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RID, RPI or both?

Presentation to
NPL IRMF

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Disclaimer

- personal view on specific technical issues related to ionising radiation metrology.

- not linked to any specific instrument / contract.

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Why?

- Homeland security
- Also:
  - Defence
  - Nuclear power industry etc..

- Why have two instruments when one can do?
- RIDs typically >£10k+ - why add another £1k-£2k if it can do *the job*?
- We may be talking 100s or 1000s at a time!
- Scale of supply, maintenance, calibration, availability…
- As everywhere: money driven! (customer, supplier, contractor..)

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RID

- **Hand-held Radionuclide Identification Devices (RIDs)** are radiation detectors that can analyse the energy spectrum given off by a radionuclide to identify it. They can be used also as survey instruments to locate nuclear and other radioactive material.

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IAEA

- Technical / Functional Specifications for Border Radiation Monitoring Equipment (Nuclear Security Series No1, Sept05).
- "These instruments can be used for searching and localization of radioactive sources and simultaneously for gamma dose rate measurements for radiation safety purposes…"
- Note: "*If the RID gives the ambient equivalent dose rate values, but is not certified for legal usage as a legal dose rate meter, it should be noted in the instrument manual or directly on the instrument*."

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Not to confuse (?) with PRDs

- Personal Radiation Detector
  - pocket-sized devices designed to detect, locate, quantify and identify radioactive and nuclear materials.

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RIDs & RPI?

- Most RIDs based on Na or Cs for high efficiency detection and identification,
- Sometime CZT (but rare and expensive, and forget HpGe ones ££!)
- GM options for high dose rates (>100s microSv/h, is it useful ??!!),
- but mostly not E-compensated.
- Small He tube or other for N detection
- Most RIDs *indicate* “gamma dose rate”
- some may claim to measure H*(10), but may not or don’t really

➢ Can they be used as RPI for gamma dose rate?

➢ Can they be used for estimating g exposures and for designating areas?

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RPI: HP survey meters

- RPI: “conventional HP survey meters”
  - Ionisation chambers
  - GM tubes (E-compensated)
  - Scintillation

- ISO / IEC salient point
  - +/- 30% variation of response over energy range

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RPI (perceived) requirements (I)

- Must measure H*(10)
- IRR99
  - **Don't have to use H*(10), can use H'(Ω), but easy enough to do**
  - **Need to ensure suitable calibration regime in relation to use (GPG14 etc..)**
  - **RIDs CAN be tested to GPG14.**
  - **RIDs could be "certified" for legal usage as a legal dose rate meter as suggested by IAEA. – should there be a UK certification scheme?**

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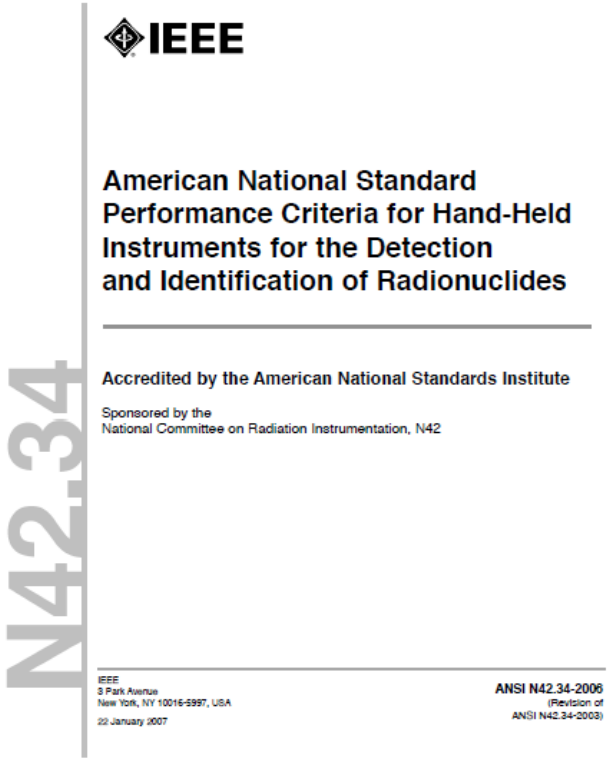
RPI (perceived) requirements (II)

- Requirements
- The relative intrinsic error in the response of the instrument to the reference exposure rate from 137Cs shall not exceed ±30% for exposure rates from 0.1 mR/h to the manufacturer-stated maximum response of th instrument.



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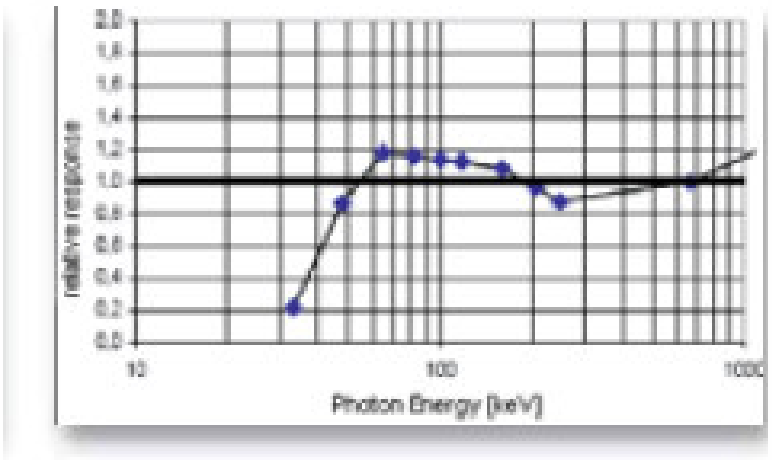
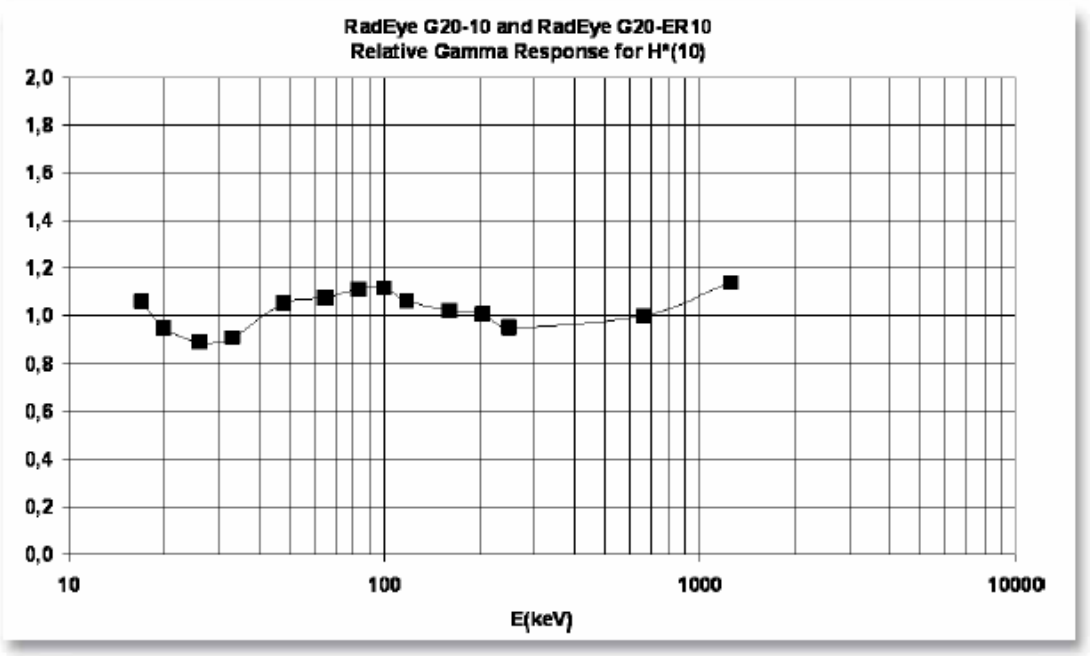
Typical energy response; RPI

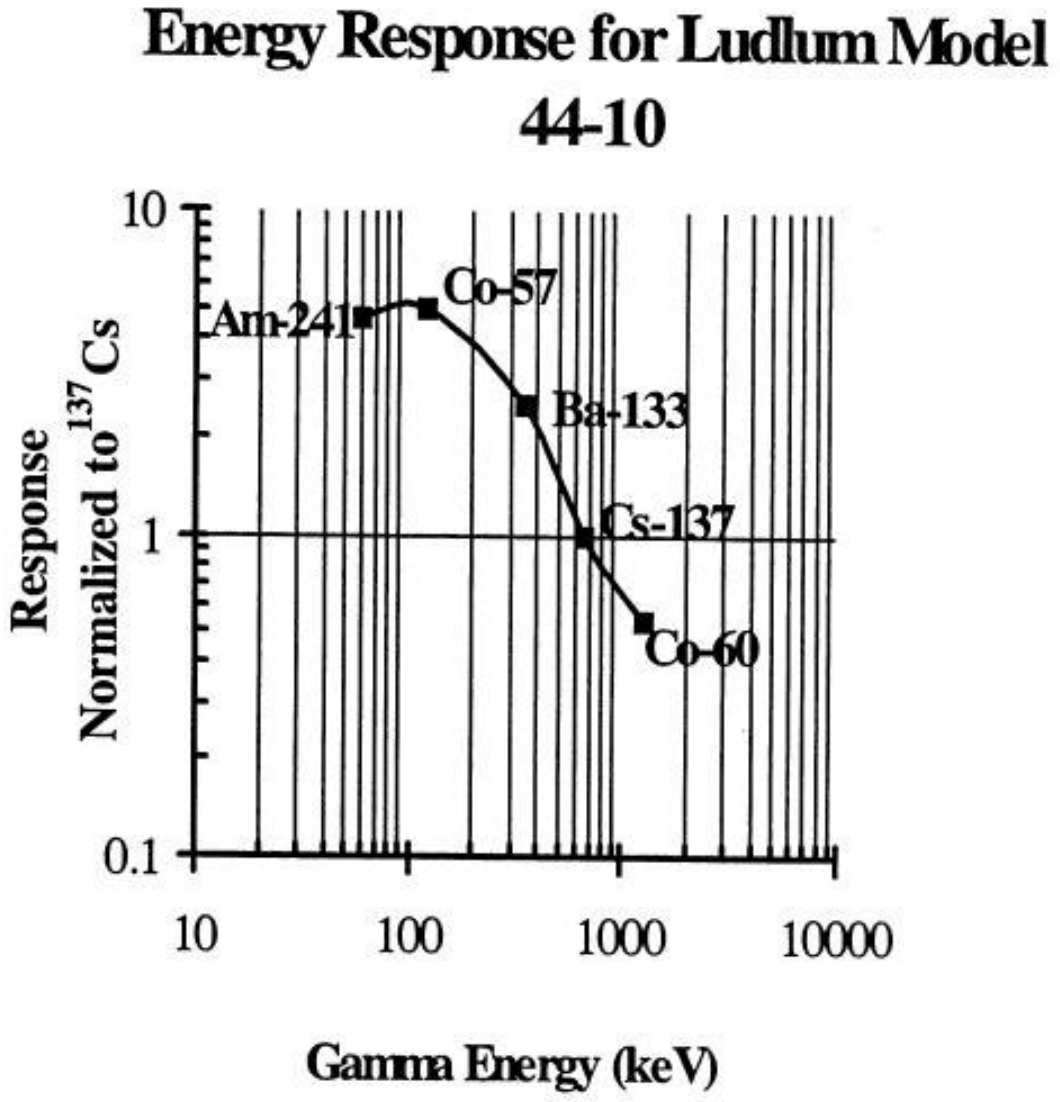


Energy response curve RadEye G-10 according to ambient equivalent dose H(10)*

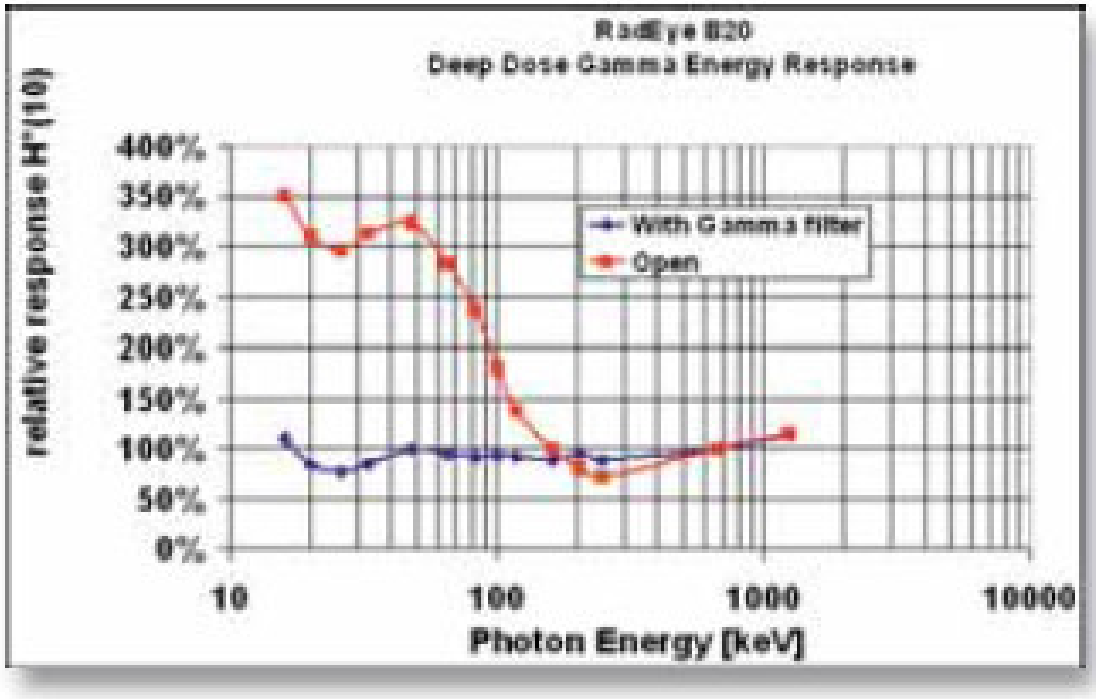


Typical energy response: RIDs

- NaI 2x2:



Use E-filters on RIDs ?



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RPI (perceived) requirements (II continue)

- ISO / IEC: similar to IEEE +/- 30% variation of response over energy range
- Some RIDs with NaI, +/- 30-*ish* % (30%-50% tbc type test data?)
- BUT ISO / IEC = guidance
  - **In HP a factor of 2 error is common; should +/- 30-ish up to 50% be acceptable? – why not?**
  - **RIDs firmware could correct response from E observed and display within +/-30% (they are intelligent spectrometers, aren't they?)**
  - **Use E-filters for gamma dose rate determination?**
  - **Alternatively, RIDs g dose rate display could come from good E-compensated GM (provided polar response etc.. ok!..)**

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Epilogue (I)

- Not necessarily H*(10), but lazy not to
- Must be fit for purpose & Must have good calibration regime, ie GPG14 IF RPI
- Conversely GPG14 not required if NOT used as RPI !!...
  - *But some testing should be required to ensure it continues to be fit for purpose….*

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Epilogue (II)

- Easy to improve sensors or firmware to achieve +/-30% indicated dose rates, May consider E-filters
- “low” rate range enough in most cases
  - Who needs gamma dose rate accuracy > 100 microSv/h for RPI? RIDs can safely indicate overload.
  - Quantify high activity / dose rate sources from afar! Measure distance with laser pointer!
  - Na and Cs … do not like very high dose rates, so there is no much point in fitting very-very high dose rate GMs!

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Conclusion

- RID AND RPI, should provide suitable gamma dose rate indication.
- Easy and clear room for improvements by RID Manufacturers to meet IEC. (More likely than IEC change or QP approval)
- For G' s sake do consult *both* RPAs AND QPs!
  - not the ones trying to sell you the equipment or calibration services unless you really trust them !!..
  - Can you just devise a suitable set up and calibration regime with what you already have?!.. consider existing equipment rather than best (Xmas) wish list advice

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