



Radiochemical &  
Decommissioning Solutions



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## About us

Raddec International is a specialist radioanalytical company that has existed since 2003. It designs, tests and produces innovative hardware and software solutions for the radioanalytical sector.

The instrumentation has found extensive application in the nuclear decommissioning and nuclear defence sectors, fusion research, regulatory agencies, AMS laboratories, academic research etc.

All instruments and software have been rigorously tested and frequently supported by publications in the international scientific literature.

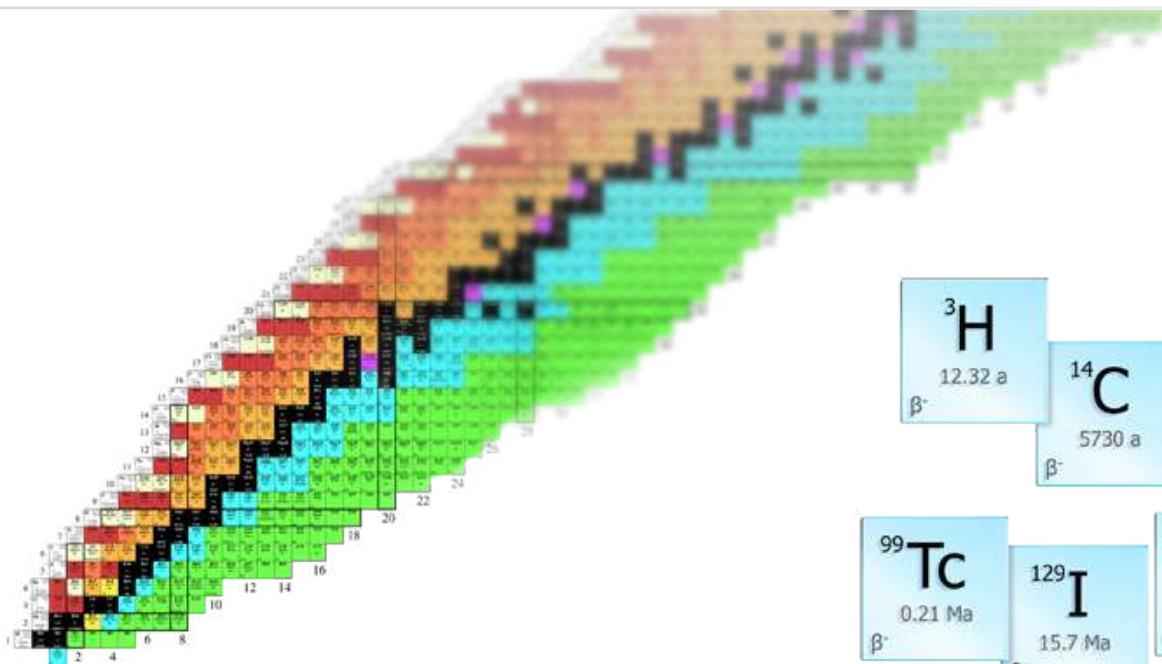
Raddec International sells either directly or through one of its valued international partnerships. These include Clover Technology Group (NuClover, China), Sowa Trading Co. (Japan), Gamble Technologies (Canada), Noki Technologies (India), Tecnasa (Spain) and Triskem International (France).

● Map shows International Raddec presence

## Providing analytical solutions across a range of industry sectors

The hardware is currently focused on the extraction of volatile radionuclides (tritium, carbon, sulphur, chlorine, iodine) although other developments are underway.

Raddec systems are routinely employed for a wide range of applications from environmental monitoring through to characterisation of intermediate level radioactive waste.



## Our customers include:

Astra Zeneca  
 AMEC-NIRAS Ltd  
 ARS International  
 AWE plc  
 Babcock RMDL  
 Babcock BES  
 Babcock International  
 BAG Switzerland  
 Bhabha Atomic Research Centre  
 Canadian Nuclear Safety Commission  
 CARER (Managlore University)  
 Cernavoda NPP

CloverTek  
 Culham Centre for Fusion Energy, CCFE  
 Defence Radiological Protection Service  
 DFI  
 DSRL  
 Eichrom Laboratories  
 ESG Ltd  
 Federal State Inst. Burnazyan Fed.  
 Med. & Biophys. Center  
 Forschungszentrum Julich  
 GAU-Radioanalytical  
 GE-Healthcare (Maynard Centre)

GE-Healthcare (Grove Centre)  
 National Nuclear Laboratory  
 National Physical Laboratory  
 PHE (Chilton)  
 PHE (Glasgow)  
 HES-GE  
 Jefferson Laboratory  
 Korean Atomic Energy Research Inst.  
 Korean Institute of Nuclear Safety  
 Korea Research Institute of Standards  
 and Science  
 Magnox

NOKI Technologies  
 PNNL  
 SCK-CEN  
 Sellafield Ltd  
 Studsvik  
 Tecnasa  
 U-Series  
 Xi'an Accelerator Mass Spectrometry  
 Center





**Efficient and rapid extraction of tritium and <sup>14</sup>C from any material**

The adaptable Pyrolyser furnace systems have been scientifically designed and evaluated to provide a safe and efficient means of extracting <sup>3</sup>H and <sup>14</sup>C (and other volatile radionuclides) from almost any type of sample (foodstuffs, biota, soil, sediment, concrete and other building materials, metals and bioassay samples).

## Key features

- Unique multi-tube thermal extraction system.
- Fully integrated and designed for efficiency and compactness.
- Internationally established and widely adopted by nuclear, environmental, defence, research and other sectors.
- Rigorously tested and evaluated through scientific research and intercomparison.

 Technical data sheet available at [www.raddec.com/technical-notes.htm](http://www.raddec.com/technical-notes.htm)

 Movie available at [www.raddec.com/hardware-pyrolyser-video.htm](http://www.raddec.com/hardware-pyrolyser-video.htm)



## The Pyrolyser system

Pyrolyser-6-Trio system designed with six individual work tubes and three independent heating zones to simultaneously extract volatile radionuclides from six samples. Four tube and two tube variants are also available.

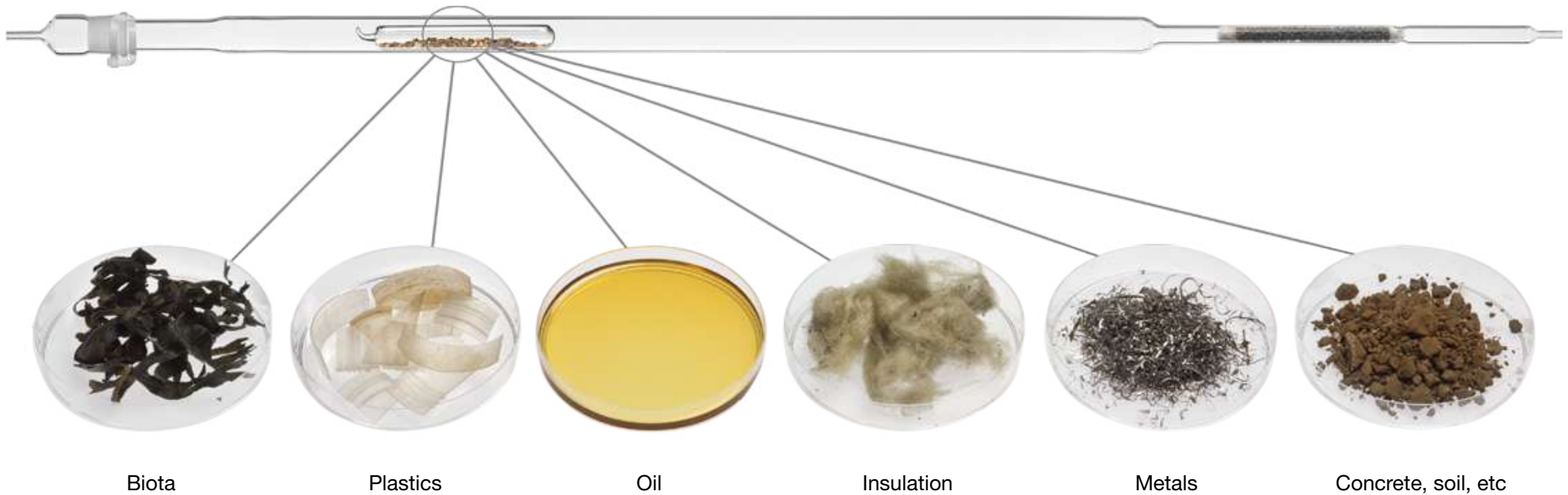
### Sample types

A wide range of sample types can be run from solid, liquids and even gases. Up to 20g of (dry) sample can be applied to each tube for testing, running up to six samples a day.

### Combustion cycle

Samples are heated using a predefined, automated heating cycle. Up to 10 different programs (4 programs on the Pyrolyser 2) can be configured on the

system, tailored to suit the sample type being processed. Combustion products are swept through to the catalyst zone where they are oxidised before being trapped in purpose-designed bubblers or in a condensing cryotrap.







Schematic view of combustion cycle

# Pyrolyser Mini

Mini Furnace System

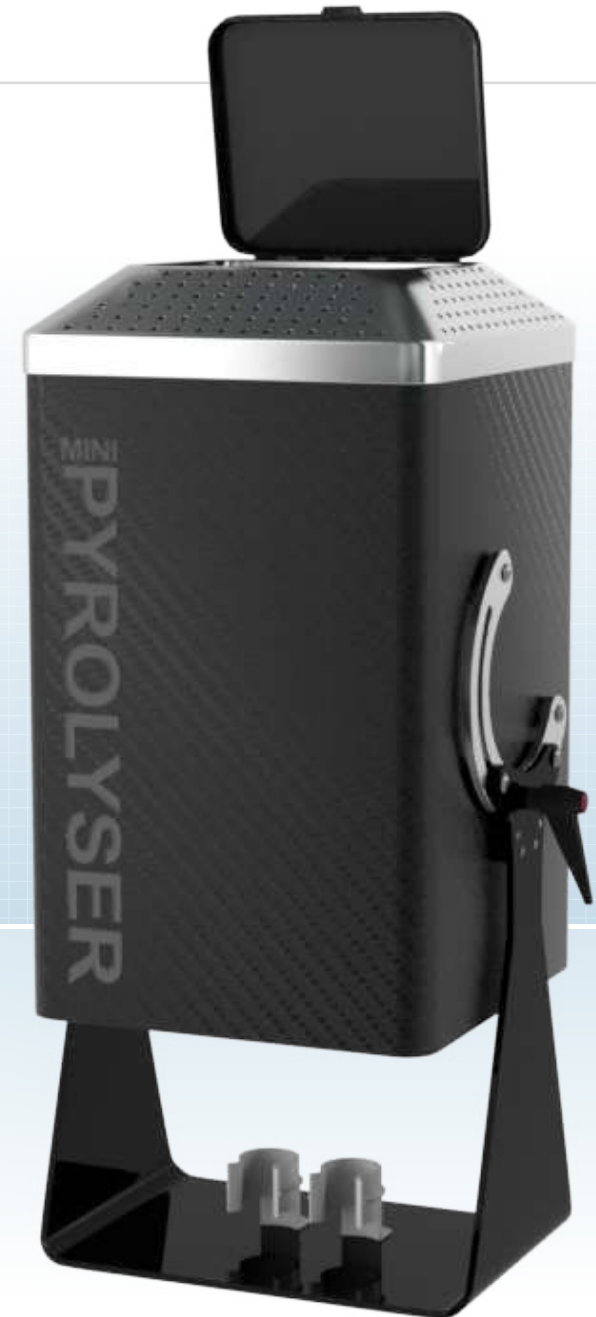
## Small-scale efficient and rapid extraction of tritium and <sup>14</sup>C from any material

The Pyrolyser Mini system is a compact two stage combustion furnace designed to complement the existing Pyrolyser-Trio family of combustion furnaces.

The Pyrolyser Mini has been designed to be installed and operated in confined spaces.

Innovative design features such as a swivel joint mounting system allows the entire furnace to be rotated forwards to permit easy access to the work tubes during work tube replacement. Furthermore, work tubes are orientated vertically to enable straightforward loading and unloading from the top of the furnace.

All controls are housed within a separate control box connected to the furnace via an umbilical. The control box can therefore be located outside the fume cupboard or glovebox for ease of operation.





### Key features

- Compact design capable of being installed in fume cupboards, gloveboxes or mobile laboratories.
- Operates from a standard UK 240V/13A socket.
- Sample zone rated to 950 degrees C.
- Designed to use only two heating zones, removing the need for a thermal isolation zone.
- Control box can be located outside the fume cupboard or glovebox for ease of operation.
- Two samples can be processed simultaneously during each run.
- Operates without oxygen.



Technical data sheet available at  
[www.raddec.com/technical-notes.htm](http://www.raddec.com/technical-notes.htm)



Movie available at  
[www.raddec.com/hardware-pyrolysermini-video.htm](http://www.raddec.com/hardware-pyrolysermini-video.htm)



### Efficient and rapid extraction of tritium and <sup>14</sup>C

Complete and clean oxidation of organic-rich materials (foodstuffs, marine and freshwater fish, meat, vegetation, wood, oils, plastics, and soft wastes) pressurised oxygen to promote efficient combustion.


The system achieves rapid combustion of samples up to 20g with minimal sample preparation. Integrated controls, safety systems and data logging permit straightforward operation.


### Application areas

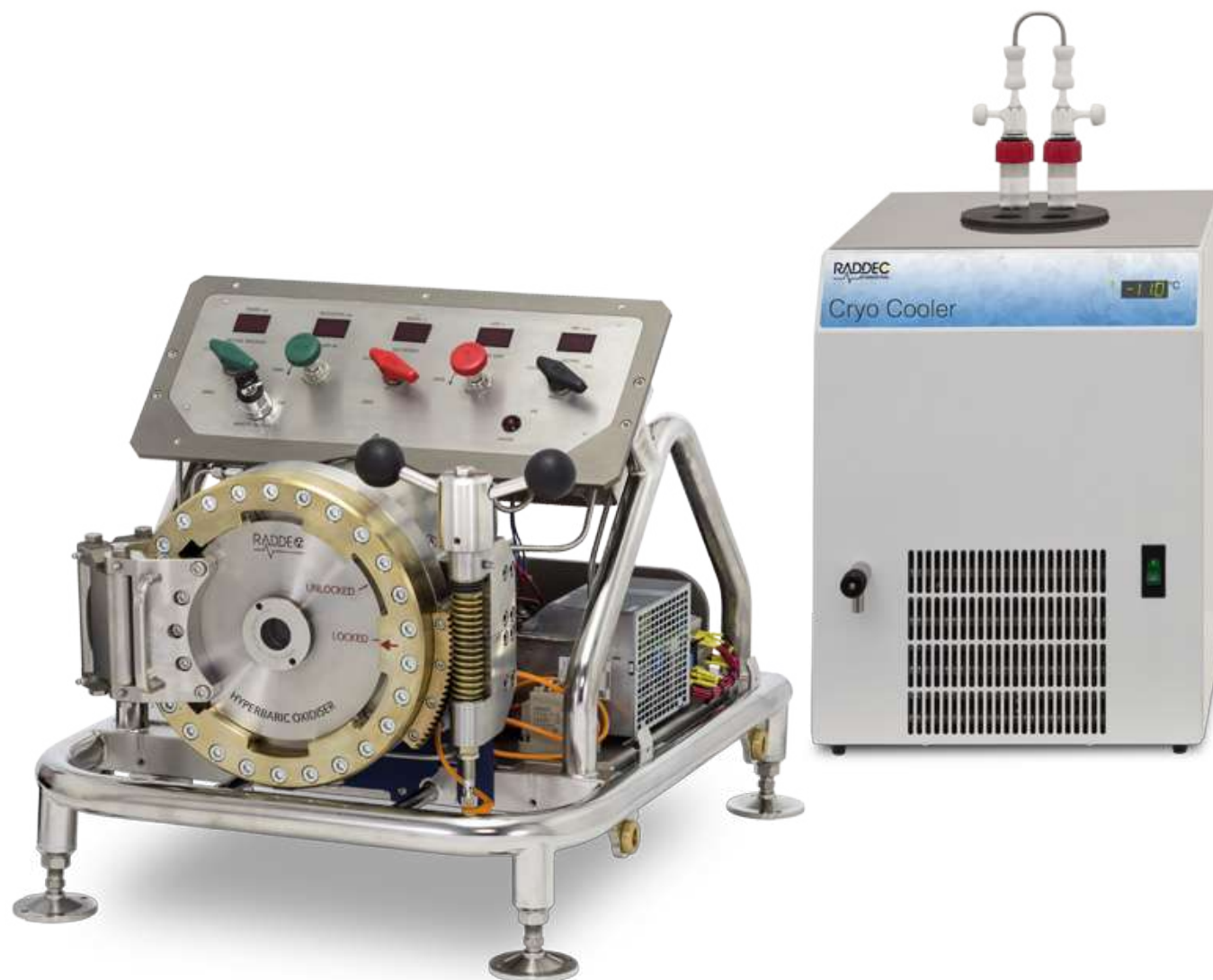
Nuclear decommissioning, waste characterization, environmental monitoring, <sup>14</sup>C extraction.

### Key features

- Efficient extraction of volatile radionuclides ( $^3\text{H}$ ,  $^{14}\text{C}$ ,  $^{36}\text{Cl}$ ,  $^{129}\text{I}$ ) from combustible materials.
- Rapid and effective combustion of samples.
- Incorporates a novel door locking mechanism with three safety interlocks.
- Complete combustion in approximately one minute.
- Permits the water generated to be used for tritium analysis by LSC or  $^3\text{He}$  in-growth mass spectrometry.

 Technical data sheet available at [www.raddec.com/technical-notes.htm](http://www.raddec.com/technical-notes.htm)

 Movie available at [www.raddec.com/hardware-HB02-video.htm](http://www.raddec.com/hardware-HB02-video.htm)




**Integrated, multi-function  
laboratory data management  
software – specifically designed  
for the radioanalytical sector**

LIMS has been designed for efficient management in busy radiochemical laboratories. The software has been developed, tested and proven through routine use in a leading ISO17025:2005 accredited laboratory.

### Key features

- Integrated software for effective data, job and financial management within the analytical laboratory.
- Intelligent use of performance data to support training, quality control and quality assurance objectives.
- Straightforward installation and set up allowing rapid implementation of the system.
- Adaptable platform enabling the system to be tailored to a particular laboratory's requirements.

 Technical data sheet available at  
[www.raddec.com/technical-notes.htm](http://www.raddec.com/technical-notes.htm)

 Movie available at  
<http://www.raddec.com/software-lims-video.htm>





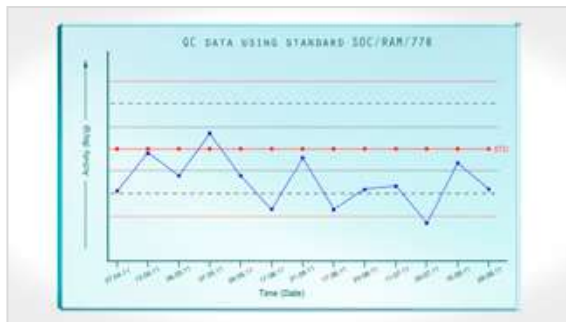
**Job control**

A job based structure is used to manage tasks or customer data, including creation of sample bar codes and labels.



**Training and approvals authorisation**

This database is linked to data-entry approvals and training authorisations. It can also be used to demonstrate ongoing competency.



**Quality control**

LIMS incorporates a range of quality control functions using QC data entered by the analyst, including highlighting any failures.



**Equipment management**

Equipment records are maintained by a searchable records database.



**Quality assurance**

Method data entered at key stages during the job are collated and used to assess overall laboratory performance.



**Financial management**

Customer details are stored in the database to aid financial management such as quotation and invoicing, job specification and customer access control.

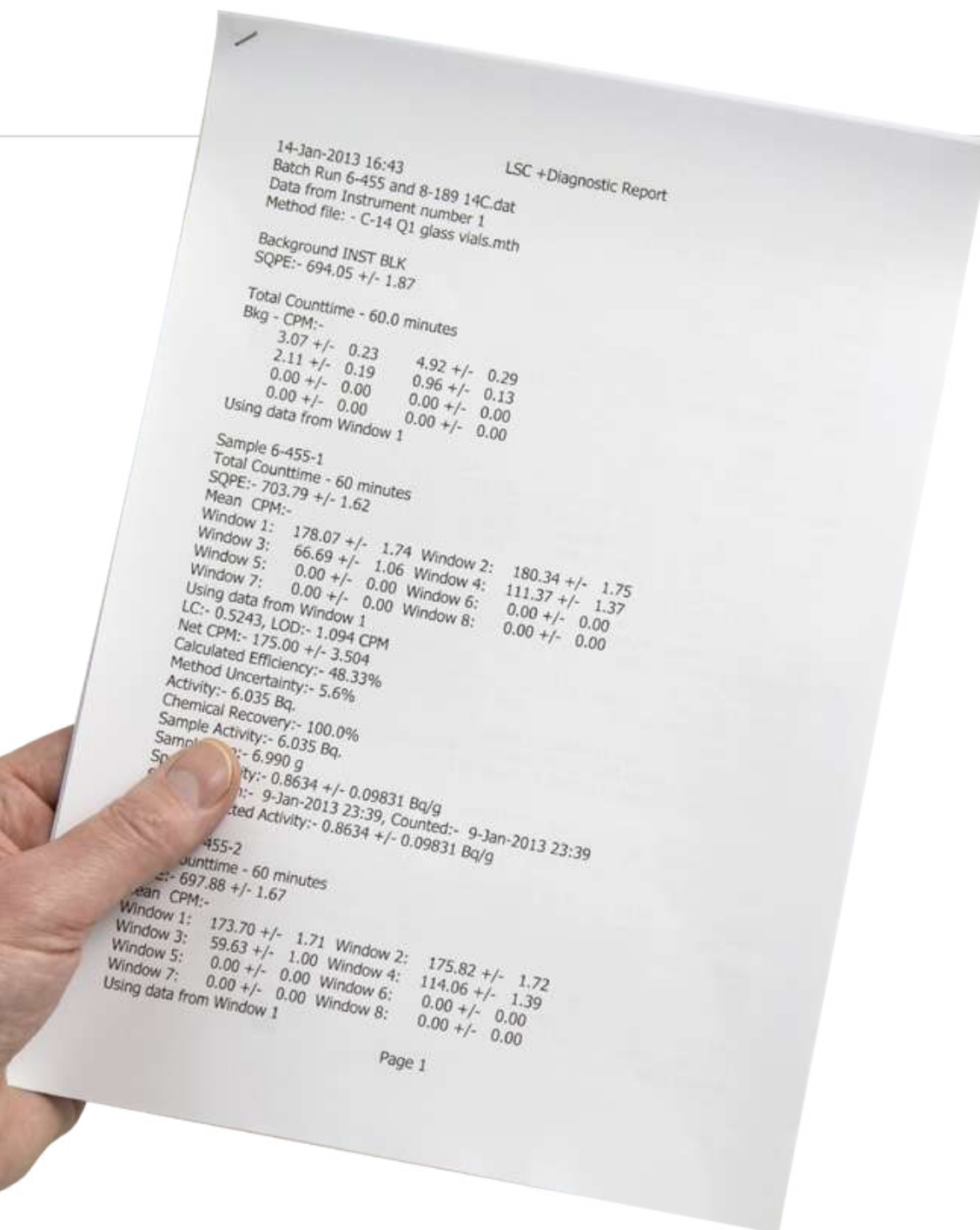


**Efficient liquid scintillation data storage, processing and quality assurance**

LSC+ software has been specifically designed to permit rapid and accurate processing of liquid scintillation data, minimising transcription errors.


The software incorporates data capture, data processing, statistical analysis, quality assurance, data reporting and spectral display.






### Key features

- User-friendly interface which guides the user through the process.
- Effectively minimises the potential for transcription errors.
- Saves hours of analysts' time.
- Enhances data quality through integrated quality control functions
- Integrates with Raddec LIMS quality management systems
- Significantly improves data processing efficiency and reduces reporting times

 Technical data sheet available at [www.raddec.com/technical-notes.htm](http://www.raddec.com/technical-notes.htm)

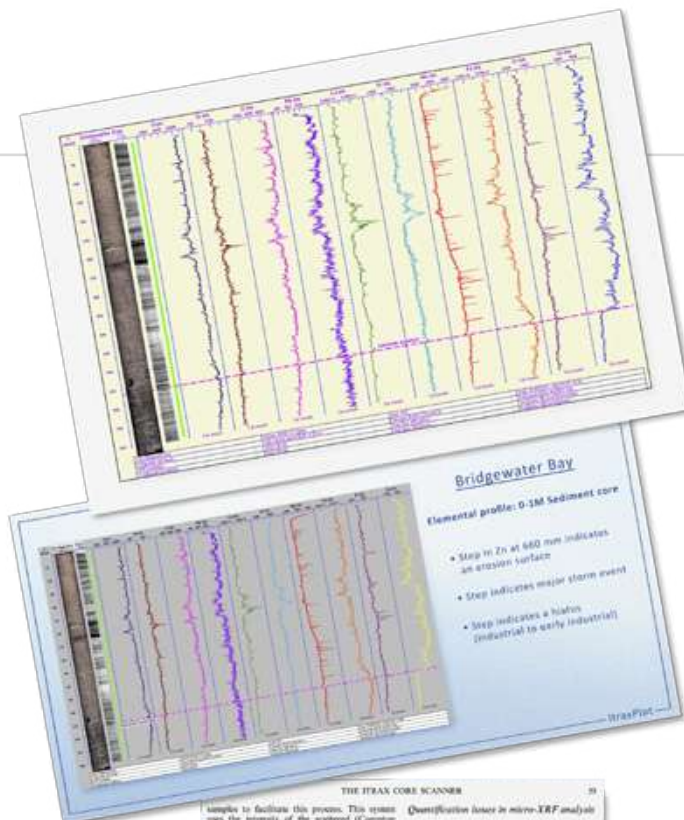
 Movie available at <http://raddec.com/software-lsc-video.htm>

### User-friendly data visualisation

ItraxPlot is a user-friendly, rapid and flexible data visualisation software package specifically designed to integrate with the Itrax core logger system. ItraxPlot provides graphical representation of your analysis data which can be used for laboratory discussion, data records or outputs to scientific papers.



Itrax manufactured by Cox Analytical, Sweden



THE ITRAX CORE SCANNER

samples to facilitate this process. This system uses the intensity of the scattered (Compton and Rayleigh) flux from the X-ray tube as a measure of normalisation, making the quantitative results independent of tube ageing or any other factor affecting the primary beam intensity. The ratio of the Compton and Rayleigh scattered intensities are used to estimate the variation of the average atomic number in the sample.

Quantitative Itrax is micro-XRF analysis. The ITRAX geochemical data are normally output as counts and can be considered semi-quantitative in nature, and as such need to be interpreted with caution. Errors may arise due to poor peak discrimination in the X-ray spectra, secondary changes, compression or granular shape-related artefacts (recorded for K and Se) and low count rates. Itrax data may be recorded when the X-ray detector is not in the correct position, particularly when the air core surface is uneven or shows sudden variability from crack-related effects. Careful study of variation in the element integral profiles, the Compton scatter integral and the detector-sediment distance (validity) index can aid in identifying such invalid data. The Itrax-Plot data visualisation software allows for ready examination of the data at various scales to consider whether they are spurious.

Quantitative ITRAX X-ray microanalysis of natural samples can be successfully carried out, but usually involves a post-processing refinement routine followed by a full batch re-analysis. Quantification uses 'XRF fundamental parameters' calculations and assumes compositional and physical homogeneity for the measured samples, and any deviation from this ideal state will introduce errors. The effectiveness of the quantification will be impaired for some sample types where the small variation volume, medium coarse grain size and mineral effects predominate.

Some visualisation software:

The efficient visualisation of the analytical data and images from the ITRAX is an important part of the evaluation process, and the National Oceanographic Centre has produced a flexible package called Itrax-Plot for examining and manipulating the core data (see, for example, Figs 3 & 6). The software opens the ITRAX files and allows the user to manipulate, re-size and re-orient image files (optical and radiographic), as well as plotting up to 10 XRF elemental profiles at a time. Other options include adjustment of scaling, data smoothing, application of element filters, inclusion of regions of interest, and the addition of horizontal and vertical reference lines. Itrax-Plot also allows temporary removal of suspect or anomalous data prior to final presentation but the original data are never modified. The images can be output or saved in high-quality formats as PDF, JPG or BMP. Cox Analytical also produce an in-house package called RadCore for inspecting and displaying the downcore profiles.

Figure 6. Itrax-Plot rendering of core log data obtained using Itrax 91 (OCCO). The screen was taken from a 17" monitor with resolution of 1024x768.

### Key features

- An intuitive and flexible visualisation tool for Itrax data
- Inter-relations between optical, radiographic and elemental variations are quickly seen
- Displays up to ten elemental profiles alongside optical and radiographic images in a single window
- Widely used by Itrax laboratories around the world
- Complements the Cox Analytical RediCore™ program
- No original data are modified

Technical data sheet available at [www.raddec.com/technical-notes.htm](http://www.raddec.com/technical-notes.htm)

# Spares & Consumables

## On-going solutions

Raddec supplies a wide range of high quality spares and consumables for use with their hardware. These parts are specifically-designed and manufactured to the highest quality to ensure optimal system performance.



# Technical Support

## Open data access

Raddec scientists provide both comprehensive pre-sales guidance and ongoing technical advice to support their range of innovative systems and software.

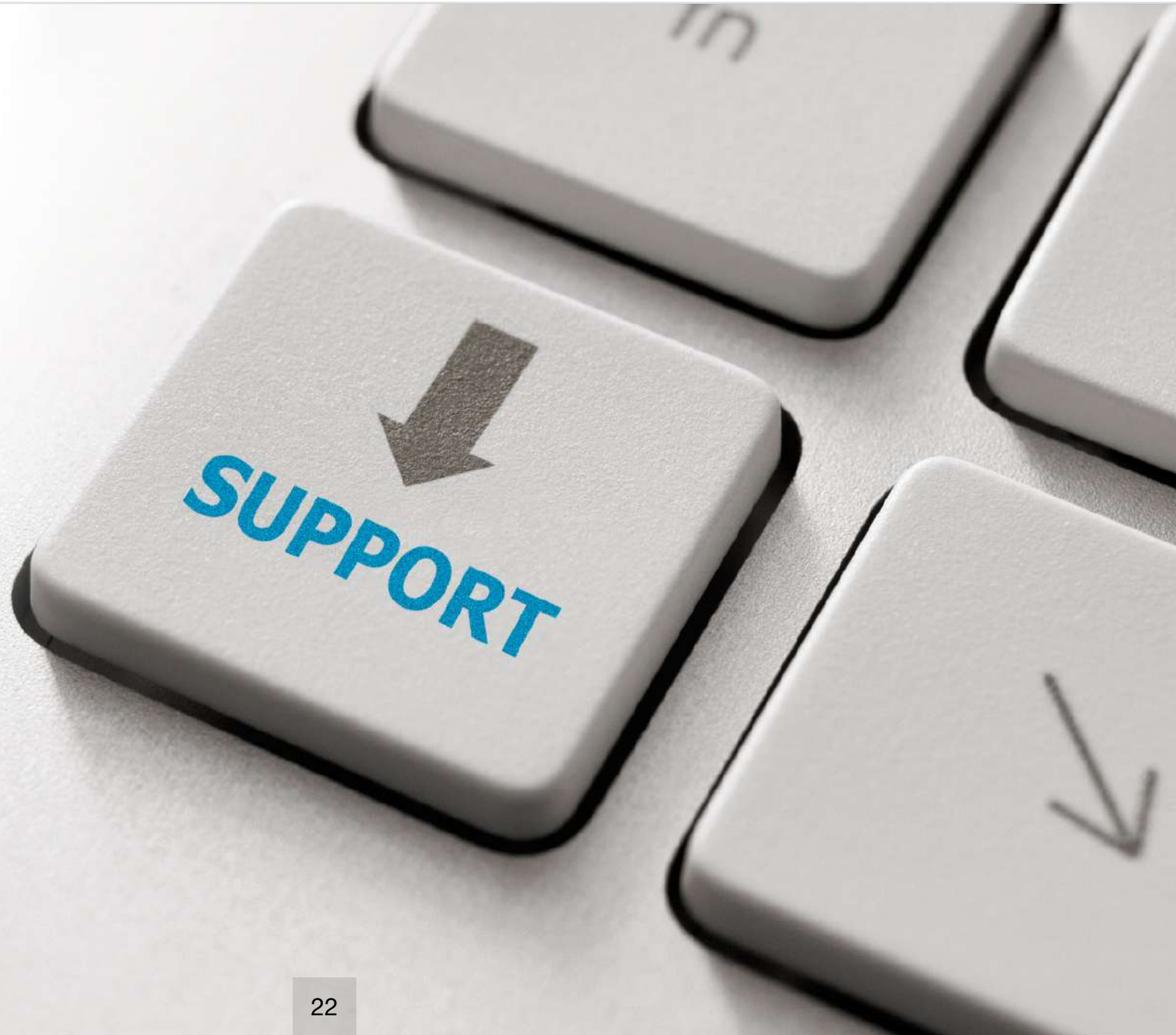
Raddec provide detailed technical support documents and training media, readily accessible through an on-line customer portal. Furthermore, Raddec have developed training courses for both beginner and advanced user levels, tailored to meet the specific needs of the customer.



## Customer support

Since 2003, Raddec Ltd has provided analytical solutions and technical support to its customers. With considerable radioanalytical experience, they routinely work with their customers to help them achieve their specific project goals.

Raddec also offer a range of service contract packages to ensure on-going reliable operation of our hardware with support provided both directly and through its network of local agents worldwide.





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