Nuclear Decay Data

TECDOC-619 Update

TECDOC-619

1988 IAEA CRP

X-ray and gamma-ray standards for detector calibration

36 radionuclides

Evaluated: P_γ and $\tau_{1/2}$

Published as TECDOC-619 in 1991

TECDOC-619

36 radionuclides

^{22}Na	^{24}Na	^{46}Sc	^{51}Cr	^{54}Mn	^{55}Fe
^{56}Co	^{57}Co	^{58}Co	^{60}Co	^{65}Zn	^{75}Se
^{85}Sr	^{88}Y	$^{93}Nb^{m}$	^{94}Nb	^{95}Nb	^{109}Cd
^{111}In	^{113}Sn	^{125}I	^{125}Sb	^{133}Ba	^{134}Cs
^{137}Cs	^{139}Ce	^{152}Eu	^{154}Eu	^{155}Eu	^{198}Au
^{203}Hg	^{207}Bi	^{228}Th	^{239}Np	^{241}Am	^{243}Am

TECDOC-619 Update

1998 IAEA CRP

- **Update previous data**
- **Add new radionuclides**

  X- and gamma-ray calibration standards
  dosimetry standards
  medical applications
  environmental monitoring
  waste management
  safeguards

- **66 nuclides**
- **Half-life evaluations: NPL**
- **Photon emission probabilities: 10 labs**

TECDOC-619 Update

66 radionuclides

^{22}Na	^{24}Na	^{40}K	^{46}Sc	^{51}Cr	^{54}Mn	^{55}Fe	^{56}Co
^{56}Mn	^{57}Co	^{58}Co	^{59}Fe	^{60}Co	^{64}Cu	^{65}Zn	^{66}Ga
^{67}Ga	^{68}Ga	^{75}Se	^{85}Kr	^{85}Sr	^{88}Y	^{93}Nb^{m}	^{94}Nb
^{95}Nb	^{99}Mo	^{99}Tc^{m}	^{103}Ru	^{106}Rh	^{106}Ru	^{109}Cd	^{110}Ag^{m}
^{111}In	^{113}Sn	^{123}I	^{123}Te^{m}	^{124}I	^{125}I	^{125}Sb	^{129}I
^{131}I	^{133}Ba	^{134}Cs	^{137}Cs	^{139}Ce	^{141}Ce	^{144}Ce	^{147}Pm
^{152}Eu	^{153}Sm	^{154}Eu	^{155}Eu	^{166}Ho	^{166}Ho^{m}	^{169}Yb	^{170}Tm
^{192}Ir	^{198}Au	^{201}Tl	^{203}Hg	^{207}Bi	^{226}Ra	^{228}Th	^{234}Pa^{m}
^{241}Am	^{243}Am						

Data Selection Rules

- **only data after 1967**
  (availability of Ge spectrometers)
- **only real measurements**
  (not equipment stability results)
- **only latest value from any institution**
- **only values with an uncertainty**
- **uncertainty taken as being at 68 % c.l.**

Evaluation rules

- **weight of any point <u>not</u> greater than 50%**

- **calculate**

  WM - weighted mean

  SW - larger of SW1 and SW2

  SW1 - external uncertainty

  SW2 – internal uncertainty

  UM – unweighted mean

  SU – standard deviation

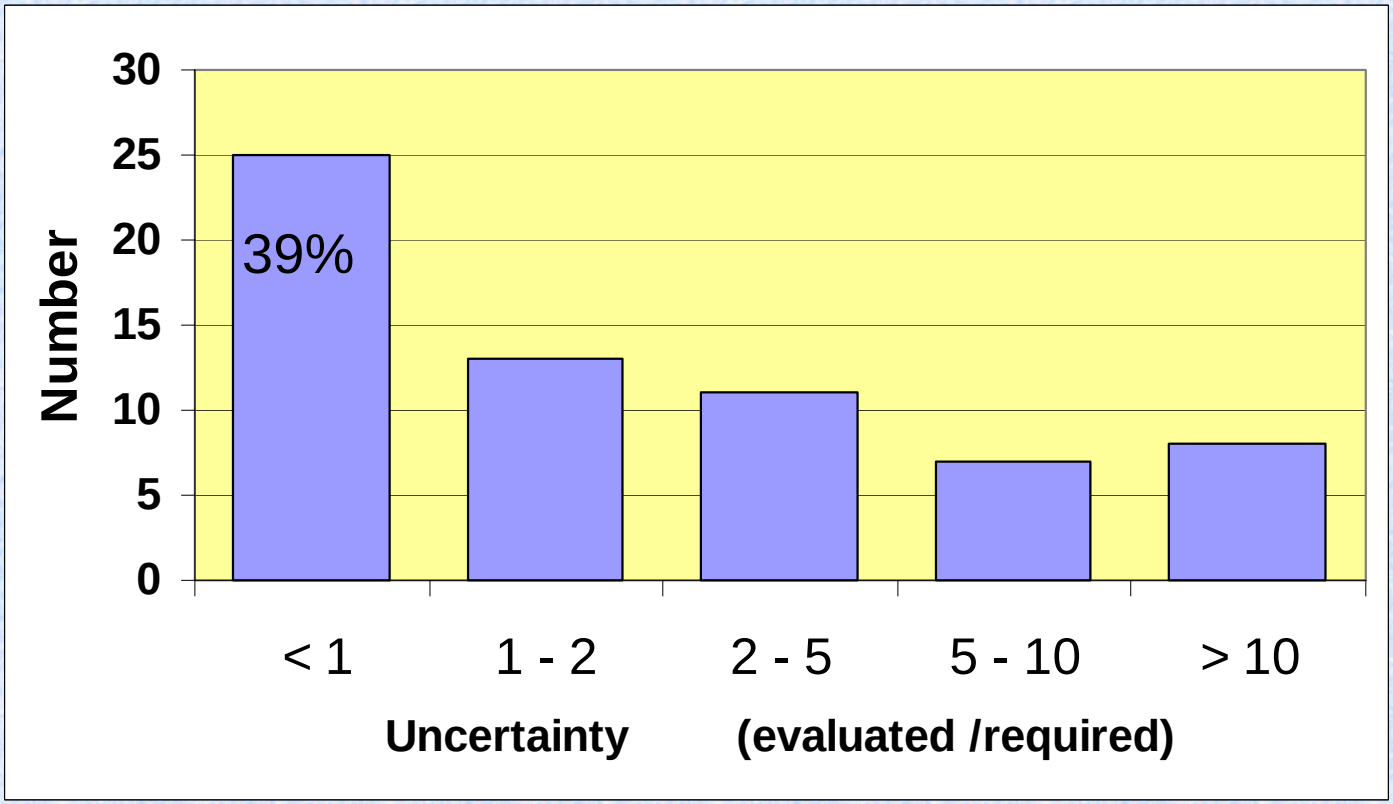
- **if (SU + SW) > WM - UM, use WM and SW**
- **if (SU + SW) < WM - UM, use UM and SU**

- **final uncertainty increased to overlap point with smallest uncertainty**

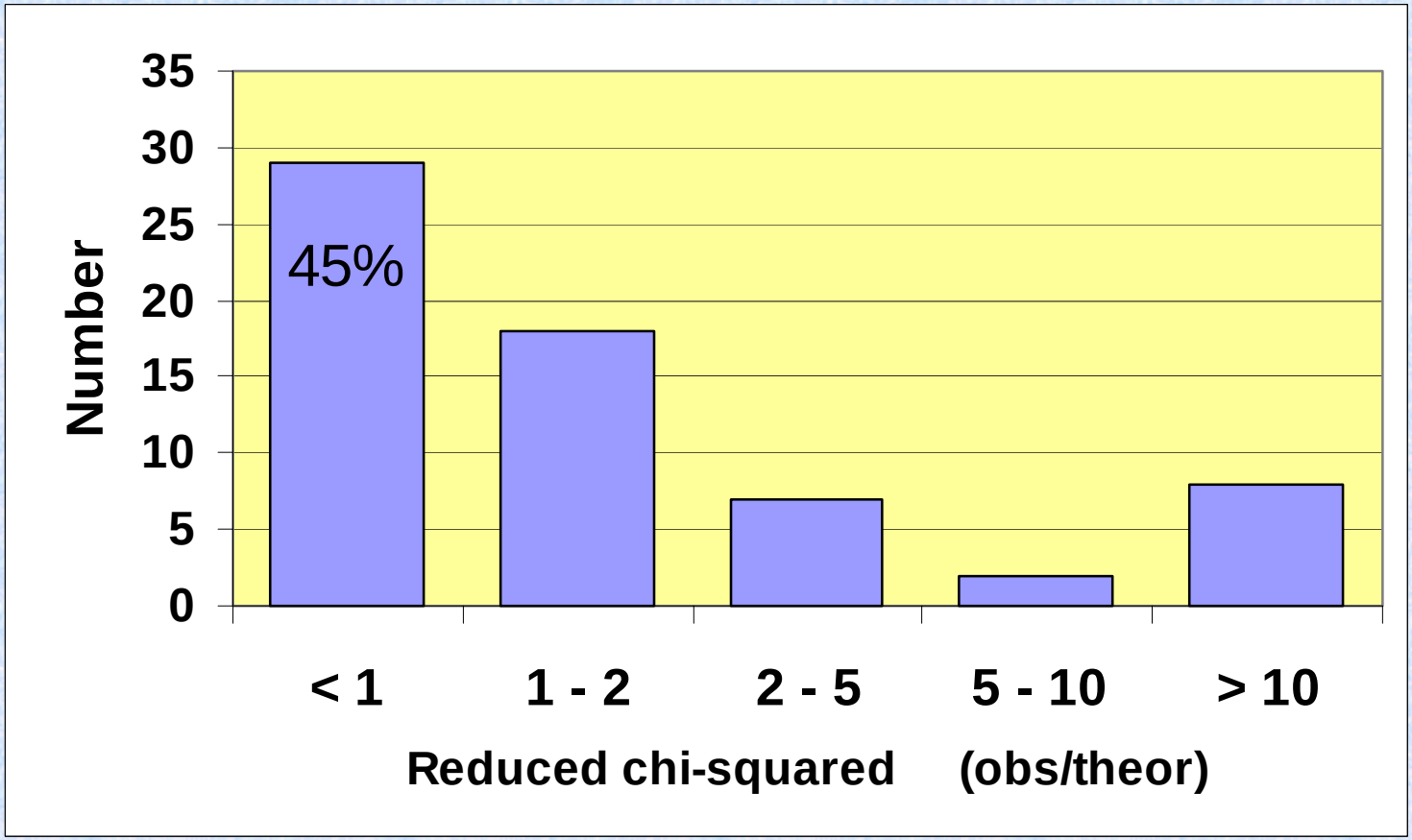
- **reject obvious outliers**

Required v. Evaluated Uncertainty

Max. contribution to uncert. = 0.1% over max. period of use – shorter of 15 years or 5 half-lives (1991)



Normality of Data



^{66}Ga, ^{166}Ho^{m}, ^{226}Ra

^{66}Ga - cal. photons > 3600 keV, $\tau_{1/2}$ = 9 hours

data - **1939, 1952, 1959, 1964**

uncertainty: **eval. = 0.87 %, reqd = 0.03%**

^{226}Ra - reference source, $\tau_{1/2}$ = 1600 years

data - **1949, 1956, 1959 and 1966**

uncertainty: eval. = 0.4 %

^{166}Ho^{m} - reference source (?), $\tau_{1/2}$ = 1200 years

data - **1964**

uncertainty: **eval. = 15 %**

Conclusions (Half-lives)

- better uncertainty estimations are being made
- no significant improvement since 1991
- 50 (75%) half-lives need more (better) measurements
- required accuracies need to be better defined

Present status

- **Half-life evaluations complete**

  - being published as NPL Report (CAIR 8, Jan 04)

- **Photon emission probability evaluations**

  - to be completed in next few months?

- **TECDOC-619 update**

  - to be published by IAEA in 2004?