PACKAGE ID - 000444IBMPC01 CINDY1.4

KWIC TITLE - Code for INternal DosimetrY

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LIMITATION CODE -COPY **AUDIENCE CODE -** LIM

COMPLETION DATE - 10/31/2001 **PUBLICATION DATE -** 06/30/1995

DESCRIPTION - The Code for Internal Dosimetry Software Package (CINDY1.4) was developed to assist in the interpretation of bioassay data, provide bioassay projections, and evaluate committed and calendar-year doses from intake or bioassay measurement data. CINDY1.4 addresses the U.S. Department of Energy's (DOE) Order 5480.11 and the U.S. Nuclear Regulatory Commission's (NRC) 10 CFR 20 by providing the capabilities to calculate organ dose equivalents and effective dose equivalents using the International Commission on radiological Protection (ICRP) 30 approach. Biokinetic models, which allow user-modified parameter values, are used to estimate intakes based on bioassay data using weighted and unweighted least-squares regression between measured and expected bioassay values, to estimate organ burdens as well as urinary and fecal excretion rates from a given intake, and to determine organ doses for annual, 50-year, calendar year, or any other time point. Intakes to be considered may be either acute or chronic, and may consist of many combinations of intake routes, radionuclides, and physical and chemical forms. A four-compartment input model (with user defined parameters) is used for wounds and absorption. Direct injection can be simulated as direct absorption. Appropriate metabolic models for each radionuclide are selected by the user from menus. Metabolic models available in CINDY1.4 are the ICRP 30 lung model, ICRP 30 gastrointestinal model, ICRP 30 general systematic model, Johnson and Dunford tritium model, ICRP 30 tritium model, including the Johnson HT lung model, Johnson alkaline earth model, ICRP 54 iodine model, tellurium-iodine model, Jones excretion model, Durbin excretion model, ICRP 54 excretion models, Wrenn-Lipsztein uranium model, Fisher Modified Wrenn-Lipsztein uranium model, and the ICRP 30 carbon model.

PACKAGE CONTENTS - Media Directory; Software Abstract; CINDY Quality Assurance Key Ordering Information; PNL-7493 part 1 Rev.1; PNL-7493 part 2 Rev.1 plus Errata; Cindy Update-October 2001; Media Includes Executables, Text Libraries, Sample Problem Input and Output;

SOURCE CODE INCLUDED? - No

MEDIA QUANTITY - 1 CD Rom

METHOD OF SOLUTION - Evaluation of radiation dose, organ retention, and excretion involves numerical solution of the differential

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METHOD OF SOLUTION -(CONT) equations describing intake of activity (by inhalation, ingestion, absorption, or wounds), metabolism nad translocation (involving various body organs and systems), and elimination from the body. CINDY obtains precise estimates of solutions to these differential equations used to determine radionuclide amounts in various model compartments over time. The heart of the CINDY1.4 package is the numerical solver used to evaluate the intake, metabolism, and excretion of radionuclides. The solver used in CINDY1.4 is the LSODES package (from the ODEPACK collection developed at Lawrence Livermore National Laboratory).

COMPUTER - IBM PC

OPERATING SYSTEMS - Windows 2000

PROGRAMMING LANGUAGES - FORTRAN AND QUICKBASIC

SOFTWARE LIMITATIONS - The following limits define the calculational capability of CINDY1.4. Only 70 time periods may be considered in a single calculational run; Only 10 intake components may be considered in a single calculational run; Only 3 bioassay types may be considered in a single calculational run; Radionuclides must be selected from the 222 radionuclides in the master list; Radionuclide chains may be comprised of up to 3 explicit chain members and any number of implicit daughters.

SOURCE CODE AVAILABLE (Y/N) - N

UNIQUE FEATURES - Four methods for intake estimation include a user-defined weight for each bioassay measurement, estimate organ burdens as well as urinary and fecal excretion rates from a given intake for any time-point, estimate organ doses for annual, 50-year, calendar-year, or any other time point; calculations of annual limit on intake, derived air concentration (DAC), and DAC-hours are available as are report formats to meet NRC internal dosimetry reporting requirements; intakes to be considered may be either acute or chronic, and may consist of many combinations of radionuclides, intake routes and physical and chemical forms; exposure modes supported include inhalation, ingestion, wound, and absorption; includes a four-compartment input model for wounds and absorption with user defined compartment deposition fractions and removal half-times. Direct injection can be simulated as direct absorption.; most model parameters may be modified by the user, modified models are automatically saved and retrieved; easy to use; menu-driven; retrieves and stores identification, bioassay data, and exposure information, as well as results of calculations by subject; bioassay data and subject information may be entered interactively or imported in a standardized format; site configuration files provide a mechanism for customizing the software to a particular site or user by defining default input variable values, available radionuclides, activity units, screen

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UNIQUE FEATURES -(CONT) colors, and option values; default values are provided for most variables; graphic representations of the models may be viewed on the screen; graphic results are available for intake assessments and bioassay; graphic results may be viewed on the screen or printed; graphs may use linear, log, or semi-log scales; graphs are automatically scaled; the user may alternately specify minimum and maximum axes values; text reports may be selected from a list of 14 report options.

RELATED SOFTWARE -

OTHER PROG/OPER SYS INFO - The CINDY1.4 Quality Assurance KEY IS NOT INCLUDED WITH THE PACKAGE, IT IS AVAILABLE FROM CANBERRA INDUSTRIES INC., (203) 238-2351. Within the software package, intakes are handled as a collection of intake components where each component consists of a single exposure pathway, exposure duration, and radionuclide physical or chemical form. CINDY1.4 determines the intake components for a given intake, based on user input describing the exposure, and on the bioassay data entered. The user interface makes CINDY1.4 easy to use. Menu-driven, the user interface anticipates the next logical action to occur and positions the cursor bar on that option. Menus stacking provides a road map of where the user is within the software. The user interface controls windows used for the display and entry of all input parameters. Version 1.4 utilizes a software quality assurance key to control access to features of CINDY1.4. This key allows you to make an unlimited number of backup and/or demonstration copies of the software. The quality assurance key is a physical device that plugs into the first parallel printer port (LPT1) and can be obtained from Canberra industries. Information for ordering the quality assurance key is included with the package. The software quality assurance key must be installed on the host computer to access all of CINDY1.4's features. If the key is not present CINDY1.4 operates in a demonstration mode where most features, but not all, may be accessed. Version 1.4 of CINDY operates successfully under PC-DOS and MS-DOS Version 3.3. PC-DOS Version 5.0 is recommended because memory resident code may reside in expanded memory consequently allowing more room for the CINDY software. Version 1.4 of CINDY has not been designed to execute under Microsoft Windows; however, execution under Windows may be possible. SOURCE CODE IS NOT INCLUDED WITH THE PACKAGE.

HARDWARE REQS - CINDY1.4 will run on an IBM PS/2 or fully-IBM-compatible comupter configure with an IBM Video Graphics Adapter (VGA) monitor, an 80387 math co-processor, 640 kilobytes of RAM, a minimum of 8 megabytes of free disk space, a 5-1/4 in. or 3-1/2 in. high-density floppy disk drive, and a parallel printer port. A printer is required if printed reports are necessary. For printed gaphic output, either an HP LaserJet or an Epson/IBM-compatible dot matrix printer is required. The CINDY1.4 software may also be installed on an IBM AT computer, configured

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HARDWARE REQS -(CONT) with a VGA monitor, an 80287 math co-processor, 640 kilobytes of RAM, a minimum of 8 megabytes of free disk space, and either a 5-1/4 in. or 3-1/2 in. high density floppy disk drive. Although most portions of the code will be operational, dose calculations for radionuclides with explicit daughters are not possible on this hardware configuration. The CINDY1.4 Quality Assurance Key, available from Canberra Industries Inc., is necessary to operate CINDY1.4 except in a demonstration mode.

TIME REQUIREMENTS - The time required for a calculation may vary from a few seconds to a few minutes based on the computer hardware, the number of intake components considered, the operational mode, the calculational complexity of the models, the number of radionuclides in the decay chain and the half lives of each chain member.

REFERENCES - D.L. Strenge, R.A. Kennedy, J.R. Johnson, and M.J. Sula, Code for Internal Dosimetry (CINDY Version 1.2) Part 1, Conceptual Representation, PNL-7493, Pt.1, Rev. 1, July 1992 plus Errata; R.A. Kennedy, and D.L. Strenge, Code for Internal Dosimetry (CINDY Version 1.2) part 2, User's Guide, PNL-7493, Pt.2, Rev. 1, July 1992 plus Errata.

ABSTRACT STATUS - Submitted August 1992. CINDY 1.3C submitted February 1993. CINDY1.4 submitted September 11, 1996. Released AS-IS 9/16/96. Cindy 1.4 updated to run under Windows 2000 in October 2001.

SUBJECT CLASS CODE - G

SPONSOR - DOE/EH

PACKAGE TYPE - AS - IS