Public Health England (PHE) and Global Dosimetry Ltd. (GD) are pleased to announce a new and improved version of the internal dosimetry software package IMBA Professional. The new software, **IMBA Professional Plus**, consists of a base unit, and various Add-Ons which increase the functionality of the software. Users can thus customise the software to meet their individual requirements. The software is faster, more powerful, and cheaper than previous versions of the IMBA Professional series.

**Base Unit**
The base unit enables the user to (a) assess an intake from bioassay measurement data; (b) calculate bioassay quantities at different times from a specified intake; (c) calculate equivalent organ doses and effective dose from a single intake. The calculations are performed 6-10 times faster than previously. The base unit will be distributed on a CD ROM together with the documentation. The cost of the base unit and documentation is **£2,200 + VAT**.

**Add-Ons**
Each Add-On can be purchased individually and increases the functionality of the base unit. The Add-Ons are grouped into 3 categories (A, B and C). A discount is available if all 5 Add-Ons in category A or B are purchased. When an Add-On is purchased, the customer will be sent an installation program for the Add-On by e-mail.

**How to Order**
An order form is available on the Global Dosimetry web site:

[http://www.globaldosimetry.co.uk/download/IMBA%20Order%20Form%20Apr%202016.pdf](http://www.globaldosimetry.co.uk/download/IMBA%20Order%20Form%20Apr%202016.pdf)

**Further Information**
For further information or specific enquiries, please email the IMBA team at:

HelpWithImba@gmail.com
IMBA Professional Plus Information Sheet

Base Unit

The base unit is the core of IMBA Professional Plus and enables the user to perform basic internal dosimetry calculations (e.g., calculating doses from specified intakes, estimating intakes from bioassay measurements and calculating bioassay quantities from given intakes). It implements the latest ICRP biokinetic models. Output is both tabular and graphical and special tools enable data transfer between Windows applications. For standard calculations, all of the ICRP default values can be selected from built-in databases at the touch of a button. For more detailed calculations, the user can enter individual parameter values. The product has been extensively quality assured and comes with complete documentation.

The following radionuclides are currently implemented.

<table>
<thead>
<tr>
<th>Ac-227</th>
<th>Ac-228</th>
<th>Am-241</th>
<th>Am-243</th>
<th>Sb-124</th>
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<th>Ba-140</th>
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<td>Zr-95</td>
<td>Zn-65</td>
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IMBA Professional Plus is the successor to the IMBA Professional (and IMBA Expert) series. It is 6-10 times faster than its predecessors, more versatile (for example, it includes intake by vapours), and cheaper (£2,200 + VAT). It can be made even more powerful (and tailored to meet the customer’s individual needs) by installing Add-Ons which enhance the functionality.

1 It is assumed that the biokinetic behaviour of radioactive progeny follows that of the parent.
IMBA Professional Plus Information Sheet

Add-On 1
Multiple Intake Regimes

Description

An intake regime defines both the mode of intake (inhalation of aerosols 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 the user 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 if required. 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 integrated seamlessly on the main screen. The user selects 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.

Cost

£1100 + VAT
**IMBA Professional Plus Information Sheet**

**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 base module. When assessing intakes from bioassay measurements, the user simply selects which data to use by checking the appropriate boxes.

**Cost**

£1100 + VAT
IMBA Professional Plus Information Sheet

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 the user 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 f1 values) of each associated radionuclide are identical to that of the indicator radionuclide.

How is it implemented?

If this Add-On is installed, then the user can specify up to 30 additional radionuclides from the main screen. The abundance of each radionuclide (the percentage of activity of the Indicator Nuclide) is entered by selecting the appropriate tab.

Associated Radionuclides

| Co-60 | Pu-241 | Am-241 | Co-131 |

Abundance: 10%
Half Life: 1.924E+06 days

Cost

£600 + VAT
Description

This option enables the user to specify a mixture of uranium isotopes (U-234, U-235, U-236 and U-238) for dose and bioassay calculations. The user 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. This option also allows the user to specify the intakes in terms of mass (mg).

How is it implemented?

This Add-On will enable the user to select ‘Uranium-mixture’ from the drop down list of uranium isotopes in the periodic table. If this is selected, then a button labelled ‘Specify U mixture’ appears on the main screen. This brings up a new form enabling the user 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.

Cost

£600 + VAT
**IMBA Professional Plus Information Sheet**

**Add-On 5**
**Uptake from wounds**

**Description**

The base module allows intakes via inhalation (aerosols and vapours), ingestion or direct injection. This Add-on enables the user to deal with intakes from a wound site. 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 values from the NCRP wound model when published.

**How is it implemented?**

If this Add-On is installed, the user can select ‘Wound’ as a route of intake from the main screen. The Wound button in Model Parameters is enabled, and the retention function for the wound can be entered as a sum of exponential terms.

**Cost**

£600 + VAT
IMBA Professional Plus Information Sheet

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 method of error fitting employed in this case is based on the Least Squares method.

How is it implemented?

The user must first select Advanced Fitting Options either 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.

Cost
£600 + VAT
IMBA Professional Plus Information Sheet

Add-On 7
Bayes Implementation

Description
The base module uses a fitting method based on the Maximum Likelihood Method to estimate intakes from measurement data. This Add-On enables the user 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 measurement data to obtain the probability distribution of intake. The user can choose from a variety of ‘prior’ intake distributions and both graphical and statistical displays are given. This module works in conjunction with the Multiple Intake Regimes Add-On to enable the probability distributions of 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 enabling the user to calculate probability distributions of intake under different prior assumptions.

The prior distributions selected in this screen will also be used in any further fitting processes.

Cost
£2200 + VAT
IMBA Professional Plus Information Sheet

Add-On 8
Tritium Tool

Description

Typical procedures for estimating tritium intakes which have occurred at some unknown time in a monitoring interval involve making assumptions about (a) the time of intake, and (b) the contribution to the current measurement from intakes in previous monitoring intervals. Because the new ICRP tritium model is no longer a single exponential, it is no longer possible to use just the previous measurement to correct the current measurement. This Add-On enables the user to select up to 10 previous tritium measurements, and to fit simultaneously the best 10 intakes. In a sense, the previous 9 intakes are used to correct for the current estimate of intake.

How is it implemented?

The user can enter the complete history of an individual’s monitoring results (up to 200 measurements) in the Table Tool. The Tritium Tool is then launched from a button which will appear in the Bioassay screen. The tool enables the user to select and analyse data directly from the Table Tool.

Cost

£600 + VAT
Description

This Add-On enables the user to select an organ, and a date on which cancer was diagnosed in the organ. The program then calculates the equivalent dose to the organ in each (of up to 99) calendar years previous to the cancer diagnosis. A simple wizard for exporting this data to other files or databases is also included. This type of information is required as part of the process of estimating causation probabilities for compensation type calculations.

How is it implemented?

A new button will appear in the Dose Calculations screen which calls up a new form. On this form, the user can specify a tissue or organ from a drop down list, the time of the incidence of the cancer, and the number of calendar doses to calculate.

This screen is fully integrated with the base module so that all of the parameters used in the intake calculation will also be used for these dose calculations.

Data can be imported or exported to other files or the Windows™ clipboard. Calculations (together with all of the assumptions made) can be added to the report file.

Cost

£1100 + VAT
Add-On 10
Ingrowth of Americium

Description

The interpretation of measurements of Am-241 in an individual can be complicated if the individual has also had an intake of Pu-241 because of the continuous ingrowth of Am-241 from Pu-241. This Add-On allows the user to take ingrowth into account automatically when performing calculations.

How is it implemented?

First, Am-241 is selected as the indicator nuclide, and Pu-241 (and its abundance) as an associated radionuclide. The user can now select Advanced Bioassay Options (main menu: Advanced/Advanced Options and hit Bioassay tab). Here, a check box can be ticked to allow automatic ingrowth of the Americium from the plutonium to take place.

This Add-On is fully integrated with the base module and other Add-Ons. If specified, ingrowth will be included automatically for all bioassay calculations, and for estimating intakes from bioassay measurements.

If more than one intake regime is specified (Add-On 1) then the user can choose to keep the defined ratio of Pu/Am to apply to (a) t=0: ie it will automatically change with time, or (b) to apply the defined Pu/Am ratio to each intake regime. At the moment only acute intakes are allowed with this option.

Cost

£600 + VAT
Description

This allows the user to bring up useful statistical information immediately after fitting intakes to measurement data. It calculates the chi-square value for each bioassay type, the total chi-square and the associated P value (probability of obtaining a chi square greater than or equal to the calculated value by random chance).

How is it implemented?

If this Add-On is installed, then a new button ‘Display Statistics’ appears on the Bioassay screen during the calculation of intakes. This button displays the chi-square value for each type of bioassay quantity used in the fit. Quantities of P greater than 0.05 (indicating a good fit) are automatically coloured green giving a quick indication that the fit is adequate.

This information is extremely useful when trying to decide whether the assumed set of parameters accurately model the measurement data.

It is planned to add other statistics to this Add-On in the future.

Cost

£1100 + VAT
IMBA Professional Plus Information Sheet

Add-On 12
ORTEC Import Tool

Description

This allows the user to import measurement data into IMBA from the ORTEC Renaissance software. The user can thus use IMBA directly after making a measurement to obtain the best estimate of the intake and the corresponding doses to organs and the total effective dose.

How is it implemented?

If this Add-On is installed, then a new item appears on the main menu (‘Tools/Import from Ortec database’). This menu launches the ORTEC database import wizard.

The user can search the ORTEC Renaissance database using several search criteria including employee name and social security number. The desired measurement data are selected from the search results list and then imported directly into the IMBA table tool. The user can also specify which bioassay data-type the measurement’s represent.

This tool eliminates the tedium, but more importantly, the errors inherent in manual data entry.

Cost

£600 + VAT
Add-On 13
Additional Radionuclides (Pack 1)

Description

The Base Unit allows the user to assess intakes from bioassay measurement data, calculate bioassay quantities at different times from a specified intake and calculate equivalent organ doses and effective dose for 75 radionuclides. This Add-On implements the 62 frequently requested additional radionuclides listed below.

<table>
<thead>
<tr>
<th>As-74</th>
<th>Ba-133</th>
<th>Bk-249</th>
<th>Br-82</th>
<th>Br-83</th>
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<td>Ga-67</td>
<td>Hg-203</td>
<td>Ho-166</td>
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<td>I-132</td>
<td>In-111</td>
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<td>Sb-129</td>
<td>Sc-46</td>
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<td>Te-131</td>
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<td>Tl-204</td>
<td>Tm-170</td>
<td>U-232</td>
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</tbody>
</table>

How is it implemented?

If this Add-On is installed, then the additional radionuclides listed above will be available from the Periodic Table tool for selection as indicator radionuclides. If Add-On 3 (Associated radionuclides) is also installed, then the additional radionuclides listed above will also be available from the Periodic Table tool for selection as associated radionuclides.

Cost

£1100 + VAT
**IMBA Professional Plus Information Sheet**

**Add-On 14**

**Additional Radionuclides (Pack 2)**

**Description**

The Base Unit allows the user to assess intakes from bioassay measurement data, calculate bioassay quantities at different times from a specified intake and calculate equivalent organ doses and effective dose for 75 radionuclides. Add-On 13 enables 62 additional radionuclides. This Add-On implements a further 603 additional radionuclides as listed below.

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<td>Ir-190ms</td>
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<td>Mo-93m</td>
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<td>Nb-90</td>
<td>Nb-93m</td>
<td>Nb-95m</td>
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</tbody>
</table>
If this Add-On is installed, then the additional radionuclides listed above will be available from the Periodic Table tool for selection as indicator radionuclides. If Add-On 3 (Associated radionuclides) is also installed, then the additional radionuclides listed above will also be available from the Periodic Table tool for selection as associated radionuclides.

**Cost**

£1100 + VAT
Description
The Base Unit allows the user to assess intakes from bioassay measurement data, calculate bioassay quantities at different times from a specified intake and calculate equivalent organ doses and effective dose for various chemical forms of hydrogen and carbon. This Add-On implements chemical forms of hydrogen and carbon that occur in CANDU type reactors using models that are currently recommended by COG (CANDU Owners Group) in Canada. These models are based on ICRP models but differ slightly from them. The chemical forms of hydrogen and carbon supplied in this Add-On are:

- Inorganic hydrogen CANDU model
- Metal tritides CANDU model
- Tritiated methane CANDU model
- Carbon dioxide CANDU model

How is it implemented?
If this Add-On is installed, then the chemical forms of hydrogen and carbon listed above will be available from the drop down isotope in Periodic Table tool for whichever isotopes of hydrogen and carbon are installed.

Cost £600 + VAT