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COLLEGE ON MEDICAL PHYSICS

10 October - 4 November 1988

C M P M

(Computer Management of Preventive Maintenance)

CMPM display screens

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INTERNATIONAL ATOMIC ENERGY AGENCY

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C. Taylor
Vienna
September 1988

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by

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1. Introduction

CMPM ("Computer Management of Preventive Maintenance") is a computer program being developed for the International Atomic Energy Agency as an aid to those responsible for the maintenance and quality control of scientific and medical equipment. This report presents the screen displays by which the user interacts with CMPM. Other related reports ("CMPM Program Documentation", "CMPM Program Print-outs") refer to the internal working of the program.

CMPM explains itself to the user through its menus and screen comments, but it is also helpful to have these in written form. Although this report is not a comprehensive "User's Guide" it will be found useful as an introduction to CMPM.

CMPM is used together with the well-known database program "dBaseIII". It runs on IBM-compatible PCs. With CMPM and dBaseIII in the same DOS directory, start CMPM by entering "DO CMPM" at the dBase dot prompt. This brings up CMPM's title screen, Fig 1, which asks for a password. Enter "CMPM". CMPM's Function Menu then appears (Fig 2). This offers a choice of thirteen ways of using the program.

When working with CMPM always keep Caps Lock at ON.

2. Layout of this report

In this report each option of the Function Menu is considered in turn. Screen displays for each function are shown in the attached Figures. These were made by printing out from the screen and then cutting and pasting the printout to present it in a more compact way.

In some cases the program offers multiple choices for responding to comments on the screen, but it is not necessary to show in detail all routes which can be followed in this way. In most cases one choice has been taken as an example.

Responses which had to be keyed in to generate the displays have been ringed.

The current diskette of CMPM, from which the printouts were made, was developed in an IAEA research programme in Southeast Asia. Its data files still contain information about instruments and maintenance workers involved in that programme. Some of this data, which refers to a nuclear research centre, appears in the printouts. It has not been cleared from the diskette, although this could easily be done, see section 15 below, as it helps to illustrate the purpose of the displays.

The thirteen Function Menu choices of CMPM are identified by the reference number or letter appearing against each choice under the heading "NO" (number) in Fig 2. At the top of each page of Figures the relevant function reference is written in a square box.

The sections of this report which follow comment in turn on each of the Function Menu choices.

3. Enter instrument information (menu ref 0)

The user must enter each instrument to be maintained, together with relevant data about it, but before this can be done the instrument must be allocated to one of 90 types of instrument previously defined in an internal data table in CMPM. Fig 38 shows types defined for this purpose in the current diskette. They are suitable for a nuclear research centre. Users in hospitals or other institutes may redefine this table, choosing instrument types more suitable to their environment (how this is done is not described here).

When menu option 0 is chosen CMPM begins by asking the user to identify the instrument type (Fig 3). In a rather confusing display it offers to show the relevant part of Fig 38 (Fig 4). When the type number has been established the program allocates a "Tag Number" to the instrument and displays a detailed inventory questionnaire (Fig 5) for the user to fill in. The Tag Number allocated to the instrument appears at the top of this questionnaire.

The Tag Number is an inventory number internal to CMPM. It identifies the instrument in all subsequent CMPM operations. Its first two digits correspond to the type number as defined in Fig 38. Its last two digits are a serial number for all instruments entered as being of that type. The program can accept up to 99 instruments in any type class.

It is not necessary to answer all questions in Fig 5, but some are essential for later operations of CMPM and if answers are not given the program demands them.

"PM" near the bottom of Fig 5 is short for "preventive maintenance". CMPM asks for the names of the technicians who will carry out PM at Levels 2 and 3 and asks when (in which week of the year) the person doing Level 2 will be ready to start. This information is needed when CMPM works out a maintenance schedule for all instruments and all maintenance technicians.

4. Scheduling or rescheduling (menu ref 1)

In CMPM "scheduling" means working out a timetable for regular preventive maintenance throughout the year. This is one of CMPM's main tasks.

The resulting timetable is not a hard-and-fast regime in which every minute is allocated to a specific task. Rather, it is a reminder system which ensures that no instrument is forgotten, that maintenance work is shared out in a sensible way, and which provides the

Maintenance Manager with printed or displayed reports which help him to organise the work of his group.

The data fed into the system gives it an element of "judgement" analogous to that applied, without much conscious thought, by a human manager when he distributes work to his staff. Thus, when setting up the classification shown in Fig 38 one can specify more or less frequent servicings, taking more or less time, for each type of instrument, and individual instruments can be given quality factors to allow more frequent servicing for critical pieces of equipment. "Skill and experience" factors are allocated to technicians, and the number of instruments cared for by each technician can be set between one and nine per week. Instruments at the same location are automatically scheduled for servicing at the same time.

When a schedule/reschedule option has been selected the program offers information about which instruments have already been scheduled (Fig 6) and offers several choices for partial scheduling - of instruments allocated to a particular technician, or in a particular location, etc - and allows the number of instruments per week serviced by each technician to be changed. When all questions have been answered the program works out a new schedule and stores this in its data files. It does not at this stage display the schedule. This may be done later in response to other Function Menu options which call for various types of written or graphical printout.

CMPM's scheduling function is complex, and there are some signs that it cannot deal correctly with all the demands it offers to accept. See for example section 12 below, and the unidentified diagnostic numbers at the end of Fig 6. Some bugs remain in the scheduler, which needs further study.

5. Look at or edit instrument information (menu ref 2)

After offering a choice of its three functions this option asks if the

user knows the Tag Number of the instrument. If not, the program lists all instruments in the system (Fig 7). When the selected Tag Number has been entered the display shows the relevant inventory questionnaire, filled up as in menu option 0. If required it will delete the instrument in question. It will also show cost values calculated by other functions of CMPM.

6. Edit scheduling parameters (menu ref 3)

The "scheduling parameters" are the location of the instrument, its servicing personnel, and the relevant quality and skill factors (Fig 8). This option shows the scheduling parameters for a selected instrument and allows them to be changed.

7. Enter a question form or design a new one (menu ref 4)

A preventive maintenance/quality control "Question Form" should be defined for each instrument . This will be seen by the service technician each time he enters a servicing report into CMPM.

The form carries three questions which can each be answered by a simple phrase, another three to be answered yes/no, and five DC voltages to be measured and compared with set values (Fig 9).

If this option is selected for an instrument for which no Question Form has yet been defined a blank form with movable cursor appears, allowing questions to be inserted from the keyboard.

8. Enter results of preventive maintenance (menu ref 5)

This presents the relevant Question Form for filling up after servicing has been done.

9. Enter details of repair (menu ref 6)

A distinction is made between recording the results of a routine QC check (menu ref 5) and reporting on a repair. In the latter case a fuller report is required, giving the nature of the fault, how it was diagnosed and repaired, relevant dates, the time taken, and any spare parts used (Fig 11). CMPM then calculates the cost of the repair and displays or prints a summary report.

10. Spare parts inventory (menu ref 7)

CMPM assumes that some spare parts may be held for specific instruments, and keeps records of this, but it will also record the use of bought-in spares or spares taken from general stock (Fig 12).

The displays refer to "part numbers" and "type numbers", and so assumes that the user already has some system of component coding. This is needed before using this part of the program.

11. Search for information (menu ref 8)

Several functions of CMPM ask for the Tag Number of an instrument, but the user may not know this. He may need other information, such as which instruments are at a particular location or which are maintained by a particular technician. Menu option 8 is very useful in such cases. It displays the Tag Number, type, manufacturer, and date of manufacture, for all instruments satisfying one of a choice of eleven criteria ("KEY" in Fig 13).

It is sufficient to enter only one or a few characters of the chosen key. For example, entering "LAB" as the key for a search by location will bring up all instruments with this series of letters anywhere in the name of the location. Entering "84" in a search by arrival date

brings up all instruments which arrived in 1984. Entering only "8" in the same search would bring up all instruments which arrived in any year of the 1980s, or in 78, or 68.

12. Generate reports (menu ref 9)

Ten types of report are offered (Fig 14). They may be displayed or printed out. Figs 15 to 24 give one example of each type of report.

The error message in Fig 21 is presumably due to a program defect.

13. Graphics representation (menu ref G)

Nine types of graphic report are available (Fig 25, Figs 26 to 34).

14. "Summary report" (menu ref S)

This reports the number of instruments scheduled for preventive maintenance at each location, how many are allocated to each technician, and the cost of the work planned. The meaning of the cost figures needs investigation.

15. "Initialise CMPM databases" (menu ref I)

This option closes all data files and empties them of data. All entered data about individual instruments is lost. However, the table of general types of instrument (Fig 38), the time required to maintain each type, and the alternative maintenance plans referred to above in section 4, will be retained.

If it is desired to preserve a set of entered data, for example while developing one of the programs of CMPM, this may be done by leaving

CMPM and using a utility such as "PC Tools" to copy all *.DBF and *.NDX files from CMPM into another directory. CMPM may then be initialised, and used experimentally or with another set of data, the stored data files being returned to it later when required.

16. Exit from CMPM (menu ref X)

This returns control to the dot prompt of dBaseIII (Fig 37). To return control from dBase to DOS enter QUIT at the dot prompt.

INTERNATIONAL ATOMIC ENERGY AGENCY
IAEA VIENNA

CMPM

Computerized Maintenance Management Preventive for

```
*****************************************************************
* THIS PROGRAM HAS BEEN  DEVELOPED BY IAEA IN COLABORATION      *
* WITH ALL RCA  MEMBER COUNTRIES AND IS AVAILABLE WITH ALL      *
* OF THEM. ANY NEW CONTRIBUTIONS TO THIS PROGRAM SHOULD BE      *
* COMMUNICATED TO IAEA SO AS TO  BENEFIT ALL THE  MEMBERS.      *
*          YOUR SUGGESTIONS ARE ALWAYS WELLCOME.                *
*****************************************************************
                    ENTER YOUR PASSWORD:
```

Fig 1. CMPM title screen

```
CMPM FUNCTION MENU
------------------

  NO     FUNCTION
  **     ********
   0     ENTTER INSTRUMENT INFORMATION
   1     SCHEDULE/RESCHEDULE INSTRUMENTS FOR QC+PM
   2     EDIT/DELETE/LOOK INSTRUMENT INFORMATION
   3     EDIT PARAMETERS OF SCHEDULE FOR QC+PM(LOCATION,PERSON)
   4     EDIT/ENTER QUESTION FORM FOR PREVENTIVE MAINTENANCE
   5     ENTER EXECUTED FINDINGS OF PREVENTIVE MAINTENANCE & QC
   6     ENTER REPAIR DETAILS
   7     ENTER/UPDATE/SEARCH SPARE PARTS
   8     INFORMATION SEARCH
   9     GENERATE REPORTS
   G     GRAPHICS REPRESENTATION
   S     SUMMARY OF PREVENTIVE MAINTENANCE
   I     INITIALISE CMPM DATABASE
   X     EXIT FROM PROGRAM

ENTER NUMBER AS REQUIRED FUNCTION :
```

Fig 2. CMPM main function menu

```
GROUP NO.    GROUP TYPE
*********    **********
 0           NUCLEAR SAFETY
 1           PRESERVATION
 2           STANDARDS
 3           NUCLEAR INSTRUMENTS
 4           RECORDERS
 5           ANALYTICAL INSTRUMENTS
 6           REPAIR INSTRUMENTS
 7           AUXILIARY EQUIPMENTS
 8           NUCLEAR DETECTORS
 9           SPECIAL SYSTEMS
 R           RETURN TO MAINMENU
DO YOU KNOW TO WHICH GROUP YOUR INSTRUMENT BELONGS?(Y/N)
OR 'R' FOR MAINMENU: (N)

CHOOSE GROUP NUMBER TO DISPLAY: (5)
```

Fig 3. Instrument group selection

```
*************************************
*GROUP NO.    GROUP TYPE           *
**********    **********           *
* 0          NUCLEAR SAFETY       *
* 1          PRESERVATION         *
* 2          STANDARDS            *
* 3          NUCLEAR INSTRUMENTS  *
* 4          RECORDERS            *
* 5          ANALYTICAL INSTRUMENTS *
* 6          REPAIR INSTRUMENTS   *
* 7          AUXILIARY EQUIPMENTS *
* 8          NUCLEAR DETECTORS    *
* 9          SPECIAL SYSTEMS      *
*                                 *
*CHOOSE GROUP NUMBER TO DISPLAY: 5 *
*                                 *
*                                 *
*                                 *
*                                 *
*************************************
```

```
ANALYTICAL INSTRUMENTS MENU
---------------------------

    NUMBER      INSTRUMENT NAME
    ------      ---------------
      1         PH METER
      2         GAS CHROMATOGRAPH
      3         LIQUID CHROMATOGRAPH
      4         OXYGEN ANALYSER
      5         HYDROGEN ANALYSER
      6         DIFF. THERMAL ANALYSER
      7         SPECTROMETER
      8         COLORIMETER
      9         OTHER


IS YOUR INSTRUMENT IN THIS GROUP?(Y/N): (Y)

ENTER NUMBER OF THE INSTRUMENT : (2)
```

Fig 4. Instrument type selection

TAG NUMBER 5203
NAME OF THE INSTRUMENT
LOCATION OF THE INSTRUMENT
PRICE IN LOCAL CURRENCY
DATE OF ARRIVAL (MM/DD/YY) / /
INVENTORY NUMBER
YEAR OF MANUFACTURE
NAME OF MANUFACTURER
ADDRESS OF MANUFACTURER
TELEX NUMBER OF MANUFACTURER
PHONE NO. OF MANUFACTURER
NAME OF THE SUPPLIER
ADDRESS OF SUPPLIER
PHONE NO.OF SUPPLIER
PRICE IN FOREIGN CURRENCY
MODEL NUMBER
SERIAL NUMBER
DATE OF COMMISSIONING(MM/DD/YY) / /
END OF WARRENTY(MM/DD/YY) / /
REPAIR CONTRACT
MAIN USER OF THE INSTRUMENT
PERSON ACCOMPANYING FOR PM
MAIN OPERATOR OF THE INSTRUMENT
PHONE NO. OF THE USER
IS OPERATING MANUAL AVAILABLE?(Y/N) ?
IS SERVICE MANUAL AVAILABLE ? (Y/N) ?
IS CIRCUIT DIAGRAM AVAILABLE ?(Y/N) ?
LOCATION OF THE MANUAL
IS PARTS LIST AVAILABLE ? (Y/N) ?
ACCESSORIES LIST
POWER CONSUMPTION WATT/ VOLT-AMP
RANGE OF OPERATING VOLTAGE
RANGE OF RELATIVE HUMIDIRY
RANGE OF OPERATING TEMPERATURE
TYPE OF STABLIZER USED
TYPE & CAPACITY OF DROP OUT RELAY
NAME OF PREVENTIVE MAINTENANCE HEAD
PHONE NO. OF PM HEAD
LIST OF SPECIAL TEST EQUIPMNET
SPARES AVAILABLE ? (Y/N) ?
LIST OF ASSOCIATED EQUIPMENTS
REFERENCE FOR PM PROCEDURE

IS THE INFORMATION OK ?(Y/N):

Fig 5. Instrument information questionnaire

EITHER LOCATION/PRICE IN LOCAL CURRENCY/DATE OF ARRIVAL IS NOT ENTERED

LOCATION OF THE INSTRUMENT
PRICE IN LOCAL CURRENCY
DATE OF ARRIVAL / /

NAME THE PERSON DOING LEVEL2 PM
NAME THE PERSON DOING LEVEL3 PM
QUALITY FACTOR OF THE INSTRUMENT
SKILL & EXPERIENCE OF LEVEL 2 PERSON
(QUALITY FACTOR: 1=GOOD 2=NORMAL 3=BAD)
(SKILL & EXP: 1=GOOD 2=NORMAL 3=JUNIOR)

DO YOU NEED LIST OF SCHEDULED/UNSCHEDULED INSTRUMENTS ?(Y/N):

KEY	FUNCTION
S	SCHEDULED INSTRUMENT LIST
U	UNSCHEDULE INSTRUMENT LIST
N	NO LIST

ENTER PROPER KEY AS REQUIRED FUNCTION:

TAGNO	INSTRUMENT NAME	LOCATION	LEVEL2 PERSON
3501	ND66-MCA	NUCLEAR PHY LAB	ANISA BEGUM
3601	ND6600 MCA	CIRUS	GHADI
5201	GAS CHROMATOGRAPH	CHEMISTRY LAB	ANISA
6301	OSCILLOSCOPE STORAGE	ROOM NO 64	RABB
9301	APPLE II PLUS COMP	MICRO COMP LAB	MORSHED

DO YOU NEED LIST OF UNSCHEDULED INSTRUMENTS ALSO ?(Y/N):

KEY	FUNCTION
S	SCHEDULE QC-PM FOR SET OF INSTRUMENTS
R	RESCHEDULE QC-PM FOR SET OF INSTRUMENTS
N	BACK TO MAINMENU

ENTER CORRECT KEY FOR THE REQUIRED FUNCTION:

CHOOSE ONE CONDITION FOR SCHEDULING
****

KEY	CONDITION
1	SCHEDULE ALL NEWLY ENTERED INSTRUMENTS
2	SCHEDULE ONLY SELECTED GROUP OF INSTRUMENTS
3	SCHEDULE INSTRUMENTS AT SELECTED LOCATION
4	SCHEDULE INSTRUMENTS MAINTENED BY SELECTED PERSON
5	SCHEDULE INSTRUMENTS FOR SELECTED GROUP AND LOCATION
6	SCHEDULE INSTRUMENTS FOR SELECTED GROUP AND PERSON
7	SCHEDULE INSTRUMENTS FOR SELECTED LOCATION AND PERSON
8	SCHEDULE INSTRUMENTS FOR SELECTED GROUP, LOCATION AND PERSON
R	RETURN TO THE MAINMENU

ENTER THE PROPER KEY FOR YOUR CHOICE:

Fig 6. (cont)

1

```
CHOOSE ONE CONDITION FOR RESCHEDULING
*************************************

 KEY                  CONDITION
 ---                  ---------
  1       RESCHEDULE ALL ENTERED INSTRUMENTS
  2       RESCHEDULE ONLY SELECTED GROUP OF INSTRUMENTS
  3       RESCHEDULE INSTRUMENTS AT SELECTED LOCATION
  4       RESCHEDULE INSTRUMENTS MAINTENED BY SELECTED PERSON
  5       RESCHEDULE INSTRUMENTS FOR SELECTED GROUP AND LOCATION
  6       RESCHEDULE INSTRUMENTS FOR SELECTED GROUP AND PERSON
  7       RESCHEDULE INSTRUMENTS FOR SELECTED LOCATION AND PERSON
  8       RESCHEDULE INSTRUMENTS FOR SELECTED GROUP,LOCATION AND PERSON
  R       RETURN TO THE MAINMENU
ENTER THE PROPER KEY FOR YOUR CHOICE:


WANT TO CHANGE MAXIMUM NO OF INSTRUMENTS/WEEK FOR PMPERSONS ?(Y/N):


 NO  MAINTENANCE PERSON NAME          INST/WEEK
 --  ------------------------         ---------
  1  ANISA                                5
  2  ANISA BEGUM                          5
  3  GHADI                                5
  4  KANI                                 5
  5  MORSHED                              5
  6  RABB                                 5


ENTER CORRECT NO WHOSE MAXIMUM NUMBER OF INSTRUMENTS/WEEK CAN BE CHANGED:


              1 INSTRUMENT  IS  SCHEDULED.....WAIT.....
 39           2 INSTRUMENTS ARE SCHEDULED.....WAIT.....
 35.00
 43.00
 51.00
  7.00
 15.00
 23.00
```

2

```
 NO  FUNCTION  TYPE
 --  --------  ----

 E   EDIT INSTRUMENT INFORMATION

 D   DELETE INSTRUMENT RECORD

 L   LOOK FOR INSTRUMENT INFORMATION

 R   RETURN TO THE MAINMENU

 ENTER LETTER AS REQUIRED FUNCTION TYPE: (L)


DO YOU KNOW THE TAG NUMBER OF THE INSTRUMENT?(Y/N): (N)


   TAGNO INST_NAME
    3501 ND66-MCA
    3601 ND6600 MCA
    5201 GAS CHROMATOGRAPH
    6301 OSCILLOSCOPE STORAGE
    9301 APPLE II PLUS COMP


 DO YOU NEED MORE INSTRUMENT TAG NUMBERS?(Y/N): (N)
 ENTER YOUR TAG NO (3501)


                  TAG NUMBER:       3501
      NAME OF THE INSTRUMENT: ND66-MCA
                MODEL NUMBER: ND66
               SERIAL NUMBER:
           INVENTORY NUMBER:
         YEAR OF MANUFACTURE:       1982
       NAME OF MANUFACTURER: NUCLEAR DATA
    ADDRESS OF MANUFACTURER: SUNNY VILLA,CALIFORNIA, USA
TELEX NUMBER OF MANUFACTURER:
   PHONE NO. OF MANUFACTURER:
        NAME OF THE SUPPLIER: IAEA
      ADDRESS OF SUPPLIER: VIENNA, AUSTRIA
     PHONE NO.OF SUPPLIER: 2360-1672
  PRICE IN FOREIGN CURRENCY: 3894
    PRICE IN LOCAL CURRENCY:     120000
           DATE OF ARRIVAL: 01/01/83
  DATE OF COMMISSIONING: 01/02/83
          END OF WARRENTY: 01/01/84
          REPAIR CONTRACT: NO
 LOCATION OF THE INSTRUMENT: NUCLEAR PHY LAB
MAIN USER OF THE INSTRUMENT: NUCLEAR PHY DIVISION

DO YOU WANT MORE INFORMATION ?(Y/N): (Y)
```

Fig 7 (cont)

2

```
        MAIN OPERATOR OF THE INSTRUMENT: MOLLA
                  PHONE NO. OF THE USER:
          IS OPERATING MANUAL AVAILABLE?: YES
           IS SERVICE MANUAL AVAILABLE ?: YES
          IS CIRCUIT DIAGRAM AVAILABLE ?: YES
                 LOCATION OF THE MANUAL: INST STORE
              IS PARTS LIST AVAILABLE ?: YES
                     ACCESSORIES LIST: PRINTER & PLOTER CABLES
     POWER CONSUMPTION WATT/ VOLT-AMP: 130
           RANGE OF OPERATING VOLTAGE: 210 TO 250
          RANGE OF  RELATIVE HUMIDIRY: 50% TO 60%
        RANGE OF OPERATING TEMPERATURE: 20 TO 25
                  TYPE OF STABLIZER USED: CVT
   TYPE & CAPACITY OF  DROP OUT RELAY: IAEA 10AMP
  NAME OF PREVENTIVE MAINTENANCE HEAD: TAHER
                  PHONE NO. OF PM HEAD: 405830/203
       LIST OF SPECIAL TEST EQUIPMMET: PULSER
                    SPARES AVAILABLE ?: YES
        LIST OF ASSOCIATED EQUIPMENTS: PRINTER & PLOTER
          REFERENCE FOR PM PROCEDURE: PM REF MANUAL PAGE 4 TO 5

DO YOU WANT MORE INFORMATION?(Y/N):(Y)


        PERSON PERFORMING LEVEL-2 JOBS: ANISA BEGUM
        PERSON PERFORMING LEVEL-3 JOBS: AFZAL
            PERSON ACCOMPANYING FOR PM: NURU ZAMAN
      CURRENT VALUE OF THE INSTRUMENT:     119967;         0
   TOTAL LOST VALUE OF THE INSTRUMENT:       1026
                   TOTAL REPAIR COST:        981
                TOTAL DOWN TIME (DAYS):          6


WOULD YOU LIKE TO EDIT,DELETE OR LOOK MORE INSTRUMENT INFORMATION?(Y/N):
```

```
ENTER TAG NUMBER FOR WHICH PARAMATERS FOR SCHEDULING ARE TO BE EDITED:(3501)


                                TAG NUMBER:       3501
                  NAME OF THE INSTRUMENT:  MD66-MCA
               LOCATION OF THE INSTRUMENT:  NUCLEAR PHY LAB
  NAME OF THE PERSON DOING LEVEL2 PM:  ANISA BEGUM
  NAME OF THE PERSON DOING LEVEL3 PM:  AFZAL
                          QUALITY FACTOR:  2
    SKILL & EXPERINCE OF LEVEL 2 PERSON:  2
(QUALITY FACTOR:1=GOOD, 2=NORMAL, 3=BAD)
(SKILL & EXP FACTOR:1=GOOD,2=NORMAL,3=JUNIOR)


                IS THE EDITED INFORMATION OK?(Y/N):
```

Fig 8. Edit scheduling parameters

ENTER THE TAG NUMBER FOR WHICH QUESTION FORM IS TO BE EDITED/ENTERED: (3501)

QUESTIONS FOR INSTRUMENT WITH TAG NUMBER: 3501

Q1. ANSWER IN ALPHANUMERIC NOTE CS-137 PEAK FOR SETTINGS IN PM REFERENCE
Q2. ANSWER IN ALPHANUMERIC NOTE COUNTS IN CHANNEL 102 & 3099 AFTER MEM TEST
Q3. ANSWER IN ALPHANUMERIC OFFSET BY 256 CHANNEL &NOTE CH.NO. OF Q1
Q4. ANSWER IN LOGICAL IS HV CLEANED
Q5. ANSWER IN LOGICAL IS FAN FILTER CLEANED
Q6. ANSWER IN LOGICAL ANY LOOSE CONTROLS TIGHTEN

ENTER DC VOLTAGES TO BE MEASURED
1: +5
2: +12
3: +24
4: -12
5: -24

ARE THE QUESTIONS OK ?(Y/N): (Y)

PARAMETERS ENTERED EARLIER CORRESPONDING TO CHANGED QUESTIONS ARE NO MORE VALID

WANT TO ENTER/EDIT QUESTION FORMS FOR MORE INSTRUMENT?(Y/N):

Fig 9. Edit a question form or design a new one.

ENTER TAG NUMBER OF THE INSTRUMENT:

NOW ENTER RESULTS

TAG NUMBER 3501
DATE OF EXECUTING PM / /

*** DC VOLAGES AND RIPPLES ***

	VOLTAGE (V)	RIPPLE (mV)
(+5)	.	
(+12)	.	
(+24)	.	
(-12)	.	
(-24)	.	

NOTE CS-137 PEAK FOR SETTINGS IN PM REFERENCE
NOTE COUNTS IN CHANNEL 102 & 3099 AFTER MEM TEST
OFFSET BY 256 CHANNEL &NOTE CH.NO. OF Q1
IS HV CLEANED
IS FAN FILTER CLEANED
ANY LOOSE CONTROLS TIGHTEN
DESCRIBE ANY REMARKS

ARE THE ENTERED RESULTS CORRECT ?(Y/N):

DO YOU WANT TO ENTER FINDINGS OF ANOTHER INSTRUMENT ?(Y/N):

Fig 10. Enter results of preventive maintenance.

ENTER TAG NUMBER OF THE INSTRUMENT : (3501)
IS THE REPAIR COMPLETE? (Y/N): (Y)

NOW ENTER REPAIR HISTORY
TAG NUMBER : 3501

FAULT STATUS
****
DATE OF FAULT (MM/DD/YY): / /
DATE OF FAULT REPORTED(MM/DD/YY): / /
CAUSE OF FAULT :
TYPE OF FAULT :
DESCRIPTION OF MALFUNCTION : 1.
2.
3.

DIAGNOSIS
****
BY WHOM :
START DATE (MM/DD/YY): / /
END DATE (MM/DD/YY): / /
WAGE/HOUR :
TIME TAKEN IN UNITS OF .1 HR/DAY:

Fig 11. Enter details of repair (cont)

REPAIR
******
BY WHOM :
START DATE (MM/DD/YY): / /
END DATE (MM/DD/YY): / /
WAGE/HOUR :
TIME TAKEN IN UNITS OF .1 HR/DAY:

REPLACED PARTS
****

	PART NO	PART NAME	TYPE NO	QNT	COST/PC
1.					
2.					
3.					
4.					

TIME TAKEN TO GET PARTS(DAY) :
OVERHEAD (%) :

RESULTS
****
COMPLETION DATE (MM/DD/YY): / /
QC CHECKED BY:
SYSTEM CONDITION :
REASON FOR ANY DELAY :
REMARKS :

ENTER REQUIRED CHOICE FOR REPAIR EVALUATION REPORT

ENTER 'P' FOR PRINT OR 'D' FOR DISPLAY: (D)

PRESS Ctrl - S TO STOP SCROLLING DURING THE REPORT
AND PRESS ANY KEY TO CONTINUE AFTER STOPPING

PRESS ANY KEY TO START REPORT

REPAIR EVALUATION

TAG NUMBER: 3501 INSTRUMENT NAME: MD66-MCA

ORIGINAL PRICE:	120000;	1983
CURRENT VALUE:	119967;	0
TOTAL REPAIR COST:	981	
LAST REPAIR COST:	0	
TOTAL LOST VALUE:	1539	
LOST VALUE OF LAST REPAIR:	171	
TOTAL DOWN TIME (DAYS):	9	
DOWN TIME IN LAST REPAIR (DAYS):	1	
REPAIR COST WITH OVERHEAD:	0	

PRESS ANY KEY TO PROCEED

DO YOU WANT TO ENTER ANOTHER REPAIR HISTORY ?(Y/N):

Fig 11. (cont)

KEY	FUNCTION
U	UPDATE SPARE PARTS
S	SEARCH SPARE PARTS
E	ENTER SPARE PARTS
R	RETURN TO MAINMENU

ENTER PROPER LETTER FOR REQUIRED FUNCTION:

ENTER TAG NUMBER FOR WHICH SPARES ARE USED:

IS PART NUMBER KNOWN ?(Y/N): (N)
ENTER TYPE NUMBER: xxx

NAME OF THE USER:
QUANTITY USED:
DATE ON WHICH PARTS USED(MM/DD/YY): / /

IS THE ENTERED INFORMATION OK ?(Y/N):

} Option key U

IS PART NUMBER KNOWN ?(Y/N): (Y)
ENTER PART NUMBER: xxx
ENTER TYPE NUMBER: yyy
NEITHER PART NUMBER NOR TYPE NUMBER IS AVAILABLE
PRESS ANY KEY TO PROCEED

} Option key S

PART NUMBER:
PART NAME:
TYPE NO:
QUANTITY:

IS THE ENTERED DATA CORRECT?(Y/N):

} Option key E

Fig 12. Spare parts inventory

SEARCH RECORDS USING ANY OF THE FOLLOWING INFORMATION

KEY	INFORMATION
***	**********
A	INSTRUMENT NAME
B	INSTRUMENT MODEL NUMBER
C	INSTRUMENT SERIAL NUMBER
D	INSTRUMENT MANUFACTURER
E	INSTRUMENT SUPPLIER
F	INSTRUMENT INVENTORY NUMBER
G	INSTRUMENT ARRIVAL DATE
H	INSTRUMENT LOCATION
I	INSTRUMENT USER NAME
J	INSTRUMENT LEVEL-2 PM PERSON
K	INSTRUMENT TAG NUMBER
R	RETURN TO THE MAINMENU

ENTER ANY ONE KEY FOR REQUIRED SEARCH: H
ENTER INSTRUMENT LOCATION: (LAB)

TAGNO	INST_LOC	INST_NAME	MNFRC_NAME	YR_MNFRC
3501	NUCLEAR PHY LAB	MD66-MCA	NUCLEAR DATA	1982
5201	CHEMISTRY LAB	GAS CHROMATOGRAPH		0
9301	MICRO COMP LAB	APPLE II PLUS COMP	APPLE INC	1979

(another search –)

SEARCH RECORDS USING ANY OF THE FOLLOWING INFORMATION

KEY	INFORMATION
***	**********
A	INSTRUMENT NAME
B	INSTRUMENT MODEL NUMBER
C	INSTRUMENT SERIAL NUMBER
D	INSTRUMENT MANUFACTURER
E	INSTRUMENT SUPPLIER
F	INSTRUMENT INVENTORY NUMBER
G	INSTRUMENT ARRIVAL DATE
H	INSTRUMENT LOCATION
I	INSTRUMENT USER NAME
J	INSTRUMENT LEVEL-2 PM PERSON
K	INSTRUMENT TAG NUMBER
R	RETURN TO THE MAINMENU

ENTER ANY ONE KEY FOR REQUIRED SEARCH: H
ENTER INSTRUMENT LOCATION: (CHEM)

TAGNO	INST_LOC	INST_NAME	MNFRC_NAME	YR_MNFRC
5201	CHEMISTRY LAB	GAS CHROMATOGRAPH		0

WANT TO SEARCH MORE INSTRUMENTS ?(Y/N):

NO	REPORT TYPE
0	WORK LOAD PER PM-PERSON FOR LEVEL2 PER YEAR
1	WORK LOAD PER PM-PERSON FOR LEVEL3 PER YEAR
2	LIST OF GOOD/BAD INSTRUMENTS
3	LIST INSTRUMENT NAME,PM-PERSON-LV2,PM-PERSON-LV3
4	QUESTION FORM FOR REPORTING EXECUTED LEVEL-2 PM
5	JOB LIST FOR LEVEL-2 PERSONS FOR REQUIRED WEEK
6	INSTRUMENT'S HISTORY OF LEVEL-2 PM EXECUTED
7	REPAIR HISTORY OF A SELECTED INSTRUMENT
8	LIST OF SPARE PARTS FOR A SELECTED INSTRUMENT
9	LIST OF PERSONS DOING LEVEL-2 JOBS FOR REQUIRED WEEK
R	RETURN TO THE MAINMENU

Fig 14. Report menu

ENTER NUMBER OF REQUIRED REPORT: (0)

ENTER 'P' FOR PRINT OR 'D' FOR DISPLAY: (P)

PREVENTIVE MAINTENANCE WORK LOAD DISTRIBUTION
FOR LEVEL-2 OVER A YEAR PER PERSON
PHILIPPINE ATOMIC ENERGY COMMISSION (PAEC)
PHILIPPINES

NAME	INSTRUMENT NAME	1st SER	2nd SER	3rd SER	4th SER	5th SER	6th SER	TOTAL TIME
** PERSON PERFORMING LEVEL-2: ANISA								
ANISA	GAS CHROMATOGRAPH	35	43	51	7	15	23	180
** Subtotal **								180
** PERSON PERFORMING LEVEL-2: ANISA BEGUM								
ANISA BEGUM	MD66-MCA	35	43	51	7	15	23	60
** Subtotal **								60
** PERSON PERFORMING LEVEL-2: GHADI								
GHADI	MD6600 MCA	39	47	3	11	19	27	120
** Subtotal **								120
** PERSON PERFORMING LEVEL-2: MORSHED								
MORSHED	APPLE II PLUS COMP	36	44	52	8	16	24	90
** Subtotal **								90
** PERSON PERFORMING LEVEL-2: RABB								
RABB	OSCILLOSCOPE STORAGE	35	7	0	0	0	0	20
** Subtotal **								20
*** Total ***								470

PREVENTIVE MAINTENANCE WORK LOAD DISTRIBUTION
FOR LEVEL-3 OVER A YEAR PER PERSON
OFFICE OF ATOMIC ENERGY FOR PEACE(OAEP)
THAILAND

TAG NO	NAME	INSTRUMENT NAME	1st SER	2nd SER	3rd SER	4th SER	TOTAL TIME
** PERSON PERFORMING LEVEL-3 : AFZAL							
3501 AFZAL		MD66-MCA	35	0	0	0	20
** Subtotal **							20
** PERSON PERFORMING LEVEL-3 : AKTER							
9301 AKTER		APPLE II PLUS COMP	36	8	0	0	120
** Subtotal **							120
** PERSON PERFORMING LEVEL-3 : ANISA							
5201 ANISA		GAS CHROMATOGRAPH	35	0	0	0	60
** Subtotal **							60
** PERSON PERFORMING LEVEL-3 : JAY							
6301 JAY		OSCILLOSCOPE STORAGE	35	0	0	0	30
** Subtotal **							30
** PERSON PERFORMING LEVEL-3 : SULE							
3601 SULE		MD6600 MCA	39	0	0	0	40
** Subtotal **							40
*** Total ***							270

Fig 16. Report 1: Work load per technician, Level 3

KEY	FUNCTION
G	LIST OF GOOD INSTRUMENTS
B	LIST OF BAD INSTRUMENTS

ENTER REQUIRED KEY: (G)

TAGNO	INST_NAME	INST_LOC
3501	MD66-MCA	NUCLEAR PHY LAB
3601	MD6600 MCA	CIRUS
5201	GAS CHROMATOGRAPH	CHEMISTRY LAB
6301	OSCILLOSCOPE STORAGE	ROOM NO 64
9301	APPLE II PLUS COMP	MICRO COMP LAB

Fig 17. Report 2: List of good or bad instruments.

TAGNO	INST_NAME	PM_PER_LV2	PM_PER_LV3
3501	ND66-MCA	AFZAL	AFZAL
3601	ND6600 MCA	SULE	SULE
5201	GAS CHROMATOGRAPH	ANISA	ANISA
6301	OSCILLOSCOPE STORAGE	JAY	JAY

Fig 18. Report 3: Technicians assigned to each instrument.

9301 APPLE II PLUS COMP AKTER AKTER

****

QUESTIONS FORM FOR THE INSTRUMENT WITH TAG NUMBER: 3501

****

1. CHECK ALL THE DC VOLTAGES AND RIPPLES !

	VOLTAGE (V)	RIPPLE (mV)
	**********	**********
(+5)		
(+12)		
(+24)		
(-12)		
(-24)		

2. NOTE CS-137 PEAK FOR SETTINGS IN PM REFERENCE

3. NOTE COUNTS IN CHANNEL 102 & 3099 AFTER MEM TEST

4. OFFSET BY 256 CHANNEL & NOTE CHANNEL. NO. OF Q1

5. IS HV CLEANED ?

6. IS FAN FILTER CLEANED ?

7. ANY LOOSE CONTROLS TIGHTENED ?

8. DESCRIBE ANY REMARKS !

****

Fig 19. Report 4: Question form for selected instrument

9

JOBS TO BE EXECUTED IN WEEK NUMBER: 3

PERSON PERFORMING LEVEL-2 JOB: ANISA

INSTRUMENT NAME	LOCATION	TIME UNITS	TAGNO	DATE	SIGNATURE
**********	********	**********	*****	****	*********

NO LEVEL-2 JOBS THIS WEEK FOR ANISA

JOBS TO BE EXECUTED IN WEEK NUMBER: 3

PERSON PERFORMING LEVEL-2 JOB: ANISA BEGUM

INSTRUMENT NAME	LOCATION	TIME UNITS	TAGNO	DATE	SIGNATURE
**********	********	**********	*****	****	*********

NO LEVEL-2 JOBS THIS WEEK FOR ANISA BEGUM

JOBS TO BE EXECUTED IN WEEK NUMBER: 3

PERSON PERFORMING LEVEL-2 JOB: GHADI

INSTRUMENT NAME	LOCATION	TIME UNITS	TAGNO	DATE	SIGNATURE
**********	********	**********	*****	****	*********
ND6600 MCA	CIRUS	20	3601		

SPECIAL TEST EQUIPMENT, PM PROCEDURES REF. AND QUESTION FORM FOR 3601

PERSON ACCOMPANYING FOR PM: NARURKAR
LIST OF SPECIAL TEST EQUIPMENT: BNC PULSER

REFERENCE FOR PM PROCEDURE FOR TAGNO 3601: PM MANUAL PAGE NO 12-14

Fig 20. Report 5: Job list for a selected week

PM HISTORY OF LEVEL - 2

* TAG NUMBER : 3501
* INSTRUMENT NAME : ND66-MCA
* PERFORMED BY : AFZAL

DATE	VTG 1	RPL 1	VTG 2	RPL 2	VTG 3	RPL 3	VTG 4	RPL 4	VTG 5	RPL 5
********	******	*****	******	*****	******	*****	******	*****	******	*****

Variable not found.

? DTOC(DATE)+' '+M1+STR(ANS1_1LV2,5,2)+' '+STR(ANS1_2LV2,3)+' '+M2+STR(ANS1_3LV2,5,2)+' '+STR(ANS1_4LV2,3)+' '+M3+STR(ANS1_5LV2,5,2)+' '+STR(ANS1_6LV2,3)+' '+M4+STR(ANS1_7LV2,5,2)+' '+STR(ANS1_8LV2,3)+' '+M5+STR(ANS1_9LV2,5,2)+' '+STR(ANS1_10L

Called from - C:HISPMLV2.prg
Called from - C:GENREP.prg
Called from - C:MAINMENU.prg
Called from - C:CMPM.prg

Cancel, Ignore, or Suspend? (C, I, or S) Cancel
Do cancelled

Fig 21. Report 6: History of level 2 ...

FOLLOWING INSTRUMENTS HAVE REPAIR HISTORY

TAG NUMBER	INSTRUMENT NAME
3501	MD66-MCA
6301	OSCILLOSCOPE STORAGE
9301	APPLE 11 PLUS COMP

ENTER THE TAG NUMBER FOR REPAIR HISTORY:3501

ENTER 'P'FOR PRINT 'D' FOR DISP:D

INSTRUMENT REPAIR HISTORY
****

INSTRUMENT NAME:MD66-MCA TAG NUMBER: 3501

REPAIR NUMBER: 1
DATE OF FAULT: 01/05/83
CAUSE OF FAULT: UNKNOWN
TYPE OF FAULT: ADC FAILURE
MALFUNCTION TYPE 1: NO PROPER STORAGE
MALFUNCTION TYPE 2:
MALFUNCTION TYPE 3:
FAULT DAIGNOSIED BY: AZAD
REPAIRED BY: ABUL KASHEM
SYSTEM CONDITION: OK

PARTS REPLACED

	PART NO	PART NAME	TYPE NO	QTY
1:	ADC-21-1	TRANSISTOR	EC 234	2
2:	ADC-22-2	IC	SN 74LS354	2
3:				0
4:				0

REPAIR NUMBER: 2
DATE OF FAULT: 01/01/86
CAUSE OF FAULT: BAD MAINS
TYPE OF FAULT: LV SUPPLY FAILURE
MALFUNCTION TYPE 1: NO ACQUISITION
MALFUNCTION TYPE 2:
MALFUNCTION TYPE 3:
FAULT DAIGNOSIED BY: SULE
REPAIRED BY: GHADI
SYSTEM CONDITION: OK

PARTS REPLACED

	PART NO	PART NAME	TYPE NO	QTY
1:	LV-C-1234	CONDENSOR	ELCTROLYTIC	2
2:	LV-IC-1256	REGULATOR	723	2
3:				0
4:				0

Fig 22. Report 7: Repair history

SPARES LIST FOR THE INSTRUMENT WITH TAG NUMBER (5201)
****

PART NUMBER	PART NAME	TYPE NUMBER	BALANCE
GS-32-1	IC	8255	2

DO YOU VANT LIST OF SPARE PARTS FOR ANOTHER INSTRUMENT ?(Y/N):

Fig 23. Report 8: Spare parts for a selected instrument

LIST OF PERSONS DOING LEVEL-2 JOBS FOR WEEK NUMBER: (3)
****

NAME	NUMBER OF INSTRUMENTS
GHADI	1

Fig 24. Report 9: Technicians with jobs in a selected week

G

```
NO   TYPE OF GRAPH
--------------------
1    TOTAL TIME FOR LEVEL-2 PER INSTRUMENT PER YEAR
2    TOTAL TIME FOR LEVEL-3 PER INSTRUMENT PER YEAR
3    NO.OF INSTRUMENTS IN EACH GROUP
4    YEARLY DISTRIBUTION OF WORK LOAD PER PERSON - FOR LV2
5    YEARLY DISTRIBUTION OF WORK LOAD PER PERSON - FOR LV3
6    WEEKLY LOAD OVER A YEAR FOR LEVEL 2 MAINTENANCE
7    WEEKLY LOAD OVER A YEAR FOR LEVEL 3 MAINTENANCE
8    INSTRUMENTS/WEEK FOR PERSON DOING LEVEL 2
9    NUMBER OF INSTRUMENTS PER LOCATION
R    RETURN TO THE MAINMENU

ENTER NUMBER AS REQUIRED GRAPH TYPE:
```

Fig 25. Graphics menu

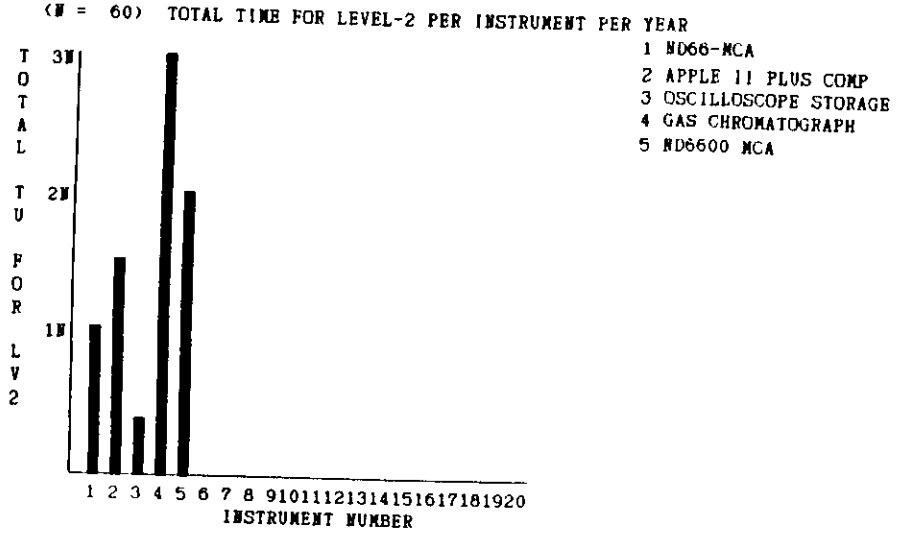


Fig 26. Graphics 1: Level 2 time per instrument

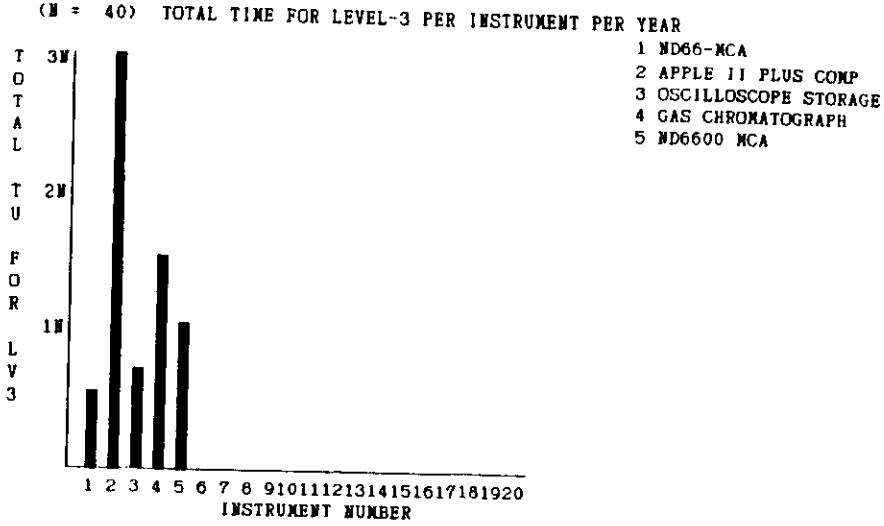


Fig 27. Graphics 2: Level 3 time per instrument

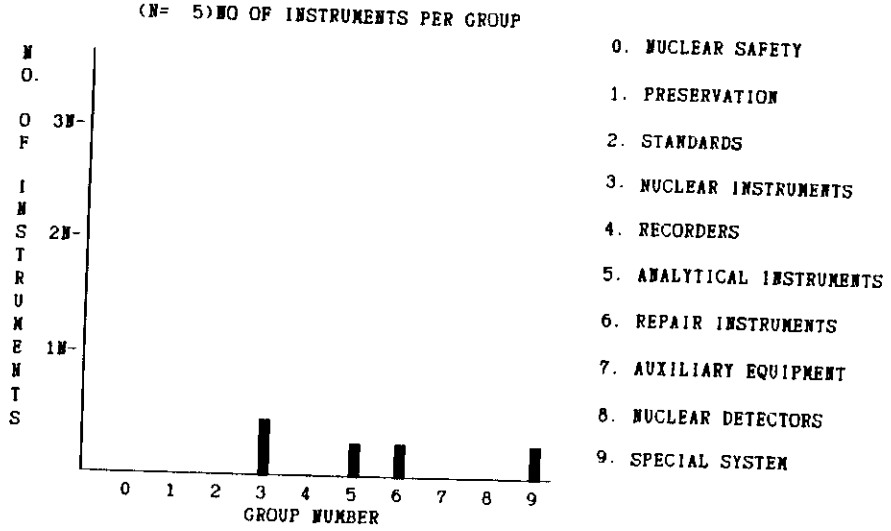


Fig 28. Graphics 3: How many instruments in each group

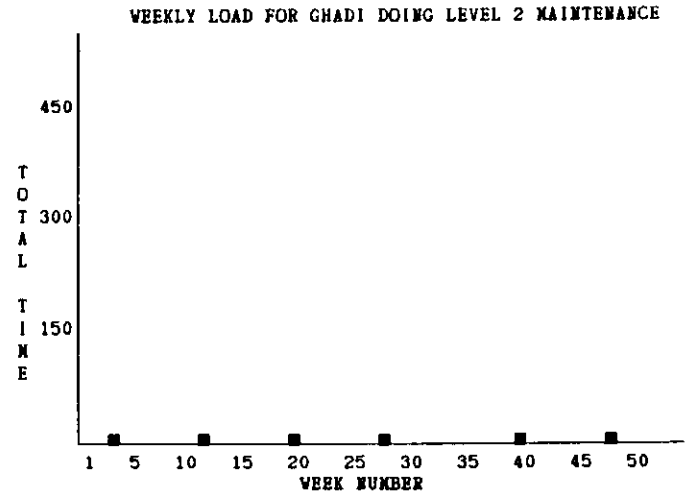


Fig 29. Graphics 4: Work load for a technician, Level 2

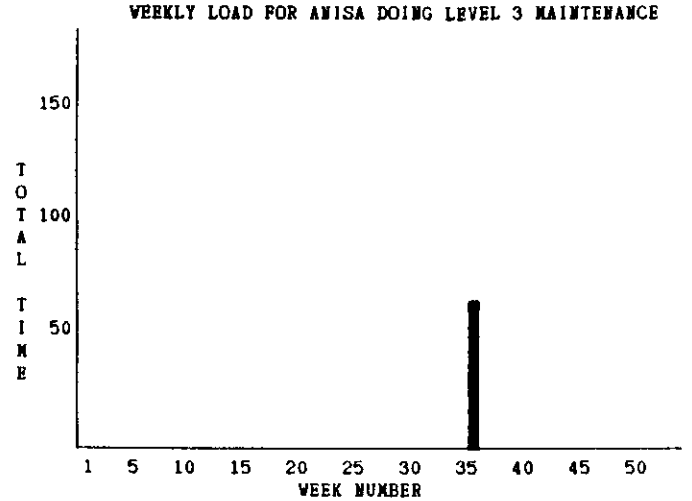


Fig 30. Graphics 5: Work load for a technician, Level 3

G

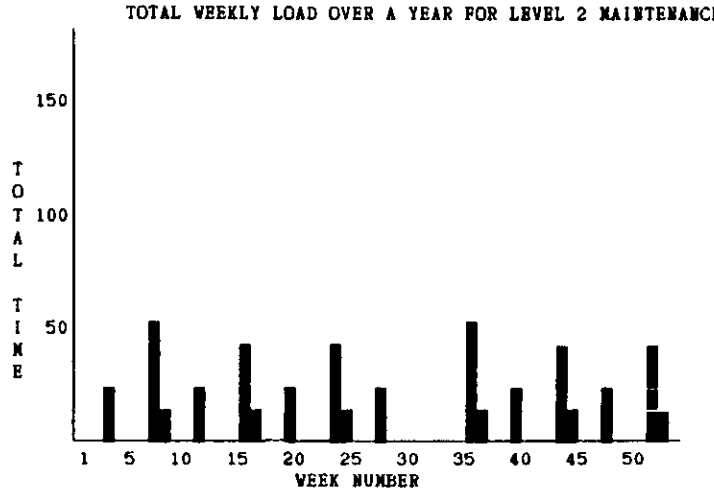


Fig 31. Graphics 6: Weekly work load, level 2

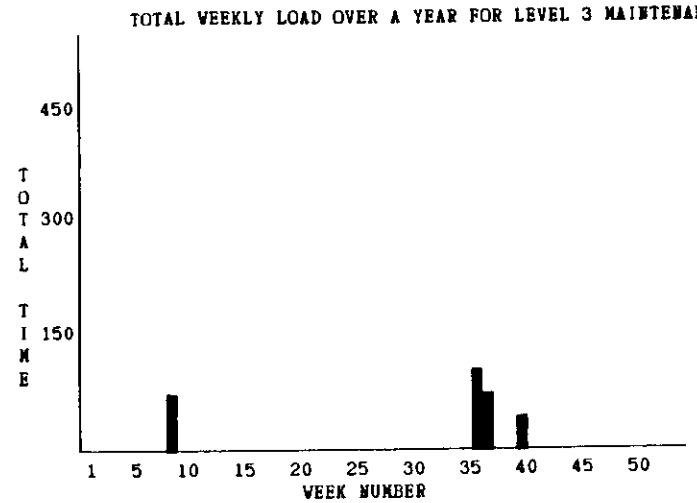


Fig 32. Graphics 7: Weekly work load, level 3

G

INSTRUMENT/WEEK FOR ANISA DOING LEVEL 2 MAINTENANCE

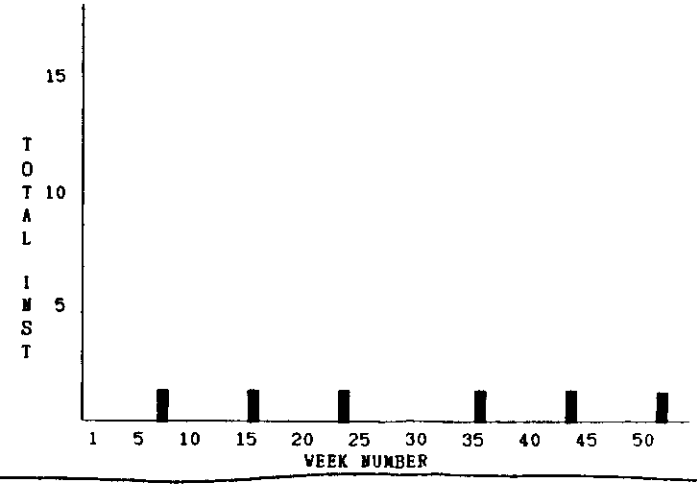
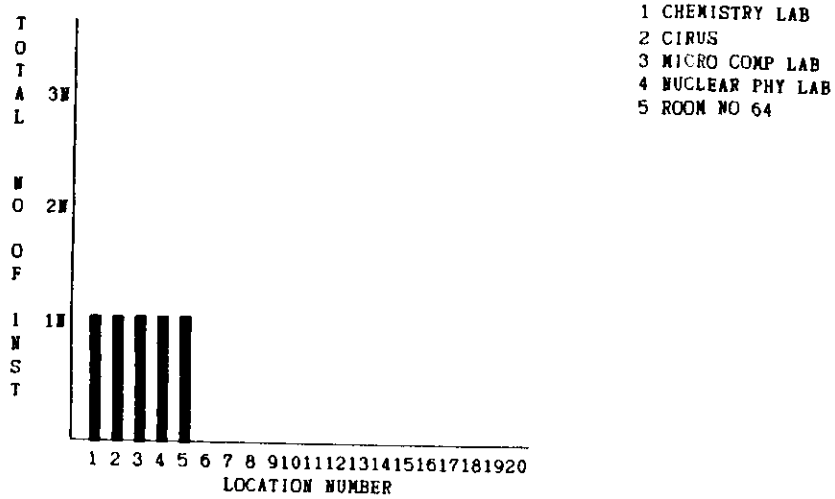


Fig 33. Graphics 8: Instruments per week for a technician, level 2.

(N = 1) NUMBER OF INSTRUMENTS PER LOCATION



1 CHEMISTRY LAB
2 CIRUS
3 MICRO COMP LAB
4 NUCLEAR PHY LAB
5 ROOM NO 64

Fig 34. Graphics 9: How many instruments at each location

S

ENTER 'P' FOR PRINT OR 'D' FOR DISPLAY: (P) (Print option)

INSTRUMENTS AT VARIOUS LOCATIONS UNDER PM CARE.
****

LOCATION	NUMBER
CHEMISTRY LAB	1
CIRUS	1
MICRO COMP LAB	1
NUCLEAR PHY LAB	1
ROOM NO 64	1

TOTAL NUMBER OF INSTRUMENTS UNDER PM CARE = 5

PERSONS DOING LEVEL-2 JOBS
****

NAME	NUMBER OF INSTRUMENTS
ANISA	1
ANISA BEGUM	1
GHADI	1
MORSHED	1
RABB	1

PERSONS DOING LEVEL-3 JOBS
****

NAME	NUMBER OF INSTRUMENT
AFZAL	1
AKTER	1
ANISA	1
JAY	1
SULE	1

TOTAL TIME REQUIRED FOR PREVENTIVE MAINTENANCE = 29 HOURS
TOTAL LOST VALUE = 14145
TOTAL REPAIR COST = 5411
AVERAGE DOWN TIME/INSTRUMENT = 28 DAYS

ENTER 'P' FOR PRINT OR 'D' FOR DISPLAY: D

PRESS Ctrl - S TO STOP SCROLLING DURING THE REPORT
AND PRESS ANY KEY TO CONTINUE AFTER STOPPING

PRESS ANY KEY TO START REPORT

(Display option)

```
************************************************************
*THIS PROGRAM  PREPARES DISK FOR A  FRESH  DATA  ENTRY. IT*
*ERASES ALL ENTERED INFORMATION REGARDING THE INSTRUMENTS *
*YOU WILL HAVE TO REENTER ALL INFORMATION AGAIN           *
************************************************************

DO YOU REALLY WANT TO INITIALISE ?(Y/N): (Y)

ARE YOU SURE ?(Y/N): (Y)

WAIT THE DISK IS PREPARED FOR FRESH DATA
```

Fig 36. Initialise CMPM databases

```
GOOD BYE - HAVE A NICE DAY
```

(.) ← [dBase dot prompt]

Fig 37. Exit from CMPM. Return to dBase.

0. NUCLEAR SAFETY
1. ALARM/NUCL. FIRE
2. POCKET DOSEMETER
3. GAMMA SURVEY M.
4. ALPHA/BETA CONT.
5. NEUTRON DOSE M.
6. TLD
7. AIR/LIQ. MONITOR
8. BODY/HAND/FOOT M.
9. DECONTAM. KIT

10. PRESERVATION
11. SAFETY CIRC./SW.
12. LAB. ENVIRONMENT
13. DEHUM./AIR-CON.
14. D.O. REL. VARIST.
15. CVT
16. NETWORK/GROUND
17. COVER/DOOR/WIND.
18. EMERGENCY POWER
19. FIRST AID KIT

20. STANDARDS
21. RADIATION SOURCE
22. DOSEMETER
23. DOSE CALIBRATOR
24. D.C. SOURCE
25. D.C. METER, AVO
26. A.C. SOURCE
27. A.C. METER, AVO
28. PREC. PULSE GEN.
29. OTHER

30. NUCLEAR INSTRUMENTS
31. BIN, D.C. SUPPLY
32. PRE/LIN/LOG AMP.
33. SCALER/TIMER
34. SCA/DD
35. MCA
36. MCA. + COMPUTER
37. SAMPLE CHANGER
38. NIM/CAMAC MODUL
39. OTHER

40. RECORDERS
41. CHART, PEN/THERMO
42. XY PLOTTER
43. PRINTER/TELETYPE
44. PAPER TAPE PUNCH
45. MAGNETIC TAPE
46. VIDEO
47. PHOTOGRAPHIC
48. RH/T AND V
49. OTHER

50. ANALYTICAL INST.
51. PH METER
52. GAS CHROMATOGR.
53. LIQ. CHROMATOGR.
54. OXYGEN ANALYSER
55. HYDROGEN ANAL.
56. DIFF. THERMAL A.
57. SPECTROMETER
58. COLORIMETER
59. OTHER

60. REPAIR INSTR.
61. AVO METER
62. DIG. MULTI METER
63. OSCILLOSCOPE
64. FUNCTION GEN.
65. NUC. PULSE GEN.
66. ELECTRIC TOOLS
67. DIGITAL PROBES
68. H.V. TEST UNIT
69. OTHER

70. AUXILIARY EQUIP.
71. OVEN/HOT PLATE
72. DEWAR
73. CENTRIFUGE
74. REFRIGERATOR
75. VACUUM PUMP
76. COMPRESSOR
77. HOT WATER BATH
78. BALANCE
79. OTHER

80. NUCLEAR DETECTORS
81. ION CHAMBER
82. PROP. COUNTER
83. G.M. COUNTER
84. LIQ. SCINT. DET.
85. SOLID SCINT. DET.
86. GELI/SILI DET.
87. INTR. GE DET.
88. SURFACE BARRIER
89. OTHER

90. SPECIAL SYSTEM
91. REACTOR CONTROL
92. ACCELERATOR
93. COMPUTER
94. TELECOMM.
95. NUCL. IMAGING
96. NUC. MED.INSTR.
97. GEOPHYSICAL
98. PROCESS CONTROL
99. OTHER

Fig 38. Instrument types for a