Usage of ERR-HL and ERR-IDD

(N. Otsuka, S. Dunaeva, 2022-01-19, Memo CP-D/1038)

The uncertainty in a decay parameter (e.g., gamma intensity, half-life) is sometimes coded under ERR-HL or ERR-IDD even if the uncertainty propagated to the cross section is coded as a partial uncertainty under ERR-1 etc. This could introduce double counting of the same uncertainty and should be avoided.

***Example*: EXFOR 23267.004**

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SUBENT        23267004   20150801
BIB                 7         27
REACTION  1(76-OS-190(N,G)76-OS-191,,SIG,,SPA)
…
DECAY-DATA (76-OS-191-G,15.4D,DG,129.4,0.2650)
…
ERR-ANALYS (ERR-T) Total uncertainty.
            Sources of uncertainties:
                  Isotopic abundance - negligible
           (ERR-2) Detector efficiency
           (ERR-3) Gamma-ray intensity
           (ERR-4,0.10,0.20) Gamma-ray self-absorption
           (ERR-5,0.07,0.12) Time factor fb
           (ERR-6) Half-life
           (ERR-S,0.14,0.22) Counting statistics
           (ERR-7) Stoichiometry.
STATUS     (TABLE)  Tables V(data),VI(uncertainties) of
           PR/C,90,065801,2014.
ENDBIB              27
COMMON               8          6
EN-MEAN    EN-MAX     ERR-2      ERR-3      ERR-6      ERR-7
ERR-HL     ERR-IDD
KEV        KEV        PER-CENT   PER-CENT   PER-CENT   PER-CENT
D          NO-DIM
 25.        106.      2.00        0.15       0.65       3.13
 0.1       0.0004
ENDCOMMON           6
…
```

Table VI of the source article (J.Marganiec et al., Phys.Rev.C90(2014)065801) gives the following error budget table:

Source	Uncertainty (%)	Heading in EXFOR
Au cross section	1.40	ERR-1 (coded in 001)
Isotopic abundance	Negligible	
Detector efficiency	2.00	ERR-2
γ-ray intensity	0.15	ERR-3
γ-ray self absorption	0.10-0.20	ERR-4
Time factor fb	0.07-0.12	ERR-5
Half-life	0.65	ERR-6
Counting statistics	0.14-0.22	ERR-S
Stoichiometry	3.13	ERR-7

The quadrature sum of these partial uncertainties give ~4.0% which agrees with the "Total uncertainty" in the last line of Table VI. Table II of the article gives the half-life uncertainty (0.1 d) and gamma intensity uncertainty (0.04 γs per 100 decays) and the original compiler of this entry provided these uncertainties under ERR-HL and ERR-IDD The corresponding fractional uncertainties propagated to the cross section and listed in the error budget table

(0.1/15.4=0.65% for half-life and 0.04/26.50=0.15% for gamma intensity) are coded under ERR-6 and ERR-3, respectively, and should not be coded again under ERR-HL and ERR-IDD.

Coding of ERR-HL and ERR-IDD should be allowed only when they are propagated to the total uncertainty (ERR-T) and also not coded as fractional (%) partial uncertainties of the quantity measured under ERR-1 etc.

Note that the "uncertainty in the half-life" is usually different from the "uncertainty in the activation cross section propagated from the uncertainty in the half-life" since the activation cross section is not proportional to the half-life. In this regard, it is questionable to see the half-live uncertainty (0.1 d /15.4 d =0.65%) in the error budget table (Table VI). I sent several questions to the first author but without any response. When we can ignore the uncertainty in the irradiation, cooling and measurement time, the half-life uncertainty can be propagated to the activation cross section uncertainty rather simply. See Eq.(47) of N. Otuka et al. Radiat.Phys.Chem.**140**(2017)502 for further details.