

Internal Dose Computer Programs

Learning Objectives

- Identify several computer codes used in internal dosimetry
- Demonstration of the IMBA code

Use of Computer Programs in Internal Dosimetry

Most bioassay codes are expensive (\$10--20k)

You may need one only if lots of situations annually with multiple data points

- single data points: $I = V/m(t)$

- multiple data points: average I

or $\Sigma V / \Sigma m(t)$ on a spreadsheet

Codes may not work the way you want (“vision” of the author)

Source code may be proprietary

Use of Codes

- Codes will give useful information
 - Intakes from bioassay data
 - $m(t)$ tables
 - Dose
 - Intakes or dose with modified parameters
 - Fitted curves
- If you use - document, document, document
 - input data
 - input data files
 - output data
 - program, version, platform
 - any confirmatory data- hand calculations, etc.

ICRP30-Based Codes

- CINDY
 - “Computerized Internal Dosimetry”
- REMedy
- INDOSE
- GENMOD
- DOSEXPERT

Other Codes

- LUDEP
 - ICRP66 lung model basis
- MIRDOSE
 - limited application to occupational exposures
- IMBA
 - Based on LUDEP, includes all newer models

CINDY

Computerized Internal Dosimetry Software Package

- Developed by PNL for DOE

- Four Modes:

Intake assessment based on bioassay

Dose assessment-specified time periods

Dose assessment-calendar year doses

Bioassay projection

Based on ICRP 30 metabolic models

Can modify models to fit individual

WORKING DRAFT

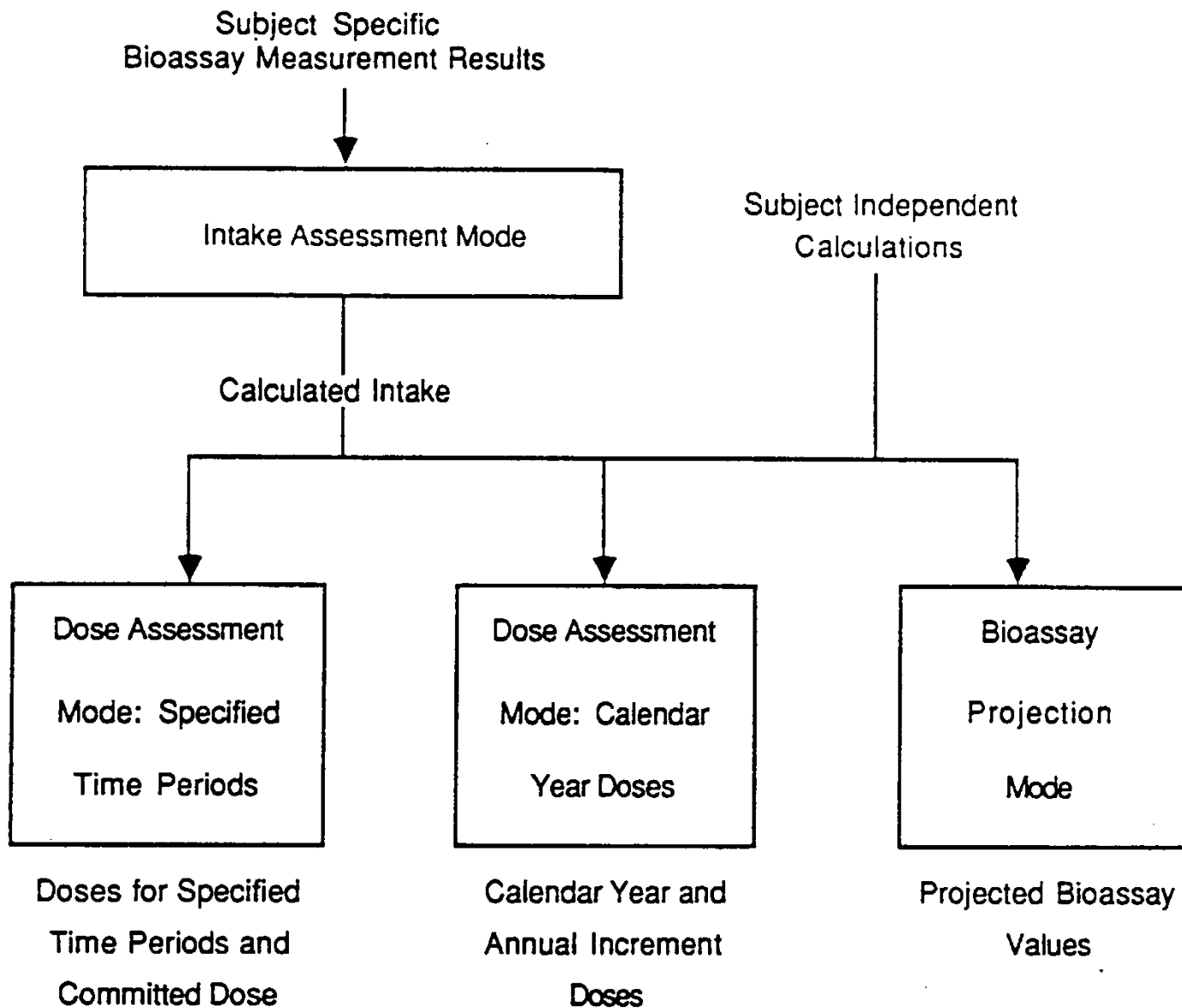
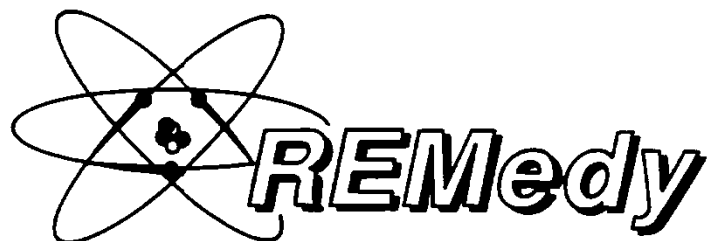


FIGURE 3.1. CINDY Operating Modes

REMedy

- Developed by SAIC
- Dose on basis of bioassay results or air concentration data
- REMedy-A: dose from air concentration data
- REMedy-B: dose from bioassay data
- REMedy-C: “Complete” combines A & B
- REMedy-D: dose for alternate metabolic models
- Also based on ICRP 30 models

SAIC-87/1578
Rev. 2



A MICROCOMPUTER PROGRAM FOR THE EVALUATION
OF RADIONUCLIDE INTAKE AND DOSE
FROM BIOASSAY OR AIR CONCENTRATION DATA

PROGRAM MANUAL
Configuration C-Plus 2.0

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Printed on 01/15/93 at 16:42:59 This report resides in File : lpt1
Generated on 01/15/93 at 16:42:59 Generated from REMedy File : Current.dat

***** SAIC REMedy Intake/Dose Evaluation Report *****
*
* CASE : Acute Inhalation of PU-239 W on 15 JUN 1992
* BIOASSAY : Fecal Analysis on 23 JUN 1992 - 3.63E-05 Bq/gm ID# 92-4098
*

***** INPUT DATA *****
Subject Name : John Doe ID# 116535
Analyst : J. Brown ID# 100349

AMAD (um) : 1.00
Days Post Exposure: 8.0

Lung Model : ICRP30 Lung Model ID : LungDat.lib

ALI (Bq) : 2.00E+02 Screening Level(Bq) : 1.00E+01
ALI (uCi) : 5.41E-03 Screening Level(uCi) : 2.70E-04

TC Half-Time(Days): 2.50E-01 Fu : 5.40E-01
F1 : 1.00E-03 Ff : 4.60E-01

***** RESULTS USING ICRP-30 SYSTEMIC MODEL *****
Retention Fraction at Time Post-Exposure : 4.90E-03
Intake (Bq) : 1.00E+00 % ALI : 0.50
Intake (uCi) : 2.70E-05 % Screening Level : 10.00

ORGAN	50-Year Committed Dose		First-Year Dose	
	[Rem]	[Sv]	[Rem]	[Sv]
GONADS	3.17E-03	3.17E-05	5.40E-05	5.40E-07
BREAST	2.98E-09	2.98E-11	8.91E-08	8.91E-10
R.MARROW	1.70E-02	1.70E-04	4.10E-05	4.10E-07
LUNGS	1.73E-03	1.73E-05	1.70E-03	1.70E-05
THYROID	4.36E-10	4.36E-12	8.91E-08	8.91E-10
ENDOSTEAL	2.10E-01	2.10E-03	5.13E-03	5.13E-05
REMAINDER	1.06E-02	1.06E-04	3.70E-04	3.70E-06
EFFECTIVE	1.10E-02	1.10E-04	5.13E-04	5.13E-06

***** DOSE FACTORS USED IN CALCULATIONS *****
Organ Dose Factor [Sv/Bq]

GONADS 3.17E-05
BREAST 2.98E-11
R.MARROW 1.70E-04
LUNGS 1.73E-05
THYROID 4.36E-12
ENDOSTEAL 2.10E-03
REMAINDER 1.06E-04
EFFECTIVE 1.10E-04

COMMENTS:

SIGNATURE:

Authorized Licensee : CPB29 BETA TEST VERSION ----- WILLIAM FAIRMAN

INDOS

- Distributed by Skrable Enterprises, Inc.
- Intake estimation
- Bioassay modeling
- Individual-specific biokinetics
- Includes MICROFIT program to do least-squares fitting to test various models

LUDEP

- LUng DEPosition using the ICRP66 lung model
- Distributed by NRPB in the UK
- Intake estimates
- Bioassay prediction
- DCF's based on new models and tissue weighting factors

IMBA

- Integrated Modules for Bioassay Analysis
- Outgrowth of LUDEP; uses ICRP-66 HRTM, ICRP-30 GI tract model, NCRP wound model, and ICRP 78 biokinetic models.
- Includes bioassay interpretation modules
- Can generate IRFs and dose coefficients
- Distributed by JABA software, Richland, WA

Issues with Codes

- Codes may have errors, so Benchmark – run a problem that you have worked out completely, understand thoroughly, and completely endorse.
 - If you run a code with several benchmarks and get within 10% of the “right” answer, then you can say that you understand it.
 - Still, never treat the codes as “black boxes”
 - read the documentation
 - understand the assumptions and methods
 - “exercise” the system regularly
 - do NOT benchmark one code with another