

# Updates to ISO 9696, 9697 and 9698

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# Radioactivity in Water

## EC Directives

- Directive 98/83/EC
- Tritium – 100 Bq/dm<sup>3</sup>
- Total Indicative dose – 0.1 mSv/year  
(Excludes dose arising from <sup>40</sup>K and radon plus radon daughters)

# Radioactivity in Water

## Radon and radon daughters

- The implication is that this means  $^{222}\text{Rn}$  (~3.8 d) only, and the 4 short lived daughter nuclides  $^{218}\text{Po}$  (~3 m),  $^{214}\text{Pb}$  (~27 m),  $^{214}\text{Bi}$  (~20 m) and  $^{214}\text{Po}$  (~160  $\mu\text{s}$ )
- But it *could* include  $^{210}\text{Pb}$  (~22 y),  $^{210}\text{Bi}$  (~5 d) and  $^{210}\text{Po}$  (~140 d)
- Radon implies  $^{222}\text{Rn}$ ,  $^{220}\text{Rn}$  (~55 s, 5 daughters) and  $^{219}\text{Rn}$  (~4 s, 4 daughters)

# Radioactivity in Water

## Dose may not be easily measured at these levels

- The derivation of dose from activity measurements is not necessarily straightforward
- ‘A Member State is not required to monitor drinking water for tritium or radioactivity to establish total indicative dose where it is satisfied that, on the basis of other monitoring carried out, the levels of tritium of the calculated total indicative dose are **well below** the parametric value. In that case, it shall communicate the grounds for its decision to the Commission, including the results of this other monitoring carried out.’
- ‘...well below...’????

# ISO TC 147/WG9

## Technical Committee 147 deals with water quality

- Working Group 4 deals with ...**radioactivity**
- Technical Experts from UK, France, Spain, Netherlands, Italy, Germany, Australia, Finland and the USA
- Meetings every six months (or so)
- Work mirrored by SCA WG9 in the UK

# ISO 9696:1992

## Water Quality - Measurement of gross $\alpha$ activity in non-saline water - thick source method

- Revision to standard is still based on evaporated source and planchette counting
- No fundamental changes
- SCA WG9 recommended acceptance as a British Standard

*Blue Book 94 (ISBN 011751909X) 1985*

- *Measurement of  $\alpha$  and  $\beta$  Activity of Water and Sludge Samples.*
- *The Determination of  $^{222}\text{Rn}$  and  $^{226}\text{Ra}$ .*
- *The Determination of Uranium (including General X-ray Fluorescent Spectrometric Analysis)*

# ISO 9697:1992

## Water Quality - Measurement of gross $\beta$ activity in non-saline water

- Revision to standard is still based on evaporated source and planchette counting
- No fundamental changes
- SCA WG9 to discuss

*Blue Book 94 (ISBN 011751909X) 1985*

- *Measurement of  $\alpha$  and  $\beta$  Activity of Water and Sludge Samples.*
- *The Determination of  $^{222}\text{Rn}$  and  $^{226}\text{Ra}$ .*
- *The Determination of Uranium (including General X-ray Fluorescent Spectrometric Analysis)*

# New work

- In drafting new versions of ISO 9696 and 9697 use of LSC was suggested
- Doesn't fit into existing standard
- New work package agreed



## Water Quality – Measurement of gross $\alpha$ and $\beta$ activity concentration in non-saline water – Liquid scintillation counting method

- Based on evaporation of water or direct measurement
- Adjust to pH 1.5 ( $\pm 0.2$ )
- Add to scintillant – 2 parts sample to 3 parts scintillant
- Measure against suitable standards

## Calibration Standards

- $^{236}\text{U}$  has been suggested as a suitable mimic for naturally occurring  $\alpha$  emitters
- $^{241}\text{Am}$  or  $^{239}\text{Pu}$  have been suggested as a suitable mimic for anthropogenic  $\alpha$  emitters
- $^{90}\text{Sr}/^{90}\text{Y}$  has been suggested as a suitable standard for  $\beta$  emitters
- $^{40}\text{K}$  has been suggested as a suitable standard for  $\beta$  emitters, especially if a potassium chemical standard is employed

## Technique

- Measure directly or slowly evaporate sample aliquot to dryness
- Ensure no solid matter or precipitation present
- Adjust ph to 1.5 ( $\pm 0.2$ )
- Prepare in plastic vials
- Measure using  $\alpha/\beta$  discrimination on a counter capable of low-level measurement

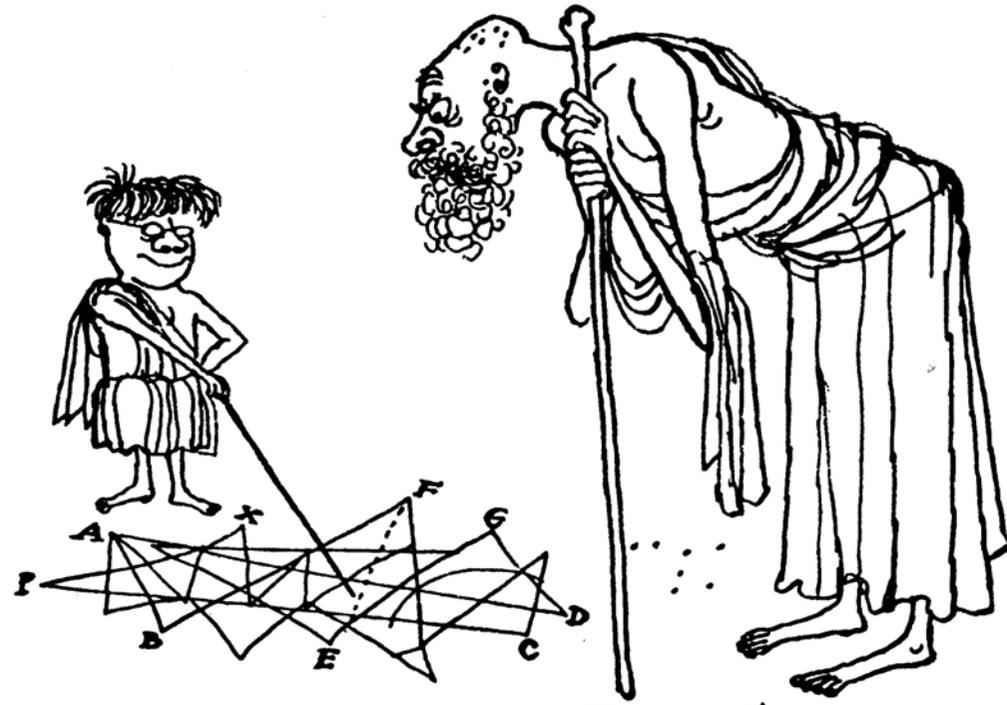
## $\alpha/\beta$ discrimination

- Recommends use of di-isopropyl naphthalene (DIN) scintillants for optimised  $\alpha$  and  $\beta$  event separation
- Possible to separate all  $\alpha$  and  $\beta$  events
- All  $\alpha$  emitters can be measured (0-10 MeV)
- Lower limit 2 MeV ( $^{147}\text{Sm}$ )
- All  $\beta$  emitters can, in theory, be measured (0-3 MeV)
- May set a limit at 0.2 MeV to make it comparable to ISO 9697

# ISO XXXXX:20YY

## Calculation

- Need to account for spillover in  $\alpha$  and  $\beta$  channels
- Calculations more complex
- Straightforward with a spreadsheet



## Activity Loss

- Assumption that evaporation loses all  $^{219}\text{Rn}$ ,  $^{220}\text{Rn}$  and  $^{222}\text{Rn}$
- These may ingrow, if parent radionuclides are present
- Assumption that  $^{210}\text{Po}$  is not lost ( $\Delta H < 400^\circ\text{C}$ )

# ISO XXXXX:20YY

**Water Quality – Measurement of gross  $\alpha$  and  $\beta$  activity concentration in non-saline water – Liquid scintillation counting method**

- Comments?

# ISO 9698:1989

## **Water Quality – Determination of tritium activity concentration – Liquid scintillation counting method**

- Based on distillation of water
- Carried out with alkaline samples
- Revision of standard
- Adjusting details
- Ensuring equations and calculations consistent with ISO 9696 and 9697

# ISO XXXXX:20YY

**Water Quality – Measurement of gross  $\alpha$  and  $\beta$  activity concentration in non-saline water – Liquid scintillation counting method**

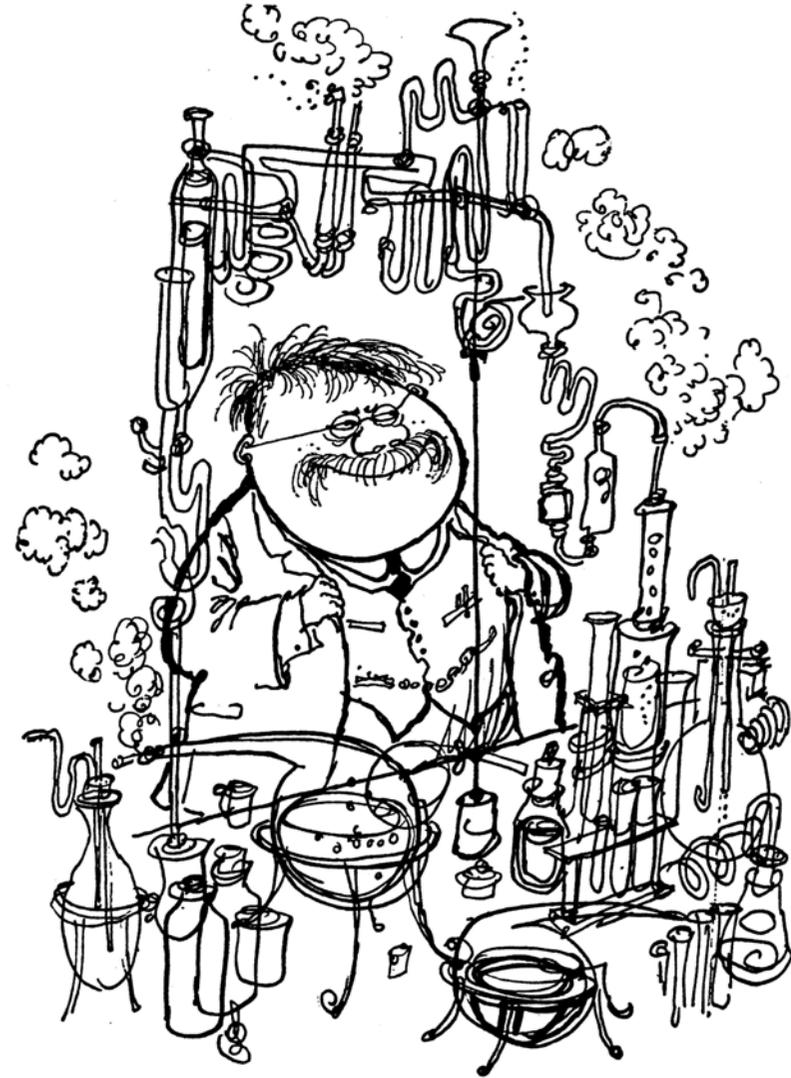
*Blue Book 173 (Does not have an ISBN) 1999*

- *The determination of tritium (tritiated water) activity concentration by alkaline distillation and liquid scintillation counting 1999*

*Blue Book 198 (Does not have an ISBN) 2005*

- *Guidance on the measurement of tritium in environmental samples*

Any questions?



'Ah yes, that removed the figs from  
syrup of figs. A grate boon.'