MASTER

National Uranium Resource Evaluation

AERIAL GAMMA RAY AND MAGNETIC SURVEY:
NASHVILLE QUADRANGLE,
TENNESSEE AND KENTUCKY

FINAL REPORT

EG&G GEOMETRICS
Sunnyvale, California 94086

September 1980

PREPARED FOR U.S. DEPARTMENT OF ENERGY
Assistant Secretary for Resource Applications
Grand Junction Office, Colorado

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AERIAL GAMMA RAY AND MAGNETIC SURVEY
MISSISSIPPI AND FLORIDA AIRBORNE SURVEY
NASHVILLE QUADRANGLE
TENNESSEE AND KENTUCKY

FINAL REPORT

Prepared by
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ABSTRACT

The Nashville quadrangle covers a portion of the interior lowland plateau region of the Midwestern Physiographic Province. The quadrangle contains a shallow to moderately thick Paleozoic section that overlies a Precambrian basement complex. Paleozoic carbonates dominate surficial exposures.

A search of available literature revealed no known uranium deposits.

A total of fifty-five (55) uranium anomalies were detected and are discussed briefly in this report. Most anomalies appear to relate to cultural features. Some have relatively high uranium concentration levels that may be significant despite their correlation with culture.

Magnetic data appears to illustrate complexities in the Precambrian basement.

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INTRODUCTION

General

The Nashville quadrangle covers a 7,650 square mile region in western Tennessee and southwestern Kentucky (see Figure 1).

The geologic map used in the interpretation was compiled by Martel Laboratories in 1980. Map unit descriptions, found in Appendix C, were taken directly from the Martel map legend. Supplementary geologic information was taken from Fairbridge (ed.) 1975, Cohee and others (1962), and Miller (princ. ed., 1966). Cultural and physiographic information was taken from the 1:250,000 scale Nashville topographic map (1969 version).

Radiometric and magnetic data from the Nashville quadrangle were acquired in July of 1980 and processed in August and September of that same year. A detailed summary of data acquisition, processing, interpretation and presentation methods is contained in Appendix A. Appendix B contains a flight summary report for the Nashville quadrangle.

Physiography

The Nashville quadrangle covers an area east of the Mississippi River in the interior low plateau region of the Midwestern Physiographic Province. The Cumberland and Tennessee Rivers drain most of the region. Topography ranges from gently-rolling plains in large plateau regions, to rugged uplands in and around the major tributaries of the drainage system and in the dissected mountainous areas of the south. Karst topography is common in the plateau areas.

Elevations range from below 400 feet at the lowermost base levels of the two rivers (at Lake Barkley and Kentucky Lake), to over 1,300 feet atop several isolated peaks in the extreme southeast.

The region is relatively well developed culturally. The largest city in the area is Nashville, Tennessee, with a population of 470,000. Nashville, as well as many other nearby towns and cities, are serviced by an extensive network of freeways and other major highways. Large reservoirs have been established along the Tennessee and Cumberland Rivers.

GEOLOGY

Structure

The region contained within the Nashville quadrangle lies on the northwestern limb of the Nashville Dome. This structure is part of a broad arch (the Cincinnati Arch) in Precambrian material that

strikes south to southwesterly, paralleling the Appalachian Front. Less than 5,000 feet of Phanerozoic sediments (primarily lower Paleozoic) overlie this portion of the axis of the arch. Sediment thickness increases to the northwest, as the Moorman Syncline area of the Illinois Basin is approached. Thickest sediments occur along the northern borders of the quadrangle, where almost 7,000 feet of Paleozoic sediments lie (see Figure 2).

The Wells Creek Astrobleme has superimposed a circular domal structure on the otherwise flat-lying Paleozoic sediments in the central western region of the quadrangle.

Several surface faults occur in the western and northern regions of the quadrangle. Some ring faults are associated with the Wells Creek Structure. Other faults, 10-20 miles long and oriented primarily in an easterly direction, appear to be associated with the Rough Creek Fault Zone. This fault zone is proposed to be associated with the formation of the Mississippi Embayment and/or a reactivated rift zone (the New Madrid Rift Zone - see EOS vol. 61, no. 33, August 12, 1980). These faults are primarily of Paleozoic age but may be as young as Cretaceous (R. Miller - personal communication, 1980).

Surficial Geology

As mapped by Martel Laboratories (1980), and Miller (princ. ed.) 1966, Paleozoic rocks dominate the surface of the Nashville quadrangle. In the Paleozoic sequence, limestones and dolomites of Ordovician through Mississippian age are the most widespread surficially. The calcareous materials are locally siliceous (cherty) and phosphatic, and contain discrete beds of sands, shales, and bentonite. Major sandstone and shale beds are present, but, since they are more resistant than the calcareous deposits, tend to form small cap rocks or cliffs that are largely masked by overlying limestones. Altogether the Paleozoic section covers approximately 98% of the quadrangle.

Cretaceous rocks of the Coffee Sand and Tuscaloosa Formation occur as small outliers in the western half of the quadrangle, but their exposure accounts for less than 0.1 percent of the surface.

The remaining 2% of the quadrangle is covered primarily by Quaternary alluvial material that occurs mainly along the major river channels.

Uranium

According to available sources, there are no known uranium deposits in the Nashville quadrangle. The Devonian Chattanooga Shale, which has been the subject of a number of studies as a potential source of uranium, appears to have extensive surficial exposure in the southern half of the quadrangle (Miller, 1966).

INTERPRETATION OF GEOPHYSICAL DATA

Radiometric Data

A total of 55 groups of uranium (Bi214) anomalies meet the minimum statistical requirements as set forth in the data interpretation section of Appendix A. These are displayed, along with all other anomalous areas and pertinent data, on Figure 3. The anomalies are summarized in table form in Appendix G. The potassium, uranium, thorium, and ratio pseudo-contour maps, which reflect radiometric responses for the entire quadrangle, are 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 data by the sensitivities calculated for the detection system. They do not directly correspond to real geochemical data.

Within the Nashville quadrangle, the concentrations of the three radioactive elements are relatively low. The average uranium concentration is approximately 2.4 ppmeU. Potassium and thorium have quadrangle-wide averages of 0.7 percent and 6.3 ppmeT respectively.

Highest average uranium and thorium concentrations occur in map unit MSG (Mississippian St. Genevieve Limestone) at 2.9 ppmeU and 7.8 ppmeT respectively. Map unit MSW (Mississippian St. Louis Limestone and Warsaw Limestone) contains the highest peak uranium concentration (8.1 ppmeU) as well as the highest peak thorium concentration (10.6 ppmeT). Highest average and peak potassium concentrations occur in map unit OBH (Ordovician Bigby-Cannon Limestone and Hermitage Formation) at 0.9 and 1.5 percent respectively.

Potassium and thorium concentrations appear to be slightly higher in the north and east. This is expressed as a slight bimodality in the thorium and potassium histograms of map unit MSW, but the bimodality is not clear enough to attempt a division. This may result from some geochemical differences between the two combined geologic units contained in this map unit.

Anomalies are scattered throughout the quadrangle, but show a high degree of correlation with cultural features (roads, railroads, pipelines, etc.). In general, anomalies have peak concentrations around 3.0 ppmeU. Three groups of anomalies have peak concentrations that are considerably higher. One group formed by anomalies 40, 41, and 42 have peak concentrations ranging from 4.3 to 7.7 ppmeU. These anomalies overlie map unit MSW in the Wells Creek Structure. Though portions of these anomalies are coincident with cultural features, the geographic extent and high uranium concentration levels argue in favor of more detailed study. No geologic reason for the high concentration levels can be ventured at this time, but the Wells Creek Structure maybe a contributing factor.

The other two groups of anomalies within map unit MSW and appear to be

coincident with cultural features for the most part. The second group consists of anomalies 44 and 45, both of which have peak uranium concentrations of 5.8 ppmeU. The third group (anomalies 26, and 46 through 50) have peak concentrations ranging from 3.3 to 6.2 ppmeU. Though most of the anomalies in this group overlie the outskirts of the city of Clarksville, the high uranium concentration levels are noteworthy. It is possible that excavations in these areas have exposed fresh bedrock that tends to have relatively higher observed uranium concentrations than areas with a mantle of soil (all other factors being equal).

In conclusion, the high degree of correlation between the anomalies and cultural features, coupled with generally low uranium concentrations suggest that most of the anomalies do not represent significant deposits of uranium. The groups of high concentration anomalies are worthy of more detailed geologic study.

Magnetic Data

Appendix H contains a pseudo-contour map of the magnetic field measured in the Nashville quadrangle.

The structural picture in this area is basically one of relatively thin Paleozoic carbonates that Precambrian basement and gradually thicken to the north. The magnetic field exhibits high and low gradient areas that do not correlate clearly with the supposed thickness of the Paleozoic section. The magnetic character more likely results from structural and/or lithologic complexities in the Precambrian. Several isolated structures and northwesterly-trending linear features are suggested by the magnetic data. Gradients generally appear to be higher in the eastern section of the map.

URANIUM ANOMALY/ INTERPRETATION MAP

NASHVILLE QUADRANGLE
U.S. DEPARTMENT OF ENERGY

APPROXIMATE SCALE 1:500,000

EXPLANATION

- - CITY OR TOWN
- - URANIUM SAMPLE MEETING FOLLOWING CRITERIA:
 - (1) $1.0 \leq U \leq \infty$
 - (2) $-1.0 \leq T \leq \infty$
 - (3) $1.0 \leq U/T \leq \infty$
- IN STANDARD DEVIATION UNITS.
EACH SQUARE REPRESENTS 1 STANDARD DEVIATION.
- - URANIUM ANOMALY:
A SINGLE SAMPLE OF 3 OR MORE STANDARD DEVIATIONS OR GROUP OF ADJOINING SAMPLES WHICH TOGETHER TOTAL 4 OR MORE STANDARD DEVIATIONS, $4.0 \leq \text{SUM} \leq \infty$, WITH AT LEAST ONE SAMPLE OF 2 OR MORE STANDARD DEVIATIONS.

SURVEY AND
COMPILED BY:
EG&G GEOMETRICS

Figure 3 - Uranium Anomaly/Interpretation Map - Nashville 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. N827Q). The Queen Air 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

For the forty three quadrangles a total of 63,748 line miles, excluding reflights and overlaps and missing data, were flown by the Queen Air. The production summary presented below and the detailed daily production in Appendix B describes a portion of the total project.

Prior to the start of the survey operations, the airplane was calibrated at the DoE test pads and Dynamic Test Range in April, 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.

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 airplane's objective ground speed was 140 mph and was 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.

DATA COLLECTION SYSTEM

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

C. Post Flight

1. Verify test line total count within 20% of average for all test lines at that base of operations.
2. 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.
3. Calculate the resolution of down and up crystal pack.
4. 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.

AIRCRAFT

The aircraft used for this survey was a Beechcraft Queen Air Model 65, U.S. Registry Number N827Q. This aircraft, being a medium twin engine aircraft, possesses overall performance and safety features which makes it ideal for low level, fixed-winged airborne geophysical survey work within areas of up to moderately rough topographic relief. It can carry the adequate payload at the necessary lower constant airspeeds and still maintain a wide envelope of safety, all while operating economically. Performance data for the Queen Air Model 65 in its present survey configuration are give below:

Maximum Aircraft Gross Weight	7,700 lbs.
Aircraft Empty (dry)	4,640 lbs.
Max. useful load including fuel	<u>3,060 lbs.</u>
Geophysical Package	1,110 lbs.
Navigation Eqpt. & Extra Avionics	125 lbs.
Main Fuel Tanks	528 lbs.
Aux. Fuel Tanks	864 lbs.
Pilot	175 lbs.
Electronics Operator	<u>175 lbs.</u>
Total	<u>2,977 lbs.</u>

Minimum Control Speed	95 MPH	*IAS at	Gross Weight
Safe Single Engine Speed	105 MPH	IAS at	Gross Weight
Rate of climb both engines	1,300	*FPM at	Gross Weight
Rate of climb single engine	210	FPM at	Gross Weight

*IAS = Indicated Air Speed

*FPM = Feet Per Minute

Avgas consumption = 36 U.S. gallons [216 lbs] per hour [at 75% power]
Endurance at 36 gallons [216 lbs.] per hour 75% power = 6 hrs. 6 mins.
Range of cruise at 75% power with 45 min. reserve = 1,200 miles

Cruise configuration stalling speed at Gross Weight [7700 lbs] at 0°
Bank = 80 MPH IAS at 45° Bank = 95 MPH IAS

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:

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

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	I
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	I
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 072577

TC (0-6 MEV) 184.87 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

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

CH	0	(0.000 MEV)	0.000 CPS	X
CH	1	(0.012 MEV)	0.000 CPS	X
CH	2	(0.024 MEV)	0.000 CPS	X
CH	3	(0.036 MEV)	0.000 CPS	X
CH	4	(0.047 MEV)	0.000 CPS	X
CH	5	(0.059 MEV)	0.000 CPS	X
CH	6	(0.071 MEV)	0.000 CPS	X
CH	7	(0.083 MEV)	0.000 CPS	X
CH	8	(0.095 MEV)	0.000 CPS	X
CH	9	(0.106 MEV)	0.000 CPS	X
CH	10	(0.118 MEV)	0.000 CPS	X
CH	11	(0.130 MEV)	0.000 CPS	X
CH	12	(0.142 MEV)	0.000 CPS	X
CH	13	(0.154 MEV)	0.000 CPS	X
CH	14	(0.165 MEV)	0.000 CPS	X
CH	15	(0.177 MEV)	0.000 CPS	X
CH	16	(0.189 MEV)	0.000 CPS	X
CH	17	(0.201 MEV)	0.000 CPS	X
CH	18	(0.213 MEV)	-0.025 CPS	X
CH	19	(0.225 MEV)	-0.050 CPS	X
CH	20	(0.236 MEV)	0.000 CPS	X
CH	21	(0.248 MEV)	1.401 CPS	XXXX
CH	22	(0.260 MEV)	3.700 CPS	XXXXXXXXXXXX
CH	23	(0.272 MEV)	4.280 CPS	XXXXXXXXXXXX
CH	24	(0.284 MEV)	4.334 CPS	XXXXXXXXXXXX
CH	25	(0.295 MEV)	3.740 CPS	XXXXXXXXXXXX
CH	26	(0.307 MEV)	3.897 CPS	XXXXXXXXXXXX
CH	27	(0.319 MEV)	3.818 CPS	XXXXXXXXXXXX
CH	28	(0.331 MEV)	4.236 CPS	XXXXXXXXXXXX
CH	29	(0.343 MEV)	3.433 CPS	XXXXXXXXXXXX
CH	30	(0.355 MEV)	2.996 CPS	XXXXXXXXXXXX
CH	31	(0.367 MEV)	2.559 CPS	XXXXXXXXXXXX
CH	32	(0.378 MEV)	2.269 CPS	XXXXXXXXXXXX
CH	33	(0.390 MEV)	2.102 CPS	XXXXXXXXXXXX
CH	34	(0.402 MEV)	2.001 CPS	XXXXXXXXXXXX
CH	35	(0.414 MEV)	2.121 CPS	XXXXXXXXXXXX
CH	36	(0.425 MEV)	2.114 CPS	XXXXXXXXXXXX
CH	37	(0.437 MEV)	1.976 CPS	XXXXXXXXXXXX
CH	38	(0.449 MEV)	2.200 CPS	XXXXXXXXXXXX
CH	39	(0.461 MEV)	2.188 CPS	XXXXXXXXXXXX
CH	40	(0.473 MEV)	2.226 CPS	XXXXXXXXXXXX
CH	41	(0.485 MEV)	1.983 CPS	XXXXXXXXXXXX
CH	42	(0.496 MEV)	2.155 CPS	XXXXXXXXXXXX
CH	43	(0.508 MEV)	2.158 CPS	XXXXXXXXXXXX
CH	44	(0.520 MEV)	2.207 CPS	XXXXXXXXXXXX
CH	45	(0.532 MEV)	2.217 CPS	XXXXXXXXXXXX
CH	46	(0.544 MEV)	1.997 CPS	XXXXXXXXXXXX
CH	47	(0.556 MEV)	2.447 CPS	XXXXXXXXXXXX
CH	48	(0.567 MEV)	2.540 CPS	XXXXXXXXXXXX
CH	49	(0.579 MEV)	2.586 CPS	XXXXXXXXXXXX
CH	50	(0.591 MEV)	2.708 CPS	XXXXXXXXXXXX
CH	51	(0.603 MEV)	2.401 CPS	XXXXXXXXXXXX
CH	52	(0.615 MEV)	2.372 CPS	XXXXXXXXXXXX
CH	53	(0.626 MEV)	1.866 CPS	XXXXXXXXXXXX
CH	54	(0.638 MEV)	1.682 CPS	XXXXXXXXXXXX
CH	55	(0.650 MEV)	1.681 CPS	XXXXXXXXXXXX
CH	56	(0.662 MEV)	1.454 CPS	XXXXXXXXXXXX
CH	57	(0.674 MEV)	1.474 CPS	XXXXXXXXXXXX
CH	58	(0.686 MEV)	1.447 CPS	XXXXXXXXXXXX
CH	59	(0.697 MEV)	1.431 CPS	XXXXXXXXXXXX
CH	60	(0.709 MEV)	1.476 CPS	XXXXXXXXXXXX
CH	61	(0.721 MEV)	1.453 CPS	XXXXXXXXXXXX
CH	62	(0.733 MEV)	1.467 CPS	XXXXXXXXXXXX
CH	63	(0.745 MEV)	1.579 CPS	XXXXXXXXXXXX
CH	64	(0.756 MEV)	1.497 CPS	XXXXXXXXXXXX
CH	65	(0.768 MEV)	1.548 CPS	XXXXXXXXXXXX
CH	66	(0.780 MEV)	1.421 CPS	XXXXXXXXXXXX
CH	67	(0.792 MEV)	1.282 CPS	XXXXXXXXXXXX
CH	68	(0.804 MEV)	1.155 CPS	XXXXXXXXXXXX
CH	69	(0.816 MEV)	1.346 CPS	XXXXXXXXXXXX
CH	70	(0.827 MEV)	1.245 CPS	XXXXXXXXXXXX
CH	71	(0.839 MEV)	1.161 CPS	XXXXXXXXXXXX
CH	72	(0.851 MEV)	1.253 CPS	XXXXXXXXXXXX
CH	73	(0.863 MEV)	1.231 CPS	XXXXXXXXXXXX
CH	74	(0.875 MEV)	1.425 CPS	XXXXXXXXXXXX
CH	75	(0.887 MEV)	1.462 CPS	XXXXXXXXXXXX
CH	76	(0.898 MEV)	1.543 CPS	XXXXXXXXXXXX
CH	77	(0.910 MEV)	1.444 CPS	XXXXXXXXXXXX
CH	78	(0.922 MEV)	1.364 CPS	XXXXXXXXXXXX
CH	79	(0.934 MEV)	1.289 CPS	XXXXXXXXXXXX
CH	80	(0.946 MEV)	1.159 CPS	XXXXXXXXXXXX
CH	81	(0.957 MEV)	1.144 CPS	XXXXXXXXXXXX
CH	82	(0.969 MEV)	1.085 CPS	XXXXXXXXXXXX
CH	83	(0.981 MEV)	1.061 CPS	XXXXXXXXXXXX
CH	84	(0.993 MEV)	0.841 CPS	XXXXXXXXXXXX
CH	85	(1.005 MEV)	0.919 CPS	XXXXXXXXXXXX
CH	86	(1.017 MEV)	0.822 CPS	XXXX
CH	87	(1.028 MEV)	0.816 CPS	XXX
CH	88	(1.040 MEV)	0.853 CPS	XXXX
CH	89	(1.052 MEV)	0.901 CPS	XXXX BISMUTH 214
CH	90	(1.064 MEV)	0.822 CPS	XXX
CH	91	(1.076 MEV)	0.967 CPS	XXXX
CH	92	(1.087 MEV)	0.969 CPS	XXXX
CH	93	(1.099 MEV)	0.851 CPS	XXXX
CH	94	(1.111 MEV)	0.905 CPS	XXXX
CH	95	(1.123 MEV)	0.847 CPS	XXXX
CH	96	(1.135 MEV)	0.861 CPS	XXXX
CH	97	(1.147 MEV)	0.800 CPS	XXX
CH	98	(1.158 MEV)	0.727 CPS	XXX
CH	99	(1.170 MEV)	0.751 CPS	XXX
CH	100	(1.182 MEV)	0.607 CPS	XXXX BISMUTH 214
CH	101	(1.194 MEV)	0.663 CPS	XXX
CH	102	(1.206 MEV)	0.657 CPS	XXX
CH	103	(1.217 MEV)	0.633 CPS	XXX
CH	104	(1.229 MEV)	0.719 CPS	XXX
CH	105	(1.241 MEV)	0.671 CPS	XXX
CH	106	(1.253 MEV)	0.475 CPS	XX
CH	107	(1.265 MEV)	0.601 CPS	XXX
CH	108	(1.277 MEV)	0.661 CPS	XXX
CH	109	(1.288 MEV)	0.668 CPS	XXX
CH	110	(1.300 MEV)	0.806 CPS	XXX
CH	111	(1.312 MEV)	0.830 CPS	XXX
CH	112	(1.324 MEV)	0.858 CPS	XXX
CH	113	(1.336 MEV)	0.844 CPS	XXX
CH	114	(1.347 MEV)	0.652 CPS	XXX
CH	115	(1.359 MEV)	0.791 CPS	XXX
CH	116	(1.371 MEV)	0.787 CPS	XXX POTASSIUM 40
CH	117	(1.383 MEV)	0.834 CPS	XXXX
CH	118	(1.395 MEV)	0.984 CPS	XXXX
CH	119	(1.407 MEV)	1.070 CPS	XXXX
CH	120	(1.418 MEV)	1.184 CPS	XXXX
CH	121	(1.430 MEV)	1.088 CPS	XXXX
CH	122	(1.442 MEV)	1.210 CPS	XXXXXX
CH	123	(1.454 MEV)	1.231 CPS	XXXXXX
CH	124	(1.466 MEV)	1.207 CPS	XXXXXX
CH	125	(1.477 MEV)	0.985 CPS	XXXXXX
CH	126	(1.489 MEV)	0.987 CPS	XXXX
CH	127	(1.501 MEV)	0.624 CPS	XXX
CH	128	(1.513 MEV)	0.635 CPS	XXX
CH	129	(1.525 MEV)	0.512 CPS	XXX
CH	130	(1.537 MEV)	0.488 CPS	XX
CH	131	(1.548 MEV)	0.409 CPS	XX
CH	132	(1.560 MEV)	0.359 CPS	XX POTASSIUM 40
CH	133	(1.572 MEV)	0.339 CPS	XX
CH	134	(1.584 MEV)	0.438 CPS	XX
CH	135	(1.596 MEV)	0.310 CPS	XX
CH	136	(1.608 MEV)	0.259 CPS	XX
CH	137	(1.619 MEV)	0.250 CPS	XX
CH	138	(1.631 MEV)	0.353 CPS	XX
CH	139	(1.643 MEV)	0.323 CPS	XX
CH	140	(1.655 MEV)	0.332 CPS	XX
CH	141	(1.667 MEV)	0.266 CPS	XX BISMUTH 214
CH	142	(1.678 MEV)	0.267 CPS	XX
CH	143	(1.690 MEV)	0.275 CPS	XX
CH	144	(1.702 MEV)	0.354 CPS	XX
CH	145	(1.714 MEV)	0.347 CPS	XX
CH	146	(1.726 MEV)	0.354 CPS	XX
CH	147	(1.738 MEV)	0.293 CPS	XX
CH	148	(1.749 MEV)	0.350 CPS	XX
CH	149	(1.761 MEV)	0.270 CPS	XX
CH	150	(1.773 MEV)	0.334 CPS	XX
CH	151	(1.785 MEV)	0.245 CPS	XX
CH	152	(1.797 MEV)	0.255 CPS	XX
CH	153	(1.808 MEV)	0.174 CPS	XX
CH	154	(1.820 MEV)	0.228 CPS	XX
CH	155	(1.832 MEV)	0.188 CPS	XX
CH	156	(1.844 MEV)	0.115 CPS	X
CH	157	(1.856 MEV)	0.094 CPS	X BISMUTH 214
CH	158	(1.868 MEV)	0.147 CPS	X
CH	159	(1.879 MEV)	0.147 CPS	X
CH	160	(1.891 MEV)	0.139 CPS	X
CH	161	(1.903 MEV)	0.109 CPS	X
CH	162	(1.915 MEV)	0.091 CPS	X
CH	163	(1.927 MEV)	0.151 CPS	X
CH	164	(1.938 MEV)	0.080 CPS	X
CH	165	(1.950 MEV)	0.136 CPS	X
CH	166	(1.962 MEV)	0.157 CPS	X
CH	167	(1.974 MEV)	0.119 CPS	X
CH	168	(1.986 MEV)	0.109 CPS	X
CH	169	(1.998 MEV)	0.113 CPS	X
CH	170	(2.009 MEV)	0.106 CPS	X
CH	171	(2.021 MEV)	0.147 CPS	X
CH	172	(2.033 MEV)	0.137 CPS	X
CH	173	(2.045 MEV)	0.171 CPS	XX
CH	174	(2.057 MEV)	0.154 CPS	X
CH	175	(2.068 MEV)	0.108 CPS	X
CH	176	(2.080 MEV)	0.162 CPS	X
CH	177	(2.092 MEV)	0.104 CPS	X
CH	178	(2.104 MEV)	0.138 CPS	X
CH	179	(2.116 MEV)	0.137 CPS	X
CH	180	(2.128 MEV)	0.119 CPS	X
CH	181	(2.140 MEV)	0.169 CPS	XX
CH	182	(2.151 MEV)	0.148 CPS	X
CH	183	(2.163 MEV)	0.101 CPS	X
CH	184	(2.175 MEV)	0.114 CPS	X
CH	185	(2.187 MEV)	0.088 CPS	X
CH	186	(2.199 MEV)	0.101 CPS	X
CH	187	(2.210 MEV)	0.085 CPS	X
CH	188	(2.222 MEV)	0.130 CPS	X
CH	189	(2.234 MEV)	0.117 CPS	X
CH	190	(2.246 MEV)	0.113 CPS	X
CH	191	(2.258 MEV)	0.116 CPS	X
CH	192	(2.269 MEV)	0.088 CPS	X
CH	193	(2.281 MEV)	0.097 CPS	X
CH	194	(2.293 MEV)	0.095 CPS	X
CH	195	(2.305 MEV)	0.087 CPS	X
CH	196	(2.317 MEV)	0.089 CPS	X
CH	197	(2.329 MEV)	0.015 CPS	X
CH	198	(2.340 MEV)	0.041 CPS	X
CH	199	(2.352 MEV)	0.070 CPS	X
CH	200	(2.364 MEV)	0.087 CPS	X
CH	201	(2.376 MEV)	0.085 CPS	X
CH	202	(2.388 MEV)	0.084 CPS	X
CH	203	(2.399 MEV)	0.064 CPS	X THALLIUM 208
CH	204	(2.411 MEV)	0.123 CPS	XX
CH	205	(2.423 MEV)	0.076 CPS	X
CH	206	(2.435 MEV)	0.116 CPS	X
CH	207	(2.447 MEV)	0.147 CPS	X
CH	208	(2.459 MEV)	0.108 CPS	X
CH	209	(2.470 MEV)	0.120 CPS	X
CH	210	(2.482 MEV)	0.092 CPS	X
CH	211	(2.494 MEV)	0.157 CPS	X
CH	212	(2.506 MEV)	0.169 CPS	XX
CH	213	(2.518 MEV)	0.206 CPS	XX
CH	214	(2.529 MEV)	0.262 CPS	XX
CH	215	(2.541 MEV)	0.184 CPS	XX
CH	216	(2.553 MEV)	0.195 CPS	XX
CH	217	(2.565 MEV)	0.173 CPS	XX
CH	218	(2.577 MEV)	0.173 CPS	XX
CH	219	(2.589 MEV)	0.201 CPS	XX
CH	220	(2.600 MEV)	0.329 CPS	XX
CH	221	(2.612 MEV)	0.232 CPS	XX
CH	222	(2.624 MEV)	0.187 CPS	XX
CH	223	(2.636 MEV)	0.171 CPS	XX
CH	224	(2.648 MEV)	0.177 CPS	XX
CH	225	(2.660 MEV)	0.089 CPS	X
CH	226	(2.671 MEV)	0.122 CPS	X
CH	227	(2.683 MEV)	0.124 CPS	X
CH	228	(2.695 MEV)	0.078 CPS	X
CH	229	(2.707 MEV)	0.090 CPS	X
CH	230	(2.719 MEV)	0.027 CPS	X
CH	231	(2.730 MEV)	0.012 CPS	X
CH	232	(2.742 MEV)	-0.026 CPS	X
CH	233	(2.754 MEV)	-0.024 CPS	X
CH	234	(2.766 MEV)	0.038 CPS	X
CH	235	(2.778 MEV)	0.003 CPS	X
CH	236	(2.790 MEV)	0.068 CPS	X
CH	237	(2.801 MEV)	0.038 CPS	X THALLIUM 208
CH	238	(2.813 MEV)	0.023 CPS	X
CH	239	(2.825 MEV)	0.008 CPS	X
CH	240	(2.837 MEV)	0.078 CPS	X
CH	241	(2.849 MEV)	0.027 CPS	X
CH	242	(2.860 MEV)	0.047 CPS	X
CH	243	(2.872 MEV)	0.039 CPS	X
CH	244	(2.884 MEV)	0.084 CPS	X
CH	245	(2.896 MEV)	0.025 CPS	X
CH	246	(2.908 MEV)	0.025 CPS	X
CH	247	(2.920 MEV)	-0.015 CPS	X
CH	248	(2.931 MEV)	0.037 CPS	X
CH	249	(2.943 MEV)	-0.005 CPS	X
CH	250	(2.955 MEV)	0.042 CPS	X
CH	251	(2.967 MEV)	0.002 CPS	X
CH	252	(2.979 MEV)	-0.018 CPS	X
CH	253	(2.990 MEV)	0.031 CPS	X
CH	254	(3.002 MEV)	-0.106 CPS	X
CH	255	(3.014 MEV)	0.000 CPS	X

THALLIUM 208

THALLIUM 208

DERIVED COSMIC SPECTRUM FROM PACIFIC OCEAN DATA

DOWNWARD-LOOKING CRYSTAL SPECTRUM FOR LINE COSMIC, DATED 072577

TC (0-0 MEV) 5275.09 TC (0.4-3.0 MEV) 3245.27 COSMIC (3-6 MEV) 1000.00
U (1.12 MEV) 165.91 K (1.46 MEV) 181.83 U (1.76 MEV) 157.56 T (2.63 MEV) 213.66

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

CH	0	(0.000 MEV)	0.000	CPS	X
CH	1	(0.012 MEV)	0.000	CPS	X
CH	2	(0.024 MEV)	0.000	CPS	X
CH	3	(0.035 MEV)	0.000	CPS	X
CH	4	(0.047 MEV)	0.000	CPS	X
CH	5	(0.059 MEV)	0.000	CPS	X
CH	6	(0.071 MEV)	0.000	CPS	X
CH	7	(0.083 MEV)	0.000	CPS	X
CH	8	(0.095 MEV)	0.000	CPS	X
CH	9	(0.106 MEV)	0.000	CPS	X
CH	10	(0.118 MEV)	0.000	CPS	X
CH	11	(0.130 MEV)	0.000	CPS	X
CH	12	(0.142 MEV)	0.000	CPS	X
CH	13	(0.154 MEV)	0.000	CPS	X
CH	14	(0.165 MEV)	0.000	CPS	X
CH	15	(0.177 MEV)	0.000	CPS	X
CH	16	(0.189 MEV)	0.000	CPS	X
CH	17	(0.201 MEV)	0.000	CPS	X
CH	18	(0.213 MEV)	1.091	CPS	XX
CH	19	(0.225 MEV)	1.313	CPS	XX
CH	20	(0.238 MEV)	2.455	CPS	XXX
CH	21	(0.250 MEV)	26.345	CPS	XXXXXXXXXXXXXXXXXXXX
CH	22	(0.260 MEV)	89.243	CPS	XXXXXXXXXXXXXXXXXXXX
CH	23	(0.272 MEV)	109.516	CPS	XXXXXXXXXXXXXXXXXXXX
CH	24	(0.284 MEV)	103.036	CPS	XXXXXXXXXXXXXXXXXXXX
CH	25	(0.295 MEV)	94.423	CPS	XXXXXXXXXXXXXXXXXXXX
CH	26	(0.307 MEV)	85.002	CPS	XXXXXXXXXXXXXXXXXXXX
CH	27	(0.319 MEV)	85.032	CPS	XXXXXXXXXXXXXXXXXXXX
CH	28	(0.331 MEV)	80.508	CPS	XXXXXXXXXXXXXXXXXXXX
CH	29	(0.343 MEV)	78.271	CPS	XXXXXXXXXXXXXXXXXXXX
CH	30	(0.355 MEV)	72.498	CPS	XXXXXXXXXXXXXXXXXXXX
CH	31	(0.368 MEV)	74.934	CPS	XXXXXXXXXXXXXXXXXXXX
CH	32	(0.378 MEV)	65.589	CPS	XXXXXXXXXXXXXXXXXXXX
CH	33	(0.390 MEV)	65.966	CPS	XXXXXXXXXXXXXXXXXXXX
CH	34	(0.402 MEV)	63.189	CPS	XXXXXXXXXXXXXXXXXXXX
CH	35	(0.414 MEV)	62.889	CPS	XXXXXXXXXXXXXXXXXXXX
CH	36	(0.426 MEV)	64.078	CPS	XXXXXXXXXXXXXXXXXXXX
CH	37	(0.437 MEV)	61.000	CPS	XXXXXXXXXXXXXXXXXXXX
CH	38	(0.449 MEV)	59.116	CPS	XXXXXXXXXXXXXXXXXXXX
CH	39	(0.461 MEV)	76.972	CPS	XXXXXXXXXXXXXXXXXXXX
CH	40	(0.473 MEV)	64.879	CPS	XXXXXXXXXXXXXXXXXXXX
CH	41	(0.485 MEV)	96.049	CPS	XXXXXXXXXXXXXXXXXXXX
CH	42	(0.496 MEV)	94.167	CPS	XXXXXXXXXXXXXXXXXXXX
CH	43	(0.508 MEV)	65.589	CPS	XXXXXXXXXXXXXXXXXXXX
CH	44	(0.520 MEV)	68.016	CPS	XXXXXXXXXXXXXXXXXXXX
CH	45	(0.532 MEV)	48.444	CPS	XXXXXXXXXXXXXXXXXXXX
CH	46	(0.544 MEV)	46.965	CPS	XXXXXXXXXXXXXXXXXXXX
CH	47	(0.556 MEV)	36.512	CPS	XXXXXXXXXXXXXXXXXXXX
CH	48	(0.567 MEV)	33.160	CPS	XXXXXXXXXXXXXXXXXXXX
CH	49	(0.579 MEV)	31.892	CPS	XXXXXXXXXXXXXXXXXXXX
CH	50	(0.591 MEV)	25.907	CPS	XXXXXXXXXXXXXXXXXXXX
CH	51	(0.603 MEV)	30.781	CPS	XXXXXXXXXXXXXXXXXXXX
CH	52	(0.615 MEV)	27.055	CPS	XXXXXXXXXXXXXXXXXXXX
CH	53	(0.626 MEV)	25.988	CPS	XXXXXXXXXXXXXXXXXXXX
CH	54	(0.638 MEV)	25.976	CPS	XXXXXXXXXXXXXXXXXXXX
CH	55	(0.650 MEV)	22.998	CPS	XXXXXXXXXXXXXXXXXXXX
CH	56	(0.662 MEV)	27.787	CPS	XXXXXXXXXXXXXXXXXXXX
CH	57	(0.674 MEV)	25.274	CPS	XXXXXXXXXXXXXXXXXXXX
CH	58	(0.686 MEV)	25.240	CPS	XXXXXXXXXXXXXXXXXXXX
CH	59	(0.697 MEV)	23.489	CPS	XXXXXXXXXXXXXXXXXXXX
CH	60	(0.709 MEV)	24.769	CPS	XXXXXXXXXXXXXXXXXXXX
CH	61	(0.721 MEV)	22.350	CPS	XXXXXXXXXXXXXXXXXXXX
CH	62	(0.733 MEV)	22.242	CPS	XXXXXXXXXXXXXXXXXXXX
CH	63	(0.745 MEV)	22.424	CPS	XXXXXXXXXXXXXXXXXXXX
CH	64	(0.756 MEV)	22.234	CPS	XXXXXXXXXXXXXXXXXXXX
CH	65	(0.768 MEV)	20.332	CPS	XXXXXXXXXXXXXXXXXXXX
CH	66	(0.780 MEV)	18.821	CPS	XXXXXXXXXXXXXXXXXXXX
CH	67	(0.792 MEV)	20.493	CPS	XXXXXXXXXXXXXXXXXXXX
CH	68	(0.804 MEV)	19.339	CPS	XXXXXXXXXXXXXXXXXXXX
CH	69	(0.816 MEV)	19.021	CPS	XXXXXXXXXXXXXXXXXXXX
CH	70	(0.827 MEV)	19.949	CPS	XXXXXXXXXXXXXXXXXXXX
CH	71	(0.839 MEV)	20.235	CPS	XXXXXXXXXXXXXXXXXXXX
CH	72	(0.851 MEV)	17.491	CPS	XXXXXXXXXXXXXXXXXXXX
CH	73	(0.863 MEV)	18.370	CPS	XXXXXXXXXXXXXXXXXXXX
CH	74	(0.875 MEV)	18.244	CPS	XXXXXXXXXXXXXXXXXXXX
CH	75	(0.887 MEV)	16.331	CPS	XXXXXXXXXXXXXXXXXXXX
CH	76	(0.898 MEV)	15.519	CPS	XXXXXXXXXXXXXXXXXXXX
CH	77	(0.910 MEV)	16.889	CPS	XXXXXXXXXXXXXXXXXXXX
CH	78	(0.922 MEV)	17.159	CPS	XXXXXXXXXXXXXXXXXXXX
CH	79	(0.934 MEV)	19.230	CPS	XXXXXXXXXXXXXXXXXXXX
CH	80	(0.946 MEV)	17.111	CPS	XXXXXXXXXXXXXXXXXXXX
CH	81	(0.957 MEV)	16.248	CPS	XXXXXXXXXXXXXXXXXXXX
CH	82	(0.969 MEV)	14.954	CPS	XXXXXXXXXXXXXXXXXXXX
CH	83	(0.981 MEV)	17.324	CPS	XXXXXXXXXXXXXXXXXXXX
CH	84	(0.993 MEV)	16.276	CPS	XXXXXXXXXXXXXXXXXXXX
CH	85	(1.005 MEV)	14.813	CPS	XXXXXXXXXXXXXXXXXXXX
CH	86	(1.017 MEV)	15.723	CPS	XXXXXXXXXXXXXXXXXXXX
CH	87	(1.028 MEV)	13.787	CPS	XXXXXXXXXXXXXXXXXXXX
CH	88	(1.040 MEV)	16.414	CPS	XXXXXXXXXXXXXXXXXXXX
CH	89	(1.052 MEV)	13.642	CPS	XXXXXXXXXXXXXXXXXXXX BISMUTH 214
CH	90	(1.064 MEV)	13.624	CPS	XXXXXXXXXXXXXXXXXXXX
CH	91	(1.076 MEV)	13.517	CPS	XXXXXXXXXXXXXXXXXXXX
CH	92	(1.088 MEV)	13.700	CPS	XXXXXXXXXXXXXXXXXXXX
CH	93	(1.099 MEV)	14.633	CPS	XXXXXXXXXXXXXXXXXXXX
CH	94	(1.111 MEV)	14.383	CPS	XXXXXXXXXXXXXXXXXXXX
CH	95	(1.123 MEV)	13.766	CPS	XXXXXXXXXXXXXXXXXXXX
CH	96	(1.135 MEV)	14.949	CPS	XXXXXXXXXXXXXXXXXXXX
CH	97	(1.147 MEV)	13.593	CPS	XXXXXXXXXXXXXXXXXXXX
CH	98	(1.159 MEV)	13.481	CPS	XXXXXXXXXXXXXXXXXXXX
CH	99	(1.170 MEV)	13.189	CPS	XXXXXXXXXXXXXXXXXXXX
CH	100	(1.182 MEV)	12.882	CPS	XXXXXXXXXXXXXXXXXXXX BISMUTH 214
CH	101	(1.194 MEV)	12.905	CPS	XXXXXXXXXXXXXXXXXXXX
CH	102	(1.206 MEV)	12.538	CPS	XXXXXXXXXXXXXXXXXXXX
CH	103	(1.217 MEV)	14.891	CPS	XXXXXXXXXXXXXXXXXXXX
CH	104	(1.229 MEV)	11.346	CPS	XXXXXXXXXXXXXXXXXXXX
CH	105	(1.241 MEV)	11.113	CPS	XXXXXXXXXXXXXXXXXXXX
CH	106	(1.253 MEV)	13.809	CPS	XXXXXXXXXXXXXXXXXXXX
CH	107	(1.265 MEV)	11.910	CPS	XXXXXXXXXXXXXXXXXXXX
CH	108	(1.277 MEV)	12.345	CPS	XXXXXXXXXXXXXXXXXXXX
CH	109	(1.289 MEV)	10.736	CPS	XXXXXXXXXXXXXXXXXXXX
CH	110	(1.300 MEV)	11.444	CPS	XXXXXXXXXXXXXXXXXXXX
CH	111	(1.312 MEV)	11.433	CPS	XXXXXXXXXXXXXXXXXXXX
CH	112	(1.324 MEV)	11.987	CPS	XXXXXXXXXXXXXXXXXXXX
CH	113	(1.336 MEV)	11.846	CPS	XXXXXXXXXXXXXXXXXXXX
CH	114	(1.347 MEV)	11.896	CPS	XXXXXXXXXXXXXXXXXXXX
CH	115	(1.359 MEV)	11.479	CPS	XXXXXXXXXXXXXXXXXXXX
CH	116	(1.371 MEV)	11.864	CPS	XXXXXXXXXXXXXXXXXXXX POTASSIUM 40
CH	117	(1.383 MEV)	10.288	CPS	XXXXXXXXXXXXXXXXXXXX
CH	118	(1.395 MEV)	10.844	CPS	XXXXXXXXXXXXXXXXXXXX
CH	119	(1.407 MEV)	9.842	CPS	XXXXXXXXXXXXXXXXXXXX
CH	120	(1.418 MEV)	11.778	CPS	XXXXXXXXXXXXXXXXXXXX
CH	121	(1.430 MEV)	12.835	CPS	XXXXXXXXXXXXXXXXXXXX
CH	122	(1.442 MEV)	10.601	CPS	XXXXXXXXXXXXXXXXXXXX
CH	123	(1.454 MEV)	9.148	CPS	XXXXXXXXXXXXXXXXXXXX
CH	124	(1.466 MEV)	11.144	CPS	XXXXXXXXXXXXXXXXXXXX
CH	125	(1.477 MEV)	10.766	CPS	XXXXXXXXXXXXXXXXXXXX
CH	126	(1.489 MEV)	9.250	CPS	XXXXXXXXXXXXXXXXXXXX
CH	127	(1.501 MEV)	11.961	CPS	XXXXXXXXXXXXXXXXXXXX
CH	128	(1.513 MEV)	10.896	CPS	XXXXXXXXXXXXXXXXXXXX
CH	129	(1.525 MEV)	10.988	CPS	XXXXXXXXXXXXXXXXXXXX
CH	130	(1.537 MEV)	9.802	CPS	XXXXXXXXXXXXXXXXXXXX
CH	131	(1.548 MEV)	10.311	CPS	XXXXXXXXXXXXXXXXXXXX
CH	132	(1.560 MEV)	10.151	CPS	XXXXXXXXXXXXXXXXXXXX POTASSIUM 40
CH	133	(1.572 MEV)	9.381	CPS	XXXXXXXXXXXXXXXXXXXX
CH	134	(1.584 MEV)	8.753	CPS	XXXXXXXXXXXXXXXXXXXX
CH	135	(1.596 MEV)	11.176	CPS	XXXXXXXXXXXXXXXXXXXX
CH	136	(1.608 MEV)	10.130	CPS	XXXXXXXXXXXXXXXXXXXX
CH	137	(1.619 MEV)	10.551	CPS	XXXXXXXXXXXXXXXXXXXX
CH	138	(1.631 MEV)	9.884	CPS	XXXXXXXXXXXXXXXXXXXX
CH	139	(1.643 MEV)	9.159	CPS	XXXXXXXXXXXXXXXXXXXX
CH	140	(1.655 MEV)	8.738	CPS	XXXXXXXXXXXXXXXXXXXX
CH	141	(1.667 MEV)	8.679	CPS	XXXXXXXXXXXXXXXXXXXX BISMUTH 214
CH	142	(1.678 MEV)	10.154	CPS	XXXXXXXXXXXXXXXXXXXX
CH	143	(1.690 MEV)	9.743	CPS	XXXXXXXXXXXXXXXXXXXX
CH	144	(1.702 MEV)	9.453	CPS	XXXXXXXXXXXXXXXXXXXX
CH	145	(1.714 MEV)	9.418	CPS	XXXXXXXXXXXXXXXXXXXX
CH	146	(1.726 MEV)	8.465	CPS	XXXXXXXXXXXXXXXXXXXX
CH	147	(1.738 MEV)	9.263	CPS	XXXXXXXXXXXXXXXXXXXX
CH	148	(1.749 MEV)	9.653	CPS	XXXXXXXXXXXXXXXXXXXX
CH	149	(1.761 MEV)	9.412	CPS	XXXXXXXXXXXXXXXXXXXX
CH	150	(1.773 MEV)	9.919	CPS	XXXXXXXXXXXXXXXXXXXX
CH	151	(1.785 MEV)	9.329	CPS	XXXXXXXXXXXXXXXXXXXX
CH	152	(1.797 MEV)	10.232	CPS	XXXXXXXXXXXXXXXXXXXX
CH	153	(1.809 MEV)	9.686	CPS	XXXXXXXXXXXXXXXXXXXX
CH	154	(1.820 MEV)	7.911	CPS	XXXXXXXXXXXXXXXXXXXX
CH	155	(1.832 MEV)	8.104	CPS	XXXXXXXXXXXXXXXXXXXX
CH	156	(1.844 MEV)	9.602	CPS	XXXXXXXXXXXXXXXXXXXX
CH	157	(1.856 MEV)	9.473	CPS	XXXXXXXXXXXXXXXXXXXX BISMUTH 214
CH	158	(1.868 MEV)	8.568	CPS	XXXXXXXXXXXXXXXXXXXX
CH	159	(1.879 MEV)	8.105	CPS	XXXXXXXXXXXXXXXXXXXX
CH	160	(1.891 MEV)	8.014	CPS	XXXXXXXXXXXXXXXXXXXX
CH	161	(1.903 MEV)	8.365	CPS	XXXXXXXXXXXXXXXXXXXX
CH	162	(1.915 MEV)	8.759	CPS	XXXXXXXXXXXXXXXXXXXX
CH	163	(1.927 MEV)	6.994	CPS	XXXXXXXXXXXXXXXXXXXX
CH	164	(1.938 MEV)	8.477	CPS	XXXXXXXXXXXXXXXXXXXX
CH	165	(1.950 MEV)	8.144	CPS	XXXXXXXXXXXXXXXXXXXX
CH	166	(1.962 MEV)	7.798	CPS	XXXXXXXXXXXXXXXXXXXX
CH	167	(1.974 MEV)	8.214	CPS	XXXXXXXXXXXXXXXXXXXX
CH	168	(1.986 MEV)	9.840	CPS	XXXXXXXXXXXXXXXXXXXX
CH	169	(1.998 MEV)	7.845	CPS	XXXXXXXXXXXXXXXXXXXX
CH	170	(2.010 MEV)	7.147	CPS	XXXXXXXXXXXXXXXXXXXX
CH	171	(2.021 MEV)	6.916	CPS	XXXXXXXXXXXXXXXXXXXX
CH	172	(2.033 MEV)	8.408	CPS	XXXXXXXXXXXXXXXXXXXX
CH	173	(2.045 MEV)	7.196	CPS	XXXXXXXXXXXXXXXXXXXX
CH	174	(2.057 MEV)	7.231	CPS	XXXXXXXXXXXXXXXXXXXX
CH	175	(2.069 MEV)	7.473	CPS	XXXXXXXXXXXXXXXXXXXX
CH	176	(2.080 MEV)	9.062	CPS	XXXXXXXXXXXXXXXXXXXX
CH	177	(2.092 MEV)	8.116	CPS	XXXXXXXXXXXXXXXXXXXX
CH	178	(2.104 MEV)	8.235	CPS	XXXXXXXXXXXXXXXXXXXX
CH	179	(2.116 MEV)	7.653	CPS	XXXXXXXXXXXXXXXXXXXX
CH	180	(2.128 MEV)	8.338	CPS	XXXXXXXXXXXXXXXXXXXX
CH	181	(2.139 MEV)	7.2.		

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

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

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

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

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

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

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 over these windows are as follows:

		QUEEN AIR	
		Aircraft	Cosmic*
TC	(cps)	152.04	2.3833
K	(cps)	16.06	0.1322
U _{dn}	(cps)	6.50	0.1098
U _{up}	(cps)	3.17	0.5540
T	(cps)	3.42	0.1503

*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>
S _{ku}	0.8437
S _{kt}	0.1584
S _{ut}	0.2703
S _{uk}	0.0
S _{tu}	0.05614
S _{tk}	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>
TC	(per foot)	0.002011
K	(per foot)	0.002740
U	(per foot)	0.002479
T	(per foot)	0.002048

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, u_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>
ℓ	0.1101
m	0.596
C' _{uk}	.00947
C' _{uu}	.07136
C' _{ut}	.04636
μℓ	-0.000032
μm	-0.000192

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>
K	1%K	91.5
U	1 ppmeu	10.4
T	1 ppmeT	6.4

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 uraniumiferous 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
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
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

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 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 (999999)
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 - JULY, 1980

NASHVILLE, COLUMBIA, BLYTHEVILLE, AND TUPELO QUADRANGLES

QUEEN AIR N9AG

7-16-80	Set up Base - Jackson, Tennessee
7-17-80	904 miles Blytheville, Columbia
7-18-80	666 miles Nashville
7-19-80	822 miles Blytheville, Tupelo
7-20-80	804 miles Columbia, Nashville
7-21 to 7-22-80	Nil production - weather
7-23-80	904 miles Blytheville, Columbia
7-24-80	898 miles Blytheville, Columbia, Nashville
7-25-80	764 miles Blytheville, Tupelo
7-26-80	684 miles Tupelo
7-27-80	883 miles Nashville, Blytheville, Columbia, Tupelo

Total for the above period - 7,329 miles as recorded by the flight crew.

Total miles for the included quadrangles:

Nashville	1,812
Columbia	1,834
Blytheville	1,834
Tupelo	1,849

APPENDIX C - Flight Path and Geologic Map

NASHVILLE

FLIGHT LINE SPACING 8.0 MILES
FLIGHT ALTITUDE 400 FEET AMT
FLOWN AND COMPILED 1980

FLIGHT PATH RECOVERY

MISSISSIPPI / FLORIDA PROJECT

U. S. DEPARTMENT OF ENERGY

SURVEY AND
COMPILED BY:

EB&G GEOMETRICS

GEOLOGIC MAP EXPLANATION
NASHVILLE QUADRANGLE
(from Martel Laboratories, 1980)

ERA	SEDIMENTARY ROCKS	EPOCH	PERIOD
CENOZOIC	Qal ALLUVIUM: HOLOCENE ALLUVIAL DEPOSITS	HOLOCENE	QUATERNARY
MESOZOIC	Kc COFFEE SAND: LIGHT GRAY FINE SAND INTERBEDDED WITH LAMINATED, LIGNITIC CLAY.		CRETACEOUS
	Kt TUSCALOOSA FORMATION: POORLY SORTED, LIGHT GRAY CHERT GRAVEL IN A MATRIX OF SILT AND SAND		
PALEOZOIC	Ps CASEYVILLE SANDSTONE: YELLOWISH-BROWN, FINE TO MEDIUM GRAINED SANDSTONE		PENNSYLVANIAN
	Ms ST. LOUIS LIMESTONE: GRAY, CHERTY, FINE - GRAINED LIMESTONE		
	Msaw SALEM AND WARSAW LIMESTONES, UNDIFFERENTIATED: OLIVE - GRAY, COARSE GRAINED LIMESTONE WITH SOME GEODES AND CHERT		
	Mfp FORT PAYNE FORMATION: LIMESTONE AND SILTSTONE		MISSISSIPPIAN
	Mc CHESTER GROUP: SANDSTONE, SHALE AND LIMESTONE		
	Msg ST. GENEVIEVE LIMESTONE: GRAY LIMESTONE, SLIGHTLY OOLITIC, WITH SOME CHERT, GREEN SHALE AND FINE - GRAINED SANDSTONE		
	Msw ST. LOUIS LIMESTONE AND WARSAW LIMESTONE, UNDIFFERENTIATED: ST. LOUIS LIMESTONE (RESIDUUM OF CHERT IN SANDY CLAY); WARSAW LIMESTONE (RESIDUUM OF POROUS CHERT BLOCKS IN SANDY CLAY)		
	D DEVONIAN SEDIMENTARY ROCKS, UNDIFFERENTIATED: INCLUDES THE PEGRAM FORMATION (GRAY LIMESTONE AND SANDSTONE), CAMDEN FORMATION (LIGHT GRAY CHERT, CLAY AND SILICEOUS LIMESTONE), HARRIMAN FORMATION (LIGHT GRAY CHERT, CLAY AND SILICEOUS LIMESTONE), FLAT GAP LIMESTONE (GRAY, COARSE - GRAINED LIMESTONE) AND ROSS FORMATION (SILICEOUS LIMESTONE, SHALE AND GLAUCONITIC LIMESTONE)		DEVONIAN
	S SILURIAN SEDIMENTARY ROCKS, UNDIFFERENTIATED: INCLUDES THE DECATOR LIMESTONE, LOBELVILLE FORMATION (MOSTLY SHALE), BOB LIMESTONE, BEECH RIVER FORMATION (MOSTLY SHALE), DIXON FORMATION (LIMESTONE, SHALE AND MUDSTONE), LEGO LIMESTONE, WALDRON SHALE, LAUREL LIMESTONE, OSGOOD FORMATION (SHALE AND LIMESTONE) AND BRASSFIELD LIMESTONE (CHERTY LIMESTONE)		SILURIAN
	O OLIGOCENE SEDIMENTARY ROCKS, UNDIFFERENTIATED: INCLUDES THE MANNIE SHALE (SHALE WITH THIN BEDS OF ARGILLACEOUS LIMESTONE), FERNVALE LIMESTONE (COARSE - GRAINED LIMESTONE) AND HERMITAGE FORMATION (GRAY SHALE AND THIN - BEDDED, SANDY, ARGILLACEOUS LIMESTONE)		ORDOVICIAN
	Oca CARTERS LIMESTONE: YELLOWISH - BROWN, FINE - GRAINED LIMESTONE WITH THIN BENTONITE BEDS		
	Olb LEBANON LIMESTONE: GRAY LIMESTONE WITH CALCAREOUS SHALE		
	Ord RIDLEY LIMESTONE: BROWNISH - GRAY, FINE - GRAINED, MAGNESIUM LIMESTONE		
	Opm PIERCE LIMESTONE AND MURFREESBORO LIMESTONE, UNDIFFERENTIATED: PIERCE LIMESTONE (GRAY LIMESTONE); MURFREESBORO LIMESTONE (DARK GRAY, FINE - GRAINED LIMESTONE)		
	Ou UPPER ORDOVICIAN SEDIMENTARY ROCKS, UNDIFFERENTIATED: INCLUDES THE MANNIE SHALE, FERNVALE LIMESTONE, SEQUATCHIE FORMATION, ARNHEIM FORMATION AND CATHEYS FORMATION		
	Obh BIGBY - CANNON LIMESTONE AND HERMITAGE FORMATION, UNDIFFERENTIATED: BIGBY - CANNON LIMESTONE (PHOSPHATIC CALCARENITE AND LIMESTONE); HERMITAGE FORMATION (MOSTLY LIMESTONE AND SHALE)		
	Oek WELLS CREEK DOLOMITE AND KNOX GROUP, UNDIFFERENTIATED: YELLOWISH - GRAY DOLOMITE INTERBEDDED WITH GRAYISH - GREEN SHALE AND LIMESTONE		

APPENDIX D - Profiles

LINE 1060
NASHVILLE QUADRANGLE - NTMS NJ 16-11
DATA ACQUIRED 802000

LINE 1070
NASHVILLE QUADRANGLE - NTMS NJ 16-11
DATA ACQUIRED 80200

LINE 1080
NASHVILLE QUADRANGLE - NTMS NJ 16-11
DATA ACQUIRED 80200

BI AIR CORR X
90. 80M 10 POK

LINE 1100
NASHVILLE QUADRANGLE - NTMS NJ 16-11
DATA ACQUIRED 80200

LINE 1110
NASHVILLE QUADRANGLE - VTMS NJ 16-11
DATA ACQUIRED 80200

[illegible]

TL/K	
MIN	5.164
MAX	19.85
MEAN	9.866
STD DEV	2.219

MIN	.0000
MAX	8.543
MEAN	3.826
STD DEV	1.064

MIN	.0000
MAX	.8036
MEAN	.3890
STD DEV	.0701

TOTAL COUNTS	
CTS/SEC	
MIN	422.2
MAX	1795
MEAN	1427
STD DEV	170.7

POTASSIUM	40
PERCENT	
MIN	.1276
MAX	1.162
MEAN	.7023
STD DEV	.1435

BISMUTH 214	
EQ. PPM	
MIN	.7250
MAX	4.285
MEAN	2.585
STD DEV	.4008

THALLIUM 208	
EQ. PPM	
MIN	1.445
MAX	9.961
MEAN	6.732
STD DEV	1.195

BI	AIR CORR	
	EQ. DPM	
MIN		.3068
MAX		1.580
MEAN		.8294
STD DEV		.2782

REGID MAC	
GAMMAS	
MIN	-1073
MAX	69.07
MEAN	-675.2
STD DEV	314.6

RADAR ALTMTR FEET	
MIN	263.4
MAX	524.5
MEAN	417.0
STD DEV	40.00

LINE 1130
NASHVILLE QUADRANGLE - NTMS NJ 16-11
DATA ACQUIRED 80202XBI AIR CORR X
EQ. PPM

LINE 1140
NASHVILLE QUADRANGLE - NTMS NJ 16-11
DATA ACQUIRED 80202

LINE 1150
NASHVILLE QUADRANGLE - NTMS NJ 16-11
DATA ACQUIRED 80202

LINE 1160
NASHVILLE QUADRANGLE - NTMS NJ 16-11
DATA ACQUIRED 80202

LINE 1170
NASHVILLE QUADRANGLE - NTMS NJ 16-11
DATA ACQUIRED 80202

LINE 5080
NASHVILLE QUADRANGLE - NTMS NJ 16-11
DATA ACQUIRED 80202

LINE 5090
NASHVILLE QUADRANGLE - NTMS NJ 13-11
DATA ACQUIRED 80208

ZBI AIR CORR X
ED. PPM

LINE 5100
NASHVILLE QUADRANGLE - NTMS NJ 16-11
DATA ACQUIRED 80208

LINE 5110
NASHVILLE QUADRANGLE - NTMS NJ 16-11
DATA ACQUIRED 80206

LINE 5120
NASHVILLE QUADRANGLE - NTMS NJ 16-11
DATA ACQUIRED 80206

LINE 5130
NASHVILLE QUADRANGLE - NTMS NJ 16-11
DATA ACQUIRED 80206

LINE 1060
NASHVILLE QUADRANGLE - NTMS NJ 16-11
DATA ACQUIRED 80200

LINE 1070
NASHVILLE QUADRANGLE - NTMS NJ 16-11
DATA ACQUIRED 80200

LINE 1080
NASHVILLE QUADRANGLE - NTMS NJ 16-11
DATA ACQUIRED 80200

BARO PRESSURE
MM HG
MIN 707.2
MAX 739.4
MEAN 724.1
STD DEV 5.116

AIR TEMPERATURE
DEG C
MIN 28.00
MAX 31.00
MEAN 30.06
STD DEV .7756

RESIDUAL MAG
GAMMAS
MIN -1051
MAX 18.49
MEAN -680.3
STD DEV 231.3

DIURNAL
GAMMAS
MIN 53992
MAX 54002
MEAN 53994
STD DEV 5.368

RADAR ALTIMTR
FEET
MIN 282.8
MAX 1198
MEAN 504.6
STD DEV 210.3

LINE 1090
NASHVILLE QUADRANGLE - NTMS NJ 16-11
DATA ACQUIRED 80200

BARO PRESSURE
MM HG
MIN 717.8
MAX 741.0
MEAN 727.2
STD DEV 2.568

AIR TEMPERATURE
DEG C
MIN 30.00
MAX 32.00
MEAN 31.12
STD DEV .5081

RESIDUAL MAG
GAMMAS
MIN -956.2
MAX 310.9
MEAN -614.3
STD DEV 272.6

DIURNAL
GAMMAS
MIN 54002
MAX 54007
MEAN 54000
STD DEV 5.032

RADAR ALTMTR
FEET
MIN 262.5
MAX 555.1
MEAN 406.9
STD DEV 47.07

LINE 1100
NASHVILLE QUADRANGLE - NTMS NJ 16-11
DATA ACQUIRED 80200

LINE 1110
NASHVILLE QUADRANGLE - NTMS NJ 16-11
DATA ACQUIRED 80200

LINE 1120
NASHVILLE QUADRANGLE - NTMS NJ 16-11
DATA ACQUIRED 80202

LINE 1130
NASHVILLE QUADRANGLE - NTMS NJ 16-11
DATA ACQUIRED 80202

LINE 1140
NASHVILLE QUADRANGLE - NTMS NJ 16-11
80202

BARO PRESSURE
MM HG
MIN 718.8
MAX 742.7
MEAN 728.0
STD DEV 2.472

AIR TEMPERATURE
DEG C
MIN 30.00
MAX 32.00
MEAN 30.96
STD DEV .2806

RESIDUAL MAG
GAMMAS
MIN -1131
MAX 847.3
MEAN -601.8
STD DEV 510.6

DIURNAL
GAMMAS
MIN 54015
MAX 54018
MEAN 54015
STD DEV 1.869

RADAR ALTMTR
FEET
MIN 319.1
MAX 553.8
MEAN 407.4
STD DEV 39.19

LINE 1140

LINE 1150
NASHVILLE QUADRANGLE - NTMS NJ 16--1
DATA ACQUIRED 80202

LINE 1160
NASHVILLE QUADRANGLE - NTMS NJ 15-11
DATA ACQUIRED 80202

LINE 5080
NASHVILLE QUADRANGLE - NTMS NJ 16-11
DATA ACQUIRED 80202

LINE 5090
NASHVILLE QUADRANGLE - NTMS NJ 16-11
DATA ACQUIRED 80208

LINE 5120
NASHVILLE QUADRANGLE - NTMS NJ 16-11
DATA ACQUIRED 80206

LINE 5130
NASHVILLE QUADRANGLE - NTMS NJ 16-11
DATA ACQUIRED 80206

LINE 5140
NASHVILLE QUADRANGLE - NTMS NJ 16-11
DATA ACQUIRED 80206

APPENDIX E - Standard Deviation Maps

NASHVILLE

E1 na

SCALE 1:500,000

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

POTASSIUM STANDARD DEVIATION MAP

MISSISSIPPI / FLORIDA PROJECT

U. S. DEPARTMENT OF ENERGY

SURVEY AND
 COMPIATION BY:

EG&G GEOMETRICS

NASHVILLE

SCALE 1:500,000

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

URANIUM STANDARD DEVIATION MAP

MISSISSIPPI / FLORIDA PROJECT

U. S. DEPARTMENT OF ENERGY

SURVEY AND
 COMPILED BY:

EG&G GEOMETRICS

NASHVILLE

E3
na

SCALE 1:500,000

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

THORIUM STANDARD DEVIATION MAP

MISSISSIPPI / FLORIDA PROJECT

U. S. DEPARTMENT OF ENERGY

SURVEY AND
 COMPILATION BY:

EG&G GEOMETRICS

NASHVILLE

E4 na

SCALE 1:500,000

○ - DATA STATISTICALLY ADEQUATE
 BLANK - DATA STATISTICALLY INADEQUATE
 * - 1 σ ABOUT MEASURE OF CENTRAL TENDENCY
 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

MISSISSIPPI / FLORIDA PROJECT

U. S. DEPARTMENT OF ENERGY

SURVEY AND
 COMPILED BY:

EG&G GEOMETRICS

NASHVILLE

E5
na

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/POTASSIUM STANDARD DEVIATION MAP

MISSISSIPPI / FLORIDA PROJECT

U. S. DEPARTMENT OF ENERGY

SURVEY AND
COMPILED BY:

EG&G GEOMETRICS

NASHVILLE

E6
na

SCALE 1:500,000

○ - DATA STATISTICALLY ADEQUATE
 ⊕ - DATA STATISTICALLY INADEQUATE
 ⊕ - 1 σ ABOUT MEASURE OF CENTRAL TENDENCY
 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

MISSISSIPPI / FLORIDA 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

THORIUM

URANIUM

POTASSIUM

U/K

U/TH

TH/K

NTMS NJ 16-11 NASHVILLE

MAP UNIT : D

TOTAL NUMBER OF SAMPLES 101

NTMS NJ 16-11 NASHVILLE

MAP UNIT : OCA TOTAL NUMBER OF SAMPLES 1952

NTMS NJ 16-11 NASHVILLE

MAP UNIT : OLB

TOTAL NUMBER
OF SAMPLES 1131

THORIUM

URANIUM

POTASSIUM

U/K

U/TH

TH/K

NTMS NJ 16-11 NASHVILLE

MAP UNIT : OBH

TOTAL NUMBER
OF SAMPLES

1927

NASHVILLE QUADRANGLEComputer Map Unit Symbol Conversion Table

<u>Computer Map Unit Symbol</u>	<u>Geologic Map Unit Symbol</u>
UNKNOWN	unlabeled unit
QAL	Qal
* KC	Kc
KT	Kt
PS	Ps
MS	Ms
MSAW	Msaw
MFP	Mfp
MC	Mc
MSG	Msg
MSW	Msw
D	D
S	S
O	O
OCA	Oca
OLB	Olb
ORD	Ord
* OPM	Opm
OU	Ou
OBH	Obh
* OCK	Ock
* OC	Oc

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 the 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.

* A statistical analysis was not performed due to an inadequate number of samples. Therefore, there are no histograms for units marked in this way.

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

ANOMALY SUMMARY TABLE

ANOMALY FLIGHT COMPUTER MAP UNIT AND NO.
ANOMALOUS SAMPLES IN UNIT

1 C	1060	QAL	/ 2	/ 0	/ 0
2 C	1060	MFP	/ 3	/ 0	/ 0
3 C	1060	OU	/ 2MFP	/ 1	/ 0
4 C	1060	OBH	/ 2	/ 0	/ 0
5 C	1060	OBH	/ 5	/ 0	/ 0
6 C	1060	OCA	/ 10BH	/ 1	/ 0
7 C	1060	OCA	/ 2	/ 0	/ 0
8 C	1060	OU	/ 20CA	/ 1	/ 0
9 C	1060	OBH	/ 10CA	/ 1	/ 0
10 C	1060	OCA	/ 4	/ 0	/ 0
11 C	1070	MFP	/ 1	/ 0	/ 0
12 C	1070	MFP	/ 2	/ 0	/ 0
13 C	1070	ORD	/ 2	/ 0	/ 0
14 C	1070	OLB	/ 3	/ 0	/ 0
15 C	1070	OCA	/ 1	/ 0	/ 0
16 C	1080	OLB	/ 20CA	/ 1	/ 0
17 C	1080	OLB	/ 1	/ 0	/ 0
18 C	1080	OBH	/ 1	/ 0	/ 0
19 C	1090	MFP	/ 10U	/ 1	/ 0
20 C	1100	MFP	/ 1	/ 0	/ 0
21 C	1100	OCA	/ 30BH	/ 1	/ 0
22 C	1100	MFP	/ 1	/ 0	/ 0
23 C	1110	OU	/ 1	/ 0	/ 0
24 C	1110	OU	/ 2	/ 0	/ 0
25 C	1120	MSG	/ 4	/ 0	/ 0
26 C	1120	MSW	/ 5	/ 0	/ 0
27 C	1120	MFP	/ 1	/ 0	/ 0
28 C	1120	MFP	/ 1	/ 0	/ 0
29 C	1130	MSW	/ 4	/ 0	/ 0
30 C	1130	MFP	/ 1	/ 0	/ 0
31 C	1130	MFP	/ 1	/ 0	/ 0
32 C	1130	MFP	/ 1	/ 0	/ 0
33 C	1150	MC	/ 1	/ 0	/ 0
34 C	1150	MC	/ 9	/ 0	/ 0
35 C	1150	MC	/ 2	/ 0	/ 0
36 C	1150	MC	/ 3	/ 0	/ 0
37 C	1160	MC	/ 1	/ 0	/ 0
38 C	1160	MC	/ 5	/ 0	/ 0
39 C	1160	MC	/ 3	/ 0	/ 0
40 C?	5090	MSW	/ 19	/ 0	/ 0
41 C?	5090	MSW	/ 15	/ 5	/ 0
42 C?	5090	QAL	/ 1MSW	/ 8	/ 0
43 C	5090	MC	/ 1	/ 0	/ 0
44 C?	5100	MSW	/ 14	/ 0	/ 0
45 C?	5100	MSW	/ 9MFP	/ 1	/ 0
46 C	5100	MFP	/ 2	/ 0	/ 0
47 C?	5100	MSW	/ 7QAL	/ 1	/ 0
48 C	5100	MSW	/ 6	/ 0	/ 0
49 C?	5100	MSW	/ 13MSG	/ 5	/ 0
50 C	5100	MSG	/ 4	/ 0	/ 0

PEAK PPM	NUMBER OF SAMPLES WITH A STANDARD DEVIATION OF :						
	1	2	3	4	5	6	7 GT7
3.1	0	2	0	0	0	0	0
2.9	2	1	0	0	0	0	0
3.9	0	2	1	0	0	0	0
3.6	0	1	1	0	0	0	0
3.8	1	3	1	0	0	0	0
3.3	0	2	0	0	0	0	0
4.3	0	1	0	1	0	0	0
4.1	0	1	1	1	0	0	0
3.4	0	2	0	0	0	0	0
3.2	2	2	0	0	0	0	0
3.5	0	0	1	0	0	0	0
3.4	1	0	1	0	0	0	0
2.7	0	2	0	0	0	0	0
2.6	2	1	0	0	0	0	0
3.6	0	0	1	0	0	0	0
3.1	2	1	0	0	0	0	0
3.4	0	0	1	0	0	0	0
3.6	0	0	1	0	0	0	0
3.5	0	1	1	0	0	0	0
3.6	0	0	1	0	0	0	0
2.9	3	1	0	0	0	0	0
4.0	0	0	0	1	0	0	0
4.1	0	0	1	0	0	0	0
4.1	0	1	1	0	0	0	0
3.8	1	3	0	0	0	0	0
3.9	3	2	0	0	0	0	0
3.5	0	0	1	0	0	0	0
3.4	0	0	1	0	0	0	0
3.5	3	1	0	0	0	0	0
3.6	0	0	1	0	0	0	0
3.6	0	0	1	0	0	0	0
3.3	0	0	1	0	0	0	0
3.4	0	0	1	0	0	0	0
3.4	3	5	1	0	0	0	0
3.3	1	0	1	0	0	0	0
3.2	0	3	0	0	0	0	0
3.3	0	0	1	0	0	0	0
3.1	4	1	0	0	0	0	0
3.0	2	1	0	0	0	0	0
7.7	0	3	1	0	3	1	6
7.0	1	0	2	1	1	0	1
4.3	0	7	2	0	0	0	0
3.5	0	0	1	0	0	0	0
5.8	1	3	1	6	3	0	0
5.8	0	3	2	3	2	0	0
3.3	0	2	0	0	0	0	0
4.4	2	3	3	0	0	0	0
4.5	3	1	2	0	0	0	0
6.2	1	4	6	5	0	2	0
3.9	2	2	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	1	2	3	4	5	6	7	GT7	

51 C	5110	MFP	/ 1	/ 0	/ 0	3.4	0	0	1	0	0	0	0
52 C	5140	DCA	/ 3	/ 0	/ 0	2.9	2	1	0	0	0	0	0
53 C	5140	MFP	/ 10U	/ 2	/ 0	4.2	0	2	1	0	0	0	0
54 C	5140	MFP	/ 1	/ 0	/ 0	3.5	0	0	1	0	0	0	0
55 C	5140	MFP	/ 2S	/ 1UNKNOWN	/ 1	3.9	2	2	0	0	0	0	0

NOTES: M INDICATES THAT THE ANOMALY LIES OVER
A URANIUM MINE OR PROSPECT.

C INDICATES THAT THE ANOMALY LIES OVER A CULTURAL FEATURE.

W INDICATES POSSIBLE INTERFERENCE BY WEATHER PHENOMENA.

			MAP UNIT UNKNOWN						
			-3	-2	-1	0	+1	+2	+3
POTASium	DIST	NORMAL	0. 1031	0. 3172	0. 5313	0. 7454	0. 9595	1. 1736	1. 3877
URANIUM	DIST	NORMAL	0. 4495	1. 0649	1. 6803	2. 2957	2. 9111	3. 5265	4. 1419
THORIUM	DIST	NORMAL	2. 1125	3. 4389	4. 7653	6. 0917	7. 4181	8. 7445	10. 0709
U/K	DIST	NORMAL	0. 7056	1. 5319	2. 3582	3. 1845	4. 0108	4. 8371	5. 6634
U/TH	DIST	NORMAL	-0. 0215	0. 1159	0. 2533	0. 3907	0. 5281	0. 6655	0. 8029
TH/K	DIST	NORMAL	2. 3512	4. 4203	6. 4894	8. 5585	10. 6276	12. 6967	14. 7658

			MAP UNIT GAL						
			-3	-2	-1	0	+1	+2	+3
POTASium	DIST	NORMAL	0. 0666	0. 2533	0. 4400	0. 6267	0. 8134	1. 0001	1. 1868
URANIUM	DIST	NORMAL	0. 4794	1. 0295	1. 5796	2. 1297	2. 6798	3. 2299	3. 7800
THORIUM	DIST	NORMAL	0. 7628	2. 3545	3. 9462	5. 5379	7. 1296	8. 7213	10. 3130
U/K	DIST	NORMAL	0. 1748	1. 3202	2. 4656	3. 6110	4. 7564	5. 9018	7. 0472
U/TH	DIST	NORMAL	0. 0680	0. 1773	0. 2866	0. 3959	0. 5052	0. 6145	0. 7238
TH/K	DIST	NORMAL	2. 8811	4. 9915	7. 1019	9. 2123	11. 3227	13. 4331	15. 5435

			MAP UNIT KT						
			-3	-2	-1	0	+1	+2	+3
POTASium	DIST	NORMAL	0. 3241	0. 4279	0. 5317	0. 6355	0. 7393	0. 8431	0. 9469
URANIUM	DIST	NORMAL	1. 2750	1. 5247	1. 7744	2. 0241	2. 2738	2. 5235	2. 7732
THORIUM	DIST	NORMAL	3. 4524	4. 0011	4. 5498	5. 0985	5. 6472	6. 1959	6. 7446
U/K	DIST	NORMAL	0. 9361	1. 7209	2. 5057	3. 2905	4. 0753	4. 8601	5. 6449
U/TH	DIST	NORMAL	0. 1883	0. 2598	0. 3313	0. 4028	0. 4743	0. 5458	0. 6173
TH/K	DIST	NORMAL	4. 8931	5. 9812	7. 0693	8. 1574	9. 2455	10. 3336	11. 4217

			MAP UNIT PS						
			-3	-2	-1	0	+1	+2	+3
POTASium	DIST	NORMAL	0. 1471	0. 3213	0. 4955	0. 6697	0. 8439	1. 0181	1. 1923
URANIUM	DIST	NORMAL	0. 5860	1. 0243	1. 4626	1. 9009	2. 3392	2. 7775	3. 2158
THORIUM	DIST	NORMAL	2. 1299	3. 3571	4. 5843	5. 8115	7. 0387	8. 2659	9. 4931
U/K	DIST	NORMAL	0. 8875	1. 5736	2. 2597	2. 9458	3. 6319	4. 3180	5. 0041
U/TH	DIST	NORMAL	0. 1682	0. 2225	0. 2768	0. 3311	0. 3854	0. 4397	0. 4940
TH/K	DIST	NORMAL	4. 3473	5. 8680	7. 3887	8. 9094	10. 4301	11. 9508	13. 4715

			MAP UNIT MS						
			-3	-2	-1	0	+1	+2	+3
POTASium	DIST	NORMAL	0. 2952	0. 3690	0. 4428	0. 5166	0. 5904	0. 6642	0. 7380
URANIUM	DIST	NORMAL	1. 3358	1. 6117	1. 8876	2. 1635	2. 4394	2. 7153	2. 9912
THORIUM	DIST	NORMAL	3. 3086	4. 0505	4. 7924	5. 5343	6. 2762	7. 0181	7. 7600
U/K	DIST	NORMAL	1. 9610	2. 7284	3. 4958	4. 2632	5. 0306	5. 7980	6. 5654
U/TH	DIST	NORMAL	0. 1950	0. 2624	0. 3298	0. 3972	0. 4646	0. 5320	0. 5994
TH/K	DIST	NORMAL	6. 5605	7. 9809	9. 4013	10. 8217	12. 2421	13. 6625	15. 0829

			MAP UNIT MSAW						
			-3	-2	-1	0	+1	+2	+3
POTASium	DIST	NORMAL	0. 2893	0. 3931	0. 4969	0. 6007	0. 7045	0. 8083	0. 9121
URANIUM	DIST	NORMAL	1. 1247	1. 5286	1. 9325	2. 3364	2. 7403	3. 1442	3. 5481
THORIUM	DIST	NORMAL	2. 9755	4. 0505	5. 1255	6. 2005	7. 2755	8. 3505	9. 4255
U/K	DIST	NORMAL	1. 0071	1. 9960	2. 9849	3. 9738	4. 9627	5. 9516	6. 9405
U/TH	DIST	NORMAL	0. 1689	0. 2391	0. 3093	0. 3795	0. 4497	0. 5199	0. 5901
TH/K	DIST	NORMAL	5. 3476	7. 0533	8. 7590	10. 4647	12. 1704	13. 8761	15. 5818

			MAP UNIT MFP						
			-3	-2	-1	0	+1	+2	+3
POTASium	DIST	NORMAL	0. 2183	0. 3399	0. 4615	0. 5831	0. 7047	0. 8263	0. 9479
URANIUM	DIST	NORMAL	0. 5694	1. 0681	1. 5668	2. 0655	2. 5642	3. 0629	3. 5616
THORIUM	DIST	NORMAL	1. 3557	2. 6031	3. 8505	5. 0979	6. 3453	7. 5927	8. 8401
U/K	DIST	NORMAL	0. 8016	1. 7456	2. 6896	3. 6336	4. 5776	5. 5216	6. 4656
U/TH	DIST	NORMAL	0. 1334	0. 2270	0. 3206	0. 4142	0. 5078	0. 6014	0. 6950
TH/K	DIST	NORMAL	2. 7454	4. 8060	6. 8666	8. 9272	10. 9878	13. 0484	15. 1090

MAP UNIT MC

			-3	-2	-1	0	+1	+2	+3
POTASium	DIST	NORMAL	0. 3411	0. 4833	0. 6255	0. 7677	0. 9099	1. 0521	1. 1943
URANIUM	DIST	NORMAL	0. 8322	1. 2802	1. 7282	2. 1762	2. 6242	3. 0722	3. 5202
THORIUM	DIST	NORMAL	3. 2142	4. 3661	5. 5180	6. 6699	7. 8218	8. 9737	10. 1256
U/K	DIST	NORMAL	1. 1467	1. 7244	2. 3021	2. 8798	3. 4575	4. 0352	4. 6129
U/TH	DIST	NORMAL	0. 1585	0. 2154	0. 2723	0. 3292	0. 3861	0. 4430	0. 4999
TH/K	DIST	NORMAL	5. 3833	6. 5131	7. 6429	8. 7727	9. 9025	11. 0323	12. 1621

MAP UNIT MSG

			-3	-2	-1	0	+1	+2	+3
POTASium	DIST	NORMAL	0. 3835	0. 5627	0. 7419	0. 9211	1. 1003	1. 2795	1. 4587
URANIUM	DIST	NORMAL	1. 2849	1. 8169	2. 3489	2. 8809	3. 4129	3. 9449	4. 4769
THORIUM	DIST	NORMAL	5. 2502	6. 0845	6. 9188	7. 7531	8. 5874	9. 4217	10. 2560
U/K	DIST	NORMAL	0. 2018	1. 2272	2. 2526	3. 2780	4. 3034	5. 3288	6. 3542
U/TH	DIST	NORMAL	0. 1321	0. 2134	0. 2947	0. 3760	0. 4573	0. 5386	0. 6199
TH/K	DIST	NORMAL	3. 4389	5. 1927	6. 9465	8. 7003	10. 4541	12. 2079	13. 9617

MAP UNIT MSW

			-3	-2	-1	0	+1	+2	+3
POTASium	DIST	NORMAL	0. 1570	0. 3530	0. 5490	0. 7450	0. 9410	1. 1370	1. 3330
URANIUM	DIST	NORMAL	0. 6328	1. 2639	1. 8950	2. 5261	3. 1572	3. 7883	4. 4194
THORIUM	DIST	NORMAL	2. 3780	3. 7774	5. 1768	6. 5762	7. 9756	9. 3750	10. 7744
U/K	DIST	NORMAL	-0. 1129	1. 1135	2. 3399	3. 5663	4. 7927	6. 0191	7. 2455
U/TH	DIST	NORMAL	0. 0560	0. 1684	0. 2808	0. 3932	0. 5056	0. 6180	0. 7304
TH/K	DIST	NORMAL	3. 6992	5. 4890	7. 2788	9. 0686	10. 8584	12. 6482	14. 4380

MAP UNIT D

			-3	-2	-1	0	+1	+2	+3
POTASium	DIST	NORMAL	0. 0225	0. 2143	0. 4061	0. 5979	0. 7897	0. 9815	1. 1733
URANIUM	DIST	NORMAL	-0. 4543	0. 4884	1. 4311	2. 3738	3. 3165	4. 2592	5. 2019
THORIUM	DIST	NORMAL	0. 3407	1. 7817	3. 2227	4. 6637	6. 1047	7. 5457	8. 9867
U/K	DIST	NORMAL	0. 3455	1. 5959	2. 8463	4. 0967	5. 3471	6. 5975	7. 8479
U/TH	DIST	NORMAL	-0. 0788	0. 1271	0. 3330	0. 5389	0. 7448	0. 9507	1. 1566
TH/K	DIST	NORMAL	3. 2147	4. 7851	6. 3555	7. 9259	9. 4963	11. 0667	12. 6371

MAP UNIT S

			-3	-2	-1	0	+1	+2	+3
POTASium	DIST	NORMAL	0. 2751	0. 4351	0. 5951	0. 7551	0. 9151	1. 0751	1. 2351
URANIUM	DIST	NORMAL	-0. 1576	0. 7266	1. 6108	2. 4950	3. 3792	4. 2634	5. 1476
THORIUM	DIST	NORMAL	1. 9406	3. 0432	4. 1458	5. 2484	6. 3510	7. 4536	8. 5562
U/K	DIST	NORMAL	0. 1096	1. 1935	2. 2774	3. 3613	4. 4452	5. 5291	6. 6130
U/TH	DIST	NORMAL	0. 0384	0. 1858	0. 3332	0. 4806	0. 6280	0. 7754	0. 9228
TH/K	DIST	NORMAL	2. 9655	4. 3363	5. 7071	7. 0779	8. 4487	9. 8195	11. 1903

MAP UNIT O

			-3	-2	-1	0	+1	+2	+3
POTASium	DIST	NORMAL	0. 3136	0. 4517	0. 5898	0. 7279	0. 8660	1. 0041	1. 1422
URANIUM	DIST	NORMAL	0. 9734	1. 3606	1. 7478	2. 1350	2. 5222	2. 9094	3. 2966
THORIUM	DIST	NORMAL	2. 5451	3. 6001	4. 6551	5. 7101	6. 7651	7. 8201	8. 8751
U/K	DIST	NORMAL	0. 0589	1. 0738	2. 0887	3. 1036	4. 1185	5. 1334	6. 1483
U/TH	DIST	NORMAL	0. 0294	0. 1503	0. 2712	0. 3921	0. 5130	0. 6339	0. 7548
TH/K	DIST	NORMAL	4. 6240	5. 7262	6. 8284	7. 9306	9. 0328	10. 1350	11. 2372

MAP UNIT OCA

			-3	-2	-1	0	+1	+2	+3
POTASium	DIST	NORMAL	0. 2313	0. 4099	0. 5885	0. 7671	0. 9457	1. 1243	1. 3029
URANIUM	DIST	NORMAL	0. 4563	0. 9901	1. 5234	2. 0567	2. 5900	3. 1233	3. 6566
THORIUM	DIST	NORMAL	3. 2064	4. 2984	5. 3904	6. 4824	7. 5744	8. 6664	9. 7584
U/K	DIST	NORMAL	0. 3050	1. 1294	1. 9538	2. 7782	3. 6026	4. 4270	5. 2514
U/TH	DIST	NORMAL	0. 0910	0. 1669	0. 2428	0. 3187	0. 3946	0. 4705	0. 5464
TH/K	DIST	NORMAL	2. 9931	4. 9128	6. 8325	8. 7522	10. 6719	12. 5916	14. 5113

			MAP UNIT		OLB				
			-3	-2	-1	0	+1	+2	+3
POTASium	DIST	NORMAL	0. 2483	0. 3888	0. 5293	0. 6698	0. 8103	0. 9508	1. 0913
URANIUM	DIST	NORMAL	0. 5540	1. 0088	1. 4636	1. 9184	2. 3732	2. 8280	3. 2828
THORIUM	DIST	NORMAL	2. 5553	3. 7924	5. 0295	6. 2666	7. 5037	8. 7408	9. 9779
U/K	DIST	NORMAL	0. 4882	1. 3002	2. 1122	2. 9242	3. 7362	4. 5482	5. 3602
U/TH	DIST	NORMAL	0. 1294	0. 1877	0. 2460	0. 3043	0. 3626	0. 4209	0. 4792
TH/K	DIST	NORMAL	3. 2152	5. 3524	7. 4896	9. 6268	11. 7640	13. 9012	16. 0384

			MAP UNIT ORD						
			-3	-2	-1	0	+1	+2	+3
POTASium	DIST	NORMAL	0. 1381	0. 3048	0. 4715	0. 6382	0. 8049	0. 9716	1. 1383
URANIUM	DIST	NORMAL	0. 1466	0. 7077	1. 2688	1. 8299	2. 3910	2. 9521	3. 5132
THORIUM	DIST	NORMAL	0. 8485	2. 4920	4. 1355	5. 7790	7. 4225	9. 0660	10. 7095
U/K	DIST	NORMAL	0. 0808	1. 0119	1. 9430	2. 8741	3. 8052	4. 7363	5. 6674
U/TH	DIST	NORMAL	0. 0889	0. 1620	0. 2351	0. 3082	0. 3813	0. 4544	0. 5275
TH/K	DIST	NORMAL	3. 2307	5. 2526	7. 2745	9. 2964	11. 3183	13. 3402	15. 3621

			MAP UNIT OU						
			-3	-2	-1	0	+1	+2	+3
POTASium	DIST	NORMAL	0. 4135	0. 5860	0. 7585	0. 9310	1. 1035	1. 2760	1. 4485
URANIUM	DIST	NORMAL	1. 0366	1. 5486	2. 0606	2. 5726	3. 0846	3. 5966	4. 1086
THORIUM	DIST	NORMAL	3. 2956	4. 4765	5. 6574	6. 8383	8. 0192	9. 2001	10. 3810
U/K	DIST	NORMAL	0. 7766	1. 4638	2. 1510	2. 8382	3. 5254	4. 2126	4. 8998
U/TH	DIST	NORMAL	0. 0814	0. 1830	0. 2846	0. 3862	0. 4878	0. 5894	0. 6910
TH/K	DIST	NORMAL	2. 8293	4. 3897	5. 9501	7. 5105	9. 0709	10. 6313	12. 1917

			MAP UNIT		OBH				
			-3	-2	-1	0	+1	+2	+3
POTASIUM	DIST	NORMAL	0. 3813	0. 5297	0. 6781	0. 8265	0. 9749	1. 1233	1. 2717
URANIUM	DIST	NORMAL	0. 7498	1. 2553	1. 7608	2. 2663	2. 7718	3. 2773	3. 7828
THORIUM	DIST	NORMAL	3. 5001	4. 5168	5. 5335	6. 5502	7. 5669	8. 5836	9. 6003
U/K	DIST	NORMAL	0. 4308	1. 2304	2. 0300	2. 8296	3. 6292	4. 4288	5. 2284
U/TH	DIST	NORMAL	0. 1173	0. 1950	0. 2727	0. 3504	0. 4281	0. 5058	0. 5835
TH/K	DIST	NORMAL	3. 5677	5. 0745	6. 5813	8. 0881	9. 5949	11. 1017	12. 6085

LINE BASED MEAN CONCENTRATIONS
AND RATIOS PER ROCK TYPE

MAP UNIT UNKNOW

	1060	1070	1080	1090	1100	1110	1120	1130	1140	1150	1160	1170	5080	5090	5100
POTASIMUM	0.671	0.000	0.807	0.714	1.023	0.000	0.000	0.000	0.634	0.000	0.562	0.000	0.000	0.000	0.727
URANIUM	2.153	0.000	2.500	1.834	2.808	0.000	0.000	0.000	2.279	0.000	2.253	0.000	0.000	0.000	2.566
THORIUM	5.846	0.000	6.986	6.298	6.389	0.000	0.000	0.000	5.970	0.000	6.337	0.000	0.000	0.000	6.421
U/K	3.207	0.000	3.116	2.686	2.757	0.000	0.000	0.000	3.656	0.000	4.002	0.000	0.000	0.000	3.542
U/TH	0.375	0.000	0.374	0.294	0.448	0.000	0.000	0.000	0.390	0.000	0.356	0.000	0.000	0.000	0.400
TH/K	8.631	0.000	8.857	9.076	6.248	0.000	0.000	0.000	9.907	0.000	11.293	0.000	0.000	0.000	8.900

	5110	5120	5130	5140
POTASIMUM	0.000	0.000	0.639	0.558
URANIUM	0.000	0.000	1.748	2.319
THORIUM	0.000	0.000	5.864	4.640
U/K	0.000	0.000	2.740	4.063
U/TH	0.000	0.000	0.298	0.511
TH/K	0.000	0.000	9.187	8.550

MAP UNIT GAL

	1060	1070	1080	1090	1100	1110	1120	1130	1140	1150	1160	1170	5080	5090	5100
POTASIMUM	0.645	0.140	0.784	0.669	0.642	0.635	0.519	0.565	0.682	0.538	0.660	0.696	0.520	0.614	0.777
URANIUM	2.387	0.927	2.278	1.981	1.859	1.915	1.722	1.754	2.172	2.042	1.975	2.435	1.873	3.604	3.544
THORIUM	5.877	1.292	6.155	6.043	4.778	4.869	4.353	4.401	5.625	4.785	5.856	6.235	4.184	5.834	6.252
U/K	3.816	6.645	2.995	3.170	3.208	2.877	3.774	3.684	3.197	3.869	3.088	3.619	3.974	5.897	4.670
U/TH	0.415	0.632	0.387	0.334	0.415	0.373	0.429	0.476	0.343	0.436	0.341	0.403	0.169	0.620	0.574
TH/K	9.233	10.522	7.876	9.543	7.843	7.646	8.701	7.935	9.348	8.853	8.946	9.137	8.736	9.525	8.136

	5110	5120	5130	5140
POTASIMUM	0.810	0.650	0.495	0.608
URANIUM	2.403	2.047	2.112	2.388
THORIUM	5.922	5.412	5.182	6.939
U/K	3.037	3.355	4.468	3.986
U/TH	0.434	0.390	0.413	0.345
TH/K	7.300	8.520	10.855	11.545

MAP UNIT KT

	1060	1070	1080	1090	1100	1110	1120	1130	1140	1150	1160	1170	5080	5090	5100
POTASium	0.483	0.000	0.000	0.000	0.000	0.000	0.722	0.725	0.000	0.000	0.000	0.000	0.629	0.000	0.000
URANIUM	2.161	0.000	0.000	0.000	0.000	0.000	1.966	1.658	0.000	0.000	0.000	0.000	2.081	0.000	0.000
THORIUM	4.493	0.000	0.000	0.000	0.000	0.000	5.235	5.869	0.000	0.000	0.000	0.000	5.037	0.000	0.000
U/K	4.576	0.000	0.000	0.000	0.000	0.000	2.722	2.299	0.000	0.000	0.000	0.000	3.354	0.000	0.000
U/TH	0.482	0.000	0.000	0.000	0.000	0.000	0.376	0.282	0.000	0.000	0.000	0.000	0.417	0.000	0.000
TH/K	9.522	0.000	0.000	0.000	0.000	0.000	7.346	8.170	0.000	0.000	0.000	0.000	8.059	0.000	0.000

	5110	5120	5130	5140
POTASium	0.000	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000	0.000
THORIUM	0.000	0.000	0.000	0.000
U/K	0.000	0.000	0.000	0.000
U/TH	0.000	0.000	0.000	0.000
TH/K	0.000	0.000	0.000	0.000

MAP UNIT PS

	1060	1070	1080	1090	1100	1110	1120	1130	1140	1150	1160	1170	5080	5090	5100
POTASium	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.669	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.945	0.000	0.000	0.000
THORIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5.826	0.000	0.000	0.000
U/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3.037	0.000	0.000	0.000
U/TH	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.338	0.000	0.000	0.000
TH/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	8.997	0.000	0.000	0.000

	5110	5120	5130	5140
POTASium	0.673	0.000	0.000	0.000
URANIUM	1.715	0.000	0.000	0.000
THORIUM	5.752	0.000	0.000	0.000
U/K	2.555	0.000	0.000	0.000
U/TH	0.302	0.000	0.000	0.000
TH/K	8.536	0.000	0.000	0.000

MAP UNIT MS

	1060	1070	1080	1090	1100	1110	1120	1130	1140	1150	1160	1170	5080	5090	5100
POTASium	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.597	0.528	0.535	0.000	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.449	2.339	1.855	0.000	0.000	0.000	0.000
THORIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5.533	5.633	4.375	0.000	0.000	0.000	0.000
U/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4.131	4.463	3.466	0.000	0.000	0.000	0.000
U/TH	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.445	0.415	0.426	0.000	0.000	0.000	0.000
TH/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	9.284	10.714	8.201	0.000	0.000	0.000	0.000

	5110	5120	5130	5140
POTASium	0.000	0.000	0.491	0.000
URANIUM	0.000	0.000	2.090	0.000
THORIUM	0.000	0.000	5.637	0.000
U/K	0.000	0.000	4.347	0.000
U/TH	0.000	0.000	0.379	0.000
TH/K	0.000	0.000	11.515	0.000

MAP UNIT MSAW

	1060	1070	1080	1090	1100	1110	1120	1130	1140	1150	1160	1170	5080	5090	5100
POTASium	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.594	0.635	0.604	0.767	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.658	2.353	1.958	2.569	0.000	0.000	0.000
THORIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	6.968	6.446	5.419	7.067	0.000	0.000	0.000
U/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4.545	3.803	3.205	3.356	0.000	0.000	0.000
U/TH	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.386	0.368	0.356	0.364	0.000	0.000	0.000
TH/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	11.805	10.314	9.076	9.255	0.000	0.000	0.000

	5110	5120	5130	5140
POTASium	0.000	0.000	0.541	0.000
URANIUM	0.000	0.000	2.255	0.000
THORIUM	0.000	0.000	5.573	0.000
U/K	0.000	0.000	4.311	0.000
U/TH	0.000	0.000	0.413	0.000
TH/K	0.000	0.000	10.485	0.000

	MAP UNIT MFP														
	1060	1070	1080	1090	1100	1110	1120	1130	1140	1150	1160	1170	5080	5090	5100
POTASIMUM	0.590	0.560	0.538	0.569	0.611	0.638	0.607	0.633	0.588	0.604	0.674	0.000	0.521	0.625	0.665
URANIUM	2.185	2.008	1.800	1.852	1.966	2.060	2.352	2.405	2.314	2.054	2.240	0.000	1.844	2.445	2.547
THORIUM	5.174	4.679	4.207	4.545	4.809	4.959	6.191	6.433	6.047	5.669	6.251	0.000	4.212	5.522	6.149
U/K	3.782	3.679	3.521	3.326	3.293	3.267	4.029	3.861	4.031	3.458	3.381	0.000	3.670	3.959	3.845
U/TH	0.435	0.438	0.431	0.415	0.417	0.424	0.384	0.379	0.386	0.367	0.358	0.000	0.450	0.446	0.415
TH/K	8.863	8.462	8.208	8.149	8.044	7.880	10.523	10.399	10.542	9.702	9.365	0.000	8.203	8.902	9.338

	5110	5120	5130	5140
POTASIMUM	0.562	0.647	0.596	0.570
URANIUM	1.837	1.694	1.927	2.179
THORIUM	4.441	4.615	5.032	5.471
U/K	3.365	2.681	3.392	3.890
U/TH	0.417	0.373	0.384	0.406
TH/K	8.182	7.324	8.791	9.853

	MAP UNIT MC														
	1060	1070	1080	1090	1100	1110	1120	1130	1140	1150	1160	1170	5080	5090	5100
POTASIMUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.894	0.785	0.738	0.000	0.859	0.736
URANIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.802	2.232	1.984	0.000	2.366	2.213
THORIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	7.894	6.957	6.264	0.000	7.032	6.397
U/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3.191	2.889	2.746	0.000	2.787	3.054
U/TH	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.357	0.325	0.321	0.000	0.338	0.350
TH/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	8.977	8.936	8.584	0.000	8.254	8.759

	5110	5120	5130	5140
POTASIMUM	0.751	0.656	0.000	0.000
URANIUM	2.116	2.103	0.000	0.000
THORIUM	6.661	6.006	0.000	0.000
U/K	2.852	3.211	0.000	0.000
U/TH	0.319	0.351	0.000	0.000
TH/K	8.918	9.181	0.000	0.000

MAP UNIT MSG

	1060	1070	1080	1090	1100	1110	1120	1130	1140	1150	1160	1170	5080	5090	5100
POTASium	0.000	0.000	0.000	0.000	0.000	0.000	0.793	1.007	0.965	0.000	0.000	0.000	0.000	0.826	0.941
URANIUM	0.000	0.000	0.000	0.000	0.000	0.000	2.897	2.877	2.747	0.000	0.000	0.000	0.000	2.602	3.343
THORIUM	0.000	0.000	0.000	0.000	0.000	0.000	7.475	8.062	7.948	0.000	0.000	0.000	0.000	7.391	7.450
U/K	0.000	0.000	0.000	0.000	0.000	0.000	3.849	2.933	2.935	0.000	0.000	0.000	0.000	3.297	3.723
U/TH	0.000	0.000	0.000	0.000	0.000	0.000	0.392	0.360	0.349	0.000	0.000	0.000	0.000	0.355	0.453
TH/K	0.000	0.000	0.000	0.000	0.000	0.000	9.847	8.177	8.401	0.000	0.000	0.000	0.000	9.245	8.011

	5110	5120	5130	5140
POTASium	0.786	0.000	0.000	0.000
URANIUM	2.886	0.000	0.000	0.000
THORIUM	7.670	0.000	0.000	0.000
U/K	3.824	0.000	0.000	0.000
U/TH	0.379	0.000	0.000	0.000
TH/K	10.133	0.000	0.000	0.000

MAP UNIT MSW

	1060	1070	1080	1090	1100	1110	1120	1130	1140	1150	1160	1170	5080	5090	5100
POTASium	0.616	0.659	0.639	0.636	0.647	0.637	0.726	0.822	0.930	0.921	0.845	0.748	0.652	0.770	0.727
URANIUM	2.262	2.389	2.168	2.076	2.208	2.274	2.647	2.720	2.682	2.673	2.520	2.445	1.883	2.988	3.200
THORIUM	5.513	5.930	5.378	5.545	5.721	5.897	6.893	7.374	7.679	7.728	7.275	6.429	4.641	6.419	6.579
U/K	3.744	3.684	3.452	3.338	3.486	3.651	3.769	3.455	3.020	3.067	3.108	3.495	2.898	4.260	4.641
U/TH	0.420	0.411	0.408	0.381	0.393	0.393	0.389	0.375	0.354	0.352	0.349	0.388	0.403	0.492	0.497
TH/K	8.999	9.068	8.499	8.808	8.921	9.365	9.720	9.222	8.510	8.677	8.901	8.964	7.296	8.564	9.228

	5110	5120	5130	5140
POTASium	0.730	0.710	0.504	0.590
URANIUM	2.529	2.622	2.350	2.045
THORIUM	6.726	7.241	5.780	5.725
U/K	3.593	3.832	4.761	3.622
U/TH	0.380	0.367	0.411	0.366
TH/K	9.444	10.463	11.633	9.882

MAP UNIT D

	1060	1070	1080	1090	1100	1110	1120	1130	1140	1150	1160	1170	5080	5090	5100
POTASium	0.799	0.000	0.000	0.000	0.832	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.477	0.000
URANIUM	2.781	0.000	0.000	0.000	2.485	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3.007	0.000
THORIUM	5.334	0.000	0.000	0.000	6.859	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3.179	0.000
U/K	3.440	0.000	0.000	0.000	2.991	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	6.111	0.000
U/TH	0.523	0.000	0.000	0.000	0.363	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.917	0.000
TH/K	6.792	0.000	0.000	0.000	8.257	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	6.658	0.000

	5110	5120	5130	5140
POTASium	0.000	0.000	0.000	0.529
URANIUM	0.000	0.000	0.000	2.037
THORIUM	0.000	0.000	0.000	4.537
U/K	0.000	0.000	0.000	3.917
U/TH	0.000	0.000	0.000	0.463
TH/K	0.000	0.000	0.000	8.633

MAP UNIT S

	1060	1070	1080	1090	1100	1110	1120	1130	1140	1150	1160	1170	5080	5090	5100
POTASium	0.759	0.720	0.704	0.934	0.926	0.870	0.666	0.630	0.648	0.000	0.000	0.000	0.000	0.887	0.000
URANIUM	2.302	2.133	2.282	2.874	2.458	2.375	2.287	2.520	2.469	0.000	0.000	0.000	0.000	4.744	0.000
THORIUM	4.812	4.689	4.081	6.049	5.955	5.725	5.207	5.478	5.336	0.000	0.000	0.000	0.000	6.520	0.000
U/K	3.119	3.024	3.159	3.105	2.649	2.749	3.633	3.980	3.833	0.000	0.000	0.000	0.000	5.426	0.000
U/TH	0.491	0.463	0.560	0.481	0.417	0.421	0.442	0.463	0.469	0.000	0.000	0.000	0.000	0.735	0.000
TH/K	6.444	6.555	5.820	6.507	6.471	6.570	8.044	8.924	8.293	0.000	0.000	0.000	0.000	7.380	0.000

	5110	5120	5130	5140
POTASium	0.649	0.594	0.794	0.632
URANIUM	1.802	2.230	2.620	2.809
THORIUM	4.316	4.860	5.615	4.984
U/K	2.816	3.862	3.272	4.443
U/TH	0.423	0.473	0.464	0.594
TH/K	6.720	8.302	7.102	8.006

MAP UNIT 0

[illegible]

	5110	5120	5130	5140
POTASSIUM	0.000	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000	0.000
THORIUM	0.000	0.000	0.000	0.000
U/K	0.000	0.000	0.000	0.000
U/TH	0.000	0.000	0.000	0.000
TH/K	0.000	0.000	0.000	0.000

MAP UNIT OCA

[illegible]

	5110	5120	5130	5140
POTASium	0.000	0.812	0.719	0.826
URANIUM	0.000	2.179	1.802	2.183
THORIUM	0.000	6.151	5.852	6.481
U/K	0.000	2.653	2.609	2.729
U/TH	0.000	0.352	0.310	0.340
TH/K	0.000	7.616	8.414	8.058

	5110	5120	5130	5140
POTASium	0.000	0.000	0.636	0.000
URANIUM	0.000	0.000	1.751	0.000
THORIUM	0.000	0.000	5.598	0.000
U/K	0.000	0.000	2.838	0.000
U/TH	0.000	0.000	0.315	0.000
TH/K	0.000	0.000	9.008	0.000

	5110	5120	5130	5140
POTASium	0.000	0.000	0.683	0.000
URANIUM	0.000	0.000	1.929	0.000
THORIUM	0.000	0.000	5.909	0.000
U/K	0.000	0.000	2.860	0.000
U/TH	0.000	0.000	0.325	0.000
TH/K	0.000	0.000	8.718	0.000

MAP UNIT DU

	1060	1070	1080	1090	1100	1110	1120	1130	1140	1150	1160	1170	5080	5090	5100
POTASium	0.901	0.867	0.880	0.857	0.893	1.035	0.000	0.709	0.000	0.000	0.000	0.000	0.000	0.000	0.000
URANIUM	2.626	2.484	2.248	2.477	2.516	2.676	0.000	2.787	0.000	0.000	0.000	0.000	0.000	0.000	0.000
THORIUM	6.647	5.682	5.900	6.994	7.278	7.181	0.000	6.166	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U/K	2.940	2.875	2.571	2.930	2.888	2.690	0.000	3.964	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U/TH	0.405	0.444	0.388	0.359	0.352	0.384	0.000	0.461	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TH/K	7.491	6.554	6.761	8.199	8.382	7.086	0.000	8.787	0.000	0.000	0.000	0.000	0.000	0.000	0.000

	5110	5120	5130	5140
POTASium	0.731	0.921	0.854	0.947
URANIUM	2.791	2.395	2.862	2.535
THORIUM	4.613	6.877	7.449	5.751
U/K	3.791	2.633	3.386	2.748
U/TH	0.638	0.348	0.388	0.450
TH/K	6.291	7.574	8.809	6.222

MAP UNIT OBH

	1060	1070	1080	1090	1100	1110	1120	1130	1140	1150	1160	1170	5080	5090	5100
POTASium	0.842	0.882	0.862	0.772	0.829	1.139	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
URANIUM	2.476	2.072	2.228	2.063	2.114	2.520	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
THORIUM	6.710	6.970	6.437	6.278	6.587	7.197	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U/K	2.999	2.365	2.638	2.802	2.635	2.246	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U/TH	0.371	0.299	0.350	0.341	0.326	0.355	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TH/K	8.076	7.954	7.570	8.247	8.141	6.351	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

	5110	5120	5130	5140
POTASium	0.000	0.893	0.783	0.763
URANIUM	0.000	1.957	2.399	2.334
THORIUM	0.000	6.577	6.636	6.235
U/K	0.000	2.228	3.270	3.121
U/TH	0.000	0.297	0.371	0.378
TH/K	0.000	7.428	8.701	8.342

MAP UNIT OC

	1060	1070	1080	1090	1100	1110	1120	1130	1140	1150	1160	1170	5080	5090	5100
POTASium	0.000	0.000	0.000	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	0.000	0.000	0.000	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	0.000	0.000	0.000	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	0.000	0.000	0.000	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	0.000	0.000	0.000	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	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

	5110	5120	5130	5140
POTASium	0.000	0.000	0.000	0.559
URANIUM	0.000	0.000	0.000	2.546
THORIUM	0.000	0.000	0.000	4.681
U/K	0.000	0.000	0.000	4.564
U/TH	0.000	0.000	0.000	0.548
TH/K	0.000	0.000	0.000	8.378

APPENDIX H - Pseudo Contour Maps

NASHVILLE

Potassium Pseudo-Contour Map - Nashville Quadrangle

EXPLANATION		
PRINT CHARACTER	VALUE	
0	LE	0.0000
1	0.0000	0.0750
2	0.0750	0.1500
3	0.1500	0.2250
4	0.2250	0.3000
5	0.3000	0.3750
6	0.3750	0.4500
7	0.4500	0.5250
8	0.5250	0.6000
9	0.6000	0.6750
0	0.6750	0.7500
1	0.7500	0.8250
2	0.8250	0.9000
3	0.9000	0.9750
4	0.9750	1.0500
5	1.0500	1.1250
6	1.1250	1.2000
7	1.2000	1.2750
8	1.2750	1.3500
9	1.3500	1.4250
GT	1.4250	1.5000

SCALE IN EQUIVALENT PERCENT

NASHVILLE

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
	GT 4. 5000

GT 4. 5000

SCALE IN EQUIVALENT PPM

NASHVILLE

[illegible]

Thorium Pseudo-Contour Map - Nashville Quadrangle

SCALE IN EQUIVALENT PPM

NASHVILLE

Thorium/Potassium Pseudo-Contour Map - Nashville Quadrangle

PRINT CHARACTER		VALUE	
0	LE	0.0000	
1	0.0000	1.0000	
2	1.0000	2.0000	
3	2.0000	3.0000	
4	3.0000	4.0000	
5	4.0000	5.0000	
6	5.0000	6.0000	
7	6.0000	7.0000	
8	7.0000	8.0000	
9	8.0000	9.0000	
10	9.0000	10.0000	
11	10.0000	11.0000	
12	11.0000	12.0000	
13	12.0000	13.0000	
14	13.0000	14.0000	
15	14.0000	15.0000	
16	15.0000	16.0000	
17	16.0000	17.0000	
18	17.0000	18.0000	
GT	18.0000		

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[illegible]

Uranium/Potassium Pseudo-Contour Map - Nashville Quadrangle

EXPLANATION		
PRINT CHARACTER		VALUE
0	LE	0. 0000
	0. 0000	0. 5000
1	0. 5000	1. 0000
	1. 0000	1. 5000
2	1. 5000	2. 0000
	2. 0000	2. 5000
3	2. 5000	3. 0000
	3. 0000	3. 5000
4	3. 5000	4. 0000
	4. 0000	4. 5000
5	4. 5000	5. 0000
	5. 0000	5. 5000
6	5. 5000	6. 0000
	6. 0000	6. 5000
7	6. 5000	7. 0000
	7. 0000	7. 5000
8	7. 5000	8. 0000
	8. 0000	8. 5000
9	8. 5000	9. 0000
	GT	9. 0000

NASHVILLE

Uranium/Thorium Pseudo-Contour Map - Nashville Quadrangle

EXPLANATION		
PRINT CHARACTER		VALUE
0	LE	0. 0000
	0. 0000	0. 0500
1	0. 0500	0. 1000
	0. 1000	0. 1500
2	0. 1500	0. 2000
	0. 2000	0. 2500
3	0. 2500	0. 3000
	0. 3000	0. 3500
4	0. 3500	0. 4000
	0. 4000	0. 4500
5	0. 4500	0. 5000
	0. 5000	0. 5500
6	0. 5500	0. 6000
	0. 6000	0. 6500
7	0. 6500	0. 7000
	0. 7000	0. 7500
8	0. 7500	0. 8000
	0. 8000	0. 8500
9	0. 8500	0. 9000
	GT	0. 9000

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Residual Magnetic Pseudo-Contour Map - Nashville Quadrangle

EXPLANATION

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

SCALE IN GAMMAS

NASHVILLE QUADRANGLE - NTMS NJ 16-11 LINE 1060
SINGLE RECORD LISTING - GEOMETRICS DATA ACQUIRED 80200

NASHVILLE QUADRANGLE - NTMS NJ 16-11 LINE 1060
AVERAGED RECORD LISTING - GEOMETRICS DATA ACQUIRED 80200