Raddec - New innovations

Phil Warwick

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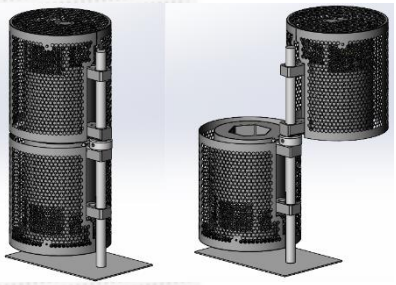

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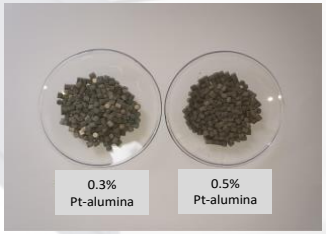

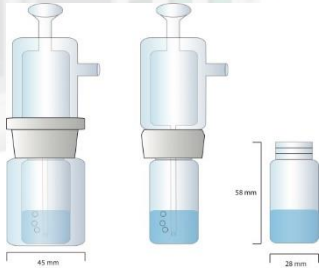

YouTube

Pyrolyser Gen III

New front panel layout

All controls are now at the front

All electronics are housed within a sliding tray accessed at the front of the furnace

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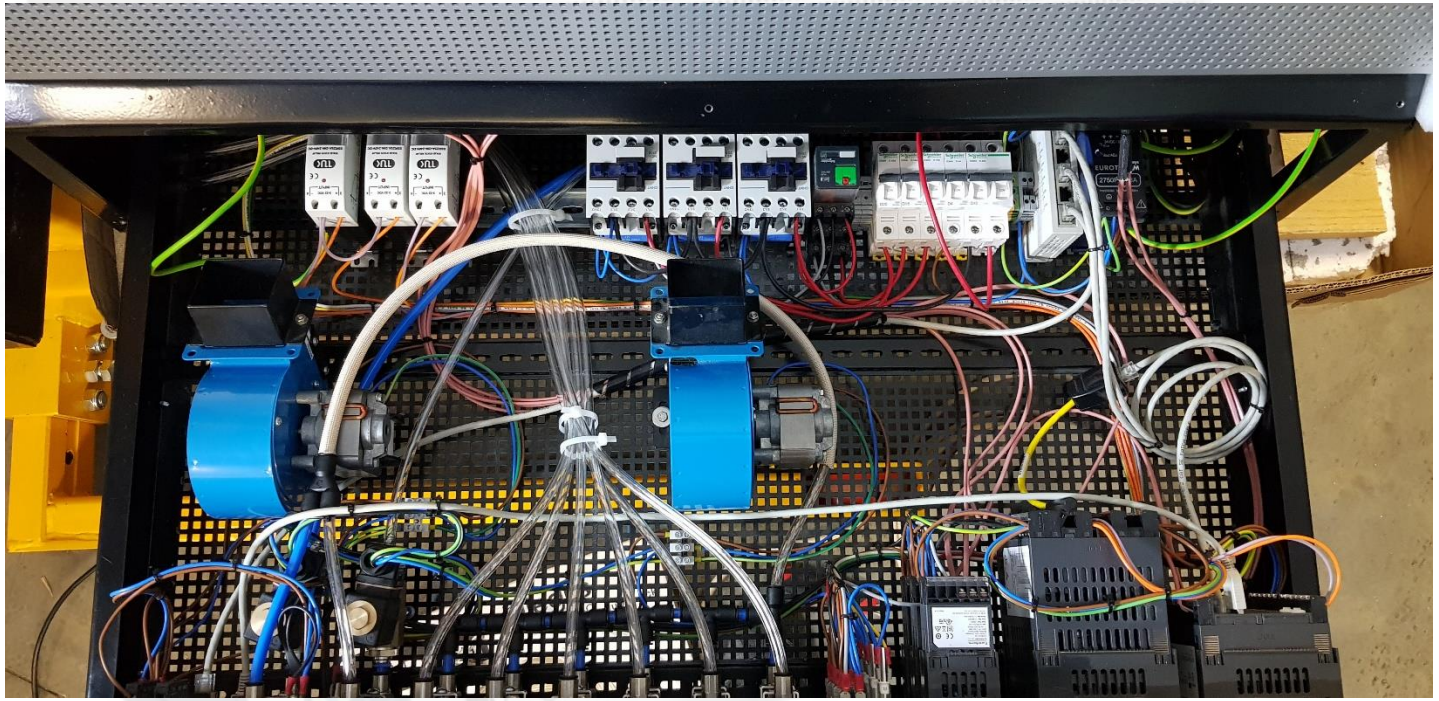
Pyrolyser Gen III draw



Straightforward maintenance and repair from the front of the furnace

Pyrolyser Gen IV

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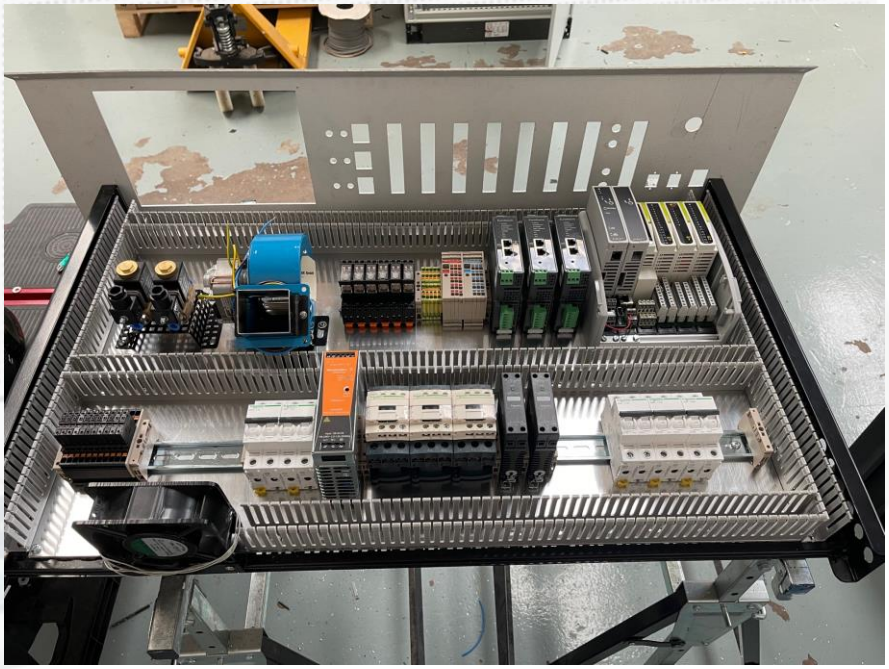
Improved system building and servicing by using an instrument drawer system

- Enhanced electrical build to meet CSA standard
- 24 Volt DC components for enhanced safety
- Single centrifugal fan with manifold to cool two zones
- AIR, OXYGEN supplies - NITROGEN OPTION



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Pyrolyser-6 Trio Generation^{IV}

- Incorporates a EUROTHERM HMI-PLC system
- E+PLC400 racks with modules
- 7” HMI (touch sensitive programming)
- Three EPC2000 O/T controllers
- Sample and Mid-zone rapid cool down facility for rapid cycling (fan+chimney)

The **Pyrolyser- Trio GenIV HMI-PLC** system :-

- 3 completely independent furnace zones
- Stores 20 editable heating programs;
- each program offers up to 15 segments.
- Ability to log and store combustion parameter data.
- The user can modify existing programs whilst the Pyrolyser is running a current program.
- A multi-level LOGIN system is available to manage users at different levels (Operator, Supervisor, Engineer)

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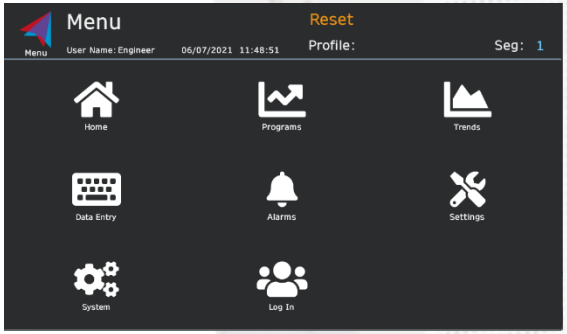
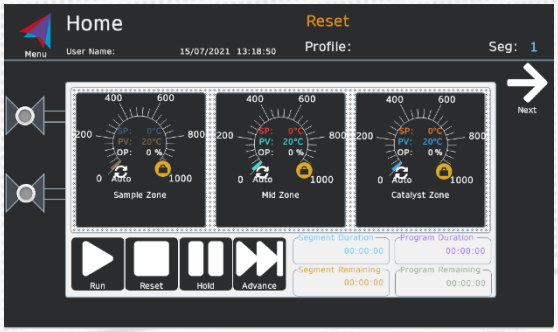
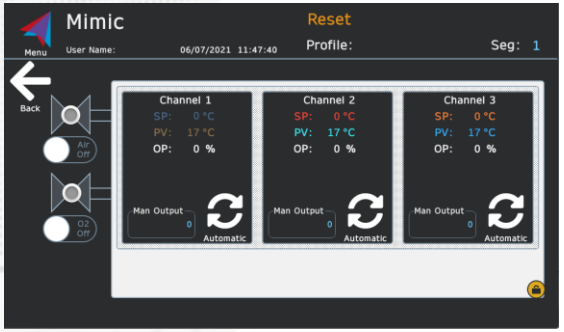
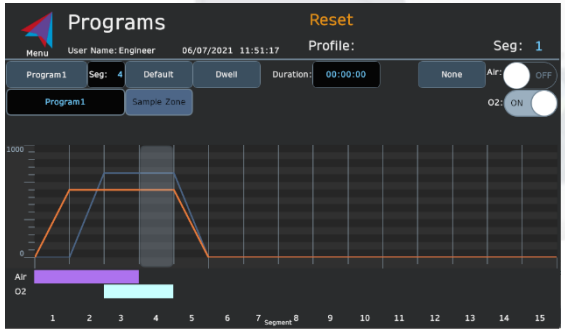
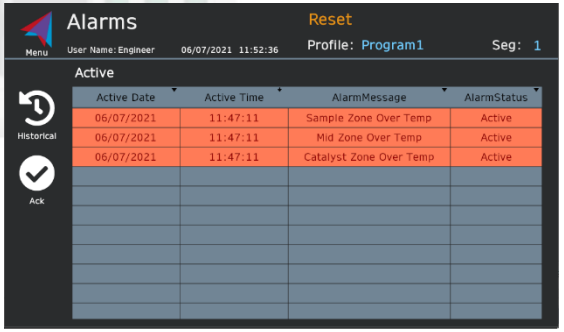


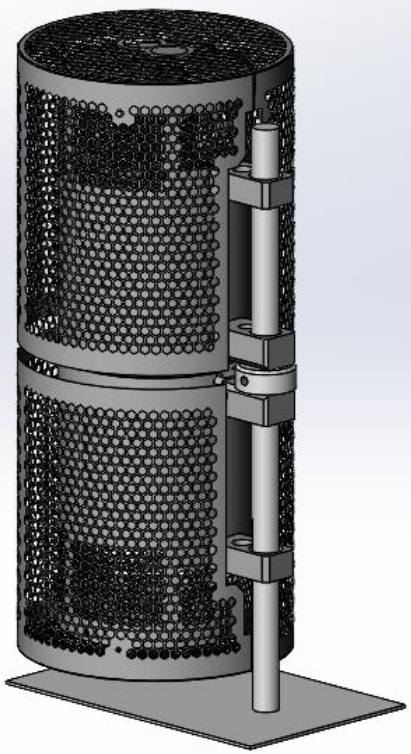


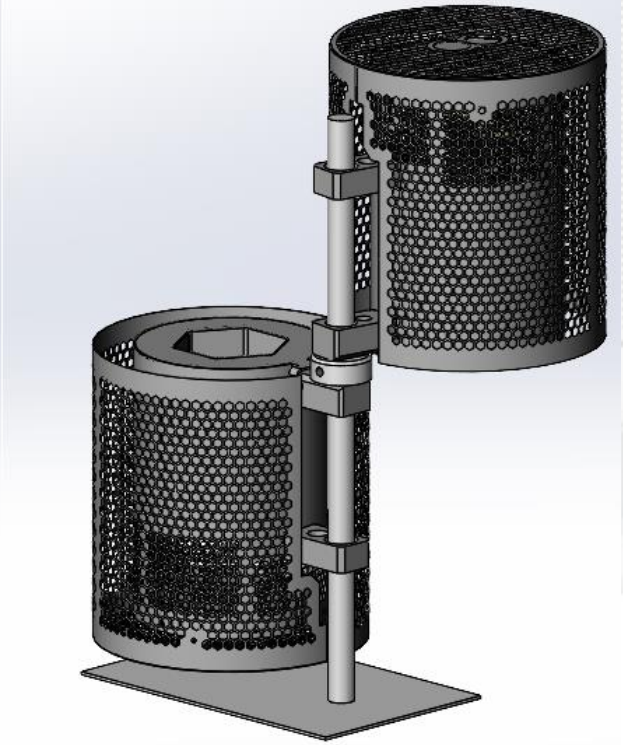






Pyrolyser mini





Modular construction for installation in glovebox environments.

Readily accessible components for ease of maintenance.

Elements installed in a replaceable module.

Remotely located control unit

Multi-function capability.

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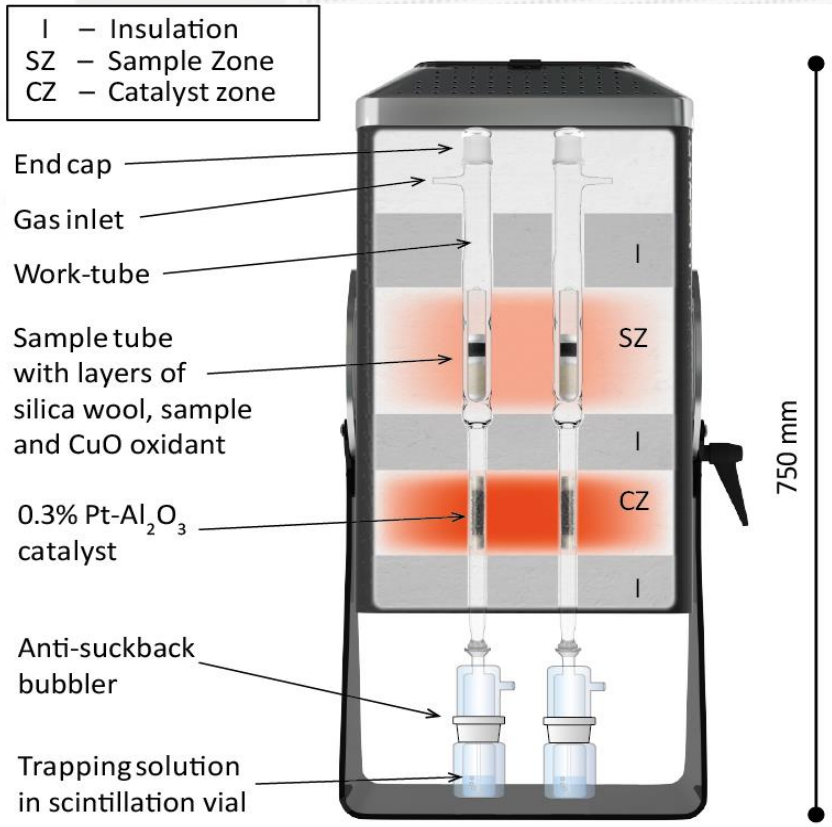
Pyrolyser Mini trials



Samples loaded at 600°C then heated to 900°C.

Catalyst zone held at 800°C

Warwick P.E., Croudace I.W. & Burrell F.M. A compact, dual-zone vertical tube furnace for the determination of tritium and carbon-14 in decommissioning wastes.(2021) *Appl. Radiat. Isot,* ***179****, 109995*.

This work was supported by the Nuclear Decommissioning Authority under their Direct Research Portfolio [NS4510-500-003].

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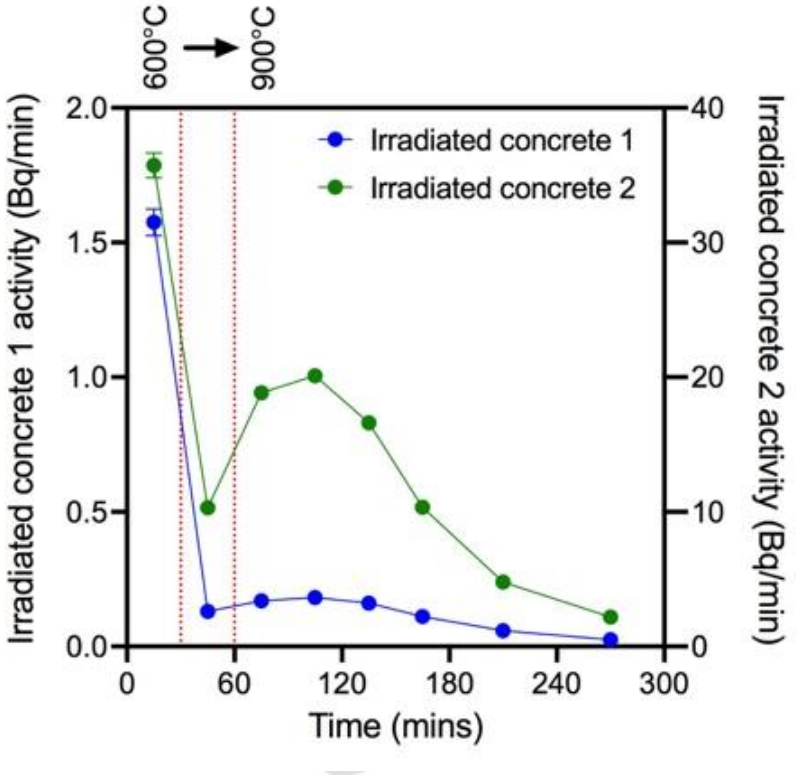
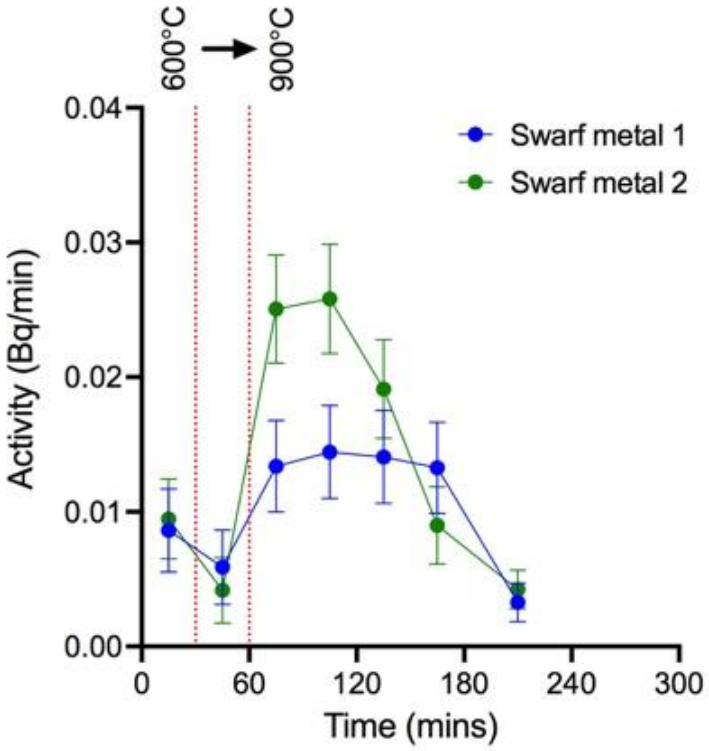
^{3}H evolution profiles





Extraction of ^{3}H and ^{14}C using a Pyrolyser Mini

Sample	H-3 activity (Bq/g)			C-14 activity (Bq/g)	
	Working value	Measured in 0.1M HNO_3	Measured in Carbontrap	Working value	Measured
Structural concrete (1.5 g)	4.8 ± 0.5	6.5 ± 0.8	6.9 ± 0.8	0.55 ± 0.07	0.59 ± 0.08
Irradiated concrete 1 (1.5 g)	37 ± 8	38 ± 4	46 ± 5	2.5 ± 0.3	2.8 ± 0.3
Irradiated concrete 2 (1.5 g)	1700 ± 200	1900 ± 200	2200 ± 300	7.7 ± 0.9	8 ± 1
Swarf metal 1 (1.5 g)	0.9 ± 0.6	7.6 ± 0.9	2.2 ± 0.3	7.0 ± 0.3	8 ± 1
Swarf metal 2 (1.5 g)	4 ± 7	3.4 ± 0.4	19 ± 2	7.9 ± 0.1	8 ± 1
OBT sediment sample (0.5 g)	11 ± 3	10 ± 1	10 ± 1	0.44 ± 0.04	0.6 ± 0.1

Note that the swarf metal contamination is highly heterogeneous

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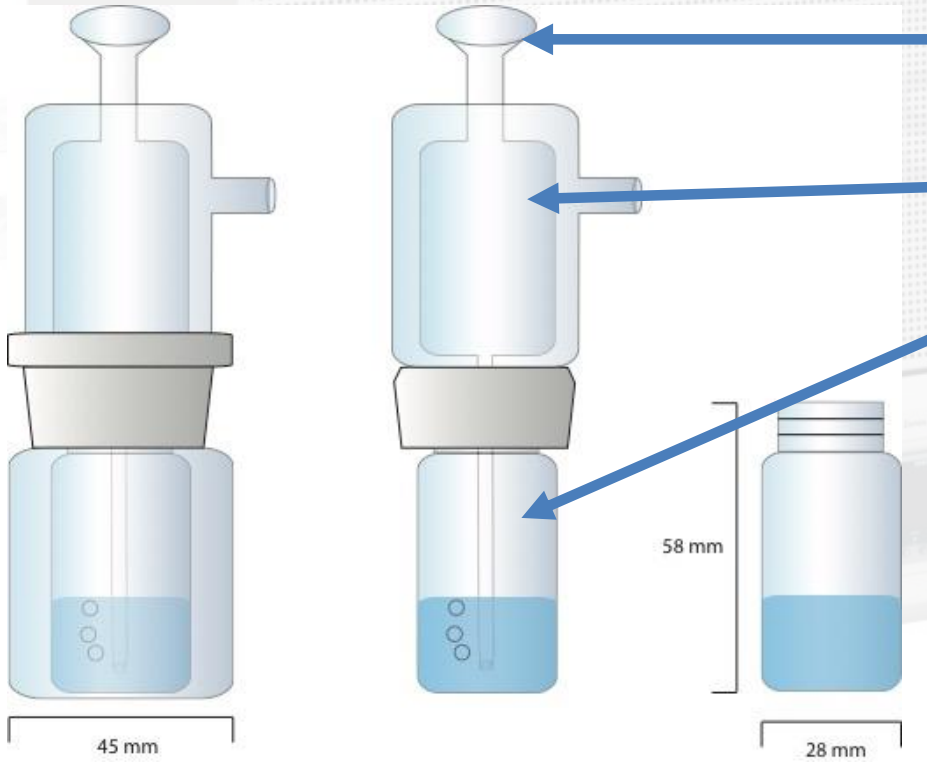
Accessories



Ground glass connection to furnace

Anti suck-back head

22ml polythene vial

Integrated vial bubbler

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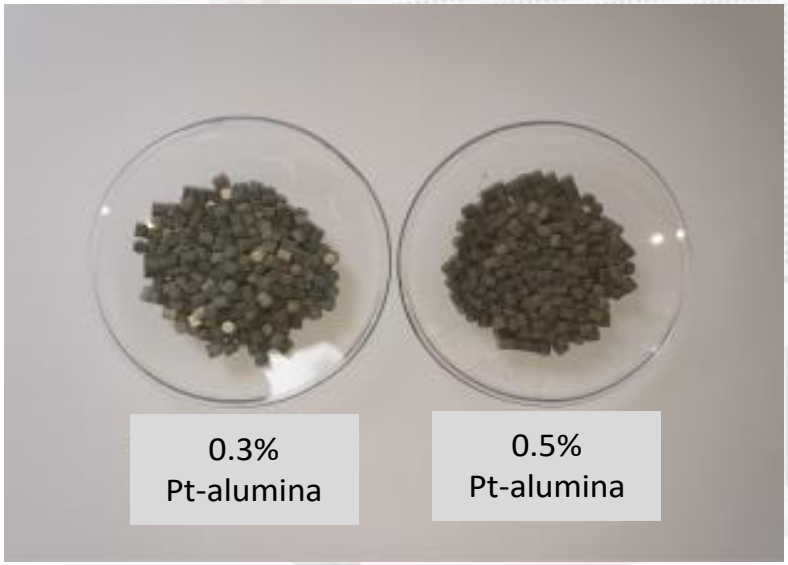
Pt-alumina catalyst

Introduction of 0.3% Pt-alumina catalyst



More robust supply of material.
0.5% Pt-alumina is being phased out.

Tested with ^{3}H-thymidine spiked milk.

Catalyst operating at 400°C.

Quantitative recovery of ^{3}H

No colouration in the bubbler.

Quench values comparable to those obtained using 0.5% Pt-alumina

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Other improvements

- New standard worktube with a B34 entry cone to enable larger diameter boats (and hence sample) to enter.
- Provision of larger diameter worktubes (up to 42 mm OD to enable even larger sample to be loaded (e.g. 10 grams Fish, biota, foodstuffs)
- Development of a method to cleanly oxidise 10 grams fish in 7.5 hours (so 60 grams of fish in 1 working day)

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Training

Pyrolyser | Pyro-Mini | HBO | ASRS

Routine operations

Methodologies

Theoretical principles

Quality control / assurance

On-site courses | Off-site courses | On-line training

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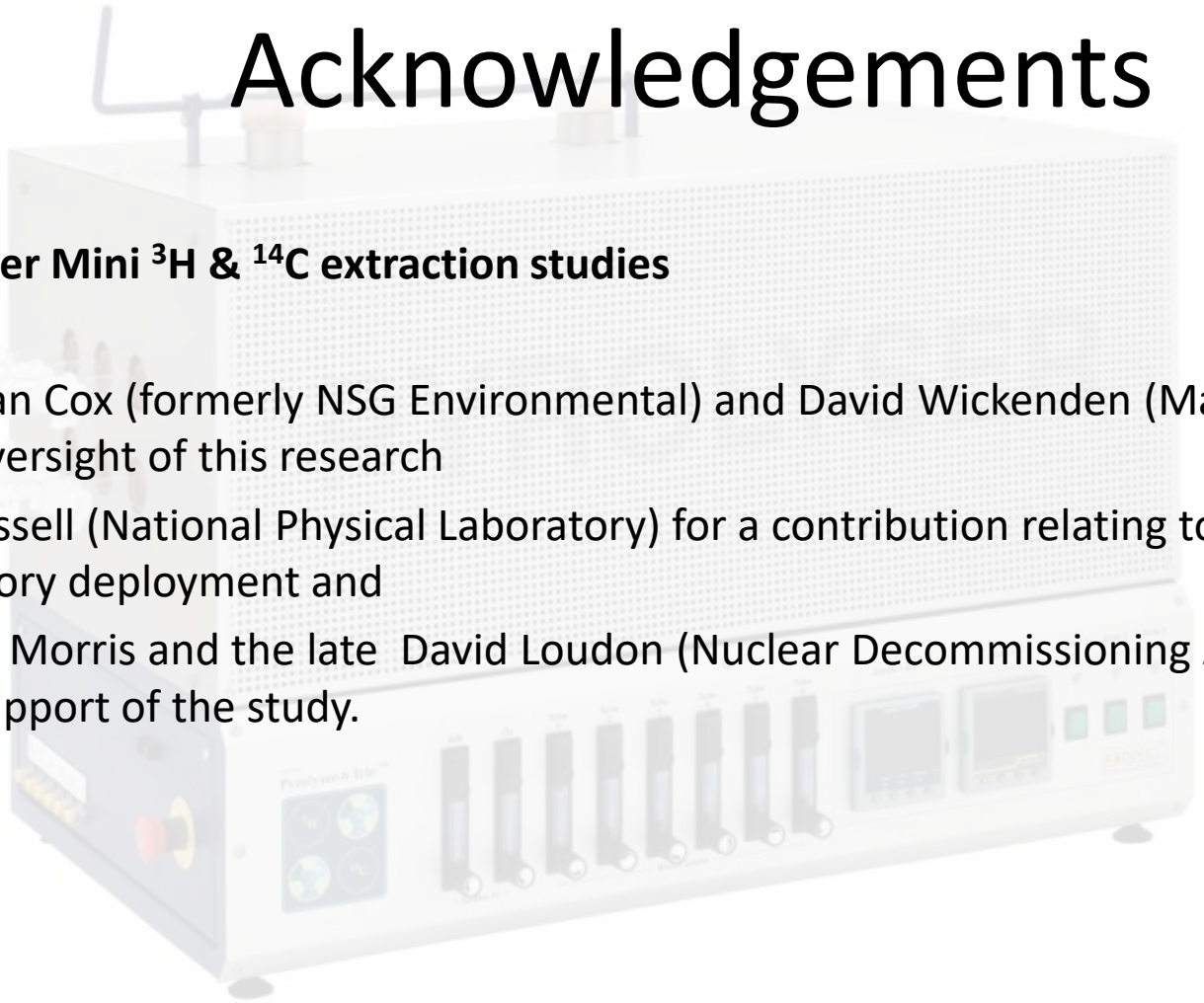
Online

- Main web site at

  www.raddec.com

- Also, see technical videos on YouTube (follow link from our website)

Acknowledgements



Pyrolyser Mini ^{3}H & ^{14}C extraction studies

Jonathan Cox (formerly NSG Environmental) and David Wickenden (Magnox Ltd), for their oversight of this research

Ben Russell (National Physical Laboratory) for a contribution relating to the mobile laboratory deployment and

Yvonne Morris and the late David Loudon (Nuclear Decommissioning Authority) for their support of the study.

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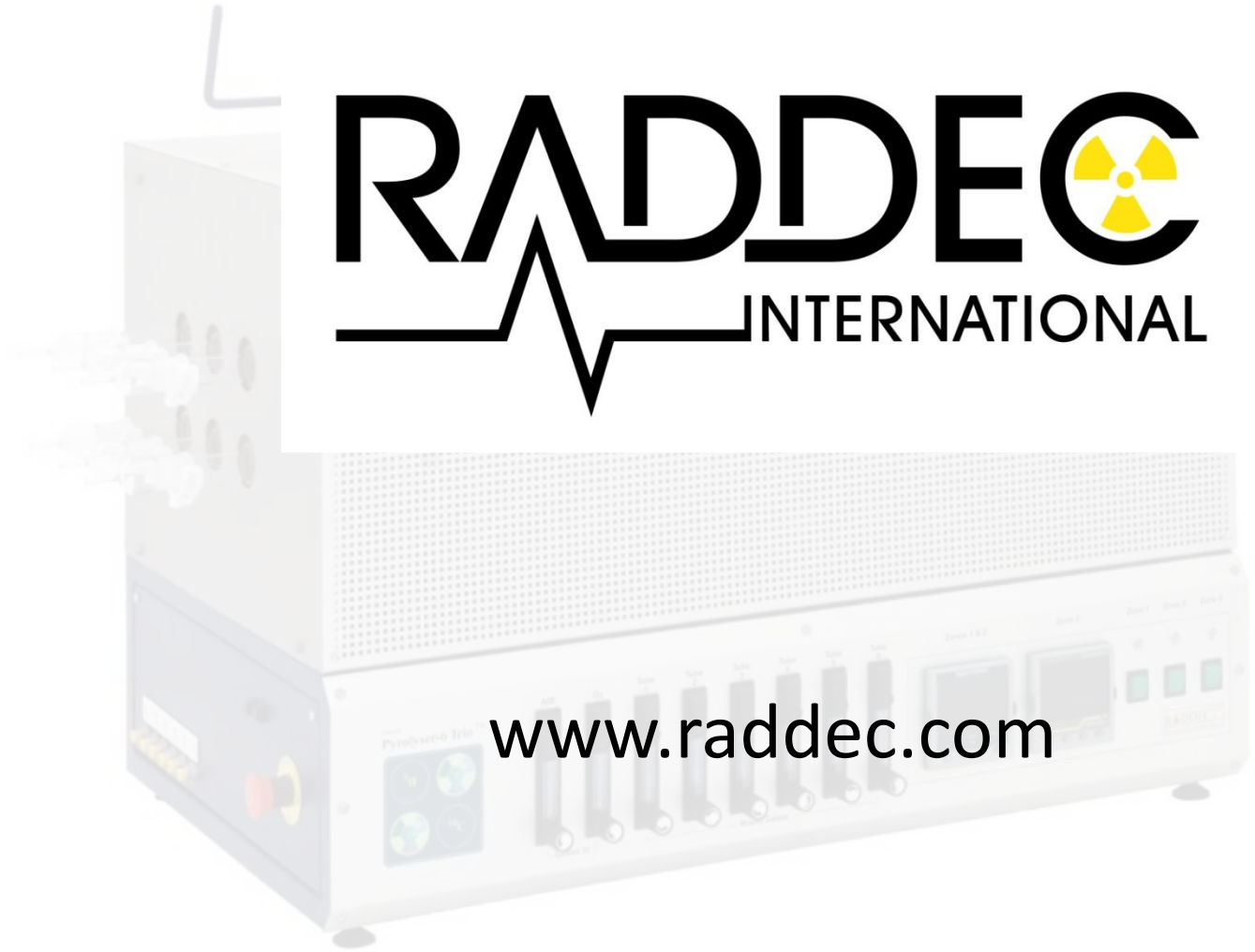

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