# 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

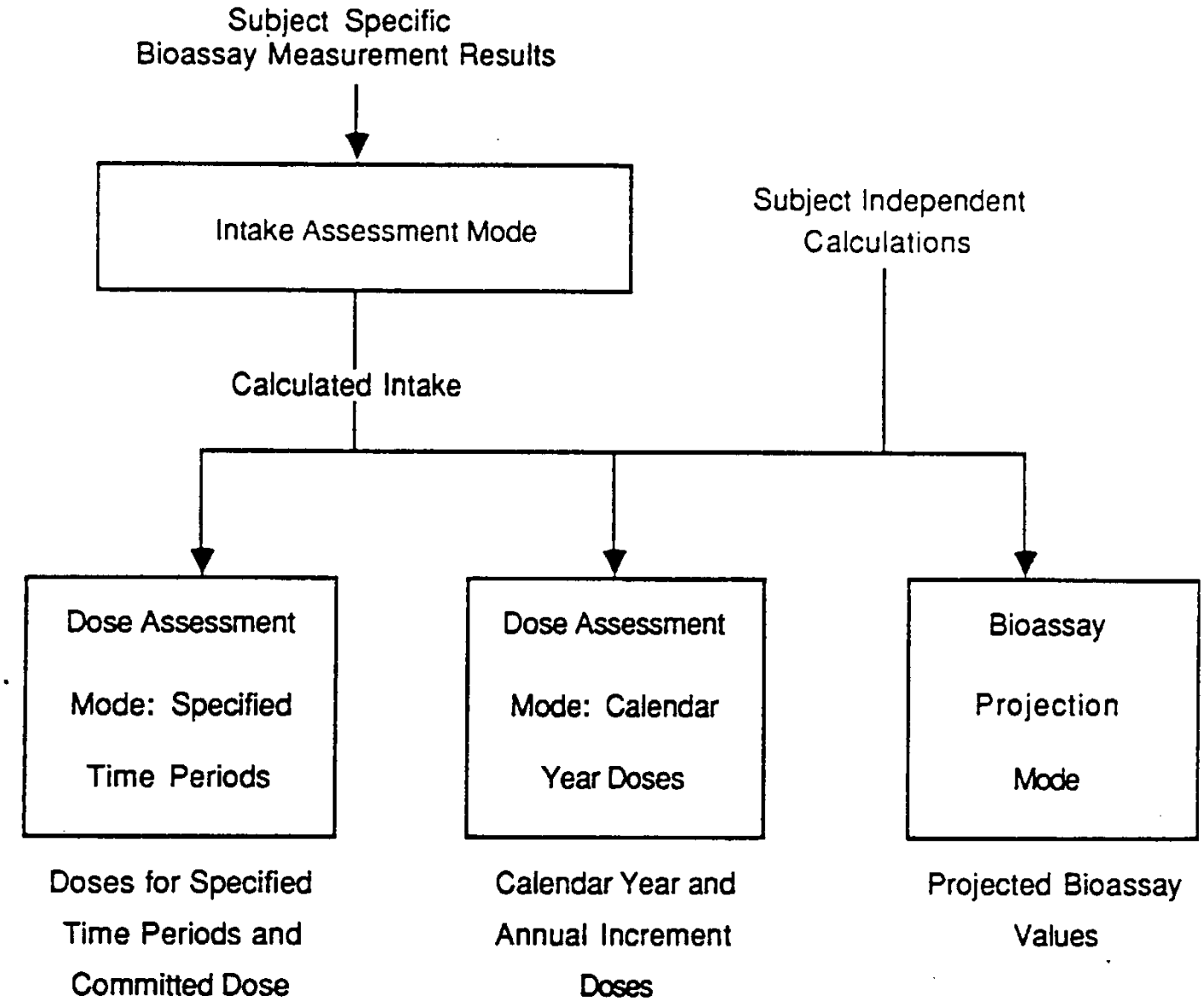
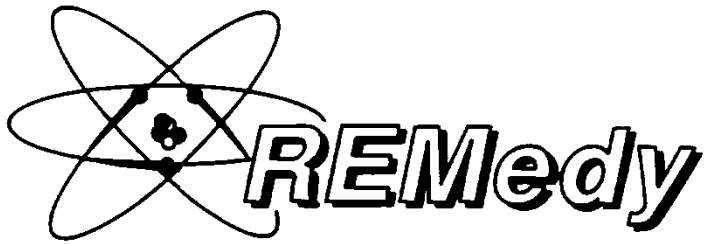



FIGURE 3.1. CINDY Operating Modes

# 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 : CP829 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