

# 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
- DOSEXPRT

# 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

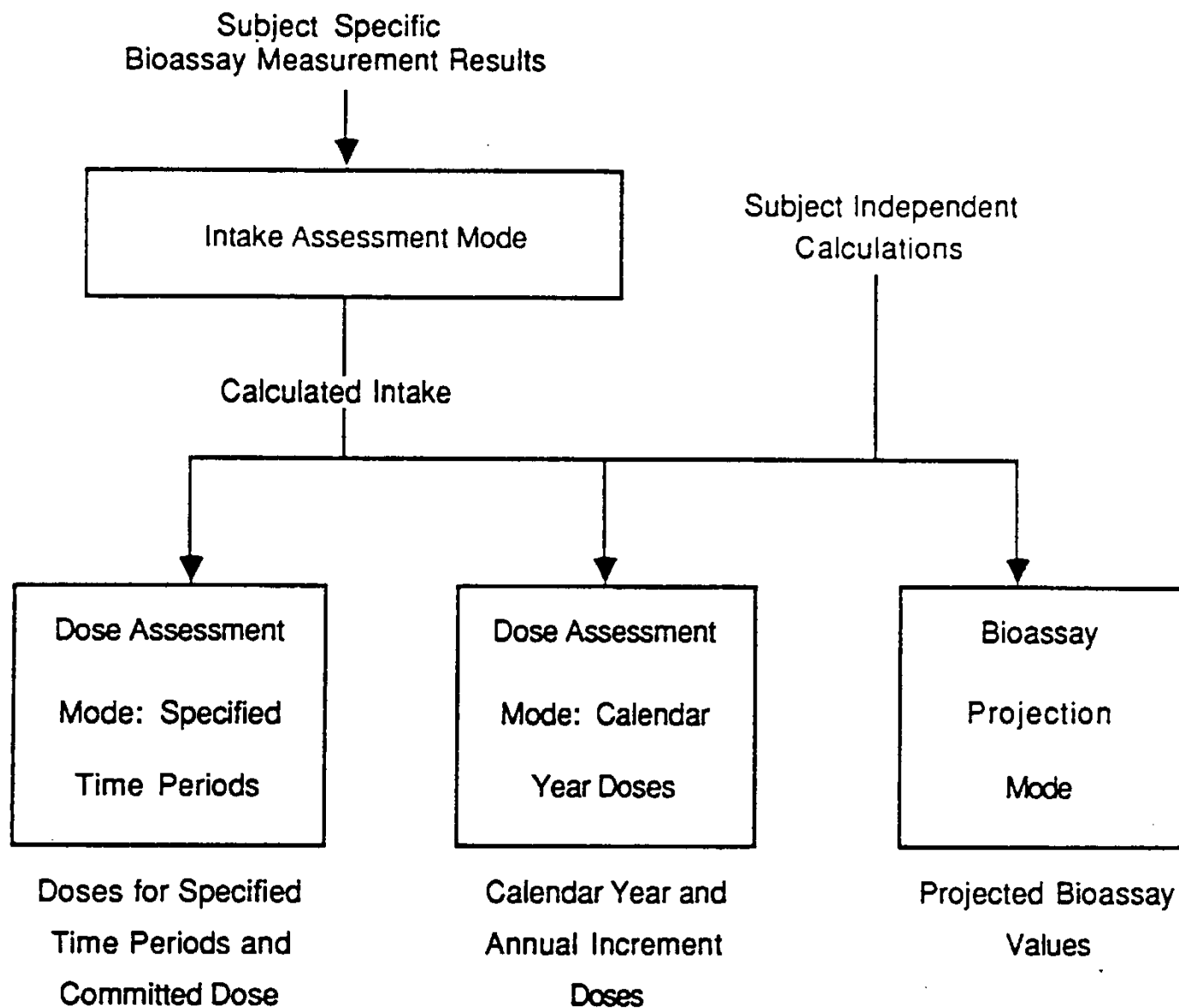
Dose assessment-calendar year doses

Bioassay projection

Based on ICRP 30 metabolic models

Can modify models to fit individual

# WORKING DRAFT



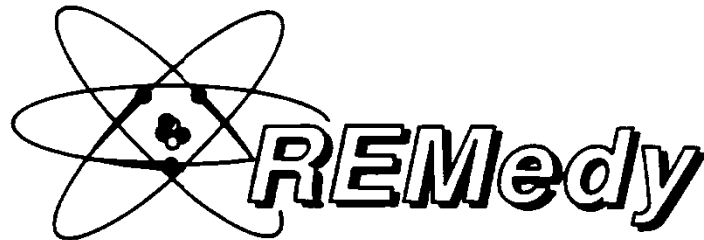
**FIGURE 3.1. CINDY Operating Modes**



# 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 Skrabble 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