Technical Paper 24

SOILIMS

Laboratory Information Management System for Soil and Plant Laboratories

Manual and Tutor

Version 1.4

ISRIC

International Soil Reference and Information Centre

CIP-GEGEVENS KONINKLIJKE BIBLIOTHEEK, DEN HAAG

Brunt, J.

Soilims manual: laboratory information management system, version 1.x / J. Brunt, L.P. van Reeuwijk. - Wageningen : International Soil Reference and Information Centre, + 2 diskettes. - (Technical Paper / International Soil Reference and Information Centre, ISSN 0923-3792 ; 24
ISBN 90-6672-055-7 losbl.
Trefw.: bodemkunde ; computerprogramma's.

CONTENTS

A. MANUAL

B. TUTOR

B. TUTOR

STATEMENTS

This Manual and Tutor can be used for both the full-fledged SOILIMS programme as well as its demonstration version SOILIMS DEMO.

The former is hardlock-protected by means of a dongle, the latter is unprotected, but has a limited capacity of 100 samples.

The contributions by Messrs. J.R.M. Huting, A.J.M. van Oostrum, R.A. Smaal, P. Tempel, J. Verhagen are gratefully acknowledged. The authors are particular indebted to Dr. J.L. Pleysier and Mr. J. Uponi, Analytical Services, IITA, Ibadan, Nigeria who stimulated the development of the programme and made several valuable suggestions.

The Land and Water Development Division, FAO, Rome, co-sponsored the development of this programme.

Users are strongly encouraged to report any "bug" encountered or suggestions to improve SOILIMS. Users encountering problems in the use of SOILIMS or having questions related to SOILIMS should not hesitate to contact ISRIC.

Frank Westerhout (Skalar Analytical, The Netherlands), Ilyassou Oumarou (ICRISAT, Niger) and José de Brito (Laboratorio Agricola, Madeira) contributed to SOILIMS 1.4 by proposing new features and reporting bugs.

When he/his is mentioned in the text, this includes she/her.

ISRIC
P.O. Box 353
6700 AJ Wageningen
The Netherlands
Phone: +31.317.471711 Fax:+31.317.471700 E-mail: SOIL@ISRIC.NL)

A. MANUAL

CHAPTER 1

INSTALLATION AND LOG-IN

1.1 Installation

The SOILIMS programme (copy-protected) consists of two diskettes, numbered 1 and 2, and a dongle.

For a good performance this programme should run on a MS-DOS computer with at least 4 Mb memory and 6 Mb free disk space. **Files and buffers in the CONFIG.SYS should be set at 99 and 40 respectively**. Also the device driver "EMM386.EXE noems" should be present in the Config.sys. An example of a simple CONFIG.SYS is the following:

```
device=c:\dos\himem.sys
device=c:\dos\emm386.exe noems
dos=high
files=99
buffers=40
```

To install and run SOILIMS on the computer's hard disk, the following procedures are necessary:

Note: For the installation of the SOILIMS DEMO, see page T-1

a. Switch on the computer.

b. Place diskette 1 in drive A (or B).

c. Type A: (or B:) followed by <ENTER>.

d. Type INS-LIMS c: followed by <ENTER> (or INS-LIMS d: if you want to install SOILIMS on your D drive).

e. The programme will be installed; follow the instructions on the screen.

f. Plug the dongle in your printer-port LPT 1. This is usually the port where your matrix printer is connected to the computer. Next plug the matrix printer cable (if any) in the dongle.

g. In order to start the programme type SOILIMS followed by <ENTER>.

When your computer has the minimum requirement of 4Mb RAM it may be that, when starting the programme. the following error appears on the screen: "Insufficient memory. Set DOS4GVM to use VMM ** initialization error **
In that case add the following line in your autoexec.bat file (e.g. on the bottom line):
SET DOS4GVM=:1M or **SET DOS4GVM=:2M** or **SET DOS4GVM=:3M**
It depends on the size of the available or free Extended Memory in your computer whether you have to use the numbers **1**, **2** or **3**. The size of free Extended Memory is expressed in kilobytes which you can diagnose yourself by typing the DOS command "MEM" after you switched your computer on. Divide this number by 1000 to obtain (roughly) the size in Megabytes. When you omit the numbers behind the decimal, you will obtain the correct number for the "SET" command in your AUTOEXEC.BAT file.

1.2 Log in/out Procedure

After starting the programme you will be requested to enter your User name and password, the User name with all authorities is *chief*, the password is also *chief*.

IMPORTANT

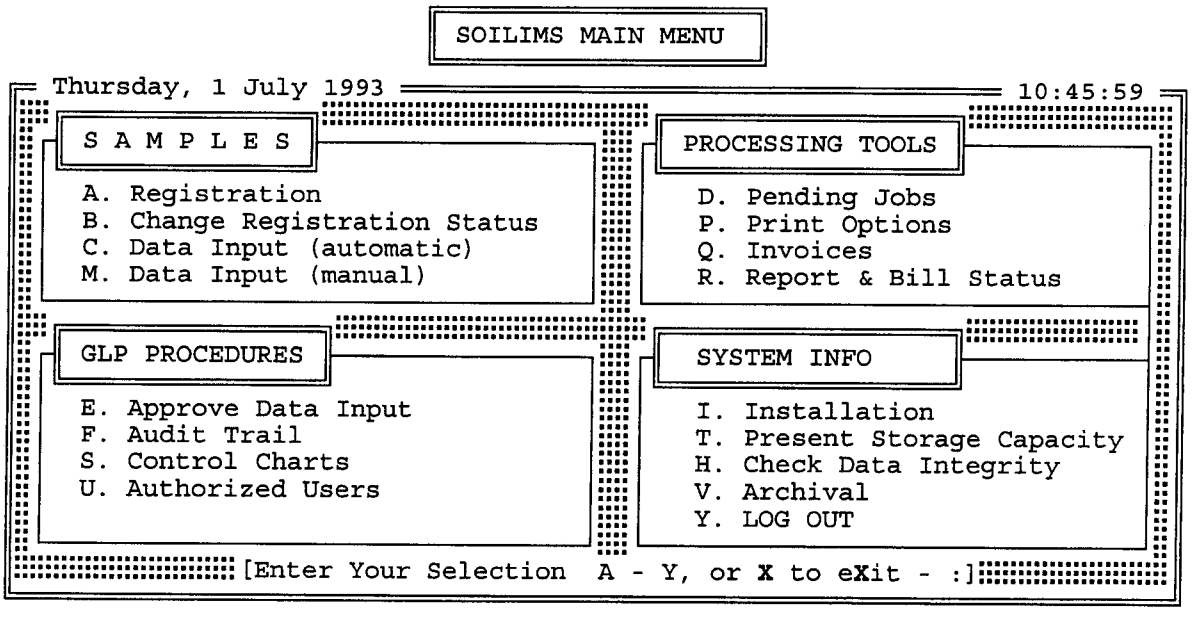
After the exploration of SOILIMS it is advised to add your own name with password to the SOILIMS system and give yourself all authorities (see Section 12.2). The User "chief" should then be removed from SOILIMS (see Section 12.3). When the User "chief" with password "chief" is still present in SOILIMS everybody who reads this manual has access to all features of SOILIMS. Once you added yourself as a User, you have to log out as chief and log in with your name and password. Next remove User "chief".

Note 1: With respect to passwords, SOILIMS distinguishes between Upper and Lower case letters.

Note 2: It is strongly recommended that the Chief of the Laboratory gives his password in custody (e.g. in a sealed envelope) of the Management of the Institute. In the unlikely event that the Chief's password cannot be produced, ISRIC should be notified by the Management in order to solve the problem instantly.

When the password has been verified the following menu will appear:

MENU 1.1. SOILIMS Main Menu



The Main Menu is divided into four parts. The User may select his option by pressing the letter of his choice. When User is not authorized by the laboratory manager to use a specific option the programme will display a message and refuses to execute User's command (see Chapter 12).

There are two ways to end a SOILIMS session:

A. Strike *X* and User will return to the DOS prompt and
B. Strike *Y* and SOILIMS asks for a new User's name and password.

Whenever User ends a session he should log out in order to prevent others using his authority to enter or handle data.

CHAPTER 2

DEFAULT SETTINGS

2.1 Install Institute

In order to let SOILIMS know the environment of your laboratory option *I* from the Main Menu should be selected and the following menu appears:

MENU 2.1. Installation Menu

```
Local Installation of SOILIMS

  A. Institute
  B. Price list and order of appearance
  C. Maximum Batch Capacity
  D. Auto Backup Warning
  E. Paper length
  F. Printer type
  G. Assign First Lab Number
  H. File Name ASCII Data
  I. File name Spreadsheet Data
  J. Minimum and Maximum values
  K. Cross-check values
  L. Old work order display
  M. Report layout
```

Strike *A* in order to supply SOILIMS with the particulars of your Institute, such as name and place, but also the percentage of Value Added Tax or other Government Tax if this should be added to the invoices. When no taxes are charged, the percentage is zero.

2.2 Install Price List and appearance order

Strike *B* in order to supply SOILIMS with the Institute's price list which is used to calculate the invoices (see Chapter 10). User can also choose the displaying order of all analyses on the screen, by assigning a rank order number to each analysis. The rank order number should be typed in the column *"ORDER"*, which is on the left side of the column *"ANALYSIS"*. column. It is obvious that analyses less frequently (or not) performed should receive the highest ranking order, while regularly used analyses should receive a low rank number.

2.3 Install Maximum Batch Capacity

Most series of analyses have a certain maximum batch capacity, depending on the method and/or instruments used. SOILIMS needs to know the maximum batch capacity of an analysis as it uses this information during the data input (see Chapter 5). At present the batch capacity is installed at 999 samples per batch. If you do not know the batch capacity of your analyses yet, leave this figure as such.

2.4 Auto Backup Warning

When you are using SOILIMS, you will slowly build up a large database of high quality analytical results which are checked and cross-checked. Therefore your hard disk will slowly, but inevitably reach the limits of its storage capacity.
At the time (or just before) this maximum is reached, SOILIMS will no longer function and loss of precious data can be expected.

Therefore you are advised to keep at least 7 Mb free disk space and remove old non-SOILIMS files and/or programmes whenever free disk space becomes less than that. Please refer to your DOS manual regarding the removal of files and programmes. If you plan to archive your data (see Chapter 13) you may temporarily need more space. Before archiving, however, SOILIMS will estimate the necessary space and show this on the screen.

SOILIMS will give a warning when it is time to back up and remove other files but provides the User with an option to set the minimum required free disk space. As soon as this space is reached, only those options of SOILIMS will function which do not require disk space (e.g. User may still do Audit Trails, check which work orders are pending, examine Control Charts, but cannot register new samples or do any other form of data input).

2.5 Paper Length

SOILIMS supports 11 as well as 12 inch paper size.

2.6 Printer Type

SOILIMS supports many printers which can be installed by selecting the printer of your choice.

TIP: It is useful to have two printers installed: one printer for report or document writing and one printer for label printing. The two printers can be separately activated by a printer splitter. When only one printer is available User has to change paper when printing labels, using the label paper. An option may be to print the labels on normal paper and cutting them afterwards to the desired length.

Note 1: The height of the label paper should be 3½ cm, the width can vary from 5 to maximum 10 cm.

Note 2: Some printers do not give an error message when out of paper. SOILIMS cannot anticipate on such event and will respond by seemingly getting jammed. In this case switch your printer off and insert paper. **When a automatic splitter or scanner is installed, the splitter/scanner should be switched off too.** In both cases the following message will appear:

```
Printer is not receiving information

Please check cable or switch printer on
```

2.7 Assign First Lab Number

When SOILIMS is installed in the laboratory, the first registered sample will have a unique number consisting of 7 digits, the last digit being number 1. In case incoming samples are already numbered before the introduction of SOILIMS, User may want to synchronize the generated numbers by SOILIMS with the already existing numbers in the laboratory.

When SOILIMS contains already data, you can only synchronize with numbers higher than the latest registered sample. This will avoid duplicate laboratory numbers. If you insist in assigning lower numbers, you have to remove all existing SOILIMS data from disk, using option *H* from the Main Menu.

2.8 File Name ASCII Data

When data are not to be entered by hand (typing from the keyboard), they can be directly imported from an ASCII file, which may be produced by instruments or spreadsheets. In order to import a file, SOILIMS needs to know the file name. Option *H* gives access to the ASCII file Menu.

MENU 2.2. ASCII File Menu

```
A. Define file names for attributes
B. Change all extensions
C. Change all drives
D. Change all directories
```

ASCII file names to be imported into SOILIMS may be pre-defined in SOILIMS (option *A* of Menu 2.2). It is advised to pre-define the file names in order to minimize the risk of retrieving, for example, pH-KCl data instead of P-Olsen data.

Option *B* of Menu 2.2 minimizes the quantity of manually changing all file extensions. File extensions may be changed if User decides to use other software or new updates to create ASCII files.

Option *C* of Menu 2.2 is useful when at first all ASCII files are written on floppy disks (A or B drive) and one decides (in a later stage) to introduce a network in the laboratory which has (for example) an F drive.

If one decides to change the directory where all ASCII files are stored, option *D* of Menu 2.2 minimizes the amount of work involved.

2.9 File Name Spreadsheet Data

SOILIMS may export data to a spreadsheet format and file names can be pre-defined SOILIMS (option *I*, Menu 2.2). It is advised to pre-define the file names in order to minimize the risk of retrieving wrong data into your spreadsheet programme.

2.10 Minimum and Maximum Values

Option *J* of Menu 2.2 allows the User to define ranges within which data are accepted (beyond the range, not accepted). At both sides of the range value may be set beyond which a warning is given. It is obvious that the warning maximum should be lower than (or equal to) the absolute maximum and the warning minimum should be higher (or equal to) the absolute minimum. The absolute minimum is defined as the Method Detection Limit (*MDL*). This is the minimum concentration of an attribute which can be detected by the analytical method. For the assessment of the *MDL* see *Guidelines for Quality Management in Soil and Plant Laboratories* (Van Reeuwijk, 1997). Suppose the *MDL* of an attribute is 0.1 and a value of 0.05 is found. In this case the value of 0.05 should be entered during the data input but SOILIMS will report it as <0.1. In case a client does not want his data to be reported as "smaller than", the absolute minimum should be set at 0.

Table 1. Assigned ranges to analyses (initial settings)

ANALYSIS	Absolute Minimum	Warning Minimum	Warning Maximum	Absolute Maximum
pH-H_2O	2.0	3.5	8.8	12.0
pH-KCl	2.0	3.5	8.8	12.0
EC	0.0	0.0	90	1000
Clay (%)	0	0	90	100
CEC	0	0	75	500
Exch. Calcium	0	0	75	500
Exch. Magnesium	0	0	75	500
Exch. Potassium	0	0	75	500
Exch. Sodium	0	0	75	500
Exch. Manganese	0	0	75	500
Exch. Acidity	0	0	75	500
Exch. Aluminium	0	0	10	50
Organic Carbon	0	0	10	50
Kjeldahl-N	0	0	1	5
Calcium carbonate	0	0	50	100
P-Bray	0	0	50	1000
P-Olsen	0	0	50	1000

2.11 Cross-check Values

Option *K* of Menu 2.2 allows User to change the standard settings of cross-check values as they are set upon delivery of the SOILIMS system, by changing the respective values in the column "YOUR_VALUE".

2.12 Old Work Order Display

Option *L* defines an "old" work order. The quantity of "old" work orders can be found in the upper right corner of the main menu. If a work order does not pass the final cross-check (see Section 6.4), it will always show up in the pending work order list (see Section 7.2). This list will then become very lengthy and (apart from bothering the User with finalized work orders) slowing down the SOILIMS system. A work order will only pass the final cross-check when all requested analyses are done.

However, some analyses in some samples may not (or can not) be done due to lack (or complete loss) of sample material. Remove then the requested analysis from the work order using option *B* from the Main Menu, followed by sub-option *E* or *F*. SOILIMS will never remove a sample from a work order or an analysis from a sample if an analysis is done.

2.13 Report Layout

Sub-option *N*, gives User several possibilities to set the SOILIMS report layout. It is possible to use pre-printed letterhead paper (with Institute logo) for the first page (or all pages) by reserving some "empty" lines. Also, user has the choice to skip the sample identification sheet and/or print the data continuously without leaving empty lines on the paper output. This may save a lot of paper.

CHAPTER 3

REGISTRATION

3.1 Order Registration

Samples arriving at the laboratory should be registered by pressing the letter *A*

When registering a new work order, SOILIMS asks for a Client ID. When the Client ID is not known (or not existing), a list appears, displaying all registered clients (in alphabetical order). User can then select a client, by moving the cursor key to the client of his choice and strike <ENTER>. When User cannot find the client in question, a "new client" should be entered into the database. This can be done by selecting the option *"Add a Client"* in the displayed client list. When user selects the option *"EXIT"*, no registration will be made and user returns to the Main Menu.

During the registration procedure, SOILIMS enables the user to add a nickname to the work order of the client. The function of the nickname is to distinguish the different work orders for one single client. It may be a serial number or project number or a "fantasy" name made by the user. The assignment of nicknames to work orders is not compulsory and can be done later if the need arises, see Main Menu option *B* (*Change Registration Status*) followed by sub-option *J* (*Edit nickname / sample ID / address*).

The client database has been kept as simple as possible. The primary functions of the client database are:

- printing an address label for a client, which can be found by selecting option *P* (*Print Menu*) followed by sub-option *B* (*Labels*).
- producing the laboratory production per client within a certain time span by selecting option *F* (*Audit Trail*) followed by sub-options *F* (*Production*) and sub-option *C* (*Production per Client*).

After identifying the client (either by selecting an existing client or adding a new client) the following input screen will appear:

MENU 3.1. Order Registration Menu

```
Sample material (Soil/Plant/Water)  [ ]
Is there a deadline?                [Y]

How many samples to register?       [   ]

What is the deadline?               [dd/mm/yy]
```

After the questions have been answered, the programme asks the User if he wants to make corrections. When no corrections are necessary, User presses the letter *"N"* for *"No"*. (*When you instruct SOILIMS to register 0 samples, the registration will be cancelled but the particulars of a new client are stored in the client database*).

3.2 Analytical Programme

SOILIMS will then ask if all samples need the same Analytical Programme. If you confirm this, Menu 3.2 appears. In case not all samples need the same Analytical Programme, SOILIMS asks how many samples have the same Programme and a list with all attributes will appear.

MENU 3.2. Choose Analysis Menu

```
Strike Y for analysis and F7 when ready
```

ANALYSIS	REQUESTED
Soil preparation	F
EC (2.5)	F
pH water	F
pH KCl	F
Calcium carbonate	F
Particle size 3 fr.	F
Gravel	F
CEC	F
Exch. Calcium	F
Exch. Magnesium	F
Exch. Potassium	F
Exch. Sodium	F

The PgUp and PgDn keys on the keyboard should be used to display other analyses. In the column REQUESTED, User has to type a *Y* or a *T* (=True) if a particular analysis is requested. The *N* or *F* (=False) implies that the analysis concerned is not requested by the client*. After striking F7 the samples will be registered by the programme and the User is asked whether the client sample ID's are coded with consecutive numbers. If so, the programme will ask for the first client's sample code number and do the rest of the numbering automatically. However, if client coded his samples in a different way, the User is requested to type client's code for each sample to be registered.

The programme will then show the unique laboratory number assigned by SOILIMS and User has to type the corresponding client code followed by <ENTER>.

NOTE: It is advised to request the client to deliver his samples numerically coded from 1 to ..., in order to avoid typing errors, but also to reduce the time for registering samples (especially when large orders with complicated code numbers are received).

After registering the incoming samples, User may want to Confirm the order and/or print corresponding labels for sample boxes. Option *P* from the Main Menu gives access to the Print Menu (see Chapter 9). When registration errors are made, Option *B* from the Main Menu (Change Registration Status) should be used (see Chapter 4).

---

* With the term "Client" is meant anyone who requests an analysis for which a work order is made. This does therefore apply to requesters from inside the institute as well as from outside.

CHAPTER 4

CHANGE REGISTRATION STATUS

4.1 Introduction

It could happen that, at a later stage, a client (or the laboratory itself) wants some extra attributes analyzed in addition to those defined during registration.

After pressing option *B*, of the Main Menu, Change Registration Status, the following menu appears.

MENU 4.1. Change Registration Menu

```
[A] Add analysis to sample(s)
[B] Delete analysis in sample(s)
[C] Cancel a sample

[D] Add analysis to work order
[E] Delete analysis in work order
[F] Cancel a work order

[G] Add sample(s) to work order

[H] Change deadline of one work order
[I] Change deadline of all work orders

[J] Edit nickname / sample ID / address
```

4.2 Add Analysis to Sample(s)

When User wants to add an analysis to one or more samples (Press option *A* of the Main Menu) SOILIMS displays first a list of pending work orders and User has to move the highlight with the cursor keys (↑ or ↓) to the work order of his choice, to be confirmed by <ENTER> (choose work order 0 to EXIT). Next a list of all sample numbers is displayed belonging to that particular work order and User has to move the highlight with the cursor keys (↑ or ↓) to lowest possible sample number where an attribute has to be added to be confirmed by <ENTER>. When only one sample should be changed User should strike <ENTER> again, otherwise User has to move the highlight with the cursor keys (↑ or ↓) to the highest sample number of the sample range to be changed, to be confirmed by <ENTER>.
Menu 3.2 appears (Attribute Registration Menu). The User can then decide which attribute should be added to the selected sample range by moving the highlight with the cursor keys (↑ or ↓) to the attribute to be added, to be confirmed by <ENTER>. SOILIMS will display the total number of samples where the registration for that particular attribute was added.

NOTE: The total number of samples selected by the User does not always equal the total number of samples in case the registration was changed (it might be that the particular attribute was already requested).

4.3 Delete Analysis in Sample(s)

This procedure is identical to the procedure as explained in 4.2. However, for economical reasons, an analysis cannot be cancelled when already performed

4.4 Cancel a Sample Range

With option *C* from Menu 4.1 (see Section 4.1) all requested analyses in a sample range can be cancelled at once and the samples will be removed from the work order. SOILIMS displays first a list of pending work orders and User has to move the highlight with the cursor keys (↑ or ↓) to the work order of his choice, to be confirmed by <ENTER> (choose work order 0 to EXIT). Next a list of all sample numbers is displayed belonging to that particular work order and User has to move the highlight with the cursor keys (↑ or ↓) to lowest sample number in the range to be confirmed by <ENTER>. When only one sample should be cancelled User should strike <ENTER> again, otherwise User has to move the highlight with the cursor keys (↑ or ↓) to the highest sample number of the sample range to be cancelled, to be confirmed by <ENTER>. When one or more analyses are already done SOILIMS will not remove the sample.

4.5 Add Analysis to Work Order

When User wants to add one or more analyses to an entire work order, press option *C* from Menu 4.1 (see Section 4.1) SOILIMS displays a list of pending work orders and User has to move the highlight with the cursor keys (↑ or ↓) to the work order of his choice, to be confirmed by <ENTER> (choose work order 0 to EXIT).

Screen display will be as follows:

```
Work order :  93047
Reg. Date  :  26/03/93
Client     :  FAO
Deadline   :  25/05/93
Lab number :  930178
```

In the upper left corner the work order number with registration date, client and deadline is displayed while the options menu appears at the lower right corner of the screen.

Next, User has to confirm that he wants to add an analysis to the entire work order displayed above by typing *"Y"* (by typing *"N"*, User returns to the previous menu).

The attribute list appears and User has to select the attribute to be added to the work order by moving the cursor key to the attribute of his choice and strike <ENTER> to select.

4.6 Delete Analysis in Work Order

The attribute list appears also when an analysis in a work order should be cancelled (option *D* from Menu 4.3), however, option *E* will not function when the analysis is already executed.

4.7 Cancel a Work Order

Option *E* from Menu 4.1 (see Section 4.1) will result in a list of pending work orders displayed on the screen and User has to move the highlight with the cursor keys (↑ or ↓) to the work order of his choice, to be confirmed by <ENTER>. The work order will then be cancelled, unless it contains already approved data (select work order 0 to exit).

NOTE: In case a work order contains already approved data, the approval should be reviewed (see Section 6.5). Resubmitting all analyses will enable you to remove the work order. The authors realize that this may cost some time. However, priority is given to avoid the accidental removal of data.

4.8 Add Sample(s) to Work Order

It may happen that after the registration of soil samples (see Chapter 3) a client decides to have one or more samples analyzed. Option *G* from Menu 4.1 will give the User the possibility to add samples to an existing work order. The procedure is identical to the procedure for sample registration (see Chapter 3).

4.9 Change Deadline of one Work Order

By means of option *H* in Menu 4.1, the deadline of a work order can be changed.

4.10 Change Deadline of all Work Orders

Circumstances may make it necessary that the deadline of all pending work orders has to be changed. Instead of using option *I* repeatedly (and consequently), SOILIMS offers the time saving option *H.*

4.11 Edit Clients's nickname / sample ID / address

When striking option *J,* User has to choose if he wants to edit the client's nickname, sample ID or address and the following menu appears:

MENU 4.2 Edit nickname / sample ID / address

```
A. Nickname client
B. Client's sample ID
C. Client address
D. Remove an address
X. Exit to Main Menu
```

When options *A* or *B* are chosen a list of work orders will appear on the screen and User has to move the highlight with the cursor keys (↑ or ↓) to the work order of his choice, to be confirmed by <ENTER> (choose work order 0 to exit). User is than able to change or correct the nickname or client's sample ID.
Option *C* results in a list of all clients. User has to move the cursor key to the client of his choice, to be confirmed by <ENTER>. The same procedure applies for option D, however, a client's address can not be removed if the client has pending or approved work orders.

CHAPTER 5

DATA INPUT

5.1 Introduction

Data can be entered manually through the keyboard or automatically by means of reading ASCII files. The latter are directly produced as final results by instruments or as calculated results in spreadsheets.

5.2 Manual Data Input

Option *M* from the Main Menu gives access to the manual data input menu of SOILIMS and the program displays a list of all available attributes in the laboratory. User has to move the highlight with the cursor keys (↑ or ↓) to the attribute of his choice, to be confirmed by <ENTER>

When a particular attribute is chosen a list of work orders appears on the screen and User has to move the highlight with the cursor keys (↑ or ↓) to the work order of his choice, to be confirmed by <ENTER> (choose work order 0 to exit).

Depending on the maximum batch size (see Section 2.3) SOILIMS asks if more samples have to be analyzed. If not, SOILIMS continues:

A. When control samples for the particular analysis are available, SOILIMS asks if a control sample was used in the batch and if so

B. a list of control samples is displayed. User has to move the highlight with the cursor keys (↑ or ↓) to the control sample which has been used, to be confirmed by <ENTER>.

C. User is asked to enter the measured value of the used control sample in the batch and finally

D. User is asked to enter the analytical results of the samples, which will be stored after striking function key *F7* after each data input process.

5.3 Automatic Data Input

In order to enter data automatically option *C* from the Main Menu should be chosen and the ASCII file name where data are stored should be typed followed by <ENTER>. The format of the imported ASCII file is of crucial importance for a successful automatic data input procedure. Data should be presented columnwise. The first column should contain the unique laboratory number, the second column should contain the data. For example:

```
199300189    7.8
199300190   10.7
199300191    0.6
199300193    3.4
199300193   12.7
199300194    9.1
199300195    0.6
```

Columns should be separated with one or more spaces.

In case of the attribute *particle-size distribution* the column following the unique laboratory number should be the coarsest fraction. The far right column should contain the clay fraction. (In other words, the further a column is situated from the unique laboratory number, the finer the fraction should be).

Note: SOILIMS will not accept data through an automatic data input procedure when the analysis was not requested or when data are already stored. Data with wrong unique laboratory numbers are not accepted either.

CHAPTER 6

APPROVAL OF DATA

6.1 Introduction

When samples are analyzed, results need to be approved. SOILIMS distinguishes two types of approval:

1. *Batch approval*
2. *Cross-checks* (interim or final)

The Batch approval has the lowest hierarchical level and compares the found attribute value of the control sample in a batch with the established Target Value (and its standard deviation, SD) of the Control Chart (see Chapter 8). When the attribute value of the control sample falls within the specifications (see Section 6.2), SOILIMS will automatically approve the batch. When the attribute value of the control sample falls beyond the specifications, User has to approve or reject the results of the batch.

In case no control samples are available in the laboratory* or an available control sample was omitted in a batch, SOILIMS will also automatically approve the batch. However, when an interim report is printed, details may be printed with respect to control sample use (see Section 9.9). This applies also for batches which should be rejected (control sample out of specifications) but are finally approved by the User.

The Cross-checks are based on cross-checking the approved values of different attributes. An Interim Cross-check can be performed at any time, whereas a Final Cross-check can only be executed when all analyses in a work order are completed and the batch approval was successfully passed.

Option *E* in the Main Menu gives access to the Data Approval Menu.

MENU 6.1. Data Approval Menu

```
A. Batch approval
B. Cross-check (interim)
C. Cross-check (final)
D. Review Batch Approval or Cross-check
E. Cross-check inconsistency listing
X.  Exit to Main Menu
```

* SOILIMS considers a control sample not present in the laboratory if the control sample and its characteristics have not been entered into SOILIMS (see Section 8.4).

6.2 Batch approval

The Batch approval is automatically performed by SOILIMS when no Control Sample (cs) accompanied the batch or the measured value of the Control Sample falls within the specifications (i.e. within "Control Limits" or "Action Limits"):

$$\text{target value} - 3\times SD \leq \text{measured value} \leq \text{target value} + 3\times SD$$

Batch approval should be done by the User when:

a. Measured value control sample is out of specifications (beyond Control Limits).

b. A cross-check (see Sections 6.3 and 6.4) resulted in a "HOLD*" status of the data.

c. A review of the batch approval or cross-check (see Section 6.5) resulted in a "HOLD" status of the data.

In other words: User has to perform the batch approval when control sample is out of specifications or data were given the "HOLD" status due to his own action.

When results of a particular attribute have to be approved, strike option *A* and the a list of all available attributes in the laboratory appears. User has to move the highlight with the cursor keys (↑ or ↓) to the attribute of his choice, to be confirmed by <ENTER>

The following columns appear on the screen:

```
Approve, Resubmit, or Hold (Strike A,R, or H) your data. (F7 to Exit)
```

WORKORDER	LABCODE	REG	CEC	ANALYST	INPUTDATE	CEC	STAR
1997018	199700063	H	4.4	SENIOR	10/05/97	15.5	+++
1997018	199700064	H	3.7	SENIOR	10/05/97	15.5	+++
1997018	199700065	H	2.8	SENIOR	10/05/97	15.5	+++
1997022	199700088	H	8.9	JUNIOR	15/05/97	2.3	---
1997022	199700087	H	7.3	JUNIOR	15/05/97	2.3	---

The table shows that five samples for CEC analyses have to be manually approved (strike *A)* or resubmitted (strike *R).* The samples were analyzed by SENIOR and JUNIOR, the measured values for the control sample in the batches were 15.3 and 2.3. In the last column + or - signs for flagging may appear:

---

* The status of data is considered to be HOLD if data are not yet approved or not yet rejected, i.e. the dis(approval) is postponed.

+	: target value + SD < measured value ≤ target value + 2×SD
++	: target value + 2×SD < measured value ≤ target value + 3×SD
+++	: measured value > target value + 3×SD
-	: target value - 2×SD ≤ measured value < target value - SD
--	: target value - 3×SD ≤ measured value < target value - 2×SD
---	: measured value < target value - 3×SD

(Thus: ++ and -- represent the "Warning Limits", and +++ and --- represent the "Control Limits" or "Action Limits" of the control chart).

No preceding sign appears when measured value is within 1 × SD from target value:

target value - SD ≤ measured value ≤ target value + SD

In case User is in doubt whether to approve or resubmit a batch, the "*H*" for *(Hold an analysis)* is an extra option to postpone the final decision. The latter may be the case when more information is needed (e.g. history of sample and/or location) or odd results appear despite the fact that the value for the control sample measured in the batch lies within the specifications.

SOILIMS always assigns a HOLD status to a batch when the value of the control sample measured in the batch lies beyond the target value ± 3×SD (beyond Control or Action Limit). The HOLD status, proposed by SOILIMS, may then be overruled by the User, either by approving (strike *"A"*) or resubmitting (strike *"R"*) the data. According to GLP a batch should also be disapproved when (not programmed in SOILIMS as yet):

a. Two successive exceedings of the same Warning Limit (i.e. target value + 2×SD, or of target value - 2×SD.
b. Six successive control values at the same side of the target value.

All of the mentioned criteria can be visually assessed by inspecting the control chart and appropriate action (when necessary) can be taken.

In case of *particle-size* analysis, only the clay content of the control sample is looked at, as it is most probable that, if errors occur, they will be represented in the finest fraction.

At the end of the process of batch approval, User is asked whether he wants to make corrections or not *(Y/N)* and upon striking *N* the Main Menu (MENU 1.1) will appear again.

6.3 Cross-check (interim)

If User wants to produce a report with all data analyzed so far, it is advised to perform an *interim* Cross-check. After striking option *B* in Menu 6.1 (see Chapter 6) SOILIMS displays a list of work orders and User has to move the highlight with the cursor keys (↑ or ↓) to the work order of his choice, to be confirmed by <ENTER> (choose work order 0 to exit).

During the process of Cross-check, SOILIMS performs cross checks between the following analyses:

1. pH-H_2O *vs.* carbonate:
   a. if pH-H_2O > 6.5, carbonate > 0%.
   b. if pH-H_2O ≤ 6.5, carbonate = 0%
2. pH-H_2O ≥ pH-KCl + 0.1.
3. pH-H_2O *vs.* exchangeable acidity:
   a. if pH-H_2O ≤ 5.4, exch. acidity > 0.
   b. if pH-H_2O > 5.4, exch. acidity = 0.
   Note: Analytically, for 0 (zero) one should rather read: < *LLD* or *MDL* (Lower Limit of Detection of the procedure or Method Detection Limit respectively).
4. pH-H_2O *vs.* base saturation:
   a. if pH-H_2O > 6.5, base saturation ≥ 100%.
   b. if pH-H_2O ≤ 6.5, base saturation < 100%.
   In addition, a results is flagged when base saturation exceeds 300%, meaning: *gypsum (or salts) might be present.*
5. Exchangeable Na > exchangeable K (only when exch. Na or exch. K > 0.5 $cmol_c/kg$).
6. Exchangeable Ca > exchangeable Mg (only when exch. Ca or exch. Mg > 0.5 $cmol_c/kg$).
7. C/N ratio: 7 < C/N < 20 (only when Organic C > 0.5%).
8. % clay ≥ % water-dispersable clay.
9. CEC ≤ 3.5 × % Org.C + 1.5 × % Clay.
10. Exchangeable acidity ≥ Exchangeable Al.
11. $Al_{oxalate} \geq Al_{pyrophosphate}$.
12. $Fe_{dithionite} \geq Fe_{oxalate}$.
13. CEC (pH 7) > the effective CEC (i.e. bases + exch. acidity; or bases + exch. Al).

When anomalities are found the status is switched to "HOLD" which may, however, be overruled by the User* (strike *"A"* to Approve or *"R"* to Resubmit).

All above mentioned numerical criteria are default values and may be customized by the User (see Section 4.9).

6.4 Cross-check (final)

When a work order is completely analyzed and all batches are fully approved, the final Cross-check should be performed in order to finalize a work order and remove it from the Pending Work Order list (Option *"C"* from menu 6.1). In case not all analyses are completed or all batches approved, User will be notified and the final cross-check cannot take place (work order will stay pending). When no anomalities are found, the work order is automatically prepared for archival procedures (see Section 13.1) and disappears from the pending work order list. The User may print the final report for the client, using option P from the Main Menu (see Section 9.8).

---

* For instance, in certain soils the pH-KCl characteristically exceeds pH-H_2O (i.e. a positive ΔpH). In such a case the "warning" of SOILIMS should be regarded as a highlighter rather than a suggestion for resubmission.

6.5 Review Batch Approval and Cross-checks

Reviewing Batch Approval or Cross-checks is a useful tool for the laboratory manager who gave authorization to one or more analysts to perform these checks themselves when necessary. By means of reviewing the manager can verify the analyst's (or SOILIMS's) decision to approve data and overrule the decision when necessary.

After striking Option *D* from the Approval Menu (Menu 6.1) Menu 6.2 appears.

MENU 6.2. Review Approvals

```
A. Samples in pending work order
B. Samples in approved work order
C. Final Cross-checks
X. Exit to Main Menu
```

After striking option *A* or *B* SOILIMS displays a list of pending or approved work orders and User has to move the highlight with the cursor keys (↑ or ↓) to the work order of his choice, to be confirmed by <ENTER>. Next a list of all available attributes in the laboratory appears. User has to move the highlight with the cursor keys (↑ or ↓) to the attribute of his choice, to be confirmed by <ENTER> and the following columns will appear on the screen:

```
Review Approvals (Strike A,R or H)   (F7 to Exit)
```

WORKORDER	LABCODE	REG	APPROVEDBY	CEC	ANALYST	INPUTDATE	CEC	STAR
1997018	199700063	A	CHIEF	4.4	SENIOR	10/05/97	15.5	+++
1997018	199700064	A	CHIEF	3.7	SENIOR	10/05/97	15.5	+++
1997018	199700065	A	CHIEF	2.8	SENIOR	10/05/97	15.5	+++
1997022	199700088	A	CHIEF	8.9	JUNIOR	15/05/97	2.3	---
1997022	199700087	A	CHIEF	7.3	JUNIOR	15/05/97	2.3	---

In this example we can see that, although the analysts SENIOR and JUNIOR found that Control Samples were out of specifications, the CHIEF approved the analyses. In case the Control Sample was within specifications, the name SOILIMS would appear instead of CHIEF. In case no control sample (cs) was used CHIEF is substituted by *cs omitted* or *cs lacking* (the laboratory has no control sample). Option C results in a cross-check for approved work orders. For the procedure see Section 6.3

6.6 Cross-check inconsistency listing

After striking option E from Menu 6.2, SOILIMS displays a list of work orders and User has to move the highlight with the cursor keys (↑ or ↓) to the work order of his choice, to be confirmed by <ENTER>. SOILIMS will make a list of cross-check anomalities (if any) in that particular work order which can be printed. The list may be used to forward to the Chief of the laboratory who will decide whether to resubmit or approve one or more analyses.

CHAPTER 7

PENDING JOBS

7.1 Introduction

The Pending Jobs option enables the laboratory manager to have a quick overview of all pending jobs (as regards analyses and approval) in the laboratory.

There are several ways of presenting pending jobs to a laboratory manager and each of them has its merits and drawbacks. Therefore, the User can make his choice through the following sub-menus.

MENU 7.1. Pending Jobs

```
A. General Information
B. Work list
C. Pending Batch Approval
D. Client
E. View one Sample (detailed)
F. View Sample numbers
```

```
Type letter of your choice or X to eXit
```

7.2 General Information

This option provides the information concerning the backlog of work orders, irrespective the types of analysis to be done.

The screen shows the registration date, unique assigned work order number, name of the client, unique assigned laboratory number, the code assigned by the client and the number of days before the deadline expires.

The pending work orders are sorted by deadline. If priority is given with respect to deadline procedures, this option will give the manager most useful information as the listing of jobs starts with those work orders which are closest to the deadline and ends with jobs which still have 365 days to go and, in practice, have no deadline (see also Chapter 3). When the number of days from the deadline is negative, the work order is overdue by that number of days. Zero days from deadline implies that the work order should be ready today.

Changing the deadline (see Section 4.9), therefore influences the order of listing.

User may then move the highlight with the cursor keys (↑ or ↓) to the work order number of his choice, to be confirmed by <ENTER>. SOILIMS will then ask if more information is requested and displays for the selected work order:

1. The list of requested attributes
2. How many samples are still pending to be analyzed for that attribute
3. How many data are pending approval for that attribute
4. How many data are approved for that attribute
5. How many resubmissions were involved for that attribute

7.3 Work List

Another way of presenting pending jobs is by showing them *per attribute to be analyzed.* This option will be useful when the manager has to quantify the work load in the laboratory (10 pending pH analyses is less work then 1 pending particle-size analysis).

In addition, this presentation informs him about the cumulative total number of pending batches sorted on deadline. The number after "»" represents the total number of vacant places in the last batch.

SOILIMS asks the User if a list of all attributes is needed (which can be used during a meeting with all laboratory personnel) or an outprint of only one attribute.

7.4 Pending Batch Approval

When analyses are done, results have to be approved (or disapproved). Approval is done by comparing the outcome of the analyzed control sample in the batch with the target value of that control sample (see also Section 6.2). Choosing option *"C. Pending Batch Approval"* displays a list of attributes awaiting approval.

7.5 Client

This option resembles option 7.2 General Information. However, only the pending samples for a specified client are displayed. SOILIMS will display a list of clients and User can select a client, by moving the cursor key to the client of his choice followed by <ENTER>.

Often, the laboratory manager will choose this option when a client enquires after the progress of his samples to be analyzed, but does not know or recall the unique assigned work order number.
This unique assigned work order number is necessary when a User requests more detailed information from SOILIMS (see Section 7.2).

7.6 View one Sample (detailed)

Option *E* results in a list of pending work orders and User can select a work order, by moving the cursor key to the work order of his choice followed by <ENTER>. Next a list of pending samples in that work order will be displayed and User can select a sample number by moving the cursor key to the sample number of his choice, followed by <ENTER>. SOILIMS will then display all particulars regarding the type of analysis requested and how many analyses for a specific sample are pending and/or awaiting approval.

7.7 View Sample Numbers

Option *F* offers User the possibility to examine all pending sample numbers within a pre-defined period. This option is, amongst others, useful if the manager wants to verify if certain samples belong to certain work orders.

7.8 Remove a Pending Work Order

In case a work order needs to be removed from the pending work order list before all analyses have been completed and approved (e.g. when one or more analyses will not be performed), this can be done by deleting the analysis from the work order: Main Menu option *B*, followed by option *E* (see Section 4.6). SOILIMS will then cancel the analysis, but keeps the data of samples already analyzed and approved. Next, User has to perform the final cross-checks in order to remove the work order from the pending work order list (Main Menu option *E*, followed by *C*).
(In case data are entered but not yet approved*, SOILIMS instructs User to approve or resubmit the data before cancelling the analysis).

---

* data need to be approved by User when:

a. Measured value control sample is out of specifications;
b. A Cross-check (see Sections 6.3 and 6.4) resulted in a "HOLD" status of the data.
c. A review of the Batch Approval or Cross-check (see Section 6.5) resulted in a "HOLD" status of the data.

CHAPTER 8

CONTROL CHARTS
(OF THE MEAN)

8.1 Introduction

The Batch Approval of analyses is done with the help of control samples* (see Chapter 6). Measured values of control samples are stored in Control Charts of the Mean. These are also referred to as Shewhart Charts or x-charts, x being the control values entered, leading to a mean value $\bar{x}$ (with standard deviation s), from which the (next) target value can be derived.
Option *S* in the Main Menu gives access to the Control Chart Menu.

MENU 8.1. Control Charts

```
A. Examine Control Charts
B. Target Value Control Samples
C. Add Control Charts
D. Delete Control Charts
E. Export Control Data to LOTUS 123
F. Export Control Data to ASCII file
X. Exit to Main Menu
```

```
Strike letter of your choice or X to eXit
```

8.2 Examine Control Charts

In order to examine the data of a Control Chart (see *Note 2* below), strike option *A* and the list of all attributes appears and User has to move the highlight with the cursor keys (↑ or ↓) to the attribute of his choice, to be confirmed by <ENTER>

A list of available control samples for that particular attribute appears and User has to move the highlight with the cursor keys (↑ or ↓) to the control sample of his choice, to be confirmed by <ENTER>. SOILIMS will then display a list of batch IDs with the respective measured values of the control samples together with the date and time registration.

Note 1: Batch IDs are automatically generated during the data input procedure (see Chapter 5). The only purpose of these numbers is to enable Audit Trail procedures (see Chapter 11).

Note 2: Due to graphical limitations of dBase, SOILIMS cannot directly produce a graphical representation of a control chart. However, most spreadsheet programs have options for this (see Section 8.6 and p. 8-6). Alternatively, or rather in addition, the "classical" way of manually filling out control charts is still a convenient procedure (see also Van Reeuwijk, 1997*).

---

* The proper preparation of a control sample and the use of the Control Chart of the Mean are described by Van Reeuwijk (1997) Guidelines for Quality Management in Soil and Plant Laboratories. ISRIC/FAO Publ. (in print).

For example:

Control Chart for pH-H2O

Control Sample: LABEX 19, Mollisol A1, 0-19cm;
Target Value: 6.2 ± 0.2

Batch ID	Measured Values	Date	Time	Analyst
19930001	8.9 +++	26/03/93	09:55	JOHN
19930008	5.5 ---	27/03/93	11:20	PETER
19930009	6.3	27/03/93	13:27	FRANCOIS
19930014	6.3	01/04/93	15:52	FRANCOIS
19930015	6.7 ++	05/04/93	08:10	JOHN
19930016	6.2	09/04/93	10:14	JOHN
19930019	5.6 --	22/05/93	15:34	JOHN

In the first column the unique batch numbers for pH-H_2O analyses are displayed. In this example batch 19930001 was the first batch for pH-H_2O in the year 1993. The batches 19930002 up to 19930007 are not displayed. Apparently other control samples were used.

The second column contains the measured values of the control samples sometimes followed with plus or minus signs (see Section 6.3). N.B. The batches 930001 and 930008 were resubmitted.

The 3rd and 4th column show the registered date and time, while the 5th column informs User about the analyst involved.

8.3 Target Value of Control Samples

Option *B* from Menu 8.1 will result in a list of available control samples used for the different attributes together with the dates of first and last use and the total number of times the sample was actually used in the different batches.

8.4 Add Control Charts

In order to add a Control Chart, strike option B and the list off all attributes appears. User has to move the highlight with the cursor keys (↑ or ↓) to the attribute of his choice, to be confirmed by <ENTER>. User has to supply SOILIMS with the target value and standard deviation of the particular control sample using the input sheet below.

```
ENTER NEW TARGET VALUE AND STANDARD DEVIATION FOR ....
```

```
What is the new target value?          [    ]

What is the new standard deviation?    [    ]

Name Control Sample: [                                    ]
```

After completion, User is asked whether he wants to make corrections and is returned to the Main Menu.

8.5 Delete Control Charts

In order to delete a Control Chart, (e.g. because the control sample has run out or has never been used), strike option *C* and the list of all attributes appears. User has to move the highlight with the cursor keys (↑ or ↓) to the attribute of his choice, to be confirmed by <ENTER>. Next, SOILIMS displays a list of available control samples for that particular attribute and User has to move the move the cursor keys (↑ or ↓) to the control sample of his choice, to be confirmed by <ENTER>. The selected control sample will disappear from the system when all its measured values have been archived (or when it has never been used). Next, User will return to the Main Menu.

In case the control sample has been used, the Control Chart contains data, which cannot be simply deleted. Data should then be archived first (see Section 13.1) or User has to confirm that the existing data for the Control Chart can be removed.

8.6 Export Control Data to a Spreadsheet Format

Option *D* gives User the possibility to transport the measured values of a control sample to a spreadsheet format for graphical presentation and User has to move the highlight with the cursor keys (↑ or ↓) to the attribute of his choice, to be confirmed by <ENTER>.

To select a control chart for export, its corresponding letter should be struck and SOILIMS displays a list of available control samples for that particular attribute and User has to move the highlight with the cursor keys (↑ or ↓) to the control sample of his choice, to be confirmed by <ENTER>. The chosen control sample with all data will be copied to a worksheet format. The name of the spreadsheet file should be given by User, e.g. CEC.WKS (see also Section 2.9). Suitable spreadsheet programs are, for instance, LOTUS 123, EXCEL, and QUATTRO-PRO.
An example is given on p. 8-6 and 8-7.

8.7 Export Control Data to ASCII File

Option *E* gives User the possibility to transport the measured control data to an ASCII format for text display (e.g. in WordPerfect, Word, WordStar) and User has to move the highlight with the cursor keys (↑ or ↓) to the attribute of his choice, to be confirmed by <ENTER>.
To select a control chart for export to ASCII format, its corresponding letter should be struck and SOILIMS displays a list of available control samples for that particular attribute and User has to move the highlight with the cursor keys (↑ or ↓) to the control sample of his choice, to be confirmed by <ENTER>. The chosen control sample with all data will be copied to ASCII format and a name should be assinged by User, e.g CEC.TXT for a CEC data file, and can be retrieved as such in any kind of text editor or word processor.

8.8 Example of using a Spreadsheet to construct a Control Chart

As an example the LOTUS 123 program is used to construct a Control Chart with CEC data exported from SOILIMS (see Section 8.6).

Start the LOTUS program and retrieve the exported file which contains CEC data (do not forget to type the extension .WKS behind the filename).

In column X the batch numbers are displayed, which are used to define the X-axis.In
In column A the measured CEC values of the control sample in 22 batches are displayed.
In column B the target value of the control sample + 3× the standard deviation is displayed (representing the Upper Control Limit).
In column C the target value of the control sample − 3× the standard deviation is displayed (representing the Lower Control Limit).
In column D the target value of the control sample + 2× the standard deviation is displayed (representing the Upper Warning Limit).
In column E the target value of the control sample − 2× the standard deviation is displayed (representing the Lower warning Limit).
Column F is composed of 30 cells each containing the target value of the control sample

As LOTUS can display six lines in one graph, the six columns A through F will be used to construct our control chart (Column X is used to define the X-axis).

Once the graph ranges are defined (see the LOTUS manual), three *essential* options should be carried out in the LOTUS graph menu.

1. Format the range containing the measured values of the control sample as "symbols" plus "lines" and the remaining ranges as "lines".
2. Remove the Grid (this makes the picture clearer).
3. Adjust the Y-scale to "manual" and choose the Lower and Upper Limits in such a way that the Upper and Lower Control Limits are displayed using the full size of the graph. This can be done by trial-and-error (choose Y-scale limits slightly higher and lower than the Control Limits until a nice graph appears).

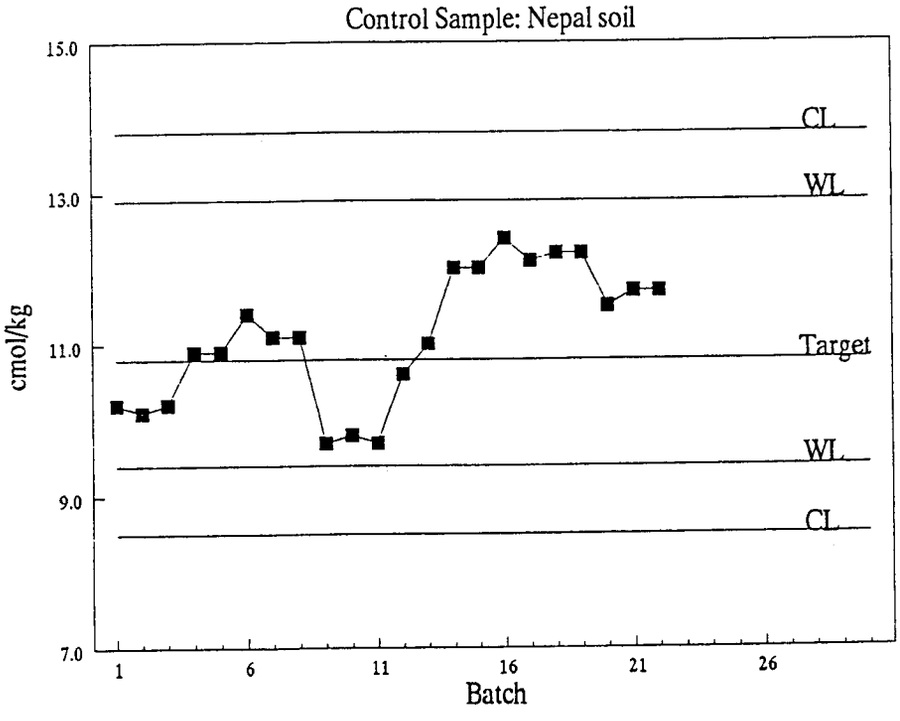
Other options may be used to construct the titles of the Chart.

When the Chart is constructed *without* column B, the Chart can be printed and used as control chart to be filled in manually: each time a control sample is analyzed, the obtained value is plotted on the graph.

Note: The values for the Mean and Standard deviation of 11.1 and 0.88 respectively can be calculated automatically by LOTUS and, when the control chart is completed, can be used for comparison with the values of the previous control chart (which are the present target value of 10.8 and SD of 0.70). (See also *Guidelines for Quality Management in Soil and Plant Laboratories.* Van Reeuwijk, 1997).

X Batch	A CEC	B Target +3s	C Target -3s	D Target +2s	E Target -2s	F Target
1	10.2	13.8	8.5	12.9	9.4	10.8
2	10.1	13.8	8.5	12.9	9.4	10.8
3	10.2	13.8	8.5	12.9	9.4	10.8
4	10.9	13.8	8.5	12.9	9.4	10.8
5	10.9	13.8	8.5	12.9	9.4	10.8
6	11.4	13.8	8.5	12.9	9.4	10.8
7	11.1	13.8	8.5	12.9	9.4	10.8
8	11.1	13.8	8.5	12.9	9.4	10.8
9	9.7	13.8	8.5	12.9	9.4	10.8
10	9.8	13.8	8.5	12.9	9.4	10.8
11	9.7	13.8	8.5	12.9	9.4	10.8
12	10.6	13.8	8.5	12.9	9.4	10.8
13	11.0	13.8	8.5	12.9	9.4	10.8
14	12.0	13.8	8.5	12.9	9.4	10.8
15	12.0	13.8	8.5	12.9	9.4	10.8
16	12.4	13.8	8.5	12.9	9.4	10.8
17	12.1	13.8	8.5	12.9	9.4	10.8
18	12.2	13.8	8.5	12.9	9.4	10.8
19	12.2	13.8	8.5	12.9	9.4	10.8
20	11.5	13.8	8.5	12.9	9.4	10.8
21	11.7	13.8	8.5	12.9	9.4	10.8
22	11.7	13.8	8.5	12.9	9.4	10.8
23		13.8	8.5	12.9	9.4	10.8
24		13.8	8.5	12.9	9.4	10.8
25		13.8	8.5	12.9	9.4	10.8
26		13.8	8.5	12.9	9.4	10.8
27		13.8	8.5	12.9	9.4	10.8
28		13.8	8.5	12.9	9.4	10.8
29		13.8	8.5	12.9	9.4	10.8
30		13.8	8.5	12.9	9.4	10.8
Mean		11.1				
Stand.dev. (s)		0.88				

X – chart CEC



Target value = 10.8 s = 0.70

CHAPTER 9

PRINT OPTIONS

9.1 Introduction

Option *P* from the Main Menu gives access to the following print menu:

MENU 9.1. Print Menu

```
A. Order Confirmation
B. Labels
C. Approved Analyses
D. Holding Analyses
E. Resubmitted Analyses
F. Control Charts
G. Approved Work Orders
   (Final Report)
H. Pending Work Orders
   (Interim report)
I. Status Pending Work Orders
J. Log-in Information

X. Exit
```

Strike letter of choice or X to eXit

9.2 Order Confirmation

When all samples of a client are registered option *A* of the Print Menu will produce the order confirmation where client's name, work order number, expected due or completion date and registration date are recorded together with two columns of sample identification, e.g. the unique laboratory number (assigned by SOILIMS) and the code the Client has given to his sample. Also, on a separate sheet, the type of requested analysis per sample or range of samples is given.

9.3 Labels

After striking option *B* of the Print Menu, the following menu appears:

MENU 9.2. Label Menu

```
A. One column of sample labels
B. Two columns of sample labels
C. Three columns of sample labels
D. Address label

X. No labels required
```

When striking options *A* through *C* SOILIMS displays a list of work orders and User has to move the highlight with the cursor keys (↑ or ↓) to the work order of his choice, to be confirmed by <ENTER> (choose work order 0 to exit). Next, User is asked if he wants labels for all or for only a selection of samples (the latter may be useful when during label printing a paper transport failure occurs and printing has to be resumed). When only a selection has to be printed, the first and last laboratory number of the range should be typed. Note that at the end SOILIMS also produces one extra label with the work order number and the name of the client for physical filing purposes, e.g. to stick onto the suspension file containing all correspondence and documents relating to the work order.

SOILIMS produces sample labels with the following data: unique laboratory number, work order number, date of registration and client sample code.

Option *D* results in a client address label.

TIP: It is useful to have two printers installed: one for report writing and one for label printing. The two printers can be separately activated by a printer splitter. When only one printer is available, User has to change paper when printing labels, using the label paper. An option may be to print the labels on normal paper and cutting them afterwards to the desired length. However, such labels have to be glued.

Note 1: The height of the labels should be 3½ cm, the width may vary from 5 to maximum 10 cm.

Note 2: Some printers do not give an error message when out of paper. SOILIMS cannot anticipate on such event and will respond by seemingly getting jammed. In this case switch your printer off and insert paper. **When an automatic splitter or scanner is installed, the splitter/scanner should be switched off too.** In both cases the following message will appear:

```
Printer is not receiving information

Please check cable or switch printer on
```

9.4 Approved Analyses

Option *C* of the Print Menu will result in a list of pending (or approved) work orders together with the nickname of the client. User has to move the highlight with the cursor keys (↑ or ↓) to the work order of his choice, to be confirmed by <ENTER> (choose work order 0 to exit). Next, a list of all attributes appears and User has to move the highlight with the cursor keys (↑ or ↓) to the attribute of his choice, to be confirmed by <ENTER>. A choice should then be made if User wants a detailed GLP report (including the responsible technician(s) with the dates of analyses and approval) or a general report with data.

Note: The detailed GLP report informs the laboratory manager among others who approved the analyses. When the approval was done by SOILIMS, the control sample was within specifications. In case the control sample was not within specifications (or an anomality was found during the cross-checks), the name of the person who approved the results is stated.

9.5 Holding Analyses

See 9.4, Approved Analyses.

9.6 Resubmitted Analyses

See 9.4, Approved Analyses.

9.7 Control Charts

In order to view or print data of a control chart, strike option *F* from the Print menu and a list of all attributes appears. User has to move the highlight with the cursor keys (↑ or ↓) to the attribute of his choice, to be confirmed by <ENTER>. Next a list of available control samples for that particular attribute appears and User has to move the highlight with the cursor keys (↑ or ↓) to the control sample of his choice, to be confirmed by <ENTER>. SOILIMS will then display or print a list of batch ID's with the respective measured values of the control samples together with the date and time of registration.

9.8 Approved Work Order (Final Report)

When striking Option *G* SOILIMS will ask if extra information regarding extreme and holding data should also be printed**. If so, SOILIMS prints "+" or "-" for extreme high and extreme low values respectively. An "H" is printed when data are not yet approved but have the status HOLDING (see also Sections 6.1 and 6.2). Next, SOILIMS asks if information is needed regarding the use of Control Samples, whereby:

* = Control Sample Out of Specifications, but data approved by a User
~ = Control Sample Omitted
≈ = Control Sample Lacking in Laboratory

Absence of a sign implies that the Control Sample was within specifications (e.g. the data were produced according to GLP).

Next User has to strike *S* for printing the report on the screen, *D* for printing the report as an ASCII file on the hard disk or *P* for printing it on paper. Finally the list of approved work orders appears and User has to move the highlight with the cursor keys (↑ or ↓) to the work order of his choice, to be confirmed by <ENTER>. SOILIMS will then print an entire work order.

** Holding data are data which are not yet approved or not yet resubmitted (see Section 6.1).

9.9 Pending Work Order (Interim Report)

When striking Option *H* SOILIMS will ask if extra information regarding extreme and holding data should also be printed***. If so, SOILIMS prints "+" or "-" for respectively extreme high and extreme low values. An "H" is printed when data are not yet approved but have the status HOLDING (see also Sections 6.1 and 6.2). Next, SOILIMS asks if information is needed regarding the use of Control Samples, whereby:

* = Control Sample Out of Specifications, but data approved by a User
~ = Control Sample Omitted
≈ = Control Sample Lacking in Laboratory

Absence of a sign signifies that the Control Sample was within specifications (e.g. the data were produced according to GLP).

Next User has to strike *S* for printing the report on the screen, *D* for printing the report as an ASCII file on the hard disk or *P* for printing it on paper. Finally the list of pending work orders appears and User has to move the highlight with the cursor keys (↑ or ↓) to the work order of his choice, to be confirmed by <ENTER>. SOILIMS will then print an entire work order as far as analyzed.

9.10 Status Pending Work Orders

Option *I* will print a status report of all pending work orders. It comprises per work order:

1. work order number
2. nickname of client
3. quantity of samples
4. input date
5. deadline
6. first unique laboratory number
7. last unique laboratory number
8. a list of requested attributes together with the total number requested, the total number pending for analyses and the total number pending for approval, the total number approved and the total number resubmitted.

In order to focus only on those analyses which are not completed, User has an option to choose for a *compressed* status report. In this way, less paper is consumed as those analyses which are completed *and approved* will not be presented.

*** Holding data are data which are not yet approved or not yet resubmitted (see Section 6.1).

9.11 Sample Work List

Option *J* Prints a sample list of the pending analysis of your choice together with the Moisture Correction Factor *(Mcf)* and results in the following menu.

MENU 9.5. Sample List

```
Sample List

   M. Monitor Display
   P. Printer Display
   S. Spreadsheet file
   X. Exit

Type letter of your choice or X to eXit
```

The Moisture Correction Factor is essential for those laboratories who are reporting the analytical results on the basis of oven-dry soil. Once the *Mcf* is entered into SOILIMS, it is available for all pending analyses. The list can be printed to Screen, Printer or Spreadsheet File.

9.12 Log-in Information

Option *K* will result in a list of one or all technicians who were logged in during a certain time span defined by the User.

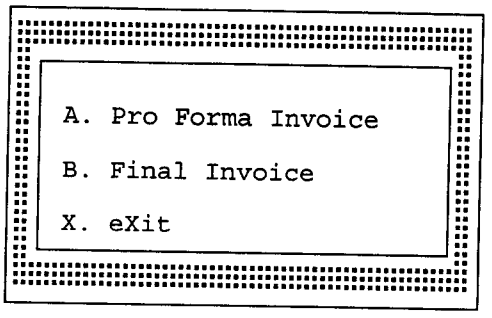
CHAPTER 10

INVOICES

10.1 Introduction

Option *Q* from the Main Menu gives access to the production of invoices and the next menu appears. This option only works if prices for analyses have been entered (see Section 2.2).

MENU 10.1. Invoice Menu



Type letter of your choice or X to eXit

10.2 Pro Forma Invoice

The Pro Forma Invoice can be sent to the client together with the order confirmation. The invoice is Pro Forma because during the process of soil analysis it may well be that some of the analyses requested by the client are not actually performed (e.g. requested $CaCO_3$ when pH turns out to be low, or when sample material has run out).

When option *A* is chosen a list of pending work orders appears on the screen and User has to move the highlight with the cursor keys (↑ or ↓) to the work order of his choice, to be confirmed by <ENTER>. SOILIMS then asks if the chosen client should pay a surcharge and if so if this surcharge is a lump sum or a percentage. Next, SOILIMS asks of the client is entitled to a discount and if so if this discount is a lump sum or a percentage. Next, SOILIMS asks if the Pro Forma Invoice should be printed. Government tax is calculated when the percentage is given in the price list table (see Section 2.2)

10.3 Final Invoice

Option *B* is identical to option *A* with the difference that the list of work orders all passed the Cross-check, e.g. all analyses in work order completed and approved.

CHAPTER 11

AUDIT TRAIL

11.1 Introduction

SOILIMS offers a variety of audit trail facilities when option *F* from the Main Menu is chosen.

MENU 11.1. Audit Trail Menu

```
A. Trail Batches with Control Samples
B. Trail Batches without Control Samples

C. Trail History of a Sample

D. Trail all Samples for a Client
E. Trail the Client for a Sample

F. Show Analyses Production during Period
G. Show Log-ins during Period
H. Log-in Time Calculation
```

Type letter of your choice or X to eXit

11.2 Trail Batches with Control Samples

When the unique batch identification number is known, (e.g. read from the control chart) the User may be interested in tracing which samples were present in that particular batch and option *A* should be chosen. A list of all attributes appears. User has to move the highlight with the cursor keys (↑ or ↓) to the attribute of his choice, to be confirmed by <ENTER>.
When more control samples for that particular attribute are used, a list of available control samples for that attribute appears and User has to move the highlight with the cursor keys (↑ or ↓) to the control sample of his choice, to be confirmed by <ENTER>. SOILIMS will then display a list of batch ID's with the respective measured values of the control samples together with the date and time of registration and User has to move the highlight with the cursor keys (↑ or ↓) to the unique identified sequential batch number, to be confirmed by <ENTER>.

First a list of approved samples appears (if there are any), together with time and date of approval. After striking any key, SOILIMS displays a list of rejected analyses (if any). If no analyses are approved and no analyses are rejected, the analyses for that particular batch are still waiting for approval.

11.3 Trail Batches without Control Samples

When no control chart for a particular attribute is available (yet), it is impossible to perform the batch approval (there is no control sample). When quality control is fully implemented and control charts are available for all attributes User might be interested to check which samples of a particular analysis were not accompanied by control samples. He may have reasons to repeat those analyses.

Also, he may want to know the reason of non-controlled batches. Is it because there were no control samples *available* or was the presence of control samples omitted for another reason?

Option *C* will supply User with all the information mentioned above, including the analyst who entered the data and a list of all attributes appears. User has to move the highlight with the cursor keys (↑ or ↓) to the attribute of his choice, to be confirmed by <ENTER>. Next, SOILIMS displays at first a list of batches together with date and time of registration, including the analyst involved for those batches which were unaccompanied by control samples due to their unavailability. Finally, SOILIMS displays those batches in which the control sample was ignored, although it was available.

11.4 Trail History of a Sample

When User (or client) is in doubt about the measured value of an attribute in a sample he may want to see the history of that sample for that particular analysis. Option *C* should then be chosen and a list of pending or approved work orders appears (depending whether the work order is pending or approved) and User has to move the highlight with the cursor keys (↑ or ↓) to the work order of his choice, to be confirmed by <ENTER> (choose work order 0 to EXIT). Next a list of all sample numbers is displayed belonging to that particular work order and User has to move the highlight with the cursor keys (↑ or ↓) to the sample number of his choice, to be confirmed by <ENTER>.

Next, SOILIMS displays the "history" of that particular sample with respect to approval and rejection.

11.5 Trail all Samples for a Client

In order to have a quick overview of all samples analyzed for a particular client option *D* should be chosen and a list of clients appears on the screen. User has to move the highlight with the cursor keys (↑ or ↓) to the client of his choice, to be confirmed by <ENTER>. SOILIMS displays then a list of all samples analyzed and approved for that particular client, together with the date of registration, the work order number, unique laboratory code, the sample code of the client, the date of final approval including the days before (or after) the deadline.

11.6 Trail the Client for a Sample

When option *E* is chosen, SOILIMS requests you to type the unique laboratory number and will then display which client requested the analysis of this particular sample.

11.7 Show Production during Period

Option *F* results in Menu 11.4.

MENU 11.5. Production Menu

```
A.  Total Production
B.  Production per Analyst
C.  Production per Client
X.  eXit
```

```
Type letter of your Choice or X to eXit
```

Option *A* gives the User an overview of all analyses done during a selected time span (an analysis is "done" when it is approved), while option *B* results in an overview of all analyses done by a particular analyst during a selected time span. (smallest time span is one day). Option *C* results in a list of clients appearing on the screen. User has to move the highlight with the cursor keys (↑ or ↓) to the client of his choice, to be confirmed by <ENTER>. Next, SOILIMS will display all samples analysed for that particular Client during a selected time span.

11.8 Show Log-ins during Period

Option *G* gives the laboratory manager an overview of log-ins. First User is asked to enter the first date of the time span and then the last date of the time span (smallest time span is one day).

Next, SOILIMS requests User to decide whether he is interested in an overview of all logged-in laboratory personnel during that particular period or in one particular person only. In that case, SOILIMS will display a list with names in alphabetical order and User has to move the highlight with the cursor keys (↑ or ↓) to the name of his choice to be confirmed by <ENTER>. User may also type the first and possible second letter of the analyst and then confirm with <ENTER>.

11.9 Log-in Time Calculation

Option *H* shows the time Users were logged in during a selected period.

CHAPTER 12

SYSTEM USERS

12.1 Introduction

Option *U* gives access to the System Users Menu which should *fundamentally only be accessible to the head of the laboratory* (and his deputy).

MENU 12.1. System User Menu

```
A. Add a User
B. Delete a User
C. Show Users
D. Show one User with Password
E. Change Authorities/Password User
X. Exit
```

```
Type letter of your choice or X to eXit
```

12.2 Add a User

Option *A* adds a User to the system and SOILIMS asks for a User name (maximum length 10 characters). SOILIMS will not accept Users with the same name. Next, SOILIMS asks for User's password which should be typed (maximum length: 10 letters, digits or signs).

Next all authorities of the User have to be given. Default the User has no authorities. Authority is given by entering *Y* after the preceding question.

Question list regarding authorities:

```
Registration?                    N   Add Control Charts?     N
Change Registration?             N   Delete Control Charts?  N
Install Institute?               N   Export data to LOTUS?   N
Install Price List?              N   Export data to ASCII?   N
Change Batch Capacity?           N   Input WATER data?       N
Change Minimum Disk Storage?     N   Input SOIL Data         N
Approve Batches?                 N   Input Plant Data?       N
Approve Cross-checks?            N   Access to user menu?    N
Make Invoices ?                  N   Send bills?             N
Archive Data?                    N   Send reports?           N
Make Labels?                     N   Use audit trails?       N
```

After assigning the above mentioned main authorities, SOILIMS will go into more detailed assignments with regard to the authorizations of Data Input and Batch Approval of *Soil* Analyses and the following table appears:

ANALYSIS	DATA_INPUT	APPROVING
Soil Preparation	F	F
Moisture CF	F	F
EC	F	F
pH water	F	F
pH KCl	F	F
Calcium carbonate	F	F
Part. size 3 fr	F	F
Part. size 8 fr	F	F
Gravel	F	F
Exch. Calcium	F	F
Exch. Magnesium	F	F
Exch. Potassium	F	F
Exch. Sodium	F	F
Exch. Acidity	F	F

Default no authorization for Data Input and Batch Approval for an attribute is issued, which is represented by the letter *F* (for False) in the columns DATA_INPUT and APPROVING. Strike for every attribute *Y* in the collum DATA_INPUT or APPROVING for respectively an authorization for data input or approval.

At the end SOILIMS asks to confirm the password. When the confirmation is correct a new User with password and authorities has been added to the system.

In this way SOILIMS is flexible in its authorization assignments and is able to support the two main approaches:

a. *An analyst should always approve or resubmit his own analysis because he has the responsibility for his job.*
b. *An analyst should never approve or resubmit his own analysis because he may be biased. Another person, usually his chief, should do this.*

12.3 Delete a User

When a User is not allowed to enter the system anymore, he should be removed by pressing option *B*. SOILIMS asks for User's name which has to be entered and confirmed by <ENTER>. User is then removed from the system.

12.4 Show Users

Option *C* gives an overview of all present Users with passwords, date and time of entering SOILIMS.

12.5 Show one User with Password

When a User's password slipped his memory, option *D* should be used. Also with the help of option *C* it is possible to find a User's password. However, for security reasons, it may not always be convenient to show all Users with all passwords on the screen display.

12.6 Change Authorities / Password User

Authorities and password of a User can be changed by striking option *E*. It is not uncommon that especially passwords are changed once a year (or more often when necessary). SOILIMS will ask for the User's name and the whole process as described in 12.2 (Add a User) starts again. The only difference is the fact that the default settings are the settings as authorized under 12.2, facilitating the change of authority.

Warning: As a safety precaution, a User cannot change his own authorities and/or password*. Another User, who has authority to enter the System User Menu, has to do this. If there is only one person authorized to enter the System User Menu, this person should first add another imaginary User (a "Dummy") with the authority to enter the System User Menu. Next, he should log out and log in as the imaginary User (the "Dummy") to change his authorities and/or password.

IMPORTANT

After the exploration of SOILIMS it is advised that heads of laboratory add their own name with password to the SOILIMS system and give themselves all authorities (see Section 12.2). The User "chief" should then be removed from SOILIMS (see Section 12.3). When the User "chief" with password "chief" is still present in SOILIMS everybody who reads this manual has access to all features of SOILIMS. Once you added yourself as a User, you have to log out as chief and log in with your name and password. Next remove User "chief".

Note 1: **With respect to passwords, SOILIMS distinguishes between Upper and Lower case letters.**

Note 2: **It is strongly recommended that the Chief of the Laboratory gives his password (and that of his deputy) in custody (e.g. in a sealed envelope) to the Management of the Institute. In the unlikely event that the Chief's password cannot be produced, ISRIC should be notified by the Management in order to solve the problem instantly.**

---

* Suppose the chief of the laboratory is the only person authorized to change authorities and passwords. If he accidentally removes his OWN authorization to assign authorizations, the User Menu will be unaccessible for all SOILIMS users and no Users can be added to or removed from the system.

CHAPTER 13

ARCHIVAL PROCEDURES

13.1 Archival of Data

Archival of data in a database management system is indispensable. The databases of SOILIMS will gradually grow and disk space is the limiting factor for database sizes. When archiving SOILIMS data, they will be physically removed from the hard disk and stored on diskettes or tapes for possible future reference. Disk space will then increase for future data storage. It is advised to archive frequently when it is expected that old data will not or only rarely be used for trailing purposes.

An advantage of archiving is also that databases become smaller and that the entire management system will run faster.

Option *V* from the Main Menu will initiate the archival procedure and SOILIMS will first ask to confirm your command.

Next, SOILIMS shows the time span of approved work orders which are ready for archiving. The first date is the oldest approved work order, the last date is the latest approved work order. Archiving starts with the oldest approved work order and SOILIMS requests you to type until and including which date you want to archive. Next, User has to type a valid date. SOILIMS estimates the extra space needed on the hard disk to store the selected period temporarily. When the disk space is sufficient, SOILIMS extracts the data from the selected period and moves them to the SOILIMS subdirectory named ARCHIVE. (SOILIMS will inform the User when the disk space is not sufficient and abort the archival procedure). The period to be archived should then be reduced and/or non-SOILIMS files should be removed).

It is then up to the User to store these data on tape or diskette for future reference and delete these data (in subdirectory ARCHIVE) from the disk. In case of storage on diskettes the MS-DOS utility (MS)BACKUP.EXE may be used. Please refer to your MS-DOS manual for details. Also utilities of PC-TOOLS or NORTON may be used. Details can be found in the respective manuals. In case of storage on tape please refer to your tape-streamer manual.

Note 1: As a general precaution, it is *strongly* advised to make a complete backup of the entire SOILIMS system before starting the archival procedure. An additional advantage is that this backup can also be used when old data have to be restored (long time) after having been removed from disk. This way of restoring data makes the User independent of the SOILIMS version in use at the time of restoring (an update might have been introduced).

Note 2: In case a final report has not yet been printed twice (one report for the client and one as a "hard copy" for your own records), SOILIMS will give a warning. This, because once a work order is archived, it is in principle removed from the hard disk and can only be printed after restoring the data to disk.

13.2 Restore Archived Data

It may happen that data which were once archived have to be inspected or printed again. To do this, these data have to be restored on hard disk (where the SOILIMS program is present).

When this procedure is necessary, it is advised to restore the entire SOILIMS system (which was backed-up during archival; see 13.1) on another computer. The reason for this is that if all archived data will be copied to the present SOILIMS directory **all present data will be lost** as they will be overwritten by the archived data. If no second computer is temporarily available SOILIMS may be installed on the same computer, but **only by using another directory** name*!

You may also install the presently used SOILIMS program temporarily on another computer and have all archived data restored on that computer in that SOILIMS directory. However, by using this procedure you might be using a different (updated) version for data of an older version. Therefore, unless you are sure that this is not the case, this procedure is not recommended.

* If SOILIMS is temporarily installed on another computer, the dongle (present in the printer port) should also be used on that computer.

CHAPTER 14

CHECK DATA INTEGRITY

14.1 Introduction

The reliability of a database system depends on its integrity. Therefore SOILIMS has three built-in tools to check its integrity and correct it when anomalies are found. Option *H* from the Main Menu gives access to the Data Integrity Menu.

MENU 14.1. Data Integrity Menu

```
A. Reindex Entire System

B. Eliminate Duplicated
   Unique Laboratory Numbers

C. Clean up Entire System
```

14.2 Reindex Entire System

When SOILIMS is started it automatically reindexes its entire system. As reindexing may take some time, SOILIMS is built in such a way that it reindexes the whole system only when it is started up for the first time during a day.

When working with SOILIMS it is essential that no power failure occurs. In the unhappy event of a sudden power failure User has to restart his computer when power is supplied again and may experience that some of his data seem to be lost. However, this is not always the case, and may rather be a matter of reindexing the entire system. In order not to wait until the next day, (when SOILIMS will reindex automatically), User may take action by himself by striking option *A* from the Data Integrity Menu.

NOTE: *It is recommended to have a UPS system (Uninterrupted Power Supply) connected to your computer system.*

14.3 Eliminate Duplicated Laboratory Numbers

SOILIMS may go astray as a result of unforeseen events such as activities of viruses which duplicate DBF data. In that case option *B* should be chosen to restore the database integrity, which may take some time to run (depending on type of computer and size of data base: from 5 minutes to one hour), but it is the only way to restore the integrity with no or minimum loss of data.

NOTE: *It is recommended to use anti virus programmes on a regular basis.*

14.4 Clean up Entire System

Option *C* will erase all SOILIMS data from your disk, which can only be restored when previously backed up.

NOTE: *It is recommended to backup SOILIMS data on a regular basis (e.g. weekly).*

CHAPTER 15

STORAGE CAPACITY

In order to provide User with the information how long SOILIMS can be used before the maximum disk storage capacity is reached, option *T* should be chosen.

SOILIMS then calculates the time span, taking into account:

a. Present free disk space
b. Estimated number of analyses per year
c. Estimated average number of analyses per sample
d. Estimated average batch size
e. Estimated percentage of resubmitted analyses

CHAPTER 16

SOME MAIN MANAGEMENT DOCUMENTS

SOILIMS can produce a number of useful management documents.

These documents are:

1. A listing of all pending work orders sorted by deadlines.
   Main Menu option *D,* next option *A* (see Manual, Section 7.2).

2. A status report of all pending work orders, sorted by work order number (chronological order of registration).
   Main Menu option *P,* next option *I.* (see Manual, Section 9.10).

3. A work list of all pending work orders grouped by attributes to be analyzed sorted by deadline.
   Main Menu option *D,* next option *B* (see Manual, Section 7.3).

4. A listing of all approved data input over a selected period (i.e. effective total data production).
   Main Menu option *F,* followed by *F* and *A* (see Manual, Section 11.7).

5. Data input per analyst over a selected period (i.e. effective data production per analyst).
   Main Menu option *F,* followed by *F* and *B* (see Manual, Section 11.7).

APPENDIX. LIST OF MENUS

B. TUTOR

B. TUTOR

INSTALLATION

The demo version of SOILIMS© consists of two diskettes which may be used to get acquainted with some features of SOILIMS and at the same will broaden your knowledge about Laboratory Information Management Systems in general. Some main features of SOILIMS are presented in the form of this brief TUTOR. However, you are encouraged to deviate from the TUTOR and explore the limits of this software package using the complete Manual.

For a good performance this program should run on a MS-DOS computer with at least 4 Mb memory and 5Mb free disk space. Files and buffers in the CONFIG.SYS should be set at 99 and 40 respectively. Also the device driver "EMM386.EXE noems" should be present in the Config.sys. An example of a simple CONFIG.SYS is the following:

```
device=c:\dos\himem.sys
device=c:\dos\emm386.exe noems
dos=high
files=99
buffers=40
```

The program assumes you have a simple matrix printer. If you have another printer choose option *I* (Install) from the SOILIMS Main Menu and select your printer type.

WARNING

The database of this demo version of SOILIMS cannot exceed 100 records. Once this number is reached, part of the database system will be deleted and data are lost.
It is therefore strongly recommended to use this Demo version of SOILIMS only for demonstration and/or exercise purposes.

INSTALL PROCEDURE

1. Switch your computer on
2. Place diskette 1 in drive A
3. Type a: (followed by <ENTER>)
4. Type ins-demo c: (followed by <ENTER>) (or ins-demo d: if you want to install the demo on your d: drive)
5. Follow the instructions on the screen

After installation type LIMSDEMO followed by <ENTER> to start the Tutor.

When your computer has the minimum requirement of 4Mb RAM it may be that, when starting the program. the following error appears on the screen: "Insufficient memory. Set DOS4GVM to use VMM ** initialization error **
In that case add the following line in your autoexec.bat file (e.g. on the bottom line):
SET DOS4GVM=:1M or **SET DOS4GVM=:2M** or **SET DOS4GVM=:3M**
It depends on the size of the available or free Extended Memory in your computer whether you have to use the numbers **1**, **2** or **3**. The size of free Extended Memory is expressed in kilobytes which you can diagnose yourself by typing the DOS command "MEM" after you switched your computer on. Divide this number by 1000 to obtain (roughly) the size in Megabytes. When you omit the numbers behind the decimal, you will obtain the correct number for the "SET" command in your AUTOEXEC.BAT file.

LESSON 1. INTRODUCTION

SOILIMS is based on a relational database management system. It produces therefore several unique code numbers which are indispensable for its performance:

a. The *laboratory number*, this is a unique number assigned by SOILIMS to each sample arriving at the laboratory.
b. The *work order number*, this is a unique number assigned by SOILIMS to each work order arriving at the laboratory.
c. The *batch number*, this is a unique number assigned by SOILIMS to each analyzed batch for a certain attribute.

All unique numbers start with the year in which they are produced, e.g. laboratory number 199300582 is the 582nd sample which arrived at the laboratory in 1993*. However, in order to save space, the first two numbers are omitted in all reports.

From the beginning, users of SOILIMS will be confronted with *laboratory numbers* and *work order numbers*. The unique *batch numbers* will be dealt with later. There are also other unique numbers generated by SOILIMS. They are used for the internal organization within the SOILIMS program and you, as user, will not be bothered by them.

Start the program by typing LIMSDEMO followed by <ENTER>

The laboratory personnel involved in this SOILIMS demo version consists of three people:

a. The head of the laboratory, named Chief
b. A senior technician, named Senior
c. A junior technician, named Junior

Chief, Senior and Junior are using SOILIMS in order to manage all information concerning the work in the laboratory. They are known to SOILIMS by their proper names (Chief, Senior and Junior). For your convenience the "secret" passwords of Chief, Senior and Junior are also *chief, senior* and *junior* (**note that, for password purposes, SOILIMS distinguishes upper case letters from lower case letters!**).

Log in as Chief by typing your name and password, *chief* and *chief* respectively.

Suppose you just arrived at your laboratory after a three months leave abroad and you absolutely don't know what is going on in your laboratory. Fortunately SOILIMS was installed and you can start by asking which jobs are pending at your laboratory.

Choose option *D* from the Main Menu and ask for General Information (see Manual, Section 7.2).

---

* SOILIMS makes use of the calender and clock installed in your computer. For proper functioning the date and time should be correctly installed. Please refer to your DOS manual to do so.

You are now immediately informed about the total number of pending work orders. You see the names of clients waiting for their data, the corresponding work order number, at which date the order was registered and the expected completion date. For your convenience, SOILIMS sorted the work orders in order of their priorities with respect to the days before deadline. When the deadline has passed, a negative value will appear. This information, however, does not inform you about which analyses are requested for a particular work order and what the status of work is at this very moment.

More detailed information per work order can be obtained by placing the cursor on a work order number and strike <ENTER> to continue. An example may be work order 93005 (the fifth work order in the year 1993), which will be displayed as follows:

```
Work order : 93005                    Client     : MR. BROWN
Input Date: 05/10/93                  Quantity   : 4 samples
```

Attribute	Requested	Pending Analyses	Pending Approval	Approved	Resubmitted
Preparation		READY			
pH-H_2O	4	READY		4	
Particle 3fr.		4		4	
Organic Carbon	4	4			
Kjeldahl-N	4	2		2	

Now you are informed in detail how far the work is in progress for this work order:

a. The work order consists of 4 samples.
b. pH-H_2O requested for 4 samples, the analyses are ready and approved.
c. Particle-size (three fractions), Organic Carbon and Kjeldahl-N are also requested for all samples. For particle-size and organic carbon the analyses are not yet done. Two samples for Kjeldahl-N are analyzed and approved.

Strike any key to return to the Main Menu.

If you are interested in the detailed status of all work orders, SOILIMS will produce a detailed report if you strike option *P* from the Main Menu, followed by option *I* from the Print Menu.

Recapitulation:

In this lesson you learned how to obtain a detailed overview of all pending work orders in your laboratory without consulting the laboratory personnel. You are now familiar with unique laboratory numbers and unique work order numbers.

Exercise:

Print a General Information Report for all pending work orders, followed by a detailed print of work order 93004 (Use the Print option).

LESSON 2. PENDING JOBS

In this lesson we will deal with more information about pending jobs:

Choose option *D* from the Main Menu.
Choose option *B* from the Pending Job Menu.

SOILIMS asks if you want a work list for all pending attributes (e.g. pH, CEC, Organic C) or for only one.

Switch your printer on and make a list of all pending attributes (Main menu, Option *D,* followed by *B*).
SOILIMS now produces a work list of pending work orders grouped by type of analysis and sorted by priority.

The list shows, amongst others, the total number of pending samples for that specific attribute, its batch capacity (see Manual, Section 2.3) and the total number of pending batches, including the empty places in the final batch (see Manual, Section 7.3).

As you can estimate (with your experience) the time involved in analyzing one particular batch for a certain attribute, this option provides you sufficient information to appraise the backload expressed in time for a certain attribute.

Recapitulation:

You learned how to estimate the total time involved to analyze the backlog of all samples.

Exercise:

Investigate the backload of *pH-H_2O, Kjeldahl-Nitrogen* and *Particle-size* analyses in the laboratory.

LESSON 3. SAMPLE LISTS

You noticed in Lessons 1 and 2 that ISRIC has a pending work order. Make a detailed report concerning the status of this pending order, using option *D* from the Main Menu, followed by Option *A*. Place the cursor with the cursor keys on the name ISRIC and strike <ENTER> to continue. Strike <ENTER> again to retrieve more information and have it printed.

Note that *Exchangeable Acidity, Exchangeable Aluminium* and *Kjeldahl-N* are still pending analyses. You will instruct your Senior technician to perform Kjeldahl-N analysis and supply him with a sample list.

Strike option *M* from the Main Menu, followed by option *O*. Place the cursor on ISRIC had hit <ENTER> to select. SOILIMS informs you that there are still vacant places left in your batch (see Manual, Section 2.3). You decide, however, to have only the ISRIC samples analyzed and instruct SOILIMS to select no more samples and have all laboratory numbers printed out. Strike *X* to exit.

This list will be supplied to your Senior technician in order to start preparing the analysis.

Recapitulation:

You learned to make a sample list for your technician in order to prepare an analysis and report the data.

Exercise:

Make two sample lists to perform analyses for work order 93004.

LESSON 4. PRINTING INTERIM AND DETAILED GLP REPORTS

At this moment your Senior technician is analyzing work order 93002 (ISRIC) for Kjeldahl-Nitrogen and you would like to see the results available so far for this work order.

Choose Option *P* from the Main Menu followed by *H* to print an INTERIM report for work order 93002. (Place the cursor on ISRIC and hit <ENTER> to start).

SOILIMS asks if extra information regarding *extreme* and *holding* data is needed (see also Manual, Section 9.9). Answer "No" by striking <ENTER>. Next, SOILIMS asks if information is needed regarding the use of Control Samples (see also Manual, Chapter 8). Answer "No" by striking <ENTER>.

The first page of the Interim Report shows a listing of the sample numbers made by the client (which he prepared in order to identify his samples) and the unique laboratory numbers SOILIMS assigned to the samples. The subsequent pages are showing the results so far obtained for work order 93002.

The interim report shows data which are important for the client. You, as a laboratory manager, may sometimes be interested in the background of these data. Who analyzed them and when? Option *C* from the Print Menu will supply you with a detailed GLP report for an approved analysis. Likewise, reports can be obtained for *resubmitted* analyses, by choosing option *E* from the Print Menu.

Recapitulation:

You learned that there are three types of produced data in a laboratory: *Approved* Data, *Resubmitted* Data and *Holding* Data. The latter being not yet approved or not yet resubmitted. You are able to print complete INTERIM reports and reports at "GLP" detail for all three types of produced data.

Exercise:

Print again an Interim Report for work order 93002 together with information regarding extreme data.

Print an Interim Report of work order 93005 and have a detailed "GLP look" at the pH data.

LESSON 5. REGISTRATION AND LABEL PRODUCTION

In this lesson we will register an incoming work order (see Manual, Chapter 3).

Mr. Smith brings 10 soil samples to the laboratory. He identified his samples with numbers from 1-10 and requests for all samples the following analyses: pH-H_2O, pH-KCl and Particle-size 3 fractions. Analyses should be ready within two months.

Choose option *A* from the Main Menu and type the client's name and other requested items, including the deadline. When everything is filled in correctly, SOILIMS asks if all samples should be analyzed for the same attributes. In this case we type *"Y"* and a list of attributes appears on the screen.

As Mr. Smith's samples have to be dried and sieved, *preparation* is needed: Type *"Y"* for Preparation, pH-H_2O, pH-KCl and Particle-size 3 fractions. Continue striking *"N"* until the cursor is positioned on "More" and SOILIMS requests you to confirm. Strike *"Y"* if everything is correct and SOILIMS starts registration, assigning unique sample and work order numbers. During the process of registration, SOILIMS asks if the samples (brought by Mr. Smith) were labelled with numbers. Strike *"Y"* to continue and type Mr. Smith's first sample number 1 (This is the identification Smith gave to his sample) followed by <ENTER>.

The registration is ready and labels can be produced using option *P* from the Main Menu followed by option *B* (see Manual, Section 9.3).

Exercise: Make labels for the work order of Mr. Smith. Note that SOILIMS prints one label extra (the last one) which can be used to identify a suspension file (which should be made for every work order, see also Manual, Section 9.3).

LESSON 6. INVOICES

SOILIMS can print simple invoices and distinguishes between *Pro-Forma Invoices* and *Final Invoices.* Pro-Forma Invoices are invoices for work orders which are still pending, final invoices are invoices for work orders which are completely analyzed. Option *Q* from the Main Menu gives access to the Invoice Menu (Prices can be changed by User, see lesson 7).

Exercise: Make an invoice for Mr. Smith's and ISRIC's work order.

LESSON 7. INSTALLATION OF LOCAL PARTICULARS

The prices used in the invoice you have made in Lesson 6 are not the prices of analyses in your laboratory. You can install your prices and other information using option *I* from the Main Menu. The Install Menu enables you to let SOILIMS know some particulars of your laboratory. For a proper report it is essential that your printer is known to SOILIMS as well as your paper length (11 or 12 inch). Also the minimum and maximum values of analytical data can be set, which is part of the Quality Control.

Exercise: Install the particulars of your institute, the price list, paper length and printer type. Inspect the minimum and maximum values of analytical data and adjust when necessary (see Manual, Section 2.9).

LESSON 8. MANUAL DATA ENTRY

The list of sample numbers for Kjeldahl-N analyses, as prepared in Lesson 3, has been filled in with data and should be entered into the SOILIMS system.

SOILIMS distinguishes between two types of data input, viz. manual and automatic data input (see Manual, Section 5). The data supplied to you are written on paper (not as ASCII file on diskette), therefore you choose option *M* from the Main Menu.

Work list for Kjeldahl-N analysis made by CHIEF

No	Name	Work order	Lab No	Kjeldahl-N
1	ISRIC	93002	9300004	0.007
2	ISRIC	93002	9300005	0.019
3	ISRIC	93002	9300006	0.009
4	ISRIC	93002	9300007	0.017
5	ISRIC	93002	9300008	0.078

Place all Kjeldahl-N data in the column DATA and press function key *F7* to store.

Recapitulation:

You learned how to enter data manually into SOILIMS.

LESSON 9. CONTROL SAMPLES

SOILIMS gives a short warning when data of analyses are stored and a control sample for that analysis is lacking in the laboratory. This control sample, including its "true" value and standard deviation should be known to SOILIMS*.

Suppose we have a control sample with a "true" value for Kjeldahl-N of 0.013% (standard deviation 0.001%) which we want to use to make a Control Chart for Kjeldahl-N analysis.

Choose option *S* from the Main Menu to enter the Control Chart Menu. Choose then option *C* and register the Control Sample (see Manual, Section 8.4)

Recapitulation: You learned how to add Control Samples to the SOILIMS system.

Exercises:

a. Enter the following Kjeldahl-N data for work order 93005:
   0.012, 0.003. The value of the control sample in this batch was 0.015%
b. Make a detailed GLP report for Kjeldahl-N analysis in this work order (see Manual, Section 9.9). Note that SOILIMS approved the data automatically.
c. Enter the following Kjeldahl-N data for work order 93003:
   0.009, 0.016, 0.009, 0.014. The value of the control sample in this batch was 0.019%. Note that data should be approved.
d. Print an *Interim Report* for work order 93003 together with extreme and holding data. Note that Kjeldahl-N data are holding. (Due to the fact that the measured value of the Control Sample was too high).
e. Perform *Batch Approval* for Kjeldahl-N analysis (see Manual, Section 6.2) and approve all data (despite the fact that the Control Sample was not within the specifications).
f. Print an Interim Report for work order 93003 with extreme and holding data, including information regarding the use of control samples.

With respect to the use of control samples you notice that data were approved while the control sample was out of specifications. You decide to review the batch approval for Kjeldahl-N analysis in work order 93003 (see Manual, Section 6.5).

g. Strike option *E* from the Main Menu, followed by *D.* Next choose Option *A* for the Batch Approval and select Kjeldahl-N analysis. Resubmit the batch by typing *R* for *Resubmit.* Return to the Main Menu.
h. Look under "Pending Jobs" (Option *D* from Main Menu) at the General Information (Option *A*) and ask more details for work order 93003. Note that rejected data are recorded **.

---

* The proper preparation of a control sample is described in Van Reeuwijk, L.P. (1997), Guidelines for Quality Management in Soil and Plant Laboratories. ISRIC-FAO Publ. (in print)

** According to Good Laboratory Practice rejected data should be kept for Audit Trail purposes.

i. Look under Control Charts, choose Option *A* to examine the Kjeldahl-N Control Chart and note that the first two values of the control sample are recorded.
j. Exit the SOILIMS Main Menu if you want to stop (strike *X*) or strike *Y* to log out.

LESSON 10. AUTHORIZATION

Log in as "Junior" with password "junior".

Exercise:

a. Enter the following Organic C data for work order 93003 (percentages): 1.32, 0.87, 0.15, 3.45.

b. Enter the following Kjeldahl-N data for work order 93003 (percentages): 0.121, 0.253, 0.010, 0.119. The value of the control sample in this batch was 0.019%.

Note: Junior has no authority to enter Kjeldahl-N data.

Users of SOILIMS must have the authority to perform certain tasks. The authority is given by the Chief or another person who has the authority to assign authorities to SOILIMS users (see Manual, Chapter 12).

Recapitulation: You learned that SOILIMS users must be authorized to perform certain tasks.

Exercise: Examine the tasks of Junior (enter data, change prices etc).

LESSON 11. CHANGE USER'S AUTHORITY

In order to give Junior the authority to enter Kjeldahl-N data the following steps have to be taken (see also Manual, Section 12.6):

a. Log out as Junior (Option *Y* in Main Menu)
b. Log in as *Chief,* password *chief*
c. Strike option *U* from the Main Menu, followed by *E*
d. Type the name of the User whose authorities you want to change (in this case: *Junior).* We will not assign a new password to Junior

The next step is to strike *"Y"* or *"N"* in order to give junior authorization for certain items.

After Junior has been given authorities to enter soil analyses data, SOILIMS wants to know for which analyses Junior is authorized. Again strike *"Y"* or *"N"* to assign authorizations.

If Junior has authority to perform the batch approval, SOILIMS wants to know for which analyses Junior is authorized to do the batch approval. For easy reference: Junior is authorized for data input of all analyses preceded with "*", which is shown on the screen.

If Junior is authorized to look at Control Charts, SOILIMS wants to know for which analyses Junior is allowed to look at the Control Charts.
Finally, you have to repeat Junior's password in order to change his authorities.

Exercise: Add two (newly appointed) technicians to SOILIMS with their user names, passwords and authorities.

LESSON 12. EXERCISE

Exercise: Log in as Junior and

a. Enter the following Kjeldahl-N data for work order 93003:
0.121, 0.253, 0.010, 0.119. The value of the control sample in this batch was 0.019%.

b. Perform a batch approval and reject the data.

d. Look at the pending jobs under *General Information* for a detailed status report for work order 93003.

c. Print a report for rejected Kjeldahl-N data in work order 93003.

LESSON 13. AUTOMATIC DATA ENTRY

Instead of manual data input, SOILIMS may read ASCII files (see Manual, Section 5.2). ASCII files can be produced by:

a. instruments connected to a PC and/or
b. analysts, when raw data are used in spreadsheets for calculation purposes.

This demo is supplied with the ASCII file containing the particle-size analyses for work order 93005 (name of ASCII file is PARTSIZE.PRN).

Choose option *C* from the Main Menu followed by Option *F* and type the full name (including drive and path) of the ASCII file and strike <ENTER>.

SOILIMS displays a list of unique sample numbers including the particle-size data. The third column is a check for the sum of all sizes.

It is possible to edit all data if necessary. After striking function key *F7* SOILIMS performs some integrity checks and stores the data.

LESSON 14. SOME MAIN MANAGEMENT DOCUMENTS

SOILIMS provides the head of the laboratory with some useful management documents.

These documents are:

1. A listing of all pending work orders sorted by deadlines.
   Main Menu option *D,* next option *A* (see also Section 7.2).

2. A work list of all pending work orders grouped by attributes to be analyzed sorted by deadline.
   Main Menu option *D,* next option *B* (see Manual, Section 7.3).

3. A status report of all pending work orders, sorted by work order number (chronological order of registration).
   Main Menu option *P,* next option *I* (see Manual, Section 9.10).

4. A listing of all approved data input over a selected period, i.e. total data production.
   Main Menu option *F,* followed by *F* (see Manual, Section 11.7).

5. A list of data input per analyst over a selected period.

Exercise: Produce the five above mentioned reports.