	0. 7903	0. 9969	1. 2035
TH/K	DIST	NORMAL	2. 8658	4. 2353	5. 6048	6. 9743	8. 3438	9. 7133	11. 0828

			MAP UNIT BU						
			-3	-2	-1	0	+1	+2	+3
POTASium	DIST	NORMAL	0.3508	0.6058	0.8608	1.1158	1.3708	1.6258	1.8808
URANIUM	DIST	NORMAL	-0.4752	0.7693	2.0138	3.2583	4.5028	5.7473	6.9918
THORIUM	DIST	NORMAL	4.7207	5.7108	6.7009	7.6910	8.6811	9.6712	10.6613
U/K	DIST	NORMAL	-0.1264	0.9133	1.9530	2.9927	4.0324	5.0721	6.1118
U/TH	DIST	NORMAL	-0.0899	0.0832	0.2563	0.4294	0.6025	0.7756	0.9487
TH/K	DIST	NORMAL	1.9954	3.7347	5.4740	7.2133	8.9526	10.6919	12.4312

			MAP UNIT OR						
			-3	-2	-1	0	+1	+2	+3
POTASium	DIST	NORMAL	0.5746	0.7894	1.0042	1.2190	1.4338	1.6486	1.8634
URANIUM	DIST	NORMAL	0.9311	1.4264	1.9217	2.4170	2.9123	3.4076	3.9029
THORIUM	DIST	NORMAL	4.3255	5.2869	6.2483	7.2097	8.1711	9.1325	10.0939
U/K	DIST	NORMAL	-0.1489	0.5951	1.3391	2.0831	2.8271	3.5711	4.3151
U/TH	DIST	NORMAL	0.1188	0.1921	0.2654	0.3387	0.4120	0.4853	0.5586
TH/K	DIST	NORMAL	1.6106	3.1143	4.6180	6.1217	7.6254	9.1291	10.6328

			MAP UNIT OMA						
			-3	-2	-1	0	+1	+2	+3
POTASium	DIST	NORMAL	0.5336	0.7681	1.0026	1.2371	1.4716	1.7061	1.9406
URANIUM	DIST	NORMAL	1.4132	1.7801	2.1470	2.5139	2.8808	3.2477	3.6146
THORIUM	DIST	NORMAL	5.1577	5.9433	6.7289	7.5145	8.3001	9.0857	9.8713
U/K	DIST	NORMAL	0.3620	0.9481	1.5342	2.1203	2.7064	3.2925	3.8786
U/TH	DIST	NORMAL	0.1624	0.2208	0.2792	0.3376	0.3960	0.4544	0.5128
TH/K	DIST	NORMAL	1.8190	3.3173	4.8156	6.3139	7.8122	9.3105	10.8088

			MAP UNIT OE						
			-3	-2	-1	0	+1	+2	+3
POTASium	DIST	NORMAL	0.6191	0.9297	1.2403	1.5509	1.8615	2.1721	2.4827
URANIUM	DIST	NORMAL	1.1074	1.5274	1.9474	2.3674	2.7874	3.2074	3.6274
THORIUM	DIST	NORMAL	4.6176	5.4651	6.3126	7.1601	8.0076	8.8551	9.7026
U/K	DIST	NORMAL	0.3370	0.7525	1.1680	1.5835	1.9990	2.4145	2.8300
U/TH	DIST	NORMAL	0.1393	0.2041	0.2689	0.3337	0.3985	0.4633	0.5281
TH/K	DIST	NORMAL	1.7314	2.7466	3.7618	4.7770	5.7922	6.8074	7.8226

			MAP UNIT OC						
			-3	-2	-1	0	+1	+2	+3
POTASium	DIST	NORMAL	0.7391	1.0295	1.3199	1.6103	1.9007	2.1911	2.4815
URANIUM	DIST	NORMAL	1.0487	1.5081	1.9675	2.4269	2.8863	3.3457	3.8051
THORIUM	DIST	NORMAL	4.9841	5.7029	6.4217	7.1405	7.8593	8.5781	9.2969
U/K	DIST	NORMAL	0.2065	0.6596	1.1127	1.5658	2.0189	2.4720	2.9251
U/TH	DIST	NORMAL	0.1005	0.1820	0.2635	0.3450	0.4265	0.5080	0.5895
TH/K	DIST	NORMAL	2.5371	3.2009	3.8647	4.5285	5.1923	5.8561	6.5199

LINE BASED MEAN CONCENTRATIONS AND RATIOS PER ROCK TYPE

MAP UNIT GAL

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MAP UNIT QU

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MAP UNIT QL

	730	740	750	760	770	780	790	800	810	820	830	840	1150	1160	1170
POTASium	0.777	0.649	0.819	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
URANIUM	2.954	2.455	2.876	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
THORIUM	7.064	6.305	6.161	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U/K	3.834	3.784	3.579	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U/TH	0.425	0.389	0.468	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TH/K	9.192	9.766	7.637	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

	1180	1190	1200
POTASium	0.797	0.000	0.000
URANIUM	2.951	0.000	0.000
THORIUM	7.200	0.000	0.000
U/K	3.765	0.000	0.000
U/TH	0.413	0.000	0.000
TH/K	9.157	0.000	0.000

MAP UNIT QIT

	730	740	750	760	770	780	790	800	810	820	830	840	1150	1160	1170
POTASium	0.841	0.856	1.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.867	0.982	0.000
URANIUM	2.361	2.315	2.280	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.245	2.298	0.000
THORIUM	6.422	6.730	6.662	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	6.483	7.456	0.000
U/K	2.865	2.738	2.089	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.667	2.351	0.000
U/TH	0.372	0.347	0.345	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.348	0.310	0.000
TH/K	7.780	7.939	6.098	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	7.635	7.625	0.000

	1180	1190	1200
POTASium	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000
THORIUM	0.000	0.000	0.000
U/K	0.000	0.000	0.000
U/TH	0.000	0.000	0.000
TH/K	0.000	0.000	0.000

MAP UNIT PD

	730	740	750	760	770	780	790	800	810	820	830	840	1150	1160	1170
POTASium	0.951	1.004	0.960	0.920	0.853	0.932	0.937	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
URANIUM	2.601	3.360	2.606	2.627	2.743	2.489	3.163	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
THORIUM	8.497	8.702	7.611	7.585	8.091	8.533	7.511	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U/K	2.732	3.362	2.729	2.862	3.250	2.721	3.368	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U/TH	0.307	0.388	0.345	0.350	0.341	0.293	0.421	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TH/K	9.024	8.718	8.045	8.263	9.578	9.259	8.033	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

	1180	1190	1200
POTASium	0.000	0.000	0.795
URANIUM	0.000	0.000	2.941
THORIUM	0.000	0.000	7.891
U/K	0.000	0.000	3.779
U/TH	0.000	0.000	0.374
TH/K	0.000	0.000	10.107

MAP UNIT PM

	730	740	750	760	770	780	790	800	810	820	830	840	1150	1160	1170
POTASium	1.004	0.987	1.025	1.037	1.051	1.050	1.010	1.040	1.124	0.000	0.000	0.000	0.000	0.000	0.000
URANIUM	2.842	2.911	2.627	2.890	2.731	2.971	3.024	2.864	2.997	0.000	0.000	0.000	0.000	0.000	0.000
THORIUM	7.943	8.634	7.753	8.075	8.363	8.636	7.571	7.898	7.869	0.000	0.000	0.000	0.000	0.000	0.000
U/K	2.844	2.997	2.599	2.825	2.627	2.852	3.023	2.771	2.668	0.000	0.000	0.000	0.000	0.000	0.000
U/TH	0.358	0.338	0.341	0.360	0.328	0.346	0.401	0.365	0.386	0.000	0.000	0.000	0.000	0.000	0.000
TH/K	7.997	8.849	7.640	7.856	8.027	8.291	7.569	7.638	7.318	0.000	0.000	0.000	0.000	0.000	0.000

	1180	1190	1200
POTASium	0.000	0.949	1.003
URANIUM	0.000	2.689	2.947
THORIUM	0.000	8.163	8.219
U/K	0.000	2.862	2.963
U/TH	0.000	0.333	0.360
TH/K	0.000	8.632	8.266

MAP UNIT PC

	730	740	750	760	770	780	790	800	810	820	830	840	1150	1160	1170
POTASium	0.973	0.969	0.974	1.011	1.087	1.130	1.003	1.113	1.045	1.018	0.955	0.977	0.000	0.000	0.000
URANIUM	2.754	3.000	2.721	2.761	2.659	3.042	2.917	2.913	2.610	2.361	2.254	2.126	0.000	0.000	0.000
THORIUM	7.557	8.379	7.405	7.295	8.158	8.425	7.613	8.098	7.553	7.157	7.004	6.410	0.000	0.000	0.000
U/K	2.876	3.138	2.846	2.769	2.473	2.709	2.943	2.638	2.524	2.341	2.397	2.205	0.000	0.000	0.000
U/TH	0.368	0.361	0.372	0.384	0.328	0.363	0.384	0.361	0.348	0.331	0.327	0.334	0.000	0.000	0.000
TH/K	7.832	8.733	7.697	7.257	7.565	7.498	7.692	7.331	7.280	7.094	7.384	6.628	0.000	0.000	0.000

	1180	1190	1200
POTASIUUM	1. 015	0. 977	0. 970
URANIUM	2. 980	2. 764	2. 962
THORIUM	7. 812	7. 630	7. 790
U/K	2. 995	2. 853	3. 071
U/TH	0. 384	0. 364	0. 381
TH/K	7. 798	7. 869	8. 076

MAP UNIT PB

	730	740	750	760	770	780	790	800	810	820	830	840	1150	1160	1170
POTASSIUM	0.000	0.000	0.000	0.000	0.817	0.927	0.966	1.111	1.046	1.014	0.986	1.015	0.000	0.000	0.975
URANIUM	0.000	0.000	0.000	0.000	2.687	2.654	2.891	2.929	2.606	2.273	2.283	2.021	0.000	0.000	2.938
THORIUM	0.000	0.000	0.000	0.000	7.043	6.623	6.540	7.654	7.189	6.776	6.576	6.037	0.000	0.000	6.975
U/K	0.000	0.000	0.000	0.000	3.455	2.897	3.076	2.716	2.501	2.267	2.342	2.011	0.000	0.000	3.063
U/TH	0.000	0.000	0.000	0.000	0.386	0.403	0.452	0.389	0.364	0.339	0.351	0.337	0.000	0.000	0.424
TH/K	0.000	0.000	0.000	0.000	8.848	7.198	6.825	6.995	6.895	6.724	6.724	5.999	0.000	0.000	7.238

	1180	1190	1200
POTASIUUM	1. 017	0. 990	0. 915
URANIUM	2. 968	2. 712	2. 422
THORIUM	7. 635	7. 082	6. 159
U/K	2. 952	2. 755	2. 655
U/TH	0. 391	0. 389	0. 396
TH/K	7. 584	7. 175	6. 762

MAP UNIT MU

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MAP UNIT DU

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MAP UNIT SU

	730	740	750	760	770	780	790	800	810	820	830	840	1150	1160	1170
POTASium	1.005	1.037	1.023	1.009	1.268	1.108	1.141	1.336	1.319	1.331	1.315	1.016	1.058	1.036	0.000
URANIUM	2.763	3.202	2.870	3.116	4.159	2.975	3.812	3.894	3.598	4.465	3.230	3.412	3.020	3.062	0.000
THORIUM	7.679	7.389	7.538	7.355	8.436	7.606	7.569	7.417	7.455	7.009	7.903	7.305	7.076	7.867	0.000
U/K	2.821	3.078	2.990	3.257	3.369	2.737	3.457	2.938	2.769	3.435	2.488	3.415	2.946	3.002	0.000
U/TH	0.368	0.444	0.389	0.439	0.502	0.394	0.509	0.545	0.484	0.643	0.409	0.466	0.423	0.393	0.000
TH/K	7.725	7.483	7.732	7.528	6.867	7.085	6.873	5.659	5.867	5.320	6.324	7.303	6.930	8.037	0.000

	1180	1190	1200
POTASium	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000
THORIUM	0.000	0.000	0.000
U/K	0.000	0.000	0.000
U/TH	0.000	0.000	0.000
TH/K	0.000	0.000	0.000

MAP UNIT OR

	730	740	750	760	770	780	790	800	810	820	830	840	1150	1160	1170
POTASium	1.019	1.137	0.998	1.257	1.216	1.391	1.143	1.342	1.406	1.365	1.175	1.158	1.157	1.125	0.000
URANIUM	2.517	2.728	2.786	2.678	2.342	2.276	2.821	2.650	2.408	2.233	2.046	2.096	2.438	2.228	0.000
THORIUM	6.601	7.913	6.766	7.210	7.689	8.236	7.462	7.817	7.228	6.964	6.491	6.815	6.886	6.985	0.000
U/K	2.510	2.473	2.845	2.176	2.030	1.679	2.536	2.060	1.716	1.689	1.836	1.873	2.281	2.055	0.000
U/TH	0.383	0.350	0.417	0.376	0.305	0.279	0.380	0.340	0.335	0.329	0.317	0.309	0.356	0.321	0.000
TH/K	6.578	7.186	6.872	5.869	6.601	5.994	6.617	5.979	5.159	5.238	5.711	6.066	6.304	6.421	0.000

	1180	1190	1200
POTASium	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000
THORIUM	0.000	0.000	0.000
U/K	0.000	0.000	0.000
U/TH	0.000	0.000	0.000
TH/K	0.000	0.000	0.000

MAP UNIT DMA

[illegible]

MAP UNIT OE

[illegible]

MAP UNIT UC

	730	740	750	760	770	780	790	800	810	820	830	840	1150	1160	1170
POTASium	0.000	0.000	0.000	1.589	0.000	0.000	1.743	1.349	0.000	1.953	0.000	0.000	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000	1.660	0.000	0.000	2.506	2.656	0.000	2.259	0.000	0.000	0.000	0.000	0.000
THORIUM	0.000	0.000	0.000	7.544	0.000	0.000	7.296	6.679	0.000	7.556	0.000	0.000	0.000	0.000	0.000
U/K	0.000	0.000	0.000	1.061	0.000	0.000	1.475	1.981	0.000	1.166	0.000	0.000	0.000	0.000	0.000
U/TH	0.000	0.000	0.000	0.220	0.000	0.000	0.345	0.404	0.000	0.299	0.000	0.000	0.000	0.000	0.000
TH/K	0.000	0.000	0.000	4.805	0.000	0.000	4.257	4.962	0.000	3.888	0.000	0.000	0.000	0.000	0.000

	1180	1190	1200
POTASSIUM	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000
THORIUM	0.000	0.000	0.000
U/K	0.000	0.000	0.000
U/TH	0.000	0.000	0.000
TH/K	0.000	0.000	0.000

APPENDIX H - Pseudo Contour Maps

Potassium Pseudo-Contour Map - Huntington Quadrangle

PRINT CHARACTER		VALUE	
0	LE	0.0000	0.0000
1	0.1250	0.2500	0.2500
2	0.3750	0.5000	0.5000
3	0.6250	0.7500	0.7500
4	0.8750	1.0000	1.0000
5	1.1250	1.2500	1.2500
6	1.3750	1.5000	1.5000
7	1.6250	1.7500	1.7500
8	1.8750	2.0000	2.0000
9	2.1250	2.2500	2.2500
GT		2.2500	

SCALE IN EQUIVALENT PERCENT

EXPLANATION

EXPLANATION

PRINT CHARACTER VALUE

Uranium Pseudo-Contour Map - Huntington Quadrangle

SCALE IN EQUIVALEN PPM

PRINT CHARACTER	VALUE
0	0.0000
1	0.2500
2	0.5000
3	0.7500
4	1.0000
5	1.2500
6	1.5000
7	1.7500
8	2.0000
9	2.2500
GT	2.5000

PRINT CHARACTER		EXPLANATION	
		VALUE	
0	LE	0.0000	
1	0.6250	0.6250	
2	1.2500	1.2500	
3	1.8750	1.8750	
4	2.5000	2.5000	
5	3.1250	3.1250	
6	3.7500	3.7500	
7	4.3750	4.3750	
8	5.0000	5.0000	
9	5.6250	5.6250	
GT	6.2500	6.2500	
	6.8750	6.8750	
	7.5000	7.5000	
	8.1250	8.1250	
	8.7500	8.7500	
	9.3750	9.3750	
	10.0000	10.0000	
	10.6250	10.6250	
	11.2500	11.2500	

Thorium Pseudo-Contour Map - Huntington Quadrangle

SCALE IN EQUIVALENT PPM

HUNTINGTON

EXPLANATION

PRINT CHARACTER		VALUE	
0	LE	2.0000	2.0000
1	2.5000	3.0000	3.0000
2	3.5000	4.0000	4.0000
3	4.0000	5.0000	5.0000
4	5.0000	6.0000	6.0000
5	6.5000	7.0000	7.0000
6	7.5000	8.0000	8.0000
7	8.5000	9.0000	9.0000
8	9.5000	10.0000	10.0000
9	10.5000	11.0000	11.0000
GT		11.0000	

Uranium/Potassium Pseudo-Contour Map - Huntington Quadrangle

HUNTINGTON

[illegible]

EXPLANATION			
PRINT CHARACTER		VALUE	
0	LE	0.0000	
		0.0000	0.2500
1		0.2500	0.5000
		0.5000	0.7500
2		0.7500	1.0000
		1.0000	1.2500
3		1.2500	1.5000
		1.5000	1.7500
4		1.7500	2.0000
		2.0000	2.2500
5		2.2500	2.5000
		2.5000	2.7500
6		2.7500	3.0000
		3.0000	3.2500
7		3.2500	3.5000
		3.5000	3.7500
8		3.7500	4.0000
		4.0000	4.2500
9		4.2500	4.5000
		4.5000	4.7500
	GT	4.7500	5.0000

EXPLANATION

PRINT CHARACTER VALUE

0	LE	0.0000
		0.0500
1	0.0500	0.1000
		0.1500
2	0.1500	0.2000
		0.2500
3	0.2500	0.3000
		0.3500
4	0.3500	0.4000
		0.4500
5	0.4500	0.5000
		0.5500
6	0.5500	0.6000
		0.6500
7	0.6500	0.7000
		0.7500
8	0.7500	0.8000
		0.8500
9	0.8500	0.9000
		0.9000

SCALE IN GAMMAS

H75

EXPLANATION	
PRINT CHARACTER	VALUE
0	LE-1500. 0000
-1500. 0000-1400. 0000	
1-1400. 0000-1300. 0000	
-1300. 0000-1200. 0000	
2-1200. 0000-1100. 0000	
-1100. 0000-1000. 0000	
3-1000. 0000 -900. 0000	
-900. 0000 -800. 0000	
4 -800. 0000 -700. 0000	
-700. 0000 -600. 0000	
5 -600. 0000 -500. 0000	
-500. 0000 -400. 0000	
6 -400. 0000 -300. 0000	
-300. 0000 -200. 0000	
7 -200. 0000 -100. 0000	
-100. 0000 0. 0000	
8 0. 0000 100. 0000	
100. 0000 200. 0000	
9 200. 0000 300. 0000	
GT 300. 0000	

HUNTINGTON QUADRANGLE - NTMS NJ 17-4
SINGLE RECORD LISTING - GEOMETRICS DATA ACQUIRED: 80143

X

HUNTINGTON QUADRANGLE - NTMS NJ 17-4
AUGMENTED RECORD LISTING - GEOMETRICS DATA ACQUIRED: 80143

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