

# ABSTRACT

Reisig, Richard C., Olson, Richard D.

Western Sugar Company

1700 Broadway - Suite 1600

Denver, CO. 80290

## **WESTERN SUGAR COMPANY - LABORATORY INFORMATION MANAGEMENT SYSTEM - IMPLEMENTATION AND OVERVIEW.**

A Laboratory Information Management System has been developed and implemented within Western Sugar. The system runs on an IBM compatible PC using a commercial software package consisting of 5 modules: spreadsheet, database, word processor, time management, and communications. The programming language allowed the creation of a multi-level menu structure for routine tasks, which enables a novice computer user to enter data or obtain current process information. Data is input by The laboratory person doing the analysis, the data is automatically checked on-line against preset limits. Numerous help screens are available. Historical information can be retrieved with a minimum of keystrokes. With the programs' extensive graphic capabilities one can easily produce statistical graphs of process variables. Time spent in the calculation of daily, weekly and yearly information, and generation of reports has been reduced by several orders of magnitude. The LIMS program has enhanced the function of the laboratory as the information center of the factory by taking the large volume of information that passes through the laboratory daily and presenting it in an easy to use, more meaningful format to both management and process personnel. Process decisions can now be based on real-time information rather than historical data.

# WESTERN SUGAR COMPANY LABORATORY INFORMATION MANAGEMENT SYSTEM IMPLEMENTATION AND OVERVIEW

"LIMS" is the name of a laboratory computer program which has been developed and implemented by Western Sugar Company. The main objective in creating the program was to improve the flow and accessibility of laboratory information to process personnel. Through the use of the LIMS program, the large volume of information generated by the laboratory each day becomes manageable. A simplified menu structure and automated graphics capabilities, allow the data to be presented to operators in a format which is easy to understand and thus becomes a tool in optimizing the process.

The program is written in "SMARTWARE Version 3.10" which is an integrated software package consisting of 5 modules: spreadsheet, database, word processor, time management, and communications. One of the main reasons SMART software was chosen is the ease of transferring information between the different modules. Information contained in one module can easily be sent to any other module without having to leave the SMART software environment. With a smooth flow of information from one module to another, the advantages of each module can be fully optimized to create a system much more powerful than any stand-alone spreadsheet or database type package.

After deciding on the software package to base the LIMS system, hardware requirements were established. Although Smartware will run on virtually any IBM compatible system, due to file size and calculation requirements of the LIMS program, the following were instituted as minimum for the main computer in the Chemist's Office: 386 based system with a 40 meg hard disk, 2 meg of RAM, math co-processor, color VGA monitor, tape backup, laser printer and 2400 baud modem. Because of it's memory usage and shell menu structure (which can insulate novices from having to learn DOS) MS-DOS

version 5.0 was selected as the operating environment. PCTOOLS Version 6.0 is being used to do daily back-ups to tape. The back-up procedure is initiated from a single menu pick.

As the typical user of the program is not a sophisticated computer operator; simplicity for the user was an overriding priority in the design of the system. All routine tasks are chosen from a variety of interconnecting menus, with the <ESC> key being used to back out of menus. Extensive use of on-screen prompting is also utilized to guide users.

In designing this program consideration was given to the fact that there is a great deal of information recorded each day (such as laboratory results, temperatures, chemical usage, etc.) and the ideal place to store this type of information was in the database module. Once the information was entered into the database, it could be sorted by shift, date, test, etc. There are also many calculations each day based on the information sent to the database. It was concluded that the spreadsheet module was the most logical place to perform and store these complex calculations.<sup>(1)</sup> By linking information between the spreadsheet and database modules, the strengths of each are used to the fullest.

In the LIMS program the archived information is contained in two files, a database file and a spreadsheet file, which is updated daily. Several smaller executable files exist which are used to create or print reports, draw graphs, process information, export data, operate communications, input data, etc. As the program runs, information can be automatically extracted from the database and sent to the spreadsheet, without the user having to request it or even knowing that it happened.

Since the size of a file in SMART is limited only by the size of the computer's hard disk, we were able to overcome the problem of limited file size which had caused several

problems with our old laboratory program. In the old program one week's data had to be carried over to a new worksheet at the beginning of each week. This caused problems when an error was found in an archived file. With the new LIMS program, the entire campaign's calculations are saved in one file. If an error is encountered on a previous week's work, it is a simple matter to make the correction, press calculate, and the entire spreadsheet is brought up to date.

A system of labeling each test or calculated result with a unique number in both the database and spreadsheet was developed. This makes retrieval of information on a particular item (such as molasses apparent purity) very easy by using that number as a key to the information. Unique ID numbers allow items to be selected from a simple list on screen for purposes such as graphing, statistical analysis or exporting data. A uniform system of numbering test results is critical if the system is to be used to compare data from different locations or from different years. A well planned numbering system also makes it possible to identify and track the source of data solely by it's ID number. In the Western Sugar LIMS system, tests result numbers are 3 digit, calculated numbers are 4 digit, and additionally each area of the factory has it's own unique number.

Another reason SMART was selected as the operating software is the sophisticated yet simple graphing capabilities. One of the most important features of the LIMS program is that anyone in the factory can view information of interest to them in a graph format simply by entering 3 to 4 keystrokes. There are four predefined types of graphs available this way: an X-Bar graph of a single test result<sup>(2)</sup>, two test results on one page to check for trends or correlations<sup>(3)</sup> and a scatter graph. More detailed information is also available in what is called "Statistical Analysis".<sup>(4)</sup> When this information is requested, a spreadsheet is generated based on a single test number. This spreadsheet contains all available data in the spreadsheet or database which pertains to that test. Calculations are automatically done which provide statistical information such as: mean, standard

deviation, variance, maximum, minimum etc. Sorting this information is a valuable tool in analyzing variables throughout the process, but it is also a means of determining consistency between laboratory and/or shift operations.

Understanding that different factories would have various requirements for internal reports, a method of designing a custom report<sup>(5,6)</sup> by simple menu choices was incorporated into the program. Custom reports can be easily created for any person, or any department, by simply giving the report a name and then using the cursor to select the appropriate ID numbers. As the ID numbers are selected, titles and formulas are automatically placed in the report as required. Once saved, the report can be recalled and printed with ease. Adding or removing tests from the report is not a problem, anyone can design their own report to meet their specific needs.

Networking trials were conducted this past campaign at two locations with very favorable results. At Scottsbluff the file server is located in the laboratory. It is used by laboratory personnel to enter test data. There are also terminals located in the Central Control Room, Pan Floor, Beet End, and Chemist's Office.<sup>(7)</sup> Process test results are available throughout the factory on-line as data is entered. Improved communications and greater awareness of process conditions are benefits to be gained from a networked LIMS system. Future expansion of the network will include the Molasses Desugarization Plant and Warehouse.

Data entry is accomplished by the laboratory personnel entering their own results as the analyses are done. For this purpose a second dedicated computer in the factory laboratory is utilized with the data being transferred via cable to the main computer in the chemists office. At Western Sugar we currently have seven laboratory sheets. Each entry screen looks exactly like the printed sheet,<sup>(8)</sup> which has helped facilitate the transition from written data to electronic data. Each laboratory sheet is accessed by a menu option. When



a sheet is selected, the appropriate file is loaded and the cursor is located at the appropriate hour. Data may be entered at this time, pressing <ESC> saves the sheet and returns to the menu. This provides a continuous backup of input data. As test results are entered a limit check is initiated by the computer, which immediately alerts the analyst to numbers out of normal range. If out of range results are entered, the computer sounds a tone, the cell is flagged in bright red, and the high and low limits for that particular test is displayed in a pop-up window.<sup>(9)</sup> On the printed lab sheet, a check-mark appears to the right of each flagged result, making identification of out of range tests easy for process personnel unfamiliar with normal operating parameters. If the analyst wishes to check the correct method for a test, they may do so by simply pressing a key, which will display the method of analysis<sup>(10)</sup> for that test. The method can be viewed on screen, and if desired sent to the printer. The limits for each test are set by the chemist and may be updated as operating conditions dictate. A report listing all out of range tests<sup>(11)</sup> for the last 24 hours can be printed from a menu choice. Upper and lower limits for each test appear on the printed lab sheet at the bottom of each column of tests. If a test is flagged, it is a simple matter to look at the bottom of the sheet and get an immediate indication if the test is above or below the acceptable range. Through use of the LIMS program, we have noticed a increased awareness and concern for abnormal test results by not only laboratory, but also process personnel. This increased awareness yields faster response to problems and changing process conditions.

Seven days of data is saved on each of the Laboratory Sheets. Having this data available when viewing a sheet allows for a feature we called "ZOOM". By placing the cursor on the column of the desired test, a pop-up spreadsheet<sup>(12)</sup> is generated containing all of the data for that particular test for the past seven days. Shift averages and twenty-four hour averages are displayed. The screen also contains statistical data such as: average, standard deviation, variance, maximum, minimum, etc. The zoom spreadsheet can also be output to the printer. After viewing the data a graph<sup>(13)</sup> can be automatically

generated for any period throughout the last seven days. The graphed test results can also be output to the printer. All this is done without ever leaving the Smartware environment or even losing your position on the laboratory sheet.

Another unique feature of the Smartware software is the programming language, which is entered in pure ASCII characters. It is the programming language that allows the pieces to be integrated smoothly together, by performing various tasks automatically in each module and then passing control to another module. It is even possible to execute DOS batch files from inside a program and to make decisions on the next module to use, depending on the outcome of the current job. "Project files" (executable files) are entered in ASCII characters, but then the run-time version is generated by compiling and cannot be altered without the original. The uncompiled originals are maintained with the program administrator and only the run-time versions are distributed to the factory locations. This has helped to make sure that all seven factories are using a uniform version.

In order to make the gathered information more widely available, including the corporate office in Denver, the communications module is used. A dedicated computer was setup in Denver and is always set to receive or send as desired except when it is processing the information late at night. All of the daily averages from each location, along with a space for comments are sent to Denver in the morning. Once the data is received, it is compiled into a very large database containing information from all seven factories. From that a summarized report<sup>(14)</sup> is generated and then drawn back to the factories in the same afternoon. The same setup is used for the weekly extraction statement<sup>(15)</sup> and weekly operating report.<sup>(16)</sup> The database format in the Corporate Office is setup to view data by location,<sup>(17)</sup> whereas the database format at each location is setup to view data by shift. Since all results and calculations are sent to Denver each day, specific reports can be customized for various people in the Denver Office the same way they are customized at each location.

## APPENDIX

Prior to implementation of the LIMS program, a one week training session was conducted involving all the chief chemists and their laboratory clerks. As with any new system, minor start-up problems were encountered. A fairly extensive series of operating instructions is available and since the programing was done in-house, technical support is only a phone call away. As a result of our experiences at Western Sugar, we feel we have benefited by developing our own LIMS system to meet the needs of our operation, rather than trying to tailor our operation to fit a "canned" LIMS system.

The LIMS program is a powerful information tool and with experience the users are able to realize it's full potential. Usage of the LIMS system is often the first step to computer literacy for many of our employees. Operators are able to input data, perform calculations, and generate graphs. As an example: pan floor operations have been improved by providing the sugar boilers with a graphical tool to monitor sugar granulation.<sup>(18)</sup> Purification has also benefited by giving the operators a means to fine-tune the preliimer operation<sup>(19)</sup>.

Fully utilizing the capabilities of the LIMS system is a challenge. Justification of the time and effort spent developing and learning the LIMS program is it's usefulness in optimizing the entire factory process. Laboratory data should not be a deep dark secret kept from all but the chief chemist and Factory Manager. Getting information out among the process personnel provides them with a tool to do a better job.



## APPENDIX

1. Spreadsheet calculations (Greenbook) - Page 1 of 2
2. X-Bar Graph of Diffusion Juice RDS
3. Correlation Graph of Diffusion Juice RDS vs. Cossette % Sugar
4. Statistical Analysis - Test results by shift for: Diffusion Juice RDS
5. Custom Report - Beet End Report
6. Custom Report - Sugar End Report
7. Local Area Network Layout - Scottsbluff Factory
8. Laboratory Sheet - Juice Sheet - Page 1 of 7
9. Pop-Up Window - Juice Sheet - Lower Limit
10. Method Of Analysis - Diffusion Juice RDS
11. Laboratory Test Results Out Of Limits Report
12. ZOOM - Pop-Up Spreadsheet - Diffusion Juice RDS
13. ZOOM - Data Graph - Diffusion Juice RDS
14. Summarized Report - Daily Report
15. Extraction Statement - Page 1 of 2
16. Weekly Operating Report - Page 1 of 8
17. Data by Location - Statistical Analysis - Test results by location for: Molasses RDS
18. Sugar Granulation - Seive Test - Shift Analysis
19. Prelimer Operation - Shift Prelimer pH Profile

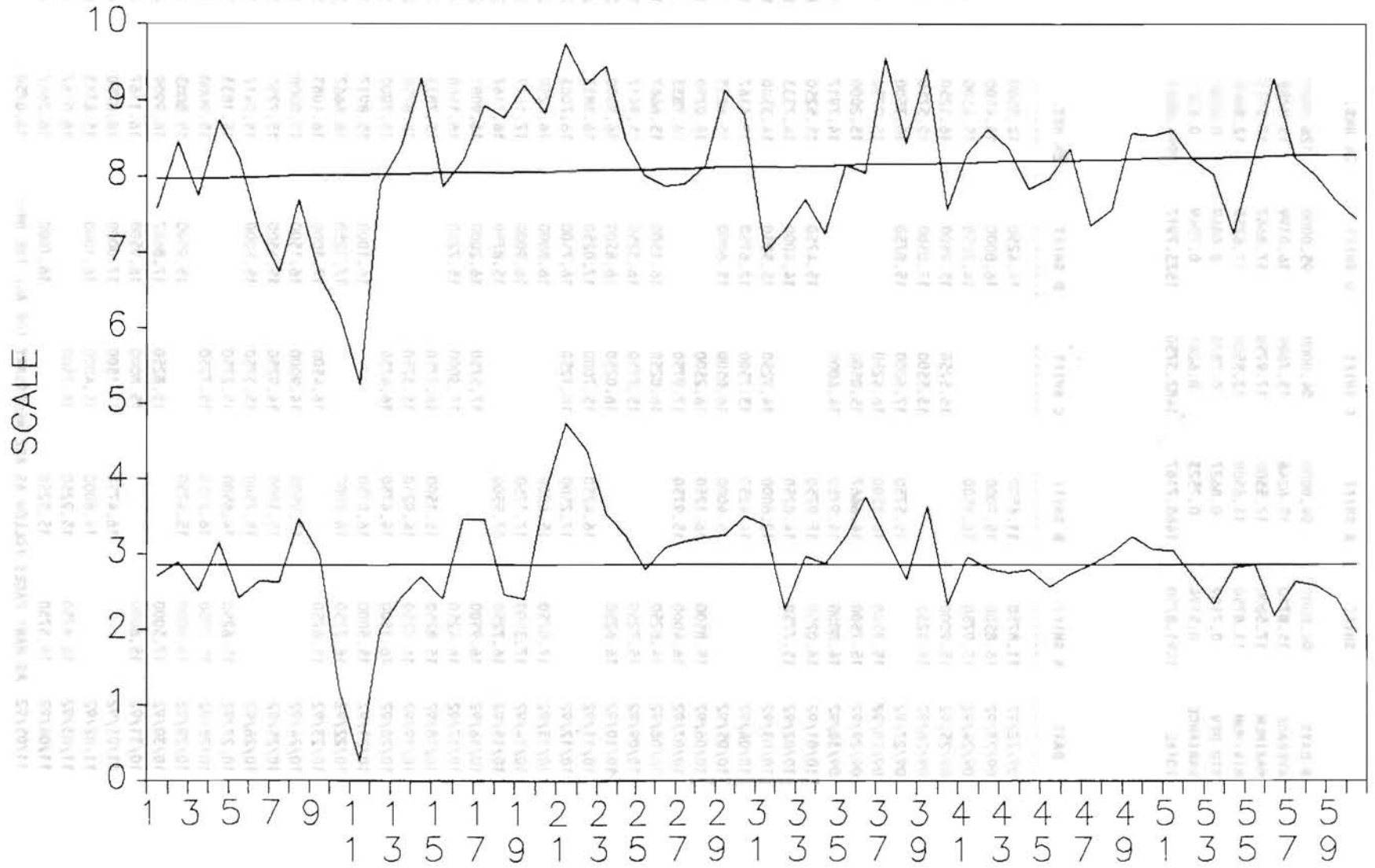
| ID # | BLEND OPERATION                           | 01/08/93 | TO DATE | ID # | DRYER OPERATION                             | 01/08/93 | TO DATE |
|------|-------------------------------------------|----------|---------|------|---------------------------------------------|----------|---------|
| 1100 | NUMBER OF SLICING DAYS                    | XXX.XX   | XXX.XX  | 1221 | HIGH RAW PAN RDS                            | XXX.XX   | XXX.XX  |
| 1101 | TONS BEETS SLICED                         | XXX.XX   | XXX.XX  | 1222 | HIGH RAW PAN MASS, % ON BEETS               | XXX.XX   | XXX.XX  |
| 1102 | COSSETTE % SUGAR                          | XXX.XX   | XXX.XX  | 1223 | LOW RAW PANS, CU FT MASS BOILED             | XXX.XX   | XXX.XX  |
| 1103 | TONS SUGAR INTRODUCED                     | XXX.XX   | XXX.XX  | 1224 | LOW RAW PAN RDS                             | XXX.XX   | XXX.XX  |
| 1104 | COSSETTE PURITY                           | XXX.XX   | XXX.XX  | 1225 | LOW RAW PAN MASS, % ON BEETS                | XXX.XX   | XXX.XX  |
| 1105 | COSSETTE PURITY PRODUCT, TONS             | XXX.XX   | XXX.XX  | 1226 | MOLASSES PRODUCED, TONS                     | XXX.XX   | XXX.XX  |
| 1106 | AVERAGE TONS SLICED PER DAY               | XXX.XX   | XXX.XX  | 1227 | MOLASSES PRODUCED, % ON BEETS               | XXX.XX   | XXX.XX  |
| 1107 | SLICING PERFORMANCE                       | XXX.XX   | XXX.XX  | 1228 | MOLASSES PRODUCED, % SUGAR                  | XXX.XX   | XXX.XX  |
| 1108 | DIFFUSION JUICE PURITY                    | XXX.XX   | XXX.XX  | 1229 | SUGAR IN MOLASSES PRODUCED, TONS            | XXX.XX   | XXX.XX  |
| 1109 | DIFFUSION JUICE PURITY PRODUCT, TONS      | XXX.XX   | XXX.XX  | 1230 | SUGAR IN MOLASSES PRODUCED, CWT             | XXX.XX   | XXX.XX  |
| 1110 | DIFFUSER ELIMINATION                      | XXX.XX   | XXX.XX  | 1231 | SUGAR IN MOLASSES PRODUCED, % ON BEETS      | XXX.XX   | XXX.XX  |
| 1111 | CARBONATION ELIMINATION                   | XXX.XX   | XXX.XX  | 1232 | MOLASSES PRODUCED APPARENT PURITY           | XXX.XX   | XXX.XX  |
| 1112 | DIFFUSER SUPPLY, % ON BEETS               | XXX.XX   | XXX.XX  | 1233 | MOLASSES PRODUCED, TONS PURITY PRODUCT      | XXX.XX   | XXX.XX  |
| 1113 | DIFFUSER SUPPLY % SUGAR                   | XXX.XX   | XXX.XX  | 1234 | MOLASSES PRODUCED, RDS                      | XXX.XX   | XXX.XX  |
| 1114 | PRESSED PULP % SUGAR                      | XXX.XX   | XXX.XX  | 1235 | SUGAR BALANCE, BEETS, TONS                  | XXX.XX   | XXX.XX  |
| 1115 | TONS OF SUGAR IN PRESSED PULP             | XXX.XX   | XXX.XX  | 1236 | SUGAR BALANCE, SUGAR INTRO., TONS           | XXX.XX   | XXX.XX  |
| 1116 | SUGAR IN PULP, % ON BEETS                 | XXX.XX   | XXX.XX  | 1237 | SUGAR BALANCE, SUGAR INTRO., % ON BEETS     | XXX.XX   | XXX.XX  |
| 1117 | SCALE FACTOR                              | XXX.XX   | XXX.XX  | 1238 | SUGAR BALANCE, KNOWN LOSS, TONS             | XXX.XX   | XXX.XX  |
| 1118 | DIFFUSION JUICE RDS                       | XXX.XX   | XXX.XX  | 1239 | SUGAR BALANCE, KNOWN LOSS, % ON BEETS       | XXX.XX   | XXX.XX  |
| 1119 | THIN JUICE RDS                            | XXX.XX   | XXX.XX  | 1240 | SUGAR BALANCE, MOLASSES LOSS, TONS          | XXX.XX   | XXX.XX  |
| 1120 | THIN JUICE PURITY                         | XXX.XX   | XXX.XX  | 1241 | SUGAR BALANCE, MOLASSES LOSS, % ON BEETS    | XXX.XX   | XXX.XX  |
| 1121 | THIN JUICE TO EVAPORATORS, % ON BEETS     | XXX.XX   | XXX.XX  | 1242 | SUGAR BALANCE, SUGAR PRODUCED, TONS         | XXX.XX   | XXX.XX  |
| 1122 | DRAFT, BY SUGAR CONTENT, % ON BEETS       | XXX.XX   | XXX.XX  | 1243 | SUGAR BALANCE, SUGAR PRODUCED, % ON BEETS   | XXX.XX   | XXX.XX  |
| 1123 | SUGAR IN PULP, % ON SUGAR INPUT           | XXX.XX   | XXX.XX  | 1244 | SUGAR BALANCE, ACCOUNTED FOR, TONS          | XXX.XX   | XXX.XX  |
| 1124 | SUGAR IN PULP, CWT                        | XXX.XX   | XXX.XX  | 1245 | SUGAR BALANCE, ACCOUNTED FOR, % ON BEETS    | XXX.XX   | XXX.XX  |
| 1125 | COSSETTES ENT. DIFFUSER TEMPERATURE       | XXX.XX   | XXX.XX  | 1246 | SUGAR BALANCE, DIFFERENCE, TONS             | XXX.XX   | XXX.XX  |
| 1126 | BEETS ENT. SLICER TEMPERATURE             | XXX.XX   | XXX.XX  | 1247 | SUGAR BALANCE, DIFFERENCE, % ON BEETS       | XXX.XX   | XXX.XX  |
| 1127 | CORRECTED % SUGAR IN COSSETTES (BY TEMP)  | XXX.XX   | XXX.XX  | 1248 | KNOWN SUGAR LOSSES, CWT, EXCEPT MOLASSES    | XXX.XX   | XXX.XX  |
| 1128 | CORRECTED % SUGAR IN COSSETTES (METERED)  | XXX.XX   | XXX.XX  |      |                                             |          |         |
| 1129 | STEAM TO SLICERS, TONS METERED            | XXX.XX   | XXX.XX  |      |                                             |          |         |
| 1129 | STEAM TO SLICERS, % ON BEETS (METERED)    | XXX.XX   | XXX.XX  |      |                                             |          |         |
| ID # | SUGAR END OPERATION                       | 01/08/93 | TO DATE | ID # | DRYER OPERATION                             | 01/08/93 | TO DATE |
| 1200 | THICK JUICE RDS                           | XXX.XX   | XXX.XX  | 1300 | PLAIN PULP EQUIVALENT, % ON BEETS           | XXX.XX   | XXX.XX  |
| 1201 | THICK JUICE PURITY                        | XXX.XX   | XXX.XX  | 1301 | PLAIN PULP EQUIVALENT, TONS                 | XXX.XX   | XXX.XX  |
| 1202 | CALCULATED THICK JUICE PURITY             | XXX.XX   | XXX.XX  | 1302 | PLAIN PULP EQUIVALENT, AVERAGE TONS PER DAY | XXX.XX   | XXX.XX  |
| 1203 | THICK JUICE LVG. EVAPORATORS, % ON BEETS  | XXX.XX   | XXX.XX  | 1303 | WET PULP MOISTURE                           | XXX.XX   | XXX.XX  |
| 1204 | BAGS OF SUGAR PRODUCED (NET)              | XXX.XX   | XXX.XX  | 1304 | PRESSED PULP MOISTURE                       | XXX.XX   | XXX.XX  |
| 1205 | BAGS OF SUGAR PRODUCED, AVG PER DAY       | XXX.XX   | XXX.XX  | 1305 | PLAIN PULP MOISTURE                         | XXX.XX   | XXX.XX  |
| 1206 | BAGS OF SUGAR PRODUCED, % ON BEETS        | XXX.XX   | XXX.XX  | 1306 | MOLASSES PULP MOISTURE                      | XXX.XX   | XXX.XX  |
| 1207 | BAGS OF SWEEPINGS REBOILED                | XXX.XX   | XXX.XX  | 1307 | PLAIN PELLETS MOISTURE                      | XXX.XX   | XXX.XX  |
| 1208 | BAGS OF SUGAR PRODUCED (GROSS)            | XXX.XX   | XXX.XX  | 1308 | MOLASSES PELLETS MOISTURE                   | XXX.XX   | XXX.XX  |
| 1209 | BAGS OF SUGAR PROD PER 100 CU FT MASS     | XXX.XX   | XXX.XX  | 1309 | MOLASSES USED, ENTG DRYER, TONS             | XXX.XX   | XXX.XX  |
| 1210 | GRAM EQUIV INTRODUCED, BAGS               | XXX.XX   | XXX.XX  | 1310 | MOLASSES USED, DRY SUBSTANCE, ENTG DRYER    | XXX.XX   | XXX.XX  |
| 1211 | EXTRACTION, SUGAR PRODUCED, BAGS          | XXX.XX   | XXX.XX  | 1311 | MOLASSES USED, DRY SUBSTANCE, LVG DRYER     | XXX.XX   | XXX.XX  |
| 1212 | EXTRACTION, SUGAR PRODUCED, % ON BEETS    | XXX.XX   | XXX.XX  | 1312 | MOLASSES USED, LVG DRYER, TONS              | XXX.XX   | XXX.XX  |
| 1213 | EXTRACTION, SUGAR PROD, % ON SUG IN COSS. | XXX.XX   | XXX.XX  | 1313 | MOLASSES USED, LVG DRYER, % ON MOL PULP     | XXX.XX   | XXX.XX  |
| 1214 | FORECAST EXTRACTION                       | XXX.XX   | XXX.XX  | 1314 | CSF USED, ENTG DRYER, TONS                  | XXX.XX   | XXX.XX  |
| 1215 | WHITE PANS, CU. FT. MASS BOILED           | XXX.XX   | XXX.XX  | 1315 | CSF USED, DRY SUBSTANCE, ENTG DRYER         | XXX.XX   | XXX.XX  |
| 1216 | WHITE PAN RDS                             | XXX.XX   | XXX.XX  | 1316 | CSF USED, DRY SUBSTANCE, LVG DRYER          | XXX.XX   | XXX.XX  |
| 1217 | WHITE PAN MASS, % ON BEETS                | XXX.XX   | XXX.XX  | 1317 | CSF USED, LVG DRYER, TONS                   | XXX.XX   | XXX.XX  |
| 1218 | GRANULATED SUGAR % ON WHITE MASS          | XXX.XX   | XXX.XX  | 1318 | CSF USED, LVG DRYER, % ON MOL PULP          | XXX.XX   | XXX.XX  |
| 1219 | WHITE MASS TO HIGH RAW MASS, CU FT        | XXX.XX   | XXX.XX  | 1319 | THIRD ADD USED, ENTG DRYER, TONS            | XXX.XX   | XXX.XX  |
| 1220 | HIGH RAW PANS, CU FT MASS BOILED          | XXX.XX   | XXX.XX  | 1320 | THIRD ADD USED, DRY SUBSTANCE, ENTG DRYER   | XXX.XX   | XXX.XX  |
|      |                                           |          |         | 1321 | THIRD ADD USED, DRY SUBSTANCE, LVG DRYER    | XXX.XX   | XXX.XX  |
|      |                                           |          |         | 1322 | THIRD ADD USED, LVG DRYER, TONS             | XXX.XX   | XXX.XX  |
|      |                                           |          |         | 1323 | THIRD ADD USED, LVG DRYER, % ON MOL PULP    | XXX.XX   | XXX.XX  |
|      |                                           |          |         | 1324 | TOTAL ADDITIVES, ENTG DRYER, TONS           | XXX.XX   | XXX.XX  |
|      |                                           |          |         | 1325 | TOTAL ADDITIVES, LVG DRYER, TONS            | XXX.XX   | XXX.XX  |
|      |                                           |          |         | 1326 | TOTAL ADDITIVES, LVG DRYER, % ON MOL PULP   | XXX.XX   | XXX.XX  |



# DIFFUSION JUICE RDS COSSETTE % SUGAR

09/24/92 THRU 11/22/92

113



|          | A SHIFT   | B SHIFT   | C SHIFT   | D SHIFT   | 24 HRS.   |
|----------|-----------|-----------|-----------|-----------|-----------|
| # DAYS   | 94.0000   | 94.0000   | 94.0000   | 95.0000   | 126.0000  |
| AVERAGE  | 15.8710   | 15.6246   | 15.7699   | 16.0399   | 15.8258   |
| MAXIMUM  | 17.5000   | 17.5500   | 17.9750   | 17.8667   | 17.5333   |
| MINIMUM  | 11.8750   | 11.6500   | 13.5500   | 12.6750   | 12.8500   |
| STD DEV  | 0.7169    | 0.8627    | 0.7870    | 0.8869    | 0.6502    |
| VARIANCE | 0.5194    | 0.7523    | 0.6261    | 0.7949    | 0.4261    |
| TOTAL    | 1491.8750 | 1468.7167 | 1482.3750 | 1523.7917 | 1994.0509 |

| DATE     | A SHIFT                                                | B SHIFT | C SHIFT | D SHIFT | 24 HRS. | DAY # |
|----------|--------------------------------------------------------|---------|---------|---------|---------|-------|
| 09/22/92 | 11.8750                                                | 11.6500 |         | 14.4250 | 12.8500 | 2     |
| 09/23/92 | 16.8500                                                | 15.7000 |         | 16.8000 | 16.4500 | 3     |
| 09/24/92 | 15.9750                                                | 16.1500 |         | 14.2250 | 15.4500 | 4     |
| 09/25/92 | 15.9000                                                |         | 16.5250 | 15.9500 | 16.1250 | 5     |
| 09/26/92 | 16.1250                                                |         | 13.5500 | 17.0500 | 15.5750 | 6     |
| 09/27/92 |                                                        | 15.5750 | 17.6000 | 15.8750 | 16.3500 | 7     |
| 09/28/92 | 15.3500                                                | 16.1500 | 16.4250 |         | 15.9750 | 8     |
| 09/29/92 | 15.7500                                                | 14.6667 | 15.0500 |         | 15.2000 | 9     |
| 09/30/92 | 14.8000                                                | 14.9750 | 14.6000 |         | 14.7917 | 10    |
| 10/01/92 | 16.0250                                                | 15.0750 |         | 15.4750 | 15.5250 | 11    |
| 10/02/92 | 15.7750                                                | 14.0250 |         | 14.4000 | 14.7333 | 12    |
| 10/03/92 |                                                        | 12.6000 | 14.9250 | 15.5250 | 14.3500 | 13    |
| 10/04/92 |                                                        | 14.4250 | 13.7500 | 12.6750 | 13.6167 | 14    |
| 10/05/92 |                                                        | 15.4000 | 16.0500 | 15.6000 | 15.6833 | 15    |
| 10/06/92 | 15.8500                                                | 16.1250 | 16.2500 |         | 16.0750 | 16    |
| 10/07/92 | 16.4000                                                | 15.9750 | 17.9750 |         | 16.7833 | 17    |
| 10/08/92 | 14.8250                                                |         | 16.0250 | 16.1500 | 15.6667 | 18    |
| 10/09/92 | 15.7250                                                |         | 15.7750 | 16.3250 | 15.9417 | 19    |
| 10/10/92 | 16.6250                                                |         | 16.0250 | 16.8500 | 16.5000 | 20    |
| 10/11/92 |                                                        | 16.4250 | 15.7000 | 17.0250 | 16.3833 | 21    |
| 10/12/92 |                                                        | 17.2500 | 16.1250 | 16.7500 | 16.7083 | 22    |
| 10/13/92 | 17.0750                                                | 15.4000 |         | 16.8000 | 16.4250 | 23    |
| 10/14/92 | 17.3500                                                | 17.1750 |         | 16.9000 | 17.1417 | 24    |
| 10/15/92 | 16.7250                                                | 17.5500 |         | 15.8750 | 16.7167 | 25    |
| 10/16/92 | 16.9500                                                |         | 17.5750 | 16.2000 | 16.9083 | 26    |
| 10/17/92 | 16.4250                                                |         | 16.3000 | 15.7250 | 16.1500 | 27    |
| 10/18/92 | 15.8250                                                | 15.1500 | 16.3750 |         | 15.7833 | 28    |
| 10/19/92 | 16.7250                                                | 14.9250 | 15.3750 |         | 15.6750 | 29    |
| 10/20/92 | 16.1500                                                | 14.4750 | 16.4750 |         | 15.7000 | 30    |
| 10/21/92 | 15.5000                                                | 16.0750 |         | 16.1000 | 15.8917 | 31    |
| 10/22/92 | 16.2750                                                | 16.6000 |         | 17.1250 | 16.6667 | 32    |
| 10/23/92 | 15.6750                                                |         | 16.4500 | 17.1000 | 16.4083 | 33    |
| 10/24/92 |                                                        | 13.9500 | 14.9000 | 16.1500 | 15.0000 | 34    |
| 10/25/92 |                                                        | 15.1000 | 14.9250 | 15.6500 | 15.2250 | 35    |
| 10/26/92 |                                                        | 15.7500 | 15.3750 | 15.5000 | 15.5417 | 36    |
| 10/27/92 | 15.6250                                                | 14.6500 | 15.2750 |         | 15.1833 | 37    |
| 10/28/92 | 15.7000                                                | 16.2750 | 15.7250 |         | 15.9000 | 38    |
| 10/29/92 | 16.0000                                                | 15.4750 |         | 15.9500 | 15.8083 | 39    |
| 10/30/92 | 17.5000                                                |         | 15.8250 | 17.8667 | 16.9909 | 40    |
| 10/31/92 | 15.6000                                                |         | 15.8000 | 16.9500 | 16.1167 | 41    |
| 11/01/92 |                                                        | 16.4750 | 17.1500 | 17.0000 | 16.8750 | 42    |
| 11/02/92 |                                                        | 14.8000 | 15.4000 | 16.1000 | 15.4333 | 43    |
| 11/03/92 | 16.6750                                                | 15.2250 | 16.1500 |         | 16.0167 | 44    |
| 11/04/92 | 16.5750                                                | 15.5250 |         | 16.7000 | 16.2667 | 45    |
| 11/05/92 | AS MANY PAGES FOLLOW AS ARE NECESSARY FOR ALL THE DATA |         |         |         | 16.0750 | 46    |



THE WESTERN SUGAR COMPANY  
BEET END REPORT

| SCOTTSBLUFF FACTORY                      | 24 Hrs. Ending |         |         | 0800     | 01/08/93 |
|------------------------------------------|----------------|---------|---------|----------|----------|
|                                          | D SHIFT        | C SHIFT | B SHIFT | 24 HOURS | TODATE   |
| TONS BEETS SLICED.....                   | XXXX           | XXXX    | XXXX    | XXXX     | XXXX     |
| COSSETTE % SUGAR.....                    | XX.XX          | XX.XX   | XX.XX   | XX.XX    | XX.XX    |
| COSSETTE APPARENT PURITY.....            | XX.XX          | XX.XX   | XX.XX   | XX.XX    | XX.XX    |
| DIFFUSION JUICE RDS.....                 | XX.XX          | XX.XX   | XX.XX   | XX.XX    | XX.XX    |
| DIFFUSION JUICE APPARENT PURITY.....     | XX.XX          | XX.XX   | XX.XX   | XX.XX    | XX.XX    |
| DIFFUSION JUICE pH.....                  | XX.XX          | XX.XX   | XX.XX   | XX.XX    | XX.XX    |
| PRESS PULP % SUGAR.....                  | XX.XX          | XX.XX   | XX.XX   | XX.XX    | XX.XX    |
| 1ST CARB JUICE pH.....                   | XX.XX          | XX.XX   | XX.XX   | XX.XX    | XX.XX    |
| 2ND CARB JUICE pH.....                   | XX.XX          | XX.XX   | XX.XX   | XX.XX    | XX.XX    |
| THIN JUICE pH.....                       | XX.XX          | XX.XX   | XX.XX   | XX.XX    | XX.XX    |
| EVAP THICK pH.....                       | XX.XX          | XX.XX   | XX.XX   | XX.XX    | XX.XX    |
| 1ST CARB JUICE RDS.....                  | XX.XX          | XX.XX   | XX.XX   | XX.XX    | XX.XX    |
| THIN JUICE RDS.....                      | XX.XX          | XX.XX   | XX.XX   | XX.XX    | XX.XX    |
| EVAP THICK RDS.....                      | XX.XX          | XX.XX   | XX.XX   | XX.XX    | XX.XX    |
| 1ST CARB JUICE ALKALINITY.....           | XX.XX          | XX.XX   | XX.XX   | XX.XX    | XX.XX    |
| 2ND CARB JUICE ALKALINITY.....           | XX.XX          | XX.XX   | XX.XX   | XX.XX    | XX.XX    |
| THIN JUICE LIME SALTS.....               | XX.XX          | XX.XX   | XX.XX   | XX.XX    | XX.XX    |
| 1ST CARB JUICE % CaO.....                | XX.XX          | XX.XX   | XX.XX   | XX.XX    | XX.XX    |
| LIME SEWER % CaO.....                    | XX.XX          | XX.XX   | XX.XX   | XX.XX    | XX.XX    |
| LIME SEWER % SUGAR.....                  | XX.XX          | XX.XX   | XX.XX   | XX.XX    | XX.XX    |
| LIME SEWER SUGAR TO 100 CaO.....         | XX.XX          | XX.XX   | XX.XX   | XX.XX    | XX.XX    |
| LIME KILN GAS % CO2.....                 | XX.XX          | XX.XX   | XX.XX   | XX.XX    | XX.XX    |
| TONS SUGAR INTRODUCED.....               | XX.XX          | XX.XX   | XX.XX   | XX.XX    | XX.XX    |
| DIFFUSER ELIMINATION.....                | XX.XX          | XX.XX   | XX.XX   | XX.XX    | XX.XX    |
| CARBONATION ELIMINATION.....             | XX.XX          | XX.XX   | XX.XX   | XX.XX    | XX.XX    |
| DRAFT, BY SUGAR CONTENT, % ON BEETS..... | XXXX           | XXXX    | XXXX    | XXXX     | XXXX     |
| SUGAR IN PULP, % ON BEETS.....           | XX.XX          | XX.XX   | XX.XX   | XX.XX    | XX.XX    |
| SUGAR IN PULP, CWT.....                  | XX.XX          | XX.XX   | XX.XX   | XX.XX    | XX.XX    |
| LIME SEWER, SUGAR, % ON BEETS.....       | XX.XX          | XX.XX   | XX.XX   | XX.XX    | XX.XX    |
| LIME SEWER, SUGAR, CWT.....              | XX.XX          | XX.XX   | XX.XX   | XX.XX    | XX.XX    |
| EVAP THICK APPARENT PURITY.....          | XX.XX          | XX.XX   | XX.XX   | XX.XX    | XX.XX    |

THE WESTERN SUGAR COMPANY  
SUGAR END REPORT

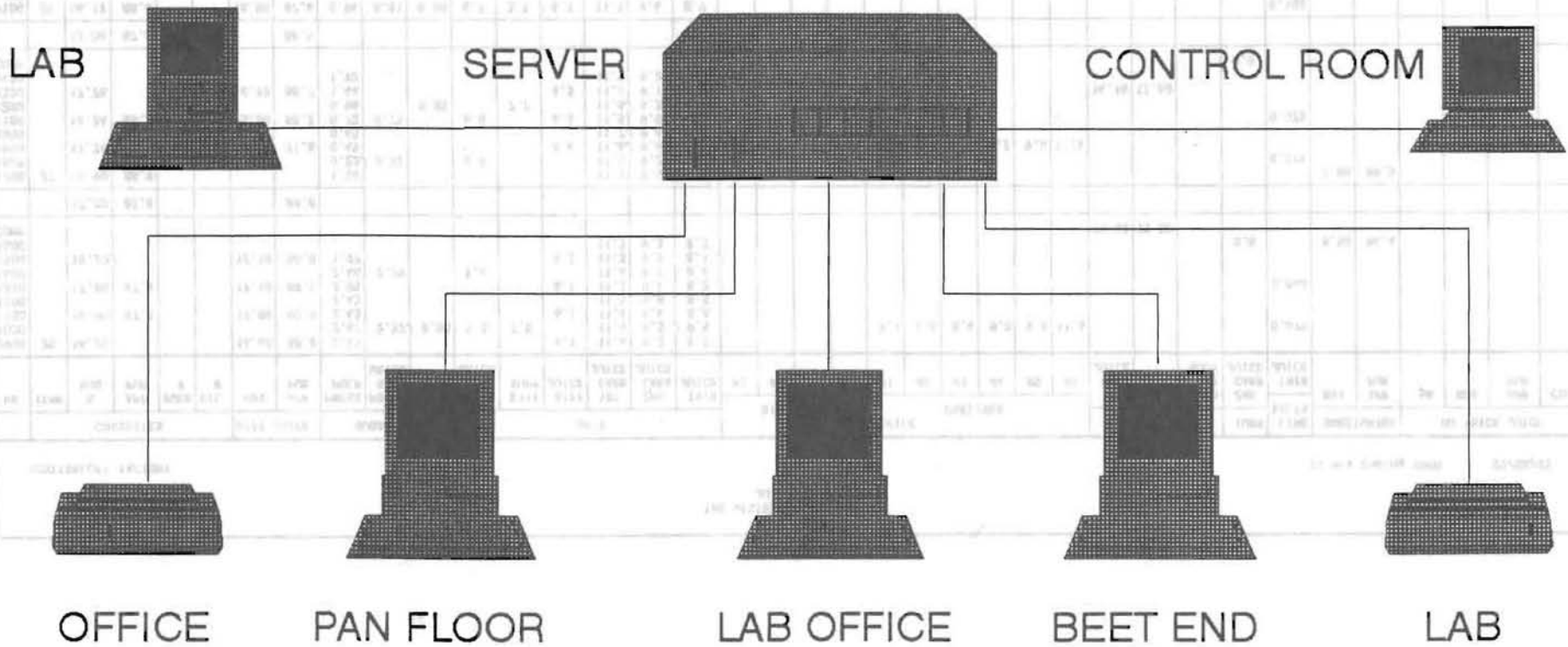
S C O T T S B L U F F F A C T O R Y

24 Hrs. Ending 0800: 01/08/93

|                                       | C SHIFT | B SHIFT | A SHIFT | 24 HOURS | TODATE |
|---------------------------------------|---------|---------|---------|----------|--------|
| STANDARD LIQUOR RDS.....              | XXX.XX  | XXX.XX  | XXX.XX  | XXX.XX   | XXX.XX |
| STANDARD LIQUOR APPARENT PURITY.....  | XXX.XX  | XXX.XX  | XXX.XX  | XXX.XX   | XXX.XX |
| WHITE PAN NUMBER OF PANS.....         | XXX.XX  | XXX.XX  | XXX.XX  | XXX.XX   | XXX.XX |
| WHITE PAN RDS.....                    | XXX.XX  | XXX.XX  | XXX.XX  | XXX.XX   | XXX.XX |
| WHITE SUGAR COLOR.....                | XXX.XX  | XXX.XX  | XXX.XX  | XXX.XX   | XXX.XX |
| WHITE SUGAR TURBIDITY.....            | XXX.XX  | XXX.XX  | XXX.XX  | XXX.XX   | XXX.XX |
| WHITE SUGAR SPECIFIC CONDUCTANCE..... | XXX.XX  | XXX.XX  | XXX.XX  | XXX.XX   | XXX.XX |
| WHITE SUGAR WHITE DISC.....           | XXX.XX  | XXX.XX  | XXX.XX  | XXX.XX   | XXX.XX |
| WHITE SUGAR BLACK DISC.....           | XXX.XX  | XXX.XX  | XXX.XX  | XXX.XX   | XXX.XX |
| WHITE SUGAR SPECK.....                | XXX.XX  | XXX.XX  | XXX.XX  | XXX.XX   | XXX.XX |
| WHITE SUGAR SO2.....                  | XXX.XX  | XXX.XX  | XXX.XX  | XXX.XX   | XXX.XX |
| WHITE SUGAR RUBBER.....               | XXX.XX  | XXX.XX  | XXX.XX  | XXX.XX   | XXX.XX |
| WHITE SUGAR METAL.....                | XXX.XX  | XXX.XX  | XXX.XX  | XXX.XX   | XXX.XX |
| WHITE SUGAR FLOC.....                 | XXX.XX  | XXX.XX  | XXX.XX  | XXX.XX   | XXX.XX |
| WHITE SUGAR MOISTURE.....             | XXX.XX  | XXX.XX  | XXX.XX  | XXX.XX   | XXX.XX |
| HIGH GREEN RDS.....                   | XXX.XX  | XXX.XX  | XXX.XX  | XXX.XX   | XXX.XX |
| HIGH GREEN APPARENT PURITY.....       | XXX.XX  | XXX.XX  | XXX.XX  | XXX.XX   | XXX.XX |
| HIGH RAW PAN RDS.....                 | XXX.XX  | XXX.XX  | XXX.XX  | XXX.XX   | XXX.XX |
| HIGH RAW PAN APPARENT PURITY.....     | XXX.XX  | XXX.XX  | XXX.XX  | XXX.XX   | XXX.XX |
| MACHINE SYRUP RDS.....                | XXX.XX  | XXX.XX  | XXX.XX  | XXX.XX   | XXX.XX |
| MACHINE SYRUP APPARENT PURITY.....    | XXX.XX  | XXX.XX  | XXX.XX  | XXX.XX   | XXX.XX |
| LOW RAW PAN RDS.....                  | XXX.XX  | XXX.XX  | XXX.XX  | XXX.XX   | XXX.XX |
| LOW RAW PAN APPARENT PURITY.....      | XXX.XX  | XXX.XX  | XXX.XX  | XXX.XX   | XXX.XX |
| LOW RAW PAN ML APPARENT PURITY.....   | XXX.XX  | XXX.XX  | XXX.XX  | XXX.XX   | XXX.XX |
| LOW RAW PAN HOURS IN PAN.....         | XXX.XX  | XXX.XX  | XXX.XX  | XXX.XX   | XXX.XX |
| LOW RAW PAN % CRYSTALS.....           | XXX.XX  | XXX.XX  | XXX.XX  | XXX.XX   | XXX.XX |
| LOW RAW PAN NS/W RATIO.....           | XXX.XX  | XXX.XX  | XXX.XX  | XXX.XX   | XXX.XX |
| LOW RAW PAN SUPER SATURATION.....     | XXX.XX  | XXX.XX  | XXX.XX  | XXX.XX   | XXX.XX |
| LOW RAW PAN TEMP FOR 1.40 S.S.....    | XXX.XX  | XXX.XX  | XXX.XX  | XXX.XX   | XXX.XX |
| LOW RAW CRYST ML APPARENT PURITY..... | XXX.XX  | XXX.XX  | XXX.XX  | XXX.XX   | XXX.XX |
| LOW RAW CRYST TEMP LVG CRYST.....     | XXX.XX  | XXX.XX  | XXX.XX  | XXX.XX   | XXX.XX |
| LOW RAW CRYST HOURS IN CRYST.....     | XXX.XX  | XXX.XX  | XXX.XX  | XXX.XX   | XXX.XX |
| LOW RAW CRYST % CRYSTALS.....         | XXX.XX  | XXX.XX  | XXX.XX  | XXX.XX   | XXX.XX |
| LOW RAW CRYST NS/W RATIO.....         | XXX.XX  | XXX.XX  | XXX.XX  | XXX.XX   | XXX.XX |
| LOW RAW CRYST SUPER SATURATION.....   | XXX.XX  | XXX.XX  | XXX.XX  | XXX.XX   | XXX.XX |
| MOLASSES RDS.....                     | XXX.XX  | XXX.XX  | XXX.XX  | XXX.XX   | XXX.XX |
| MOLASSES APPARENT PURITY.....         | XXX.XX  | XXX.XX  | XXX.XX  | XXX.XX   | XXX.XX |

916

# LOCAL AREA NETWORK Scottsbluff Factory



117



JUICE SHEET - SWING SHIFT

LOWER LIMIT FOR THIS  
TEST IS:

12.00

| HR   | COSSETTES |       |         |        |       | DIFF JUICE |         |        | WATER | WATER |
|------|-----------|-------|---------|--------|-------|------------|---------|--------|-------|-------|
|      | TEMP      | % SUG | APP PUR | SWED # | SIL # | RDS        | APP PUR | PRE PU |       |       |
| 1700 | 27        | 16.90 | 88.9    |        |       | 1.50       |         | 1.56   |       |       |
| 1800 |           |       |         |        |       |            |         | 0.22   | 0.52  | 6.9   |
| 1900 |           | 17.34 |         |        | 3     | 15.30      | 91.6    | 0.45   |       |       |
| 2000 |           |       |         |        |       |            |         | 0.45   |       |       |
| 2100 |           | 16.24 | 86.3    |        |       | 15.20      | 88.2    | 0.72   | 0.75  | 6.0   |
| 2200 |           |       |         |        |       |            |         | 0.96   | 0.05  | 7.7   |
| 2300 |           | 17.76 |         |        |       | 16.10      | 88.7    | 1.44   |       |       |
| 2400 |           |       |         |        |       |            |         | 1.92   |       |       |
| COMP |           |       |         |        |       |            |         |        |       |       |

119

type L to continue:



DIFFUSION JUICE RDS

Diffusion Juice RDS is a number used to express the percentage of total solids in the Diffusion Juice.

1. Obtain a sample of Diffusion Juice from the sampling station or other appropriate sample location before any liming has taken place.
2. Cool sample to approximately 20°C and if necessary filter using coarse filter.
3. Place enough sample on refractometer to cover the prism surface.
4. Allow 1 to 2 minutes for temperature to equalize and to de-air the sample.
5. Read and record the RDS indicated on the refractometer when stable.
6. Diffusion Juice RDS is rounded to 1 decimal place.

Note: Save a portion of the sample if an apparent purity is to be run.

Note: For additional information on RDS determination see Chapter 6 "Refractometer Dry Substance or RDS".

1066 P 10 CONTINUED

| CONC | TEMP | N    | REF  | TEMP | RDS  |
|------|------|------|------|------|------|
| 0087 | 20.0 | 1.38 | 1.38 | 20.0 | 88.0 |
| 0088 | 20.0 | 1.38 | 1.38 | 20.0 | 88.0 |
| 0089 | 20.0 | 1.38 | 1.38 | 20.0 | 88.0 |
| 0090 | 20.0 | 1.38 | 1.38 | 20.0 | 88.0 |
| 0091 | 20.0 | 1.38 | 1.38 | 20.0 | 88.0 |
| 0092 | 20.0 | 1.38 | 1.38 | 20.0 | 88.0 |
| 0093 | 20.0 | 1.38 | 1.38 | 20.0 | 88.0 |
| 0094 | 20.0 | 1.38 | 1.38 | 20.0 | 88.0 |
| 0095 | 20.0 | 1.38 | 1.38 | 20.0 | 88.0 |
| 0096 | 20.0 | 1.38 | 1.38 | 20.0 | 88.0 |
| 0097 | 20.0 | 1.38 | 1.38 | 20.0 | 88.0 |
| 0098 | 20.0 | 1.38 | 1.38 | 20.0 | 88.0 |
| 0099 | 20.0 | 1.38 | 1.38 | 20.0 | 88.0 |
| 0100 | 20.0 | 1.38 | 1.38 | 20.0 | 88.0 |

DIFFUSION JUICE RDS - 20.0

| TEST # | TEST NAME                     | TIME | RESULT | UPPER | LOWER |
|--------|-------------------------------|------|--------|-------|-------|
| 101    | COSSETTE % SUGAR              | 1500 | 18.20  | 18.00 | 12.00 |
| 107    | PRESS PULP % SUGAR            | 1800 | 0.22   | 3.00  | 0.40  |
| 108    | PRESS RETURN WATER % SUGAR    | 1000 | 2.52   | 2.50  | 0.30  |
| 111    | DIFFUSER SUPPLY pH            | 0100 | 3.5    | 8.0   | 5.0   |
| 113    | 1ST CARB JUICE pH             | 1900 | 11.6   | 11.5  | 10.5  |
| 113    | 1ST CARB JUICE pH             | 2000 | 11.7   | 11.5  | 10.5  |
| 113    | 1ST CARB JUICE pH             | 2200 | 11.6   | 11.5  | 10.5  |
| 113    | 1ST CARB JUICE pH             | 0500 | 11.6   | 11.5  | 10.5  |
| 114    | 2ND CARB JUICE pH             | 1000 | 8.3    | 9.9   | 8.5   |
| 115    | THIN JUICE pH                 | 1300 | 8.2    | 9.5   | 8.3   |
| 115    | THIN JUICE pH                 | 1500 | 8.1    | 9.5   | 8.3   |
| 115    | THIN JUICE pH                 | 1900 | 7.2    | 9.5   | 8.3   |
| 201    | 1ST CARB JUICE ALKALINITY     | 1900 | 0.122  | 0.120 | 0.070 |
| 201    | 1ST CARB JUICE ALKALINITY     | 0700 | 0.128  | 0.120 | 0.070 |
| 212    | MILK OF LIME BRIX             | 0900 | 41.0   | 40.0  | 25.0  |
| 213    | MILK OF LIME % CaO            | 0100 | 12.5   | 12.0  | 6.0   |
| 214    | MILK OF LIME % SUGAR          | 0900 | 6.2    | 15.0  | 7.0   |
| 214    | MILK OF LIME % SUGAR          | 0100 | 6.4    | 15.0  | 7.0   |
| 215    | LIME SEWER % CaO              | 1700 | 1.0    | 15.0  | 3.0   |
| 301    | THIN JUICE % SUGAR            | 0900 | 18.1   | 17.0  | 10.0  |
| 303    | EVAP THICK pH                 | 0900 | 10.2   | 9.8   | 7.5   |
| 304    | EVAP THICK RDS                | 0900 | 72.10  | 70.00 | 45.00 |
| 304    | EVAP THICK RDS                | 2100 | 73.00  | 70.00 | 45.00 |
| 306    | EVAP THICK COLOR              | 0900 | 3783   | 3500  | 800   |
| 321    | STANDARD LIQUOR COLOR         | 1100 | 4297   | 4000  | 800   |
| 307    | HIGH MELTER RDS               | 1000 | 67.70  | 65.00 | 50.00 |
| 307    | HIGH MELTER RDS               | 0200 | 69.90  | 65.00 | 50.00 |
| 309    | HIGH MELTER COLOR             | 1000 | 4279   | 4000  | 800   |
| 417    | HIGH WASH COLOR               | 2400 | 6136   | 6000  | 500   |
| 312    | LOW MELTER RDS                | 0800 | 81.90  | 81.00 | 60.00 |
| 313    | LOW MELTER APPARENT PURITY    | 1000 | 96.6   | 95.0  | 83.0  |
| 424    | MACHINE SYRUP APPARENT PURITY | 1500 | 78.4   | 78.0  | 68.0  |
| 424    | MACHINE SYRUP APPARENT PURITY | 1700 | 78.2   | 78.0  | 68.0  |
| 311    | HIGH RAW SUGAR COLOR          | 2200 | 2291   | 2000  | 200   |
| 311    | HIGH RAW SUGAR COLOR          | 0200 | 2124   | 2000  | 200   |
| 316    | LOW RAW SUGAR COLOR           | 0200 | 5850   | 5000  | 200   |
| 327    | DUST BOX RDS                  | 1700 | 28.20  | 27.00 | 14.00 |
| 401    | WHITE PAN pH                  | 1000 | 9.8    | 9.6   | 7.4   |
| 419    | HIGH RAW PAN pH               | 1500 | 9.7    | 9.6   | 7.4   |
| 515    | LOW RAW CRYST APPARENT PURITY | 0400 | 76.0   | 75.0  | 69.0  |
| 600    | PULP ADDITIVE MOLASSES RDS    | 1600 | 58.80  | 85.00 | 60.00 |
| 603    | WET PULP MOISTURE             | 1800 | 94.0   | 93.0  | 88.0  |
| 606    | DRY MOLASSES PULP MOISTURE    | 0600 | 4.9    | 15.0  | 6.0   |

| THE WESTERN SUGAR COMPANY<br>Scottsbluff Factory |          |          |          |          |          |          |          |                         |         |
|--------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|-------------------------|---------|
| TEST NAME : DIFFUSION JUICE RDS                  |          |          |          |          |          |          |          |                         |         |
| HR                                               | 01/08/93 | 01/07/93 | 01/06/93 | 01/05/93 | 01/04/93 | 01/03/93 | 01/02/93 | STATISTICAL INFORMATION |         |
| 0900                                             | 16.40    | 14.20    | 14.10    | 16.40    | 16.00    | 16.50    | 15.80    | AVERAGE                 | 15.83   |
| 1000                                             |          |          |          |          |          |          |          |                         |         |
| 1100                                             | 17.00    | 14.60    | 15.20    | 16.80    | 16.70    |          | 16.80    | MAXIMUM                 | 17.20   |
| 1200                                             |          |          |          |          |          |          |          |                         |         |
| 1300                                             | 17.10    | 17.00    | 15.60    | 16.50    | 17.10    | 10.30    | 17.10    | MINIMUM                 | 10.30   |
| 1400                                             |          |          |          |          |          |          |          |                         |         |
| 1500                                             | 17.10    | 15.90    | 14.50    | 12.30    | 16.20    | 12.90    | 16.80    | SUM                     | 1187.50 |
| 1600                                             |          |          |          |          |          |          |          |                         |         |
| COMP                                             |          |          |          |          |          |          |          | STANDARD DEV            | 1.46    |
|                                                  | 16.90    | 15.43    | 14.85    | 15.50    | 16.50    | 13.23    | 16.63    |                         |         |
| 1700                                             |          | 15.30    |          | 14.10    | 16.40    | 12.50    | 17.10    | VARIANCE                | 2.13    |
| 1800                                             |          |          |          |          |          |          |          |                         |         |
| 1900                                             | 15.30    | 16.20    |          | 14.40    | 15.90    | 10.90    | 16.80    | NUMBER ENTRIES          | 75.00   |
| 2000                                             |          |          |          |          |          |          |          |                         |         |
| 2100                                             | 15.20    | 15.30    |          | 15.80    | 16.30    | 14.50    | 16.80    | LOWER LIMIT             | 12.00   |
| 2200                                             |          |          |          |          |          |          |          |                         |         |
| 2300                                             | 16.10    | 15.70    |          | 16.20    | 16.20    | 17.20    | 16.60    | UPPER LIMIT             | 18.00   |
| 2400                                             |          |          |          |          |          |          |          |                         |         |
| COMP                                             |          |          |          |          |          |          |          |                         |         |
|                                                  | 15.53    | 15.63    |          | 15.13    | 16.20    | 13.78    | 16.83    |                         |         |
| 0100                                             | 16.30    | 16.10    |          | 15.90    | 16.20    | 16.70    | 17.00    |                         |         |
| 0200                                             |          |          |          |          |          |          |          |                         |         |
| 0300                                             | 16.20    | 17.00    |          | 16.30    | 16.80    | 16.80    | 17.00    |                         |         |
| 0400                                             |          |          |          |          |          |          |          |                         |         |
| 0500                                             | 16.70    | 16.60    |          | 17.00    | 16.20    | 17.20    | 15.80    |                         |         |
| 0600                                             |          |          |          |          |          |          |          |                         |         |
| 0700                                             | 17.10    | 16.50    | 12.40    | 14.00    | 16.70    | 16.60    | 16.70    |                         |         |
| 0800                                             |          |          |          |          |          |          |          |                         |         |
| COMP                                             |          |          |          |          |          |          |          |                         |         |
|                                                  | 16.58    | 16.55    | 12.40    | 15.80    | 16.48    | 16.83    | 16.63    |                         |         |
| AVG                                              | 16.41    | 15.87    | 14.36    | 15.48    | 16.39    | 14.74    | 16.69    |                         |         |



WESTERN SUGAR COMPANY  
DAILY REPORT

DATE: 01/08/93

|                                 | BAYARD | BILLINGS | FT MORGAN | GREELEY | LOVELL | MITCHELL | SCOTTSBLUFF | COMPANY |
|---------------------------------|--------|----------|-----------|---------|--------|----------|-------------|---------|
| Number of Slicing Days.....     | XXX.XX | XXX.XX   | XXX.XX    | XXX.XX  | XXX.XX | XXX.XX   | XXX.XX      |         |
| Tons of Beets Sliced.....       | XXX.XX | XXX.XX   | XXX.XX    | XXX.XX  | XXX.XX | XXX.XX   | XXX.XX      | XXXXXX  |
| Cossettes, % Sugar.....         | XXX.XX | XXX.XX   | XXX.XX    | XXX.XX  | XXX.XX | XXX.XX   | XXX.XX      |         |
| Molasses Worked Tons.....       |        |          |           |         |        |          |             |         |
| Draft.....                      | XXX.XX | XXX.XX   | XXX.XX    | XXX.XX  | XXX.XX | XXX.XX   | XXX.XX      |         |
| Diffusion Juice App. Purity.... | XXX.XX | XXX.XX   | XXX.XX    | XXX.XX  | XXX.XX | XXX.XX   | XXX.XX      |         |
| Pulp Loss, % Sugar on Beets.... | XXX.XX | XXX.XX   | XXX.XX    | XXX.XX  | XXX.XX | XXX.XX   | XXX.XX      |         |
| Pressed Pulp Moisture.....      | XXX.XX | XXX.XX   | XXX.XX    | XXX.XX  | XXX.XX | XXX.XX   | XXX.XX      |         |
| Active CaO Produced, % on Beets | XXX.XX | XXX.XX   | XXX.XX    | XXX.XX  | XXX.XX | XXX.XX   | XXX.XX      |         |
| Lime Sewer, % Sugar on Beets... | XXX.XX | XXX.XX   | XXX.XX    | XXX.XX  | XXX.XX | XXX.XX   | XXX.XX      |         |
| Thin Juice App. Purity.....     | XXX.XX | XXX.XX   | XXX.XX    | XXX.XX  | XXX.XX | XXX.XX   | XXX.XX      |         |
| Standard Liquor RDS.....        | XXX.XX | XXX.XX   | XXX.XX    | XXX.XX  | XXX.XX | XXX.XX   | XXX.XX      |         |
| Standard Liquor App. Purity.... | XXX.XX | XXX.XX   | XXX.XX    | XXX.XX  | XXX.XX | XXX.XX   | XXX.XX      |         |
| Molasses Produced, App. Purity. | XXX.XX | XXX.XX   | XXX.XX    | XXX.XX  | XXX.XX | XXX.XX   | XXX.XX      |         |
| Molasses Produced, True Purity. | XXX.XX | XXX.XX   | XXX.XX    | XXX.XX  | XXX.XX | XXX.XX   | XXX.XX      |         |
| Sugar Produced CWT.....         | XXX.XX | XXX.XX   | XXX.XX    | XXX.XX  | XXX.XX | XXX.XX   | XXX.XX      | XXXXX   |
| Extraction.....                 | XXX.XX | XXX.XX   | XXX.XX    | XXX.XX  | XXX.XX | XXX.XX   | XXX.XX      |         |
| Days No Lost Time Accidents.... | XXX.XX | XXX.XX   | XXX.XX    | XXX.XX  | XXX.XX | XXX.XX   | XXX.XX      |         |

BAYARD

NO COMMENTS

BILLINGS

TARGET SLICE XXXX TONS  
NO COMMENTS

FT. MORGAN

FINISHED REDUS PILE AT MIDNIGHT  
TARGET SLICE XXXX TONS

GREELEY

TARGET SLICE XXXX TONS  
NO COMMENTS

LOVELL

ALL PULP PRESSES IN SERVICE  
TARGET SLICE XXXX TONS

MITCHELL

CITYWIDE POWER OUTAGE CREATED PROBLEMS - xxx TONS DELAY TO SLICE  
TARGET SLICE XXXX TONS

SCOTTSBLUFF

COMMENTS RELATING TO THE OPERATION OF THE FACTORY GO IN THESE FOUR LINES  
SECOND LINE FOR COMMENTS  
THIRD LINE FOR COMMENTS  
FOURTH LINE FOR COMMENTS

DIFFUSION JUICE RDS

10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25



EXTRACTION STATEMENT

Mitchell Factory # 19 Regular PERIOD: 01/02/93 TO 01/08/93

| BET AND MOLASSES        | PERIOD | TO DATE | POUNDS               | PERIOD | TO DATE |
|-------------------------|--------|---------|----------------------|--------|---------|
| Beets Sliced, Tons      | xxxx   | xxxx    | Held over            |        |         |
| Tons Daily Average      | xxxx   | xxxx    | Gran eq.             |        |         |
| % Sugar                 | xx.xx  | xx.xx   | Sug in Mol           |        |         |
| Purity                  | xx.xx  | xx.xx   |                      |        |         |
| No. of Slicing Days     | xx.x   | xx.xx   |                      |        |         |
| Slicing Performance     | xxx.x  | xxx.x   |                      |        |         |
| Molasses Produced, Tons | xxx.x  | xxx.x   |                      |        |         |
| Polarization            | xx.xx  | xx.xx   |                      |        |         |
| Tons Last Yr.'s Crys.   |        |         |                      |        |         |
| Molasses Prod. Tons     | xxx.x  | xxx.x   | Sugar Prod. Bags     | xxxx   | xxxxxx  |
| Dry Substance, Tons     | xxx.x  | xxx.x   | Corr. for Powd.      | xxxx   | xxxxxx  |
| Sucrose, Tons           | xxx.x  | xxx.x   | Sweepings            | xxxx   | xxxxxx  |
| True Purity             | xx.xx  | xx.xx   | Corr. for Sweepings  | xxxx   | xxxxxx  |
|                         |        |         | Avg. Bags / Slic day | xxxx   | xxxxxx  |

|                                                 | PERIOD | TO DATE         |
|-------------------------------------------------|--------|-----------------|
|                                                 | TONS   | % BEETS % SUGAR |
| -----SUGAR ENTERING FACTORY-----                |        |                 |
| 1. Sugar in cosettes                            | xxx.xx | xx.xx xx.xx     |
| 2.                                              |        |                 |
| 3. Total Sugar Introduced (1+2)                 | xxx.xx | xx.xx xx.xx     |
| -----YIELD OF GRANULATED SUGAR-----             |        |                 |
| 4. Gran. sugar actually sacked (corrected)      | xxx.xx | xx.xx xx.xx     |
| 5. Gran. sugar in process at end of run         | xxx.xx | xx.xx xx.xx     |
| 6. (4+5)                                        | xxx.xx | xx.xx xx.xx     |
| -----DEDUCT-----                                |        |                 |
| 7. Gran. equiv of sugar from prev. camp. melted | xxx.xx | xx.xx xx.xx     |
| 8. Gran. sugar in process at beginning of run   | xxx.xx | xx.xx xx.xx     |
| 9. Gran. equiv. of sugar bought and refined     | xxx.xx | xx.xx xx.xx     |
| 10. (7+8+9)                                     | xxx.xx | xx.xx xx.xx     |
| 11. Extraction (6-10)                           | xxx.xx | xx.xx xx.xx     |
| 12. Total Losses Including Molasses (3-11)      | xxx.xx | xx.xx xx.xx     |
| -----MOLASSES BALANCE-----                      |        |                 |
| 13. Sug in mol. prod. from crys. prev. years    |        |                 |
| 14. Sugar in molasses produced from this yr.    | xxx.xx | xx.xx xx.xx     |
| 15. Sugar in molasses in process at end of run  | xxx.xx | xx.xx xx.xx     |
| 16. (13+14+15)                                  | xxx.xx | xx.xx xx.xx     |
| -----DEDUCT-----                                |        |                 |
| 17. Sug. in mol. est'd in sug. from prev. camp. |        |                 |
| 18. Sugar in mol in process at beg. of run      | xxx.xx | xx.xx xx.xx     |
| 19. Sug in mol. in sugar bought & refined       | xxx.xx | xx.xx xx.xx     |
| 20. (17+18+19)                                  | xxx.xx | xx.xx xx.xx     |
| 21. Sugar in net molasses produced (16-20)      | xxx.xx | xx.xx xx.xx     |
| 22. Total Losses Except Molasses (12-21)        | xxx.xx | xx.xx xx.xx     |
| -----KNOWN LOSSES-----                          |        |                 |
| 23. Loss in pulp and pulp water                 | xxx.xx | xx.xx xx.xx     |
| 24. Loss in lime sewer                          | xxx.xx | xx.xx xx.xx     |
| 25.                                             |        |                 |
| 26. Total Known Loss (23+24+25)                 | xxx.xx | xx.xx xx.xx     |
| 27. Unaccountable Loss (22-26)                  | xxx.xx | xx.xx xx.xx     |

01/15/93  
 Week Ending: 01/15/93  
 SCOTTSBLUFF  
 TONDATE

MITCHELL  
 TONDATE  
 WEEK

LOVELL  
 TONDATE  
 WEEK

GREELEY  
 TONDATE  
 WEEK

FT. MORGAN  
 TONDATE  
 WEEK

BAYARD  
 TONDATE  
 WEEK

| WESTERN SUGAR COMPANY                  | BAYARD  |         | FT. MORGAN |         | GREELEY |         | LOVELL  |         | MITCHELL |         | SCOTTSBLUFF |         |
|----------------------------------------|---------|---------|------------|---------|---------|---------|---------|---------|----------|---------|-------------|---------|
|                                        | WEEK    | TONDATE | WEEK       | TONDATE | WEEK    | TONDATE | WEEK    | TONDATE | WEEK     | TONDATE | WEEK        | TONDATE |
| BEETS SLICED                           | XXXX.XX | XXXX.XX | XXXX.XX    | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX  | XXXX.XX | XXXX.XX     | XXXX.XX |
| NUMBER OF SLICED DAYS                  | XXXX.XX | XXXX.XX | XXXX.XX    | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX  | XXXX.XX | XXXX.XX     | XXXX.XX |
| TONS BEETS SLICED                      | XXXX.XX | XXXX.XX | XXXX.XX    | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX  | XXXX.XX | XXXX.XX     | XXXX.XX |
| AVERAGE TONS SLICED PER DAY            | XXXX.XX | XXXX.XX | XXXX.XX    | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX  | XXXX.XX | XXXX.XX     | XXXX.XX |
| COSSETTE % SUGAR                       | XXXX.XX | XXXX.XX | XXXX.XX    | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX  | XXXX.XX | XXXX.XX     | XXXX.XX |
| COSSETTE PURITY                        | XXXX.XX | XXXX.XX | XXXX.XX    | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX  | XXXX.XX | XXXX.XX     | XXXX.XX |
| BEETS ENT. SLICER TEMPERATURE          | XXXX.XX | XXXX.XX | XXXX.XX    | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX  | XXXX.XX | XXXX.XX     | XXXX.XX |
| COSSETTES ENT. DIFFUSER TEMPERATURE    | XXXX.XX | XXXX.XX | XXXX.XX    | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX  | XXXX.XX | XXXX.XX     | XXXX.XX |
| SILIN #                                | XXXX.XX | XXXX.XX | XXXX.XX    | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX  | XXXX.XX | XXXX.XX     | XXXX.XX |
| SWEDISH #                              | XXXX.XX | XXXX.XX | XXXX.XX    | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX  | XXXX.XX | XXXX.XX     | XXXX.XX |
| STEAM TO SLICERS, % ON BEETS (METERED) | XXXX.XX | XXXX.XX | XXXX.XX    | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX  | XXXX.XX | XXXX.XX     | XXXX.XX |
| DIFFUSION                              | XXXX.XX | XXXX.XX | XXXX.XX    | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX  | XXXX.XX | XXXX.XX     | XXXX.XX |
| DIFFUSION JUICE % SUGAR                | XXXX.XX | XXXX.XX | XXXX.XX    | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX  | XXXX.XX | XXXX.XX     | XXXX.XX |
| DIFFUSION JUICE ROS                    | XXXX.XX | XXXX.XX | XXXX.XX    | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX  | XXXX.XX | XXXX.XX     | XXXX.XX |
| DIFFUSION JUICE APPARENT PURITY        | XXXX.XX | XXXX.XX | XXXX.XX    | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX  | XXXX.XX | XXXX.XX     | XXXX.XX |
| DIFFUSION JUICE PH                     | XXXX.XX | XXXX.XX | XXXX.XX    | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX  | XXXX.XX | XXXX.XX     | XXXX.XX |
| DRAFT BY SUGAR CONTENT % ON BEETS      | XXXX.XX | XXXX.XX | XXXX.XX    | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX  | XXXX.XX | XXXX.XX     | XXXX.XX |
| KNIFE CHANGES/1000 TONS BEETS          | XXXX.XX | XXXX.XX | XXXX.XX    | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX  | XXXX.XX | XXXX.XX     | XXXX.XX |
| LACTIC ACID PPM                        | XXXX.XX | XXXX.XX | XXXX.XX    | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX  | XXXX.XX | XXXX.XX     | XXXX.XX |
| SUGAR IN PULP, % ON BEETS              | XXXX.XX | XXXX.XX | XXXX.XX    | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX  | XXXX.XX | XXXX.XX     | XXXX.XX |
| DIFFUSER SUPPLY TEMPERATURES           | XXXX.XX | XXXX.XX | XXXX.XX    | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX  | XXXX.XX | XXXX.XX     | XXXX.XX |
| FRESH WATER TO DIFF TEMP               | XXXX.XX | XXXX.XX | XXXX.XX    | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX  | XXXX.XX | XXXX.XX     | XXXX.XX |
| DIFF SUPP WATER TEMP                   | XXXX.XX | XXXX.XX | XXXX.XX    | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX  | XXXX.XX | XXXX.XX     | XXXX.XX |
| DIFFUSER TEMPERATURES                  | XXXX.XX | XXXX.XX | XXXX.XX    | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX  | XXXX.XX | XXXX.XX     | XXXX.XX |
| DIFF AVG MAX TEMP                      | XXXX.XX | XXXX.XX | XXXX.XX    | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX  | XXXX.XX | XXXX.XX     | XXXX.XX |
| DIFFUSER CELL #1 TEMP                  | XXXX.XX | XXXX.XX | XXXX.XX    | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX  | XXXX.XX | XXXX.XX     | XXXX.XX |
| DIFFUSER CELL #2 TEMP                  | XXXX.XX | XXXX.XX | XXXX.XX    | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX  | XXXX.XX | XXXX.XX     | XXXX.XX |
| DIFFUSER CELL #3 TEMP                  | XXXX.XX | XXXX.XX | XXXX.XX    | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX  | XXXX.XX | XXXX.XX     | XXXX.XX |
| DIFFUSER CELL #4 TEMP                  | XXXX.XX | XXXX.XX | XXXX.XX    | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX  | XXXX.XX | XXXX.XX     | XXXX.XX |
| DIFFUSER CELL #5 TEMP                  | XXXX.XX | XXXX.XX | XXXX.XX    | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX  | XXXX.XX | XXXX.XX     | XXXX.XX |
| DIFFUSER CELL #6 TEMP                  | XXXX.XX | XXXX.XX | XXXX.XX    | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX  | XXXX.XX | XXXX.XX     | XXXX.XX |
| DIFFUSER CELL #7 TEMP                  | XXXX.XX | XXXX.XX | XXXX.XX    | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX  | XXXX.XX | XXXX.XX     | XXXX.XX |
| DIFFUSER CELL #8 TEMP                  | XXXX.XX | XXXX.XX | XXXX.XX    | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX  | XXXX.XX | XXXX.XX     | XXXX.XX |
| DIFFUSION JUICE TEMPERATURES           | XXXX.XX | XXXX.XX | XXXX.XX    | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX  | XXXX.XX | XXXX.XX     | XXXX.XX |
| RAW JUICE LVG DIFF TEMP                | XXXX.XX | XXXX.XX | XXXX.XX    | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX  | XXXX.XX | XXXX.XX     | XXXX.XX |
| RECIRC JUICE LVG DIFF TEMP             | XXXX.XX | XXXX.XX | XXXX.XX    | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX  | XXXX.XX | XXXX.XX     | XXXX.XX |
| RECIRC JUICE LVG HEATERS TEMP          | XXXX.XX | XXXX.XX | XXXX.XX    | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX  | XXXX.XX | XXXX.XX     | XXXX.XX |
| RAW JUICE LVG HEATERS TEMP             | XXXX.XX | XXXX.XX | XXXX.XX    | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX | XXXX.XX  | XXXX.XX | XXXX.XX     | XXXX.XX |

TEST RESULTS BY LOCATION FOR: MOLASSES RDS

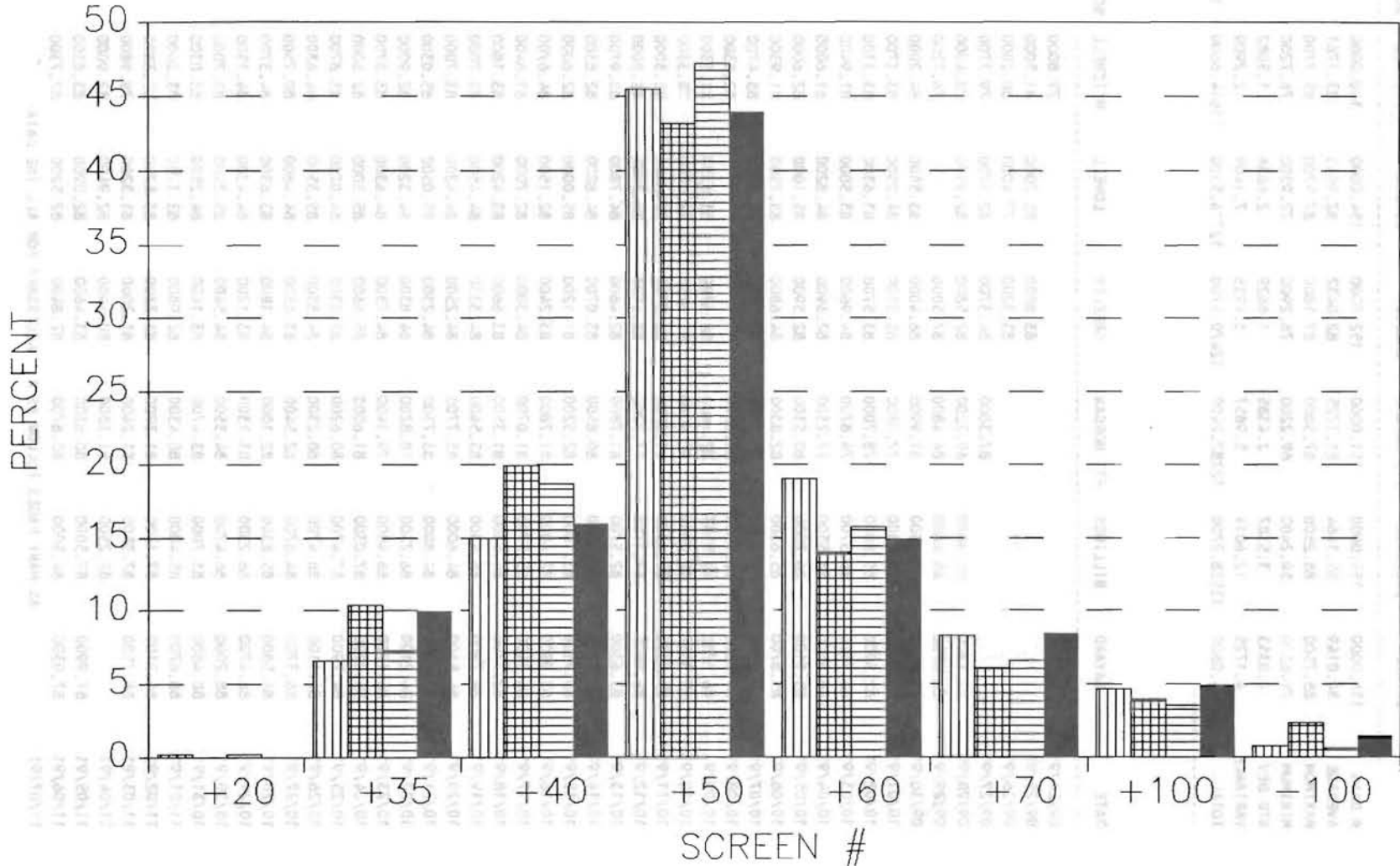
|          | BAYARD     | BILLINGS   | FT. MORGAN | GREELEY    | LOVELL     | MITCHELL   | SCOTTSBLUFF | COMPANY    |
|----------|------------|------------|------------|------------|------------|------------|-------------|------------|
| # DAYS   | 138.0000   | 159.0000   | 151.0000   | 152.0000   | 154.0000   | 140.0000   | 141.0000    | 1035.0000  |
| AVERAGE  | 84.0149    | 85.1464    | 81.3725    | 82.0432    | 82.9645    | 83.1761    | 79.9001     | 82.6597    |
| MAXIMUM  | 88.7500    | 88.2500    | 87.3000    | 87.5800    | 87.5700    | 85.7700    | 88.3000     | 88.7500    |
| MINIMUM  | 79.6300    | 50.2400    | 69.2200    | 76.2900    | 72.9300    | 76.7200    | 71.4000     | 50.2400    |
| STD DEV  | 2.0353     | 3.5387     | 2.4385     | 1.8629     | 2.6636     | 1.5082     | 3.5955      | 2.5204     |
| VARIANCE | 4.1725     | 12.6019    | 5.9857     | 3.4935     | 7.1409     | 2.2909     | 13.0197     | 6.9579     |
| TOTAL    | 11594.0600 | 13538.2700 | 12287.2400 | 12470.5700 | 12776.5300 | 11644.6600 | 11265.9100  | 85577.2400 |

| DATE     | BAYARD  | BILLINGS | FT. MORGAN | GREELEY | LOVELL  | MITCHELL | SCOTTSBLUFF | COMPANY |
|----------|---------|----------|------------|---------|---------|----------|-------------|---------|
| 09/24/91 |         |          |            |         |         | 79.8000  |             | 79.8000 |
| 09/25/91 |         |          |            | 83.8800 | 85.2000 | 81.5000  | 74.8000     | 81.3450 |
| 09/26/91 |         |          |            | 83.3200 | 77.4000 | 80.2000  | 72.7500     | 78.4175 |
| 09/27/91 |         |          | 87.3000    | 84.3700 | 82.5700 | 79.7700  | 74.1700     | 81.6360 |
| 09/28/91 | 82.4800 | 50.2400  | 69.2200    | 82.5800 | 82.9500 | 78.4000  | 79.8300     | 75.1000 |
| 09/29/91 | 82.3700 | 69.4000  | 84.4800    | 87.5800 |         | 76.7200  | 81.7500     | 80.3833 |
| 09/30/91 | 82.3700 | 77.6300  | 81.9900    | 86.4000 | 83.5500 | 84.2000  | 77.5200     | 81.9514 |
| 10/01/91 | 83.7300 | 79.9300  | 77.0800    | 85.3500 | 84.0500 | 83.3700  | 76.1000     | 81.3729 |
| 10/02/91 | 82.5900 | 85.8000  | 78.7000    | 83.5700 | 83.6300 | 83.3300  | 76.7400     | 82.0514 |
| 10/03/91 | 85.9100 | 86.3700  | 76.8700    | 84.9600 | 83.5800 | 81.9400  | 81.5200     | 83.0214 |
| 10/04/91 | 86.5000 | 86.5500  | 77.2300    | 82.6900 | 84.8200 | 81.6000  | 83.3000     | 83.2414 |
| 10/05/91 | 85.9100 | 86.2000  | 80.5300    | 82.3900 | 85.1000 | 82.6000  | 81.6300     | 83.4800 |
| 10/06/91 | 85.8700 | 85.6300  | 82.8300    | 84.6800 | 83.7500 | 81.9300  | 81.9700     | 83.8086 |
| 10/07/91 | 85.9100 | 84.1300  | 79.5000    | 81.9000 | 83.2700 | 83.4700  | 84.2300     | 83.2014 |
| 10/08/91 | 87.0300 | 86.9500  | 84.0300    |         |         | 82.0300  | 85.2000     | 85.0480 |
| 10/09/91 | 86.1700 | 87.5500  | 82.7600    | 84.6800 | 83.4300 | 81.3300  | 80.9300     | 83.8357 |
| 10/10/91 | 85.3500 | 88.2500  | 82.9000    | 85.5800 | 84.4300 | 78.3300  | 78.8700     | 83.3871 |
| 10/11/91 | 85.3500 | 87.6300  | 81.6700    | 85.7700 | 85.0800 | 81.3000  | 81.9000     | 84.1000 |
| 10/12/91 | 86.0600 | 87.1700  | 77.7200    | 83.4900 | 84.2700 | 82.8000  | 84.1300     | 83.6629 |
| 10/13/91 | 83.6300 | 82.5700  | 81.7800    | 82.4600 | 84.7800 | 83.9700  | 84.0000     | 83.3129 |
| 10/14/91 | 84.8600 | 84.2300  | 80.8500    | 83.0700 | 84.8800 | 82.8300  | 83.9700     | 83.5271 |
| 10/15/91 | 83.9100 | 83.1000  | 82.5200    | 81.1200 | 85.0000 | 82.6000  | 83.8300     | 83.1543 |
| 10/16/91 | 83.9900 | 82.4000  | 81.7800    | 83.2400 | 82.1500 | 84.6700  | 83.3000     | 83.0757 |
| 10/17/91 | 86.0400 | 85.5700  | 81.0700    | 84.3000 | 82.7000 | 81.8400  | 86.4000     | 83.9886 |
| 10/18/91 | 82.7700 | 84.5300  | 81.3500    | 83.6600 | 83.4200 | 83.1800  | 83.5200     | 83.2043 |
| 10/19/91 | 84.7900 | 86.4300  | 83.5400    | 84.3300 | 84.4500 | 83.7000  | 81.5700     | 84.1157 |
| 10/20/91 | 84.5100 | 84.6000  | 83.7700    | 84.2500 | 84.4200 | 83.7000  | 77.0400     | 83.1843 |
| 10/21/91 | 86.1800 | 84.8000  | 83.7300    | 84.2300 | 85.0500 | 85.0300  | 85.0200     | 84.8629 |
| 10/22/91 | 84.2100 | 86.7300  | 78.8200    | 84.8300 | 84.3200 | 82.9000  | 84.8000     | 83.8014 |
| 10/23/91 | 86.1900 | 86.4000  | 79.1400    | 84.7300 | 84.6300 | 83.8700  | 81.6700     | 83.8043 |
| 10/24/91 | 85.0900 | 87.0300  | 81.6000    | 85.6600 | 85.3000 | 82.6000  | 86.0000     | 84.7543 |
| 10/25/91 | 84.7900 | 87.4700  | 80.6200    | 85.0300 | 84.0200 | 83.8700  | 85.4000     | 84.4571 |
| 10/26/91 | 86.1100 | 86.4700  | 80.2300    | 84.3300 | 85.3500 | 84.6300  | 84.4000     | 84.5029 |
| 10/27/91 | 86.3700 | 84.6700  | 82.5400    | 83.6500 | 84.4800 | 80.7500  | 83.0700     | 83.6471 |
| 10/28/91 | 86.5800 | 85.8300  | 82.1000    | 84.1800 | 83.6300 | 84.3700  | 84.8000     | 84.4986 |
| 10/29/91 | 86.4700 | 86.2300  | 83.1300    | 83.1200 | 84.4200 | 84.1500  | 85.8700     | 84.7700 |
| 10/30/91 | 88.2000 | 86.4700  | 84.3500    | 84.5400 | 85.2400 | 83.7000  | 85.7300     | 85.4614 |
| 10/31/91 | 88.4800 | 83.7000  | 83.4700    | 83.1400 | 84.2500 | 83.0300  | 84.7700     | 84.4057 |
| 11/01/91 | 88.6700 | 85.4000  | 80.4300    | 82.9800 | 83.1700 | 83.2000  | 84.3700     | 84.0314 |
| 11/02/91 | 86.2100 | 87.1300  | 81.3900    | 83.3300 | 83.5700 | 82.3800  | 88.3000     | 84.6157 |
| 11/03/91 | 88.7500 | 87.3500  | 81.2400    | 81.2000 | 81.3200 | 79.9800  | 84.6700     | 83.5014 |
| 11/04/91 |         | 87.2500  | 81.3800    | 80.5400 | 82.9400 | 82.9000  | 85.6300     | 83.4400 |
| 11/05/91 | 87.9900 | 87.5000  | 80.6300    | 83.4600 | 82.0900 | 83.8300  | 86.3000     | 84.5429 |
| 11/06/91 | 87.0300 | 84.5000  | 80.8700    | 82.8400 | 82.5200 | 82.7300  | 85.6700     | 83.7371 |
| 11/07/91 |         |          |            |         |         |          | 84.6300     | 83.9729 |

AS MANY PAGES FOLLOW AS ARE NECESSARY FOR ALL THE DATA

# SEIVE TEST — SHIFT ANALYSIS

24 HRS. ENDING 02/08/93

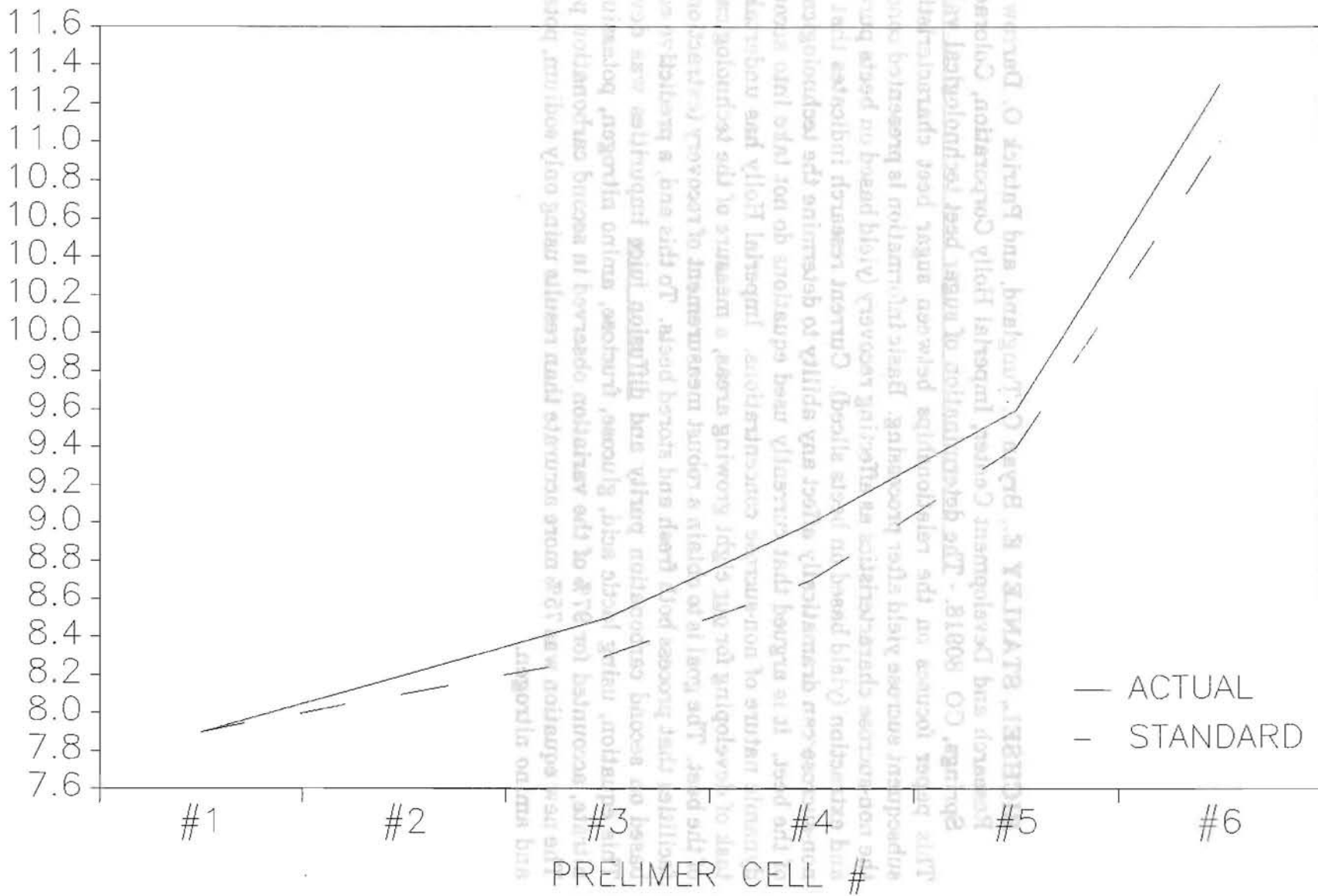


Day Shift
  Swing Shift
  Graveyard Shift
  TARGET

# SHIFT PRELIMER pH PROFILE

DATE: 01/08/93

TIME: 13:00



Hd

129