User Guide: Computer Program for Tissue Doses in
Diagnostic Radiology (CDI3 – IBM-Compatible PC Version)

Introduction

There are two modes of operation for the CDI3 program, BATCH and INTERACTIVE. In the BATCH mode, the program reads and processes input data from an external data file, until all of the records have been read from the file and processed. In the INTERACTIVE mode, the user is prompted for the required input data during the program run.

Description of Files on Diskette

The program files are stored on a double-sided, IBM-compatible floppy diskette, with at least 360k storage. It was formatted with the command FORMAT A: and does not have system files on it. The program file is a compiled version of the FORTRAN source code and is named CDI3.EXE. The file containing the input data (for BATCH mode only) is an ASCII text file with the name CDI3.DAT. The file in which tissue-air-ratios (TARs) are stored is CDI3TAR.DAT which is a direct access sequential data file with fixed length records. X-ray spectra are stored in the file CDI3HVL.DAT, which is also a direct access sequential data file with fixed length records. The file CDI3.OUT, which is an ASCII text file, is the output file containing the tissue dose tables from the computer run.

Getting Started

For PCs with a hard-disk (internal) drive

On first use of the program on hard-disk, the user must create a directory on the hard-disk drive in order to store the program files. To do this, first go to the root directory of the hard-disk drive by typing CD\. Then make the directory called XRAY by entering the command MKDIR XRAY. Now that the directory has been made, place the floppy diskette into the A drive of the computer and copy all of the diskette files into the XRAY directory by entering COPY A:*.* C:\XRAY. The program files have now been copied from the diskette onto the hard-disk in the XRAY directory. The program is now ready to run in BATCH mode or INTERACTIVE mode.

On subsequent use of the program on hard-disk, recall the directory created above by entering CD \XRAY before running in BATCH or INTERACTIVE mode.

For PCs with only one or two floppy drives (no hard-disk)

When running the program in a floppy drive, just place the diskette into the desired drive. The program is now ready to run in either BATCH or INTERACTIVE mode.

BATCH Mode

During BATCH mode processing, the external data file CDI3.DAT, which contains the input data for each record is read. There is no limit to the number of records that may exist in this file. A description of the proper format for

input data is given on pages 8, 9 and 10 of the reference report (1). Examples of input records (each is contained on a single line) are given at the bottom of the tables on pages 55 through 60 of reference (1).

Before attempting to run the program in BATCH mode, prepare the external data file CDI3.DAT. There are two ways to accomplish this:

1. Create (or edit) CDI3.DAT using an ASCII text file editor in DOS. Be sure that each input record has the proper format and is on a single line. Or,

2. Call up XRAY directory in whatever wordprocessing program is resident on the computer. Create (or edit) CDI3.DAT. Be sure that each input record has the proper format and is on a single line. Save the file as an ASCII text file, not a wordprocessing document, retaining the name CDI3.DAT. Exit to DOS and access the XRAY directory.

The user is now ready to run the program in BATCH mode. Make sure the CAPS LOCK is set ON. Enter the command CDI3. The program first asks the user if BATCH or INTERACTIVE mode is to be used. Answer this prompt with a B (meaning BATCH mode). Next, the program types to the screen the message OUTPUT FILENAME IS "CDI3.OUT" which tells the user the name of the output file which will contain the tissue dose tables. During the program run, data in the input data file CDI3.DAT are read and processed. For each record in CDI3.DAT, a tissue dose table will be stored in the output file CDI3.OUT.

When the run is complete, the output file CDI3.OUT can be printed, but before continuing, the printer mode must be set. For laser printers, it is recommended that the "compressed" or "condensed" mode be used in either "portrait" or "landscape" format. For dot-matrix printers, it is also recommended that the "compressed" or "condensed" mode be used. Consult the instructions that came with the printer for how to do this. Once the mode has been set on the printer, enter the command PRINT CDI3.OUT. Then, specify the device by entering either LPT1 if the parallel output port is used or COM1 if the serial output port is used. CDI3.OUT can also be printed from your wordprocessing program after proper formatting.

Examples of tissue dose tables for various program options are given in reference (1), Appendix G.

INTERACTIVE Mode

Before running the program in INTERACTIVE mode, make sure the CAPS LOCK is set ON. Then, type the command CDI3. The program first asks the user whether the BATCH or INTERACTIVE mode is to be used. Enter I to select INTERACTIVE mode.*

Now the user is prompted for the necessary input data as follows:

(a) Enter the appropriate projection number from the list provided (e.g., 17).

(b) When projection number 44 is selected, the user is asked if it is also a fluoroscopic projection. At the prompt, select a Y or N. If Y is selected, additional instructions about input are given later. See also page 1 of reference report (1).

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*   The INTERACTIVE mode can be aborted at any time by holding the CTRL key down and pressing the C key at the same time. This will return the user to DOS.

(c) Enter the projection name (e.g., CHEST), not to exceed 20 characters.

(d) Some projections require a view to be selected. At the prompt, select a 1, 2, or 3, for PA, AP, or LAT view, respectively.

(e) The next option prompts for the use of x-ray spectra for high-Z (i.e., erbium) filters. If this option is to be used, enter Y, and then select choice 1 or 2, which correspond to erbium composite and erbium foil, respectively. A sample tissue dose table using this option is given on p. 59 of reference (1). (If this option is used, the user will not be asked for the next two entries for kVp and HVL, nor the last option on original x-ray spectra.)

(f) Enter the tube potential in kVp, (e.g., 100) or leave blank. When left blank, the program uses all 27 x-ray spectra for conventional aluminum filtration and will produce a tissue dose table as given on p. 57 of reference (1); otherwise it uses only the 9 x-ray spectra appropriate to the entered kVp and will produce tables as indicated in (g).

(g) If a kVp value has been entered, the user will be prompted for the HVL (mm Al). If a specific HVL is entered (e.g., 2.70), the program will compute and display data for only that HVL. See the sample tissue dose table on p. 58 of reference (1). If no specific HVL is entered, the program will compute and display a table for the appropriate range of HVLs. See the sample tissue dose table on p. 55 of reference (1).

(h) Enter the skin entrance exposure (free-in-air) in mR (e.g., 25).

(i) If projection number 44 was selected and it is also a fluoroscopic projection, the user is instructed to input both the source-to-image receptor distance (SID) and the source-to-skin entrance distance (SSD). If the projection is a radiographic projection, only one distance (SID or SSD) is input.

Note: In steps (j), (k), (l), (m), and (n), the input must include one decimal place, even if it is zero.

(j) Enter the source-to-image receptor distance (SID) in centimeters (e.g., 183.0).

(k) Enter the source-to-skin entrance distance (SSD) in centimeters (e.g., 163.0). The SSD is required for a fluoroscopic projection. The SSD is requested for a radiographic projection only if the SID is not entered.

(l) Enter the horizontal field size at the image receptor in centimeters (e.g., 35.6).

(m) Enter the vertical field size at the image receptor in centimeters (e.g., 43.2).

(n) If projection number 44 was selected, the user now enters the field center coordinates (at the surface of the patient) expressed as the distance from the reference patient midline in centimeters (e.g., 0.0 or -5.0), followed by the distance from the vertex (top of the head) of the reference patient in centimeters (e.g., 42.4). See Appendix E in reference (1) for the reference patient coordinate system. For a sample tissue dose table for projection 44 that is also a fluoroscopic projection, see p. 60 of reference (1).

(o) When a specific kVp was entered in (f) and no specific HVL was entered in (g), one can choose whether or not to present the tissue doses in the output table for the appropriate 9 original x-ray spectra instead of as a function of HVL. To do this enter a Y or N. This option applies only to conventional aluminum filtration. See the sample tissue dose table on p. 56 of reference (1).

After all of the input data have been entered, the input data specified by the user are displayed on the screen. If all of these data are correct, enter Y; otherwise enter N and select the field that needs to be changed. If corrections need to be made, follow the ensuing directions, and then finally enter a Y. The program will now display on the screen OUTPUT FILENAME IS "CDI3.OUT" and proceed to estimate tissue doses. When this run is complete, the user will be asked whether there is another record. If you want to enter another record, enter Y, if not enter N.

When all the desired records have been run, the output file CDI3.OUT can be printed, but the printer mode must first be set. For laser printers, it is recommended that the "compressed" or "condensed" mode be used in either "portrait" or "landscape" format. For dot-matrix printers, it is also recommended that "compressed" or "condensed" mode be used. Once the mode has been set on the printer, enter the command PRINT CDI3.OUT. Then, specify the device by entering LPT1 if the parallel output port is used, or COM1 if the serial output port is used.

Run-time Statistics

The following table gives typical run-time performance on various PCs.

Type of PC	Run-time per record*
XT 8088	5 minutes
AT 80286	85 seconds
XT 8088 w/8087 math coprocessor	25 seconds
AT 80286 w/80287 math coprocessor	15 seconds
AT 80386 w/80387 math coprocessor	5 seconds

* Run times listed are for a hard-disk (internal) drive. Run times may be as much as twice as long if a floppy drive is used.

(1) L.E. Peterson and M. Rosenstein. Computer Program for Tissue Doses in Diagnostic Radiology (for VAX and IBM-Compatible PC Systems), April 1989. Available from the Office of Health Physics, Center for Devices and Radiological Health, 1901 Chapman Avenue, Rockville, Maryland 20857.