Technical Report No. 287

GRASSLANDS LAB INFORMATION MANAGEMENT SYSTEM: USER'S MANUAL

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GRASSLAND BIOME

U.S. International Biological Program

August 1975

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ABSTRACT

The Grasslands Lab Information Management System is an information storage and retrieval system designed to reduce the clerical work in the Analytical Chemcial Facility (ACF) and to provide a unified data library or "bank" of the requests for analysis and results of analysis of samples collected at various Grassland Biome sites. The computer programs were written to be run on the CDC 6400 computer at Colorado State University. This document reviews operation of the ACF prior to GLIMS, ACF procedure after implementation of GLIMS and presents instructions on the use of the GLIMS system for data bank creation and management and for retrieval of information from the data bank.

INTRODUCTION

The Grasslands Lab Information Management System, GLIMS, is a computerized information storage and retrieval system designed by William Ferguson, Unab Bokhari, and Bob Robinson. System programming was done by Bob Robinson, subsequent modification and maintenance programming was done by Jerry Peltz. The programs comprising the GLIMS system were written to be run on the CDC 6400 computer at Colorado State University.

The purposes of the system are to assist the chemical lab director with management of the laboratory, reduce clerical work within the laboratory to a minimum and provide a unified method and source for retrieving information from the data bank.

This document discusses procedures in the Chem Lab prior to implementing GLIMS; The design of the system; Use of the Chem Bank Maintenance Program; Use of the Chem Bank Retrieval Program. A separate document, the GLIMS System Program Maintenance Manual describes the programs in detail.

The Natural Resource Ecology Laboratory is the headquarters for the United States Grassland Biome portion of the International Biological Program. The NREL has become the central data facility for all data collected at 11 Grassland Biome sites and also houses the Analytical Chemistry Facility (ACF) for processing samples from the sites.

PROCEDURES IN THE ACF PRIOR TO GLIMS

When a sample was sent to the ACF, it was accompanied by a request form for chemical analysis which was filled out by the investigator. This form contains the site the sample is from, date of collection, initials of investigator, treatment and replicate the sample comes from, the source or type of sample, a taxonomic identifier if any, non-taxonomic description,

the investigator's sample number, and a check list of analyses to be performed. The ACF director received the sample and request for analysis and assigned the sample and request a unique Lab number. He then filed the request form and put the sample(s) into storage for later use by ACF technicians.

The ACF technicians used request forms to determine Lab numbers of samples which were to have a particular analysis. This involved pulling the forms from the file and jotting down Lab numbers which had particular analyses requested. The technician would refile the forms, locate the samples with those Lab numbers in storage, extract a portion of each sample and perform the analyses. The result was recorded on a separate form which contains the technician's initials, the date of analysis, the type of analysis, the Lab number and the result. If there was not enough sample material to perform the analysis, a column on the result form was checked to show that fact. The result forms were then filed and made available to investigators and the Lab director.

The above procedure was further complicated by a system used to check the accuracy and consistency of analysis by the ACF technicians. The director would randomly select a certain percentage of requests, divide the samples and fill out identical requests for the duplicate half. He would assign the duplicate samples Lab numbers which would insure that the analyses were performed at a later date. When original and duplicate analyses were completed, the accuracy of the technician process could be checked by comparing the two halves. However, the duplicate sample results were not available to investigators and had to be pulled from the files after they were complete.

To retrieve results for an investigator, the person retrieving the information would search the request file, (which was ordered by Lab number) record the Lab numbers of the samples of interest and search the result file (also ordered by Lab number) and record the results.

GLIMS SYSTEM DESIGN

The Grasslands Laboratory Information Management System was designed to facilitate the procedure used by the ACF. By analyzing procedures in use, routine functions which could be performed by the system were outlined.

1. The system should relieve the ACF Director of assigning Lab numbers and selecting samples for duplicate processing. Lab numbers should be generated at the Director's request and the percentage of samples selected for duplicates and their time lag could be changed.
2. The system should store the Lab requests as soon as the samples are received. The requests could be referenced by Lab number so the result information would be easily appended to the request in the data bank. Duplicate samples should be separated from the originals by the system.
3. The system should be capable of updating the record for each Lab number as the results are input to the system.
   During updating, the operator should be notified if a result was input for a Lab number which has no request or the analysis was not requested.
4. The system should allow the user to change a request for result after it had been entered in the bank.
5. The system should relieve the technician of the duty of pulling Lab numbers which request a particular analysis.

6. The system should provide the Lab Director:
   a) The average number of requests entered per week.
   b) The average number of results entered per week for each type of analysis.
   c) A statistical measurement of the accuracy attained in the duplicate processing technique.
7. The system should provide a status report showing work which has been requested but not completed.
8. The system should provide an easy method by which data in the bank could be accessed.

ACF Operational Procedure Using GLIMS

Procedure in the ACF using the GLIMS system is very similar to that used before. The major difference is that a major portion of the clerical work for the Lab is handled by the system. Present ACF operation is discussed below.

The process begins with the ACF Director's request for serial Lab numbers. This request includes how many numbers he wants and the percentage and time lag that should be used for duplicate selection. The operator of the system then "creates" a list of Lab numbers for the ACF Director. When samples arrive at the Laboratory, they are accompanied by request forms filled out by the investigator. The ACF Director adds a Lab number for each sample from his list, splitting the sample when a Lab number which is to have a duplicate is assigned and giving the second half of the sample the Lab number produced by the system for the duplicate. An additional request form for duplicate samples is not necessary because the system is keeping track of them and automatically reserves space in the data bank for duplicates when a request for the original sample is encountered. The

samples are then stored to await analysis and the request forms are given to the GLIMS system operator.

The GLIMS system operator checks the request forms for format errors and has them keypunched. The forms are filed and the cards are "stored" in the data bank. Requests which are improperly structured are flagged by the system and are not entered into the bank until they are acceptably formatted. Any requests which may have later additions or corrections that have been stored in the bank can be "changed" by the system operator.

When requested by the ACF Director, the system operator "lists" (has printed) result forms for analyses checked on requests in the data bank. ACF technicians use these forms to pull samples from storage and record analysis results. Completed result forms are returned to the system operator who checks them for format errors, has them keypunched, files the result forms, and "updates" the bank to enter the results. Errors on result cards during updating are flagged by the system and are not accepted until they are formatted correctly. Corrections of results already stored in the data bank may be "changed" by the system operator.

The GLIMS system is divided into two portions; one for data bank maintenance and the other for information retrieval. The data bank maintenance portion of the GLIMS system may produce, upon request, reports which show the production, accuracy and outstanding requests in the ACF. These reports include:

1. A production report showing, for each analysis, the number of requests received for the last two weeks, the last four weeks and the year to date. Included with the report are the number of results received and the number of outstanding results.
2. A control report showing, for each analysis type, the number of duplicates received for the year to date, the last four weeks,

and the last two weeks. Included in this report is an analysis of the duplicate samples for each analysis type.

3. A summary report showing, for each analysis, the total number of requests in the bank, the number completed, and the number still due. Also, the number of duplicate pairs is shown.
4. A status report showing, for each Lab number, the analyses which have been received and those which are still due.

The information retrieval portion of the GLIMS system can be used to fill a request for the results of analysis from an investigator. Using the retrieval language, the system operator can access any portion of the data bank for output to the printer or to a storage device.

USING THE CHEM BANK MANAGEMENT PROGRAM

The data bank management program performs a set of tasks designed to assist the Laboratory Director in the management of the Analytical Chemistry Facility. A task is executed by the program upon encountering a command card on the input file. A command card consists of an asterisk (*) in column 1, a key word associated with the task, and a list of arguments which define the limits of the task. These arguments are necessary for some commands and optional for others. Additional words and numbers on a command card other than those used as the key word and its arguments are ignored by the program. If more than one key word appears on a command card, the leftmost key is the one which determines the task. Arguments are encountered from left to right so care must be taken to insure that the correct arguments are encountered. For example, perhaps the Director requests 300 Lab numbers to be created in the 1975 data bank. The following commands are equivalent and would accomplish the task.

*CREATE 300[1/]

*CREATE 300 LAB NUMBERS

However, the following command would create 1975 Lab numbers.

*CREATE FOR THE 1975 BANK 300 LAB NUMBERS.

In addition, the above command would create 1975 Lab numbers starting at number 300. This example shows that if additional words and numbers are added to a command for clarity, care must be taken in the structuring of the command. Table 1 displays the key words associated with each task and the number of agruments.

[1/] Key words and agruments are underscored.

Table 1. List of key words associated with each task.

KEYWORD	TASK PERFORMED	NO. OF ARGS.
CREATE	Create a list of serial lab numbers.	1-2
SELECT	Change the percentage of duplicate samples selected.	1
LAG	Change the range for lagging the second half of the duplicate pair.	2-3
PAIRS	Generate a list of the duplicate pairs.	0
STORE	Enter new request cards into the bank.	0
LIST	Generate a list of result forms.	1-3
UPDATE	Enter new results into the data bank.	0
CHANGE	Allow requests or results to be changed.	0
SUMMARY	Generate a summary report.	0-2
STATUS	Generate a status report.	0-2
PRODUCTION	Generate a production report.	0-15
CONTROL	Generate a control report.	0-15
DUPLICATE	Generate a duplicate report.	1-4
UTILITY	Call the user-supplied utility routine.	0-19
STOP	Halt the execution of the program.	0

Each command will be described in detail in the remainder of this section.

Creating New Serial Lab Numbers

The data bank is started and extended by the CREATE portion of the management program. A set of sequential Lab numbers is reserved in the bank each time a CREATE command is executed. Duplicate selection is also defined at this time. Default values for duplicate selection are 5% of the numbers created with a time lag of 1 to 7 days based on a 20 sample per day analysis rate in the laboratory. The duplicate selection process can be modified by using the SELECT and LAG commands with the CREATE command.

The key word for the task is CREATE. The first argument is necessary and specifies the amount of serial lab numbers desired. To create 200 new lab numbers the command would be:

*CREATE 200[2/]

or

*CREATE 200 LAB NUMBERS

Each time the CREATE function is called, the system determines the last number created and begins the new list of numbers at that point. A second optional argument may be used to specify the number to begin with. This allows numbers to be recreated.

For Example:

*CREATE 200 876

and,

*CREATE 200 LAB NUMBERS BEGINNING WITH 876

will reserve 200 Lab numbers in the bank beginning with Lab number 876. The second argument is restricted, however, to protect data already stored in the bank. If the number (876 in the above example) precedes a Lab number for which a request is stored, a message will be issued and the task will not be performed.

Two other commands which may be used in conjunction with the CREATE command to modify the default values of duplicate selection and time lag are SELECT and LAG. The percentage of duplicate samples to be selected may be changed from the default value by following the CREATE command with the SELECT command. For example the selection of duplicates for a new set of Lab numbers could be increased by following the CREATE command with,

*SELECT 10

[2/] Key words and arguments will be underscored.

or;

*SELECT 10 PERCENT FOR DUPLICATE PROCESSING

The amount of time lag to separate duplicate pairs can be changed by following the CREATE command or SELECT command with a LAG command. The lag time of a new set of lab numbers could be changed with the command.

*LAG 10 20

or,

*LAG THE SAMPLES FROM 10 TO 20 DAYS.

As shown in the example, the LAG command requires at least 2 arguments. In the above example, duplicate lag would be calculated assuming a 20 sample per day analysis rate in the Lab. If the analysis rate was no longer 20, another argument could be added to the LAG command to change the default value. For example,

*LAG THE SAMPLES FROM 10 TO 20 DAYS USING 30 SAMPLES PER DAY

would change the rate from 20 to 30. Once the values for duplicate selection are changed by the SELECT and LAG commands, they are retained by the system as default values until they are changed during a subsequent creation of Lab numbers.

Storing the Request Cards

Request cards are entered into the data bank with a STORE command. This command has no arguments and is followed by all request cards which are to be entered.

*STORE THE FOLLOWING REQUEST CARDS

When the STORE command is encountered, the system begins reading request cards which follow and enters them into the bank. This process continues until either another command card is encountered, or the end of the deck is reached. Before each request is stored it is checked for the following key punch errors.

1. The site code in columns 3-4 must be a number from 1-11.
2. The date in columns 8-13 must be valid and between 1/1/69 and 12/31/76.
3. The treatment code in column 14 must be 0-9, A-Z, or blank.
4. The replicate in column 15 must be 0-7.
5. The source in columns 16-17 must be 0-36.

If an error exists on a request card, a message is printed and the request is not stored in the bank. If a request has already been stored for a Lab number on a request card, the request is not stored unless a CHANGE command (explained later) is in effect. This is to insure a mispunched Lab number on a request is not stored. Requests not entered may be corrected and entered with another STORE command. See Figure 1 for an example of the current request form. Additions, of new analyses available and new sources are outlined in Appendix C, page 50.

Listing Result Forms

Once requests are stored in the bank, result forms may be obtained with a LIST command which requires one argument specifying the code number of the analysis to be listed. Two optional arguments may be used to specify the first and last numbers for the list. Below are some examples.

*LIST 4

*LIST ANALYSIS TYPE 4 STARTING WITH LAB NUMBER 25

*LIST TYPE 6 FOR LAB NUMBERS 52 THROUGH 78

The program retains the value of the highest Lab number which has been listed for each analysis. If a starting number is not used, the list will begin at the last number +1. If the command does not have an ending number, the program will list result forms for all remaining requests currently in the bank.

IBP

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U.S. INTERNATIONAL BIOLOGICAL PROGRAM

REQUEST FORM FOR LABORATORY ANALYSIS

Date of Request _____ Name of Investigator _____

Routine Sample ___

Special Sample ___

Data Type	Site	Initials	Date Collected			Treatment	Replicate	Source	Order, Family or Non-taxonomic Identification	Taxonomic Identification			Investigator's Specimen or Data Number	NREL Laboratory Number	Analyses Requested										
															Chemical Analyses										
			Day	Month	Year					Genus	Species	Sub-species			Dry Matter	Ash	Gross En.	Kjedahl N	P	CWC	ADF	Lignin	Carbon	In Vitro	Pigment	TAC
1-2	3-4	5-7	8-9	10-11	12-13	14	15	16-17	18-23	24-26	27-29	30-32	33-36	39-44	50	51	52	53	54	55	56	57	58	59	60	61
60																										

Site

01 ALE
02 Bison
03 Bridger
04 Cottonwood
05 Dickinson
06 Hays
07 San Joaquin
08 Jornada
09 Osage
10 Pantex
11 Pawnee
12 NREL

Treatment

1 Ungrazed
2 Lightly grazed
3 Moderately grazed
4 Heavily grazed
5 Ungrazed current year only
A Diet light
B Diet moderate
C Diet heavy
D ESA - O
E ESA - W
F ESA - N
G ESA - WN

Source

01 mouth & cheeks
02 esophageal
03 rumen
05 stomach
06 crop
08 caecum
09 colon
11 fecal
13 caches & stores
15 hand-clippings
16 hand-plucks
17 animal clips & wastes
18 mechanical harvested
19 litter & detritus
20 aboveground plants (live + dead)
21 roots (live + dead)
22 reproductive
23 standing dead
24 standing live
25 roots (live)
26 roots (dead)
27 crowns
28 recent dead

NREL-60 NATURAL RESOURCE ECOLOGY LABORATORY — COLORADO STATE UNIVERSITY — PHONE (303)491-5642 — FORT COLLINS, COLORADO 80521

Figure 1

Adding Results to the Data Bank

When result forms are filled out and keypunched, they may be added to the data bank with the UPDATE command. This command requires only the key word UPDATE as shown below.

*UPDATE

or,

*UPDATE THE FOLLOWING RESULTS

When this command is encountered, the program will read each result card following the command and add it to the data bank. Updating continues until a new command is encountered or the end of the deck is reached.

Before a result is entered in the bank, the card is checked for the following keypunch errors.

1. The date in columns 6-11 must be valid and between 1/1/69 and 12/31/76.
2. The type of analysis in columns 12-13 must be between 1 and 30.
3. The method of analysis in columns 14-15 must be between 0 and 30.
4. The lab number in columns 16-21 must have a request for the analysis type specified in columns 12-13.

A message is printed if the result card is in error and the result is not entered in the bank. If a result is already in the bank for the analysis type, the new result is not entered unless the CHANGE function is in effect; a message is printed. Results which are rejected can be corrected and entered again with the UPDATE command. See Figure 2 for an example of a result form.

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INTERNATIONAL BIOLOGICAL PROGRAM

RESULT FORM FOR LABORATORY ANALYSIS

#DATA #TYPE	#INI-TIALS	#DAY	MO	YR	# TYPE AND METHOD	# GERL LAB NUMBER	# NO SAMPLE	FINAL RESULT	#IDENT. NUMBER	# TARE WT.	# INI-TIAL wT.	# FINAL WT.					
#1-2	# 3-5	#6-7	8-9	10-11	# 12-15	# 16-21	# 22	# 23-33	#	#	#	#	#	#	#	#	#
63	---	--	--	--	05	--	1	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
							2	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
							3	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
							4	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
							5	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
							6	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
							7	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
							8	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
							9	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
							10	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
							11	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
							12	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
							13	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
							14	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
							15	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
							16	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
							17	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
							18	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
							19	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

TYPE		
01		
02		
03		
04	DRY MATTER	PERCENT
05	ASH	PERCENT
06	GROSS ENERGY	KCAL/G DRY WT.
07	KJEDAHL N	PERCENT
08	PHOSPHORUS	PERCENT
09	C W C	PERCENT
10	A D F	PERCENT
11	LIGNIN	PERCENT
12	CARBON	PERCENT.
13	INVITRO	PERCENT
14	PIGMENT	MG/G DRY WT.
15	T A C	PERCENT
16	CALCIUM	PERCENT
17	MAGNESIUM	PERCENT
18	SODIUM	PERCENT
19	POTASSIUM	PERCENT
20	TOTAL SULFUR	PERCENT
21	COPPER	PERCENT
22	MANGANESE	PERCENT
23	ZINC	PERCENT
24		
25		
26		
27		
28		
29		
30		

THE LAST THREE LINES ARE FOR OPERATOR USE ONLY. THEY ARE NOT TO BE KEYPUNCHED.	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Figure 2

Changing Requests or Results

In the previous two subsections on storing requests and adding results it was noted that a request or result would be rejected if there was already one in the data bank for the same Lab number or analysis type. This was to insure that valid data in the bank would not be destroyed. However, perhaps request records or results already in the bank are incorrect and need to be changed. The CHANGE command helps accomplish this task. Incorrect requests and results may be re-entered correctly in the bank by preceding the STORE or UPDATE commands with a CHANGE command.

*CHANGE

*STORE

followed by request cards will replace existing records with new ones.

*CHANGE

*UPDATE

followed by result cards will replace existing results with new ones.

*CHANGE

*STORE

followed by request cards and

*UPDATE

followed by result cards will replace requests and results in the bank. Once the CHANGE command is in effect, it will remain in effect until the execution terminates.

Producing a Status Report

The status report will give the requestor a detailed listing of each sample showing the initial request information and the current status of each analysis requested for that sample. Four different values are used to indicate the status for each analysis of each sample.

They are:

1. A dot (.) will appear if the analysis was not requested for the sample.
2. The analysis type code will appear if the analysis is to be performed for the sample.
3. The letters, RC, will appear if the analysis was requested and the results have been received.
4. The letters, NS, will appear if the analysis was requested but there was an insufficient amount of the sample to perform the analysis.

The command for the status report requires only the key word, STATUS, which will generate the report for all samples in the data bank. The report may be limited however, by two optional arguments which specify the first and last Lab numbers for the report. Three possible commands are:

*GENERATE A STATUS REPORT

*GENERATE A STATUS REPORT BEGINNING WITH 1345

*GENERATE A STATUS REPORT FROM 1345 to 1897

The summary report, described in the following subsection is also included at the end of a status report.

Producing a Summary Report

The summary report lists, for each analysis type, the number of analyses still due, the number of results received to date, the total number of requests made to date, and the number of duplicate pairs. The key word SUMMARY is the only requirement for the command. It will generate the summary report for all samples in the data bank. However, the report may be limited to a particular set of samples by including two optional arguments for the first and last sample numbers to be reported. The possible commands are:

*GENERATE A SUMMARY REPORT

*GENERATE A SUMMARY REPORT BEGINNING WITH NUMBER 1000

*GENERATE A SUMMARY REPORT FROM 1000 to 1200

Producing a Production Report

The production report presents a table for each analysis type requested. The table displays three columns for the number of requests received, the number of requests completed, and the number of requests remaining. Under each of the columns are the number for the year to date, the number during the last four weeks and the number during the last two weeks. The report can be generated with the key word PRODUCTION which will produce a table for each of the analysis types 4 through 15. If specific analysis types are requested, up to 15 may be listed on the command card. In this case the report will be generated only for those analyses specified. Examples of the command are:

*GENERATE A PRODUCTION REPORT

*GENERATE A PRODUCTION REPORT FOR ANALYSIS 7

*GENERATE A PRODUCTION REPORT FOR ANALYSES 2, 3, 6, 7, and 10

Producing a Control Report

The control report presents a table for each analysis type which displays the following four columns:

1. The number of pairs for which both duplicate results are available.
2. The mean value for the original results.
3. The standard deviation for the absolute differences between the original result and the duplicate result.
4. The number of outliers for which the difference appeared to be too large.

The analyses which are considered as outliers are not included in the mean and standard deviation computations. Under each column are the values for all duplicates received during the year to date, during the last four weeks, and during the last two weeks. The outliers are determined by a statistical method described by Dixon and Massey (W. J. Dixon and F. J. Massey, Jr. 1969. Introduction to statistical analysis. 3rd Ed. McGraw-Hill Book Co., New York. 638 p. Page 500, Table A-8e.)

The control report may be generated for the standard set of analyses 4 through 15 with the command,

*PRODUCE A CONTROL REPORT

A set of code numbers for the analyses desired in the report may be included by listing them on the command card as shown below.

*MAKE A CONTROL REPORT FOR ANALYSES 2, 3, 4, and 5

If any outliers are found, a detailed deviation report is automatically produced for the analysis type.

Producing a Deviation Report

The deviation report produces a table of duplicates for a specific analysis. It includes four columns which are:

1. The lab number for the original sample.
2. The value of the result for the original sample, O_i
3. The value of the result for the duplicate sample, D_i
4. The deviation between the original and duplicate, $O_i - D_i$

The samples are ordered by the magnitude of the deviation. The report also includes:

5. The mean for the original samples, $\Sigma\ O_i/N$
6. The mean for the duplicate samples, $\Sigma\ D_i/N$
7. The mean for the deviations or differences between the original and the duplicate, $\Sigma\ (O_i - D_i)/N$

8. The number of duplicate pairs, N

9. The standard deviation for the differences, $\Sigma(O_i - D_i)^2/2N$

10. The mean absolute deviation, $\Sigma(O_i - D_i)/N$

The deviation report for analysis 4 can be generated with the command,

*GENERATE A DEVIATION REPORT FOR ANALYSIS 4

The key word, DEVIATION, and the analysis number are required. Three optional arguments are provided for entering a date. This will restrict the report to only the duplicates received after the date specified. The date must be in the order of month, day, and year as shown on the command below.

*GENERATE A DEVIATION REPORT FOR ANALYSIS 5 AFTER 5/31/72

Using the Utility Routine for Special Tasks

Occasionally, problems come up in the laboratory which require a special report on a one time basis. The report may be written and coded as a UTILITY subroutine, linked to the main program, and can be called at any time during the execution of the program. The reason for linking the utility subroutine to the main program is that it can take advantage of all the data bank communication routines that are present in the GLIMS system. The procedure for using the utility subroutine is described in the GLIMS system program maintenance manual.

Setting up the Program Deck to Use the Data Bank Maintenance Program

Because of the high cost of storing the chemical banks on the 6400 system permanent files, they are stored on magnetic tape along with associated programs. The currently active (open) data bank resides on a single tape and is backed up by another, separate tape. The banks which are not actively being updated are all stored on one tape with a separate backup tape.

The structure of the current 1973-1975 Chem Lab Data Bank tape is:

1. Tape is labelled "LABDATA73"
2. File 1 contains a binary copy of the data bank management program
3. File 2 contains a binary copy of the data bank retrieval program.
4. File 3 contains a binary copy of the program that loads the bank on a disk file, LODBNK.
5. File 4 contains a binary copy of the program that loads the bank from disk to tape, STOR.
6. File 5 contains the data bank.

Procedure for storing the data bank on a disk file and updating the bank is:

```
TA000,AXXXXXXX,CM57000,T50,PR50,MT1.EXAMPLE.3/
RFL,10000.
LABEL(TAP,R,L=LABDATA73,VSN=DXXXX)READ.SWIFT.
COPYBF,TAP,CHEMPRG.
SKIPF,TAP,1,17,B.
COPYBF,TAP,LODBNK.
SKIPF,TAP,1,17B.
REWIND,CHEMPRG,LODBNK.
RFL,43000.
REDUCE.
LODBNK.
RETURN,TAP.
RFL,57000.
REDUCE.
CHEMPRG.
CATALOG,BANK,LABDATA73-75,ID=ΔΔΔ,RP=ΔΔΔ.4/
```

7_{8_9} end-of-record card

Commands for management program.

$6_{7_{8_9}}$ end-of-file card

3/ A sequence of "X" must be replaced by the user with his charge number or the tape number.

4/ A sequence of "Δ" must be replaced by the user with an Identification Code (ID) and the retention period in days for the permanent file (RP).

Procedure for running the management program from disk files is:

```
TA000,AXXXXXXX,CM57000,T50,PR50.EXAMPLE.
RFL,10000.
ATTACH,BANK,LABDATA73-75,ID=ΔΔΔ.
ATTACH,CHEMPRG,1CHEM6975,ID=JDP.
RFL,57000.
REDUCE.
CHEMPRG.
EXTEND(BANK)
```

7_{8_9} end-of-record

Commands for the management program

$6_{7_{8_9}}$ end-of-file.

The EXTEND(BANK) card is necessary only if the data bank is being changed during the run.

The procedure for storing the data bank on magnetic tape is:

```
TA000,AXXXXXXX,CM57000,T50.EXAMPLE.
RFL,1000.
LABEL(TAP,R,L=LABDATA73,VSN=DXXXX)READ.SWIFT.5/
SKIPF,TAP,4,17,B.
COPYBF,TAP,STOR.
REWIND,STOR.
ATTACH,BANK,LABDATA73-75,ID=ΔΔΔ6/
RFL,43000.
REDUCE.
STOR.                                  (Stores the bank on tape)
RFL,10000.
RETURN,BANK,STOR.
REWIND,TAP.
COPYBF,TAP,CHEMPRG.
SKIPF,TAP,1,17,B.
COPYBF,TAP,LODBNK.
SKIPF,TAP,1,17,B.
REWIND,LODBNK.
```

5/ A sequence of "X" must be replaced by the user with his charge number or the tape number.

6/ A sequence of "Δ" must be replaced by the user with an Identification Code (ID) and the retention period in days for the permanent file (RP).

```
RFL,43000.                          (Checks the tape for a good
REDUCE.                              transfer of the bank to tape.)
LODBNK.
RFL,57000.
REDUCE.
CHEMPRG.
7
8
9
*SUMMARY
6
7
8
9
```

When the bank and programs on the primary bank tape are correct, the bank can be copied to the backup tape. A procedure for this is:

```
TA000,AXXXXXXX,MT1.EXAMPLE.
RFL,10000.
LABEL(TAP,R,L=LABDATA73,VSN=DXXXX)READ,SWIFT.
COPY,TAP,INTER.
RETURN,TAP.
LABEL(TAP,R,L=LABDATA73,VSN=DXXXX)WRITE,SWIFT.
REWIND,INTER.
COPY,INTER,TAP.
REWIND,TAP.
6
7
8
9   end-of-file card
```

USING THE RETRIEVAL PROGRAM

The retrieval program operates from a user-supplied retrieval language to select and display specific portions of information from the data bank. The retrieval language was designed with simplicity of use as the major aim.

To retrieve information from the data bank you begin by building a list of samples. Once the list of samples has been built you may (1) print any desired information from each sample in the list, (2) prepare a data file with the samples for analysis by another program, (3) call your own utility subroutine to analyze the list of samples, or (4) count the number of samples selected.

Building a List of Records

You may build a list of records by first indicating the type of selection procedure desired. There are five possible types, each of which is designated by a one-word command:

1. RETRIEVE - To select a new list of samples from the data bank.
2. REDUCE - To reduce the current list of samples to a selected portion.
3. DELETE - To delete selected samples from the current list of samples.
4. ADD - To add selected samples from the data bank to the current list of samples.
5. BACK - To restore the last list of samples which were available prior to the current reduction, deletion, or addition.

To illustrate the list building procedure, assume that you want all treatment 1 samples from Pawnee plus all treatment 5 samples from Osage. The list would be built by first retrieving the treatment 1 samples from the Pawnee site (RETRIEVE), and then adding the treatment 5 samples from Osage to the list (ADD). Or, assume that you want all Pawnee samples for all treatments except treatment 1. This list would be built by retrieving all Pawnee samples (RETRIEVE), and then deleting the treatment 1 samples from the list (DELETE).

Specifying the Criterion for Selection or Deletion of Samples

You may indicate the samples which are to be selected, deleted, or added by specifying the values for each of the fields on the sample's request card. That is, the samples from the ALE site are retrieved by specifying that the site field for each sample must have the value of 1 before it is to be retrieved. To do that you merely punch the name of the field, which is SITE, and follow it by the value desired, which is 1, as shown below.

```
RETRIEVE
SITE 1
```

If samples from more than one site are desired, they may be punched on the card, too, with each value being separated by commas as shown below.

```
RETRIEVE
SITE 1, 3, 4, 5, 8
```

It is also possible to specify a range of values rather than a single value by putting a dash between the lowest and highest value as below.

```
RETRIEVE
SITE 1, 3-5, 8
```

Values for each field on the request form may be specified in the

same manner. However, not all of the fields on the request card are numerical fields like the site field. In fact, there are four different types of fields: numerical, character, date, and yes-or-no fields.

Character fields may contain letters, numbers, special symbols, or blanks. The initials, treatment, description, genus, species, subspecies, and investigators data number are all character fields. You may specify the values for a character field by punching first an asterisk, followed by the actual characters, followed by another asterisk as in the examples below.

```
TREATMENT *1*, *5*, *A*-*D*
DESCRIPTION *CATTLE*, *SHEEP*, * SHEEP*
GENUS *BO *
SPECIES *GR *
```

Note that if some of the characters are blank, the position of the blanks are important and must be included.

The date field contains three numbers rather than just one number. The value for the date is specified by punching the month, followed by a slash, followed by the day, followed by another slash, followed by the year as shown below.

```
DATE 5/21/72, 3/3/72
DATE 1/1/71-12/31/71
```

The request fields are yes-or-no type fields. That is, either there is a request for a particular analysis, or there is not a request. Instead of specifying the value for the request fields, which is either x or blank, it is easier to specify the code numbers for the analyses which have requests indicated. For example, if you want all samples which request a nitrogen analysis you would punch:

```
REQUEST 7.
```

If you want all samples which request either nitrogen or phosphorus, you would punch:

```
REQUEST 7, 8
```

Other examples are shown below.

```
REQUEST 4-6

REQUEST 7, 9-12, 14, 15
```

Many times it becomes necessary to retrieve samples for which, in addition to having a request for a particular analysis, the result has also been received for the analysis. You may do this by using the word RESULT as the field name rather than REQUEST. For example, if you want to retrieve all samples for which gross energy results are available you should punch:

```
RESULT 6.
```

In this case, if a sample has a request for gross energy, but the result is still due, the sample will not be selected.

Table 2 outlines the name of each field and gives the range allowed for that field.

Now that the basics have been covered, let's go back and try a few examples. Assume that you need all treatment 1 and treatment 5 samples from the Pawnee and Osage sites. You would punch the following cards.

```
RETRIEVE

SITE 9, 11

TREATMENT *1*, *5*
```

In this case, a sample would be selected if its site field had a value of either 9 or 11 and its treatment field had a value of either 1 or 5.

For a second example, assume that you need all treatment 1 samples from Pawnee plus all treatment 5 samples from Osage. To retrieve these you would punch:

```
RETRIEVE

SITE 11

TREATMENT *1*
```

Table 2. Specifying values for selection or deletion of records.

FIELD	NAME	TYPE	RANGE ALLOWED	EXAMPLES
Site	SITE	Numeric (2 digits)	1-12	SITE 7 SITE 5, 8-10
Initials	INITIALS INI	Character (3 chars.)	Any three characters	INITIALS *CED* INI *AAA* - *222*
Date	DATE	Character (8 chars.)	1/1/69 to 12/31/76	DATE 5/31/71 DATE 1/1/72 - 12/31/72
Treatment	TREATMENT TRT	Character (1 char)	0-9, A-Z or Blank	TREATMENT *1*, *5* TRT *A* - *D*, *G*
Replicate	REPLICATE REP	Numeric (1 digit)	0-7	REPLICATE 1, 3-5 REP 4
Source	SOURCE	Numeric (2 digits)	1-36	SOURCE 19 SOURCE 21, 25-27, 29
Description	DESCRIPTION DESC	Character (6 chars.)	Any 6 characters	DESCRIPTION *CATTLE* DESC *SHEEP *,* SHEEP*
Genus	GENUS GEN	Character (3 chars.)	Any 3 characters	GENUS *BO * GEN *BO *,* BO*
Species	SPECIES SPP	Character (3 chars.)	Any 3 characters	SPECIES *GR * SPP *GR *,* GR*
Sub-Species	SUB	Character (3 chars.)	Any 3 characters	SUB* 2*,* 2 *,*2 *
Investigators data number	DATANO ID	Character (4 chars.)	Any 4 characters	DATANO * C147 * ID * 100* - * 200*
NREL Lab number	LABNO	Numeric (6 digits)	1-15360	LABNO 1237 LABNO 1000 - 1432
Requests	REQUEST TEST	Yes-or-no	1-30	REQUEST 7 TEST 5, 8-10, 13
Results	RESULT	Yes-or-no	1-30	RESULT 8, 12, 15 RESULT 13

See Appendix C, page 50 for the Grassland Biome Chemical Analysis Bank field descriptions.

ADD

SITE 9

TREATMENT *5*

In this case, a sample would be selected if its site field contained a value of 11 and the treatment field had a value of 1, or it would be selected if its site field was 9 and its treatment field had a value of 5.

For a third example, assume that you need all live root samples from Ale which request either a nitrogen or a phosphorus analysis. The Ale site has a value of 1, live roots have a source code of 25, and the codes for nitrogen and phosphorus analyses are 7 and 8 respectively. Consequently, you would punch:

RETRIEVE

SITE 1

SOURCE 25

REQUEST 7, 8

These examples should also illustrate that for a sample to be selected it must match at least one of the values on each field specification. That is, in the third example above, the sample must have a matching site, a matching source, and a match for at least one of the "request" numbers before it will be selected.

The following example should illustrate this from a different viewpoint. Assume this time that you want the same samples as before, except that you now want only the ones which request <u>both</u> a nitrogen <u>and</u> a phosphorus analysis. The solution is:

RETRIEVE

SITE 1

SOURCE 25

REQUEST 7

REQUEST 8

Counting the Number of Samples in the List

Once the list of samples has been built, you may request for the number of samples selected with the command:

COUNT

The program will respond to this command by displaying the message:

"XX records have been selected."

Displaying the Samples in the List

The samples selected may be displayed with a print command, which consists of the word PRINT, followed by a list of the fields that are to be printed for each sample. The fields are printed in the order that they appear on the command. Figure 2 shows fields that may be printed. The following command would be used if the site, date, treatment, and lab number is desired for each sample in the list.

PRINT SITE, DATE, TREATMENT, LABNO

If you want to display a particular result, you may indicate it by punching the word RESULT, followed by the code number for the analysis. For example, if you want to display the site, source, date, treatment, replicate, ash content, and nitrogen content for each sample, you would use the following command.

PRINT SITE, SOURCE, DATE, TRT, REP, RESULT 5, RESULT 7

When a print command is encountered, the requested fields for each sample are printed onto a file called DATA. The file is formatted with column headings for each field requested at the top of each page and 54 samples per page. This file must be copied to OUTPUT after the retrieval program has executed. (See page 33).

When a result is requested on the print command, one of four possible values will be displayed in that column depending on the status of the result:

1. The field will be blank if the analysis has not been requested for the sample.
2. The letters DUE will appear if the analysis has been requested but not completed.
3. The letters NO SAMPLE will appear if the analysis has been requested but could not be performed.
4. The actual result will appear if the analysis has been requested and completed.

If a print command asks for so many fields that more than 136 columns are necessary, a message will be printed and each line will be truncated to 136 columns. As a general rule, all of the request information and up to 6 results may be printed without this occurring.

Preparing a Data File for Another Program

The print command displayed the samples in the list in a formatted fashion with page controls and column headings. The list command allows the samples to be listed in the same way, except that page controls and column headings are suppressed. Consequently the DATA file can be used as an input file to another program. The structure of the list command is exactly the same as the print command as shown on the examples below.

LIST SITE, TRT, DATE, LABNO, RESULT 4, RESULT 5

LIST SITE, INI, DATE, TRT, GEN, SPP, SUB, RESULT 7, RESULT 8

When the information for each sample is written onto the DATA file, the requested fields are printed in the same order as on the list command. Each field is preceded by a blank and takes up the number of characters indicated in column 3 of Table 3 (Each result field takes up 12 characters).

Table 3. Fields that may be printed.[a/]

FIELD	NAME	TYPE
Site	SITE	Numeric (2 digits)
Initials	INITIALS INI	Character (3 chars.)
Date	DATE	Character (8 chars.)
Julian day	JDAY	Numeric (3 digits)
Treatment	TREATMENT TRT	Character (1 char.)
Replicate	REPLICATE REP	Numeric (1 digit)
Source	SOURCE	Numeric (2 digits)
Description	DESCRIPTION DESC	Character (6 chars.)
Genus	GENUS GEN	Character (3 chars.)
Species	SPECIES SPP	Character (3 chars.)
Sub-species	SUB	Character (3 chars.)
Investigators data number	DATANO ID	Character (4 chars.)
NREL Lab number	LABNO	Numeric (6 digits)
Requests	REQUEST TEST	Character (12 chars.)[b/]
Results	RESULT	Character (12 chars.)[b/]

[a/] Each field is preceded by a blank.

[b/] Printed in character mode because of "DUE" AND "NO SAMPLE". Otherwise, this field is numeric (Real with a decimal point).

For example, the first list command above would generate a file on DATA with the following format:

Field	Columns
SITE	2-3
TRT	5
DATE	7-14
LABNO	16-21
RESULT 4	23-34
RESULT 5	36-47

If the list command asks for so many fields that more than 136 columns are necessary, a message will be printed and each line will be truncated to 136 columns. As with the print command, the output from a list command is written onto a file called DATA. The DATA file is not rewound after execution of the retrieval program. Consequently, if you want to read the DATA file with another program you must rewind it first.

Sorting the Data to be Output by the Retrieval Program

Data in the bank is organized by lab number. The list of retrieved records is also organized by lab number. However, the use the data is put to once it has been retrieved may require it to be sorted in a particular way. The SORT feature of the retrieval program provides this capability.

The SORT command begins with the keyword SORT and follows with the fields to be sorted on (key fields) with the most important field first. Fields which may be used as key fields are those on the request record except lab number and request or result numbers.

SORT SITE, DATE, TRT, REP, SOURCE, GENUS, SPP

The sort command must precede a PRINT or LIST command. When the sort command is encountered data is output to a scratch file when PRINT or LIST is encountered. The scratch file is then used as input to the sort routine and sorted records are output to the DATA file. Up to a maximum of 7 key fields can be used on a SORT command, more fields will be ignored.

Examples of the SORT command:

SORT DATE, TREATMENT, REPLICATE, GENUS, SPECIES

PRINT, INI, DATE, JDAY, TRT, REP, GEN, SPP, LABNO, RESULT 7

and

SORT DATE, TRT, REP, SOURCE, DATANO

LIST SITE, DATE, TRT, REP, SOURCE, DATANO, RESULT 16

Calling the Utility Routine

If information from a selected list of samples is to be summarized it may be desirable to supply your own utility subroutine which can be called at any time during the execution of the retrieval program. The command used is:

CALL.

When this command is encountered, the system responds with the following call statement:

CALL UTILITY (IAD, MP, LIST)

where IAD is a vector of 3000 elements containing the lab numbers of the samples which have been selected. MP contains the number of samples in IAD and LIST contains all other words, numbers and symbols which appear after the word CALL on the command card. It is a vector of 19 elements. The procedures for writing the utility subroutine are described in the GLIMS System Program Maintenance Manual.

Special Commands

Although interactive use of the 6400 is not currently available, the retrieval program was designed for use both interactively and in a batch processing environment. It assumes that each job is an interactive job and will respond with the message, "Enter a command, please." each time it is ready for a new command. If you have punched your commands onto cards and are going to run the job as a "batch" job, then the first command in your deck should be:

INPUT

This will inform the system that the commands are on cards and they should be listed on the OUTPUT file.

If you are using the program interactively, that is, you are entering your commands from the cathode ray tube, there are two commands which you may find helpful. The first is:

HELP.

HELP may be requested at any time when you are confused or lost. The system will respond by telling you what you have done so far and will show you a list of possible commands which you may want to use next. The second command is:

STOP.

STOP must be used when you are finished and want to terminate the execution of the program.

Normally, the second half of the blind duplicates are not available for retrieval since they are not actually a part of the field collected data. If, however, you need to retrieve them you may do so with the command:

INCLUDE.

After this command is encountered, the system will include all blind duplicate samples with the original samples if they match the field specifications. This command will remain in effect until a RETRIEVE command is encountered.

Control Card Decks for Using the Retrieval Program

As described in the last section, the Chem Lab data banks reside on magnetic tapes along with programs which comprise the GLIMS system. A binary copy of the retrieval program resides on the permanent file disk of the 6400.

The card deck for retrieving data from the 1973-1975 data bank stored on tape is:

```
TA000,AXXXXXXX,CM120000,T50,MT1,JP/EXAMPLE.
RFL,10000.
LABEL(TAP,R,L=LABDATA73,VSN=DXXXX)READ,SWIFT.
SKIPF,TAP,1,17,B.
COPYBF,TAP,RETREVE.
COPYBF,TAP,LODBNK.
SKIPF,TAP,1,17,B.
REWIND,RETREVE,LODBNK.
RFL,43000.
REDUCE.
LODBNK.
RFL,120000.
LOAD,RETREVE.
EXECUTE.
RFL,10000.
REWIND,DATA.
COPYCF,DATA,OUTPUT.
```

7_{8_9} end-of-record card

Commands for the retrieval program.

$6_{7_{8_9}}$ end-of-file card

The card deck for retrieving data from a bank which resides on the permanent file disk is:

```
TA000,CM120000,T50,AXXXXXXX.JP/EXAMPLE.
ATTACH,BANK,LABDATA73,ID=JDP,MR=1
ATTACH,RETREVE,SORTRETREVE,ID=JDP,MR=1
LOAD,RETREVE.
EXECUTE.
RFL,10000.
REWIND,DATA.
COPYCF,DATA,OUTPUT.
```

7_{8_9} end-of-record card

Commands for the retrieval program.

$6_{7_{8_9}}$ end-of-file card

ARCHIVED DATA BANKS

Three Chem Lab data banks which contain data collected from 1969 to 1972 reside on magnetic tape along with associated GLIMS programs. The structure of the Chem Lab archive tape is:

1. Tape is labelled "Chembanks" and is a read only tape.
2. File 1 contains a binary copy of the Chem Lab maintenance program.
3. File 2 contains a binary copy of the Chem Lab retrieval program.
4. File 3 contains a binary copy of LODBNK, the program that loads a bank onto disk.
5. File 4 contains a binary copy of STOR, the program that loads a bank to tape.
6. File 5 contains the 69-70 data bank.
7. File 6 contains the 71 data bank.
8. File 7 contains the 72 data bank.

Retrieving Data from the Archived Banks

```
TA000,AXXXXXXX,CM120000,T50,MT1.EXAMPLE.
RFL,10000.
LABEL(TAP,R,L=CHEMBANKS,VSN=AXXXX)READ,SWIFT.
SKIPF,TAP,1,17,B.
COPYBF,TAP,RETREVE.
COPYBF,TAP,LODBNK.
SKIPF,TAP,1,17,B.                    (positions tape to 69 bank)
```

```
REWIND,LODBNK,RETREVE.
RFL,43000.
REDUCE.
LODBNK.                                    (loads 69 bank to disk)
RFL,120000.
LOAD,RETREVE.
EXECUTE.
7
8
9   end of record card
Commands for retrieval program.
6
7
8
9   end of file card
```

The example shown above will retrieve Chem Lab data from the 1969-1970 bank. To position the tape to other banks insertion of:

```
SKIPF,TAP,1,17,B.
```

is all that is required to skip a bank file. For example, to position the tape to the 1972 bank. Insert 2 SKIPF cards after the one used to position the tape to the 1969 bank. These cards will cause skipping over the 69-70 bank and the 71 bank.

It is possible to retrieve information from all banks on the archive tape in one run.

```
TA000,AXXXXXXX,CM120000,T240,MT1.EXAMPLE.
RFL,10000.
LABEL(TAP,R,L=CHEMBANKS,VSN=AXXXX)READ,SWIFT.
SKIPF,TAP,1,17,B.
COPYBF,TAP,RETREVE.
COPYBF,TAP,LODBNK.
SKIPF,TAP,1,17,B.                          (positions tape to 69 bank)
REWIND,LODBNK,RETREVE.
RFL,43000.
REDUCE.
LODBNK.                                    (loads 69-70 bank on disk)
RFL,120000.
LOAD,RETREVE.
EXECUTE.
RFL,10000.                                 (executes retrieval program for 69 bank)
REWIND,DATA,LODBNK,RETREVE.
COPYCF,DATA,ALDATA.
BKSP,ALDATA.
RETURN,BANK,DATA.
RFL,43000.
REDUCE.
LODBNK.                                    (loads 71 bank to disk)
```

```
RFL,120000.
LOAD,RETREVE.
EXECUTE.                          (Executes retrieval program for 71 bank)
RFL,10000.
REWIND,DATA,LODBNK,RETREVE.
COPYCF,DATA,ALDATA.
BKSP,ALDATA.
RETURN,BANK,DATA.
RFL,43000
REDUCE.
LODBNK.                           (Loads 72 bank to disk)
RFL,120000.
LOAD,RETREVE.
EXECUTE.
RFL,10000.
REWIND,DATA
COPYCF,DATA,ALDATA.
REWIND,ALDATA.
COPYCF,ALDATA,OUTPUT.
```

7_{8_9} end of record card

Commands for the retrieval program for the 1969-70 bank.

7_{8_9} end of record card

Commands for the retrieval program for the 1971 bank.

7_{8_9} end of record card

Commands for the retrieval program for the 1972 bank.

$6_{7_{8_9}}$ end of file card

Depending on the amount of data retrieved the above example may take more time than the daytime limit of 240 seconds.

INDEX

Chemical Bank Maintenance Program Commands

Chemical Bank Retrieval Commands

Appendix A

GLIMS System

Maintenance Program Examples

06/06/75

```
*CREATE 300 LAB NUMBERS
*SELECT 10 PER CENT FOR DUPLICATE PROCESSING
*LAG THE SAMPLES FROM 3 TO 10 DAYS USING 30 SAMPLES PER DAY AS A RATE
        1      174
        2
        3
        4
        5
        6
        7
        8
        9
       10
       11
       12
       13
       14
       15
       16
       17
       18
       19      159
       20
       21
       22
       23
       24
       25
       26
       27
       28
       29
       30
       31
       32
       33
       34
       35
       36
       37      293
       38
       39      132
       40
       41
       42
       43
       44      342
       45
       46
       47
       48
       49
       50
       51
       52
       53
       54
       55
       56      329
       57
       58
       59
       60
       61      255
```

06/10/75

```
RESTORE THE FOLLOWING REQUEST CARDS PLEASE
 1KMO11 47217151EVAL          2536       1       A AA
 1KMO11 47217161EVAL          3050       2       A AA
 1KMO10 4721723     AG SP     2536       3       A AAAAA
 1KMO10 4721723     EE SE     2536       4       A AAAAA
 1KMO11 4721723     PO CO     2536       5       A AAAAA
 1KMO10 4721723     EE EE     2536       6       A AAAAA
 1KMO10 4721723     AE DI     2536       7       A AAAAA
 1KMO10 4721723     EE AI     2536       8       A AAAAA
 1KMO10 4721723     AE TH     2536       9       A AAAAA
 1KMO10 4721723     AG SP     2536      10       A AAAAA
 MEES 2 1731029     PO EP     4COP      11      AA AA AAA   A
 MEES 2 1731022     LA DI     2LOM      12      AA AA AAA   A
 MEES15 5731029022773PO ER    4C046     13       A AA AAA   A
 MEES15 5731029022673LA DI    2R025     14       A AA AAA   A
 MEES18 6731029051673LA DI    2011      15       A AA XAA   A
 MEES18 6731029051673PO ER    4C004     16       A AA AAA   A
 MEES18 7731029022073LA DI    2R060     17       A AA AAA   A
 MEES19 7731029022773PO ER    45C43     18       A AA AAA   A
 MEES25 6731029071673LA DI    2R036     19       A AA AAA   A
 MEES25 6731029071673PO ER    4C014     20       A AA AAA   A
11CEP10 573R124     PO GR     2   1     21       A AA AA    A
11CEP12127 R224     AR ER     4   1     22      AA AA AA    A
11CEP23 5740 7 4    PO GR     2   2     23       A AA AA    A
11CEP27 5740 7 4    PO GR     2         25       A AA AA    A
11CEP28 5740219                         26       A AA AA    A
11CEP12 67407 4     PO GR     2   2     27       A AA AA    A
11CEP22 77407 4     PO GR     2   2     28       A AA AA    A
11CEP29 87407 4     PO GR     2   2     29       A AA AA    A
11CED 3 97407 4     PO GR     2   2     30       A AA AA    A
```

Should be AGSP

Species code AG for lab number 3 is mispunched. The system will accept the error as a valid code

06/10/75

*GENERATE A SUMMARY REPORT

S U M M A R Y   R E P O R T 06/10/75

ANALYSIS TYPE	NUMBER DUE	NUMBER RECEIVED	TOTAL REQUESTS	NUMBER OF DUPLICATES
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	3	0	3	0
5	29	0	29	2
6	0	0	0	0
7	29	0	29	2
8	29	0	29	2
9	8	0	8	0
10	27	0	27	1
11	27	0	27	1
12	10	0	10	1
13	0	0	0	0
14	0	0	0	0
15	19	0	19	1
16	0	0	0	0
17	0	0	0	0
18	0	0	0	0
19	0	0	0	0
20	0	0	0	0
21	0	0	0	0
22	0	0	0	0
23	0	0	0	0
24	0	0	0	0
25	0	0	0	0
26	0	0	0	0
27	0	0	0	0
28	0	0	0	0
29	0	0	0	0
30	0	0	0	0

THIS COUNT WAS CALCULATED FROM   29 REQUEST RECORDS
FOR SAMPLE NUMBERS BETWEEN   1 AND.   30

2 SAMPLES WERE SELECTED FOR DUPLICATE PROCESSING.

06/10/75

THE DATA BANK IS SUCCESSFULLY CLOSED

```
   06/10/75  CSU SCOPE 3.3.14  B C012 C013 C140 C141 05/20/75
08.54.15.TA1453W   FROM  AB        13A
08.54.15.TA145,ANMH****,CM57000,T50.JP/EXAMPLE.
08.54.16.ATTACH,BANK,SAMPLEBANK,ID=JOP.
08.54.18.CYCLE **. SAMPLEBANK
08.54.18.PFN FOUND IN SD  010
08.54.18.CYCLE 01. SAMPLEBANK
08.54.18.FILE HAS BEEN ATTACHED
08.54.18.ATTACH,CHEMBK,ICHEM0975,ID=JOP.
08.54.19.CYCLE **. ICHEM0975
08.54.19.PFN FOUND IN SD  016
08.54.19.CYCLE 01. ICHEM0975
08.54.19.FILE HAS BEEN ATTACHED
08.54.19.PFDUMP.
08.54.19.CHEMBK.
08.54.26.FL= 054700 CP 000E1.492SEC.  IO 00001.000SEC.
08.54.26.STOP
08.54.26.EXTEND,BANK.
08.54.27.CYCLE 01. SAMPLEBANK
08.54.27.FILE EXTENDED
08.54.29.CP        2.120 SEC.
08.54.29.PP        7.708 SEC.
08.54.29.IO        1.095 SEC.
```

06/10/75

*LIST TYPE S

GRASSLANDS BIOME

INTERNATIONAL BIOLOGICAL PROGRAM

RESULT FORM FOR LABORATORY ANALYSIS

#DATA #TYPE	#INI- #TIALS	# DAY	MO	YR	# TYPE # AND # METHOD	# GERL # LAB # NUMBER	# NO # SAMPLE	# FINAL RESULT	#IDENT.# NUMBER	# TARE # WT.	# INI- # TIAL # WT.	# FINAL # WT.	#	#	#	#	#
#1-2	# 3-5	#6-7	8-9	10-11	# 12-15	# 16-21	# 22	# 23-33	#	#	#	#	#	#	#	#	#
83	---	--	--	--	05	--	1	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----
							2	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----
							3	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----
							4	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----
							5	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----
							6	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----
							7	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----
							8	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----
							9	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----
							10	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----
							11	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----
							12	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----
							13	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----
							14	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----
							15	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----
							16	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----
							17	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----
							18	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----
							19	-	-----.-----	-----	-----	-----	-----	-----	-----	-----	-----

TYPE

01
02
03
04 DRY MATTER PERCENT
05 ASH PERCENT
06 GROSS ENERGY KCAL/G DRY WT.
07 KJELDAHL N PERCENT
08 PHOSPHORUS PERCENT
09 C N C PERCENT
10 A D F PERCENT
11 LIGNIN PERCENT
12 CARBON PERCENT
13 IN VITRO PERCENT
14 PIGMENT MG/G DRY WT.
15 T A C PERCENT
16 CALCIUM PERCENT
17 MAGNESIUM PERCENT
18 SODIUM PERCENT
19 POTASSIUM PERCENT
20 TOTAL SULFUR PERCENT
21 COPPER PERCENT
22 MANGANESE PERCENT
23 ZINC PERCENT
24
25
26
27
28
29
30

THE LAST THREE LINES ARE FOR OPERATOR USE ONLY.

THEY ARE NOT TO BE KEYPUNCHED.

Error messages for tab numbers 23, 5, and 13 are due to mispunched analysis type codes on the previous card.

```
CREATE
JDP  10  6  75  5  -0   20   22.57000
JDP  10  6  75  5  -0   21    7.59000
JDP  10  6  75  5  -0   23    7.11000
JDP  10  6  75  5  -0   23    7.07000

THE ANALYSIS TYPE  5 HAS ALREADY BEEN RECEIVED FOR NO.      23
JDP  10  6  75  5  -0   25   16.37000
JDP  10  6  75  5  -0   26    9.42000
JDP  10  6  75  5  -0   27   20.17000
JDP  10  6  75  7  -0    1     .77700
JDP  10  6  75  7  -0    2     .29700
JDP  10  6  75  7  -0    3     .50700
JDP  10  6  75  7  -0    4     .84200
JDP  10  6  75  7  -0    5     .76500
JDP  10  6  75  7  -0    5     .97400     6

THE ANALYSIS TYPE  7 HAS ALREADY BEEN RECEIVED FOR NO.       5
JDP  10  6  75  7  -0    7     .94000
JDP  10  6  75  7  -0    8     .29400
JDP  10  6  75  7  -0    9    2.01100
JDP  10  6  75  7  -0   10     .88000
JDP  10  6  75  7  -0   11     .52900
JDP  10  6  75  7  -0   13    2.14000    12
JDP  10  6  75  7  -0   13    1.42000

THE ANALYSIS TYPE  7 HAS ALREADY BEEN RECEIVED FOR NO.      13
JDP  10  6  75  7  -0   14    2.22200
JDP  10  6  75  7  -0   15    2.46000
JDP  10  6  75  7  -0   16     .97400
JDP  10  6  75  7  -0   17    2.25000
JDP  10  6  75  7  -0   18     .88300
JDP  10  6  75  7  -0   19    1.51000
                                              06/11/75

*GENERATE A SUMMARY REPORT
     S U M M A R Y   R E P O R T  06/11/75
```

ANALYSIS TYPE	NUMBER DUE	NUMBER RECEIVED	TOTAL REQUESTS	NUMBER OF DUPLICATES
1	0	0	6	0
2	0	0	0	0
3	0	0	0	0
4	3	0	3	0
5	23	6	29	2
6	0	0	0	0
7	12	17	29	2
8	29	0	29	2
9	6	0	8	0
10	27	0	27	1
11	27	0	27	1
12	10	0	10	1
13	0	0	0	0
14	0	0	0	0
15	19	0	19	1
16	0	0	0	0
17	0	0	0	0
18	0	0	0	0
19	0	0	0	0
20	0	0	0	0
21	0	0	0	0
22	0	0	0	0
23	0	0	0	0
24	0	0	0	0
25	0	0	0	0
26	0	0	0	0
27	0	0	0	0
28	0	0	0	0
29	0	0	0	0
30	0	0	0	0

```
THIS COUNT WAS CALCULATED FROM       29 REQUEST RECORDS
FOR SAMPLE NUMBERS BETWEEN        1 AND      30

     2 SAMPLES WERE SELECTED FOR DUPLICATE PROCESSING.
                                              06/11/75

THE DATA BASE IS SUCCESSFULLY CLOSED

  06/11/75  CSU SCOPE 3.3.14  6 C012 C013 C140 C141 05/20/75
09.13.03.TE1456C    FROM   AH       134
09.13.03.TA145.ADMR0000.CM57000.T50.JP/EXAMPLE.
09.13.03.ATTACH,BANK,SAMPLEBANK,ID=JDP.
09.13.40.CYCLE 00. SAMPLEBANK
09.13.40.PFN FOUND IN SD  030
09.13.40.CYCLE 01. SAMPLEBANK
09.13.40.FILE HAS BEEN ATTACHED
09.13.40.ATTACH,CHEM,CHEM0609750,ID=JDP.
09.13.41.CYCLE 00. ICHEM0675
09.13.41.PFN FOUND IN SD  016
09.13.41.CYCLE 01. ICHEM0675
09.13.41.FILE HAS BEEN ATTACHED
09.13.41.RECLCE.
09.13.41.CHEMPRG.
09.13.45.FL= 054700 CP 00001.510SEC.  IO 00001.360SEC.
09.13.46.STOP
09.13.49.EXTEND,BANK.
09.13.49.CYCLE 01. SAMPLEBANK
09.13.49.FILE EXTENDED
09.13.49.CP      1.516 SEC.
09.13.49.PP     22.690 SEC.
09.13.49.IO      1.229 SEC.
```

SUBSTRATE & STATUS REPORT

STATUS REPORT 06/11/75

GRASSLANDS LAB CHEMICAL ANALYSIS DATA

SITE 3-4	INI 5-7	DAY 8-9	MO 10-11	YR 12-13	T 14	R 15	SOURCE 16-17	DESC. 18-23	VEGUS 24-26	SPECIES 27-29	SUB-SPP 30-32	ID 33-38	LABNO 39-44	MS 47 CA 62	ML 48 MG 63	MN 49 NA 64	GM 50 K 65	AS 51 TS 66	GE 52 CU 67	KN 53 MN 68	P 54 ZN 69	CW 55	AD 56	LI 57	C 58	IV 59	PI 60	TC 61	RESU COMP
1	KMP	10	4	72	1	7	14	UEVAC				2930	1	.	.	.	.	05	.	HC	08	.	.	.	.	.	.	.	
1	KMP	10	4	72	1	7	14	UEVAC				3950	2	.	.	.	.	05	.	HC	08	.	.	.	.	.	.	.	
1	KMP	10	4	72	1	7	23		MO	SP		2930	3	.	.	.	.	05	.	HC	08	09	10	11	.	.	.	.	
1	KMP	10	4	72	1	7	23		MO	SE		2930	4	.	.	.	.	05	.	HC	08	09	10	11	.	.	.	.	
1	KMP	10	4	72	1	7	23		MO	CU		2930	5	.	.	.	.	05	.	HC	08	09	10	11	.	.	.	.	
1	KMP	10	4	72	1	7	23		EM	FI		2930	6	.	.	.	.	05	.	07	08	09	10	11	.	.	.	.	
1	KMP	10	4	72	1	7	23		AM	DI		2930	7	.	.	.	.	05	.	HC	08	09	10	11	.	.	.	.	
1	KMP	10	4	72	1	7	23		UM	AT		2930	8	.	.	.	.	05	.	HC	08	09	10	11	.	.	.	.	
1	KMP	10	4	72	1	7	23		AM	TR		2930	9	.	.	.	.	05	.	HC	08	09	10	11	.	.	.	.	
1	KMP	10	4	72	1	7	23		MO	SP		2930	10	.	.	.	.	05	.	HC	08	09	10	11	.	.	.	.	
M	EES	2	1	73	1	0	24		BO	EM	4	COM	11	.	.	.	04	05	.	HC	08	.	10	11	12	.	.	15	
M	EES	2	1	73	1	0	24		LA	DI	2	COM	12	.	.	.	04	05	.	07	08	.	10	11	12	.	.	15	
M	EES	15	5	73	1	0	24	022773	BO	EM	4	C040	13	.	.	.	.	05	.	HC	08	.	10	11	12	.	.	15	
M	EES	15	5	73	1	0	24	022673	LA	DI	2	M025	14	.	.	.	.	05	.	HC	08	.	10	11	12	.	.	15	
M	EES	14	4	73	1	0	24	051873	LA	DI	2	D11	15	.	.	.	.	05	.	HC	08	.	10	11	12	.	.	15	
M	EES	14	M	73	1	0	24	051873	BO	EM	4	C004	16	.	.	.	.	05	.	HC	08	.	10	11	12	.	.	15	
M	EES	14	7	73	1	0	24	022673	LA	DI	2	M060	17	.	.	.	.	05	.	HC	08	.	10	11	12	.	.	15	
M	EES	19	7	73	1	0	24	022773	BO	EM	4	S043	18	.	.	.	.	05	.	HC	08	.	10	11	12	.	.	15	
M	EES	25	8	73	1	0	24	071873	LA	DI	2	M030	19	.	.	.	.	05	.	HC	08	.	10	11	12	.	.	15	
M	EES	25	M	73	1	0	24	071873	BO	EM	4	C014	20	.	.	.	.	HC	.	07	08	.	10	11	12	.	.	15	
11	CED	16	9	73	F	1	24		BO	GR	2	1	21	.	.	.	.	HC	.	07	08	.	10	11	.	.	.	15	
11	CED	12	12	73	F	2	24		AM	FH	4	1	22	.	.	.	04	05	.	07	08	.	10	11	.	.	.	15	
11	CED	23	5	74	D	7	4		BO	GR	2	2	23	.	.	.	.	HC	.	07	08	.	10	11	.	.	.	15	
													24																
													25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	AA
11	CED	27	5	74	E	7	4		BO	GR	2		26	.	.	.	.	HC	.	07	08	.	10	11	.	.	.	15	
11	CED	24	5	74	G	2	14						27																
													28	.	.	.	.	HC	.	07	08	.	10	11	.	.	.	15	
11	CED	12	A	74	D	7	4		CO	GR	2	2	29	.	.	.	.	HC	.	07	08	.	10	11	.	.	.	15	
11	CED	22	7	74	D	7	4		BO	GR	2	2	30	.	.	.	.	05	.	07	08	.	10	11	.	.	.	15	

STATUS REPORT 06/11/75

GRASSLANDS LAB CHEMICAL ANALYSIS DATA

SITE 3-4	INI 5-7	DAY 8-9	MO 10-11	YR 12-13	T 14	R 15	SOURCE 16-17	DESC. 18-23	VEGUS 24-26	SPECIES 27-29	SUB-SPP 30-32	ID 33-38	LABNO 39-44	MS 47 CA 62	ML 48 MG 63	MN 49 NA 64	GM 50 K 65	AS 51 TS 66	GE 52 CU 67	KN 53 MN 68	P 54 ZN 69	CW 55	AD 56	LI 57	C 58	IV 59	PI 60	TC 61	RESU COMP
11	CED	24	4	74	F	7	4		BO	GR	2	2	29	.	.	.	.	05	.	07	08	.	10	11	.	.	.	15	
11	CED	3	4	74	G	7	4		BO	GR	2	2	30	.	.	.	.	05	.	07	08	.	10	11	.	.	.	15	

REQUESTS RECEIVED AND COMPLETED BY TYPE OF TO 06/11/75

		4			5			6		
		NUMBER OF REQUESTS RECEIVED	NUMBER OF REQUESTS COMPLETED	NUMBER OF REQUESTS REMAINING	NUMBER OF REQUESTS RECEIVED	NUMBER OF REQUESTS COMPLETED	NUMBER OF REQUESTS REMAINING	NUMBER OF REQUESTS RECEIVED	NUMBER OF REQUESTS COMPLETED	NUMBER OF REQUESTS REMAINING
THIS YEAR TO DATE		3	0	3	31	6	25	0	0	0
SINCE	6/ 6/75	3	0		31	6		0	0	
SINCE	6/ 6/75	3	0		31	6		0	0	

		7			8			9		
		NUMBER OF REQUESTS RECEIVED	NUMBER OF REQUESTS COMPLETED	NUMBER OF REQUESTS REMAINING	NUMBER OF REQUESTS RECEIVED	NUMBER OF REQUESTS COMPLETED	NUMBER OF REQUESTS REMAINING	NUMBER OF REQUESTS RECEIVED	NUMBER OF REQUESTS COMPLETED	NUMBER OF REQUESTS REMAINING
THIS YEAR TO DATE		31	17	14	31	0	31	8	0	8
SINCE	6/ 6/75	31	17		31	0		8	0	
SINCE	6/ 6/75	31	17		31	0		8	0	

		10			11			12		
		NUMBER OF REQUESTS RECEIVED	NUMBER OF REQUESTS COMPLETED	NUMBER OF REQUESTS REMAINING	NUMBER OF REQUESTS RECEIVED	NUMBER OF REQUESTS COMPLETED	NUMBER OF REQUESTS REMAINING	NUMBER OF REQUESTS RECEIVED	NUMBER OF REQUESTS COMPLETED	NUMBER OF REQUESTS REMAINING
THIS YEAR TO DATE		28	0	28	28	0	28	11	0	11
SINCE	6/ 6/75	28	0		28	0		11	0	
SINCE	6/ 6/75	28	0		28	0		11	0	

		13			14			15		
		NUMBER OF REQUESTS RECEIVED	NUMBER OF REQUESTS COMPLETED	NUMBER OF REQUESTS REMAINING	NUMBER OF REQUESTS RECEIVED	NUMBER OF REQUESTS COMPLETED	NUMBER OF REQUESTS REMAINING	NUMBER OF REQUESTS RECEIVED	NUMBER OF REQUESTS COMPLETED	NUMBER OF REQUESTS REMAINING
THIS YEAR TO DATE		0	0	0	0	0	0	20	0	20
SINCE	6/ 6/75	0	0		0	0		20	0	
SINCE	6/ 6/75	0	0		0	0		20	0	

		16			17			18		
		NUMBER OF REQUESTS RECEIVED	NUMBER OF REQUESTS COMPLETED	NUMBER OF REQUESTS REMAINING	NUMBER OF REQUESTS RECEIVED	NUMBER OF REQUESTS COMPLETED	NUMBER OF REQUESTS REMAINING	NUMBER OF REQUESTS RECEIVED	NUMBER OF REQUESTS COMPLETED	NUMBER OF REQUESTS REMAINING
THIS YEAR TO DATE		0	0	0	0	0	0	0	0	0
SINCE	6/ 6/75	0	0		0	0		0	0	
SINCE	6/ 6/75	0	0		0	0		0	0	

		19			20			21		
		NUMBER OF REQUESTS RECEIVED	NUMBER OF REQUESTS COMPLETED	NUMBER OF REQUESTS REMAINING	NUMBER OF REQUESTS RECEIVED	NUMBER OF REQUESTS COMPLETED	NUMBER OF REQUESTS REMAINING	NUMBER OF REQUESTS RECEIVED	NUMBER OF REQUESTS COMPLETED	NUMBER OF REQUESTS REMAINING
THIS YEAR TO DATE		0	0	0	0	0	0	0	0	0
SINCE	6/ 6/75	0	0		0	0		0	0	
SINCE	6/ 6/75	0	0		0	0		0	0	

		22			23		
		NUMBER OF REQUESTS RECEIVED	NUMBER OF REQUESTS COMPLETED	NUMBER OF REQUESTS REMAINING	NUMBER OF REQUESTS RECEIVED	NUMBER OF REQUESTS COMPLETED	NUMBER OF REQUESTS REMAINING
THIS YEAR TO DATE		0	0	0	0	0	0
SINCE	6/ 6/75	0	0		0	0	
SINCE	6/ 6/75	0	0		0	0	

Appendix B

GLIMS System

Retrieval Program Examples

EXAMPLE 1

```
ENTER A COMMAND, PLEASE

  RETRIEVE

    SITE 11

      GENUS *BO *,*AG *

      SPECIES *GR *,*SP *

PRINT SITE,DATE,TRT,REP,SOURCE,DESC,GEN,SPP,ID,RESULT 5,RESULT 6,RESULT 7

SI   DATE    T R SO DESC    GEN SPP ID             ASH         ENERGY       NITROGEN

11  9/18/73 F 1 24          BO  GR    1      7.39000
11  5/23/74 F 7  4          BO  GR    2      7.60000                          DUE
11  5/27/74 F 7  4          BO  GR          14.07000                          DUE
11  6/12/74 D 7  4          BO  GR    2     20.17000                          DUE
11  7/22/74 D 7  4          BO  GR    2          DUE                          DUE
11  8/29/74 F 7  4          BO  GR    2          DUE                          DUE
11  9/ 3/74 D 7  4          BO  GR    2          DUE                          DUE
 06/11/75  CSU SCOPE 3.3.14  E C012 C013 C140 C141 05/20/75                   DUE
10.41.54.TA145AF    FROM  AB       11A
10.41.54.TA145,CM120000,ANM****G,T50.JP/EXAMPLE.
10.41.54.
10.41.54.RFL,10000.
10.41.54.FL= 010000 CP 00000.000SEC.  IO 00000.000SEC.
10.42.02.ATTACH,RETREVE,SORTRETREVE,ID=JDP.
10.42.02.CYCLE **. SORTRETREVE
10.42.02.PFN FOUND IN SD  015
10.42.02.CYCLE 01. SORTRETREVE
10.42.02.FILE HAS BEEN ATTACHED
10.42.02.ATTACH,BANK,SAMPLEBANK,ID=JDP,MR=1.
10.42.03.CYCLE **. SAMPLEBANK
10.42.03.PFN FOUND IN SD  030
10.42.03.CYCLE 01. SAMPLEBANK
10.42.03.FILE HAS BEEN ATTACHED
10.42.03.RFL,120000.
10.42.03.FL= 120000 CP 00000.014SEC.  IO 00000.070SEC.
10.42.03.LOAD,RETREVE.
10.46.39.EXECUTE.
10.46.47.FL= 056700 CP 00001.507SEC.  IO 00001.835SEC.
10.46.49.STOP
10.46.49.RFL,10000.
10.46.49.FL= 010000 CP 00001.772SEC.  IO 00002.005SEC.
10.46.49.REWIND,DATA.
10.46.49.COPYCF,DATA,OUTPUT.
10.46.49.CP        1.776 SEC.
10.46.49.PP       14.558 SEC.
10.46.49.IO        2.075 SEC.
```

EXAMPLE 2

```
RETRIEVE
  SITE 1-11
  COPY 1
      29 RECORDS SELECTED AND WRITTEN TO UNIT  2
SORT SITE,DATE,TRT,REP,SOURCE,DESC,GEN,SPP
PRINT SITE,DATE,TRT,REP,SOURCE,DESC,GEN,SPP,ID,RESULT 5,RESULT 6,RESULT 7 ?
     RESULT 8,RESULT 9
 9 KEY FIELDS( 1, 3)( 11, 2)( 5, 2)( 8, 2)( 13, 2)( 15, 2)( 17, 3)( 27, 4)( 31, 4)(
```

SI	DATE	T	R	SO	DESC	GEN	SPP	ID	ASH	ENERGY	NITROGEN	PHOSPHORUS	C.W.C.
1	4/19/72	1	7	19	DEVAC			2536	DUE		.77700	DUE	
1	4/18/72	1	7	19	DEVAC			3558	DUE		.89700	DUE	
1	4/10/72	1	7	23		AG	SP	2536	DUE		.66000	DUE	DUE
1	4/10/72	1	7	23		AS	LI	2535	DUE		.34500	DUE	DUE
1	4/10/72	1	7	23		AR	TR	2536	DUE		2.61100	DUE	DUE
1	4/10/72	1	7	23		CH	AI	2535	DUE		.89400	DUE	DUE
1	4/10/72	1	7	23		EH	FI	2535	DUE		DUE	DUE	DUE
1	4/10/72	1	7	23		HS	SP	2536	DUE		.60700	DUE	DUE
1	4/10/72	1	7	23		PU	CU	2535	DUE		.76300	DUE	DUE
1	4/19/72	1	7	23		PU	SE	2536	DUE		.59200	DUE	DUE
8	1/ 2/73	1	0	29		RO	ER	C06	DUE		.92900	DUE	
8	1/ 2/73	1	0	29		LA	DI	L08	DUE		DUE	DUE	
8	5/15/73	1	0	29	022773	RO	ER	L046	DUE		2.14000	DUE	
8	5/15/73	1	0	29	022673	LA	DI	R025	DUE		2.22200	DUE	
8	6/18/73	1	0	29	051873	RO	ER	C004	DUE		.97400	DUE	
8	6/18/73	1	0	29	051873	LA	DI	011	DUE		2.46000	DUE	
8	7/18/73	1	0	29	022673	LA	DI	R060	DUE		2.25000	DUE	
8	7/19/73	1	0	29	022773	RO	ER	S043	DUE		.68300	DUE	
8	8/25/73	1	0	29	071873	RO	ER	L01[illegible]	22.57000		DUE	DUE	
8	8/25/73	1	0	29	071873	LA	DI	R035	DUE		1.91000	DUE	
11	9/18/73	F	1	24		RO	GR	1	7.39000		DUE	DUE	
11	12/12/73	F	2	24		AP	FR	1	DUE		DUE	DUE	
11	5/2[illegible]/74	F	7	[illegible]		RO	GR	2	7.60000		DUE	DUE	
11	5/27/74	F	7	4		RO	GR		14.07000		DUE	DUE	
11	5/28/74	F	2	19					5.32000		DUE	DUE	
11	6/12/74	F	7	4		RO	GR	2	20.17000		DUE	DUE	
11	7/22/74	F	7	4		RO	GR	2	DUE		DUE	DUE	
11	8/29/74	F	7	4		RO	GR	2	DUE		DUE	DUE	
11	9/ 3/74	F	7	4		RO	GR	2	DUE		DUE	DUE	

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 06/11/75  CSU SCOPE 3.3.14  B C012 C013 C140 C141 05/20/75
11.39.56.TA14508    FROM  AB        10A
11.39.57.TA145,CM120000,AJP****0.T50.JP/EXAMPLE.
11.39.57.
11.39.57.RFL.10000.
11.39.57.FL= 010000 CP 00000.000SEC.  IO 00000.000SEC.
11.40.01.ATTACH,RETREVE,SORTRETREVE,ID=JOP.
11.40.02.CYCLE **. SORTRETREVE
11.40.02.PFN FOUND IN SO  015
11.40.02.CYCLE 01. SORTRETREVE
11.40.02.FILE HAS BEEN ATTACHED
11.40.02.ATTACH,BANK,SAMPLEBANK,ID=JOP,MR=1.
11.40.03.CYCLE **. SAMPLEBANK
11.40.03.PFN FOUND IN SO  030
11.40.03.CYCLE 01. SAMPLEBANK
11.40.03.FILE HAS BEEN ATTACHED
11.40.03.RFL.120000.
11.40.03.FL= 120000 CP 00000.013SEC.  IO 00000.070SEC.
11.40.03.LOAD,RETREVE.
11.41.11.EXECUTE.
11.41.16.FL= 056700 CP 00001.419SEC.  IO 00001.535SEC.
11.41.19.FL= 120000 CP 00002.178SEC.  IO 00002.015SEC.
11.41.19.** INSERTIONS DURING INPUT     *********0
11.41.19. ** DELETIONS DURING INPUT     *********0
11.41.19. ** TOTAL RECORDS SORTED       ********29
11.41.19. ** INSERTIONS DURING OUTPUT   *********0
11.41.19. ** DELETIONS DURING OUTPUT    ********29
11.41.19. ** TOTAL RECORDS OUTPUT       *********0.
11.41.19. ** INPUT PADDING RECORDS      *********0
11.41.19. ** OUTPUT PADDING RECORDS     *********0
11.41.19. **END SORT RUN
11.41.20.FL= 056700 CP 00002.418SEC.  IO 00003.415SEC.
11.41.20.STOP
11.41.20.RFL.10000.
11.41.20.FL  010000 CP 00002.422SEC.  IO 00003.440SEC.
11.41.20.REWIND,DATA.
11.41.20.COPYCF,DATA,OUTPUT.
11.41.21.CP       2.42  SEC.
11.41.21.PP      10.[illegible] SEC.
11.41.21.IO       [illegible] SEC.
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Appendix C

Grassland Biome

Chemical Analysis Banks

Description of Fields

FIELD	OUTPUT NAME	DESCRIPTION
SITE	SI	GRASSLANDS BIOME RESEARCH SITE 1 ALE — 7 SAN JOAQUIN 2 BISON — 8 JORNADA 3 BRIDGER — 9 USAGE 4 COTTONWOOD — 10 PANTEX 5 DICKINSON — 11 PAWNEE 6 HAYS — 12 NREL
INI	INI	INITIALS OF COLLECTOR OF SAMPLE
DATE	DATE	DATE OF COLLECTION OF SAMPLE AT THE SITE.
TRT	T	SAMPLING TREATMENT 0 COMPOSITED 1 UNGRAZED - ALL SITES 2 LIGHT GRAZING CURRENT YEAR 3 MODERATE GRAZING CURRENT YEAR 4 HEAVY GRAZING CURRENT YEAR 5,6 WITHHELD FROM GRAZING CURRENT YEAR, OR ANY NETWORK (EXCEPT THAT TRT 6 DESIGNATES A 4 FT. SNOW FENCE AT BRIDGER) 7,9 FOOT SNOW FENCE- BRIDGER ONLY 8 FIRE 9 UNUSED LETTER CODES - PAWNEE ONLY A 30 YEAR ENCLOSURE, ASCALON - BRIDGE SET - 1969 B 30 YEAR ENCLOSURE, MCGREW - BRIDGE SET - 1969 C DIET PASTURE - LIGHT/MODERATE D,E,F,G ESA - PAWNEE D=CONTROL E=WATER F=NITROGEN G=WATER AND NITROGEN EXCEPT TRT D PAWNEE 1971 IS A COMPOSITE OF ALL NONFERTILIZED TREATMENTS (1,2,3,4,5,D,E) FOR ALL SPECIES EXCEPT BOGR 2 TRT F PAWNEE 1971 IS A COMPOSITE OF BOTH FERTILIZED TREATMENTS (F,G) FOR ALL SPECIES EXCEPT BOGR 2 H,I,J RUSS GROW INSECTICIDE PLOTS - PAWNEE H=CONTROL I=DURSBAN J=DURSBAN+SUPRACIDE (EXCEPT TRT H ON NEUTRON PROBE DATA INDICATES LYNN LANE) K,L,M,N JACK LLOYD HERBICIDE - PAWNEE K=SILVEX L=DALAPON+SILVEX M=DALAPON N=CONTROL P VERO COLE PHOSPHOROUS TRT WITHIN ESA S,T SPECIAL CODES - PAWNEE ONLY S=PAWNEE IRRIGATED T=PAWNEE NON-IRRIGATED C,D,R DIET PASTURES - PAWNEE ONLY C=LIGHT/MOD GRAZING 21S D=HEAVY GRAZING 21S R=ANTELOPE PASTURE WITH PREDATOR PROOF FENCE 21N U,V 30 YEAR ENCLOSURES ON MCGREW SOIL - PAWNEE ONLY U=LIGHT GRAZED V=MODERATE GRAZED (USED FOR SEED PRODUCTION STUDY) W LYSIMETER- PAWNEE ONLY X,Y,Z B,S,F,W, INSECTICIDE PLOTS - PAWNEE X=TOXAPHENE Y=MALATHION Z=CONTROL

FIELD	OUTPUT NAME	DESCRIPTION
REP	R	SAMPLING REPLICATE (0-7 ALLOWED) 7 COMPOSITED SAMPLE BLANK NO SPECIFIED PLOT 0 NOT APPLICABLE
SOURCE	SO	SOURCE OF THE SAMPLE 0 UNKNOWN 1 MOUTH AND CHEEKS 2 ESOPHAGEAL 3 RUMEN 4 OLD DEAD 5 STOMACH 6 CROP 7 PERENNIAL LIVE 8 CAECUM 9 COLON 10 UNSPECIFIED AT THIS TIME 11 FECAL 12 URINE 13 CACHES AND STORES 14 UNSPECIFIED AT THIS TIME 15 HAND-CLIPPINGS 16 HAND-PLUCKS 17 ANIMAL CLIPS AND WASTES 18 MECHANICAL HARVESTED 19 LITTER AND DETRITUS 20 PLANTS(LIVE + DEAD) 21 ROOTS(LIVE + DEAD) 22 REPRODUCTIVE 23 STANDING DEAD 24 STANDING LIVE 25 ROOTS(LIVE) 26 ROOTS(DEAD) 27 CROWNS 28 RECENT DEAD 29 DECOMPOSITION BAGS 30 UNSPECIFIED AT THIS TIME
DESC	DESC	ORDER,FAMILY, OR NON-TAXONOMIC IDENTIFIER SOURCE 29:FIELD CONT. BURIAL DATE SOURCE 21,25,26: FIELD CONT. DEPTH AND EXTRACTION METHOD D=DRY W=WET A=UNSPECIFIED
GEN	GEN	GENUS
SPP	SPP	SPECIES
SUB	SUB	SUBSPECIES
ID	ID	INVESTIGATORS SPECIMEN OR DATA NUMBER
LABNO	LABNO	NREL LAB NUMBER ASSIGNED TO THE SAMPLE
RESULT 4	DRY MATTER	DRY MATTER IN WT. PERCENT WHEN HEATED 24 HRS. AT 100 DEGREES CENTIGRADE
RESULT 5	ASH	ASH IN WT. PERCENT WHEN HEATED 4 HRS. AT 600 DEGREES CENTIGRADE
RESULT 6	ENERGY	GROSS ENERGY IN KCAL PER GRAM
RESULT 7	NITROGEN	KJELDAHL NITROGEN IN WT. PERCENT
RESULT 8	PHOSPHORUS	TOTAL PHOSPHORUS IN WT. PERCENT
RESULT 9	C. W. C.	CELL WALL CONSTITUENTS IN WT. PERCENT USING NEUTRAL DETERGENT
RESULT 10	A. D. F.	ACID DETERGENT FIBER IN WT. PERCENT
RESULT 11	LIGNIN	LIGNIN IN WT. PERCENT METHOD 1 PERMANGANATE LIGNIN METHOD USED 1969 TO 1970 METHOD 2 72 SULFURIC ACID METHOD USED 1971 TO DATE.
RESULT 12	CARBON	METHOD 1 SCHONIGER COMBUSTION METHOD USED FOR INVESTIGATORS AND VL METHOD 2 LECO FURNACE COMBUSTION WITH VOLUMETRIC DETERMINATOR
RESULT 13	INVITRO	INVITRO DIGESTIBILITY IN WT. PERCENT BY THE TILLEY AND TERRY METHOD AS MODIFIED BY NREL
RESULT 14	PIGMENT	TOTAL CHLOROPHYLL IN MILLIGRAMS PER GRAM
RESULT 15	T. A. C.	TOTAL AVAILABLE CARBOHYDRATES IN WT. PERCENT
RESULT 16	CALCIUM	CALCIUM IN WT. PERCENT BY ATOMIC ABSORPTION SPECTROSCOPY
RESULT 17	MAGNESIUM	MAGNESIUM IN WT. PERCENT BY ATOMIC ABSORPTION SPECTROSCOPY
RESULT 18	SODIUM	SODIUM IN WT. PERCENT BY ATOMIC ABSORPTION SPECTROSCOPY
RESULT 19	POTASSIUM	POTASSIUM IN WT. PERCENT BY ATOMIC ABSORPTION SPECTROSCOPY
RESULT 20	TOTAL SULFUR	
RESULT 21	COPPER	MG/KG BY ATOMIC ABSORPTION SPECTROSCOPY
RESULT 22	MANGANESE	MG/KG BY ATOMIC ABSORPTION SPECTROSCOPY
RESULT 23	ZINC	MG/KG BY ATOMIC ABSORPTION SPECTROSCOPY