

# Quick Reference Guide to ICAT

## A Program to Help Radiation Professionals Use Radiation Measuring Instruments To Assess Acute Intakes of Radionuclides

**Note to Users:** This guide is intended to assist in entering data and displaying results. It does not provide guidance for acquiring the data and interpreting the results.

ICAT (Internal Contamination Assessment Tool) includes two screens for user input and output. The first screen is displayed when the program opens—you can return to it by pressing the *Client* tab in the upper left-hand corner of each screen. The other screen is marked *Energy Windows*. The use of these screens is discussed below. On some computer display monitors, the first screen may overflow the size of the display. Scroll bars are provided on the right and bottom sides of the screen, as needed, to enable you to see the rest of the screen.

I. *Client*: The screen consists of five panels. The panels are discussed in counter-clockwise order, starting with the upper left-hand corner.

A. First Panel (upper left-hand side of screen)

1. Last name of the client—required
2. First name—optional
3. Age—required. Actual age must be selected for all clients under 25 years of age
  - a. For clients 25 years or older, select “25 or older”
  - b. For infants under 1 year, enter age in months.
4. Sex—required for clients over 15
5. Weight of client—you should specify known or estimated weight if client is less than 15 years old. This entry is optional but recommended: entering the weight enables a more accurate assessment since body size affects the instrument reading for a given intake.

B. Second Panel (lower left-hand side of screen)

1. Select instrument—required. ICAT includes data on three actual instruments, as well as exposure rates that can be measured using a generic survey meter.
  - a. Ludlum 44-2 gamma scintillation probe: The detector is a 1 × 1 in (2.54 × 2.54 cm) NaI(Tl) scintillation crystal. The data may apply to other probes that employ the same-size crystal and an aluminum housing—the applicability of the data depends on the similarity of the design of such a probe to the Ludlum model.
  - b. Captus 3000 thyroid probe: The detector is a 2 × 2 in (5.08 × 5.08 cm) NaI(Tl) scintillation crystal. The data may apply to other probes that employ the same-size crystal and a lead-lined collimator—the applicability of the data depends on the similarity of the design of such a probe to the Captus model.
  - c. TPM-903B Portal Monitor: This monitor contains two 1.5 × 3 × 72 in (3.81 × 7.62 × 183 cm) PVT (polyvinyltoluene) plastic scintillators. The monitor can have one of two configurations: standard, with a space of 32 in (81.3 cm) between the columns, and extra-wide, with 39.4 in (100 cm) between the columns. (This is the actual clearance between columns, not the center-to-center distance.) The data may apply to other monitors of similar design.
  - d. Exposure rate: Select this option if the radiation monitor cannot be represented by one of the above three instruments, but has an output that displays exposure rates in units of μR/h. Be aware that the nominal meter readings may be dependent on photon energies.

2. Date and time of measurement—required. The correct date and time are essential, since the readings will change with time.
  3. Location: Select the location of the detector with respect to the body for any instrument except the TPM-903B. For all radionuclides, you can select the chest location for inhalation and the abdomen location for ingestion, but not vice-versa. In the case of  $^{131}\text{I}$ , you can also take readings from the thyroid. For the chest location, center the detector on the lungs, either in front of the body (anterior aspect), or the back (posterior). For the abdomen, center the detector on the stomach, either anterior or posterior. For the thyroid, center the detector in front of the thyroid. For all three locations, you can place the detector at the default distances displayed on the screen, or at some intermediate distance by clicking “Other” and selecting the units (inches, feet, or cm). Using one of the default distances improves the accuracy of the assessment.
  4. Client readings—required: For the Ludlum 44-2 or the Captus 3000 probes, you have a choice of four units: cpm, kcpm, total counts, or total kcounts. Use whichever units are applicable. For total counts or total kcounts, you must also enter the counting time in minutes. There are no choices of units for the TPM-903B nor for instruments reading exposure rates.
  5. Background—required: Background should be measured with the client at a distance from the detector and repeated periodically.
- C. Third Panel (bottom of screen): Notes—optional. Notes entered about the client will appear in the client’s file and the printout.
- D. Fourth Panel (lower right-hand side of screen)
1. Principal mode of intake—required: If the client was exposed to radioactive material that was dispersed as an aerosol or airborne dust, the intake was primarily by inhalation. If the individual consumed radioactively contaminated food or drink, the intake was by ingestion.
  2. Date and time of intake—required: Enter the actual date and time the client inhaled or ingested the radioactive material. Assessments cannot be performed if the intake was less than 1 hour or more than 30 days before the time of measurement.
  3. Principal radionuclide: Any of the four listed radionuclides can be assessed by this program. The radionuclide should be identified by radiation professionals with expertise in radionuclide identification.
  4. Lung absorption type—required for inhalation of  $^{60}\text{Co}$  or  $^{192}\text{Ir}$ . A field will appear to the right of the principal radionuclide selection buttons listing the different lung absorption types for either of these radionuclides. Type *F* (fast), *M* (medium), or *S* (slow) refers to the speed with which different chemical forms of the radionuclide are absorbed by the lungs. The various chemical forms corresponding the lung absorption types of each radionuclide are also listed. If the chemical form is unknown, select the type that corresponds to “Unspecified compounds,” which is the default selection.
- E. Fifth Panel (upper right-hand side of screen)
1. Choose units for displaying results
    - a. Conventional units: intake in  $\mu\text{Ci}$  (microcuries), doses in rem
    - b. SI units: intake in MBq, doses in mSv.
  2. Press “Calculate Results” only after you have reviewed or revised entries in the next screen.

## II. Energy Windows

You will see a set of default energy windows—upper and lower energy limits—for the selected instrument and for the radionuclides in the current data base. In the case of the Ludlum 44-2 and the Captus 3000 probes, the limits are listed in units of keV of photon energy. If you use a simple ratemeter, you cannot set energy limits on the Ludlum 44-2 and should therefore use the default energy window specified by ICAT. However, the probe can also be used with a single- or multichannel analyzer, in which case you can set upper and lower energy limits to reduce counts due to background. The Captus 3000 system incorporates default energy windows for radionuclides of clinical interest that are different from the ones listed by ICAT. You should change either the instrument settings or the default values in ICAT to ensure that the ICAT values you use are the same as those on the instrument. To change an ICAT energy window for either instrument, select “Custom” and then click the “Edit Energy Windows” box at the top of the screen. You can then edit the upper and/or lower energy limits for the radionuclide of interest. Next, click the “Save Energy Windows” box at the top of the screen. This will save the custom windows. To utilize these windows the next time you run ICAT, you need only select “Custom.” Clicking “Restore Original” undoes the changes for the given instrument.

In the case of the TPM-903B, the energy windows are governed by the upper and lower discriminators (ULD and LLD) on the controller. These settings are displayed in units of volts (V)—according to the manufacturer, 1 V  $\approx$  330 keV photon energy. However, photon energies calculated in this manner can vary by  $\pm 20$  keV, especially at the lower end of the spectrum. Two sets of windows are provided by the program, with LLDs of 0.068 V and 0.098 V, respectively. The lower value is the factory default on units being currently sold, while the higher one was set on units produced earlier. You can reset these values on the instrument as well as in ICAT. Again, the ICAT values must correspond to those on the instrument to produce a meaningful result.

## III. Results

### A. Calculate Results

After all entries are completed, return to the *Client* screen and press “Calculate Results.” The calculated intake, the cumulative effective dose from the time of intake to the time you press the button (not to the time of measurement), and the committed lifetime dose in the absence of medical intervention are displayed in the specified units. Note: Make certain the correct time and date are set on your computer in order to correctly calculate the cumulative effective dose to the present time.

Press “Print Results” to produce a one-page report on the individual client that lists the calculated results as well as all the information you have entered.

The information on each client is saved to a text file in the *Clients* subfolder that can be viewed using the Microsoft Notepad program that is furnished with Microsoft Windows or any other text editor. The file is named according to the following convention: *lastname\_firstname\_yymmdd\_n.txt*, where *yy* is the 2-digit year, *mm* is the month and *dd* is the day of the month, both expressed as 2-digit numbers, *n* is a sequence number, starting with 1. The sequence number is incremented if more than one assessment is performed on a person with the same first and last name on the same day. To access the file, click on the link that appears in the bottom margin of the *Client* screen, and then click on the name of the file you want to examine.

B. Next Client: Pressing this box will reset all the client-specific data. New entries must be made as follows:

1. The client's name

2. The client's age
  3. The client's sex if the age is 15 or older
  4. The weight should be entered if known and if the client is younger than 15.
  5. The date of measurement will be reset to today's date—it must be changed if this is not correct.
  6. The time will be reset to the present—a new time must be entered if this is not correct.
  7. The background will not be reset, but should be re-entered if the background has changed since the previous client was counted.
  8. The client measurement data must be entered.
  9. All other entries will remain unchanged. However, you should review these entries to make sure they are still valid.
- C. Clear Incident Data: Pressing this box, which is in the lower right-hand panel, will reset the date and time of the incident, the data on the radionuclide, and the instrument reading.