26. FILE 26. SECONDARY DISTRIBUTIONS FOR PHOTO- AND ELECTRO-ATOMIC DATA

26.1. General Description

This file is used to represent the secondary photons or electrons emitted after electro-atomic reactions, energy given to the residual atom, and the energy transfer associated with excitation. It is based on File 6 with appropriate simplifications.

Elastic scattering is represented by the normalized angular distribution for the scattered electron given in tabulated form (LAW=2, LANG=12) for scattering cosines ranging from -1 to .999999. Because of the very large mass of the residual atom with respect to the mass of the electron, it is assumed that the electron scatters without a change of energy, and there is no energy transfer to the residual atom.

Bremsstrahlung is represented using two subsections. The electron is assumed to scatter straight ahead with an energy loss described using the LAW=8 format. The photon is assumed to be emitted isotropically with spectra given as tabulated distributions (LAW=1, LANG=1, NA=0). Energy transfer to the residual atom is ignored.

Excitation occurs when the incident electron losses some of its energy by exciting the outer electrons of the atom to higher energy states. The energy transfer to the residual atom is represented using LAW=8. The electron is assumed to continue in the straight-ahead direction.

Ionization is represented by giving a section of File 26 for each sub-shell (MT=534,535,...). There are two electrons coming out of each ionization reaction: the scattered electron and the recoil electron. Because these two particles are identical, it is arbitrarily assumed that the particle with the lower energy is the "recoil" electron, and the one with the higher energy is the "scattered" electron. If E_k is the binding energy for the sub-shell, the energy of the recoil electron varies from 0 to $(E-E_k)/2$, and the energy of the scattered electron varies from $(E-E_k)/2$ to $E-E_k$. Only the distribution for the "recoil" electron is given in File 26. The user can select a recoil energy E_r from the distribution and then generate the corresponding scattered electron with energy $E-E_k-E_r$. The value of E_k is given in the corresponding section of File 3. It is assumed that both the scattered and the recoil electrons continue in the direction of the incident electron, and that no kinetic energy is transferred to the residual atom.

The relaxation of the residual atom left after ionization results in the emission of additional X-rays and electrons. Those spectra can be computed using the atomic relaxation data described in Section 28.

26.2. Formats

The following quantities are defined:

ZA,AWR	Standard material charge and mass parameters
NK	Number of subsections in this section (MT). Each subsection describes one reaction product (in this case, photons or electrons), or a subsection can describe the energy transfer associated with excitation or bremsstrahlung.
ZAP	Product identifier: zero for photons, and 11 for electrons.
LAW	Distinguishes between different representations of the product distributions: LAW=1, continuum distribution (used for bremsstrahlung and ionization); LAW=2, two-body angular distribution (used for elastic); and LAW=8, energy transfer for excitation (used for excitation and bremsstrahlung).
NR,NP,E_{int}	Standard TAB1 parameters.
y(E)	Yield for the particle being described (always 1 in File 26, but we keep this for consistency with File 6).
ET(E)	Energy transfer during electro-atomic excitation or bremsstrahlung (eV).

The structure of a section is:

```
[MAT,26, MT/ZA,  0.0,   0,   0,  NK,   0] HEAD
[MAT,26, MT/ZAP, 0.0,   0, LAW,  NR,  NP/ Eint / y(E)] TAB1
[LAW-dependent structure for product]
           -----------------------------
           repeat TAB1 and LAW-dependent structures
           for the rest of the NK subsections
           -----------------------------
[MAT,26,MT/ 0.0, 0.0,   0,   0,   0,   0] SEND
```

The subsections for bremsstrahlung are given in the order photons, then electrons. The contents of the subsection for each LAW are given below.

26.2.1. Continuum Distribution (LAW=1)

This law is the same as LAW=1 for File 6, except that only LANG=1, NA=0, representing a simple tabulated energy distribution without angle dependence, is allowed.

26.2.2. Two-Body Angular Distribution (LAW=2)

This law is the same as LAW=2 for File 6, except that only LANG=11-15 for linear-linear tabulated angular distributions, is allowed. It is only used for the electro-atomic elastic scattering reaction, and the cosine range is -1 to 0.99999.

26.2.3. Energy Transfer for Excitation (LAW=8)

This law is used to give only the energy transfer during excitation and the energy loss for bremsstrahlung:

```
[MAT,26, MT/  0.0,  0.0,   0,   0,  NR,  NP/ Eint / ET(E)] TAB1
```