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**Preparation of Magnetic
Anomaly Profile and
Contour Maps from
DOE-NURE Aerial Survey Data
Volume I: Processing Procedures**

Eddie P. Tinnel
William J. Hinze

PREPARATION OF MAGNETIC
ANOMALY PROFILE AND
CONTOUR MAPS FROM
DOE-NURE AERIAL SURVEY DATA

Volume I: Processing Procedures

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(Sponsor: R. C. Durfee)

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ABSTRACT

Total intensity magnetic anomaly data acquired as a supplement to radiometric data in the DOE National Uranium Resource Evaluation (NURE) Program are useful in preparing regional profile and contour maps. Survey-contractor-supplied magnetic anomaly data are subjected to a multiprocess, computer-based procedure which prepares these data for presentation. This procedure is used to produce the following machine plotted maps of National Topographic Map Series quadrangle units at a 1:250,000 scale: (1) profile map of contractor-supplied magnetic anomaly data, (2) profile map of high-cut filtered data with contour levels of each profile marked and annotated on the associated flight track, (3) profile map of critical-point data with contour levels indicated, and (4) contour map of filtered and selected data. These quadrangle maps are supplemented with a range of statistical measures of the data which are useful in quality evaluation.

1. INTRODUCTION

The National Uranium Resource Evaluation (NURE) Program of the U.S. Department of Energy (DOE) was initiated to assess uranium resources of the nation and to provide data and technology for discovery and exploration of uranium ores. The National Aerial Radiometric Reconnaissance Survey (ARRS), an important element of this program, is a form of remote geochemical reconnaissance designed to search for potential uraniferous provinces and formations utilizing airborne gamma-ray spectrometer measurements. Principal products of this aerial survey program will be 1) national radio-element maps to supplement the national geologic map and 2) related statistics on uranium, thorium, and potassium concentrations. Since the beginning of the ARRS program in 1974, total intensity magnetic observations have been recorded concurrently with the spectrometer measurements. The objective of these magnetic measurements is to provide a degree of three-dimensional investigative capacity over and above the

essentially one-dimensional radiometric measurements while incurring only a minimal survey cost increase.

Although the aerial survey program is designed to optimize radiometric observations without concern for magnetic observation problems, comparisons of selected magnetic anomaly maps prepared from the NURE-ARRS program data with maps derived from surveys performed specifically for magnetic mapping indicate the NURE survey data generally are useful in mapping the regional magnetic anomaly field of the United States.

The utility of magnetic anomaly maps is a function of flight-track spacing, flight elevation relative to the depth of magnetic sources, flight direction relative to prevailing strike of magnetic anomalies, and temporal magnetic activity during data acquisition. Reasonably precise magnetic anomaly maps can be prepared from surveys observed along flight tracks perpendicular to the strike of magnetic anomalies and spaced at two or less times the vertical distance to magnetic sources. Considering the predominate flight-track spacing of the NURE survey, this condition will be approached only in regions underlain by the deepest portions of sedimentary basins. Furthermore, the aerial survey program is performed regardless of the intensity of temporal magnetic activity. Despite these recognized limitations, maps prepared from NURE-ARRS data are the best publicly available over many areas of the conterminous U.S. and Alaska and, furthermore, represent the only digitally available magnetic anomaly data over much of the U.S.

NURE magnetic data maps are significant to the completion of photo-composite U.S. magnetic anomaly maps currently in preparation by the U.S. Geological Survey and the Society of Exploration Geophysicists as well as to other potential regional mapping uses. The data in digital form find

importance in the preparation of a variety of machine-processed maps and other analyses that enhance specific characteristics of the anomaly field and thus aid geologic interpretation. In recognition of the potential usefulness of NURE-ARRS magnetic anomaly data, profile and contour maps and digital data sets of National Topographic Map Series (NTMS) quadrangle units are being prepared from aerial survey contractor-supplied data by the Geographic Data Systems (GDS) Group, Computer Sciences Division, Union Carbide Corporation, Nuclear Division, at Oak Ridge, Tennessee, for the Department of Energy, NURE Program, Grand Junction, Colorado.

Several specific characteristics of the aerial survey data collection and reduction procedures, as well as time and financial limitations, have had an important role in defining and constraining processes developed for the preparation of maps and data sets. The large number of NTMS quadrangle units to be examined requires that manual effort be minimized and that generality be maximized in the procedures for manipulation and presentation of data. Thus the use of computers, particularly in machine plotting of survey data, has been given priority in the attempt to meet these goals.

Acceptable machine contouring of aeromagnetic data normally presents a difficult problem because of high data density along relatively widely spaced survey tracks. The low flight elevation and wide track spacing predicated by the radiometric survey requirements of the NURE-ARRS program make this a particularly significant situation. This problem has been considerably reduced, however, by the application of techniques developed for selective data filtering and critical observation retention.

The development of a process to analyze and present the magnetic data has also been influenced by prior reduction of data by the aerial-survey

contractors. Corrections are commonly already applied for temporal variations, instrumental noise and bias, and variations caused by long-wavelength, core-derived magnetic fields. Although these procedures vary widely among contractors for pre-1979 data, no attempt has been made to re-reduce the data in a consistent manner. Nevertheless, previous reduction of data by the contractors has often lessened problems associated with the presentation of these data in map form.

Data quality limitations imposed upon the magnetic data by differing reduction procedures and required survey parameters mandate that information be presented which will aid in evaluating not only the maps produced, but also the precision of the data itself. Thus, computerized "quality evaluation" (QE) procedures are included in the processing sequence. Both the anomaly maps and the QE results are available as open-file reports from the DOE Grand Junction office.

The purpose of this report is the documentation of the methodology that has been developed to present magnetic anomaly data, maps, and collateral quality evaluation statistics of NTMS quadrangle units that, because of their peculiar magnetic or geologic importance, have been selected for processing. This report is intended to encourage the use and increase the effectiveness of the maps and data sets released to the public. Furthermore, it should serve to bring attention to the entire collection of NURE-ARRS program magnetic anomaly data as a national resource and foster increased utilization of these data for a variety of scientific and applied purposes.

This report is supplemented by a companion volume¹ which provides the computer codes developed for presentation of NURE-ARRS data. Although

discussion of procedures and computer programs in this report centers on magnetic anomaly data, much of the methodology is also applicable to radiometric data processing and presentation.

2. AERIAL-SURVEY CONTRACTORS ACQUISITION AND REDUCTION PROCEDURES

General airborne survey data acquisition procedures for the NURE Aerial Radiometric Reconnaissance Survey have remained essentially constant since inception of the program in 1974. Magnetic data collection and reduction procedures, however, have evolved to extend the utility of the data by taking advantage of readily applied technological and scientific developments and to improve the consistency of procedures used by the several geophysical contractors involved in the surveys. Modification of magnetic data acquisition procedures has always been achieved within an overall data collection framework which maximizes the quality and utility of radiometric data. Specific details concerning the methods used in each aerial survey are presented in individual reports, prepared by survey contractors, which are on open-file with the Department of Energy.

The basic project and reporting units, with few exceptions, are NTMS 1:250,000 scale quadrangles or groups thereof. Survey tracks (flight lines) are normally oriented east-west and are separated in the conterminous U.S. by an average of 7 km. Depending upon geologic conditions relative to potential uranium occurrences, track spacings of up to 10 km have been used in some quadrangles and detailed surveys with spacings of less than 2 km have been employed in others. Track separation is generally constant within any one NTMS quadrangle, although in some

cases specific sub-areas of a unit have received more detailed treatment. Figure 1 shows the track spacing used in the conterminous U.S. The extent of NURE-ARRS program efforts in Alaska is shown in Fig. 2., where, unlike those in the contiguous states, the surveys have utilized a consistent 10 km flight-track spacing. In most cases, tie lines are flown normal to survey traverses at approximately a 1:4 ratio. Both fixed- and rotary-winged aircraft are employed with selection so as to best meet survey specifications. Observations are recorded at one-second intervals which correspond to a median horizontal distance between samples in the range of 45 to 60 meters. Although varying as a function of air speed and terrain conditions, flight elevation is nominally 122 meters with an accepted envelope of 60 to 215 meters.

Total intensity (scalar) magnetic field data are measured using either relative (flux-gate) or absolute (proton-precession) magnetometers with a sensitivity of one gamma (nanotesla) or less. Observations made with flux-gate magnetometers necessarily result in data referenced to an arbitrary datum. Whenever possible, such surveys are tied to the absolute datum with auxiliary absolute measurements. Since 1979, all magnetic systems have been required to have, at the two-standard deviation level, resolution of 0.25 gamma and noise limited to plus or minus one gamma for fixed-winged aircraft and plus or minus two gammas for rotary-winged aircraft installations. The observation system is compensated for aircraft heading error to within one gamma. Survey contractors have been required,

AERIAL SURVEY PROGRAM FLIGHT LINE SPACING

Fig. 1. DOE-NURE Aerial Radiometric Reconnaissance Survey Flight-Track Spacing in the Conterminous U.S.

AERIAL SURVEY PROGRAM FLIGHT LINE SPACING

Fig. 2. DOE-NURE Aerial Radiometric Reconnaissance Survey Coverage of Alaska (1/81). Flight Track Spacing is 10 km (6.2 miles).

since 1979, to record total intensity magnetic observations, at a sampling rate of four seconds or less, from a magnetic monitor operated at the local base of operations. This information provides a record of diurnal magnetic variations occurring during flight periods.

Flight path recovery data at each observation point are converted to latitude-longitude and recorded to a ten-thousandth of a degree. Radar altimeter measurements, flight-level barometric pressure, and outside air-temperature are sampled and digitally recorded along with a range of radiometric measurements which will not be discussed here. Survey contractors have been required, post-1979, to correct total intensity magnetic data for heading error, diurnal variation using tie-line data, and the earth's core-derived (normal) field using the 1975 International Geomagnetic Reference Field (IGRF) updated to the month of the survey. Previously, a variety of core-derived fields and other reduction procedures were used by contractors necessitating review of the specifications for a particular survey to determine the exact reduction procedures. The reduced magnetic (anomaly) data, in profile form, are presented together with ancillary data in the survey reports. Reports prepared from surveys performed since 1979 have included a printer-plot contour map of the total intensity magnetic anomaly data at a scale of 1:500,000. The preceding specifications for surveys and reports were established in a report by Bendix Field Engineering Corporation.²

Contractors are required to provide on magnetic tape several data sets pertaining to a given quadrangle survey. Most information used in the processing described in this report is obtained from the Single Record Reduced Data Set with the Magnetic Data Set providing magnetic monitor and auxiliary data. This latter data set is not always available or usable.

3. PROCESSING PROCEDURE

3.1 Introduction

Recognition of the Department of Energy NURE-ARRS magnetic anomaly data as a valuable national resource has led to the development of a procedure for total intensity magnetic anomaly map preparation and the execution of this procedure for selected NTMS quadrangle units. The preparation-priority ranking of quadrangle units is based upon their potential usefulness in other NURE programs and upon coverage needed for national and regional maps, in both the conterminous U.S. and Alaska, where other magnetic anomaly maps are not publicly available.

The objective of this map preparation procedure is the machine-based production of profile and contour total intensity magnetic anomaly maps and related quality evaluation statistics of quadrangles for the DOE-NURE program and its contractors, federal and state agencies preparing national and regional maps, and the resource exploration industry. Maps being produced for each quadrangle are: (1) A profile map of the contractor-supplied, reduced magnetic anomaly data using the survey- and tie-line tracks as an arbitrary, but constant, level within a quadrangle. This map is occasionally supplemented by a similar profile map of data adjusted for errors and inconsistencies. (2) A profile map of high-cut filtered magnetic anomaly data with contour levels of each profile marked and annotated on the flight tracks. (3) A profile map of critical-point data also with annotated contour levels. (4) A contour map of critical-point total intensity magnetic anomaly data at an appropriate contour interval. The processing procedure is schematically diagrammed in Fig. 3 and detailed

Fig. 3. Simplified Processing Flow Chart of DOE-NURE Program Magnetic Anomaly Map Preparation.

in Appendix A. This appendix specifies the interrelationship of the elements (manual processing steps, computer programs, data files, hardcopy products) of the processing system.

The initial step in processing NURE-ARRS program data is the review of contractor reports for specifications concerning acquisition and reduction of survey and base magnetic-monitor observations. Each survey report is carefully perused and a specification form prepared for use in the presentation and evaluation of magnetic data. This form provides such information as magnetometer sensitivity, core-derived field and diurnal removal schemes, survey dates, and survey- and tie-line spacing as well as other pertinent data. Figure 4 illustrates a specification form appropriately completed for the O'Neill, Nebraska, quadrangle survey.

3.2 Format Conversion

Data used in preparation of maps and statistics are obtained from aerial survey contractor-supplied Single Record Reduced and Magnetic Data tapes. The former provides navigational, radiometric, and magnetic anomaly values, while the latter, which is not available for all quadrangles, supplies base magnetic-monitor, barometric pressure, and time-of-sample information. Bendix Field Engineering Corporation established specifications relating to the data content and format of these (and other) contractor-furnished tapes in 1979.² Previously, data were released in formats inconsistent even among tapes supplied by a single organization. As a result of this variation, and for later processing efficiency, a routine was prepared to rewrite these data in a standardized arrangement.

Quadrangle *O'Neill*
Report No. *GJBX-100 (78)*

NURE-DOE

Magnetic Aerial Survey Specification Form

- I. **QUADRANGLE** *O'Neill (Nebraska)*
Latitude *42°-43°N*
Longitude *98°-100°W*
Other Quadrangles in Report - *Yes*
Date of Report *June, 1978*
Prepared by *Texas Instruments, Inc.*
- II. **SURVEY**
Date of Survey *July-October, 1977*
Flight Line
Spacing *8 km*
Direction *East/West*
Tie-Line
Spacing *48 km*
Direction *North/South*
- III. **INSTRUMENTATION**
Type of Magnetometer *Proton Magnetometer*
Sensitivity
Sampling Interval *1 second (= 54 meters)*
(Doppler Used?) *No, VLF Navigation Systems with 35mm Tracking Camera*
Information on Location of the Numbered Flight Lines - *Yes (maps)*
Magnetic Monitor Data - *Yes*
- IV. **REDUCTION**
What magnetic reference field used? *IGRP 1975*
Updated? *Yes (to nearest month)*
DC Bias Applied? - *no*
Diurnal Correction Applied? (Method?) *Yes, line biasing with linear adjustments*
Tie-Line Adjustment? - *yes*
Cultural Effects Removed? - *Corrected for Spikes*
Noise Filter? - *Spike Filter*
- V. **DATA PRESENTATION AND INTERPRETATION**
Magnetic Contour Map with Report? - *No*
(Scale, Contour interval)
Stacked Magnetic Profiles Provided? - *Yes*
Magnetic Depths Determined? - *No*
Method
Magnetic Interpretation? - *No*

LIST OF OTHER QUADRANGLES IN REPORT

<i>Beloit</i>	<i>Grand Island</i>	<i>Lamar</i>	<i>Tulsa</i>
<i>Broken Bow</i>	<i>Great Bend</i>	<i>O'Neill</i>	<i>Wichita</i>
<i>Dodge City</i>	<i>Joplin</i>	<i>Pratt</i>	
<i>Enid</i>	<i>La Junta</i>	<i>Sioux City</i>	

Fig. 4. DOE-NURE Magnetic Aerial Survey Specification Form.

The reformatting program, CONVERT,* reads data in sundry contractor-defined formats, determines data elements (variables) to be retained, identifies traverse types (survey- or tie-lines), and computes common unit conversions and statistics. A report, partially illustrated in Appendix B, containing data tabulations and rough frequency distributions is then generated and the standardized binary form, GDS format (Appendix C), of the contractor-supplied data is written. Essentially all other routines in the processing scheme read and write data sets in this format.

3.3 Data Adjustment

In some cases, it is necessary to adjust anomaly data from a given quadrangle survey to the same base level as that of a neighbor or to remove data obviously in error. These adjustment and editing facilities are provided by a transformation generator, TRANS, which, if used, is generally applied only to the contractor-supplied data set produced by CONVERT. TRANS supports a range of numerical operations which can be selectively performed either on a complete data set or specified sections therefrom. In addition, comparative operators are supplied which can often be used to reduce the effects of sensor-related problems by effecting the removal from the data set of those points having values over or under specified constants. For those few cases in which the data on a line contain uncorrectable errors, the entire traverse can be removed. The necessity for data adjustment does not arise in every case and therefore the intermediate, or adjusted, data set is not always created. In the

* Computer program names are represented in all capital letters.

remainder of this report, any mention of adjusted data processing is subject to this consideration.

3.4 Filtering

The contractor-supplied magnetic anomaly data commonly include high-frequency components which can cause complication of or erroneous results in machine contouring. These constituents may be dichotomized into general classes depending on origin. The simplest to recognize and eliminate can be considered noise resulting from instrumentation problems or cultural effects. These signals involve relatively few data points (both sequentially and totally) and occur at apparently random locations within a survey area. Although some may be recognized as originating from cultural features through correlation of related magnetic signatures with man-made features identified and located on maps, others show no such relationship and can be generally attributed to some system problem. This noise type is readily removed from the anomaly data through the application of a moving median filter³ with a window width of around 13 to 17 data points (0.6 to 1.0 km). This procedure, which is incorporated in program NFILTR, has proven effective in rejecting isolated spurious values or small sets thereof.

The other type of undesirable high-frequency signal is caused by local geologic features which produce anomalies with no correlation between adjacent flight tracks. The relatively large separation between survey lines allows these localized anomalies to cause aliasing problems which in turn make effective machine-contouring difficult and often lead to invalid contour lines. Reduction or elimination of this signal type, which tends

to pervade a large portion, or all, of an entire quadrangle, requires a more severe filter than the moving median. Thus, this filter is applied with caution and only as a last resort in the development of a data set which can be machine-contoured. The procedure (within NFILTER) used to remove this signal type is a one-dimensional recursive filter.⁴ By operating on the data of a survey track without requiring prior transformation to the frequency domain, the procedure is quite efficient in processing large quantities of data. This filter has the inherent assumption of a constant sample separation although this is actually the case only along acquisition tracks where the sampling rate has been Doppler-controlled. An average separation value of approximately 60 meters has been determined from survey reports and data analysis and is the value employed in the design of the filter. The attenuation of this high-frequency (wavenumber) filter is set at 12 dB per octave and the wavelength specified corresponds to the -3 dB level. Figures 5, 6, 7, 8, and 9 show, respectively, profile maps of contractor-supplied and 1, 2, 4, and 6 km wavelength, high-cut filtered data for the Lime Hills, Alaska, quadrangle unit.

3.5 Critical-Point Selection

One of the problems encountered in machine contouring aerial survey data is the high density of data along widely spaced acquisition tracks. In addition to the expense of machine contouring such biased data sets (containing from 30,000 to more than 200,000 samples), this situation generally results in unacceptable maps by suppressing track-to-track interactions in gridding processes. To reduce this problem, a method of critical-point selection⁵ has been adapted.

LIME HILLS QUADRANGLE; TOTAL INTENSITY MAGNETIC ANOMALY PROFILE MAP

CONTRACTOR-SUPPLIED DATA

ORNL-ORNL 80-000

SURVEY PARAMETERS
 SURVEY DATE(S): 8-9/1977
 DATA COLLECTED AND REDUCED BY: TEXAS INSTRUMENTS
 CORE-DETERMINED FIELD REMOVED: UPDATED SCRY 1975
 FLIGHT LINE ELEVATION: 400 FT (122 M) AMT
PROFILING PARAMETERS
 FLIGHT PATH BASE LEVEL: 0.0 GAMMAS (nT)
 PROFILE SCALE: 400.00 GAMMAS (nT)/INCH
 CONTOUR LEVEL: NOT USED

PROFILING SCALE: 400.00 GAMMAS (nT)/INCH
 OF THE MAGNETIC FIELD IN THE AREA SHOWN.
 IF THE SCALE IS NOT 400.00 GAMMAS (nT)/INCH, THE SCALE SHOULD BE ADJUSTED.

STATISTICS OF PROFILED VARIABLE
 MINIMUM VALUE: -0.030000E 02
 MAXIMUM VALUE: 3.014000E 03
 ARITHMETIC MEAN: 0.000779E 00
 STANDARD DEVIATION: 1.170570E 02
 DATA POINTS PLOTTED: 48211

Fig. 5. Lime Hills, Alaska, Quadrangle Total Intensity Magnetic Anomaly Profile Map Prepared from Contractor-Supplied Anomaly Data. In this and Other Profile or Contour Maps Reproduced in this Report the Map Scale is About 12.7 km/cm and the Magnetic Anomaly Scale is Approximately 800 gammas (nT)/cm.

Fig. 6. Lime Hills, Alaska, Quadrangle Total Intensity Magnetic Anomaly Profile Map Prepared from High-Cut Filtered Data. Filtering Performed Utilizing a 1-km Cutoff Wavelength.

LIME HILLS QUADRANGLE: TOTAL INTENSITY MAGNETIC ANOMALY PROFILE MAP

2 KM. HIGH-CUT, RECURSIVE FILTERED DATA

ORNL-6790 01-8570

SURVEY PARAMETERS
 SURVEY DATE(S): 6-9/1977
 DATA COLLECTED AND REDUCED BY: TEXAS INSTRUMENTS
 CORE-DERIVED FIELD REMOVED: UPDATED IGR7 1975
 FLIGHT LINE ELEVATION: 400 FT (122 M) AMT

PROFILING PARAMETERS
 FLIGHT PATH BASE LEVEL: 0.0 GAMMAS (nT)
 PROFILE SCALE: 400.00 GAMMAS (nT)/INCH
 CONTOUR LEVEL: NOT USED

ORNL-6790 01-8570
 SCALE 1:5000
 TRANSFORMED RELATIVE PROJECTION
 PREPARATION DATE 01-10-81
 PREPARED FOR THE LIME HILLS QUADRANGLE PROJECT
 BY THE GEOPHYSICAL RESEARCH DIVISION, TEXAS INSTRUMENTS CORPORATION
 OF THE LIME HILLS QUADRANGLE, ALASKA

STATISTICS OF PROFILED VARIABLE
 MINIMUM VALUE: -5.6207321 02
 MAXIMUM VALUE: 2.1721222 03
 ARITHMETIC MEAN: 9.8750822 00
 STANDARD DEVIATION: 1.1020892 02
 DATA POINTS PLOTTED: 48211

Fig. 7. Lime Hills, Alaska, Quadrangle Total Intensity Magnetic Anomaly Profile Map Prepared from High-Cut Filtered Data. Filtering Performed Utilizing a 2-km Cutoff Wavelength.

Fig. 8. Lime Hills, Alaska, Quadrangle Total Intensity Magnetic Anomaly Profile Map Prepared from High-Cut Filtered Data. Filtering Performed Utilizing a 4-km Cutoff Wavelength.

Fig. 9. Lime Hills, Alaska, Quadrangle Total Intensity Magnetic Anomaly Profile Map Prepared from High-Cut Filtered Data. Filtering Performed Utilizing a 6-km Cutoff Wavelength.

Points not necessary to the reproduction, within a specified error tolerance, of a data profile are eliminated from data sets by a procedure incorporated in program SELPT2. The selection mechanism can be illustrated by tracing typical operations on the simple data set whose profile is shown in Fig. 10(a). The first approximation (Fig. 10 (b)) is obtained by choosing the endpoints of the profile and constructing the line between them. All other points are now examined to find their respective distances from this initial line segment, and the maximum of these distances and the specified error tolerance are compared. Should the maximum distance be greater than the acceptable error, the initial approximation is insufficiently precise and the algorithm continues by adding the point so indicated to the data set (Fig. 10(c)). The distance test is now repeated for each point falling between currently selected points and the data set is updated accordingly. Figure 10(d) shows the resulting profile for the sample data set when sufficient points have been included to ensure that no remaining point exceeds the error tolerance in distance from its associated line segment.

An extension to the algorithm, not illustrated in Fig. 10, allows a constraint to be placed on the maximum linear separation of adjacent selected data points. After the critical points are initially chosen, the distance between each pair is examined to determine whether it exceeds this specified maximum separation. If so, the number of equally spaced interim points needed to relieve this condition is computed and, if available from the initial data set, these samples are added to the set of critical points. These secondary critical points, although not necessary to the satisfaction of the error tolerance criterion, ensure that

ORNL-DWG 81-3607

ORNL-DWG 81-3609

- Data Point
- Data Point Selected by Algorithm
- Data Profile
- - - Error Tolerance Boundary

Fig. 10. Critical-Point Selection Procedure.

ORNL-DWG 81-3608

ORNL-DWG 81-3610

- Data Point
- Data Point Selected by Algorithm
- Data Profile
- - - Error Tolerance Boundary

Fig. 10 (Cont'd).

sufficient data will be available for later gridding processes in sections where profiles exhibit gradually changing slope.

Establishment of critical-point magnetic anomaly selection parameters is based on the smoothness of existing data, the amount of further smoothing allowable, and the spacing of survey tracks. Although data dependency and parameter interplay make definition of set rules for the specification of selection parameters quite difficult, generally, an error criterion in the range of 5 to 20 gammas and a maximum distance of 2 to 4 km have proven acceptable. These characteristically result in the retention of 1,500 to 3,000 samples from filtered data sets originally containing 40,000 to 75,000 data points. It should be noted that only survey-line data are utilized for the selection process; no samples from tie-lines are included in critical-point data sets. Table 1 summarizes the numerical results from several critical-point selection trials involving various error tolerance and maximum distance specifications for the O'Neill, Nebraska, quadrangle.

Table 1. Relationship of Error Tolerance and Maximum Distance Specifications to Number of Critical Points Chosen. Selection Performed on O'Neill, Nebraska, 13-Point Median Filtered Data.

ERROR TOLERANCE (GAMMAS)	MAXIMUM DISTANCE (METERS)	NUMBER OF POINTS CHOSEN	PERCENT OF SURVEY LINE POINTS
2	2000	2897	8.46
5	2000	1770	5.17
15	2000	1432	4.18
20	2000	1379	4.02
50	2000	1266	3.70
2	3000	2723	7.95
5	3000	1456	4.25
15	3000	1062	3.10
20	3000	1008	2.94
50	3000	889	2.59
2	4000	2684	7.83
5	4000	1327	3.87
15	4000	870	2.54
20	4000	811	2.37
50	4000	693	2.02

Total Number of Points in Quadrangle: 40,954
Number of Points on Survey Lines: 34,261

3.6 Data Display

A program is used in conjunction with several of the data sets derived during general production processing to graphically present magnetic anomaly data by the production of profile maps. PROFIL accepts data in GDS format and plots a map of any quadrangle unit in the transverse Mercator projection. Flight paths are indicated within the map boundary by incremental lines connecting the coordinates of successive data points for a given traverse and each path is labeled on the right or bottom of the map border with its corresponding contractor-assigned identifier. All flight tracks are assigned a constant value, and each thus serves as a base relative to which its associated profile curve is drawn. Data values exceeding that assigned the flight tracks result in profile curves plotted above or to the right of the associated track, depending on flight orientation, while values less than the base level are plotted below or to the left. The anomaly data profiles consistently utilize a displacement scale of one inch equals 400 gammas relative to the mean anomaly value for that quadrangle rounded to the nearest hundred gammas. Production maps prepared from contractor-supplied and adjusted data have profiles embellished only with the path identifier to aid flight track to profile correlation. Filtered and critical-point data maps have, in addition, interpolated contour levels indicated by tick marks on the same side of the path as the profile itself. These ticks occur at 20, and are labeled at 100, gamma increments. All production maps are plotted at a scale of 1:250,000 with the northing-easting origin located at the intersection of the southern parallel and central meridian of the specified window. Although not generally applied, options such as marking of data point

locations, windowing to any latitude-longitude boundary, scaling to any desired ratio, and automatic computation of profile scale and base level are available for analysis of exceptional cases. Legends, titles, barscales, and numerical statistics are provided on the map in all cases. Figures 5 through 9 and 11 through 13 illustrate maps produced by PROFIL for the Lime Hills, Alaska, and O'Neill, Nebraska, quadrangles.

The other cartographic data display produced by this processing scheme is a total intensity magnetic anomaly contour map, shown for the O'Neill quadrangle in Fig. 14. Utilizing critical-point data, this map is prepared for a quadrangle unit only after careful evaluation of related profile maps to determine the effects of previous processing steps.

SELPT2, the critical-point selection routine, generates two data files. One, in GDS format, is used to produce profile maps, while the other, which contains only anomaly-related information in "XYZ" format (Appendix D), serves as the basis for contour maps. This latter file is read, with control parameters, by an annotation generating and data reformatting program, GPCFMT, which prepares the command and data files necessary for contouring. Actual machine contouring is performed by the General Purpose Contouring Program, GPCP-II, from California Computer Products, Inc. (CalComp).⁶ Most basic control information produced by GPCFMT is standardized for consistency in map plotting. The map scale and projection (and its origin) are the same as used for profile maps, flight paths are indicated, and legends, titles, barscales, statistics, and related data are again provided. Contours are usually drawn at an interval of 20 gammas, with hundred gamma multiples bold and closed minima hatchured.

Fig. 11. O'Neill, Nebraska, Quadrangle Total Intensity Magnetic Anomaly Profile Map Prepared from Contractor-Supplied Anomaly Data. Numbers on Lower and Right-Hand Map Margins are Track-Line Identifiers.

Fig. 12. O'Neill, Nebraska, Quadrangle Total Intensity Magnetic Anomaly Profile Map Prepared from 13-Point Median Filtered Data. Contour Levels (20 gamma Intervals) Marked And Annotated on Flight Tracks.

Fig. 13. O'Neill, Nebraska Quadrangle Total Intensity Magnetic Anomaly Profile Map Prepared from Critical-Point Data Selected From 13-Point Filtered Data Using a 5 gamma Error Tolerance And a Maximum Distance Between Data Points of 2000 Meters.

Fig. 14. O'Neill, Nebraska, Quadrangle Total Intensity Magnetic Anomaly Contour Map Prepared from Data Shown in Figure 13. Machine Contoured from a 50 (E-W) by 25 (N-S) Cell Orthogonal Grid Interpolated from 4C Nearest Neighboring Data Points.

GPCP-II interpolates a neighborhood of data point values to an orthogonal contouring grid whose origin is located at the lower left boundary of the map. The size of the individual cells in this grid is derived from survey-line spacing and is generally specified so that on the order of 50 cells span the east-west extent of the quadrangle while 25 cells cover north to south. Use of grid cells that are small with respect to the flight-line separation of the aerial survey will produce overly complex maps. Figure 15 illustrates the effect of a 150 by 75 cell grid on the same data as contoured in Fig. 14 where a grid of 50 by 25 cells was utilized. The number of neighboring data points specified for grid value interpolation ranges from 20 to 40 as more smoothing is mandated by data fluctuations. An example contour map, again of the O'Neill data, prepared from a grid (50 by 25 cells) established by interpolation from 20 nearest neighbors is shown in Fig. 16. The unacceptable contouring obtained is illustrated by the comparison of this map with Fig. 14 where 40 neighboring points were used to define the grid.

The orthogonal contouring grid described above gives rise to some undesirable artifacts in the contour maps produced by GPCP-II. Figures 14 through 16 show that the map border drawn is rectangular, unlike the projection boundary drawn by PROFIL (Fig. 11, for example). Inasmuch as map projections are not supported by GPCP-II, all coordinate conversions are performed by GPCFMT. The commands necessary to draw a projection boundary could be generated at the same time, but because the contouring program will either contour completely or leave blank a given cell in the orthogonal grid, unacceptable stairstepping of the contoured area would result.

Fig. 15. O'Neill, Nebraska, Quadrangle Total Intensity Magnetic Anomaly Contour Map Prepared from Data Shown in Figure 13. Machine Contoured From a 150 (E-W) by 75 (N-S) Cell Orthogonal Grid Interpolated From 40 Nearest Neighboring Data Points.

Fig. 16. O'Neill, Nebraska, Quadrangle Total Intensity Magnetic Anomaly Contour Map Prepared from Data Shown in Figure 13. Machine Contoured From a 50 (E-W) by 25 (N-S) Cell Orthogonal Grid Interpolated From 20 Nearest Neighboring Data Points.

3.7 Quality Evaluation

Information to aid in assessment of data validity is extracted from various GDS format data sets by a series of three quality evaluation (QE) programs. Contractor-supplied, adjusted, and filtered data sets are processed and results are presented in the form of tabular listings, bargraphs, and related numeric statistics. Appendix E provides representative samples of reports produced by the QE routines for the O'Neill, Nebraska, quadrangle unit.

Frequency distributions of sample point data values are developed by QEVAL. Normally, the classification limits for a variable are determined automatically from the arithmetic mean of the data plus or minus three standard deviations and the class interval is specified by the user. Magnetic anomaly, terrain clearance, and interpoint distance* information from contractor-supplied and adjusted data are analyzed using nominal class intervals of 20 gammas, 5 meters, and 50 meters, respectively (Appendix E.1). After filtering, magnetic anomaly data are again processed utilizing the same class interval as before (Appendix E.2).

Another parameter reflecting the quality of a survey is derived from values at or near survey- and tie-line intersections. Reduced magnetic anomaly data, for example, should be very similar for points from each line type near such a crossing. Actual mathematical intersections, in which points share precisely the same coordinates, are unlikely because traverses consist of strings of discrete points. FLTLQE searches for the best

*Interpoint distance is defined in this case to be the separation of adjacent samples along a given traverse.

approximations to true intersections through a combination of coordinate bracketing and distance minimization. Output, in addition to tabular listings and bargraphs, includes an intersection-by-intersection trace noting line identifiers, values of pertinent variables, and survey- to tie-line differences and distances. Exceptional conditions identified include separation of intersection components greater than three standard deviations from the mean interpoint distance for the quadrangle unit and failure of lines to intersect as can occur at national boundaries or the Great Lakes. FLTLQE is usually applied to contractor-supplied and adjusted data in order to provide assessment information for survey- minus tie-line magnetic anomaly differences, distances between component intersection points, and survey- minus tie-line terrain clearance differences. Respective class intervals are 5 gammas, 10 meters, and 5 meters (Appendix E.3).

The remaining QE program, TBQE, is used in analysis of magnetic monitor data, when available, from contractor-supplied and adjusted data sets. A linear, least-squares fit is computed for data covering each 1-, 3-, and 10-minute time interval along flight paths and interval slope and dispersion characteristics are determined. For each interval, least mean-squared error, correlation coefficient, standard deviation of computed versus observed values, and slope comprise information tabulated and bargraphed (Appendix E.4). Correlation coefficient values are generally processed utilizing overall limits of plus and minus 1.0 and a class interval of 0.025. Classification limits for the remaining values are developed from their respective means plus or minus two standard deviations with class intervals then selected as one-fiftieth this computed range.

4. FINAL PRODUCTS PROCESSING

After the validity of parameters chosen for data adjustment, filtering, critical point selection, and contouring have been confirmed by manual review of preliminary profile and contour maps and quality evaluation statistics, final Mylar map copies can be prepared. Contractor-supplied, adjusted, filtered, and critical-point total intensity magnetic anomaly profile maps are produced as shown in the Final Products Processing Flow Chart (Appendix F). These maps are prepared in the same manner as described in Section 3.6, and Figs. 5 through 9 and 11 through 13 are again illustrative.

Final contour maps on Mylar are produced in a fashion analogous to that described in Section 3.6, but with a modification to minimize, where possible, contour mismatch between adjacent quadrangle units. As shown in Appendix F, program XYZCOP produces a data base, in "XYZ" format, containing the critical-point data from all quadrangle units processed to date. GPCFMT then accesses this data base and retrieves points falling within a latitude-longitude boundary specified to include not only the quadrangle desired, but also a 7.5-minute ingress into those surrounding regions known to have been previously processed. Though this additional area is not visible on the map, data contained therein are considered by the gridding procedure and hence affect contour generation. This method does improve contouring performance but slight discrepancies in orthogonal grid positions from quadrangle to quadrangle make exact matches unlikely. Where adjacent data are not available, a blank region equivalent to the width or height of one grid cell is generated to avoid erroneous contours.

5. SUMMARY

A general, computer-based processing procedure has been developed and is being applied to DOE National Uranium Resource Evaluation Program data to produce regional total intensity magnetic anomaly profile and contour maps of NTMS quadrangle units. These maps and their related quality evaluation information, both available as open-file reports from the DOE Grand Junction Office, should not only prove useful in themselves, but also serve to illustrate the value of the NURE data as a whole and encourage its use in applied and scientific uses.

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Appendix A

General Production Processing Flow Chart of
Magnetic Anomaly Map Preparation from
DOE-NURE Aerial Survey Data

Appendix A (Cont'd.)

Appendix A (Cont'd.)

Appendix A (Cont'd.)

Appendix A (Cont'd.)

Appendix A (Cont'd.)

Appendix A (Cont'd.)

Appendix A (Cont'd.)

Appendix A (Cont'd.)

APPENDIX B

GENERAL DATA STATISTICS TABULATION
EXAMPLE - O'NEILL, NEBRASKA, QUADRANGLE,
CONTRACTOR-SUPPLIED DATA

Appendix B

General Data Statistics Tabulation
Example - O'Neill, Nebraska, Quadrangle
Contractor-Supplied Data

GDS FORMAT DATA CONVERSION ROUTINE
FOR THE
NATIONAL URANIUM RESOURCE EVALUATION PROGRAM

***** ONEILL QUADRANGLE *****

DATE OF CONVERSION	:	01-12-81
SOUTHERN LATITUDE	:	42.00
NORTHERN LATITUDE	:	43.00
EASTERN LONGITUDE	:	98.00
WESTERN LONGITUDE	:	100.00
NUMBER OF VARIABLES	:	14
NUMBER OF FLIGHT LINES	:	14
NUMBER OF TIE LINES	:	4
NUMBER OF POINTS (QUAD)	:	40954

FLIGHT LINES ARE PARALLEL TO LATITUDE

QUAD HEADER COMMENTS:
ONEILL QUADRANGLE - T1002

VARIABLE NAME : LAT		
LOWER LIMIT	UPPER LIMIT	MEMBERS
42.00	42.10	3261
42.10	42.20	5448
42.20	42.30	3117
42.30	42.40	5526
42.40	42.50	3190
42.50	42.60	3113
42.60	42.70	5568
42.70	42.80	3058
42.80	42.90	5205
42.90	43.00	3450

CLASS INTERVAL = 0.10

VARIABLE NAME : LONG		
LOWER LIMIT	UPPER LIMIT	MEMBERS
98.00	98.20	5120
98.20	98.40	3469
98.40	98.60	3504
98.60	98.80	5163
98.80	99.00	3422
99.00	99.20	3451
99.20	99.40	5090
99.40	99.60	3371
99.60	99.80	3401
99.80	100.00	4945

CLASS INTERVAL = 0.20

VARIABLE NAME : MAGNETOM		
LOWER LIMIT	UPPER LIMIT	MEMBERS
-652.00	-568.20	4547
-568.20	-484.40	12104
-484.40	-400.60	10815
-400.60	-316.80	7120
-316.80	-233.00	3230
-233.00	-149.20	1587
-149.20	-65.40	1217
-65.40	18.40	165
18.40	102.20	132
102.20	186.00	19

CLASS INTERVAL = 83.80

Appendix B (Cont'd.)

VARIABLE NAME : ALTITUDE		
LOWER LIMIT	UPPER LIMIT	MEMBERS
74.98	91.63	188
91.68	108.39	5305
108.39	125.09	24891
125.09	141.79	8717
141.79	158.50	1152
158.50	175.20	341
175.20	191.90	247
191.90	208.61	53
208.61	225.31	17
225.31	242.01	25

CLASS INTERVAL = 16.70

VARIABLE NAME : MAGNUM		
LOWER LIMIT	UPPER LIMIT	MEMBERS
57505.00	57510.40	1332
57510.40	57515.80	4613
57515.80	57521.20	3580
57521.20	57526.60	1264
57526.60	57532.00	10313
57532.00	57537.40	3877
57537.40	57542.80	6655
57542.80	57548.20	4773
57548.20	57553.60	1059
57553.60	57559.00	3070

CLASS INTERVAL = 5.40

Appendix B (Cont'd.)

Appendix B (Cont'd.)

GEOLOGIES IN ONEILL QUADRANGLE

GEOLOGY CODE	NUMBER OF OCCURRENCES
GUS	31398
KP	1876
GAL	1543
(WATER)	129
KN-1	79
KN-2	28
TC	412
TCS	2973
CTS	2618

NUMBER OF DIFFERENT GEOLOGIES: 9

VARIABLE MAGNETOM
 DATA LINE

INTERNAL SEQUENCE NUMBER	CENTRA LINE NUMBER	NUMBER POINTS	AVERAGE LATITUDE	AVERAGE LONGITUDE	MINIMUM	MAXIMUM	MEAN	STANDARD DEVIATION
FL1	101	2404	42.971	98.968	-495.000	25.000	-245.240	17.704
FL2	102	2354	42.618	98.992	-486.000	138.000	-247.280	14.609
FL3	103	2404	42.824	98.984	-461.000	128.000	-317.317	10.700
FL4	104	2384	42.784	98.977	-513.000	136.000	-311.508	10.600
FL5	105	2404	42.640	98.996	-479.000	126.000	-301.782	12.900
FL6	106	2437	42.610	98.990	-501.000	117.000	-416.000	10.700
FL7	107	2427	42.516	98.994	-537.000	117.000	-400.780	12.700
FL8	108	2416	42.464	98.991	-559.000	100.000	-407.591	16.503
FL9	109	2440	42.392	98.996	-599.000	127.000	-500.640	11.007
FL10	110	2470	42.310	98.995	-611.000	109.000	-511.670	10.144
FL11	111	2470	42.247	98.990	-643.000	100.000	-527.024	14.630
FL12	112	2470	42.174	98.997	-677.000	140.000	-500.601	15.040
FL13	113	2450	42.102	98.994	-636.000	104.000	-500.700	10.900
FL14	114	2430	42.014	98.994	-636.000	25.000	-510.140	10.400
FL15	115	1641	42.503	98.983	-552.000	102.000	-425.708	11.130
TL16	211	1086	42.534	98.995	-562.000	94.000	-417.658	17.303
TL17	211	1081	42.504	98.999	-631.000	133.000	-441.823	10.720
TL18	212	1039	42.473	98.113	-621.000	102.000	-364.927	14.001
3000	3000	40934	42.500	98.993	-652.000	180.000	-435.221	12.911

Appendix B (Cont'd.)

VARIABLE: ALTITUDE
QUAD: CNEILL

INTERNAL SEQUENCE NUMBER	CONTRACTOR LINE NUMBER	NUMBER OF POINTS	AVERAGE LATITUDE	AVERAGE LONGITUDE	MINIMUM	MAXIMUM	MEAN	STANDARD DEVIATION
FL1	101	2464	42.971	98.968	92.354	181.051	117.528	11.151
FL2	102	2354	42.898	98.992	83.620	184.055	120.223	13.557
FL3	103	2493	42.824	98.984	74.981	182.575	121.399	13.938
FL4	104	2332	42.754	98.997	76.200	200.863	124.677	20.210
FL5	105	2452	42.682	98.996	87.782	175.870	118.513	11.333
FL6	106	2437	42.610	98.999	89.611	174.041	117.873	9.786
FL7	107	2437	42.536	98.998	88.146	242.011	126.260	20.471
FL8	108	2516	42.464	99.001	87.782	199.335	118.671	12.647
FL9	109	2490	42.392	98.982	75.286	199.072	116.681	19.369
FL10	110	2379	42.320	98.995	82.596	195.045	121.955	15.364
FL11	111	2442	42.247	98.997	88.392	145.045	116.768	8.847
FL12	112	2470	42.174	98.994	90.321	158.496	118.462	9.171
FL13	113	2455	42.103	98.994	90.830	194.767	121.201	11.920
FL14	114	2470	42.034	99.004	86.258	145.085	120.584	9.197
TL15	209	1641	42.503	95.889	51.745	182.575	121.250	10.485
TL16	210	1682	42.504	95.295	84.734	146.914	115.240	9.871
TL17	211	1681	42.504	98.699	88.697	107.640	118.421	12.663
TL18	212	1689	42.498	98.113	53.269	179.222	123.264	12.435
QUAD	-->	4054	42.500	98.993	74.581	242.011	119.535	13.164

Appendix B (Cont'd.)

VARIABLE: MAGMON
QUAD: CNEILL

INTERNAL SEQUENCE NUMBER	CONTRACTOR LINE NUMBER	NUMBER OF POINTS	AVERAGE LATITUDE	AVERAGE LONGITUDE	MINIMUM	MAXIMUM	MEAN	STANDARD DEVIATION
FL1	101	2464	42.971	98.968	57520.000	57531.000	57528.580	1.395
FL2	102	2354	42.898	98.992	57520.000	57531.000	57529.727	1.882
FL3	103	2493	42.924	98.984	57538.000	57549.000	57541.332	1.949
FL4	104	2382	42.754	98.997	57540.000	57545.000	57541.512	1.308
FL5	105	2452	42.642	98.996	57540.000	57545.000	57543.012	1.241
FL6	106	2437	42.610	98.999	57531.000	57538.000	57534.281	2.309
FL7	107	2437	42.536	98.998	57526.000	57531.000	57529.625	1.328
FL8	108	2510	42.464	99.001	57530.000	57535.000	57531.645	0.916
FL9	109	2490	42.392	98.982	57524.000	57533.000	57527.688	2.395
FL10	110	2373	42.320	98.995	57517.000	57523.000	57519.277	1.175
FL11	111	2442	42.247	98.990	57534.000	57543.000	57539.770	1.472
FL12	112	2470	42.174	98.997	57550.000	57557.000	57554.551	1.619
FL13	113	2453	42.103	98.994	57511.000	57529.000	57518.824	5.649
FL14	114	2490	42.034	99.004	57505.000	57521.000	57511.414	3.056
TL15	209	1641	42.503	99.989	57544.000	57548.000	57546.039	1.122
TL16	210	1682	42.504	99.293	57548.000	57559.000	57554.578	3.642
TL17	211	1681	42.509	98.699	57510.000	57517.000	57513.172	2.765
TL18	212	1689	42.498	98.113	57510.000	57515.000	57512.520	1.206
QUAD	-->	40954	42.500	98.993	57505.000	57559.000	57532.137	12.834

APPENDIX C

GDS (GEOGRAPHIC DATA SYSTEMS) DATA FORMAT

Appendix C

GDS (Geographic Data Systems) Data Format

This format, designed to accommodate aerial radiometric and magnetic data from the NURE-ARRS program, is the form written and read by most routines described in the text of this report. Utilizing IBM computers, all information in the three record types is recorded in binary (FORTRAN unformatted I/O) and consists of blocked, variable-length, spanned records in sequential data sets with a standard block size of 13,030 8-bit bytes. Data types described on the following pages are as defined by IBM FORTRAN IV, and all are four bytes (32 bits) in length. Unless specifically indicated, data items are numeric and coordinate information is in decimal degrees.

Quadrangle Header Record

General information concerning an entire quadrangle unit is contained in this record type. It occurs one time only, at the beginning of a GDS format data set, and has a maximum length of 4372 bytes.

<u>data type</u>	<u>description</u>
real	first four characters of quadrangle name
real	last four characters of quadrangle name
real	southern latitude boundary
real	northern latitude boundary
real	eastern longitude boundary
real	western longitude boundary

Appendix C (Cont'd.)

integer	total number of sample points
integer	number of survey lines
integer	number of tie lines
real	survey line orientation code; ≤ 1 : E-W; > 1 N-S
integer	data of conversion to GDS format
integer	number of unique geology codes (300 maximum)

- the following 12 bytes occur once for each geology code -

integer	first four characters of geology code
integer	last four characters of geology code
integer	number of samples with this geology code
integer	number of variables (20 maximum)

- the following 8 bytes occur once for each variable -

real	first four characters of variable name
real	last four characters of variable name

- the following 16 bytes occur once for each variable -

real	variable minimum
real	variable maximum
real	variable arithmetic mean
real	variable standard deviation

- the following 4 bytes occur 60 times -

integer	comments field (240 characters)
---------	---------------------------------

Appendix C (Cont'd.)

Line Header Record

Information specific to a particular survey- or tie-line is contained in this record type. It occurs once at the beginning of the data for each traverse and has a maximum length of 340 bytes.

<u>data type</u>	<u>description</u>
integer	four-character line sequence and type flag
integer	contractor-assigned line number
integer	number of samples on this line
real	average latitude of line
real	average longitude of line

- the following 16 bytes are repeated once for each variable -

real	variable minimum
real	variable maximum
real	variable arithmetic mean
real	variable standard deviation

Appendix C (Cont'd.)

Sample-Point Data Record

Information concerning each individual data point is included in this record type. It occurs once for each sample point and the collection of those defining the data for a given traverse follows the associated Line Header Record. It is of fixed, 120-byte length.

<u>data type</u>	<u>description</u>
integer	contractor-assigned tape sequence number
integer	contractor-assigned record number
integer	contractor-assigned data quality number
integer	date of sample (mmddyy)
integer	contractor-assigned line number
integer	first four characters of geology code
integer	last four characters of geology code
integer	time of sample (hhmmss)
integer	reserved for future use
integer	reserved for future use

- the following 4 bytes are repeated once for each variable -

real	positional variable value [*]
------	--

- any length remaining is reserved for future use -

* Variable values occur in the same order as variable names in the Quadrangle Header Record.

APPENDIX D
"XYZ" DATA FORMAT

20

Appendix D

"XYZ" Data Format

In order to minimize contour mismatch between adjacent quadrangle units, information from those neighboring areas is needed for use in contour grid construction. "XYZ" format contains a subset of the data contained in a GDS format file, and, while variable-specific, allows much faster selection of data from a specified latitude-longitude boundary. As in the GDS format, all information is binary and all data elements are of four-byte length. Data in "XYZ" format are associated with specific quadrangle units solely by latitude-longitude, necessitating definition of only two record types.

Line Header Record

This record type functions to identify the line and indicate its orientation. It occurs once at the beginning of each traverse and has a fixed, 16-byte length.

<u>data type</u>	<u>description</u>
integer	four-character line sequence and type flag
integer	contractor-assigned line number
integer	number of points on this line
real	survey line orientation code; ≤ 1 : E-W; > 1 : N-S

Appendix D (Cont'd.)

Sample-Point Data Record

Any variable from a standard GDS format data set may be stored in "XYZ" format sample-point data records. One occurrence of this record type appears for each data point in the file, and collections defining traverse lines follow Line Header Records. The records are of fixed, 16-byte length.

<u>data type</u>	<u>description</u>
real	latitude of sample
real	longitude of sample
real	z-value of sample, e.g., magnetic anomaly, etc.
real	terrain clearance of sample

APPENDIX E

QUALITY EVALUATION PROGRAM REPORT EXAMPLES -
O'NEILL, NEBRASKA, QUADRANGLE

Appendix E-1

Data Value Frequency Distribution Analysis: Magnetic Anomaly,
Terrain Clearance, and Interpoint Distance Data from
Contractor-Supplied Data Set

NURE DATA QUALITY EVALUATION

GEOGRAPHIC DATA SYSTEMS GROUP
UNION CARBIDE CORPORATION
NUCLEAR DIVISION

DATE: 01-21-81 TIME: 18.43.18

RUN IDENTIFICATION: ONEILL; CONTRACTOR-SUPPLIED MAGNETOMETER DATA (CARPAS)

QUAD BOUNDARY:
MINIMUM LATITUDE: 4.200000E 01 MAXIMUM LATITUDE: 4.300000E 01
MINIMUM LONGITUDE: 9.000000E 01 MAXIMUM LONGITUDE: 1.000000E 02

COMMENTS FROM INPUT FILE: ONEILL QUADRANGLE - T1002

THE VARIABLE CHOSEN IS 'MAGNETON' AND THE FLIGHT LINE/TIE LINE SWITCH IS SET TO 'BOTH'

BALGRAPH HEADING CONTROL IS 'PPLIT' AND THE UNIT TO BE USED FOR INPUT IS 50

CLASS INTERVAL IN USE IS 2.000000D 01

----> BEGINNING POINT DATA INPUT

----> POINT DATA INPUT COMPLETED USING 5.96 CPU SECONDS

FOR THE ENTIRE DATASET, 18 MAP (14 FLIGHT AND 4 TIE) LINES WERE PROCESSED, 40954 VALUES WERE WRITTEN,
AND 0 VALUES WERE DISCARDED

FOR THE VARIABLE SELECTED, THE FOLLOWING STATISTICS WERE COMPUTED:

MINIMUM: -6.520000D 02; MAXIMUM: 1.060000D 02; MEAN: -4.353200D 02; STD DEV: 1.249107D 02

OVERALL DATA LIMITS, -8.100529D 02 TO -6.058884D 01, WERE CHOSEN FROM DATA MEAN - AND + THREE STD DEVIATIONS

* * * * * B A R C R * * * * *

TITLE: ONEILL; CONTRACTOR-SUPPLIED MAGNETOMETER DATA (CAMMAS)

40630 VALUES CLASSIFIED; 304 VALUES NOT CLASSIFIED; 40934 TOTAL VALUES PROCESSED
CLASS INTERVAL IN USE IS 2.000000D 01

FOR THE CLASSIFIED DATA VALUES:	MINIMUM:	-6.520000D 02	MAXIMUM:	-6.100000D 01
	MEAN:	-4.387442D 02	STD. DEV.:	1.188070D 02

EACH BARGRAPH SYMBOL REPRESENTS 2.816667D 01 CLASS MEMBERS

FOR THE ENTIRE DATA SET:	MINIMUM:	-6.520000D 02	MAXIMUM:	1.860000D 02
	MEAN:	-4.353208D 02	STD. DEV.:	1.249107D 02

Appendix E-1 (Cont'd.)

Appendix E-1 (Cont'd.)

ONEILL: CONTRACTOR-SUPPLIED MAGNETOMETER DATA (CANTRAS)			CLASS LISTING - PAGE 1		01-21-81/18.48.48
CLASS 1	(-8.200000 02:-8.000000 02)	0 MEMBERS	CLASS 2	(-8.000000 02:-7.800000 02)	0 MEMBERS
CLASS 3	(-7.800000 02:-7.600000 02)	0 MEMBERS	CLASS 4	(-7.600000 02:-7.400000 02)	0 MEMBERS
CLASS 5	(-7.400000 02:-7.200000 02)	0 MEMBERS	CLASS 6	(-7.200000 02:-7.000000 02)	0 MEMBERS
CLASS 7	(-7.000000 02:-6.800000 02)	0 MEMBERS	CLASS 8	(-6.800000 02:-6.600000 02)	0 MEMBERS
CLASS 9	(-6.600000 02:-6.400000 02)	88 MEMBERS	CLASS 10	(-6.400000 02:-6.200000 02)	712 MEMBERS
CLASS 11	(-6.200000 02:-6.000000 02)	1222 MEMBERS	CLASS 12	(-6.000000 02:-5.800000 02)	1330 MEMBERS
CLASS 13	(-5.800000 02:-5.600000 02)	1858 MEMBERS	CLASS 14	(-5.600000 02:-5.400000 02)	2799 MEMBERS
CLASS 15	(-5.400000 02:-5.200000 02)	3380 MEMBERS	CLASS 16	(-5.200000 02:-5.000000 02)	2862 MEMBERS
CLASS 17	(-5.000000 02:-4.800000 02)	3683 MEMBERS	CLASS 18	(-4.800000 02:-4.600000 02)	2936 MEMBERS
CLASS 19	(-4.600000 02:-4.400000 02)	2624 MEMBERS	CLASS 20	(-4.400000 02:-4.200000 02)	2831 MEMBERS
CLASS 21	(-4.200000 02:-4.000000 02)	2226 MEMBERS	CLASS 22	(-4.000000 02:-3.800000 02)	2194 MEMBERS
CLASS 23	(-3.800000 02:-3.600000 02)	1448 MEMBERS	CLASS 24	(-3.600000 02:-3.400000 02)	1946 MEMBERS
CLASS 25	(-3.400000 02:-3.200000 02)	1406 MEMBERS	CLASS 26	(-3.200000 02:-3.000000 02)	811 MEMBERS
CLASS 27	(-3.000000 02:-2.800000 02)	893 MEMBERS	CLASS 28	(-2.800000 02:-2.600000 02)	807 MEMBERS
CLASS 29	(-2.800000 02:-2.600000 02)	680 MEMBERS	CLASS 30	(-2.600000 02:-2.400000 02)	480 MEMBERS
CLASS 31	(-2.200000 02:-2.000000 02)	318 MEMBERS	CLASS 32	(-2.000000 02:-1.800000 02)	415 MEMBERS
CLASS 33	(-1.800000 02:-1.600000 02)	350 MEMBERS	CLASS 34	(-1.600000 02:-1.400000 02)	213 MEMBERS
CLASS 35	(-1.400000 02:-1.200000 02)	426 MEMBERS	CLASS 36	(-1.200000 02:-1.000000 02)	873 MEMBERS
CLASS 37	(-1.000000 02:-0.800000 01)	222 MEMBERS	CLASS 38	(-0.800000 01:-0.600000 01)	93 MEMBERS

B A R C N

* * * * * B A R C R * * * * *

TITLE: ONEILL; CONTRACTOR-SUPPLIED TERRAIN CLEARANCE DATA (METERS)

40205 VALUES CLASSIFIED; 669 VALUES NOT CLASSIFIED; 40954 TOTAL VALUES PROCESSED
CLASS INTERVAL IN USE IS 5.000000D 00

FOR THE CLASSIFIED IN	VALUES:	MINIMUM:	0.016300D 01	MAXIMUM:	1.597152D 02
		MEAN:	1.109938D 02	STD. DEV.:	1.063016D 01

EACH BARGRAPH SYMBOL REPRESENTS 6.697500D 01 CLASS MEMBERS

FOR THE ENTIRE DATA SET:	MINIMUM:	7.400079D 01	MAXIMUM:	2.420112D 02
	MEAN:	1.199347D 02	STD. DEV.:	1.316401D 01

Appendix E-1 (Cont'd.)

Appendix E-1 (Cont'd.)

ONEILL: CONTRACTOR-SUPPLIED TERRAIN CLEARANCE DATA (NETTERS) CLASS LISTING - PAGE 1

CLASS 1 (0.000000 01:: 0.500000 01)	24 MEMBERS	CLASS 2 (0.500000 01:: 0.000000 01)	93 MEMBERS	01-21-01/10.44.00
CLASS 3 (0.000000 01:: 0.500000 01)	237 MEMBERS	CLASS 4 (0.500000 01:: 1.000000 02)	646 MEMBERS	
CLASS 5 (1.000000 02:: 1.050000 02)	1886 MEMBERS	CLASS 6 (1.050000 02:: 1.100000 02)	4309 MEMBERS	
CLASS 7 (1.100000 02:: 1.150000 02)	7789 MEMBERS	CLASS 8 (1.150000 02:: 1.200000 02)	8037 MEMBERS	
CLASS 9 (1.200000 02:: 1.250000 02)	7359 MEMBERS	CLASS 10 (1.250000 02:: 1.300000 02)	4352 MEMBERS	
CLASS 11 (1.300000 02:: 1.350000 02)	2851 MEMBERS	CLASS 12 (1.350000 02:: 1.400000 02)	1474 MEMBERS	
CLASS 13 (1.400000 02:: 1.450000 02)	724 MEMBERS	CLASS 14 (1.450000 02:: 1.500000 02)	403 MEMBERS	
CLASS 15 (1.500000 02:: 1.550000 02)	244 MEMBERS	CLASS 16 (1.550000 02:: 1.600000 02)	107 MEMBERS	

ONEILL, CONTRACTOR-SUPPLIED TERRAIN CLEARANCE DATA (METERS) CLASS BARGRAPHS - PAGE 1 01-21-81/18.44.05

MEMBERS:	8.037D 02	1.607D 03	2.411D 03	3.215D 03	4.019D 03	4.822D 03	5.626D 03	6.430D 03	7.233D 03	8.037D 03
CLASS 1:										
CLASS 2:*										
CLASS 3:****										
CLASS 4:*****										
CLASS 5:*****										
CLASS 6:*****										
CLASS 7:*****										
CLASS 8:*****										
CLASS 9:*****										
CLASS 10:*****										
CLASS 11:*****										
CLASS 12:*****										
CLASS 13:*****										
CLASS 14:*****										
CLASS 15:****										
CLASS 16:**										
MEMBERS:	8.037D 02	1.607D 03	2.411D 03	3.215D 03	4.019D 03	4.822D 03	5.626D 03	6.430D 03	7.233D 03	8.037D 03

+ + + + + B A R C R + + + + +

Appendix E-1 (Cont'd.)

+ + + + + B A R C H + + + + +

TITLE: ONEILL; INTERPOINT DISTANCES FROM CONTRACTOR DATA (METERS)

40377 VALUES CLASSIFIED; 609 VALUES NOT CLASSIFIED; 40986 TOTAL VALUES PROCESSED
CLASS INTERVAL IN USE IS 3.000000D 01

FOR THE CLASSIFIED DATA VALUES:	MINIMUM:	4.854568D 01	MAXIMUM:	1.404337D 02
	MEAN:	6.498404D 01	STD. DEV.:	6.127883D 00

EACH BARGRAPH SYMBOL REPRESENTS 3.336083D 02 CLASS MEMBERS

FOR THE ENTIRE DATA SET:	MINIMUM:	4.854568D 01	MAXIMUM:	3.559894D 02
	MEAN:	6.696440D 01	STD. DEV.:	1.744536D 01

Appendix E-1 (Cont'd.)

ONEILL, INTERPOINT DISTANCES FROM CONTRACTOR DATA (METERS) CLASS LISTING - PAGE 1 01-21-81/18.44.28

CLASS 1 (0.0	:: 3 0000000 01)	248 MEMBERS	CLASS 2 (5.0000000 01:: 1.0000000 02)	40033 MEMBERS
CLASS 3 (1.0000000 02:: 1.5000000 02)		46 MEMBERS		

ONEILL; INTERPOINT DISTANCES FROM CONTRACTOR DATA (METERS) CLASS BARGRAPHS - PAGE 1 01-21-81/18.44.28

MEMBERS:	4.003D 03	8.007D 03	1.201D 04	1.601D 04	2.002D 04	2.402D 04	2.802D 04	3.203D 04	3.603D 04	4.003D 04
CLASS 1:	*									
CLASS 2:	*****									
CLASS 3:										
MEMBER 3:	4.003D 03	8.007D 03	1.201D 04	1.601D 04	2.002D 04	2.402D 04	2.802D 04	3.203D 04	3.603D 04	4.003D 04

+ + + + + B A R G R + + + + +

Appendix E-1 (Cont'd.)

Appendix E-2

Data Value Frequency Distribution Analysis: Magnetic Anomaly
Data From 13-Point Median Filtered Data Set.

PURE DATA QUALITY EVALUATION

GEOGRAPHIC DATA SYSTEMS GROUP
UNION CARBIDE CORPORATION
NUCLEAR DIVISION

DATE: 01-21-81 TIME: 18.46.54

RUN IDENTIFICATION: ONEILL; 13-POINT MEDIAN FILTERED MAGNETOMETER DATA (CARTAS)

QUAD BOUNDARY:
MINIMUM LATITUDE: 4.200000E 01 MAXIMUM LATITUDE: 4.300000E 01
MINIMUM LONGITUDE: 9.800000E 01 MAXIMUM LONGITUDE: 1.000000E 02

COMMENTS FROM INPUT FILE: ONEILL QUADRANGLE - T1002; NFILTR 01-12-81, TYPE-MED, RWIDTH-13.0, VAR-MAGNETOM

THE VARIABLE CHOSEN IS 'MAGNETOM' AND THE FLIGHT LINE/TIE LINE SWITCH IS SET TO 'BOTH'
BARGRAPH HEADING CONTROL IS 'SPLIT' AND THE UNIT TO BE USED FOR INPUT IS 50
CLASS INTERVAL IN USE IS 2.000000D 01

----> BEGINNING POINT DATA INPUT

----> POINT DATA INPUT COMPLETED USING 3.95 CPU SECONDS

FOR THE ENTIRE DATASET, 18 MAP (14 FLIGHT AND 4 TIE) LINES WERE PROCESSED. 40954 VALUES WERE WRITTEN,
AND 6 VALUES WERE DISCARDED

FOR THE VARIABLE SELECTED, THE FOLLOWING STATISTICS WERE COMPUTED:
MINIMUM: -6.310000D 02; MAXIMUM: 1.700000D 02; MEAN: -4.35328D 02; STD DEV: 1.248368D 02

OVERALL DATA LIMITS, -8.099032D 02 TO -6.076230D 01, WERE CHOSEN FROM DATA MEAN - AND + THREE STD DEVIATIONS

+ + + + + B A R G R + + + + +

TITLE: ONEILL, 15-POINT MEDIAN FILTERED MAGNETOMETER DATA (GAMMAS)

40680 VALUES CLASSIFIED; 304 VALUES NOT CLASSIFIED; 40984 TOTAL VALUES PROCESSED
CLASS INTERVAL IN USE IS 2.000000D 01

FOR THE CLASSIFIED DATA VALUES: MINIMUM: -6.510000D 02 MAXIMUM: -6.100000D 01
MEAN: -4.387536D 02 STD. DEV.: 1.187522D 02

EACH BARGRAPH SYMBOL REPRESENTS 2.829167D 01 CLASS MEMBERS

FOR THE ENTIRE DATA SET: MINIMUM: -6.510000D 02 MAXIMUM: 1.700000D 02
MEAN: -4.353328D 02 STD. DEV.: 1.246568D 02

Appendix E-2 (Cont'd.)

Appendix E-2 (Cont'd.)

ONEILL, 15-POINT MEDIAN FILTERED SACRETOMETER DATA (CARNAS)					CLASS LISTING - PAGE 1		01-21-01/10.47.37	
CLASS 1	(-8.200000D 02:-8.000000D 02)	0 MEMBERS	CLASS 2	(-8.000000D 02:-7.600000D 02)	0 MEMBERS			
CLASS 3	(-7.800000D 02:-7.600000D 02)	0 MEMBERS	CLASS 4	(-7.600000D 02:-7.400000D 02)	0 MEMBERS			
CLASS 5	(-7.400000D 02:-7.200000D 02)	0 MEMBERS	CLASS 6	(-7.200000D 02:-7.000000D 02)	0 MEMBERS			
CLASS 7	(-7.000000D 02:-6.800000D 02)	0 MEMBERS	CLASS 8	(-6.800000D 02:-6.600000D 02)	0 MEMBERS			
CLASS 9	(-6.600000D 02:-6.400000D 02)	82 MEMBERS	CLASS 10	(-6.400000D 02:-6.200000D 02)	700 MEMBERS			
CLASS 11	(-6.200000D 02:-6.000000D 02)	1231 MEMBERS	CLASS 12	(-6.000000D 02:-5.800000D 02)	1324 MEMBERS			
CLASS 13	(-5.800000D 02:-5.600000D 02)	1844 MEMBERS	CLASS 14	(-5.600000D 02:-5.400000D 02)	2802 MEMBERS			
CLASS 15	(-5.400000D 02:-5.200000D 02)	3395 MEMBERS	CLASS 16	(-5.200000D 02:-5.000000D 02)	2875 MEMBERS			
CLASS 17	(-5.000000D 02:-4.800000D 02)	3103 MEMBERS	CLASS 18	(-4.800000D 02:-4.600000D 02)	2899 MEMBERS			
CLASS 19	(-4.600000D 02:-4.400000D 02)	2637 MEMBERS	CLASS 20	(-4.400000D 02:-4.200000D 02)	2343 MEMBERS			
CLASS 21	(-4.200000D 02:-4.000000D 02)	2231 MEMBERS	CLASS 22	(-4.000000D 02:-3.800000D 02)	2215 MEMBERS			
CLASS 23	(-3.800000D 02:-3.600000D 02)	1430 MEMBERS	CLASS 24	(-3.600000D 02:-3.400000D 02)	1973 MEMBERS			
CLASS 25	(-3.400000D 02:-3.200000D 02)	1371 MEMBERS	CLASS 26	(-3.200000D 02:-3.000000D 02)	827 MEMBERS			
CLASS 27	(-3.000000D 02:-2.800000D 02)	888 MEMBERS	CLASS 28	(-2.800000D 02:-2.600000D 02)	807 MEMBERS			
CLASS 29	(-2.600000D 02:-2.400000D 02)	600 MEMBERS	CLASS 30	(-2.400000D 02:-2.200000D 02)	492 MEMBERS			
CLASS 31	(-2.200000D 02:-2.000000D 02)	517 MEMBERS	CLASS 32	(-2.000000D 02:-1.800000D 02)	407 MEMBERS			
CLASS 33	(-1.800000D 02:-1.600000D 02)	343 MEMBERS	CLASS 34	(-1.600000D 02:-1.400000D 02)	322 MEMBERS			
CLASS 35	(-1.400000D 02:-1.200000D 02)	417 MEMBERS	CLASS 36	(-1.200000D 02:-1.000000D 02)	377 MEMBERS			
CLASS 37	(-1.000000D 02:-0.800000D 01)	218 MEMBERS	CLASS 38	(-0.800000D 01:-0.600000D 01)	93 MEMBERS			

01-21-01/10.47.37

MEMBERS: 3.395D 02 6.790D 02 1.019D 03 1.358D 03 1.698D 03 2.037D 03 2.377D 03 2.716D 03 3.056D 03 3.395D 03

CLASS 1:
CLASS 2:
CLASS 3:
CLASS 4:
CLASS 5:
CLASS 6:
CLASS 7:
CLASS 8:
CLASS 9:***
CLASS 10:*****
CLASS 11:*****
CLASS 12:*****
CLASS 13:*****
CLASS 14:*****
CLASS 15:*****
CLASS 16:*****
CLASS 17:*****
CLASS 18:*****
CLASS 19:*****
CLASS 20:*****
CLASS 21:*****
CLASS 22:*****
CLASS 23:*****
CLASS 24:*****
CLASS 25:*****
CLASS 26:*****
CLASS 27:*****
CLASS 28:*****
CLASS 29:*****
CLASS 30:*****
CLASS 31:*****
CLASS 32:*****
CLASS 33:*****
CLASS 34:*****
CLASS 35:*****
CLASS 36:*****
CLASS 37:*****
CLASS 38:***

MEMBERS: 3.395D 02 6.790D 02 1.019D 03 1.358D 03 1.698D 03 2.037D 03 2.377D 03 2.716D 03 3.056D 03 3.395D 03

+ + + + + B A R G R + + + + +

Appendix E-3

**Survey- and Tie-line Intersection Analysis: Magnetic Anomaly
And Terrain Clearance Differences and Intersection Component
Separation from Contractor-Supplied Data Set.**

```

+-----+
| NURE DATA |
| FLIGHT LINE/TIE LINE |
| INTERSECTION ROUTINE |
+-----+
  
```

GEOGRAPHIC DATA SYSTEMS GROUP
UNION CARBIDE CORPORATION
NUCLEAR DIVISION

DATE: 01-21-81 TIME: 18.44.46

RUN IDENTIFICATION: ONEILL, FL/TL INTERSECT, CONTRACTOR MAGNETOM DATA (GAMMAS)

QUAD BOUNDARY:
MINIMUM LATITUDE: 4.200000E 01 MAXIMUM LATITUDE: 4.300000E 01
MINIMUM LONGITUDE: 9.600000E 01 MAXIMUM LONGITUDE: 1.000000E 02

INFORMATION READ FROM INPUT FILE HEADER:

QUADRANGLE IDENTIFICATION: ONEILL
DATE OF CONVERSION TO GUS FORMAT: 11281
SLOPE OF FLIGHT LINES: 0.0

COMMENTS:
ONEILL QUADRANGLE - T1002

VARIABLE CHOSEN IS 'MAGNETOM' AND THE CLASS INTERVAL IS 1.0000

MEAN QUADRANGLE INTERPOINT DISTANCE (METERS): 6.662900E 01
INTERPOINT DISTANCE STANDARD DEVIATION (METERS): 1.849339E 01
THREE STANDARD DEVIATIONS (METERS): 5.548077E 01

COMPUTED SEARCH INCREMENTS (DEGREES): LATITUDE: 4.501289E-04; LONGITUDE: 6.082754E-04

FLIGHT LINE NUMBER 101 - LAT: 4.297260E 01; LON: 9.988499E 01; N: 1.084149E 05; E: -7.219606E 04
 VARIABLE VALUE: -4.690000E 02; CLEARANCE: 1.188720E 02 METERS
 TIE LINE NUMBER 209 - LAT: 4.297249E 01; LON: 9.988519E 01; N: 1.084033E 05; E: -7.221238E 04
 VARIABLE VALUE: -4.690000E 02; CLEARANCE: 1.191768E 02 METERS
 >>>>FL POINT -> TL POINT DISTANCE: 2.096728E 01 METERS; CLEARANCE DIFFERENCE: -3.048096E-01 METERS
 >>>>-----> VALUE DIFFERENCE: 0.0 UNITS

***** THE DISTANCE BETWEEN THE POINT SELECTED FROM FLIGHT LINE 101 AND THE POINT SELECTED FROM TIE LINE 210 IS GREATER *****
 ***** THAN THREE STANDARD DEVIATIONS AWAY FROM THE MEAN INTERPOINT DISTANCE FOR THE QUAD. ASSUMING NO INTERSECTION. *****

***** THE DISTANCE BETWEEN THE POINT SELECTED FROM FLIGHT LINE 101 AND THE POINT SELECTED FROM TIE LINE 211 IS GREATER *****
 ***** THAN THREE STANDARD DEVIATIONS AWAY FROM THE MEAN INTERPOINT DISTANCE FOR THE QUAD. ASSUMING NO INTERSECTION. *****

***** THE DISTANCE BETWEEN THE POINT SELECTED FROM FLIGHT LINE 101 AND THE POINT SELECTED FROM TIE LINE 212 IS GREATER *****
 ***** THAN THREE STANDARD DEVIATIONS AWAY FROM THE MEAN INTERPOINT DISTANCE FOR THE QUAD. ASSUMING NO INTERSECTION. *****

***** THE DISTANCE BETWEEN THE POINT SELECTED FROM FLIGHT LINE 102 AND THE POINT SELECTED FROM TIE LINE 209 IS GREATER *****
 ***** THAN THREE STANDARD DEVIATIONS AWAY FROM THE MEAN INTERPOINT DISTANCE FOR THE QUAD. ASSUMING NO INTERSECTION. *****

FLIGHT LINE NUMBER 102 - LAT: 4.289609E 01; LON: 9.929549E 01; N: 9.957819E 04; E: -2.413500E 04
 VARIABLE VALUE: -3.430000E 02; CLEARANCE: 1.103376E 02 METERS
 TIE LINE NUMBER 210 - LAT: 4.289560E 01; LON: 9.929539E 01; N: 9.952394E 04; E: -2.412771E 04
 VARIABLE VALUE: -3.420000E 02; CLEARANCE: 1.130156E 02 METERS
 >>>>FL POINT -> TL POINT DISTANCE: 3.473749E 01 METERS; CLEARANCE DIFFERENCE: -3.048004E 00 METERS
 >>>>-----> VALUE DIFFERENCE: -1.000000E 00 UNITS

***** THE DISTANCE BETWEEN THE POINT SELECTED FROM FLIGHT LINE 102 AND THE POINT SELECTED FROM TIE LINE 211 IS GREATER *****
 ***** THAN THREE STANDARD DEVIATIONS AWAY FROM THE MEAN INTERPOINT DISTANCE FOR THE QUAD. ASSUMING NO INTERSECTION. *****

***** THE DISTANCE BETWEEN THE POINT SELECTED FROM FLIGHT LINE 102 AND THE POINT SELECTED FROM TIE LINE 212 IS GREATER *****
 ***** THAN THREE STANDARD DEVIATIONS AWAY FROM THE MEAN INTERPOINT DISTANCE FOR THE QUAD. ASSUMING NO INTERSECTION. *****

***** THE DISTANCE BETWEEN THE POINT SELECTED FROM FLIGHT LINE 103 AND THE POINT SELECTED FROM TIE LINE 209 IS GREATER *****
 ***** THAN THREE STANDARD DEVIATIONS AWAY FROM THE MEAN INTERPOINT DISTANCE FOR THE QUAD. ASSUMING NO INTERSECTION. *****

FLIGHT LINE NUMBER 103 - LAT: 4.282430E 01; LON: 9.929610E 01; N: 9.160319E 04; E: -2.421289E 04
 VARIABLE VALUE: -3.630000E 02; CLEARANCE: 1.133036E 02 METERS
 TIE LINE NUMBER 210 - LAT: 4.282320E 01; LON: 9.929610E 01; N: 9.148113E 04; E: -2.421332E 04
 VARIABLE VALUE: -3.620000E 02; CLEARANCE: 1.005068E 02 METERS
 >>>>FL POINT -> TL POINT DISTANCE: 1.220632E 02 METERS; CLEARANCE DIFFERENCE: 4.876801E 00 METERS
 >>>>-----> VALUE DIFFERENCE: -3.000000E 00 UNITS

***** THE DISTANCE BETWEEN THE POINT SELECTED FROM FLIGHT LINE 103 AND THE POINT SELECTED FROM TIE LINE 211 IS GREATER *****
 ***** THAN THREE STANDARD DEVIATIONS AWAY FROM THE MEAN INTERPOINT DISTANCE FOR THE QUAD. ASSUMING NO INTERSECTION. *****

FLIGHT LINE NUMBER 103 - LAT: 4.282489E 01; LON: 9.811069E 01; N: 9.201038E 04; E: 7.272175E 04
 VARIABLE VALUE: -2.310000E 02; CLEARANCE: 1.407424E 02 METERS
 TIE LINE NUMBER 212 - LAT: 4.282399E 01; LON: 9.811069E 01; N: 9.213244E 04; E: 7.272044E 04
 VARIABLE VALUE: -2.300000E 02; CLEARANCE: 1.267968E 02 METERS
 >>>>FL POINT -> TL POINT DISTANCE: 1.220695E 02 METERS; CLEARANCE DIFFERENCE: 2.194560E 01 METERS
 >>>>-----> VALUE DIFFERENCE: -1.000000E 00 UNITS

***** THE DISTANCE BETWEEN THE POINT SELECTED FROM FLIGHT LINE 104 AND THE POINT SELECTED FROM TIE LINE 209 IS GREATER *****
 ***** THAN THREE STANDARD DEVIATIONS AWAY FROM THE MEAN INTERPOINT DISTANCE FOR THE QUAD. ASSUMING NO INTERSECTION. *****

***** THE DISTANCE BETWEEN THE POINT SELECTED FROM FLIGHT LINE 103 AND THE POINT SELECTED FROM TIE LINE 210 IS GREATER *****
 ***** THAN THREE STANDARD DEVIATIONS AWAY FROM THE MEAN INTERPOINT DISTANCE FOR THE QUAD. ASSUMING NO INTERSECTION. *****

***** THE DISTANCE BETWEEN THE POINT SELECTED FROM FLIGHT LINE 104 AND THE POINT SELECTED FROM TIE LINE 211 IS GREATER *****
 ***** THAN THREE STANDARD DEVIATIONS AWAY FROM THE MEAN INTERPOINT DISTANCE FOR THE QUAD. ASSUMING NO INTERSECTION. *****

Appendix E-3 (Cont'd.)

***** THE DISTANCE BETWEEN THE POINT SELECTED FROM FLIGHT LINE 104 AND THE POINT SELECTED FROM TIE LINE 212 IS GREATER *****
***** THAN THREE STANDARD DEVIATIONS AWAY FROM THE MEAN INTERPOINT DISTANCE FOR THE QUAD. ASSUMING NO INTERSECTION. *****

FLIGHT LINE NUMBER 105 - LAT: 4.267940E 01; LON: 9.989040E 01; N: 7.584925E 04; E: -7.290088E 04
VARIABLE VALUE: -3.850000E 02; CLEARANCE: 1.097280E 02 METERS
TIE LINE NUMBER 209 - LAT: 4.267949E 01; LON: 9.989049E 01; N: 7.585950E 04; E: -7.298025E 04
VARIABLE VALUE: -3.850000E 02; CLEARANCE: 1.277112E 02 METERS
>>>>FL POINT -> TL POINT DISTANCE: 1.262747E 01 METERS; CLEARANCE DIFFERENCE: -1.798320E 01 METERS
>>>>-----> VALUE DIFFERENCE: 0.0 UNITS

***** THE DISTANCE BETWEEN THE POINT SELECTED FROM FLIGHT LINE 105 AND THE POINT SELECTED FROM TIE LINE 210 IS GREATER *****
***** THAN THREE STANDARD DEVIATIONS AWAY FROM THE MEAN INTERPOINT DISTANCE FOR THE QUAD. ASSUMING NO INTERSECTION. *****

***** THE DISTANCE BETWEEN THE POINT SELECTED FROM FLIGHT LINE 105 AND THE POINT SELECTED FROM TIE LINE 211 IS GREATER *****
***** THAN THREE STANDARD DEVIATIONS AWAY FROM THE MEAN INTERPOINT DISTANCE FOR THE QUAD. ASSUMING NO INTERSECTION. *****

***** THE DISTANCE BETWEEN THE POINT SELECTED FROM FLIGHT LINE 105 AND THE POINT SELECTED FROM TIE LINE 212 IS GREATER *****
***** THAN THREE STANDARD DEVIATIONS AWAY FROM THE MEAN INTERPOINT DISTANCE FOR THE QUAD. ASSUMING NO INTERSECTION. *****

***** THE DISTANCE BETWEEN THE POINT SELECTED FROM FLIGHT LINE 106 AND THE POINT SELECTED FROM TIE LINE 209 IS GREATER *****
***** THAN THREE STANDARD DEVIATIONS AWAY FROM THE MEAN INTERPOINT DISTANCE FOR THE QUAD. ASSUMING NO INTERSECTION. *****

***** THE DISTANCE BETWEEN THE POINT SELECTED FROM FLIGHT LINE 106 AND THE POINT SELECTED FROM TIE LINE 210 IS GREATER *****
***** THAN THREE STANDARD DEVIATIONS AWAY FROM THE MEAN INTERPOINT DISTANCE FOR THE QUAD. ASSUMING NO INTERSECTION. *****

***** THE DISTANCE BETWEEN THE POINT SELECTED FROM FLIGHT LINE 106 AND THE POINT SELECTED FROM TIE LINE 211 IS GREATER *****
***** THAN THREE STANDARD DEVIATIONS AWAY FROM THE MEAN INTERPOINT DISTANCE FOR THE QUAD. ASSUMING NO INTERSECTION. *****

***** THE DISTANCE BETWEEN THE POINT SELECTED FROM FLIGHT LINE 106 AND THE POINT SELECTED FROM TIE LINE 212 IS GREATER *****
***** THAN THREE STANDARD DEVIATIONS AWAY FROM THE MEAN INTERPOINT DISTANCE FOR THE QUAD. ASSUMING NO INTERSECTION. *****

***** THE DISTANCE BETWEEN THE POINT SELECTED FROM FLIGHT LINE 107 AND THE POINT SELECTED FROM TIE LINE 209 IS GREATER *****
***** THAN THREE STANDARD DEVIATIONS AWAY FROM THE MEAN INTERPOINT DISTANCE FOR THE QUAD. ASSUMING NO INTERSECTION. *****

FLIGHT LINE NUMBER 107 - LAT: 4.253539E 01; LON: 9.929059E 01; N: 5.950867E 04; E: -2.387279E 04
VARIABLE VALUE: -4.610000E 02; CLEARANCE: 1.240536E 02 METERS
TIE LINE NUMBER 210 - LAT: 4.253529E 01; LON: 9.929070E 01; N: 5.949853E 04; E: -2.388159E 04
VARIABLE VALUE: -4.610000E 02; CLEARANCE: 1.143000E 02 METERS
>>>>FL POINT -> TL POINT DISTANCE: 1.343219E 01 METERS; CLEARANCE DIFFERENCE: 9.753601E 00 METERS
>>>>-----> VALUE DIFFERENCE: 0.0 UNITS

+ + + + + B A R G R + + + + +

TITLE: ONEILL, FL/TL INTERSECT; CONTRACTOR MAGNETOM DATA (CAMMAS)

12 VALUES CLASSIFIED; 0 VALUES NOT CLASSIFIED; 12 TOTAL VALUES PROCESSED
CLASS INTERVAL IN USE IS 1.000000D 00

FOR THE CLASSIFIED DATA VALUES: MINIMUM: -3.000000D 00 MAXIMUM: 1.000000D 00
MEAN: -4.166667D-01 STD. DEV.: 9.537936D-01

EACH BARGRAPH SYMBOL REPRESENTS 5.833333D-02 CLASS MEMBERS

Appendix E-3 (Cont'd.)

ONEILL; FL/TL INTERSECT; CONTRACTOR MAGNETOM DATA (GAMMAS)

CLASS LISTING - PAGE 1

01-21-81/18.45.29

CLASS 1 (-3.000000D 00:: -2.000000D 00) 1 MEMBERS
CLASS 3 (-1.000000D 00:: 0.0) 3 MEMBERS
CLASS 5 (1.000000D 00:: 2.000000D 00) 1 MEMBERS

CLASS 2 (-2.000000D 00:: -1.000000D 00) 6 MEMBERS
CLASS 4 (0.0 :: 1.000000D 00) 7 MEMBERS

Appendix E-3 (Cont'd.)

ONEILL; FL/TL INTERSECT; CONTRACTOR MAGNETOM DATA (GAMMAS) CLASS BARGRAPHS - PAGE 1 01-21-81/18.45.29

MEMBERS: 7.000D-01 1.400D 00 2.100D 00 2.800D 00 3.500D 00 4.200D 00 4.900D 00 5.600D 00 6.300D 00 7.000D 00

CLASS 1:*****
 CLASS 2:*****
 CLASS 3:*****
 CLASS 4:*****
 CLASS 5:*****

MEMBERS: 7.000D-01 1.400D 00 2.100D 00 2.800D 00 3.500D 00 4.200D 00 4.900D 00 5.600D 00 6.300D 00 7.000D 00

+ + + + + B A R C R + + + + +

Appendix E-3 (Cont'd.)

+ + + + + B A R G R + + + + +

TITLE: CLEARANCE DIFFERENCES: FL AND TL INTERSECTION POINTS--METERS

12 VALUES CLASSIFIED; 0 VALUES NOT CLASSIFIED; 12 TOTAL VALUES PROCESSED
 CLASS INTERVAL IN USE IS 5.000000D 00

FOR THE CLASSIFIED DATA VALUES:	MINIMUM:	-1.798320D 01	MAXIMUM:	2.194560D 01
	MEAN:	9.651985D-01	STD. DEV.:	1.002126D 01

EACH BARGRAPH SYMBOL REPRESENTS 2.500000D-02 CLASS MEMBERS

CLEARANCE DIFFERENCE: FL AND TL INTERSECTION POINTS--METERS CLASS LISTING - PAGE 1

01-21-81/18.48.30

CLASS 1 (-2.000000D 01:-1.500000D 01) 1 MEMBERS
 CLASS 3 (-1.000000D 01:-0.500000D 00) 2 MEMBERS
 CLASS 5 (0.0 : 0.500000D 00) 3 MEMBERS
 CLASS 7 (1.000000D 01: 1.500000D 01) 1 MEMBERS
 CLASS 9 (2.000000D 01: 2.500000D 01) 1 MEMBERS

CLASS 2 (-1.500000D 01:-1.000000D 01) 0 MEMBERS
 CLASS 4 (-0.500000D 00: 0.0) 0 MEMBERS
 CLASS 6 (0.500000D 00: 1.000000D 01) 1 MEMBERS
 CLASS 8 (1.500000D 01: 2.000000D 01) 0 MEMBERS

Appendix E-3 (Cont'd.)

CLEARANCE DIFFERENCES: FL AND TL INTERSECTION POINTS--METERS CLASS BARGRAPH - PAGE 1

01-21-01/10.40.00

MEMBERS:	3.000D-01	6.000D-01	9.000D-01	1.200D 00	1.500D 00	1.800D 00	2.100D 00	2.400D 00	2.700D 00	3.000D 00
CLASS 1:	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
CLASS 2:	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
CLASS 3:	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
CLASS 4:	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
CLASS 5:	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
CLASS 6:	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
CLASS 7:	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
CLASS 8:	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
CLASS 9:	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
MEMBERS:	3.000D-01	6.000D-01	9.000D-01	1.200D 00	1.500D 00	1.800D 00	2.100D 00	2.400D 00	2.700D 00	3.000D 00

* * * * * B A R G R * * * * *

Appendix E-3 (Cont'd.)

* * * * * B A R G R * * * * *

TITLE: DISTANCES BETWEEN FL AND TL INTERSECTION POINTS - METERS

12 VALUES CLASSIFIED; 0 VALUES NOT CLASSIFIED; 12 TOTAL VALUES PROCESSED
CLASS INTERVAL IN USE IS 1.000000D 01

FOR THE CLASSIFIED DATA VALUES:	MINIMUM:	1.262747D 01	MAXIMUM:	1.220695D 02
	MEAN:	5.602323D 01	STD. DEV.:	4.165111D 01

EACH BARGRAPH SYMBOL REPRESENTS 3.333333D-02 CLASS MEMBERS

Appendix E-3 (Cont'd.)

DISTANCES BETWEEN FL AND TL INTERSECTION POINTS - METERS				CLASS LISTING - PAGE 1		01-21-01/10.45.00
CLASS	1 (1.000000 01:: 2.000000 01)	4 MEMBERS	CLASS	2 (2.000000 01:: 3.000000 01)	3 MEMBERS	
CLASS	3 (3.000000 01:: 4.000000 01)	0 MEMBERS	CLASS	4 (4.000000 01:: 5.000000 01)	0 MEMBERS	0 MEMBERS
CLASS	5 (5.000000 01:: 6.000000 01)	1 MEMBERS	CLASS	6 (6.000000 01:: 7.000000 01)	2 MEMBERS	0 MEMBERS
CLASS	7 (7.000000 01:: 8.000000 01)	1 MEMBERS	CLASS	8 (8.000000 01:: 9.000000 01)	0 MEMBERS	0 MEMBERS
CLASS	9 (9.000000 01:: 1.000000 02)	0 MEMBERS	CLASS	10 (1.000000 02:: 1.100000 02)	0 MEMBERS	0 MEMBERS
CLASS	11 (1.100000 02:: 1.200000 02)	1 MEMBERS	CLASS	12 (1.200000 02:: 1.300000 02)	2 MEMBERS	0 MEMBERS

DISTANCES BETWEEN FL AND TL INTERSECTION POINTS - METERS

CLASS BARGRAPHS - PAGE 1

01-21-51/18.45.00

MEMBERS:	4.000D-01	8.000D-01	1.200D 00	1.600D 00	2.000D 00	2.400D 00	2.800D 00	3.200D 00	3.600D 00	4.000D 00
CLASS 1:	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
CLASS 2:	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
CLASS 3:	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
CLASS 4:	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
CLASS 5:	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
CLASS 6:	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
CLASS 7:	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
CLASS 8:	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
CLASS 9:	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
CLASS 10:	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
CLASS 11:	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
CLASS 12:	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
MEMBERS:	4.000D-01	8.000D-01	1.200D 00	1.600D 00	2.000D 00	2.400D 00	2.800D 00	3.200D 00	3.600D 00	4.000D 00

* * * * * B A R G R * * * * *

Appendix E-3 (Cont'd.)

Appendix E-4

**Time-Based Slope and Dispersion Analysis: Magnetic Monitor Data
For 10-Minute Intervals from Contractor-Supplied Data Set.**

TIME BASED QUALITY EVALUATION *****

DATE JOB RUN: 01-21-01

NAME OF QUADRANGLE: ONEILL, MAGNETIC MONITOR DATA

SOUTHERN LATITUDE: 42.00 NORTHERN LATITUDE: 43.00

EASTERN LONGITUDE: 98.00 WESTERN LONGITUDE: 100.00

FLIGHT LINE OPTION (FL/L/BOH): BOTH

VARIABLE TYPE: MAGNETIC

CLASS INTERVALS

TIME MINUTES	SLOPE CAR/MIN	SIGMA CAR/MIN	REQ CAR/MIN	REQ CAR/MIN
1	0.0	0.0	0.25000E-01	0.0
3	0.0	0.0	0.25000E-01	0.0
10	0.0	0.0	0.25000E-01	0.0

*NOTE: CLASS INTERVAL OF 0.0 WILL CAUSE PROGRAM TO USE DEFAULTS COMPUTED AS 1/50 THE TOTAL INTERVAL IF AND ONLY IF MIN > MAX IN BOUNDARY SELECTION CRITERIA (SEE BELOW).

MIN/MAX BOUNDARIES

MIN/MAX	MIN/MAX	MIN/MAX	MIN/MAX
0.10000E 01	0.10000E 01	-0.10000E 01	0.10000E 01
-0.10000E 01	-0.10000E 01	0.10000E 01	-0.10000E 01
0.10000E 01	0.10000E 01	-0.10000E 01	0.10000E 01
-0.10000E 01	-0.10000E 01	0.10000E 01	-0.10000E 01
0.10000E 01	0.10000E 01	-0.10000E 01	0.10000E 01
-0.10000E 01	-0.10000E 01	0.10000E 01	-0.10000E 01

*NOTE: MIN > MAX WILL CAUSE PROGRAM TO COMPUTE BOUNDARIES WITHIN 2 STANDARD DEVIATIONS OF THE MEAN. MIN = 0. WILL CAUSE PROGRAM TO USE ACTUAL DATA MIN/MAX.

NUMBER OF RECS: 420

♦ ♦ ♦ ♦ ♦ ♦ ♦ ♦ ♦ ♦ B A R C R ♦ ♦ ♦ ♦ ♦ ♦ ♦ ♦ ♦ ♦

TITLE: ONEILL, MAGNETIC MONITOR DATA

SLOPE 10 RIR

64 VALUES CLASSIFIED, 8 VALUES NOT CLASSIFIED, 69 TOTAL VALUES PROCESSED
CLASS INTERVAL IN USE IS 1.788333D-02

FOR THE CLASSIFIED DATA VALUES:	MINIMUM:	-3.891836D-01	MAXIMUM:	4.062960D-01
	MEAN:	8.170177D-03	STD. DEV.:	1.810348D-01

EACH BARGRAPH SYMBOL REPRESENTS 4.166667D-02 CLASS MEMBERS

FOR THE ENTIRE DATA SET:	MINIMUM:	-5.190121D-01	MAXIMUM:	6.266851D-01
	MEAN:	-1.174775D-02	STD. DEV.:	2.205416D-01

Appendix E-4 (Cont'd.)

ONEILL, RACHETIC MONITOR DATA			CLASS LISTING - PAGE 1		01-21-01/18.46.34	
CLASS	1	SLOPE	10 MIN	CLASS LISTING - PAGE 1		
CLASS 1	(-0.64966D-01:-4.47083D-01)		0 MEMBERS	CLASS 2	(-4.47083D-01:-4.29199D-01)	0 MEMBERS
CLASS 3	(-4.29199D-01:-4.11316D-01)		0 MEMBERS	CLASS 4	(-4.11316D-01:-3.93433D-01)	0 MEMBERS
CLASS 5	(-3.93433D-01:-3.75549D-01)		0 MEMBERS	CLASS 6	(-3.75549D-01:-3.57666D-01)	1 MEMBERS
CLASS 7	(-3.57666D-01:-3.39783D-01)		1 MEMBERS	CLASS 8	(-3.39783D-01:-3.21899D-01)	0 MEMBERS
CLASS 9	(-3.21899D-01:-3.04016D-01)		2 MEMBERS	CLASS 10	(-3.04016D-01:-2.86133D-01)	1 MEMBERS
CLASS 11	(-2.86133D-01:-2.68249D-01)		1 MEMBERS	CLASS 12	(-2.68249D-01:-2.50366D-01)	0 MEMBERS
CLASS 13	(-2.50366D-01:-2.32483D-01)		0 MEMBERS	CLASS 14	(-2.32483D-01:-2.14599D-01)	1 MEMBERS
CLASS 15	(-2.14599D-01:-1.96716D-01)		2 MEMBERS	CLASS 16	(-1.96716D-01:-1.78833D-01)	1 MEMBERS
CLASS 17	(-1.78833D-01:-1.60936D-01)		2 MEMBERS	CLASS 18	(-1.60936D-01:-1.43066D-01)	0 MEMBERS
CLASS 19	(-1.43066D-01:-1.25183D-01)		4 MEMBERS	CLASS 20	(-1.25183D-01:-1.07300D-01)	3 MEMBERS
CLASS 21	(-1.07300D-01:-8.94164D-02)		2 MEMBERS	CLASS 22	(-8.94164D-02:-7.18331D-02)	1 MEMBERS
CLASS 23	(-7.18331D-02:-5.36499D-02)		1 MEMBERS	CLASS 24	(-5.36499D-02:-3.57666D-02)	1 MEMBERS
CLASS 25	(-3.57666D-02:-1.78833D-02)		3 MEMBERS	CLASS 26	(-1.78833D-02:-0.0)	0 MEMBERS
CLASS 27	(0.0)		3 MEMBERS	CLASS 28	(1.78833D-02:-3.57666D-02)	5 MEMBERS
CLASS 29	(3.57666D-02:-5.36499D-02)		4 MEMBERS	CLASS 30	(5.36499D-02:-7.18331D-02)	2 MEMBERS
CLASS 31	(7.18331D-02:-8.94164D-02)		4 MEMBERS	CLASS 32	(8.94164D-02:-1.07300D-01)	2 MEMBERS
CLASS 33	(1.07300D-01:-1.25183D-01)		1 MEMBERS	CLASS 34	(1.25183D-01:-1.43066D-01)	2 MEMBERS
CLASS 35	(1.43066D-01:-1.60936D-01)		3 MEMBERS	CLASS 36	(1.60936D-01:-1.78833D-01)	0 MEMBERS
CLASS 37	(1.78833D-01:-1.96716D-01)		2 MEMBERS	CLASS 38	(1.96716D-01:-2.14599D-01)	1 MEMBERS
CLASS 39	(2.14599D-01:-2.32483D-01)		0 MEMBERS	CLASS 40	(2.32483D-01:-2.50366D-01)	1 MEMBERS
CLASS 41	(2.50366D-01:-2.68249D-01)		0 MEMBERS	CLASS 42	(2.68249D-01:-2.86133D-01)	3 MEMBERS
CLASS 43	(2.86133D-01:-3.04016D-01)		0 MEMBERS	CLASS 44	(3.04016D-01:-3.21899D-01)	1 MEMBERS
CLASS 45	(3.21899D-01:-3.39783D-01)		0 MEMBERS	CLASS 46	(3.39783D-01:-3.57666D-01)	1 MEMBERS
CLASS 47	(3.57666D-01:-3.75549D-01)		1 MEMBERS	CLASS 48	(3.75549D-01:-3.93433D-01)	0 MEMBERS
CLASS 49	(3.93433D-01:-4.11316D-01)		1 MEMBERS	CLASS 50	(4.11316D-01:-4.29199D-01)	0 MEMBERS

Appendix E-4 (Cont'd.)

ONEILL, MAGNETIC MONITOR DATA SLOPE 10 MIN CLASS BARGRAPHS - PAGE 1 01-21-81/18.44.34

NUMBERS:	5.000D-01	1.000D 00	1.000D 00	2.000D 00	2.000D 00	3.000D 00	3.000D 00	4.000D 00	4.000D 00	5.000D 00	5.000D 00	6.000D 00	6.000D 00	7.000D 00	7.000D 00	8.000D 00	8.000D 00	9.000D 00	9.000D 00	10.000D 00	10.000D 00	11.000D 00	11.000D 00	12.000D 00	12.000D 00	13.000D 00	13.000D 00	14.000D 00	14.000D 00	15.000D 00	15.000D 00	16.000D 00	16.000D 00	17.000D 00	17.000D 00	18.000D 00	18.000D 00	19.000D 00	19.000D 00	20.000D 00	20.000D 00	21.000D 00	21.000D 00	22.000D 00	22.000D 00	23.000D 00	23.000D 00	24.000D 00	24.000D 00	25.000D 00	25.000D 00	26.000D 00	26.000D 00	27.000D 00	27.000D 00	28.000D 00	28.000D 00	29.000D 00	29.000D 00	30.000D 00	30.000D 00	31.000D 00	31.000D 00	32.000D 00	32.000D 00	33.000D 00	33.000D 00	34.000D 00	34.000D 00	35.000D 00	35.000D 00	36.000D 00	36.000D 00	37.000D 00	37.000D 00	38.000D 00	38.000D 00	39.000D 00	39.000D 00	40.000D 00	40.000D 00	41.000D 00	41.000D 00	42.000D 00	42.000D 00	43.000D 00	43.000D 00	44.000D 00	44.000D 00	45.000D 00	45.000D 00
CLASS	1:	2:	3:	4:	5:	6:	7:	8:	9:	10:	11:	12:	13:	14:	15:	16:	17:	18:	19:	20:	21:	22:	23:	24:	25:	26:	27:	28:	29:	30:	31:	32:	33:	34:	35:	36:	37:	38:	39:	40:	41:	42:	43:	44:	45:																																														

NUMBERS: 5.000D-01 1.000D 00 1.000D 00 2.000D 00 2.000D 00 3.000D 00 3.000D 00 4.000D 00 4.000D 00 5.000D 00 5.000D 00 6.000D 00 6.000D 00 7.000D 00 7.000D 00 8.000D 00 8.000D 00 9.000D 00 9.000D 00 10.000D 00 10.000D 00 11.000D 00 11.000D 00 12.000D 00 12.000D 00 13.000D 00 13.000D 00 14.000D 00 14.000D 00 15.000D 00 15.000D 00 16.000D 00 16.000D 00 17.000D 00 17.000D 00 18.000D 00 18.000D 00 19.000D 00 19.000D 00 20.000D 00 20.000D 00 21.000D 00 21.000D 00 22.000D 00 22.000D 00 23.000D 00 23.000D 00 24.000D 00 24.000D 00 25.000D 00 25.000D 00 26.000D 00 26.000D 00 27.000D 00 27.000D 00 28.000D 00 28.000D 00 29.000D 00 29.000D 00 30.000D 00 30.000D 00 31.000D 00 31.000D 00 32.000D 00 32.000D 00 33.000D 00 33.000D 00 34.000D 00 34.000D 00 35.000D 00 35.000D 00 36.000D 00 36.000D 00 37.000D 00 37.000D 00 38.000D 00 38.000D 00 39.000D 00 39.000D 00 40.000D 00 40.000D 00 41.000D 00 41.000D 00 42.000D 00 42.000D 00 43.000D 00 43.000D 00 44.000D 00 44.000D 00 45.000D 00 45.000D 00

ONEILL, MAGNETIC MONITOR DATA

SLOPE 10 MIN CLASS BARGRAPHS - PAGE 2

01-21-81/18.46.34

MEMBERS:	5.000D-01	1.000D 00	1.500D 00	2.000D 00	2.500D 00	3.000D 00	3.500D 00	4.000D 00	4.500D 00	5.000D 00
CLASS 46:*****										
CLASS 47:*****										
CLASS 48:										
CLASS 49:*****										
CLASS 50:										
MEMBERS:	5.000D-01	1.000D 00	1.500D 00	2.000D 00	2.500D 00	3.000D 00	3.500D 00	4.000D 00	4.500D 00	5.000D 00

+ + + + + B A R G R + + + + +

+ + + + + B A R C R + + + + +

TITLE: ONEILL, MAGNETIC MONITOR DATA

SIGMA 10 MIN

46 VALUES CLASSIFIED, 3 VALUES NOT CLASSIFIED, 49 TOTAL VALUES PROCESSED
CLASS INTERVAL IN USE IS 9.742038D-03

FOR THE CLASSIFIED DATA VALUES:	MINIMUM:	1.097680D-01	MAXIMUM:	4.821131D-01
	MEAN:	2.806313D-01	STD. DEV.:	8.698461D-02

EACH BARGRAPH SYMBOL REPRESENTS 8.833333D-02 CLASS MEMBERS

FOR THE ENTIRE DATA SET:	MINIMUM:	1.097680D-01	MAXIMUM:	8.844128D-01
	MEAN:	2.675466D-01	STD. DEV.:	1.217733D-01

Appendix E-4 (Cont'd.)

Appendix E-4 (Cont'd.)

ONEILL, MAGNETIC MONITOR DATA			CLASS LISTING - PAGE 1			01-21-01/10.46.07	
CLASS	SIGNA	10 MIN	CLASS	MEMBERS	CLASS	MEMBERS	MEMBERS
CLASS 1 (1.948408D-02:: 2.922611D-02)		0 MEMBERS	CLASS 2 (2.922611D-02:: 3.096815D-02)				0 MEMBERS
CLASS 3 (3.896815D-02:: 4.871019D-02)		0 MEMBERS	CLASS 4 (4.871019D-02:: 5.845233D-02)				0 MEMBERS
CLASS 5 (5.845233D-02:: 6.819427D-02)		0 MEMBERS	CLASS 6 (6.819427D-02:: 7.793631D-02)				0 MEMBERS
CLASS 7 (7.793631D-02:: 8.767834D-02)		0 MEMBERS	CLASS 8 (8.767834D-02:: 9.742038D-02)				0 MEMBERS
CLASS 9 (9.742038D-02:: 1.071624D-01)		0 MEMBERS	CLASS 10 (1.071624D-01:: 1.169045D-01)				1 MEMBERS
CLASS 11 (1.169045D-01:: 1.266465D-01)		1 MEMBERS	CLASS 12 (1.266465D-01:: 1.363885D-01)				0 MEMBERS
CLASS 13 (1.363885D-01:: 1.461306D-01)		1 MEMBERS	CLASS 14 (1.461306D-01:: 1.558726D-01)				2 MEMBERS
CLASS 15 (1.558726D-01:: 1.656147D-01)		3 MEMBERS	CLASS 16 (1.656147D-01:: 1.753567D-01)				4 MEMBERS
CLASS 17 (1.753567D-01:: 1.850987D-01)		4 MEMBERS	CLASS 18 (1.850987D-01:: 1.948408D-01)				2 MEMBERS
CLASS 19 (1.948408D-01:: 2.045828D-01)		3 MEMBERS	CLASS 20 (2.045828D-01:: 2.143248D-01)				6 MEMBERS
CLASS 21 (2.143248D-01:: 2.240669D-01)		7 MEMBERS	CLASS 22 (2.240669D-01:: 2.338089D-01)				5 MEMBERS
CLASS 23 (2.338089D-01:: 2.435510D-01)		0 MEMBERS	CLASS 24 (2.435510D-01:: 2.532930D-01)				2 MEMBERS
CLASS 25 (2.532930D-01:: 2.630350D-01)		4 MEMBERS	CLASS 26 (2.630350D-01:: 2.727771D-01)				0 MEMBERS
CLASS 27 (2.727771D-01:: 2.825191D-01)		1 MEMBERS	CLASS 28 (2.825191D-01:: 2.922611D-01)				2 MEMBERS
CLASS 29 (2.922611D-01:: 3.020032D-01)		3 MEMBERS	CLASS 30 (3.020032D-01:: 3.117452D-01)				1 MEMBERS
CLASS 31 (3.117452D-01:: 3.214873D-01)		0 MEMBERS	CLASS 32 (3.214873D-01:: 3.312293D-01)				0 MEMBERS
CLASS 33 (3.312293D-01:: 3.409713D-01)		2 MEMBERS	CLASS 34 (3.409713D-01:: 3.507134D-01)				2 MEMBERS
CLASS 35 (3.507134D-01:: 3.604554D-01)		0 MEMBERS	CLASS 36 (3.604554D-01:: 3.701975D-01)				1 MEMBERS
CLASS 37 (3.701975D-01:: 3.799395D-01)		1 MEMBERS	CLASS 38 (3.799395D-01:: 3.896815D-01)				1 MEMBERS
CLASS 39 (3.896815D-01:: 3.994236D-01)		2 MEMBERS	CLASS 40 (3.994236D-01:: 4.091656D-01)				1 MEMBERS
CLASS 41 (4.091656D-01:: 4.189076D-01)		0 MEMBERS	CLASS 42 (4.189076D-01:: 4.286497D-01)				0 MEMBERS
CLASS 43 (4.286497D-01:: 4.383917D-01)		1 MEMBERS	CLASS 44 (4.383917D-01:: 4.481338D-01)				1 MEMBERS
CLASS 45 (4.481338D-01:: 4.578758D-01)		1 MEMBERS	CLASS 46 (4.578758D-01:: 4.676178D-01)				0 MEMBERS
CLASS 47 (4.676178D-01:: 4.773599D-01)		0 MEMBERS	CLASS 48 (4.773599D-01:: 4.871019D-01)				1 MEMBERS
CLASS 49 (4.871019D-01:: 4.968440D-01)		0 MEMBERS	CLASS 50 (4.968440D-01:: 5.065860D-01)				0 MEMBERS

MEMBERS:	7.000D-01	1.400D 00	2.100D 00	2.800D 00	3.500D 00	4.200D 00	4.900D 00	5.600D 00	6.300D 00	7.000D 00
CLASS 1:										
CLASS 2:										
CLASS 3:										
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CLASS 41:										
CLASS 42:										
CLASS 43:	*****									
CLASS 44:	*****									
CLASS 45:	*****									

ONEILL, MAGNETIC MONITOR DATA

SIGMA 10 MIN CLASS BARGRAPHS - PAGE 2

01-21-01/18.46.37

MEMBERS: 7.000D-01 1.400D 00 2.100D 00 2.800D 00 3.500D 00 4.200D 00 4.900D 00 5.600D 00 6.300D 00 7.000D 00

CLASS 46:

CLASS 47:

CLASS 48:*****

CLASS 49:

CLASS 50:

MEMBERS: 7.000D-01 1.400D 00 2.100D 00 2.800D 00 3.500D 00 4.200D 00 4.900D 00 5.600D 00 6.300D 00 7.000D 00

+ + + + + B A R C R + + + + +

Appendix E-4 (Cont'd.)

+ + + + + B A R G R + + + + +

TITLE: ONEILL, MAGNETIC MONITOR DATA

RHO 10 MIN

69 VALUES CLASSIFIED; 0 VALUES NOT CLASSIFIED; 69 TOTAL VALUES PROCESSED
CLASS INTERVAL IN USE IS 2.500000D-02

FOR THE CLASSIFIED DATA VALUES:	MINIMUM:	-9.529399D-01	MAXIMUM:	9.685546D-01
	MEAN:	1.190321D-02	STD. DEV.:	6.613176D-01

EACH BARGRAPH SYMBOL REPRESENTS 4.166667D-02 CLASS MEMBERS

Appendix E-4 (Cont'd.)

OREILL, MAGNETIC MONITOR DATA			CLASS LISTING - PAGE 1		91-21-81/18.46.40	
NO	MIN	MEMBERS	CLASS	2	MEMBERS	MEMBERS
CLASS 1	1	MEMBERS	CLASS 2	2	MEMBERS	MEMBERS
CLASS 3	3	MEMBERS	CLASS 4	4	MEMBERS	MEMBERS
CLASS 5	5	MEMBERS	CLASS 6	6	MEMBERS	MEMBERS
CLASS 7	7	MEMBERS	CLASS 8	8	MEMBERS	MEMBERS
CLASS 9	9	MEMBERS	CLASS 10	10	MEMBERS	MEMBERS
CLASS 11	11	MEMBERS	CLASS 12	12	MEMBERS	MEMBERS
CLASS 13	13	MEMBERS	CLASS 14	14	MEMBERS	MEMBERS
CLASS 15	15	MEMBERS	CLASS 16	16	MEMBERS	MEMBERS
CLASS 17	17	MEMBERS	CLASS 18	18	MEMBERS	MEMBERS
CLASS 19	19	MEMBERS	CLASS 20	20	MEMBERS	MEMBERS
CLASS 21	21	MEMBERS	CLASS 22	22	MEMBERS	MEMBERS
CLASS 23	23	MEMBERS	CLASS 24	24	MEMBERS	MEMBERS
CLASS 25	25	MEMBERS	CLASS 26	26	MEMBERS	MEMBERS
CLASS 27	27	MEMBERS	CLASS 28	28	MEMBERS	MEMBERS
CLASS 29	29	MEMBERS	CLASS 30	30	MEMBERS	MEMBERS
CLASS 31	31	MEMBERS	CLASS 32	32	MEMBERS	MEMBERS
CLASS 33	33	MEMBERS	CLASS 34	34	MEMBERS	MEMBERS
CLASS 35	35	MEMBERS	CLASS 36	36	MEMBERS	MEMBERS
CLASS 37	37	MEMBERS	CLASS 38	38	MEMBERS	MEMBERS
CLASS 39	39	MEMBERS	CLASS 40	40	MEMBERS	MEMBERS
CLASS 41	41	MEMBERS	CLASS 42	42	MEMBERS	MEMBERS
CLASS 43	43	MEMBERS	CLASS 44	44	MEMBERS	MEMBERS
CLASS 45	45	MEMBERS	CLASS 46	46	MEMBERS	MEMBERS
CLASS 47	47	MEMBERS	CLASS 48	48	MEMBERS	MEMBERS
CLASS 49	49	MEMBERS	CLASS 50	50	MEMBERS	MEMBERS

Appendix E-4 (Cont'd.)

ONEILL; MAGNETIC MONITOR DATA	REQ	10 MIN	CLASS LISTING - PAGE 2	01-21-01/10.46.40
CLASS 51 (2.250000D-01:: 2.500000D-01)	1 MEMBERS	CLASS 52 (2.500000D-01:: 2.750000D-01)	0 MEMBERS	
CLASS 53 (2.750000D-01:: 3.000000D-01)	2 MEMBERS	CLASS 54 (3.000000D-01:: 3.250000D-01)	1 MEMBERS	
CLASS 55 (3.250000D-01:: 3.500000D-01)	1 MEMBERS	CLASS 56 (3.500000D-01:: 3.750000D-01)	0 MEMBERS	
CLASS 57 (3.750000D-01:: 4.000000D-01)	1 MEMBERS	CLASS 58 (4.000000D-01:: 4.250000D-01)	1 MEMBERS	
CLASS 59 (4.250000D-01:: 4.500000D-01)	2 MEMBERS	CLASS 60 (4.500000D-01:: 4.750000D-01)	0 MEMBERS	
CLASS 61 (4.750000D-01:: 5.000000D-01)	2 MEMBERS	CLASS 62 (5.000000D-01:: 5.250000D-01)	3 MEMBERS	
CLASS 63 (5.250000D-01:: 5.500000D-01)	1 MEMBERS	CLASS 64 (5.500000D-01:: 5.750000D-01)	1 MEMBERS	
CLASS 65 (5.750000D-01:: 6.000000D-01)	0 MEMBERS	CLASS 66 (6.000000D-01:: 6.250000D-01)	2 MEMBERS	
CLASS 67 (6.250000D-01:: 6.500000D-01)	1 MEMBERS	CLASS 68 (6.500000D-01:: 6.750000D-01)	0 MEMBERS	
CLASS 69 (6.750000D-01:: 7.000000D-01)	1 MEMBERS	CLASS 70 (7.000000D-01:: 7.250000D-01)	1 MEMBERS	
CLASS 71 (7.250000D-01:: 7.500000D-01)	0 MEMBERS	CLASS 72 (7.500000D-01:: 7.750000D-01)	1 MEMBERS	
CLASS 73 (7.750000D-01:: 8.000000D-01)	1 MEMBERS	CLASS 74 (8.000000D-01:: 8.250000D-01)	0 MEMBERS	
CLASS 75 (8.250000D-01:: 8.499999D-01)	1 MEMBERS	CLASS 76 (8.499999D-01:: 8.749999D-01)	2 MEMBERS	
CLASS 77 (8.749999D-01:: 8.999999D-01)	0 MEMBERS	CLASS 78 (8.999999D-01:: 9.249999D-01)	3 MEMBERS	
CLASS 79 (9.249999D-01:: 9.499999D-01)	3 MEMBERS	CLASS 80 (9.499999D-01:: 9.749999D-01)	1 MEMBERS	
CLASS 81 (9.749999D-01:: 9.999999D-01)	0 MEMBERS	CLASS 82 (9.999999D-01:: 1.025000D-00)	0 MEMBERS	

ORZILL, MAGNETIC MONITOR DATA				RHO				10 MIN CLASS BARGRAPHS - PAGE 1				01-21-81/18,46.40			
MEMBERS:				5.000D-01	1.000D 00	1.500D 00	2.000D 00	2.500D 00	3.000D 00	3.500D 00	4.000D 00	4.500D 00	5.000D 00		
CLASS	1:														
CLASS	2:														
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CLASS	43:														
CLASS	44:														
CLASS	45:														
MEMBERS:				5.000D-01	1.000D 00	1.500D 00	2.000D 00	2.500D 00	3.000D 00	3.500D 00	4.000D 00	4.500D 00	5.000D 00		

ONEILL, MAGNETIC MONITOR DATA

RRO 10 NIN CLASS BARGRAPHS - PAGE 2

01-21-81/18.46.40

MEMBERS:	5.000D-01	1.000D 00	1.500D 00	2.000D 00	2.500D 00	3.000D 00	3.500D 00	4.000D 00	4.500D 00	5.000D 00
CLASS 46:										
CLASS 47:*****										
CLASS 48:*****										
CLASS 49:										
CLASS 50:*****										
CLASS 51:*****										
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CLASS 81:										
CLASS 82:										

+ + + + + B A R G R + + + + +

Appendix E-4 (Cont'd.)

+ + + + + B A N C R + + + + +

TITLE: ONEILL, MAGNETIC MONITOR DATA LMRZ 10 MIN

67 VALUES CLASSIFIED; 2 VALUES NOT CLASSIFIED; 69 TOTAL VALUES PROCESSED
 CLASS INTERVAL IN USE IS 2.148851D-02

FOR THE CLASSIFIED DATA VALUES:	MINIMUM:	1.154021D-01	MAXIMUM:	9.417404D-01
	MEAN:	4.403098D-01	STD. DEV.:	1.817512D-01

EACH BANCGRAPH SYMBOL REPRESENTS 5.833333D-02 CLASS MEMBERS

FOR THE ENTIRE DATA SET:	MINIMUM:	1.154021D-01	MAXIMUM:	2.030477D 00
	MEAN:	4.713310D-01	STD. DEV.:	2.686063D-01

Appendix E-4 (Cont'd.)

ONEILL, MAGNETIC MONITOR DATA			CLASS LISTING - PAGE 1			01-21-81/18.46.44	
		LINE	10 MIN	MEMBERS	CLASS	2 (-6.446532D-02:: -4.297701D-02)	MEMBERS
CLASS 1	(-8.595402D-02:: -6.446532D-02)		0	MEMBERS	CLASS 2	(-6.446532D-02:: -4.297701D-02)	0
CLASS 3	(-4.297701D-02:: -2.148851D-02)		0	MEMBERS	CLASS 4	(-2.148851D-02:: 0.0)	0
CLASS 5	(0.0:: 2.148851D-02)		0	MEMBERS	CLASS 6	(2.148851D-02:: 4.297701D-02)	0
CLASS 7	(4.297701D-02:: 6.446532D-02)		0	MEMBERS	CLASS 8	(6.446532D-02:: 8.595402D-02)	0
CLASS 9	(8.595402D-02:: 1.074425D-01)		0	MEMBERS	CLASS 10	(1.074425D-01:: 1.289310D-01)	1
CLASS 11	(1.289310D-01:: 1.504193D-01)		0	MEMBERS	CLASS 12	(1.504193D-01:: 1.719086D-01)	1
CLASS 13	(1.719086D-01:: 1.933966D-01)		2	MEMBERS	CLASS 14	(1.933966D-01:: 2.148851D-01)	1
CLASS 15	(2.148851D-01:: 2.363736D-01)		1	MEMBERS	CLASS 16	(2.363736D-01:: 2.578621D-01)	1
CLASS 17	(2.578621D-01:: 2.793306D-01)		1	MEMBERS	CLASS 18	(2.793306D-01:: 3.008391D-01)	4
CLASS 19	(3.008391D-01:: 3.223275D-01)		7	MEMBERS	CLASS 20	(3.223275D-01:: 3.438161D-01)	2
CLASS 21	(3.438161D-01:: 3.653046D-01)		3	MEMBERS	CLASS 22	(3.653046D-01:: 3.867931D-01)	4
CLASS 23	(3.867931D-01:: 4.082816D-01)		3	MEMBERS	CLASS 24	(4.082816D-01:: 4.297701D-01)	5
CLASS 25	(4.297701D-01:: 4.512586D-01)		7	MEMBERS	CLASS 26	(4.512586D-01:: 4.727471D-01)	1
CLASS 27	(4.727471D-01:: 4.942356D-01)		1	MEMBERS	CLASS 28	(4.942356D-01:: 5.157241D-01)	2
CLASS 29	(5.157241D-01:: 5.372126D-01)		2	MEMBERS	CLASS 30	(5.372126D-01:: 5.587012D-01)	1
CLASS 31	(5.587012D-01:: 5.801897D-01)		2	MEMBERS	CLASS 32	(5.801897D-01:: 6.016782D-01)	1
CLASS 33	(6.016782D-01:: 6.231667D-01)		1	MEMBERS	CLASS 34	(6.231667D-01:: 6.446532D-01)	0
CLASS 35	(6.446532D-01:: 6.661437D-01)		4	MEMBERS	CLASS 36	(6.661437D-01:: 6.876322D-01)	0
CLASS 37	(6.876322D-01:: 7.091207D-01)		0	MEMBERS	CLASS 38	(7.091207D-01:: 7.306092D-01)	1
CLASS 39	(7.306092D-01:: 7.520977D-01)		1	MEMBERS	CLASS 40	(7.520977D-01:: 7.735862D-01)	0
CLASS 41	(7.735862D-01:: 7.950747D-01)		1	MEMBERS	CLASS 42	(7.950747D-01:: 8.165632D-01)	0
CLASS 43	(8.165632D-01:: 8.380517D-01)		0	MEMBERS	CLASS 44	(8.380517D-01:: 8.595402D-01)	1
CLASS 45	(8.595402D-01:: 8.810287D-01)		0	MEMBERS	CLASS 46	(8.810287D-01:: 9.025172D-01)	1
CLASS 47	(9.025172D-01:: 9.240058D-01)		1	MEMBERS	CLASS 48	(9.240058D-01:: 9.454943D-01)	1
CLASS 49	(9.454943D-01:: 9.669828D-01)		0	MEMBERS	CLASS 50	(9.669828D-01:: 9.884713D-01)	0

[illegible]

ONEILL, MAGNETIC MONITOR DATA

LMSE 10 MIN CLASS BARGRAPHS - PAGE 2

01-21-81/18.46.44

MEMBERS:	7.000D-01	1.400D 00	2.100D 00	2.800D 00	3.500D 00	4.200D 00	4.900D 00	5.600D 00	6.300D 00	7.000D 00
CLASS 46:	*****									
CLASS 47:	*****									
CLASS 48:	*****									
CLASS 49:										
CLASS 50:										
MEMBERS:	7.000D-01	1.400D 00	2.100D 00	2.800D 00	3.500D 00	4.200D 00	4.900D 00	5.600D 00	6.300D 00	7.000D 00

* * * * * B A R G R * * * * *

Appendix E-4 (Cont'd.)

***** SUMMARY PAGE *****

TITLE : ONEILL, MAGNETIC MONITOR DATA

ATTRIBUTE : MAGNON

SLOPE : MIN

 MINIMUM VALUE : -3.333838E-00
 MAXIMUM VALUE : 4.242567E-00
 ARITHMETIC MEAN : -2.068344E-02
 MEDIAN ESTIMATE : 3.141457E-03
 MODE ESTIMATE : 5.079123E-02

SIGMA : MIN

 MINIMUM VALUE : 2.018955E-02
 MAXIMUM VALUE : 7.041337E-01
 ARITHMETIC MEAN : 1.900012E-01
 MEDIAN ESTIMATE : 1.823321E-01
 MODE ESTIMATE : 1.676338E-01

RHO : MIN

 MINIMUM VALUE : -9.810817E-01
 MAXIMUM VALUE : 9.427334E-01
 ARITHMETIC MEAN : -1.120945E-02
 MEDIAN ESTIMATE : 5.350674E-03
 MODE ESTIMATE : 3.865492E-02

LNSE : MIN

 MINIMUM VALUE : 1.265049E-01
 MAXIMUM VALUE : 9.609215E-01
 ARITHMETIC MEAN : 3.148095E-01
 MEDIAN ESTIMATE : 3.018604E-01
 MODE ESTIMATE : 2.759861E-01

Appendix E-4 (Cont'd.)

***** SUMMARY PAGE *****

TITLE : OREILLI MAGNETIC MONITOR DATA

ATTRIBUTE : MAGNON

SLOPE 3 MIN

 MINIMUM VALUE : -2.095504E-00
 MAXIMUM VALUE : 1.875623E-00
 ARITHMETIC MEAN : -2.800926E-02
 MEDIAN ESTIMATE : -1.240007E-03
 MODE ESTIMATE : 5.229822E-02

SIGNA 3 MIN

 MINIMUM VALUE : 7.434583E-02
 MAXIMUM VALUE : 6.621737E-01
 ARITHMETIC MEAN : 2.003709E-01
 MEDIAN ESTIMATE : 1.923652E-01
 MODE ESTIMATE : 1.759337E-01

RHO 3 MIN

 MINIMUM VALUE : -9.779524E-01
 MAXIMUM VALUE : 9.471939E-01
 ARITHMETIC MEAN : -1.096820E-02
 MEDIAN ESTIMATE : -2.895361E-03
 MODE ESTIMATE : 1.320031E-02

LNSE 3 MIN

 MINIMUM VALUE : 7.540440E-02
 MAXIMUM VALUE : 1.251118E-00
 ARITHMETIC MEAN : 3.365740E-01
 MEDIAN ESTIMATE : 3.209091E-01
 MODE ESTIMATE : 2.895792E-01

Appendix E-4 (Cont'd.)

***** SUMMARY PAGE *****

TITLE : ONEILL: MAGNETIC MONITOR DATA

ATTRIBUTE : MAGNON

SLOPE 10 MIN

 MINIMUM VALUE : -5.196120E-01
 MAXIMUM VALUE : 6.266031E-01
 ARITHMETIC MEAN : -1.174773E-02
 MEDIAN ESTIMATE : 1.973736E-02
 MODE ESTIMATE : 8.276733E-02

SIGMA 10 MIN

 MINIMUM VALUE : 1.097649E-01
 MAXIMUM VALUE : 8.844128E-01
 ARITHMETIC MEAN : 2.673466E-01
 MEDIAN ESTIMATE : 2.241603E-01
 MODE ESTIMATE : 1.379078E-01

RHO 10 MIN

 MINIMUM VALUE : -9.529399E-01
 MAXIMUM VALUE : 9.683346E-01
 ARITHMETIC MEAN : 1.190321E-02
 MEDIAN ESTIMATE : 1.633384E-01
 MODE ESTIMATE : 4.662687E-01

LMSE 10 MIN

 MINIMUM VALUE : 1.154021E-01
 MAXIMUM VALUE : 2.030477E-00
 ARITHMETIC MEAN : 4.713310E-01
 MEDIAN ESTIMATE : 4.148297E-01
 MODE ESTIMATE : 3.018270E-01

Appendix E-4 (Cont'd.)

APPENDIX F

FINAL PRODUCTS PROCESSING FLOW CHART

Appendix F

Final Products Processing Flow Chart

Appendix F (Cont'd.)

Appendix F (Cont'd.)

Appendix F (Cont'd.)

Appendix F (Cont'd.)

Appendix F (Cont'd.)

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