

# Comparison of Gas Monitor Responses to $^{85}\text{Kr}$ and Tritium

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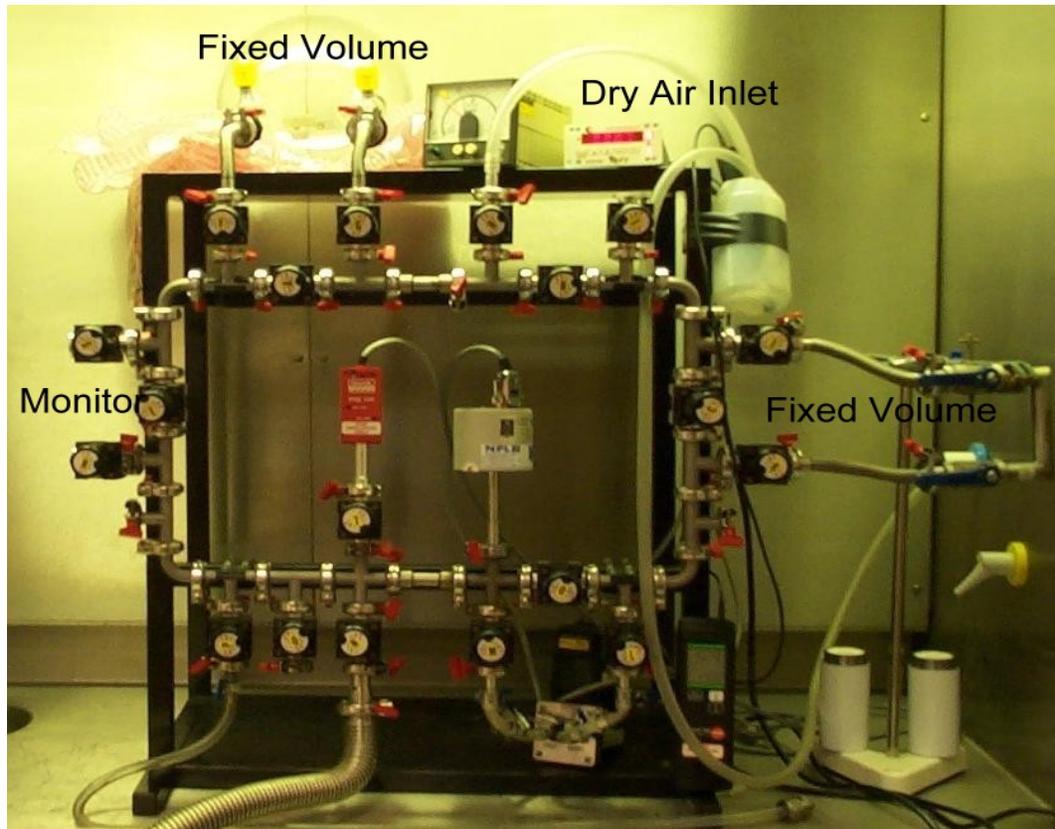
ARMUG, NPL Teddington, November 2006

- Calibration of gas in air monitors
- Response of monitors
- Conclusions

## Need for calibration of monitors

- Regulatory compliance  
(BS EN 60761 & Radioactive Substance Act 1993 -  
Section 13)
- Measurement traceability

## NPL Monitor Calibration Rig



Types of monitor background and gamma compensation

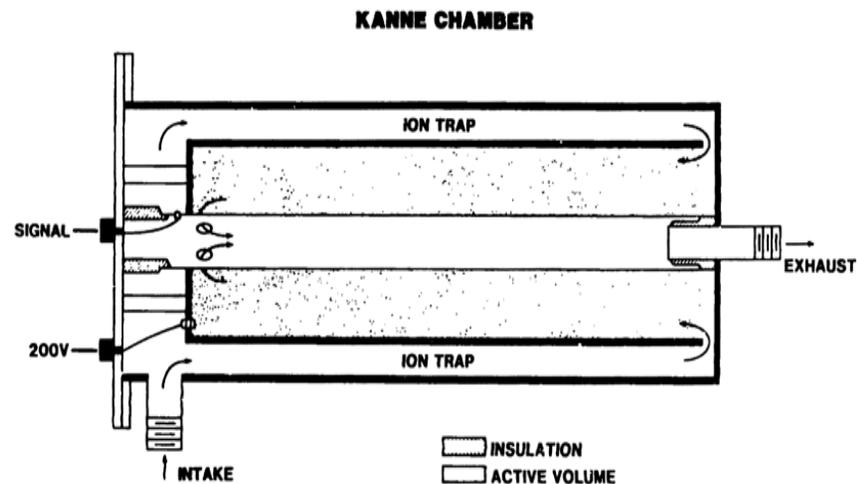
- Second identical isolated ion chamber

Or

- Surrounding co-axial ion chamber (Kanne)

Both with radon suppression and ~2.4l ion chamber volumes

# Response of monitors



- 3 concentric cylinders
- Outer and inner cylinders at  $\sim$  ground potential
- Intermediate cylinder at  $\sim 200$  V
- Ion trap between outer and intermediate cylinders
- Inner cylinder acting as collecting electrode

## Experimental procedure

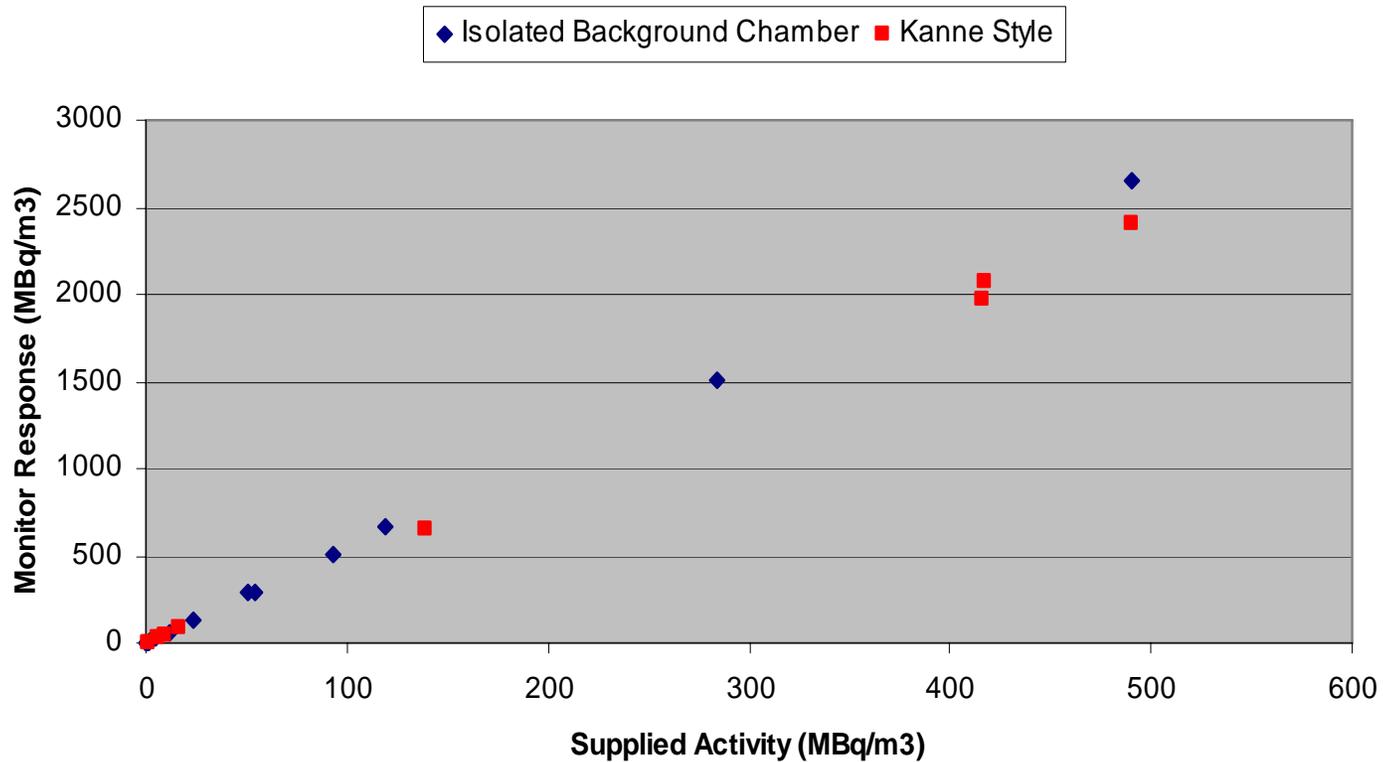
- Monitor compatible with rig?
- Fill fixed volume
- Connect monitor to rig
- Expose monitor
- Trap gas for further dilution
- Return monitor to background reading

# Response of monitors

|                             | $^{85}\text{Kr}$ Response               |   | $^3\text{H}$ Response                   |   |
|-----------------------------|---|---|---|---|
| Monitor Type                | Supplied Activity (MBq/m <sup>3</sup> ) | Mean Monitor Response / Supplied Activity | Supplied Activity (MBq/m <sup>3</sup> ) | Mean Monitor Response / Supplied Activity |
| Isolated Background Chamber | 0.5 - 12                                | 5.54                                      | 0.5 - 20                                | 1.156                                     |
|                             | 100 - 500                               | 5.48                                      |   |   |
| Kanne Style                 | 0.5 - 12                                | 4.81                                      | 0.5 - 20                                | 1.031                                     |
|                             | 100 - 500                               | 4.82                                      |   |   |

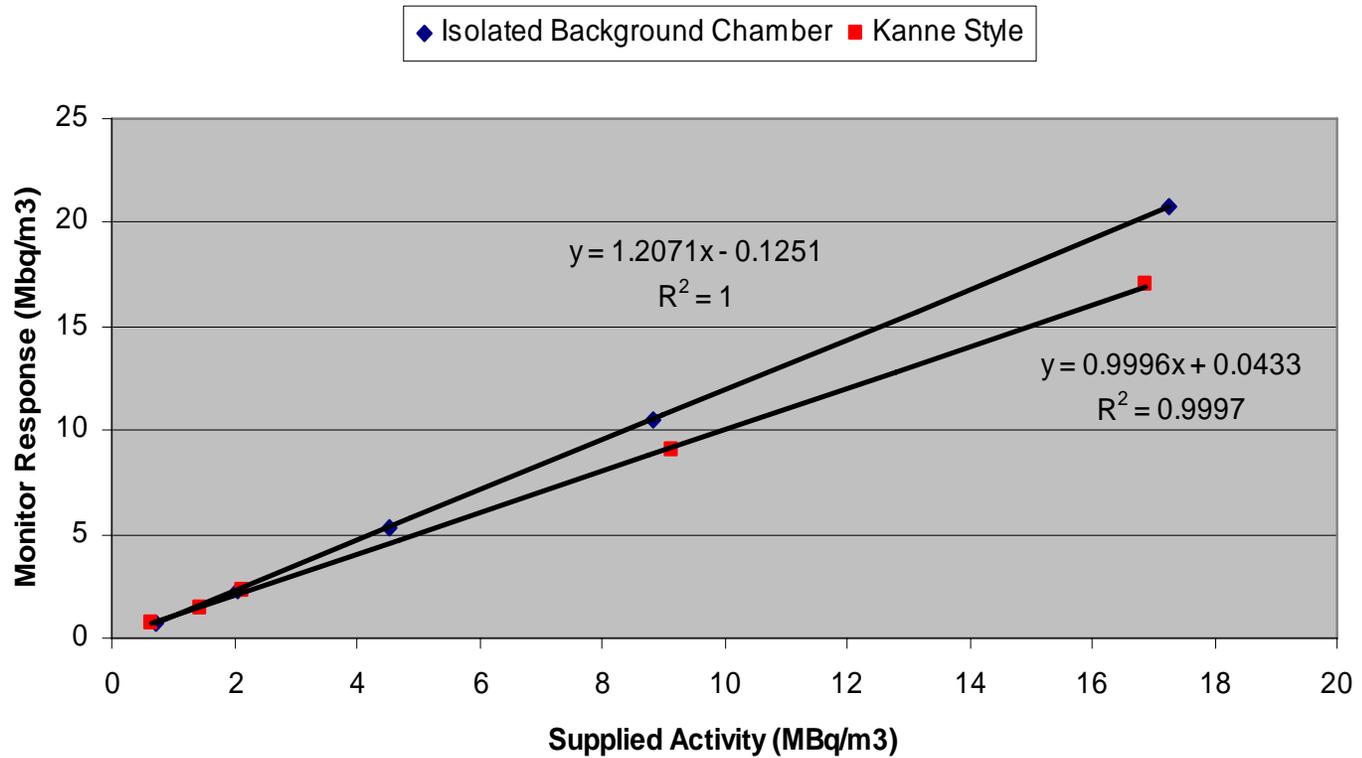
# Response of monitors

Monitors response to Kr85



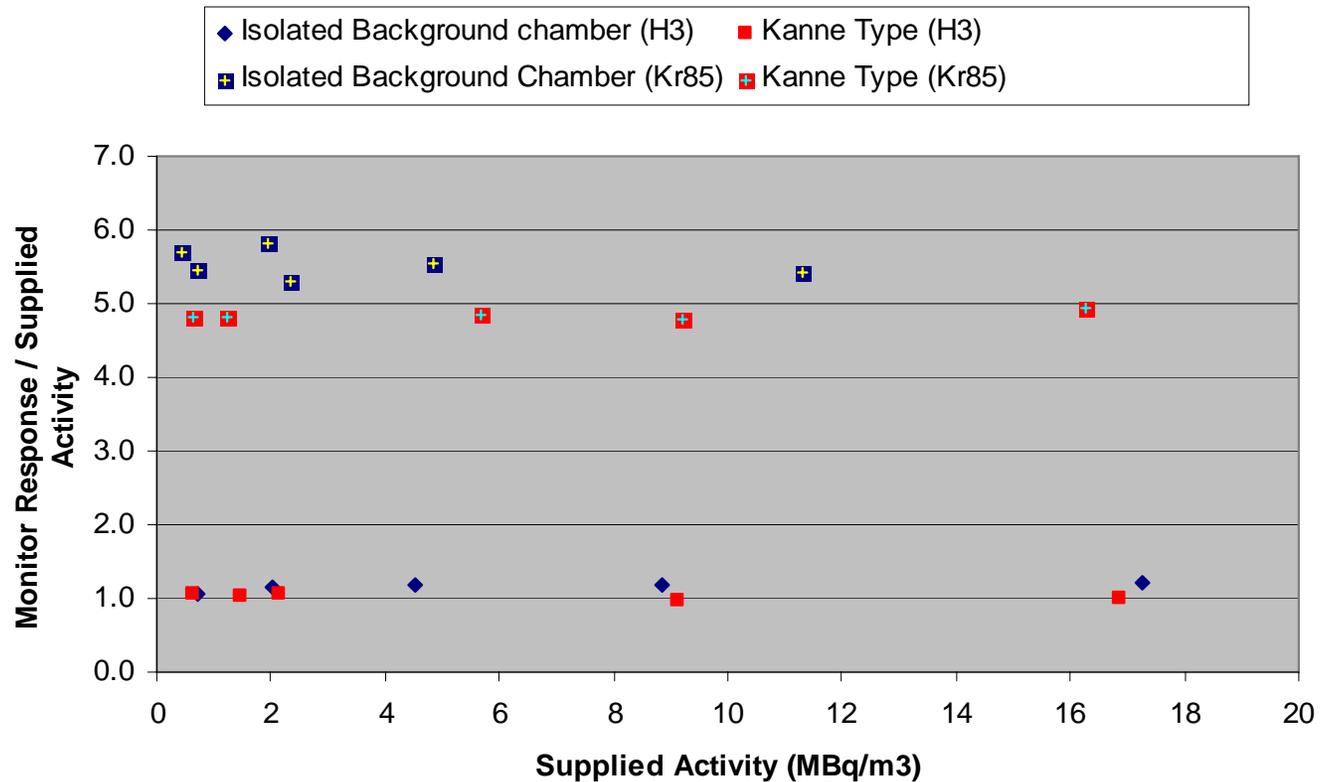
# Response of monitors

## Monitors Response to H3



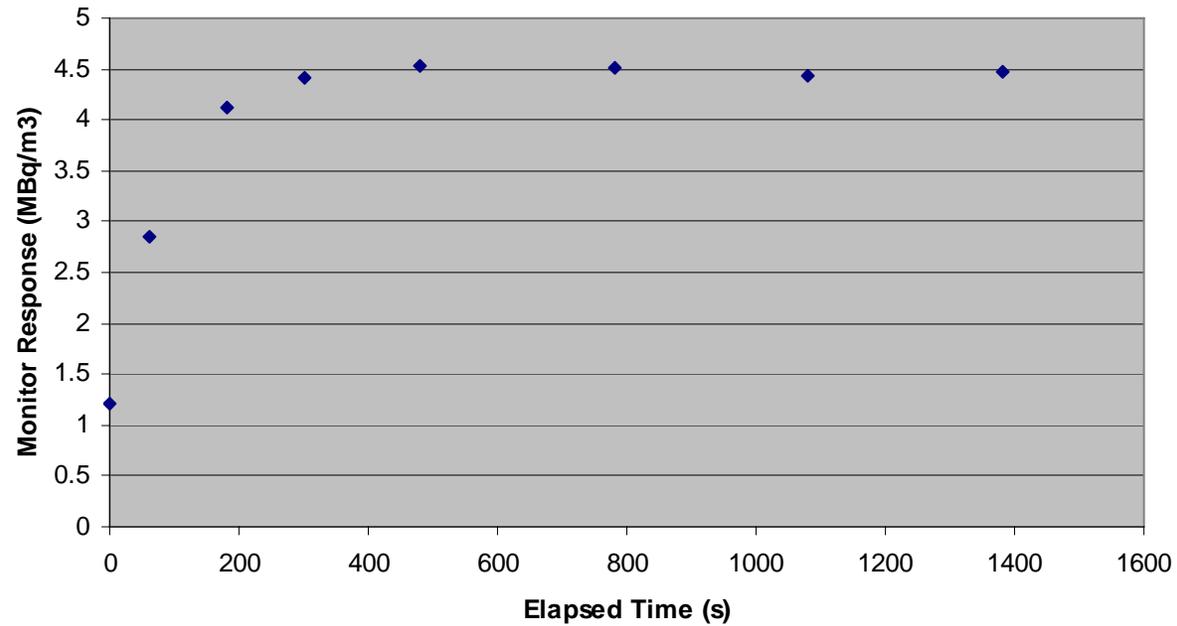
# Response of monitors

## Monitor Response / Supplied Activity v Supplied Activity



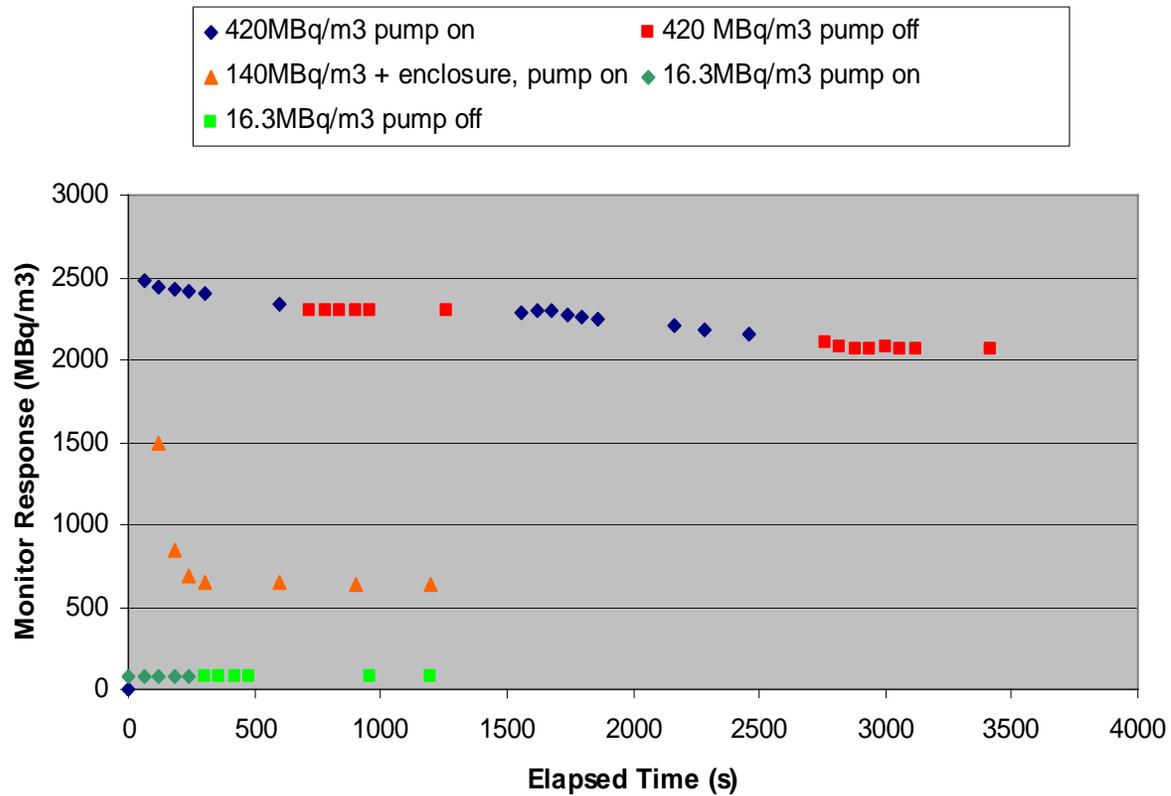
# Response of monitors

Typical Monitor Response with Time



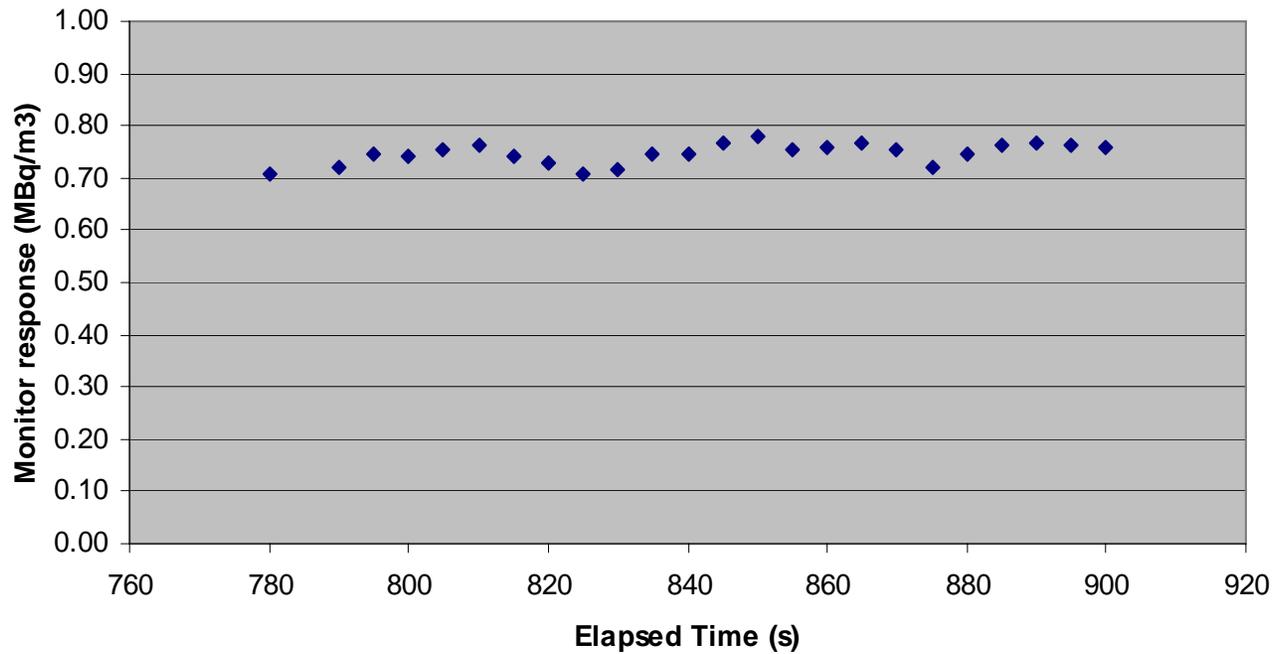
# Response of monitors

## Kanne Style Kr85 Response



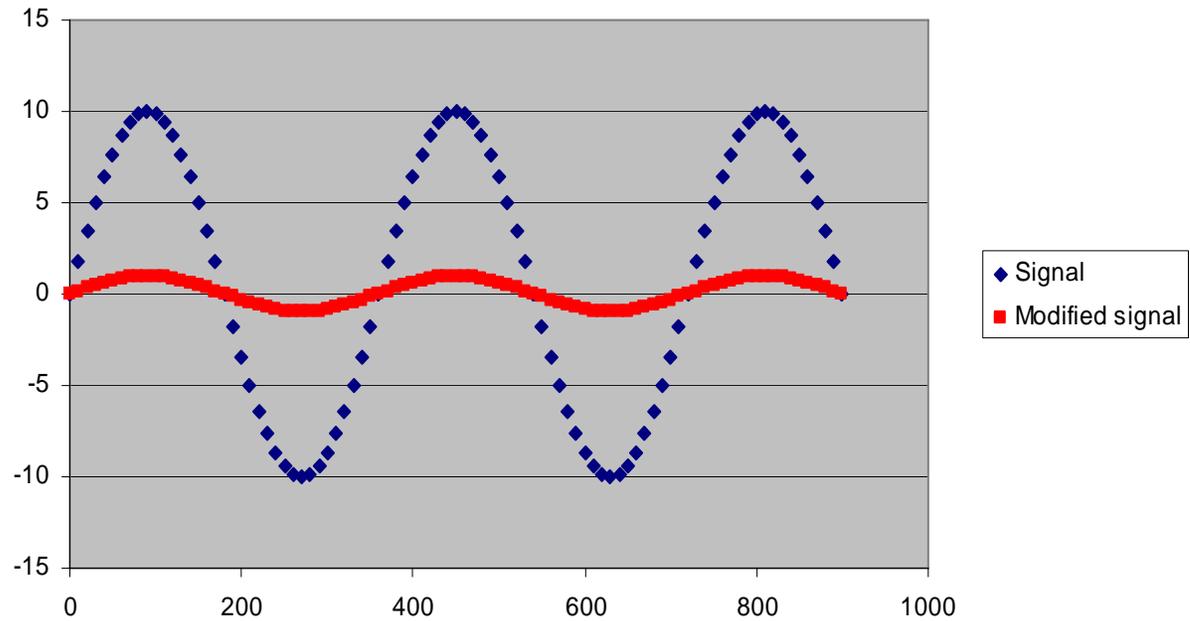
# Response of monitors

Isolated Background Chamber Monitor 5s from 13 to 15 mins after initial exposure



# Response of monitors

Effect of ion chamber collection time on displayed measurement



# Conclusions

- Both isolated background chamber and Kanne style monitors had linear response to  $^{85}\text{Kr}$  and  $^3\text{H}$
- Responses were similar – small differences (differing traceability, calibration factors, electronics)
- Kanne style  $^{85}\text{Kr}$  response affected by circulating pump operation /  $^{85}\text{Kr}$  sticking /leakage from monitor?
- Fluctuating response of isolated background chamber monitor attributed to ion chamber output-time constant signal processing / varying activity concentration in rig?