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GJBX--405-81 Vol. 1

DE82 005540

National Uranium Resource Evaluation

**Airborne Gamma-Ray Spectrometer
And Magnetometer Survey
Huron Quadrangle, South Dakota**

Final Report - Volume I

**Aero Service Division
Western Geophysical Company of America
Houston, Texas 77001**

April 1981

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

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AIRBORNE GAMMA-RAY SPECTROMETER
AND
MAGNETOMETER SURVEY

HURON QUADRANGLE
SOUTH DAKOTA

FINAL REPORT
VOLUME I

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AERO SERVICE DIVISION
WESTERN GEOPHYSICAL COMPANY
OF AMERICA
HOUSTON, TEXAS

APRIL, 1981

PREPARED FOR THE U. S. DEPARTMENT OF ENERGY
ASSISTANT SECRETARY FOR RESOURCE APPLICATIONS
GRAND JUNCTION OFFICE, COLORADO
UNDER CONTRACT NO. DE-AC13-76GJ01664
AND BENDIX FIELD ENGINEERING CORPORATION
SUBCONTRACT NO. 80-449-L
PROJECT NO. IGO207-PROJECT A

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Figure 1

HURON QUADRANGLE

INDEX MAP

TABLE OF CONTENTS

INTRODUCTION	7
DATA ACQUISITION	11
Aircraft	11
Gamma-Ray Spectrometer System	11
Magnetometer	13
PRODUCTION SUMMARY	15
DATA REDUCTION	23
DATA PRESENTATION	29
General	29
Radiometric Multiple-Parameter Stacked Profiles	29
Magnetic and Ancillary Parameter Stacked Profiles	30
Histograms	30
Anomaly Maps	30
Computer Printer Maps	31
GEOLOGY	33
General	33
Stratigraphy	33
Structure	35
INTERPRETATION	37
General	37
Geochemical Analysis	38
Printer Contour and Anomaly Map Analysis	39
SELECTED REFERENCES	71

LIST OF FIGURES

Figure 1	
Index Map	Frontispiece
Figure 2	
Final Flight Path Map	9
Figure 3	
Block Diagram HISENS AGRS 3000F System	12
Figure 4	
Terrain Clearance Histogram	20
Figure 5	
Ground Speed Histogram	21
Figure 6	
Data Reduction Flow Diagram	24
Figure 7	
Total Magnetic Field Contour Map	41
Figure 8	
Potassium Average Contour Map	45
Figure 9	
Uranium Average Contour Map	49
Figure 10	
Thorium Average Contour Map	53
Figure 11	
Uranium/Potassium Ratio Map	57
Figure 12	
Uranium/Thorium Ratio Map	61
Figure 13	
Thorium/Potassium Ratio Map	65
Figure 14	
Interpretation Map	69

LIST OF TABLES

Table I	
Aircraft Specifications and Characteristics	11
Table II	
Daily Production Summary	16
Table III	
Legend to Total Field Map	40
Table IV	
Legend to Potassium Average Map	43
Table V	
Legend to Uranium Average Map	47
Table VI	
Legend to Thorium Average Map	51
Table VII	
Legend to Uranium/Potassium Ratio Map	55
Table VIII	
Legend to Uranium/Thorium Ratio Map	59
Table IX	
Legend to Thorium/Potassium Ratio Map	63

TABLE OF APPENDICES

Appendix A	
Geologic Legend	73
Appendix B	
List of Geologic Units by Anomaly	75
Appendix C	
List of Anomalies by Geologic Unit	79
Appendix D	
Mean Radiometric Values by Geologic Unit	81
Appendix E	
Standard Deviation Table	87
Appendix F	
Format, Single Record Data Listing	91
Appendix G	
Format, Average Record Data Listing	93
Appendix H	
Format, DOE SINGLE RECORD REDUCED DATA TAPE	95
Appendix I	
Format, DOE RAW SPECTRAL DATA TAPE	99
Appendix J	
Format, DOE STATISTICAL ANALYSIS DATA TAPE	103
Appendix K	
Format, DOE STATISTICAL ANALYSIS SUMMARY DATA TAPE	107
Appendix L	
Format, DOE MAGNETIC DATA TAPE	111
Appendix M	
Reduced Calibration and Test Line Data	113
Appendix N	
Renumbered to Original Fiducial Correlations	115

INTRODUCTION

During the months of June through October, 1980, Aero Service Division Western Geophysical Company of America conducted an airborne high sensitivity gamma-ray spectrometer and magnetometer survey over eleven (11) 2° x 1° NTMS quadrangles located in the states of Minnesota and Wisconsin and seven (7) 2° x 1° NTMS quadrangles in North and South Dakota. These include the Kenora, Roseau, International Falls, Quetico, Bemidji, Hibbing, Two Harbors, Brainerd, Duluth, Stillwater, and St. Paul quadrangles of Minnesota and Wisconsin. The quadrangles located within the North and South Dakota survey area include Devil's Lake, New Rockford, Jamestown, Aberdeen, Huron, Mitchell, and Sioux Falls. This report discusses the results obtained over the Huron map area.

Traverse lines were flown in an east-west direction at a line spacing of six (6) miles. Tie lines were flown north-south approximately twenty-four (24) miles apart. A total of 21,481 line miles of geophysical data were acquired, compiled, and interpreted during the survey, of which 1459 line miles are in this quadrangle.

This report is a result of work performed under Bendix Field Engineering Corporation Subcontract No. 80-449-L, Project No. IG0207-Project A, as part of the National Uranium Resources Evaluation. NURE is a program of the U. S. Department of Energy's Grand Junction, Colorado, office to acquire 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.

The data were reduced and compiled in accordance with the technical specifications of the contract as stated in BFEC 1200-C and BFEC 1250-A. The parameters used in the processing of the radiometric data have been substantiated in a previously submitted calibration report of the Douglas DC-3 installed airborne gamma-ray spectrometer system.

AERO SERVICE
HOUSTON, TEXAS 77001

X.....FILM IDENTIFIED TRAVERSE/TIE LINE INTERSECTION
 ▲.....FILM IDENTIFIED GROUND CONTROL
 □.....INDEX FIDUCIAL (100 FIDUCIAL INTERVALS)
 FLOWN 1980

FLIGHT PATH
HURON
NL 14-11
DOE/MURE

FIGURE 2
9/10

DATA ACQUISITION

Aircraft

The survey was conducted using a Douglas DC-3 fixed wing aircraft, registration N5000E, owned and operated by Aero Service Division Western Geophysical Company of America. The flight crew consisted of a pilot, a navigator and an electronic operator. Some of the more pertinent characteristics and specifications of the aircraft are listed below:

T A B L E I

<u>Aircraft Specifications and Characteristics</u>	
Aircraft	Douglas DC-3 - N5000E
Power Plant	2 ea. - Pratt Whitney - R1830-94 Engines, Twin Row, Radial - 1,350 H. P.
Allowable Gross Weight	26,900 lbs.
Empty Weight - Survey Configuration .	23,000 lbs.
Avionics - Dual RT41A VHF Comm Transceiver	
Dual Collins 51V VOR/LOC/RMI Receiver	
Dual Collins Glide Scope Receiver	
1 KDM 705 DME	
1 KXP 750 Transponder	
1 618T3B H.F. Transceiver	
Sperry A-12 Autopilot System	
Bendix Doppler Navigation System	
Honeywell Radar Altimeter	
Cruise Airspeed	120 to 165 M.P.H.
Rate of Climb	1,200 f.p.m.
Service Ceiling	24,000 Feet
Fuel	100/130 Octane
Fuel Consumption	Approx. 100 Gal. Per Hour

Gamma-Ray Spectrometer System

The survey was carried out using Aero Service's HISENS A(irborne) G(amma)-R(ay) S(pectrometer) 3000F system, shown in block diagrammatic form in Figure 3, page 12.

J
H
G
F
E
-12-
D
C
B
A

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AERO SERVICE DIVISION
WESTERN GEOPHYSICAL
HOUSTON TEXAS 77002

DWN
CHKD
APVD *ABH*

DATE
12/76

TITLE
BLOCK DIAGRAM.
HISENS AGRS 300GF SYSTEM

SIZE	DRAWING NO	REV	SHEI
B	230-548-002		

16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1

The primary detector package consists of 14 logs of 4" x 4" x 15" of Polyscin®, NaI(Tl), each log hermetically sealed in a stainless steel container and coupled to a high quality photo-multiplier tube. The logs are assembled in 3 slabs of respectively 4, 4 and 6 logs each. Each slab is enclosed in a heated and thermally stabilized container. Total volume of the primary detector is 3360 cubic inches (55.06 liters). The upward looking (2π) detector consists of two 4" x 4" x 16" logs of Polyscin®, NaI(Tl), also hermetically sealed in a steel container and coupled to high quality photo-multiplier tubes. The two logs are enclosed as a slab in the same container that houses the slab of 6 logs of Polyscin®. The upward looking crystals are mounted on top of the 4π sensor, separated by a 0.75" slab of lead shielding, in order to obtain the prescribed shielding effect of 85% @ 3000KeV.

The preamplifiers, which with the photo-multipliers provide virtually the total signal amplification, are also enclosed in the thermally stabilized packages, to ensure maximum signal stability. The output of the preamplifiers is fed into the amplifiers, whose main function is to shape the incoming pulses into a bipolar gaussian form.

The mixer/router, the 50 MHz Wilkinson ramp analog to digital converter and the multi-channel analyzer of both the primary and 2π spectrometer systems are commercially available units, supplied by Canberra Industries. The data from the two spectrometers are output to the data controller, formed by a Hewlett Packard 21 MX minicomputer system, which stores the data, formats them, outputs them on tape and compares the tape recorded data with the data stored in memory. Additional data recorded on tape are radar altitude, barometric pressure, atmospheric temperature, magnetometer data, real time, gamma-ray spectrometer system live-time and other ancillary data such as additional navigational data. Two tape drives were employed and automatic switching between the two occurs as each tape ends. Additional ancillary equipment includes a cathode ray tube display, a Clevite Brush 6-channel analog recorder and a 35mm frame camera, triggered by the data controller at a preset interval.

Magnetometer

The magnetic sensor used for the survey was a Geometrics G-803 proton free-precession magnetometer, housed in a high-drag, fiberglass bird and towed approximately 100' behind and 25' below the aircraft, in order to assure reliable data with minimal aircraft compensation.

PRODUCTION SUMMARY

The 2° x 1° NTMS quadrangle of Huron, South Dakota, was surveyed as part of a subcontract covering eleven (11) quadrangles located in Minnesota and Wisconsin along with seven (7) quadrangles in North and South Dakota. The subcontract covered the flying of a total of 21,481 line miles of geophysical data, of which 1459 miles are in the Huron quadrangle.

The main base of operations of all survey flights was located between the two survey areas at Fargo, North Dakota.

The aircraft arrived on site on June 28, 1980. The first production flight was made on July 1, 1980, with the last flight being completed on October 25, 1980. Production operations within these survey areas were interrupted over the period of July 11, 1980, through August 10, 1980, during which time the aircraft was conducting a similar NURE program of airborne radiometric surveying over twelve (12) quadrangles located in northern Alaska. The aircraft and crew were on site, carrying out flight operations in the Minnesota, Wisconsin and Dakotas areas for a total of eighty-eight days. It was not possible to complete production flights on fifty-nine of these days. Twenty-two days were lost due to inclement weather or atmospheric conditions. Six days were lost due to electronic equipment maintenance and thirty-one days were lost due to aircraft maintenance including twenty-three days for multiple engine changes. A complete summary of daily flight operations is given in Table II, pages 16, 17, 18 and 19.

Production averaged 75.8 miles per hour of flight time. An average of 740.7 miles of data was acquired each actual production day. When computed over the total number of days on site, data acquisition averaged 244.1 miles per day.

Flight line directions and spacing for the Huron quadrangle were east-west traverse lines 6 miles apart and north-south tie lines flown at 24 mile intervals. The nominal terrain clearance for the survey was 400 feet. Figure 4 shows a histogram of the terrain clearance of the aircraft as recorded by the radar altimeter. The histogram takes into account all final samples in this quadrangle. The mean terrain clearance, as observed, is approximately 420 feet. The ground speed of the aircraft, as determined from the distances between samples based on their final X-Y positions, is depicted in graphic form in the histogram of Figure 5, page 21.

T A B L E I I
Daily Production Summary

<u>DATE</u>	<u>BASE</u>	<u>ACTIVITY</u>	<u>FLIGHT NO.</u>
06/28/80	Fargo, North Dakota	Arrive Fargo	
06/29/80	Fargo, North Dakota	Weather	
06/30/80	Fargo, North Dakota	Aircraft maintenance	
07/01/80	Fargo, North Dakota	Production	4, 5
07/02/80	Fargo, North Dakota	Production	6
07/03/80	Fargo, North Dakota	Production	7
07/04/80	Fargo, North Dakota	Electronic maintenance	
07/05/80	Fargo, North Dakota	Production	8
07/06/80	Fargo, North Dakota	Weather	
07/07/80	Fargo, North Dakota	Aircraft maintenance and tests	9, 10
07/08/80	Fargo, North Dakota	Production	11, 12
07/09/80	Fargo, North Dakota	Production	13
07/10/80	Fargo, North Dakota	Electronic maintenance	
07/11/80	Fargo, North Dakota	Depart for Alaska	
07/12/80 to 08/09/80		Operations in North Slope airborne survey quadrangles	
08/10/80	Fargo, North Dakota	Arrive Fargo	31
08/11/80	Fargo, North Dakota	Aircraft maintenance	
08/12/80	Fargo, North Dakota	Aircraft maintenance	
08/13/80	Fargo, North Dakota	Aircraft maintenance	
08/14/80	Fargo, North Dakota	Aircraft test flight	32
08/15/80	Fargo, North Dakota	Production	33, 34
08/16/80	Fargo, North Dakota	Weather	
08/17/80	Fargo, North Dakota	Weather	
08/18/80	Fargo, North Dakota	Production	35
08/19/80	Fargo, North Dakota	Production	36

Daily Production Summary

<u>DATE</u>	<u>BASE</u>	<u>ACTIVITY</u>	<u>FLIGHT NO.</u>
08/20/80	Fargo, North Dakota	Weather	
08/21/80	Fargo, North Dakota	Weather	
08/22/80	Fargo, North Dakota	Production	37, 38
08/23/80	Fargo, North Dakota	Weather	
08/24/80	Fargo, North Dakota	Excessive radon	39, 40
08/25/80	Fargo, North Dakota	Weather	
08/26/80	Fargo, North Dakota	Production	41
08/27/80	Fargo, North Dakota	Aircraft maintenance	
08/28/80	Fargo, North Dakota	Aircraft maintenance	
08/29/80	Fargo, North Dakota	Aircraft test flight	42
08/30/80	Minneapolis, Minnesota	Aircraft engine change #1	
08/31/80	Minneapolis, Minnesota	Aircraft engine change #1	
09/01/80	Minneapolis, Minnesota	Aircraft engine change #1	
09/02/80	Minneapolis, Minnesota	Aircraft engine change #1	
09/03/80	Minneapolis, Minnesota	Aircraft engine change #1	
09/04/80	Minneapolis, Minnesota	Aircraft engine change #1	
09/05/80	Minneapolis, Minnesota	Aircraft engine change #1	
09/06/80	Minneapolis, Minnesota	Aircraft engine change #1	
09/07/80	Minneapolis, Minnesota	Aircraft test flight	44
09/08/80	Minneapolis, Minnesota	Aircraft engine change #2	
09/09/80	Minneapolis, Minnesota	Aircraft engine change #2	
09/10/80	Minneapolis, Minnesota	Aircraft test flight	45
09/11/80	Minneapolis, Minnesota	Aircraft maintenance	
09/12/80	Minneapolis, Minnesota	Aircraft maintenance	
09/13/80	Fargo, North Dakota	Ferry to Fargo	46
09/14/80	Fargo, North Dakota	Weather	
09/15/80	Fargo, North Dakota	Abort - Count rates too high	47
09/16/80	Fargo, North Dakota	Abort electronics	48
09/17/80	Fargo, North Dakota	Weather	49
09/18/80	Fargo, North Dakota	Production	50
09/19/80	Fargo, North Dakota	Production	51

Daily Production Summary

<u>DATE</u>	<u>BASE</u>	<u>ACTIVITY</u>	<u>FLIGHT NO.</u>
09/20/80	Fargo, North Dakota	Weather	
09/21/80	Fargo, North Dakota	Fog then production	52
09/22/80	Fargo, North Dakota	Aircraft Maintenance	
09/23/80	Fargo, North Dakota	Production and reflights	53
09/24/80	Fargo, North Dakota	Production then rain	54
09/25/80	Fargo, North Dakota	Electronic maintenance	
09/26/80	Fargo, North Dakota	Production and reflights	55
09/27/80	Fargo, North Dakota	Abort, electronics	56
09/28/80	Fargo, North Dakota	Electronic maintenance	
09/29/80	Fargo, North Dakota	Abort, excessive radon	57
09/30/80	Fargo, North Dakota	Production	58
10/01/80	Fargo, North Dakota	Production	59
10/02/80	Fargo, North Dakota	Weather	
10/03/80	Fargo, North Dakota	Production	60
10/04/80	Fargo, North Dakota	Production	61
10/05/80	Fargo, North Dakota	Production	62
10/06/80	Fargo, North Dakota	Production	63
10/07/80	Fargo, North Dakota	Production	64
10/08/80	Fargo, North Dakota	Abort, engine out	65
10/09/80	Fargo, North Dakota	Aircraft engine change #3	
10/10/80	Fargo, North Dakota	Aircraft engine change #3	
10/11/80	Fargo, North Dakota	Aircraft engine change #3	
10/12/80	Fargo, North Dakota	Aircraft engine test flight	66
10/13/80	Fargo, North Dakota	Reflights	67
10/14/80	Fargo, North Dakota	Weather	
10/15/80	Fargo, North Dakota	Weather	
10/16/80	Fargo, North Dakota	Weather	
10/17/80	Fargo, North Dakota	Weather	
10/18/80	Fargo, North Dakota	Aircraft maintenance	
10/19/80	Fargo, North Dakota	Production	68
10/20/80	Fargo, North Dakota	Production	69

Daily Production Summary

<u>DATE</u>	<u>BASE</u>	<u>ACTIVITY</u>	<u>FLIGHT NO.</u>
10/21/80	Fargo, North Dakota	Production and reflights	70
10/22/80	Fargo, North Dakota	Weather	
10/23/80	Fargo, North Dakota	Weather	
10/24/80	Fargo, North Dakota	Weather	
10/25/80	Fargo, North Dakota	Reflights	71
		Complete Airborne Operations	

AERC SERVICE
QUAD FURON

TERRAIN CLEARANCE HISTOGRAM
JOB 624

AERC SERVICE
QUAD HURON

GROUND SPEED
JOB 624

HISTOGRAM

NUMBER OF DATA POINTS

1300

2600

3900

5200

6500

7800

9100

10400

11700

13000

14300

21/22

MILES
PER
HOUR

Figure 5

DATA REDUCTION

The data reduction process as used in the processing of the airborne gamma-ray spectrometer and magnetometer data obtained within the Department of Energy (DOE) National Uranium Resource Evaluation (NURE) program is shown in flow chart form in Figure 6, page 24.

Upon arrival in the Houston office, the digital data are edited and a back-up tape is generally produced. The EDIT consists partly of a data quality check, enabling the elimination of single record spikes in any field, outside a specified preselected limit. The EDIT program further checks for data continuity and flags all data acquired at terrain clearances exceeding the survey specification. The EDIT further sums a preselected number of spectral records at the beginning and end of each survey line and fits a gaussian curve to diagnostic photopeaks, such as the Tl^{208} peak at 2614.5 KeV and the K^{40} peak at 1460 KeV for low altitude lines and the annihilation peak at 511 KeV and the K^{40} peak at 1460 KeV for high altitude lines. The position of these photopeaks is determined with an accuracy of better than 0.1 of a channel and is used to determine the exact position of the energy windows with regard to channel numbers. At the same time the calculated standard deviations of the fitted gaussian curves serve to obtain the system resolution at the photopeaks used. The window count rates are normalized for live time and are calculated as follows:

K	:	1362 KeV - 1566 KeV (Channel 114 → 130, @ 12 KeV/Channel)
U	:	1662 KeV - 1866 KeV (Channel 139 → 155, @ 12 KeV/Channel)
T	:	2406 KeV - 2826 KeV (Channel 201 → 235, @ 12 KeV/Channel)
T.C.	:	390 KeV - 2982 KeV (Channel 33 → 248, @ 12 KeV/Channel)
Cosmic	:	2994 KeV - 6138 KeV (Channel 250 → 512, @ 12 KeV/Channel)
$U_{2\pi}$	:	1662 KeV - 1866 KeV (Channel 139 → 155, @ 12 KeV/Channel)

The above channel numbers are valid only if system gain corresponds exactly to 12 KeV per channel and there is no zero shift.

The CORRECT program applies the background and cosmic corrections to the single record window count rates, corrects the data for Compton scatter and atmospheric radon, and normalizes the terrain clearance. Background count rates and cosmic factors were determined from high altitude test data acquired over the Pacific Ocean, offshore California.

Potassium Background	=	32.01 counts per second
Uranium Background	=	10.09 counts per second
Thorium Background	=	6.86 counts per second
Total Count Background	=	278.04 counts per second
2 π Bismuth Background	=	1.55 counts per second

Potassium Cosmic factor	=	0.20 c.p.s. per count 4 π cosmic
Uranium Cosmic factor	=	0.165 c.p.s./cps 4 π cosmic
Thorium Cosmic factor	=	0.22 c.p.s./cps 4 π cosmic
Total Count Cosmic factor	=	3.64 c.p.s./cps 4 π cosmic
2 π Bismuth Cosmic factor	=	0.0344 c.p.s./cps 4 π cosmic

The Compton scatter functions were determined from data obtained over the Grand Junction test pads, using the radiometric analysis of the bulk sample with natural water content.

$$\begin{aligned}
 T/U &= \tau = 0.076 \\
 U/T &= \alpha = 0.35 + 0.02 + 0.000076H \\
 K/T &= \beta = 0.44 \\
 K/U &= \gamma = 0.96
 \end{aligned}$$

The 2 π and 4 π uranium window count rates are related through the geometric or equivalency factor. For the present system, installed in the Douglas DC-3, this factor, $f = 6.0$. Part of the terrestrial radiation of energy higher than 1662 KeV - the lower threshold of the uranium window - is detected in the uranium window of the upward looking detector, due to incomplete shielding, skyshine and shine-around. This shine-through/shine-around effect is assumed to be a function of both the intensity of the terrestrial uranium and thorium radiation and of the aircraft terrain clearance. From multi-altitude data acquired over the Lake Mead Dynamic Test Range the shine-through/shine-around effect was determined for each altitude level. The data provided a best fit for a linear terrain clearance function as follows:

$$\text{shine-through/shine-around} = (0.05 - 3.8 \times 10^{-5}H) (U_{4\pi} + 0.35T_{4\pi})$$

The shine-through/shine-around corrected Biair Count rate is then:

$$U_{2\pi c} = \frac{U_{2\pi} - (U_{4\pi} + 0.35T) (0.05 - 3.8 \times 10^{-5}H)}{1 - 6.0 (0.05 - 3.8 \times 10^{-5}H)}$$

The shine-through/shine-around correction is applied to the $U_{2\pi}$ count rate at each single record. The single record $U_{2\pi}$ count rates are then averaged over 35 records to make them statistically compatible with the data of the primary system. The atmospheric radon correction is applied to both the $U_{4\pi}$ and the Total Count count rates. The equivalency factor for the $U_{4\pi}/U_{2\pi} = 6.0$, for Total Count/ $U_{2\pi}$ it is 61.75.

Within the CORRECT program the data are normalized to a common datum of 400 feet terrain clearance. An exponential formula is used, based on an air column reduced to a standard temperature and pressure of 0°C and 760mm Hg. (32°F and 29.92" Hg). The air absorption coefficients used are those derived from the multiple altitude flight over the Lake Mead Dynamic Test Range for thorium, potassium and Total Count. The air absorption factor for uranium is obtained by straight interpolation between the potassium and thorium air absorption factors. Their values are respectively:

$$\begin{aligned}\mu_K &= 2.71 \times 10^{-3} \text{ per foot} \\ \mu_U &= 2.56 \times 10^{-3} \text{ per foot} \\ \mu_T &= 2.15 \times 10^{-3} \text{ per foot} \\ \mu_{TC} &= 2.16 \times 10^{-3} \text{ per foot}\end{aligned}$$

The formula used for the altitude normalization is:

$$N_{400} = N_H \cdot e^{\mu(400 - \frac{273}{273+t} \cdot \frac{P}{29.92} \cdot H)}$$

Where N_{400} , N_H are respectively the count rates at 400 feet and at altitude H, μ is air absorption factor, t is temperature in degrees Celsius and P is barometric pressure in inches Hg.

The last operation in the CORRECT program is the determination of statistical adequacy of the data. The criteria for adequacy of the data are based on the work of Lloyd A. Currie (op.cit.). A critical level is recognized, below which all observations made fail to detect a signal, i.e. 95% of all measurements fall within the "normal" distribution of "noise". The detection level is similarly defined as the level above which 95% of the measurements made fall within the normal Poisson distribution of "signal". Currie's critical level has been adopted as the count rate level below which data are inadequate. Data with count rates above the critical level but below

the detection level are considered marginal. Above the detection level data are considered adequate. For the single record data the formulas are then:

Count Rate ≤ 2.33 (Sum Corrections) $^{1/2}$: data inadequate

2.33 (Sum Corrections) $^{1/2} <$ Count Rate $\leq 2.71 + 4.65$ (Sum Corrections) $^{1/2}$:
data marginal

Count Rate $> 2.71 + 4.65$ (Sum Corrections) $^{1/2}$: data adequate.

No ratios have been calculated involving inadequate data in either numerator or denominator. Ratios have been calculated when the data in the numerator are marginal, provided the data in the denominator are adequate.

The thorium, uranium and potassium data are subsequently averaged over 9 records in the SPECAVG program. The output is a spectrometer master tape containing both averaged and single record data.

Parallel with the radiometric data reduction process, the magnetic data are edited and processed. Using the recovered film intersections and the established ground identities, preliminary flight paths are prepared. The flight path is refined in the magnetic adjustment program until an accurate final flight path has been obtained. The reduced spectrometer data are then merged with the final X-Y position of the data points, the reduced magnetic data and the digitized geology, and a master tape is produced with data that pertain to each $2^\circ \times 1^\circ$ NTMS quadrangle only. The REGROUP program then eliminates all duplicate line segments, inserts reflight segments where required, orders the remaining line segments and rennumbers the fiducials of these segments such that the resulting line is directionally consistent with location sequential sample numbers. The renumbered fiducials increase from west to east for traverse lines and south to north for tie lines. A listing relating the renumbered fiducials to the original fiducial numbers as recorded in flight is included in this volume as Appendix N and can also be found in the back of Volume II. This listing gives both the line number as it appears on all final data and the line number as recorded in flight. Similarly, the start and end fiducials of each final line and/or line segment shown on the flight path base map are given along with the corresponding start and end fiducials as recorded in flight. When correlated with the final fiducial numbers, the original fiducials will increase sequentially for lines flown west to east or south to north and decrease for lines flown in the opposite

directions.

The following processing steps are STATANAL and HISTGRM. HISTGRM groups the radiometric data by geological cell units, determines the distribution of the data as normal or lognormal, calculates the mean (for normally distributed data) or the mode (for lognormal distributions) as well as the standard deviations. The results from HISTGRM are used in the STATANAL program, which calculates the signed standard deviation from the mean for each averaged sample for each of the six radiometric parameters. Its output is the Final Spectrometer Master Tape, from which the anomaly maps, the statistical analysis tape, the averaged record and single record reduced data tapes and listings, the flight path maps and the radiometric and magnetic profiles are produced.

High 2π uranium count rates were encountered during many of the data acquisition flights over this quadrangle. This resulted in correspondingly high atmospheric radon corrections to the 4π uranium data reducing this data to very low count rate levels which fell, for the most part, in the range of statistically marginal to inadequate data. The data of both the 4π and 2π acquisition systems were extensively tested and all possible system malfunctions were eliminated as the source of the high $U_{2\pi}$ count rates recorded in flight.

After consultation with BFEC, it was agreed that the fully corrected single record $U_{4\pi}$ data would be adjusted upward to levels corresponding to $U_{4\pi}$ concentrations obtained over those quadrangles bordering this area on the east and west. The normalization factors as applied to the data were obtained by comparing $U_{4\pi}$ data levels averaged over 200 samples at the east and west ends of the traverse lines with similar averages over the nearest lines within the adjacent quadrangles. The east and west end factors were in turn averaged to obtain the final normalization factor. After adjustment of the single record $U_{4\pi}$ count rates, the data were again tested for statistical adequacy and the two uranium ratios were re-computed. The data along the tie lines were adjusted in a similar manner using the normalized $U_{4\pi}$ data along the northernmost and southernmost traverse with this quadrangle.

The single record data were then averaged over 9 records using the SPECAVG program. All subsequent processing steps were then followed as outlined above.

DATA PRESENTATION

General

The final data are presented in four different forms: on magnetic tape; on microfiche; in graphic form as profiles and histograms; and in map form as anomaly maps, flight path maps, and computer printer maps.

The histograms and the multiparameter profiles are presented with the anomaly maps and flight path map in a separate bound volume. Complete data listings of both the reduced single record and the reduced averaged record data are found in the back of this report. The format of the printout of the microfiches and the format of the data files delivered on magnetic tape are in accordance with the specifications of the BFEC 1200-C and are described in appendices F through L of this report.

Radiometric Multiple-Parameter Stacked Profiles

The radiometric profiles have been prepared at the horizontal scales of 1:250,000 and 1:500,000 on an automated flatbed plotter. Displayed are from top to bottom: total magnetic intensity, IGRF removed, in gammas; radar altimeter, in feet; ratio of eT concentration in ppm/potassium concentration in %; ratio of eU/K; eU/eT ratio, atmospheric radon (BIAC) in counts per second, equivalenced to the 4π count rate; apparent concentration of terrestrial eT in ppm, apparent concentration of terrestrial eU in ppm; apparent concentration of potassium in %; "Total Count" count rate. Flags are indicated, where needed, below the base line of the corresponding parameter. A short flag indicates marginal data, including terrain clearances between 700 and 1000 feet, while a long flag indicates inadequate data. Fiducial markers are plotted every 200 records, along the top of the profile, every 10 records near the bottom.

The flight path and the geologic formations overflown along the line are shown on the bottom of both the radiometric and magnetic multiple-parameter stacked profiles below the lower fiducial markers. Six tiers of formation identifiers along with short markers on the flight line are used to indicate changes along the profile with the base of the identifier letters aligned with the corresponding marker. The first identifier found on the westernmost end of the profile applies to the start of the line and this formation continues until the next marker is encountered. Subsequent changes to the geology are similarly indicated along the profile.

Magnetic and Ancillary Parameter Stacked Profiles.

The magnetic profiles have also been plotted at scales of 1:250,000 and 1:500,000 on an automated flatbed plotter. The plotting sequence of the profiles is, from top to bottom: barometric pressure at aircraft altitude in mm Hg; atmospheric ambient temperature in degrees Celsius, terrain clearance in feet; magnetic variations at base station, in gammas; total magnetic intensity, IGRF removed, plotted at 50 gammas per scale division. Fiducial markers are again plotted every 200 records along the top of the profiles, every 10 records near the bottom.

Histograms

Histograms have been prepared for the six radiometric parameters for each geologic cell unit of the NTMS quadrangle area. The horizontal scale of the plots is constant for each of the parameters. Frequency grouping has generally been done in 100 groups per full scale, although in some cases more groups may have been used for better definition. In all cases the vertical scale was normalized to the number of samples observed in the group with the highest sample frequency.

For each histogram the frequency distribution type (normal or lognormal) is listed, as well as the mean (or mode in case of lognormal distribution) and the signed standard deviations. Note that for both the normal and lognormal distribution curves the standard deviation is given in terms of the parameter value (K, eU, eT, eU/K, eU/eT and eT/K). The actual standard deviation is obtained by subtracting the mean parameter value from the +1 standard deviation figure in case of a normal distribution, by dividing the mode value into the +1 standard deviation figure in case of a lognormal distribution. In case of lognormal distribution curves the standard deviation is thus a multiplication factor.

Each histogram further lists the total number of samples observed in the geologic unit and the number of statistically adequate/marginal data samples in each parameter plot.

Anomaly Maps

The anomaly maps have been prepared at scales of 1:250,000 and 1:500,000 on an automated flatbed plotter. The fiducial numbers along the flight lines match those of the corresponding profiles. Positive signed deviations of the

mean are indicated by a plus sign to the north or west of the flight lines, while negative signed deviations are indicated by a minus, plotted to the south or east of the line. The number of pluses or minuses corresponds with the levels of standard deviation from the mean. To avoid crowding, standard deviation signs are calculated and plotted for every fifth sample only.

Computer Printer Maps

Computer printer plots are produced for the total field and the six radiometric channels. Upper and lower limits were chosen based on the minimum and maximum values of the gridded data. Ten intervals are represented by the contour values 0 to 9. A minus (-) or a plus (+) sign represents those values less than the lower limit or those values higher than the upper limit.

The interval for each integer contour is further divided into two groups. For those values less than .5, the contour is printed; e.g. for values 4.0 to 4.5, the value 4 is printed, while values of 4.6 through 4.9 are left blank.

GEOLOGY

General

The Huron quadrangle is located in east central South Dakota and includes the area between 44°N and 45°N latitude and between 98°W and 100°W longitude.

The geomorphology of this area is somewhat a product of glacial erosion and deposition. Two major topographic features are present in the Huron quadrangle. First is the Coteau du Missouri, a vast highland of diverse topography extending north-south through North and South Dakota. It is bounded by the Missouri River on the west and it extends eastward approximately 75 miles. On its eastern border, somewhat marked by a topographic change, is the James Basin. This basin is a broad lowland of gently undulating to relatively flat topography usually 200-300 feet lower in elevation than the Coteau du Missouri.

Almost all the mapped surface lithology is Quaternary glacial till and drift except where Cretaceous rock crops out in the southwest corner of the sheet. The glacial till tends to thin east of the Coteau du Missouri in the James Basin, and also southwest of the Missouri River, where bedrock is exposed. The Missouri River had its course effected by glacial advances, and the river within the Huron quadrangle parallels the terminus of a lobe of the Wisconsin ice sheet.

There are numerous small lakes and ponds in this quadrangle; this is especially true in the Coteau region. Most of those lakes and ponds are seasonal. Drainage off the Coteau consists of a network of intermittent or seasonal springs and creeks. Drainage is generally southeast off of the Coteau and turns generally south to southeast in the James Basin where these systems eventually meet the James River. A few intermittent streams drain to the southwest off the Coteau into the Missouri River.

Stratigraphy

The geology of the area was compiled in 1980 by Martel Laboratories, Inc., Baltimore, Maryland. The compilation was made using pre-existing data published by the U. S. Geological Survey, the South Dakota Geological Survey and the Bureau of Mines. This map delineates surface deposits of Quaternary age, and formations of Cretaceous age.

The surface lithology of the Huron quadrangle consists almost entirely of glacial sediments, but outcroppings of the Cretaceous Pierre Shale Formation are found in the southwest portion of this area. Cretaceous shales, marl deposits, limestones, and sandstones directly underlie the Pierre Formation. A description of the various geologic rock-types mapped in this quadrangle is given below, beginning with the oldest.

Sedimentary Rock

Pierre Shale (Kps)

Cretaceous shale is the only bedrock exposed in this quadrangle. It is the first formation found below the glacial sediments. It consists of blue-gray, calcareous to noncalcareous shale, which locally contains marl zones and bentonite beds, and frequently contains limestone concretions. Its lower zones are composed of bituminous shale which is rich in organic material.

Sediments

The physical characteristics of the Wisconsin Stage tills are very similar to each other and distinguishing one till from another is very difficult. Lateral changes within a single till are more conspicuous than changes between separate tills. Wisconsin tills possess weak fissility parallel to their surfaces, are less compact, and joints are less abundant or continuous as compared with older pre-Wisconsin tills. Also, rock fragments of pebble, cobble and boulder size are more abundant in Wisconsin tills than in pre-Wisconsin tills. Boulders of the Wisconsin tills are described as numerous, large, and easily seen. The average thickness of the drift is 50 to 100 feet, but variations can range from over 300 feet to zero feet.

Glacial Drift-Iowan Substage (Qwi)

Thinly scattered boulders and rare patches of till resulting from the Iowan Substage of the Wisconsin Stage of Pleistocene glacial advance.

Ground Moraine (Qwig, Qwgc, Qwmg)

Till, with stratified drift. These deposits are divided into three substages of Wisconsin glaciation: Iowan (Qwig), Cary (Qwgc), and Mankato (Qwmg).

End Moraine (Qwim, Qwcm, Qwmm)

Till, with stratified drift. These deposits are divided into three substages of Wisconsin glaciation: Iowan (Qwim), Cary (Qwcm) and Mankato (Qwmm).

Glacial Lake Sediments (Ql)

Silt and sand deposited with parallel bedding. Most of these glacial lakes were small and short lived, and many have no shoreline or strandlines. In larger glacial lake environments, minor amounts of coarse sediments may be found within the silt and clay beddings. These may come from sediments being dropped from floating ice. The thickness of glacial lake bed deposits vary greatly, dependent on glacial lake duration and sediment supply. This landform tends to be flat or nearly flat. Slumping and collapse are common at its margins if it were a glacial lake, dammed by the glacier itself. Large deposits are found in the northeast portion of the quadrangle.

Dune Sand (Qd)

These landforms are composed mostly of windblown sands. They form an irregular hummock topography with generally 10 feet or less relief. Sand dunes are only mapped in the southeastern corner of this quadrangle.

Alluvium (Qal)

These sediments are largely post-glacial fluvial deposits. Most of these sediments are found along relatively recent stream beds, and consist of fine-grained sands, silts, and clays.

Structure

The Huron quadrangle, which is almost entirely under glacial deposits, has little basement structural information. It is known however, that basement reaches a local structural high in this quadrangle. This high, the Sioux uplift, located in the southeast corner of this quadrangle, is separated from the Black Hills uplift in western South Dakota by the Williston Basin.

INTERPRETATION

General

The airborne gamma-ray spectrometer survey is conducted in support of the Department of Energy's National Uranium Resource Evaluation (NURE) program. The primary purpose of the survey is regional resource evaluation as opposed to local anomaly identifications. The interpretation of the radiometric data is directed towards determining zones of possible depletion of uranium which may have served as possible uranium sources, outlining areas of regional enrichment in uranium and indicating the geological formations which are most likely to be mineralized within a possible uranium province.

The areas of possible uranium depletion/enrichment are outlined with the aid of anomaly maps, which have been previously described. Enrichment or depletion of uranium on a regional scale is assumed to have taken place if the U/T and U/K ratio values remain higher/lower than at least one standard deviation above/below the mean for a distance of at least a mile, provided the K, U and T count rates are at the same time not less than one standard deviation below the mean. One mile equals approximately 25 samples.

The probability of a geologic formation to be mineralized by a given element may be estimated from the dispersion of the geochemical distribution curve. The smaller the ratio of the standard deviation over the mean, the less the likelihood that an extremely high concentration of that element exists within that formation. Obviously, the opposite holds true as well.

The decision of both the "favorability" of a formation and of the presence of a regional geochemical anomaly is influenced to a large extent by the choice of the geological cell units used in the correlation of the radiometric and geologic data.

The radiometric parameters used in the present report are concentrations in parts per million of equivalent uranium and equivalent thorium and in percent of potassium and their ratios. The radiometric count rates of the Douglas DC-3 borne A.G.R.S. (Airborne Gamma-Ray Spectrometer) system were calibrated at the Lake Mead Dynamic Test Range against sources of known concentrations of potassium, uranium and thorium. The sensitivities of the A.G.R.S. system, normalized to 400 feet terrain clearance at standard temperature and pressure are:

<u>Radioelement</u>	<u>Count Rate</u>	<u>Concentration</u>
Potassium	96.42 cps	1%k
Uranium	12.02 cps	1ppm eU
Thorium	6.31 cps	1ppm eT

Geochemical Analysis

The geologic map of the Huron quadrangle, compiled by Martel Laboratories, Inc., distinguishes eleven geologic units all of which were sampled in the present NURE survey. Due to very limited occurrence, unit Qd, dune sand, at 13 samples, and unit Qwim, end moraine of the Iowan Substage, at 41 samples, contain too few samples for adequate statistical evaluation. These units were therefore combined with surrounding geologic units of similar lithology, Qd with Qal, and Qwim with Qwlg, for the purpose of this analysis. No changes were made on the geologic map.

Comprising roughly 16% of the total samples taken, data for unit Qal, alluvial sediments, produce very clean curves having normal distribution for all parameters. The majority of samples occurring under the upper end of the uranium curve probably correlate with those higher concentration levels encountered along t-1520 just west of tl-5030.

Relatively narrow, clean distribution histograms represent the 2022 samples taken over unit Ql, glacial lake sediments. Samples for this unit were collected primarily in the northeastern corner of the quadrangle, north of the James River.

Samples collected over unit Qwmm, end moraine of the Mankato Substage, comprise 31% of the total samples taken. Well distributed over the map area, the very clean and symmetrical histogram curves indicate a fairly homogeneous composition for this unit throughout the quadrangle.

The clean distribution curves produced over unit Qwmg, ground moraine of the Mankato Substage, mirror parameter distributions within the Qwmm unit. Broad-based uranium dispersions with a mean value of $1.8 \text{ ppm} \pm 0.52 \text{ ppm}$ characterize the high radiometric potential of the two similar units.

Unit Qwcm with 3450 samples comprises 10% of the total samples taken and exhibits very clean distribution curves. Similar to the other morainal units, the broad normally distributed uranium curve is centered at 1.9 ppm and has an identical standard deviation of 0.52 ppm.

Fourteen percent of the total samples are contained in the samples collected over the ground morainal unit, Qwgc. Very clean, normal distributions occur around moderate to high means for potassium, uranium and thorium at 1.4%, 1.8 ppm and 6.7 ppm respectively which are characteristic for the general radiometric response over the area.

Distribution curves for units Qwig and Qwi, ground moraine and glacial drift of the Iowan Substage, are very similar with broad, slightly less smooth uranium histograms centered around a mean at 1.8 ppm and slightly higher means for thorium and potassium at 7.0 ppm and 1.4% respectively.

The Cretaceous shale unit, Kps, occurs in the southwest corner of the quadrangle and produces slightly more erratic curves but very similar characteristics to the other units in the map area.

The geologic unit with the highest number of uranium anomalies is unit Qwmm, end moraine of the Mankato Substage, with six anomalies. The greatest number of uranium anomalies per thousand samples occurs in unit Qwgc, with 2.42 anomalies followed by unit Qwmm with 1.54 and unit Qal with 1.06 anomalies per thousand samples.

Computer Printer and Anomaly Map Analysis

Computer printer maps of the total magnetic intensity and of the six radiometric parameters at a scale of 1:500,000 have been prepared in addition to the radiometric anomaly maps of the area. The grid spacing of the pseudo-contour maps is 2117 by 1270 meters. As a result, only the broader features can be seen on these maps while the narrower events are normally not noticed.

The magnetic map for the Huron quadrangle, at an average intensity of 59,150 gammas, displays a large-scale northwest trending anomaly pattern in the western part of the quadrangle described by a high lobe which noses out to the southeast between two lows. Anomaly amplitudes in this area range from 800 gammas in the south central area to 240 gammas where features broaden to the northwest. Two other magnetic trends become evident in the northeastern and north central regions of the quadrangle. An east-west trending high-low ridge occurs along the northern map border and a lower amplitude northeast trending magnetic ridge occurs in the eastern third of the map area.

Basement rocks, according to known structural geology, are gently dipping northwestward from the Sioux Uplift to the southeast, northward to the

TABLE III

LEGEND TO TOTAL FIELD MAP (GAMMAS)

CONTOUR VALUE	LOWER LIMIT	UPPER LIMIT
-		58750.0
0	58750.0	58830.0
1	58830.0	58910.0
2	58910.0	58990.0
3	58990.0	59070.0
4	59070.0	59150.0
5	59150.0	59230.0
6	59230.0	59310.0
7	59310.0	59390.0
8	59390.0	59470.0
9	59470.0	59550.0
+	59550.0	

X4= 418000.0
Y4= 4990669.0

X3= 580560.0
Y3= 4990669.0

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44
444444444 5554333322211 2 3 4444443211111111000 00000000 1111 330--- 0 11110000 122111 222222221100 1 2344 44433333333 44333.
.44 5 54 3 2 2 3 4 432 1 1 2321 0 1 1 1 2 2 2 2 1 123 4 555 4 4 4 3.
.4 4 55 4 3 2 3 4 432 111 1 11 2 21000 11 111 2 222 2 23 45 6665 44 4444 43 .
.4 444 4 4 33 44 5555 4 32 111 11 11111 2 333322222222222 3 4433 333333333 4555 55 4 44 55555 4 .
.44 4 4 4 555 66 7766 43 21 111 1 222222222 34555555444333 4 5666543 3 444444 5 6776 5 4 4 5 6666655 .
.44 33 44 4 56777 88887543 2 1 11 11 22 35677776655444 56 7776543 4 55555 6788876 5 4 4 5 677776 5 .
.4 3 3 44 4 6789999 9765432 1 1 22 333333333333 4 56788 77665 66 7 88876555 666 7777 8998776665444 5 67777 65 .
.54 3 3 4444 4 568 98764321 1 2 3 4444444 55555 6788 88 776 777 88 877777 888 9999 9987 66 665555 66 6 5 .
.643 3 44 44 5689 9865321 1 2 344 55555 6666 77 88 88 77 88 888 99999 9876 6 66 66 6 55 .
.7643 344 5 78 9754211 1 2 3455 66 7777 88 8 88 9 99 976 5 6 77 66 6 5 4 .
.7643 34444 5678 976432 111 1 23 4 5 6 7 8 8 777 8 888 999999 976 5 5677 6 5 4 .
.54 3 3 33 4 56 78 976543322 1 1 23 4 5 6 7 8 8888888 7 7 7777 8 8888 99 9976 55 6 666 7776665 .
.4 4 3 3 45 66 78 9 998765555432 0 122 3 456 7 77 77777 666 6 6 55555 6 66 77765 5 666 6 6 7 7777 .
.3 4 4 3 34 5 6 78 9 99 8765 666420 0 122 3456 666 7 7777777 666 555555 4 4 4444 5 54 467777 6 6 788888 8 .
.3 4 4 3 3 4 5 6 78999 8 77655 676530 0122 345 555 6 666 5 4 33 4 5 4 5677 666 67 8 88 8 .
.34 4 33333333 4 5 66 78 8 7 655 5677531 0122 3 4 4 5 6 666666 555 5 4 3 33 455 5 6 65 5 6 7 7777 .
.3 4 4444444444 5 6788 88 8 76 54 45676310 12333 222 3 4 5 55555 5 444 4 3 3 4566 777765 5 6 66666 .
.3 4 55 666665 6789999999 8 76 543 35677410 134443 21 0 12 34 5 5 44444 44 3 4 555 4 33 345678 99987655 5 555 444 .
.33 4 5 6 777 66 78 9 98 7654322 2478751 013555432 0 01 234 4444 4 3 3 4 5 5 4 3 3 4568 9 9865 5 5 44 3 .
.33 4 5 6 77 7 789 9 87 654322 2478852 01356653210 012 3 33 3 34 5 5 4 3 3 456899 9765 5 5 4 3 .
.3 4 5 677 77 78999 888 7 654 3 3578864 3468876421 0 0 1 2 2 3 3 3 4 4 3 4567 8 99988655 5 5 4 33 .
.3 4 56 77 6 777777777 654444 578987 78 864321100 0 1 2 3 3333 4 4 4 56 77 777776 5555 5 4 3 2 .
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.55 444 3 22 22222 22 1 0 1 2 3 2 234 4 444444444333 22 3467765555432 2 3 4 5 5 4 3 22222 3 33 22 1 .
.44 3 33332 1 0 0 1 22 2 3 4 5 6665555432 1 1 233 222222 2 3 45 5 4 3 2 2 22 1 .
.33 33333 3333 3 4432 1 0 0 1 111 2 3 4 56 7766665421 11 00 1 2 34 444 32 1 2 222222 1 .
.33 3 33 2 3 33 2 1 000 11 1 2 3 4 5677 777 6532 0 0 1 2 3 44 3333 2 1 1 2 222222 1 .
.3 3333 33 22 11 2 2 2222111111 0 1 2 34 567888888764211 0 0 1 2222222 3 33 2 2 22 1 2 2 1 .
.3 3 3 2 1 1 2 33332222 1 0 0 1 11 234 56799999987532 1111 00 12 33 3 3 21 1 22222 333 2 111 1 .
.33 2 3 3 2 1 1 23 44 333 2 1 0 0 1234 6799999 97532 1 1 2 33 33 21 1 23 4444 32 1 1 1 .
.32 2 2 3 3 444321 1 23 44 44 32 1 00 1234 4 578 88 987532 222 1 12 33 33 21 12 34555 43 2 11 1 1 .
.2 2 2 3 4567765333333 44 44 32 1111 12 3 3 456 7 7 765432 21 0000 12 2222 3 3 21 1 23 4 55 4 3 222 1 1 .
.2 2 2 3 457898766 7654 5555 432222222111111 11 2 34 44 5 54433333210 0 1 1 2 3 3 2111 233 4 4 333322 2 .
.22 2 2 3 4 67 77 899875 5 5 4 3 33332222222 1 1 2 22 3 4443 3210 0 1 2 3 3322 2 33 3 4 4 444432 22 .
.22 2 2 3 4 56 7899875 5 5 4 33 4443 21 0 1 2 3 3 3 3210 0 1 2 3 3 2 33 3 3 4 43 2 22 2 .
.2 333222 2 2 3 4 56788765 44444444 44 433 33321 0 0 1 111 2 33 3 22 100000 111 2 3 44 3 33 3 3 33 44 3 2 3 .
.23 4444322 2 3 45 66 5 4 333333333 44 43 33 321 0 11 00 1 111 2 1 11 11 222222 3 4 4 33 3 222222 333 .
.2 345665432 2 3 3 44 3 2222 34 5 43 44432 1 10 0 1 11 2 33333 2 3 4 44 3 2 11 2 343 .
.2 345676532 1 2 3 3 3 3 2 2 3455 43 4 542 0 1 10 0 1 1 23 44 3 2 234 5 4 33333 22 1 134443 .
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X1= 418000.0
Y1= 4870000.0

X2= 580560.0
Y2= 4870000.0

Figure 7
41/42

TABLE IV

LEGEND TO POTASSIUM AVERAGE MAP (PERCENT)

CONTOUR VALUE	LOWER LIMIT	UPPER LIMIT
-		1.10
0	1.10	1.14
1	1.14	1.18
2	1.18	1.22
3	1.22	1.26
4	1.26	1.30
5	1.30	1.34
6	1.34	1.38
7	1.38	1.42
8	1.42	1.46
9	1.46	1.50
+	1.50	

POTASSIUM AVERAGE

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X3= 580560.0
Y3= 4990669.0
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Figure 8

45/46

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.....
X2= 580560.0
Y2= 4870000.0

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TABLE V

LEGEND TO URANIUM AVERAGE MAP (PPM)

CONTOUR VALUE	LOWER LIMIT	UPPER LIMIT
-		1.05
0	1.05	1.20
1	1.20	1.35
2	1.35	1.50
3	1.50	1.65
4	1.65	1.80
5	1.80	1.95
6	1.95	2.10
7	2.10	2.25
8	2.25	2.40
9	2.40	2.55
+	2.55	

```
X3= 580560.0
Y3= 4990669.0
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Figure 9
49/50

TABLE VI

LEGEND TO THORIUM AVERAGE MAP (PPM)

CONTOUR VALUE	LOWER LIMIT	UPPER LIMIT
-		4.50
0	4.50	4.83
1	4.83	5.16
2	5.16	5.49
3	5.49	5.82
4	5.82	6.15
5	6.15	6.48
6	6.48	6.81
7	6.81	7.14
8	7.14	7.47
9	7.47	7.80
+	7.80	

TABLE VII

LEGEND TO URANIUM/POTASSIUM RATIO MAP

CONTOUR VALUE	LOWER LIMIT	UPPER LIMIT
-		0.90
0	0.90	1.01
1	1.01	1.12
2	1.12	1.23
3	1.23	1.34
4	1.34	1.45
5	1.45	1.56
6	1.56	1.67
7	1.67	1.78
8	1.78	1.89
9	1.89	2.00
+	2.00	

TABLE VIII

LEGEND TO URANIUM/THORIUM RATIO MAP

CONTOUR VALUE	LOWER LIMIT	UPPER LIMIT
-		0.18
0	0.18	0.21
1	0.21	0.24
2	0.24	0.27
3	0.27	0.30
4	0.30	0.33
5	0.33	0.36
6	0.36	0.39
7	0.39	0.42
8	0.42	0.45
9	0.45	0.48
+	0.48	

X4= 418000.0

X3= 580560.0

Y4= 4990669.0

Y3= 4990669.0

.....+
.
.
.
.
100 33 7 22
10 1433 46321 64 366 55 664 5751 2100 573+ 2 345754332 24 541 1599 684 42 5552 25631 453 554 655 485 798663 4 55 354 55 58 76.
1 13 4422 24433 5 5 5 5 55421 1 2456885 34554 3 2 34542 25787 643 3 4432 24532 3444 55 566 6776 4 4 43 4 5 68886.
1 123 443 2 332 345 5 5 5432 1 1235677533 3 4 43 3 4432 346776 54 4 423 44 3 344 55 5 6 654 44 43 4 44 56788 .
1 12 3 3 33 345 55 444 43222 2 3456 655544 43 3 33322 345 55 44 5665544 333 44 4 4444 4 5 654 4 4 4 4 45679+ .
4211 23 2 34 32 35 5 4 3 4 4333333 4 56788865 5 43 2 2 3 4 56 7764 3 3 44 4 4 33 345543 344 443 34679+ .
6431 22 443 4 543 456 5 4 3 34 44 4 578986 5 543 2 2 34 55 5 654 3 34 4 3 345532 234 4 43 3578 + .
5322 234 43 3 4 44 566654 3 3 4 4 33333 4 56 765 5 54333 2 2222 3 45 55 65 4 3 455 4 4433 35 543 3 44 443 34567+ .
654333 45 43 3 3 35677 532 234 43 2 2 34 5 444 456543 3 33 444 4 55 666 55 54 5 654 4 56544 56765444 4 4 4444 67 .
75554 455543 3 3 35788653 1 23454321 123454 4 5665 4 3 34 5554 55 66 6 6 55 67643 3567655 678765 4 4 5555 4 5 .
67665 4 56643 3 468887531 2355532 123554 4 5 666 54 3 345 66655 66 6 66666 78643 357776 678875 4 4 566654 442 .
6766 5 56643 3 4688864221 24555421 1245554 4 5 666 54 3 45677 666 6666 6 78753 3678876 788876 4 4 45 6 65 4 42 .
7665 4 665333 5666 5443 345554322 3566654 5 665 444 46777 6 555 6 77777 8765 5788876 788764 4 444 5 6 765 55 .
765 4 4 5 5444 3 344 4565555 5443 456776555 5 5554 46887 66 7 65 4 456 7 77 78 9877 788654 555 67766 8 .
776 4 45 5 4 3 3567776 554 56788877654 45 6654 579986 67654 3 34677 888 8 98 87 6 68887555 55 56776 79+ .
7764 3 45 5 4 3 3567 76 55 678886654 45 66 654 58998 66 77543 4677 89 8 998 87 6 6898766 55 55 6776 79+ .
7543 3 45 555 4 3 356776 5 6 8886654 45666 665 568997 76 543 4578888 7 89999 98 8 7 6 787655 66 67766 8 .
753 3 455 555443 3566 5 5 55 5 67 77766 6 6 5 679987 776 554 57899 8 7 789 9 98 8 777765 4 56776666 766 6 .
74 2 23455 5 54333 345654 3 4565 5 5 56788877777 5 5 679 987 7 76 6788 9 9987 6 89 998 8 8875 4678877 6 555 .
8642 2345 56654 3 3456542 35 5 5654 45677 66 78765 5689 987 7 76 689999 99876 679 988 8 8754 45678887 6 5 41 .
8642 234 44 566544 3 3455532 35 5 5654 4554 3 578764 4679 986 6 77 6777 8999 876 78 998 77 8875 4 6 78887 66 5 41 .
64 2 23 44 4 5 5554 3 455532 3454 5654 4 42 2467764 456888876 77 5 4444 567 77 6 68999 987 7 8876 567 8 76 5 6 555 .
543 2 3 3 4 444 3 344 4322 343 34565444 3 2 3456 64 3 4567 77 6 64 33 3 456 6 67899876 5 78 86 566 7776 4 566666 .
33 333 22 3 3 2 3 4 43 332 235665 4 3 2 3456 6 43 2 3456 66 6 643 3 3 46 6 55 6789875 4 68 865 66 6 7653 35677777 .
233 4432 23 32 2 3 4 43 2 3566543 2 2345 6543 2 2 34 5 54 3 45433 456 5 5 78 8654 467875 56 6 653 3567 7 7 .
2 3 4432 2 3 44432 2 3 4322 2 2356654321 12345 5432 1 1 235 54 467654 4 55 44 568 865 456 65 55 6 65 4566 7 .
33 232 23444 4322 33 2 2 2 3456543210 012 34 4 3 222 1 1245 4 5676554 4 44 3 4567 765444 4 4444 5 6654 45666 7 .
422 111 2345555 555433 2 1 2 3 45 65432 11 2 3 3 3 222111 234 4 4555555444 3 356 6655 4 32 23 4 56776 56 6 67 .
6521 1235 65 4 5 5443 221 12 345666542 1 2 333 3 2 33333222 23 444 44 4 3 34565 554321 1 2 34567 65 566 66 .
6521 12355 54 4 5443 3321 12 3456665321 12 333 2 2 3 332 2 3 333 3 344 4 3 3455 54321 12 3 45676 5 5 6 5 66 .
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21 11 23444 3 2 3 3 32 2 2 3 32 2 332 2 2 111 2 2 2 11 23 3 3 44 3 3 5665 4 3 343 35 6 6 543 36 .
11 222 3444321 12 3 33 322 3332 11 1 122 2222 2 2 1 0 1 2 2 1 0 122 1 234 4 3 34566 4443 34553 3456 6 543 355 .
00 12 344421 012 3 4 3 34432 10 012 2 2 210 1 2 2 1 0 0 1 1345 43 345664 43 346544 55555 5 5 3 455 .
00 12333 44420 012 3 4 3 34432 10 0123 2 2 2 3321 0 1 2 2 1 0 0121 135 54 3 45654 3 34565 666 444 5 5 5 6 .
01 2 3443210 2333 3 3 344321111 0 12 2 2 33 211 12 33 2 1 123322 35 54 4554 3 3 455444444 45 5 5 .
222 222 333 22 34443 3 3 333 222211 233 2 22 2 3 33322 333 3 2 22 344444 5 5 4 3 45543 3 444443 3 3 4444 5 66654 .
43 2 1 2 33 3 4544 3 44 2 3 33333333 333333 2 2 34554444444 3 2 333 45666665 543 34532 3554 44 4 5555 6 653 .
654321 12 3 3 344 43 344 4 3 3 44 3 4 554443 2 245 55 55 43 3444 57777 666543 34431 13554 4 54 5 6 6 7653- .
5432 1 2 33 3 44 3 34566543 22 3 333333 3 4 44 32 245 54 4 4 3 3 3 4 56777 6 543 34431 12454 4 55 55 66 764 .
53 22 333 3 3 3 2 357898643 1111 2 22 11 2 3 44432 235542 111 2 3 3 2 3 4566 5 5 5432 235431 24 44 676666 5 568887 665 .
53 2 23433 332 369 9631 00 1 111 00 1 345432 245531 00 013432 2 345664 455431 135432 23 45799877664 469 976 66 .
8532 23443 3 31 26 730 0 0 0 1 2455321 245520 13442 245764 345421 13443 23 467887 66643 36 7 6 7 .
8432 23433 21 259 730 0 0 0 135532 245420 13442 235653 24432 2432 2 346 75 4 5542 369 97 567 .
32 2 33333 3222 57 9620 0 0 013 32 124420 013442 23332 1 23321 122 11 2 34554 33332 257975 45 .
1 1 1 0 1245554 566544 69 7310 01100 0 02210 13320 0124542 1 1 1 1 2 21 000 01 2 3 3 222 1 1245653 34 .
00 110 02466 68 86 689852 012 10 0 0 1220 02321000 1235543 1 1 12 3210 01 2 21 1 0 0124 431 1247 .
00 110 014565 579986 699841 012210 0111000 220 023321111 2456432 1 11 1233210 0 1 2 2 11 10 01344321 1247 .
011 10 013453 4566 6 788741 12221 0 1222111 10 0233 2222 3566542222111 111 23 3210 0 1 2 22 3321 1 3455432 234 .
12333221 12332 2356777666520 000 012332 1 12 2 2 10 134433333 56665433333222 2 333 44322111 2222 3 4444 32 346776543 456 .
134444321 1 1 13457 876 541 01 1 3443 210 0 122 1 24 555544 67776544444 3 34 544 5443 33 44333 455543 3579 97655 6 8 .
4 355 431 00 246 79975 42 011 13543 20 012 2 22 3455 665 4688 65 4 332 2455 4 554 3 44 4 45653 4689 85 66 789 .
4 376 531 - 0 589999 644 51 1220 375 2320 1 13 1 22 265 56863 7 7 665 4 63 31 66 5 764 34 54 44 37653 2 897 65 66 799 .
.....+
X1= 418000.0 X2= 580560.0
Y1= 4870000.0 Y2= 4870000.0

TABLE IX

LEGEND TO THORIUM/POTASSIUM RATIO MAP

CONTOUR VALUE	LOWER LIMIT	UPPER LIMIT
-		3.75
0	3.75	3.95
1	3.95	4.15
2	4.15	4.35
3	4.35	4.55
4	4.55	4.75
5	4.75	4.95
6	4.95	5.15
7	5.15	5.35
8	5.35	5.55
9	5.55	5.75
+	5.75	

Y3= 4990669.0

Figure 13
65/66

Williston Basin yet that subtle feature is difficult to discern. The broad, criss-cross pattern of anomalies probably relates to Precambrian structural features while smaller higher frequency anomalies represent intrusives.

The radiometric computer printer maps display a rather high level of response for each of the K, U and T parameters. The greatest thorium and potassium response occurs in the west and southwestern areas of the map. In this area the Coteau du Missouri is a topographic high, the result of Cretaceous shales holding up Quaternary sediments to an elevation of 200 to 300 feet above the James Basin to the east. Increased concentrations for the T and K parameters range from 6.8 to 7.8 ppm and 1.4% to 1.5% over lower limits of 4.5 ppm and 1.10% respectively. Areas of high uranium response are peppered over the map area following no apparent trend. From a lower limit of 1.05 ppm, uranium concentrations range up to maximums of 2.1 to 2.55 ppm. The area of greatest ratio support for preferential uranium accumulation is found in the northeastern quadrant of the map area.

Based on the criteria outlined in the general section on interpretation, a total of nineteen uranium anomalies have been defined on the interpretation map. Many of the anomalies outlined consist of support from only one of the U/T or U/K ratios with the other being either normal or anomalous due only to a low potassium or thorium response. Such zones include all but zones seven and nine and are felt to be adequately discussed in the anomaly listing of Appendix B and will not be discussed further here.

Anomaly 7 is located over approximately 13 kilometers of t-1520 where it intersects tl-5020. Weak K, U, and T anomalies occur over unit Qwmm in this area with concentrations reaching 1.5%, 2.55 ppm and 7.8 ppm respectively. Relatively high uranium concentrations at this location along with the relatively strong ratio support visible on the U/T and U/K computer printer maps make this particular anomaly one of the more convincing areas of possible enrichment. Anomaly 9 occurs to the east of anomaly 7 along t-1520 between fiducials 4470 and 4630. Increasing in uranium response eastward, this anomaly occurs over unit Qal, Quaternary alluvium. Support for an anomalous concentration at this locale in the alluvium is also exposed on tl-5030 to the immediate east, where a narrow but sharp spike occurs on all but the potassium profile over a small section of Qal crossed by the tie line. The computer printer maps support this anomaly with relatively strong ratio support in the

area of Anomaly 9.

Of the nineteen uranium anomalies outlined, anomalies 7 and 9, based on their high background levels of uranium response and ratio support, present themselves as possible areas for uranium enrichment in the Huron quadrangle.

0 10 20
STATUTE MILES

AERO SERVICE

LEGEND

③ URANIUM ANOMALY NO. 3

INTERPRETATION MAP
HURON QUADRANGLE
U.S. DEPARTMENT OF ENERGY

FIGURE 14
69/70

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A P P E N D I X A

Geologic Legend

GEOLOGIC LEGEND

<u>Aero Symbol</u>	<u>Map Symbol</u>	<u>Unit Description</u>
<u>Quaternary</u>		
QAL	Qal & Qd	Alluvium Dune sand
QL	Ql	Glacial lake sediments
QWMM	Qwmm	End moraine-Mankato Substage
QWML	Qwml	Ground moraine-Mankato Substage
QWCM	Qwcm	End moraine-Cary Substage
QWCG	Qwcg	Ground moraine-Cary Substage
QWIG	Qwig & Qwim	Ground moraine-Iowan Substage End moraine-Iowan Substage
QWI	Qwi	Glacial drift-Iowan Substage
<u>Cretaceous</u>		
KPS	Kps	Pierre shale
W	Wa	Water

A P P E N D I X B

List of Geologic Units by Anomaly

List of Geologic Units by Anomaly

<u>Anomaly</u>	<u>Geologic Unit</u>	<u>t-traverse tl-tie line</u>	<u>Fiducial</u>	<u>Description</u>
1	Qwcm	t-1500	20270	weak U and U/T anomalies
2	Qwmg	t-1510	910	weak U, U/T and U/K anomalies
3	Qwmg	t-1510	1155	weak to moderate U and U/K anomalies
4	Ql Qal Qwmm	t-1510	2160	weak U, U/T and U/K anomalies
5	Qwmg	tl-5010	7735	weak to moderate U and U/K and weak U/T anomalies
6	Qwmg	t-1520	3710	weak to moderate U/T anomaly in area of weak uranium expressions
7	Qwmm	t-1520	4150	very broad, weak U, U/T and U/K anomalies with substantial support from intersecting tie line 5020
8	Qal	t-1520	4330	weak U and U/K anomalies
9	Qal	t-1520	4550	very broad, weak U, U/K and U/T anomalies with highest U concentration toward east end, supporting peak on profiles of intersecting tl-5030 over unit Qal
10	Qwmm	t-1530	7575	weak U and U/T anomalies
11	Qwmm	tl-5020	2240	moderate U/K and weak to moderate U anomalies in area of very weak U/T support

<u>Anomaly</u>	<u>Geologic Unit</u>	<u>t-traverse tl-tie line</u>	<u>Fiducial</u>	<u>Description</u>
12	Qal	t-1560	4450	weak U and U/K anomalies
13	Qwi	tl-5000	7480	weak U and U/T anomalies
14	Qwcg	t-1560	5590	weak U, U/K and U/T anomalies
15	Qwmm	t-1560	6730	weak U/T anomaly
16	Qwi	t-1580	9980	weak U/T anomaly with some very weak U/K support in area of normal U expression
17	Qwi	t-1590	12800	weak U and U/K anomalies
18	Qwcg Qal	t-1590	13490	weak U/K anomaly
19	Qwmm	t-1590	14740	weak U, U/K and U/T anomalies

A P P E N D I X C

List of Anomalies by Geologic Unit

List of Anomalies by Geologic Unit

<u>Aero Symbol</u>	<u>Map Symbol</u>	<u>No. of Samples</u>	<u>No. of U. Anomalies</u>	<u>No. of Th. Anomalies</u>
QAL	Qal Qd	5357	5	-
QL	Ql	2022	1	-
QWMM	Qwmm	10761	6	-
QWMG	Qwmg	4383	4	-
QWCM	Qwcm	3450	1	-
QWCG	Qwcg	4834	2	-
QWIG	Qwig Qwim	834	-	-
QWI	Qwi	2382	3	-
KPS	Kps	288	-	-

A P P E N D I X D

Mean Radiometric Values by Geologic Unit

MEAN VALUE BY GEOLOGIC MAP UNIT

FLRCA

QUAD

LINE 1480

UNIT	E THCR	E URN	PCT PCT	U/TH	U/K	TH/K
QWIG	0.47	1.88	22.02	0.265	1.318	5.007
QAL	0.38	1.84	19.25	0.325	1.467	4.575
QWCM	0.38	1.91	18.65	0.332	1.577	4.793
QL	0.41	2.07	20.22	0.335	1.566	4.654

UNIT	E THCR	E URN	PCT PCT	U/TH	U/K	TH/K
QWCG	0.40	1.75	19.49	0.297	1.411	4.847
QWPM	0.37	1.76	19.34	0.318	1.408	4.493
QWPG	0.39	1.74	19.60	0.295	1.365	4.631

LINE 1490

UNIT	E THCR	E URN	PCT PCT	U/TH	U/K	TH/K
QWIG	0.47	1.76	21.22	0.248	1.274	5.151
QAL	0.36	1.68	18.14	0.325	1.462	4.592
QWCM	0.41	1.65	19.32	0.296	1.472	5.001
W	0.24	1.51	13.74	0.444	1.711	3.987

UNIT	E THCR	E URN	PCT PCT	U/TH	U/K	TH/K
QWCG	0.40	1.81	19.83	0.304	1.400	4.659
QWPM	0.38	1.75	18.90	0.309	1.420	4.639
QWPG	0.38	1.49	19.08	0.259	1.199	4.686
CL	0.40	1.64	19.65	0.273	1.292	4.762

LINE 1500

UNIT	E THCR	E URN	PCT PCT	U/TH	U/K	TH/K
QWCM	0.43	2.17	19.94	0.335	1.671	5.041
QAL	0.34	1.88	18.38	0.367	1.592	4.352
QL	0.38	2.21	19.40	0.391	1.755	4.560

UNIT	E THCR	E URN	PCT PCT	U/TH	U/K	TH/K
QWPM	0.37	1.82	19.04	0.330	1.473	4.530
QWPG	0.39	1.97	19.42	0.333	1.561	4.708

LINE 1510

UNIT	E THCR	E URN	PCT PCT	U/TH	U/K	TH/K
QWCM	0.44	2.08	21.33	0.312	1.519	4.922
QWCG	0.40	2.13	19.90	0.354	1.648	4.702
QAL	0.34	1.90	18.56	0.380	1.581	4.240

UNIT	E THCR	E URN	PCT PCT	U/TH	U/K	TH/K
QWPM	0.38	2.01	19.21	0.358	1.607	4.544
QWPG	0.41	2.09	20.46	0.337	1.571	4.711
CL	0.38	2.27	19.22	0.420	1.886	4.561

MEAN VALUE BY GEOLOGIC MAP UNIT

FLRCH

QUAC

LINE 1520

UNIT	E THCR	E URN	POT PCT	U/TH	U/K	TH/K
QWCM	0.43	2.01	21.21	0.304	1.447	4.775
QWCG	0.45	1.86	21.55	0.275	1.321	4.854
QWMM	0.37	2.18	19.20	0.395	1.742	4.474

UNIT	E THCR	E URN	PCT PCT	U/TH	U/K	TH/K
QAL	0.36	2.24	18.86	0.409	1.823	4.503
QWNG	0.42	2.07	20.80	0.327	1.528	4.722
CL	0.34	2.01	18.51	0.393	1.659	4.283

LINE 1530

UNIT	E THCR	E URN	POT PCT	U/TH	U/K	TH/K
QWCG	0.47	1.93	21.74	0.272	1.355	5.037
QWCM	0.41	1.60	20.43	0.265	1.206	4.611
QAL	0.36	1.83	19.07	0.339	1.481	4.415

UNIT	E THCR	E URN	PCT PCT	U/TH	U/K	TH/K
QWNG	0.42	1.86	20.53	0.293	1.387	4.792
QWMM	0.38	1.93	19.62	0.343	1.510	4.471
CL	0.44	2.18	21.02	0.329	1.592	4.896

LINE 1540

UNIT	E THCR	E URN	POT PCT	U/TH	U/K	TH/K
QAL	0.35	1.57	18.16	0.300	1.328	4.504
QWCG	0.45	1.89	20.67	0.281	1.408	5.043
QWCM	0.44	1.92	20.35	0.287	1.448	5.067

UNIT	E THCR	E URN	POT PCT	U/TH	U/K	TH/K
CL	0.36	1.61	19.37	0.297	1.283	4.313
QWNG	0.40	1.61	20.20	0.267	1.226	4.623
QWMM	0.34	1.58	18.75	0.305	1.288	4.258

LINE 1550

UNIT	E THCR	E URN	POT PCT	U/TH	U/K	TH/K
QWIG	0.49	1.46	20.66	0.197	1.089	5.560
QWCG	0.47	1.76	21.13	0.250	1.277	5.140
QWCM	0.44	1.67	20.41	0.253	1.252	4.997

UNIT	E THCR	E URN	POT PCT	U/TH	U/K	TH/K
QAL	0.40	1.65	19.03	0.280	1.352	4.873
QWMM	0.39	1.64	19.70	0.283	1.289	4.590
QWNG	0.42	1.21	19.94	0.189	0.926	4.876

MEAN VALUE BY GEOLOGIC MAP UNIT

FLRCH

QUAC

LINE 1560

UNIT	E THCR	E URN	PCT PCT	U/TH	U/K	TH/K
QAL	0.43	2.00	19.86	0.317	1.565	5.027
QWIG	0.45	1.65	20.64	0.246	1.243	5.053
QWI	0.47	2.05	20.93	0.286	1.511	5.277
QWMC	0.44	2.05	19.64	0.315	1.666	5.215

UNIT	E THCR	E URN	PCT PCT	U/TH	U/K	TH/K
QWCG	0.45	2.06	20.71	0.302	1.532	5.113
QWCM	0.44	2.13	20.60	0.320	1.588	4.981
QWPM	0.37	1.82	19.28	0.329	1.456	4.482

LINE 1570

UNIT	E THCR	E URN	PCT PCT	U/TH	U/K	TH/K
QWI	0.48	1.72	20.58	0.241	1.278	5.410
W	0.08	0.97	2.38	0.555	4.256	6.380
QAL	0.41	1.91	19.30	0.321	1.529	4.940
QWIG	0.51	2.16	21.83	0.284	1.520	5.390

UNIT	E THCR	E URN	PCT PCT	U/TH	U/K	TH/K
QWCG	0.45	1.73	20.57	0.259	1.300	5.072
QWCM	0.45	1.80	20.24	0.267	1.359	5.188
QWPM	0.38	1.70	19.64	0.299	1.343	4.546
QWPG	0.41	2.03	19.37	0.339	1.624	4.941

LINE 1580

UNIT	E THCR	E URN	PCT PCT	U/TH	U/K	TH/K
QWI	0.48	1.59	21.23	0.223	1.155	5.241
W	0.09	0.76	3.17	0.646	4.765	6.828
QAL	0.39	1.33	19.99	0.226	1.037	4.555
QWMC	0.41	1.48	19.27	0.244	1.191	4.980

UNIT	E THCR	E URN	PCT PCT	U/TH	U/K	TH/K
QWCG	0.43	1.58	20.34	0.244	1.192	4.960
QWCM	0.46	1.56	20.78	0.228	1.155	5.124
QWPM	0.38	1.31	19.75	0.231	1.020	4.453

LINE 1590

UNIT	E THCR	E URN	PCT PCT	U/TH	U/K	TH/K
KPS	0.46	1.78	21.48	0.259	1.283	5.028
QWI	0.47	1.85	21.58	0.264	1.330	5.054
QAL	0.35	1.81	18.61	0.360	1.506	4.372
W	0.20	0.79	7.18	0.335	2.115	5.864

UNIT	E THCR	E URN	PCT PCT	U/TH	U/K	TH/K
QWCG	0.46	2.17	20.72	0.316	1.617	5.141
QWCM	0.45	1.99	20.08	0.292	1.513	5.156
QWPM	0.39	2.05	19.59	0.352	1.601	4.583
QWPG	0.43	2.25	20.68	0.346	1.667	4.901

MEAN VALUE BY GEOLOGIC MAP UNIT

HLRCN

QUAC

LINE 5000

UNIT	E THCR	E URN	POT PCT	U/TH	U/K	TH/K
QWI	0.47	2.42	22.06	0.345	1.688	4.951
W	0.10	0.85	4.12	0.820	5.246	5.104
QAL	0.44	1.95	22.14	0.254	1.358	4.646
QWIG	0.48	2.18	23.67	0.300	1.416	4.775

UNIT	E THCR	E URN	POT PCT	U/TH	U/K	TH/K
QWCG	0.50	2.34	22.59	0.311	1.600	5.158
QWCM	0.48	2.03	22.94	0.283	1.358	4.843
QWPM	0.47	2.09	23.12	0.294	1.384	4.737
QWNG	0.48	2.21	23.33	0.297	1.441	4.840

LINE 5010

UNIT	E THCR	E URN	POT PCT	U/TH	U/K	TH/K
QWI	0.55	1.88	23.40	0.228	1.233	5.482
QAL	0.49	1.66	21.47	0.222	1.177	5.312
QWCG	0.49	1.80	22.64	0.242	1.217	5.107

UNIT	E THCR	E URN	POT PCT	U/TH	U/K	TH/K
QWCM	0.51	2.23	22.41	0.292	1.530	5.294
QWNG	0.49	2.03	22.90	0.276	1.369	4.963
QWPM	0.44	2.10	20.42	0.315	1.587	5.088

LINE 5020

UNIT	E THCR	E URN	POT PCT	U/TH	U/K	TH/K
QWCG	0.46	1.94	20.50	0.283	1.452	5.210
QWCM	0.44	1.90	19.41	0.289	1.510	5.271
QAL	0.33	1.73	18.15	0.356	1.458	4.179

UNIT	E THCR	E URN	POT PCT	U/TH	U/K	TH/K
QWPM	0.37	1.81	18.48	0.323	1.503	4.693
QWNG	0.38	2.16	18.92	0.376	1.763	4.710

LINE 5030

UNIT	E THCR	E URN	POT PCT	U/TH	U/K	TH/K
QWPM	0.42	2.05	22.17	0.329	1.425	4.374
QWNG	0.42	1.99	22.41	0.315	1.368	4.362

UNIT	E THCR	E URN	POT PCT	U/TH	U/K	TH/K
QAL	0.42	1.74	21.58	0.276	1.226	4.511
CL	0.46	1.99	23.62	0.284	1.293	4.569

85/86

A P P E N D I X E

Standard Deviation Table

HUREM

QUAD

FORMATION

W

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	101	0.84	LOGNORMAL	0.12	0.23	0.44	1.62	3.11	5.96
E URANIUM	333	0.70	LOGNORMAL	0.20	0.30	0.46	1.06	1.61	2.46
POTASSIUM	90	0.10	LOGNORMAL	0.01	0.02	0.05	0.24	0.53	1.20
EU/K	39	1.23	LOGNORMAL	0.21	0.37	0.68	2.23	4.06	7.37
EU/ETH	40	0.37	LOGNORMAL	0.13	0.18	0.26	0.53	0.75	1.07
ETH/K	39	5.09	NORMAL	0.60	2.09	3.59	5.59	8.09	9.58

FORMATION

QAL

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	5355	5.59	NORMAL	2.07	3.24	4.42	6.77	7.95	9.12
E URANIUM	5308	1.73	NORMAL	0.04	0.60	1.17	2.30	2.86	3.43
POTASSIUM	5355	1.25	NORMAL	0.79	0.95	1.10	1.41	1.56	1.71
EU/K	5308	1.32	NORMAL	-0.14	0.35	0.83	1.81	2.30	2.78
EU/ETH	5308	0.31	NORMAL	-0.04	0.08	0.19	0.42	0.54	0.65
ETH/K	5308	4.19	NORMAL	1.96	2.70	3.45	4.94	5.68	6.42

FORMATION

QL

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	2022	5.98	NORMAL	3.46	4.30	5.14	6.82	7.66	8.50
E URANIUM	2022	1.89	NORMAL	0.51	0.97	1.43	2.35	2.81	3.27
POTASSIUM	2022	1.33	NORMAL	0.89	1.03	1.18	1.47	1.62	1.76
EU/K	2022	1.36	NORMAL	0.20	0.59	0.98	1.75	2.14	2.53
EU/ETH	2022	0.31	NORMAL	0.04	0.13	0.22	0.40	0.48	0.57
ETH/K	2022	4.25	NORMAL	2.42	3.03	3.64	4.86	5.47	6.08

FORMATION

QWMM

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	10760	5.53	NORMAL	3.13	3.93	4.73	6.33	7.12	7.92
E URANIUM	10703	1.75	NORMAL	0.20	0.72	1.24	2.27	2.79	3.31
POTASSIUM	10760	1.25	NORMAL	0.94	1.05	1.15	1.36	1.46	1.57
EU/K	10703	1.32	NORMAL	0.03	0.46	0.90	1.77	2.20	2.64
EU/ETH	10703	0.31	NORMAL	0.01	0.11	0.21	0.41	0.51	0.61
ETH/K	10703	4.15	NORMAL	2.24	2.88	3.52	4.79	5.43	6.07

HUREN

QUAD

FORMATION

QWMG

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	4383	6.15	NORMAL	3.84	4.61	5.38	6.91	7.68	8.45
E URANIUM	4369	1.83	NORMAL	0.26	0.78	1.31	2.35	2.87	3.40
POTASSIUM	4383	1.32	NORMAL	1.00	1.11	1.22	1.43	1.54	1.64
EU/K	4369	1.31	NORMAL	0.05	0.47	0.89	1.73	2.15	2.56
EU/ETH	4369	0.29	NORMAL	0.01	0.10	0.19	0.38	0.47	0.57
ETH/K	4369	4.39	NORMAL	2.57	3.18	3.78	4.99	5.60	6.20

FORMATION

QWCM

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	3447	6.51	NORMAL	4.18	4.96	5.73	7.28	8.05	8.83
E URANIUM	3444	1.85	NORMAL	0.29	0.81	1.33	2.37	2.89	3.41
POTASSIUM	3447	1.32	NORMAL	0.97	1.09	1.20	1.44	1.56	1.67
EU/K	3444	1.33	NORMAL	0.08	0.50	0.91	1.75	2.16	2.58
EU/ETH	3444	0.27	NORMAL	0.02	0.11	0.19	0.36	0.44	0.53
ETH/K	3444	4.67	NORMAL	2.96	3.53	4.10	5.24	5.81	6.38

FORMATION

QWCG

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	4832	6.69	NORMAL	4.23	5.05	5.87	7.52	8.34	9.16
E URANIUM	4813	1.84	NORMAL	0.30	0.81	1.32	2.35	2.86	3.37
POTASSIUM	4832	1.35	NORMAL	1.00	1.12	1.23	1.47	1.59	1.71
EU/K	4813	1.29	NORMAL	0.09	0.49	0.89	1.69	2.09	2.48
EU/ETH	4813	0.26	NORMAL	0.01	0.10	0.18	0.35	0.43	0.52
ETH/K	4813	4.69	NORMAL	2.88	3.48	4.08	5.29	5.90	6.50

FORMATION

QWIG

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	831	7.01	NORMAL	4.91	5.61	6.31	7.70	8.40	9.10
E URANIUM	828	1.81	NORMAL	0.08	0.66	1.23	2.38	2.96	3.53
POTASSIUM	831	1.40	NORMAL	1.04	1.16	1.28	1.52	1.64	1.75
EU/K	828	1.22	NORMAL	0.05	0.37	0.80	1.65	2.07	2.49
EU/ETH	828	0.25	NORMAL	0.00	0.08	0.17	0.33	0.41	0.49
ETH/K	828	4.76	NORMAL	2.99	3.58	4.17	5.34	5.93	6.52

HURCN

QUAD

FORMATION

QWI

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	2378	7.05	NORMAL	4.51	5.36	6.21	7.90	8.75	9.59
E URANIUM	2317	1.77	NORMAL	-0.34	0.37	1.07	2.47	3.17	3.87
POTASSIUM	2378	1.39	NORMAL	1.00	1.13	1.26	1.52	1.65	1.78
EU/K	2317	1.20	NORMAL	-0.33	0.18	0.69	1.71	2.22	2.73
EU/ETH	2317	0.24	NORMAL	-0.06	0.04	0.14	0.34	0.45	0.55
ETH/K	2317	4.81	NORMAL	2.71	3.41	4.11	5.52	6.22	6.92

FORMATION

KPS

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	287	6.79	NORMAL	4.34	5.16	5.97	7.61	8.43	9.25
E URANIUM	286	1.70	NORMAL	-0.04	0.54	1.12	2.27	2.85	3.43
POTASSIUM	287	1.39	NORMAL	1.01	1.14	1.26	1.51	1.63	1.76
EU/K	286	1.16	NORMAL	-0.27	0.21	0.69	1.64	2.12	2.60
EU/ETH	286	0.24	NORMAL	-0.06	0.04	0.14	0.34	0.44	0.54
ETH/K	286	4.65	NORMAL	2.35	3.45	4.05	5.25	5.86	6.46

A P P E N D I X F

Format, Single Record Data Listing

REC NO.	LAT	LONG	RESID MAG GAMMA	FERR CL FEET	FLG	GEOL UNIT	ALM COSM CPS	TOTAL U CPS	FLG	ETH PPM	FLG	EU PPM	FLG	K PCT	FLG	LU/ETH	EU/K	ETH/K	TEMP CELCIUS	BARO PRES MMHG	
5079	64.0086	-160.9197	55305	763	MAR	W	31	1	-12	NAD	-1.1	NAD	-0.5	NAD	0.0	MAD	0.0	0.0	12.7	746.8	
5080	64.0087	-160.9189	55305	751	MAR	W	28	1	36	MAR	0.0	NAD	0.1	NAD	0.1	MAD	0.0	0.0	12.7	747.1	
5081	64.0087	-160.9176	55305	741	MAR	W	26	1	4	NAD	0.2	NAD	0.1	NAD	-0.1	NAD	0.0	0.0	12.7	747.4	
5082	64.0088	-160.9166	55305	730	MAR	W	35	1	-60	NAD	0.0	NAD	0.3	NAD	-0.1	NAD	0.0	0.0	12.7	747.7	
5083	64.0088	-160.9154	55305	722	MAR	W	26	1	-4	NAD	-2.7	NAD	2.3		-0.4	NAD	0.0	0.0	12.7	748.0	
5084	64.0089	-160.9144	55305	712	MAR	W	28	1	-12	NAD	0.5	NAD	-1.7	NAD	0.0	NAD	0.0	0.0	12.7	748.1	
5085	64.0089	-160.9131	55305	702	MAR	W	23	1	37	MAR	0.0	NAD	0.4	NAD	-0.3	NAD	0.0	0.0	12.7	748.5	
5086	64.0090	-160.9121	55305	691		W	22	1	50		0.3	NAD	-0.1	NAD	0.0	MAD	0.0	0.0	12.7	748.8	
5087	64.0091	-160.9109	55305	680		W	23	1	46		0.3	NAD	0.0	NAD	-0.0	NAD	0.0	0.0	12.7	749.1	
5088	64.0092	-160.9099	55305	673		W	17	1	72		0.6	MAR	0.3	NAD	-0.3	NAD	0.0	0.0	12.8	749.3	
5089	64.0092	-160.9087	55305	668		W	20	1	156		-1.6	NAD	0.7	MAR	-0.0	NAD	0.0	0.0	12.8	749.4	
5090	64.0093	-160.9075	55304	666		W	32	1	113		0.0	NAD	0.6	MAR	0.0	NAD	0.0	0.0	12.8	749.4	
5091	64.0093	-160.9064	55304	667		W	30	1	247		-0.2	NAD	0.6	MAR	0.1	NAD	0.0	0.0	12.8	749.3	
5092	64.0094	-160.9052	55304	671		W	29	1	343		0.2	NAD	1.1		0.3		0.0	4.0	12.8	749.2	
5093	64.0094	-160.9042	55304	679		W	23	1	659		2.9		-0.8	NAD	0.8		0.0	0.0	12.8	748.9	
5094	64.0095	-160.9030	55304	663		W	34	0	965		3.2		1.4		0.8		0.5	1.9	12.9	748.5	
5095	64.0096	-160.9017	55305	647		KS	24	0	1208		8.6		0.0	NAD	0.5		0.0	0.0	12.9	748.1	
5096	64.0096	-160.9007	55305	463		KS	12	0	945		2.5		1.7		0.5		0.7	3.5	12.9	747.8	
5097	64.0098	-160.8995	55305	455		KS	20	0	831		3.0		1.5		0.6		0.5	2.8	12.9	747.6	
5098	64.0098	-160.8985	55305	457		KS	22	0	759		2.2		1.4		0.3		0.8	5.1	12.9	747.1	
5099	64.0099	-160.8973	55305	465		KS	29	0	699		1.7		2.0		0.5		1.1	4.4	12.9	746.5	
5100	64.0100	-160.8962	55305	479		KS	28	0	610		0.5	NAD	1.3		0.4		0.0	3.7	12.9	746.1	
5101	64.0100	-160.8950	55305	497		KS	26	0	581		2.2		0.5	MAR	0.3		0.2	1.6	12.9	746.0	
5102	64.0101	-160.8940	55304	518		KS	35	0	512		1.3		-0.2	NAD	0.3		0.0	0.0	12.9	745.7	
5103	64.0101	-160.8928	55303	540		KS	20	0	677		2.1		1.0		0.2		0.5	5.6	12.8	745.5	
5104	64.0102	-160.8918	55303	569		KS	26	0	579		1.7		1.2		0.1	MAR	0.7	12.8	12.8	745.5	
5105	64.0103	-160.8905	55304	608		KS	21	-1	611		3.2		3.1		0.0	NAD	1.0	0.0	12.8	745.6	
5106	64.0103	-160.8895	55303	614		KS	16	-1	551		3.7		0.2	NAD	0.3		0.0	0.0	12.8	745.5	
5107	64.0104	-160.8883	55304	595		KS	37	-1	488		1.6		2.4		0.1	MAR	1.5	18.6	12.5	745.4	
5108	64.0105	-160.8873	55302	575		KS	22	-1	510		0.2	NAD	1.3		0.3		0.0	5.1	0.0	12.8	745.3
5109	64.0106	-160.8860	55304	552		KS	28	-1	437		0.0	NAD	1.0		0.1	MAR	0.0	9.0	0.0	12.8	745.2
5110	64.0107	-160.8848	55305	532		KS	25	-1	405		0.5	NAD	1.1		0.3		0.0	4.0	0.0	12.8	745.1
5111	64.0107	-160.8838	55305	514		KS	25	-1	379		1.0	MAR	-0.1	NAD	0.3		0.0	0.0	3.0	12.8	744.7
5112	64.0108	-160.8826	55305	501		KS	35	-1	325		0.5	MAR	1.4		0.1	MAR	2.5	13.6	5.5	12.8	744.5
5113	64.0108	-160.8816	55305	490		KS	20	-1	411		0.0	NAD	1.1		0.0	NAD	0.0	0.0	0.0	12.8	744.3
5114	64.0109	-160.8803	55305	481		KS	22	-1	417		1.0		1.0		0.1	MAR	1.0	12.7	12.9	12.8	744.3
5115	64.0110	-160.8791	55305	477		KS	28	-1	517		0.8	MAR	1.1		0.3		1.3	4.0	3.1	12.8	744.1
5116	64.0110	-160.8781	55304	479		KS	17	0	616		1.4		0.7		0.5		0.5	1.4	2.8	12.8	744.0
5117	64.0111	-160.8769	55304	486		KS	23	0	623		4.3		0.8		0.6		0.2	1.4	7.0	12.8	743.9
5118	64.0111	-160.8759	55303	493		KS	22	0	607		2.5		1.5		0.1		0.6	10.2	17.5	12.8	744.0
5119	64.0112	-160.8746	55303	500		KS	21	0	693		3.5		0.5	MAR	0.5		0.2	1.1	7.4	12.8	744.2
5120	64.0113	-160.8734	55303	509		KS	22	-1	633		2.2		2.6		0.3		1.2	8.6	7.2	12.8	744.2
5121	64.0113	-160.8724	55302	516		KS	30	-1	636		3.7		0.2	NAD	0.3		0.0	0.0	10.9	12.8	744.5
5122	64.0113	-160.8712	55302	519		KS	25	-2	777		5.1		1.5		0.3		0.3	9.9	20.2	12.8	744.9
5123	64.0113	-160.8701	55302	518		KS	26	-2	658		3.8		0.9		0.4		0.2	2.2	9.0	12.8	745.1
5124	64.0113	-160.8689	55302	517		KS	32	-2	718		0.8	MAR	1.9		0.7		2.1	2.8	1.3	12.8	745.6
5125	64.0113	-160.8677	55302	523		KS	32	-2	763		2.7		2.2		0.2		0.8	13.0	16.0	12.8	746.1
5126	64.0114	-160.8667	55302	541		KS	25	-1	781		3.2		1.3		0.6		0.4	2.4	5.9	12.8	746.4
5127	64.0114	-160.8654	55301	559		KS	26	-1	736		1.1	MAR	2.6		0.3		2.2	8.2	3.8	12.9	746.8
5128	64.0114	-160.8644	55300	574		KS	23	-1	668		3.2		0.2	NAD	0.4		0.0	0.0	7.4	12.9	747.1
5129	64.0114	-160.8632	55300	592		KS	21	0	640		2.4		3.5		-0.0	NAD	1.4	0.0	0.0	12.9	747.3
5130	64.0113	-160.8620	55303	606		KS	14	0	696		1.9		1.9		0.3		1.0	7.1	6.9	12.9	747.3
5131	64.0113	-160.8609	55302	617		KS	27	0	595		1.4		0.7	MAR	0.3		0.5	2.4	4.4	13.0	747.7

SINGLE RECORD DATA LINE 240 PAGE 1

FINISHED OUTPUTTING LINE 240
LINE 220 FIDS 2935 TO 4865

OUTPUT TO SRRD TAPE

A P P E N D I X G

Format, Average Record Data Listing

RECORD NUMBER	LATITUDE	LONGITUDE	RESULT TOTAL FIELD GAMMA	GEOL UNIT	COSM CPS	ATM. URAN CPS	TOTAL COUNT CPS	ETH PPM	STD FLG	STD DEV	POT PCT	STD FLG	STD DEV	FU LTH RATIO	STD DEV	FU POTA RATIO	STD DEV	ETH POTA RATIO	STD DEV
5238	64.0098	-160.7455	55295	W	33	-6	790	3.7	1	1.9	2	0.7	1	0.5	0	2.8	0	5.2	0
5239	64.0098	-160.7444	55293	KS	43	-6	952	3.7	0	1.9	0	0.7	0	0.5	1	2.9	0	5.3	0
5240	64.0098	-160.7434	55285	KS	27	-5	998	3.7	0	2.1	0	0.7	0	0.6	2	3.1	1	5.3	0
5241	64.0098	-160.7422	55287	KS	33	-5	1047	3.5	0	2.2	0	0.7	0	0.6	2	3.2	1	5.2	0
5242	64.0098	-160.7412	55298	KS	31	-5	1083	3.5	0	2.1	0	0.7	0	0.6	2	2.9	0	4.8	0
5243	64.0097	-160.7399	55287	KS	30	-4	1156	3.7	0	1.9	0	0.7	0	0.5	1	2.7	0	5.0	0
5244	64.0097	-160.7389	55287	KS	31	-4	1182	4.1	0	1.9	0	0.8	0	0.5	1	2.5	0	5.3	0
5245	64.0097	-160.7379	55286	KS	26	-4	1245	4.0	0	1.7	0	0.8	0	0.4	0	2.1	0	4.9	0
5246	64.0096	-160.7366	55285	KS	38	-4	1148	3.8	0	1.6	0	0.8	0	0.4	0	2.1	0	4.8	0
5247	64.0097	-160.7356	55285	KS	30	-3	1211	3.7	0	1.5	0	0.8	0	0.4	0	1.9	0	4.5	0
5248	64.0096	-160.7344	55295	KS	30	-3	1076	3.8	0	1.5	0	0.8	0	0.4	0	1.9	0	4.7	0
5249	64.0096	-160.7334	55284	KS	29	-3	1016	3.7	0	1.3	0	0.8	0	0.4	0	1.6	0	4.6	0
5250	64.0096	-160.7324	55283	KS	33	-3	975	3.7	0	1.2	0	0.8	0	0.3	0	1.6	0	4.8	0
5251	64.0095	-160.7311	55283	KS	23	-3	976	3.5	0	1.2	0	0.7	0	0.3	0	1.7	0	5.0	0
5252	64.0095	-160.7301	55283	KS	30	-3	948	3.7	0	1.1	0	0.7	0	0.3	0	1.6	0	5.1	0
5253	64.0095	-160.7289	55284	KS	33	-3	921	3.8	0	1.0	-1	0.7	0	0.3	0	1.4	-1	5.2	0
5254	64.0095	-160.7278	55284	KS	37	-2	803	4.0	0	1.0	-1	0.7	0	0.3	0	1.5	-1	5.6	0
5255	64.0095	-160.7266	55283	KS	23	-2	954	4.1	0	1.0	-1	0.7	0	0.3	-1	1.4	-1	5.5	0
5256	64.0094	-160.7256	55293	KS	29	-1	1006	4.3	0	1.0	-1	0.7	0	0.2	-1	1.3	-1	5.8	0
5257	64.0094	-160.7244	55283	KS	37	-1	1133	4.0	0	1.0	-1	0.7	0	0.2	-1	1.3	-1	5.5	0
5258	64.0094	-160.7233	55284	KS	23	0	1106	4.1	0	1.0	-1	0.7	0	0.2	-1	1.4	-1	5.9	0
5259	64.0094	-160.7221	55285	KS	28	0	1034	4.1	0	0.8	-1	0.7	0	0.2	-1	1.2	-1	6.1	0
5260	64.0094	-160.7211	55284	KS	21	0	963	4.1	0	0.8	-1	0.7	0	0.2	-1	1.3	-1	6.2	0
5261	64.0093	-160.7199	55294	KS	27	0	840	3.7	0	0.8	-1	0.6	0	0.2	-1	1.3	-1	6.1	0
5262	64.0093	-160.7188	55294	KS	29	0	718	3.2	0	0.9	-1	0.5	-1	0.3	0	1.7	0	6.0	0
5263	64.0092	-160.7176	55284	KS	33	0	605	2.5	-1	0.9	-1	0.5	-1	0.4	0	1.8	0	5.2	0
5264	64.0092	-160.7166	55294	KS	32	0	635	2.1	-1	0.8	-1	0.4	-1	0.4	0	1.9	0	5.2	0
5265	64.0093	-160.7156	55283	KS	35	0	507	1.7	-1	0.7	-1	0.3	-1	0.4	0	2.2	0	5.3	0
5266	64.0092	-160.7143	55283	KS	26	-1	521	1.6	-1	0.7	-1	0.3	-1	0.5	1	2.5	0	5.4	0
5267	64.0092	-160.7133	55283	KS	19	-1	465	1.4	-1	0.8	-1	0.3	-1	0.6	2	2.9	1	5.1	0
5268	64.0091	-160.7121	55283	W	34	-1	287	1.3	0	0.9	1	0.3	1	0.7	1	3.1	0	4.6	-1
5269	64.0091	-160.7110	55292	KS	29	-1	398	1.3	-1	1.0	-1	0.3	-1	0.8	3	3.4	1	4.4	0
5270	64.0092	-160.7100	55282	KS	42	-1	516	1.7	-1	1.1	0	0.3	-1	0.6	2	3.2	1	5.1	0
5271	64.0092	-160.7090	55283	KS	29	0	716	1.9	-1	1.0	-1	0.4	-1	0.6	2	2.8	0	5.1	0
5272	64.0092	-160.7078	55283	KS	25	0	781	2.1	-1	1.1	0	0.4	-1	0.5	1	2.9	0	5.2	0
5273	64.0092	-160.7068	55282	KS	32	0	738	2.4	-1	1.1	0	0.4	-1	0.5	1	2.7	0	6.0	0
5274	64.0091	-160.7057	55281	KS	25	0	853	2.5	-1	1.1	0	0.4	-1	0.5	1	2.7	0	5.9	0
5275	64.0091	-160.7047	55282	KS	22	0	796	2.5	-1	1.1	0	0.5	-1	0.4	0	2.4	0	5.8	0
5276	64.0091	-160.7037	55281	KS	21	0	904	2.9	-1	1.0	-1	0.5	-1	0.4	0	2.2	0	6.1	0
5277	64.0092	-160.7025	55281	KS	37	1	810	2.9	-1	1.0	-1	0.4	-1	0.4	0	2.3	0	6.5	0
5278	64.0092	-160.7014	55280	KS	27	2	764	3.0	0	0.9	-1	0.5	-1	0.3	0	1.9	0	6.3	0
5279	64.0092	-160.7004	55292	KS	31	1	750	2.9	-1	0.9	-1	0.5	-1	0.3	0	2.0	0	6.0	0
5280	64.0092	-160.6994	55283	KS	33	1	790	2.9	-1	1.0	-1	0.5	-1	0.3	0	2.1	0	6.2	0
5281	64.0092	-160.6984	55283	KS	32	1	745	3.3	0	0.8	-1	0.5	-1	0.2	-1	1.7	0	7.1	0
5282	64.0092	-160.6973	55283	KS	36	1	779	3.7	0	0.8	-1	0.5	0	0.2	-1	1.5	-1	6.5	0
5283	64.0092	-160.6963	55283	KS	31	1	821	3.8	0	0.8	-1	0.6	0	0.2	-1	1.4	-1	6.6	0
5284	64.0092	-160.6951	55283	KS	31	1	858	3.8	0	1.0	-1	0.6	0	0.3	0	1.8	0	6.5	0
5285	64.0092	-160.6941	55284	KS	30	1	948	3.7	0	1.2	0	0.6	0	0.3	0	2.0	0	6.0	0
5286	64.0093	-160.6931	55284	KS	26	0	1054	3.7	0	1.3	0	0.6	0	0.3	0	2.1	0	6.0	0
5287	64.0093	-160.6920	55282	KS	32	0	963	3.3	0	1.5	0	0.6	0	0.4	0	2.4	0	5.7	0
5288	64.0093	-160.6910	55281	KS	30	0	1040	3.3	0	1.3	0	0.6	0	0.4	0	2.1	0	5.5	0
5289	64.0093	-160.6900	55281	KS	25	0	997	3.3	0	1.3	0	0.6	0	0.4	0	2.2	0	5.5	0
5290	64.0093	-160.6890	55281	KS	32	0	944	3.0	0	1.5	0	0.6	0	0.5	1	2.5	0	5.0	0

A P P E N D I X H

Format, DOE SINGLE RECORD REDUCED DATA TAPE

DOE SINGLE RECORD REDUCED DATA TAPE

Line	Character Number
Number	12345678901234567890123456789012345678901234567890123456789012

1	02	0978	(DATA TAPE TYPE AND FORMAT SPECIFICATION DATE CODES)
2			
3			SINGLE RECORD REDUCED DATA TAPE
4			
5			FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK)
6			
7	ITEM	FORMAT	DESCRIPTION
8	1	A40	QUADRANGLE NAME AS PROJECT IDENTIFICATION
9	2	A20	NAME OF SUBCONTRACTOR
10	3	I4	APPROXIMATE DATE OF SURVEY (MONTH, YEAR)
11	4	I1	NUMBER OF AERIAL SYSTEMS USED TO COLLECT DATA FOR
12			THIS QUADRANGLE
13	5	I1	AERIAL SYSTEM IDENTIFICATION CODE FOR FIRST SYSTEM
14	6	A20	AIRCRAFT IDENTIFICATION BY TYPE AND FAA NUMBER FOR
15			FIRST SYSTEM
16	7	F6.1	NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO
17			TERRESTRIAL POTASSIUM (K-40) TO ONE DECIMAL PLACE
18			IN CPS PER PERCENT K FOR FIRST SYSTEM
19	8	F6.1	NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO
20			TERRESTRIAL URANIUM (BI-214) TO ONE DECIMAL PLACE
21			IN CPS PER PPM EQUIVALENT U
22	9	F6.1	NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO
23			TERRESTRIAL THORIUM (TL-208) TO ONE DECIMAL PLACE
24			IN CPS PER PPM EQUIVALENT TH
25	10	I6	BLANK FIELD (999999)
26	11	F6.3	4PI-SYSTEM DATA COLLECTION INTERVAL TO THREE DECIMAL
27			PLACES IN SECONDS FOR FIRST SYSTEM
28	12	F6.3	2PI-SYSTEM DATA COLLECTION INTERVAL TO THREE DECIMAL
29			PLACES IN SECONDS FOR FIRST SYSTEM
30	13	I3	NUMBER OF CHANNELS (0-3 MEV) IN 4 PI SYSTEM FOR FIRST
31			AERIAL SYSTEM
32	14	I3	NUMBER OF CHANNELS (0-3 MEV) IN 2 PI SYSTEM FOR FIRST
33			AERIAL SYSTEM
34	15-24	(SAME)	REPEAT OF ITEMS 5-14 FOR SECOND AERIAL SYSTEM
35	*	*	*
36	*	*	*
37	*	*	*
38	85-94	(SAME)	REPEAT OF ITEMS 5-14 FOR NINTH AERIAL SYSTEM
39	95	I3	NUMBER OF FLIGHT LINES ON THIS TAPE
40	96	I4	FIRST FLIGHT LINE NUMBER ON THIS TAPE
41	97	I6	FIRST RECORD NUMBER OF FIRST FLIGHT LINE
42	98	I3	JULIAN DATE (DAY OF YEAR) FIRST FLIGHT-LINE DATA WAS
43			COLLECTED
44	99-101	I4,6, &3	REPEAT OF ITEMS 96-98 FOR SECOND FLIGHT LINE ON THIS
45			TAPE
46	*	*	*
47	*	*	*
49	390-392	I4,6, &3	REPEAT OF ITEMS 96-98 FOR 99TH FLIGHT LINE ON THIS
50			TAPE
51			

Line	Character Number											
Number	1	2	3	4	5	6	7	8	9	0	1	2

52	FORMAT FOR SINGLE RECORD REDUCED DATA RECORD (THIRD THRU LAST BLOCK)											
53												
54	ITEM	FORMAT	DESCRIPTION									
55	1	I1	AERIAL SYSTEM IDENTIFICATION CODE									
56	2	I4	FLIGHT LINE NUMBER									
57	3	I6	RECORD IDENTIFICATION NUMBER									
58	4	I6	GMT TIME OF DAY (HHMMSS)									
59	5	F8.4	LATITUDE TO FOUR DECIMAL PLACES IN DEGREES									
60	6	F8.4	LONGITUDE TO FOUR DECIMAL PLACES IN DEGREES									
61	7	F6.1	TERRAIN CLEARANCE TO ONE DECIMAL PLACE IN METERS									
62	8	F7.1	RESIDUAL (IGRF REMOVED) MAGNETIC FIELD INTENSITY									
63			TO ONE DECIMAL PLACE IN GAMMAS									
64	9	A8	SURFACE GEOLOGIC MAP UNIT CODE									
65	10	I4	QUALITY FLAG CODES									
66	11	F6.1	APPARENT CONCENTRATION OF TERRESTRIAL POTASSIUM									
67			(K-40) TO ONE DECIMAL PLACE IN PERCENT K									
68	12	F4.1	UNCERTAINTY IN TERRESTRIAL POTASSIUM TO ONE DECIMAL									
69			PLACE IN PERCENT K									
70	13	F6.1	APPARENT CONCENTRATION OF TERRESTRIAL URANIUM									
71			(BI-214) TO ONE DECIMAL PLACE IN PPM EQUIVALENT U									
72	14	F4.1	UNCERTAINTY IN TERRESTRIAL URANIUM TO ONE DECIMAL									
73			PLACE IN PPM EQUIVALENT U									
74	15	F6.1	APPARENT CONCENTRATION OF TERRESTRIAL THORIUM									
75			(TL-208) TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH									
76	16	F4.1	UNCERTAINTY IN TERRESTRIAL THORIUM TO ONE DECIMAL									
77			PLACE IN PPM EQUIVALENT TH									
78	17	F6.1	URANIUM-TO-THORIUM RATIO TO ONE DECIMAL PLACE IN									
79			PPM EQUIVALENT U PER PPM EQUIVALENT TH									
80	18	F6.1	URANIUM-TO-POSTASSIUM RATIO TO ONE DECIMAL PLACE IN									
81			PPM EQUIVALENT U PER PERCENT K									
82	19	F6.1	THORIUM-TO-POTASSIUM RATIO TO ONE DECIMAL PLACE IN									
83			PPM EQUIVALENT TH PER PERCENT K									
84	20	F8.1	GROSS GAMMA (0.4-3.0 MEV) COUNT RATE TO ONE DECIMAL									
85			PLACE IN COUNTS PER SECOND									
86	21	F6.1	UNCERTAINTY IN GROSS GAMMA COUNT RATE TO ONE DECIMAL									
87			PLACE IN COUNTS PER SECOND									
88	22	F5.1	ATMOSPHERIC BI-214 4PI CORRECTION TO ONE DECIMAL									
89			PLACE IN PPM EQUIVALENT U									
90	23	F4.1	UNCERTAINTY IN ATMOSPHERIC BI-214 4PI CORRECTION									
91			TO ONE DECIMAL PLACE IN PPM EQUIVALENT U									
92	24	F4.1	OUTSIDE AIR TEMPERATURE TO ONE DECIMAL PLACE IN									
93			DEGREES CELSIUS									
94	25	F5.1	OUTSIDE AIR PRESSURE TO ONE DECIMAL PLACE IN MMHG									

A P P E N D I X I

Format, DOE RAW SPECTRAL DATA TAPE

DOE RAW SPECTRAL DATA TAPE

Line Character number
Number 12345678901234567890123456789012345678901234567890123456789012

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1 01 0978 (DATA TAPE TYPE AND FORMAT SPECIFICATION DATE CODES)
2
3 RAW SPECTRAL DATA TAPE
4
5 FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK ON TAPE)
6
7 ITEM      FORMAT  DESCRIPTION
8 1         A40     QUADRANGLE NAME AS PROJECT IDENTIFICATION
9 2         A20     NAME OF SUBCONTRACTOR
10 3        I4      APPROXIMATE DATE OF SURVEY (MONTH, YEAR)
11 4        I1      AERIAL SYSTEM IDENTIFICATION CODE
12 5        A20     AIRCRAFT IDENTIFICATION BY TYPE AND FAA NUMBER
13 6        I3      BFEC CALIBRATION REPORT NUMBER
14 7        F6.3    4PI SYSTEM DATA COLLECTION INTERVAL TO THREE DECIMAL
15                PLACES IN SECONDS
16 8        F6.3    2PI SYSTEM DATA COLLECTION INTERVAL TO THREE DECIMAL
17                PLACES IN SECONDS
18 9        I3      NUMBER OF CHANNELS (0-3 MEV) FOR 4PI SYSTEM
19 10       I3      NUMBER OF CHANNELS (0-3 MEV) FOR 2PI SYSTEM
20 11       I3      NUMBER OF FLIGHT LINES ON THIS TAPE
21 12       I4      FIRST FLIGHT LINE NUMBER ON THIS TAPE
22 13       I6      FIRST RECORD NUMBER OF FIRST FLIGHT LINE
23 14       I3      JULIAN DATE (DAY OF YEAR) FIRST FLIGHT LINE WAS
24                COLLECTED
25 15-17    I4,6 &3 REPEAT OF ITEMS 12-14 FOR SECOND FLIGHT LINE ON THIS
26                TAPE
27 *        *              *
28 *        *              *
29 *        *              *
30 306-308  I4,6 &3 REPEAT OF ITEMS 12-14 FOR 99TH FLIGHT LINE ON THIS
31                TAPE
32
33 FORMAT FOR RAW SPECTRAL DATA RECORD (THIRD THRU LAST BLOCK ON TAPE)
34
35 ITEM      FORMAT  DESCRIPTION
36 1         I1      AERIAL SYSTEM IDENTIFICATION CODE
37 2         I4      FLIGHT LINE NUMBER
38 3         I6      RECORD IDENTIFICATION NUMBER
39 4         I6      GMT TIME OF DAY (HHMMSS)
40 5         F8.4    LATITUDE TO FOUR DECIMAL PLACES IN DEGREES
41 6         F8.4    LONGITUDE TO FOUR DECIMAL PLACES IN DEGREES
42 7         F6.2    TERRAIN CLEARANCE TO ONE DECIMAL PLACE IN METERS
43 8         F7.1    TOTAL MAGNETIC FIELD INTENSITY TO ONE DECIMAL PLACE
44                IN GAMMAS
45 9         A8      SURFACE GEOLOGIC MAP UNIT CODE
46 10        I4      QUALITY FLAG CODES
47 11        F4.1    OUTSIDE AIR TEMPERATURE TO ONE DECIMAL PLACE IN
48                DEGREES CELSIUS
49 12        F5.1    OUTSIDE AIR PRESSURE TO ONE DECIMAL PLACE IN MMHG
50 13        F5.3    LIVE TIME COUNTING PERIOD TO THREE DECIMAL PLACES IN
51                SECONDS

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Line	Character Number																					
Number	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2
52	14			I4																		
53																						
54	15			I4																		
55	16			I4																		
56	*			*																		
57	*			*																		
58	*			*																		
59	270			I4																		

A P P E N D I X J

Format, DOE STATISTICAL ANALYSIS DATA TAPE

DOE STATISTICAL ANALYSIS DATA TAPE

Line	Character Number
Number	12345678901234567890123456789012345678901234567890123456789012

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1 03 0978 (DATA TAPE TYPE AND FORMAT SPECIFICATION DATE CODES)
2
3 STATISTICAL ANALYSIS DATA TAPE
4
5 FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK)
6
7 ITEM      FORMAT  DESCRIPTION
8 1         A40     QUADRANGLE NAME AS PROJECT IDENTIFICATION
9 2         A20     NAME OF SUBCONTRACTOR
10 3        I4      APPROXIMATE DATE OF SURVEY (MONTH, YEAR)
11 4        I1      NUMBER OF AERIAL SYSTEMS USED TO COLLECT DATA FOR
12                THIS QUADRANGLE
13 5         I1      AERIAL SYSTEM IDENTIFICATION CODE FOR FIRST SYSTEM
14 6        A20     AIRCRAFT IDENTIFICATION BY TYPE AND FAA NUMBER FOR
15                FIRST SYSTEM
16 7        F6.1    NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO
17                TERRESTRIAL POTASSIUM (K-40) TO ONE DECIMAL PLACE
18                IN CPS PER PERCENT K
19 8        F6.1    NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO
20                TERRESTRIAL URANIUM (B1-214) TO ONE DECIMAL PLACE
21                IN CPS PER PPM EQUIVALENT U
22 9        F6.1    NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO
23                TERRESTRIAL THORIUM (TL-208) TO ONE DECIMAL PLACE
24                IN CPS PER PPM EQUIVALENT TH
25 10       I6      BLANK FIELD (9999999)
26 11       F6.3    4PI-SYSTEM DATA COLLECTION INTERVAL TO THREE DECIMAL
27                PLACES IN SECONDS FOR FIRST SYSTEM
28 12       F6.3    2PI-SYSTEM DATA COLLECTION INTERVAL TO THREE DECIMAL
29                PLACES IN SECONDS FOR FIRST SYSTEM
30 13       I3      NUMBER OF CHANNELS (0-3 MEV) IN 4 PI SYSTEM FOR FIRST
31                AERIAL SYSTEM
32 14       I3      NUMBER OF CHANNELS (0-30 MEV) IN 2 PI SYSTEM FOR FIRST
33                AERIAL SYSTEM
34 15-24    (SAME)  REPEAT OF ITEMS 5-14 FOR AERIAL SYSTEM
35 *        *
36 *        *
37 *        *
38 85-94    (SAME)  REPEAT OF ITEMS 5-14 FOR NINTH AERIAL SYSTEM
39 95       I3      NUMBER OF FLIGHT LINES ON THIS TAPE
40 96       I4      FIRST FLIGHT LINE NUMBER ON THIS TAPE
41 97       I6      FIRST RECORD NUMBER OF FIRST FLIGHT LINE
42 98       I3      JULIAN DATE (DAY OF YEAR) FIRST FLIGHT LINE DATA WAS
43                COLLECTED
44 99-101   I4,6 &3 REPEAT OF ITEMS 96-98 FOR SECOND FLIGHT LINE ONE THIS
45                TAPE
46 *        *
47 *        *
48 *        *
49 390-392  I4,6 &3 REPEAT OF ITEMS 96-98 FOR 99TH FLIGHT LINE ON THIS
50                TAPE
51

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Line	Character Number
12345678901234567890123456789012345678901234567890123456789012	12345678901234567890123456789012345678901234567890123456789012

52	FORMAT FOR STATISTICAL ANALYSIS DATA RECORD (THIRD THRU LAST BLOCK)		
53			
54	ITEM	FORMAT	DESCRIPTION
55	1	I1	AERIAL SYSTEM IDENTIFICATION CODE
56	2	I4	FLIGHT LINE NUMBER
57	3	I6	RECORD IDENTIFICATION NUMBER
58	4	I6	GMT TIME OF DAY (HHMMSS)
59	5	F.84	LATITUDE TO FOUR DECIMAL PLACES IN DEGREES
60	6	F8.4	LONGITUDE TO FOUR DECIMAL PLACES IN DEGREES
61	7	F6.1	TERRAIN CLEARANCE TO ONE DECIMAL PLACE IN METERS
62	8	F7.1	RESIDUAL (IGRF REMOVED) MAGNETIC FIELD INTENSITY
63			TO ONE DECIMAL PLACE IN GAMMAS
64	9	A8	SURFACE GEOLOGIC MAP UNIT CODE
65	10	I5	QUALITY FLAG CODES
66	11	F6.1	AVERAGED CONCENTRATION OF TERRESTRIAL POTASSIUM
67			(K-40) TO ONE DECIMAL PLACE IN PERCENT K
68	12	F4.1	UNCERTAINTY IN TERRESTRIAL POTASSIUM TO ONE DECIMAL
69			PLACE IN PERCENT K
70	13	F5.1	POTASSIUM STANDARD DEVIATION FROM THE MEAN TO ONE
71			DECIMAL PLACE AND ALGEBRAICALLY SIGNED
72	14	F6.1	AVERAGED CONCENTRATION OF TERRESTRIAL URANIUM
73			(BI-214) TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
74	15	F4.1	UNCERTAINTY IN TERRESTRIAL URANIUM TO ONE DECIMAL
75			PLACE IN PPM EQUIVALENT U
76	16	F5.1	URANIUM STANDARD DEVIATION FROM THE MEAN TO ONE
77			DECIMAL PLACE AND ALGEBRAICALLY SIGNED
78	17	F6.1	AVERAGED CONCENTRATION OF TERRESTRIAL THORIUM
79			(TL-208) TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH
80	18	F4.1	UNCERTAINTY IN TERRESTRIAL THORIUM TO ONE DECIMAL
81			PLACE IN PPM EQUIVALENT TH
82	19	F5.1	THORIUM STANDARD DEVIATION FROM THE MEAN TO ONE
83			DECIMAL PLACE AND ALGEBRAICALLY SIGNED
84	20	F8.1	GROSS GAMMA (0.4-3.0 MEV) COUNT RATE TO ONE DECIMAL
85			PLACE IN COUNTS PER SECOND
86	21	F6.1	UNCERTAINTY IN GROSS GAMMA COUNT RATE TO ONE DECIMAL
87			PLACE IN COUNTS PER SECOND
88	22	F5.1	ATMOSPHERIC BI-214 4PI CORRECTION TO ONE DECIMAL
89			PLACE IN PPM EQUIVALENT U
90	23	F4.1	UNCERTAINTY IN ATMOSPHERIC BI-214 4PI CORRECTION
91			TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
92	24	F6.1	AVERAGED URANIUM-TO-THORIUM RATIO TO ONE DECIMAL
93			PLACE IN PPM EQUIVALENT U PER PPM EQUIVALENT TH
94	25	F5.1	URANIUM-TO-THORIUM RATIO STANDARD DEVIATION FROM THE
95			MEAN TO ONE DECIMAL PLACE AND ALGEBRAICALLY SIGNED
96	26	F6.1	AVERAGED URANIUM-TO-POTASSIUM RATIO TO ONE DECIMAL
97			PLACE IN PPM EQUIVALENT U PER PERCENT K
98	27	F5.1	URANIUM-TO-POTASSIUM RATIO STANDARD DEVIATION FROM
99			THE MEAN TO ONE DECIMAL PLACE AND ALGEBRAICALLY
100			SIGNED
101	28	F6.1	AVERAGE THORIUM-TO-POTASSIUM RATIO TO ONE DECIMAL
102			PLACE IN PPM EQUIVALENT TH PER PERCENT K
103	29	F5.1	THORIUM-TO-POTASSIUM RATIO STANDARD DEVIATION FROM
104			THE MEAN TO ONE DECIMAL PLACE AND ALGEBRAICALLY
105			SIGNED

A P P E N D I X K

Format, DOE STATISTICAL ANALYSIS SUMMARY DATA TAPE

DOE STATISTICAL ANALYSIS SUMMARY DATA TAPE

Line	Character Number
Number	1234567890123456789012345678901234567890123456789012

1	05	0978	(DATA TAPE TYPE AND FORMAT SPECIFICATION DATE CODE)
2			
3			STATISTICAL ANALYSIS SUMMARY TAPE (OR FILE)
4			
5			FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK)
6			
7	ITEM	FORMAT	DESCRIPTION
8	1	A40	QUADRANGLE NAME AS PROJECT IDENTIFICATION
9	2	A20	NAME OF SUBCONTRACTOR
10	3	I4	APPROXIMATE DATE OF SURVEY (MONTH, YEAR)
11	4	I6	NUMBER OF GEOLOGIC MAP UNITS USED FOR THIS
12			QUADRANGLE
13			
14			FORMAT FOR STATISTICAL ANALYSIS SUMMARY DATA RECORD (THIRD THRU LAST
15			BLOCK)
16			
17	ITEM	FORMAT	DESCRIPTION
18	1	A8	SURFACE GEOLOGIC MAP UNIT IDENTIFYING CODE
19	2	I6	TOTAL RECORDS FOR GEOLOGIC MAP UNIT
20	3	I6	NUMBER OF POTASSIUM RECORDS COMPUTED FOR GEOLOGIC
21			UNITS
22	4	F6.1	POTASSIUM CONCENTRATION MEAN TO ONE DECIMAL PLACE
23			IN PERCENT K
24	5	F6.1	POTASSIUM CONCENTRATION STANDARD DEVIATION TO ONE
25			DECIMAL PLACE IN PERCENT K
26	6	A3	POTASSIUM CONCENTRATION DISTRIBUTION CODE
27	7	I6	NUMBER OF URANIUM RECORDS COMPUTED FOR GEOLOGIC UNIT
28	8	F6.1	URANIUM CONCENTRATION MEAN TO ONE DECIMAL PLACE
29			IN PPM EQUIVALENT U
30	9	F6.1	URANIUM CONCENTRATION STANDARD DEVIATION TO ONE
31			DECIMAL PLACE IN PPM EQUIVALENT U
32	10	A3	URANIUM CONCENTRATION DISTRIBUTION CODE
33	11	I6	NUMBER OF THORIUM RECORDS COMPUTED FOR GEOLOGIC UNIT
34	12	F6.1	THORIUM CONCENTRATION MEAN TO ONE DECIMAL PLACE IN
35			PPM EQUIVALENT TH
36	13	F6.1	THORIUM CONCENTRATION STANDARD DEVIATION TO ONE
37			DECIMAL PLACE IN PPM EQUIVALENT TH
38	14	A3	THORIUM CONCENTRATION DISTRIBUTION CODE
39	15	I6	NUMBER OF URANIUM-TO-THORIUM RATIO RECORDS COMPUTED
40			FOR GEOLOGIC UNIT
41	16	F6.1	URANIUM-TO-THORIUM RATIO MEAN TO ONE DECIMAL PLACE
42			IN PPM EQUIVALENT U PER PPM EQUIVALENT TH
43	17	F6.1	URANIUM-TO-THORIUM RATIO STANDARD DEVIATION TO ONE
44			DECIMAL PLACE IN PPM EQUIVALENT U PER PPM EQUIVALENT
45			TH
46	18	A3	URANIUM-TO-THORIUM RATIO DISTRIBUTION CODE
47	19	I6	NUMBER OF URANIUM-TO-POTASSIUM RATIO RECORDS
48			COMPUTED FOR GEOLOGIC UNIT
49	20	F6.1	URANIUM-TO-POTASSIUM RATIO MEAN TO ONE DECIMAL PLACE
50			IN PPM EQUIVALENT U PER PERCENT K

Line	Character Number																															
Number	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2
51	21	F6.1	URANIUM-TO-POTASSIUM RATIO STANDARD DEVIATION TO ONE																													
52			DECIMAL PLACE IN PPM EQUIVALENT U PER PERCENT K																													
53	22	A3	URANIUM-TO-POTASSIUM RATIO DISTRIBUTION CODE																													
54	23	I6	NUMBER OF THORIUM-TO-POTASSIUM RATIO RECORDS																													
55			COMPUTED FOR GEOLOGIC UNIT																													
56	24	F6.1	THORIUM-TO-POTASSIUM RATIO MEAN TO ONE DECIMAL PLACE																													
57			IN PPM EQUIVALENT TH PER PERCENT K																													
58	25	F6.1	THORIUM-TO-POTASSIUM RATIO STANDARD DEVIATION TO ONE																													
59			DECIMAL PLACE IN PPM EQUIVALENT TH PER PERCENT K																													
60	26	A3	THORIUM-TO-POTASSIUM RATIO DISTRIBUTION CODE																													

A P P E N D I X L

Format, DOE MAGNETIC DATA TAPE

DOE MAGNETIC DATA TAPE FORMAT

Line Number	Character Number
12345678901234567890123456789012345678901234567890123456789012	

1	04 0978	(DATA TAPE TYPE AND FORMAT SPECIFICATION DATE CODES)	
2			
3	MAGNETIC DATA TAPE		
4			
5	FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK)		
6			
7	ITEM	FORMAT	DESCRIPTION
8	1	A40	QUADRANGLE NAME AS PROJECT IDENTIFICATION
9	2	A20	NAME OF SUBCONTRACTOR
10	3	I4	APPROXIMATE DATE OF SURVEY (MONTH, YEAR)
11	4	I3	NUMBER OF FLIGHT LINES ON THIS TAPE
12	5	I4	FIRST FLIGHT LINE OF THIS TAPE
13	6	I6	FIRST RECORD NUMBER OF FIRST FLIGHT LINE
14	7	I3	JULIAN DATE (DAY OF YEAR) FIRST FLIGHT LINE DATA WAS
15			COLLECTED
16	8	F8.4	LATITUDE OF GROUND BASE STATION TO FOUR DECIMAL
17			PLACES IN DEGREES FOR FIRST FLIGHT LINE
18	9	F8.4	LONGITUDE OF GROUND BASE STATION TO FOUR DECIMAL
19			PLACES IN DEGREES FOR FIRST FLIGHT LINE
20	10-14	(SAME)	REPEAT OF ITEMS 5-9 FOR SECOND FLIGHT LINE ON THIS
21			TAPE
22	*	*	*
23	*	*	*
24	*	*	*
25	495-499	(SAME)	REPEAT OF ITEMS 5-9 FOR 99TH FLIGHT LINE ON THIS
26			TAPE
27			
28	FORMAT FOR MAGNETIC DATA RECORD (THIRD THRU LAST BLOCK)		
29			
30	ITEM	FORMAT	DESCRIPTION
31	1	I1	AERIAL SYSTEM IDENTIFICATION CODE
32	2	I4	FLIGHT LINE NUMBER
33	3	I6	RECORD IDENTIFICATION NUMBER
34	4	I6	GMT TIME OF DAY (HHMMSS)
35	5	F8.4	LATITUDE TO FOUR DECIMAL PLACES IN DEGREES
36	6	F8.4	LONGITUDE TO FOUR DECIMAL PLACES IN DEGREES
37	7	F6.1	TERRAIN CLEARANCE TO ONE DECIMAL PLACE IN METERS
38	8	F5.1	OUTSIDE AIR PRESSURE TO ONE DECIMAL PLACE IN MMHG
39	9	A8	SURFACE GEOLOGIC MAP UNIT CODE
40	10	F7.1	TOTAL MAGNETIC FIELD INTENSITY TO ONE DECIMAL PLACE
41			IN GAMMAS
42	11	F7.1	RESIDUAL (IGRF REMOVED) MAGNETIC FIELD INTENSITY
43			TO ONE DECIMAL PLACE IN GAMMAS
44	12	F7.1	DIURNAL MAGNETIC INTENSITY VARIATION TO ONE DECIMAL
45			PLACE IN GAMMAS
46	13	F7.1	MAGNETIC DEPTH-TO-BASEMENT TO ONE DECIMAL PLACE
47			IN METERS (IF REQUIRED)

A P P E N D I X M

Reduced Calibration and Test Line Data

Reduced Calibration and Test Line Data

<u>Date</u>	<u>Flight</u>	<u>Res. Thor.</u> <u>583</u>	<u>Res. Thor.</u> <u>2615</u>	<u>Low Preflight</u> <u>Alt. T.C. 2π</u>	<u>Low Postflight</u> <u>Alt. T.C. 2π</u>
09/18/30	50	5.1%	9.8%	400' 212C 5	400' 2180 6
09/19/30	51	5.1%	9.8%	400' 252C 9	400' 2400 10
09/30/30	53	N/A	N/A	400' 236C 9	400' 2420 9
10/04/30	61	5.0%	9.3%	400' 264C 9	400' 1920 N/A

N/A = NOT AVAILABLE

A P P E N D I X N

Renumbered to Original Fiducial Correlations

HURON QUADRANGLE

LINE 1480 FLOWN AS 1480
MAP FIDUCIALS 14517 TO 16775 CORRESPOND TO ORIGINAL FIDUCIALS 16775 TO 14517

LINE 1490 FLOWN AS 1490
MAP FIDUCIALS 17129 TO 19634 CORRESPOND TO ORIGINAL FIDUCIALS 19634 TO 17129

LINE 1500 FLOWN AS 1500
MAP FIDUCIALS 19886 TO 22119 CORRESPOND TO ORIGINAL FIDUCIALS 22119 TO 19886

LINE 1510 FLOWN AS 1510
MAP FIDUCIALS 48 TO 2483 CORRESPOND TO ORIGINAL FIDUCIALS 2483 TO 48

LINE 1520 FLOWN AS 1520
MAP FIDUCIALS 2725 TO 5477 CORRESPOND TO ORIGINAL FIDUCIALS 5477 TO 2725

LINE 1530 FLOWN AS 1530
MAP FIDUCIALS 5733 TO 8178 CORRESPOND TO ORIGINAL FIDUCIALS 8178 TO 5733

LINE 1540 FLOWN AS 1540
MAP FIDUCIALS 8404 TO 10655 CORRESPOND TO ORIGINAL FIDUCIALS 10655 TO 8404

LINE 1550 FLOWN AS 1550
MAP FIDUCIALS 1854 TO 4268 CORRESPOND TO ORIGINAL FIDUCIALS 4168 TO 1854

LINE 1560 FLOWN AS 1560
MAP FIDUCIALS 4424 TO 6836 CORRESPOND TO ORIGINAL FIDUCIALS 6836 TO 4424

LINE 1570 FLOWN AS 1570
MAP FIDUCIALS 7070 TO 9425 CORRESPOND TO ORIGINAL FIDUCIALS 9425 TO 7070

LINE 1580 FLOWN AS 1580
MAP FIDUCIALS 9657 TO 12051 CORRESPOND TO ORIGINAL FIDUCIALS 12051 TO 9657

LINE 1590 FLOWN AS 1590
MAP FIDUCIALS 12387 TO 14762 CORRESPOND TO ORIGINAL FIDUCIALS 14762 TO 12387

LINE 5000 FLOWN AS 5001
MAP FIDUCIALS 7028 TO 8651 CORRESPOND TO ORIGINAL FIDUCIALS 8651 TO 7028

LINE 5010 FLOWN AS 5018
MAP FIDUCIALS 6629 TO 8275 CORRESPOND TO ORIGINAL FIDUCIALS 8275 TO 6629

LINE 5020 FLOWN AS 5020
MAP FIDUCIALS 1653 TO 3272 CORRESPOND TO ORIGINAL FIDUCIALS 3272 TO 1653

LINE 5030 FLOWN AS 5038
MAP FIDUCIALS 8188 TO 9786 CORRESPOND TO ORIGINAL FIDUCIALS 9726 TO 8188