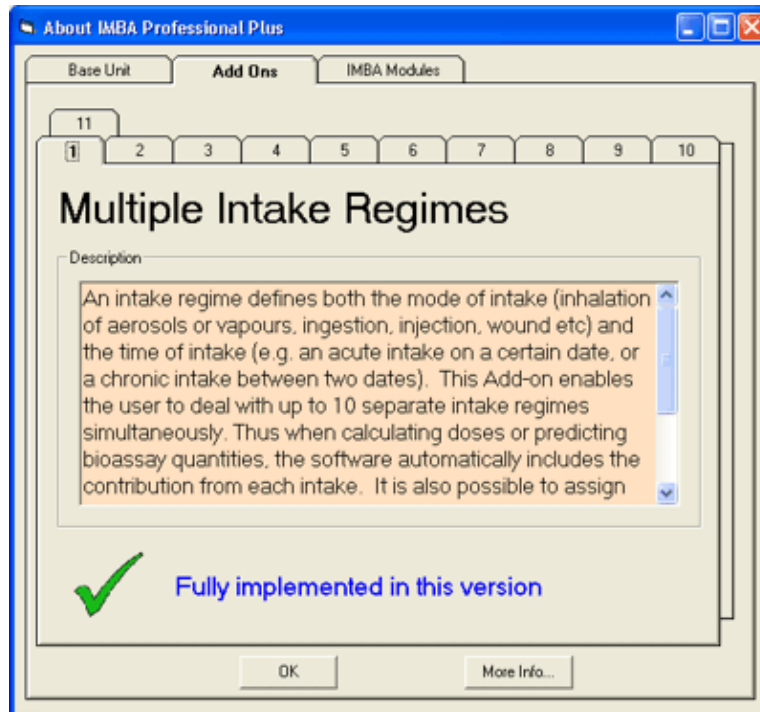


Additional Functionality in IPP "Add-Ons"



The following [Add-On](#) modules increase the functionality of the [IMBA Professional Plus \(IPP\) - Base Unit](#):

- Add-On 1 - [Multiple Intake Regimes](#).
- Add-On 2 - [Multiple Bioassay Types](#).
- Add-On 3 - [Associated Radionuclides](#).
- Add-On 4 - [Uranium Mixtures](#).
- Add-On 5 - [Uptake from a Wound](#).
- Add-On 6 - [Errors on Intake](#).
- Add-On 7 - [Bayes Implementation](#).
- Add-On 8 - [Tritium Tool](#).
- Add-On 9 - [Dose Calculations for Causation](#).
- Add-On 10 - [Ingrowth of Americium-241](#).
- Add-On 11 - [Statistics Package](#).

Selected [Add-On](#) modules can be provided with the initial [IMBA Professional Plus - Base Unit](#) installational, or can be added later by downloading *via* the HPA-RPD [IMBA Professional Plus](#) web site.

Add-On 1: Multiple Intake Regimes



Description

An intake regime defines both the mode of intake (inhalation of an aerosol or vapours, ingestion, injection, wound, etc) and the time of intake (e.g., an acute intake on a certain date, or a chronic intake between two dates). This [Add-On](#) enables you to deal with up to 10 separate intake regimes simultaneously. Thus, when calculating doses or predicting bioassay quantities, the software automatically includes the contribution from each intake. It is also possible to assign different model parameter values separately to each intake regime. This option also works during intake estimation, and so up to 10 intakes can be fitted to the measurement data simultaneously.

How is it implemented?

This [Add-On](#) is implemented seamlessly on the [Main screen](#). You select the number of intake regimes, and each intake regime (IR) can be set up independently by selecting the appropriate tab.

In the [Bioassay screen](#), the single intake on the left hand side of the screen is replaced by the chosen number of intakes. For [dose calculations](#), the dose to each organ is calculated separately for each intake regime. The total dose (from all intake regimes) is also given.

- For an example bioassay case analysis involving multiple intakes see [Case of Multiple Intakes](#).
- Return to [List of Add-Ons](#).

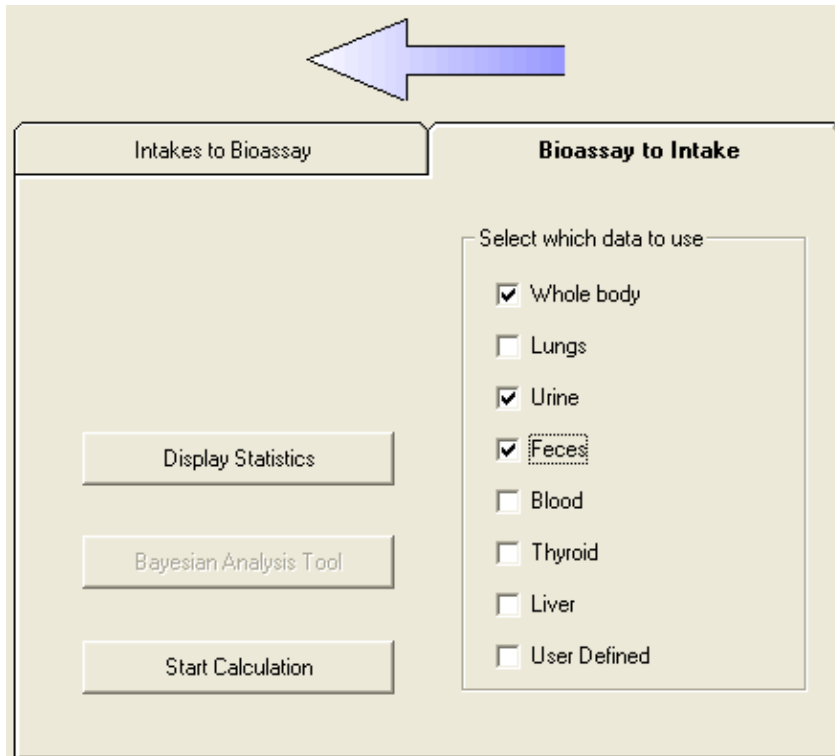
Add-On 2: Multiple Bioassay Types

Description

The base unit will deal with 8 different bioassay quantities (whole body, lung, urinary and faecal excretion, blood, thyroid, liver and user defined). However, only one type of data set can be used at any one time. This Add-on enables the user to fit the intake to different bioassay types simultaneously. This Add-on also works with [Add-On 1 \(Multiple Intake Regimes\)](#) to enable multiple intakes to be fitted to multiple bioassay data types simultaneously.

How is it implemented?

This Add-On integrates seamlessly into the [Bioassay screen](#) of the base module. When assessing intakes from bioassay measurements, you simply select which type of bioassay data to use by checking the appropriate boxes.



The screenshot shows a software interface with two main panels. The left panel is titled 'Intakes to Bioassay' and contains three buttons: 'Display Statistics', 'Bayesian Analysis Tool', and 'Start Calculation'. The right panel is titled 'Bioassay to Intake' and contains a section 'Select which data to use' with a list of checkboxes: 'Whole body' (checked), 'Lungs' (unchecked), 'Urine' (checked), 'Feces' (checked), 'Blood' (unchecked), 'Thyroid' (unchecked), 'Liver' (unchecked), and 'User Defined' (unchecked). A large blue arrow points from the right towards the 'Intakes to Bioassay' tab.

- For an example bioassay case analysis involving multiple intakes see [Case of Multiple Bioassay Quantities](#).
- Return to [List of Add-Ons](#).

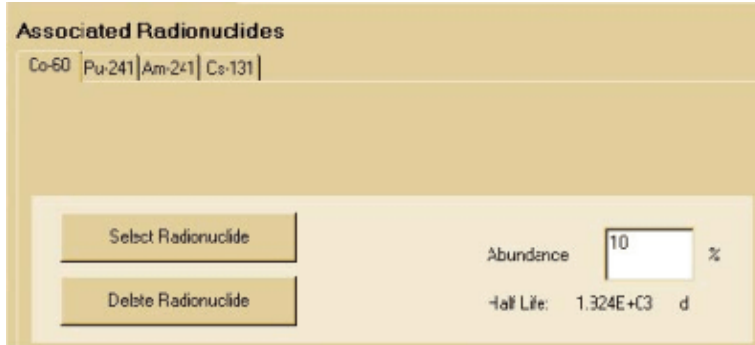
Add-On 3: Associated Radionuclides

Description

The base unit performs dose calculations on the selected radionuclide (known in [IMBA Professional Plus](#) as the [indicator nuclide](#)). In some situations, many different radionuclides are bound together in a particle matrix (e.g., fission products). This Add-on enables you to specify up to 30 additional associated radionuclides, defining the amount of each with respect to the indicator radionuclide. Subsequent dose calculations will include the components from all of the associated radionuclides. In the dose calculations, it is assumed that the absorption rates (and f_1 values) of each [associated radionuclide](#) are identical to that

of the indicator radionuclide.
How is it implemented?

With this [Add-On](#), you can specify up to 30 additional radionuclides from the main screen. The abundance of each associated radionuclide (the percentage of activity relative to the Indicator Nuclide) is entered by selecting the appropriate tab.



- For an example of a dose calculation involving associated radionuclides see [Doses from Associated Radionuclides](#).
- Return to [List of Add-Ons](#).

Add-On 4: Uranium Mixtures

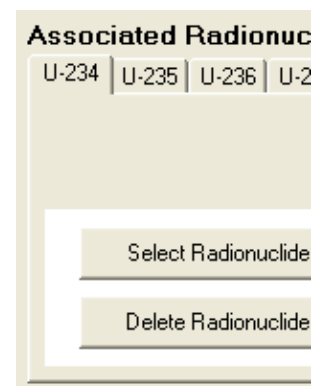


Description


This [Add-On](#) enables you to specify a mixture of uranium isotopes (U-234, U-235, U-236 and U-238) for dose and bioassay calculations. You can choose default values for enriched, depleted, or natural uranium, or specify the mixtures directly. The specific activity of the resulting mixture is automatically calculated. The [Add-On](#) also allows you to specify the intakes in terms of mass (mg).

How is it implemented?

You select 'Uranium-mixture' from the drop down list of uranium isotopes in the periodic table. When this is selected, a button labelled 'Specify U mixture' appears on the Main screen. This brings up a new form enabling you to specify the isotopic composition.



After exiting this screen, the uranium isotopes are automatically included as associated radionuclides with the selected [abundances](#). In this case, the 'indicator' radionuclide is the complete uranium isotope mixture.



Note: The 'Uranium Mixture' [Add-On](#) does not require the 'Associated Radionuclides' [Add-On](#) to be installed. However, the latter module is needed to include associated radionuclides for all Indicator Nuclides other than the uranium isotopic mixture.

- For an example of a bioassay analysis and dose calculation involving a uranium mixture see [Case of Uranium Isotopic Mixture](#).
- Return to [List of Add-Ons](#).

Add-On 5: Uptake from a Wound



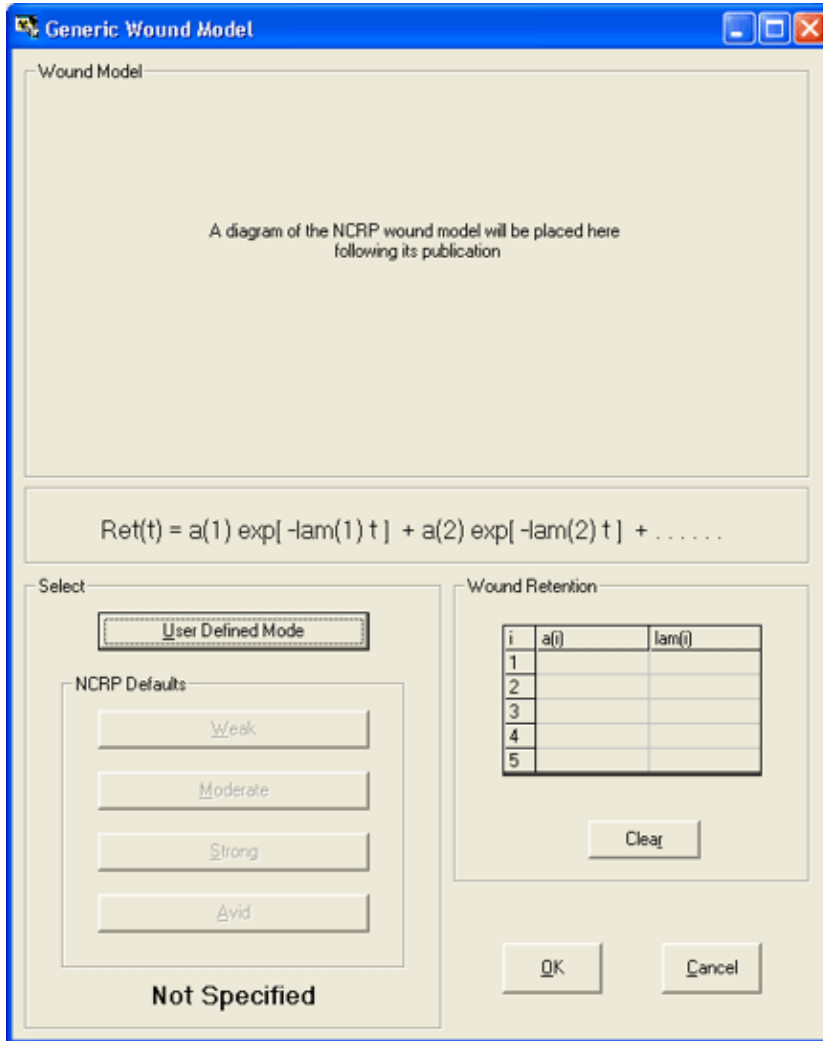
Description

The [Base Unit](#) allows intakes via inhalation (aerosols and vapours), ingestion or direct injection. This [Add-on](#) enables you to deal with intakes from a wound site, i.e., transdermal intake. A generic wound model is specified by the user. This functionality is integrated automatically with all of the calculations (dosimetry, bioassay and intake fitting). It is planned to include default parameter values from the forthcoming NCRP wound model (when

these are available).

How is it implemented?

With this [Add-On](#), you can select 'Wound' as a route of intake (from the **Main** screen). The 'Wound' button in the 'Model Parameters' panel is enabled, and the retention function can be entered as a sum of exponential terms.



- For an example of a bioassay analysis and dose calculation involving a intake via a wound see [Case of Wound Uptake](#).
- Return to [List of Add-Ons](#).

Add-On 6: Errors on Intake



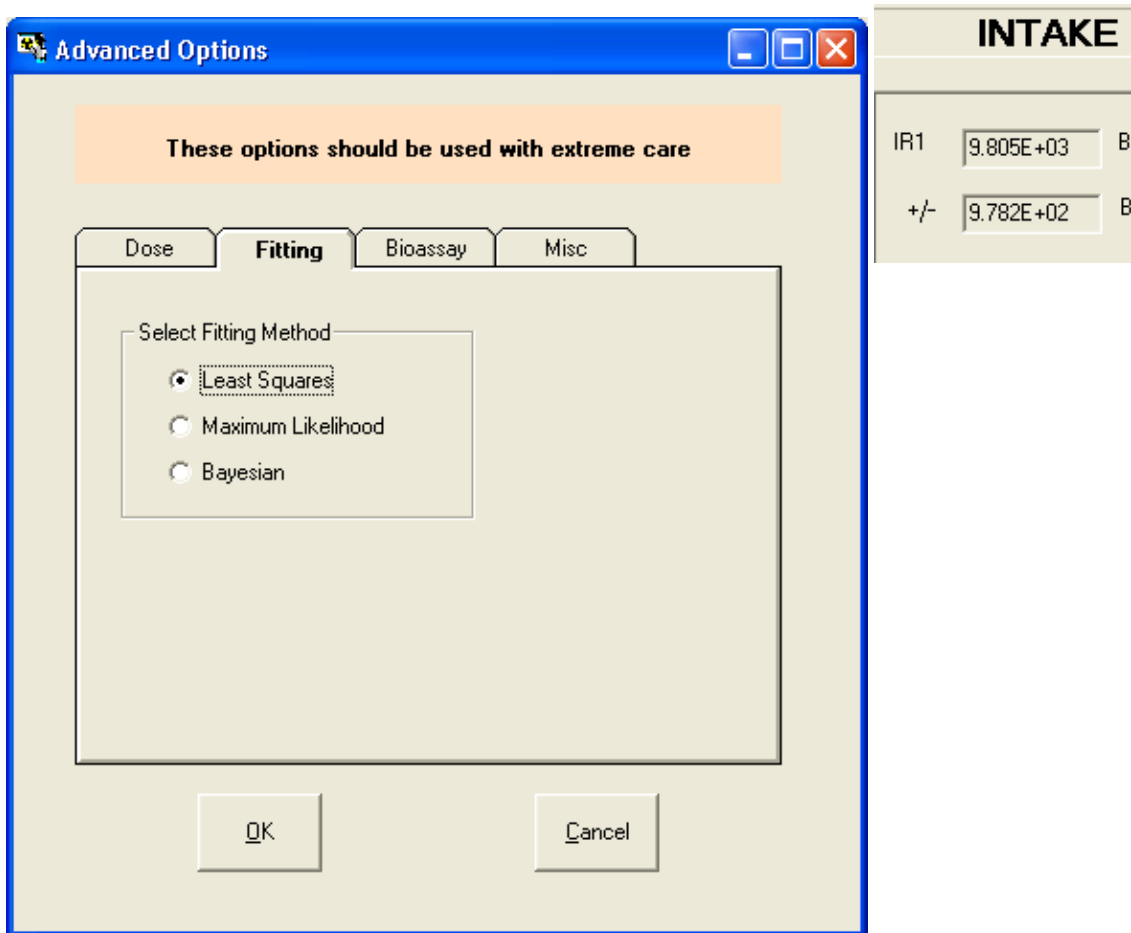
Description

In cases where an intake is being estimated from bioassay data, and all of the data are assumed to be normally distributed with a specified standard deviation, then this [Add-On](#) will propagate the errors to calculate their contribution to the error in the estimate of intake. The error propagation is based on the Least Squares method.

How is it implemented?

You must first select **Advanced Fitting Options** from the **Main** screen (**Advanced | Advanced Options | Fitting Tab**), or from the Bioassay screen (**Advanced | Advanced Fitting Options**) and select **Least Squares** as the method of fitting.

After calculating the **Intake**, the **Error value** will be displayed automatically below the intake value - on the left side of the **Bioassay** screen.



- For an example involving the estimation of errors on calculated values of intake see [Case Evaluating Errors on Intake](#).
- See **Technical Basis** of [Least Squares Fitting](#).
- Return to [List of Add-Ons](#).

Add-On 7: Bayes Implementation



Description

The **Base Unit** uses a fitting method based on the [Maximum Likelihood Method](#) to estimate

intakes from measurement data. This [Add-On](#) enables you to use a [Bayesian approach](#) to estimate an intake. Thus, prior knowledge about the intake (either from other measurements such as air sampling, or from hypothetical judgements) can be used in conjunction with the bioassay measurement data to obtain the probability distribution of intake. You can choose from a variety of 'prior' intake distributions, and both graphical and statistical displays are provided. This [Add-On](#) works in conjunction with the [Multiple Intake Regimes Add-On](#) to enable the probability distributions of several different intakes (each with their own prior) to be estimated simultaneously.

How is it implemented?

From the Bioassay screen menu, select 'Advanced | Fitting Options' and click the Bayesian option. A new button called Bayesian Analysis Tool will appear in the Bioassay screen. Pressing this button will call up the Bayesian Analysis Tool and enable you to calculate probability distributions of intake under different prior assumptions.

The [prior distribution](#) selected in this screen will also be used in any further fitting processes.

- For an example involving Bayesian analysis of intake see [Case Implementing Bayesian Analysis](#).
 - See **Technical Basis** of [Bayesian Analysis](#).
- Return to [List of Add-Ons](#).

Add-On 8: Tritium Tool



- For an example using the tritium tool see [Case Implementing Tritium Tool](#).
- Return to [List of Add-Ons](#).

Add-On 9: Dose Calculations for Causation



- For an example calculation of equivalent doses received each year by a specified tissue (for use in the determination of cancer causation likelihood) see [Dose Calculations for Causation](#).
- Return to [List of Add-Ons](#).

Add-On 10: In-growth of Americium-241



- For an example intake and dose calculation using external measurements of ²⁴¹Am

- activity as an indicator of plutonium activity in the lungs see [Case of Am-241 In-growth](#).
- Return to [List of Add-Ons](#).

Add-On 11: Statistics Package



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- For an example using the statistics package to evaluate an intake see [Case Using Statistics Package](#).
- Return to [List of Add-Ons](#).