Uncertainty Analysis Contribution Tables Definition

The uncertainties associated to the cross-section can be represented in the form of a variance-covariance matrix:

$$D_\sigma = \begin{pmatrix} d_{11} & d_{12} & \cdots & d_{1J} \\ d_{12} & d_{22} & \cdots & d_{2J} \\ \cdots & \cdots & \cdots & \cdots \\ d_{1J} & d_{2J} & \cdots & d_{JJ} \end{pmatrix} \qquad (1)$$

where the elements d_{ij} represent the expected values related to the parameters σ_j, and σ_i.
The variance of Q can then be obtained as:

$$\mathrm{var}(Q) = \sum_{j.i}^{J} S_j S_i d_{ij} \qquad (2)$$

In the case of an integral parameter R, once the sensitivity coefficient matrix S_R and the covariance matrix D are available, the uncertainty ΔR on the integral parameter can be evaluated by the sandwich formula:

$$\Delta R^2 = S_R^+ D S_R \qquad (3)$$

In order to evaluate the individual contribution the uncertainty associated to a single cross section σ_{lmn} (i.e for a specific isotope l, reaction m, and energy group n), ΔR_{lmn} is calculated as:

$$\Delta R_{lmn} = \sqrt{S_{lmn}^2 d_{lmn}^2 + \sum_{k}^{Ncorr} Corr_k S_{lmn} d_{lmn} S_k d_k} \quad (4)$$

where k is the index for all $Ncorr$ (i.e. the total number of other cross sections that are correlated to σ_{lmn}). Note that, because of the symmetry in D, there will be a corresponding correlation term (equal in value) when the uncertainty for the correlated σ_k will be calculated. Therefore, we have arbitrarily equally split the correlation contribution to each individual cross section; however, some combination of sensitivity coefficient and/or $Corr_k$ term can give rise to an imaginary value. In this case, for sake of better presentation and understanding, just take the negative value of the real part of (4). In this way, it is clear that σ_{lmn} is giving a negative contribution to the total uncertainty.
The summary over groups and/or reaction, and/or isotopes is calculated in a statistical way, i. e. as the square root of the sum of the squares. For instance for reaction m of isotope l:

$$\Delta R_{lm} = \sqrt{\sum_n \Delta R_{lmn}^2} \quad (5)$$

As before if an imaginary value arises, the negative value is retained. In the following we report an example of a typical summary table:

Isotope	σ_{cap}	σ_{fiss}	ν	σ_{el}	σ_{inel}	Total
U238	50	-2	32	13	12	62
PU239	-29	-57	-10	-1	-13	-66
PU240	93	71	108	14	46	167
FE56	40	0	0	28	38	62
PU241	93	61	37	1	21	120
PU242	88	37	31	2	5	101
NA23	5	0	0	-5	35	35
O16	7	0	0	23	3	24
Total	169	83	122	41	73	239