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**Memo CP-C/476**

**Date:** February 7, 2020

**To:** Distribution

**From:** B. Pritychenko

**Subject:** **Spontaneous Fission Assembly (SFASS) Code, Update of Dictionary 18**

The EXFOR format FACILITY field provides important information about the institution where the measurements were made, helps to find the responsible compilation centers and arrange institutes during the compilation process. The LEXFOR manual defines it as:

``FACILITY is used to identify the main apparatus or machine used in the experiment, e.g.,

reactor or cyclotron. The institute at which the facility resides may be entered, if known, following the facility code. This is especially important if there is more than one institute associated with the

experiment.”

Unfortunately, this rule does not apply for spontaneous fission measurements because the list of 34 facilities completely ignores spontaneous fission sources that are present in 1614 EXFOR data sets. There are Dictionary 19 incoming source codes for CF252, CM244, CM246 and CM248 spontaneous fission sources. They are obviously not applicable for experiments on the spontaneous fission of Cf-252 itself where no incident particles and, therefore, no INC-SOURCE plays a role. The total number of such data sets are 714, 98, 23 and 43 for CF252, CM244, CM246 and CM248, respectively. Such entries contain authors institution information; however, institutions can be different from the research facilities. This may result in the situations when external user facilities would not be credited in an EXFOR compilations.

To resolve this issue and provide the proper credits to user facilities a new facility code SFASS (Spontaneous Fission Assembly) is proposed. Examples of affected entries and future updates for Cf-252 and Cm-244 are shown in Appendix.

**Technical Note:**

Spontaneous fission sources (i.e. 252Cf) represent complex assemblies that provide high neutron fluxes with an average energy of 2.13 MeV and absorb gammas and other fission products. 252Cf emits ~3.757 neutrons/fission, and 1 mg of californium produces ∼2.3×109 neutrons/s. Therefore, large samples of 252Cf (>l00 mg) are often described as ``poor man nuclear reactors” and even small ~25 g sources include extensive radiation shielding [1]. These spontaneous fission sources are produced at the Oak Ridge National Laboratory (ORNL) in the United States and the Research Institute of Atomic Reactors, Dimitrovgrad, Russian Federation. In fact, the ORNL High Flux Isotope Reactor (HFIR) and the adjacent Radiochemical Engineering Development Center (REDC) are responsible for ~70% of the world’s 252Cf supply.

**Appendix: Original entries and future updates.**

1. **Original Cf-252**

ENTRY 13067 890518 20050926 0000

SUBENT 13067001 890518 20050926 0000

BIB 7 8

INSTITUTE (1CANCRC,1USALRL)

REFERENCE (J,CJP,41,2080,63)

AUTHOR (J.S.FRASER,J.C.D.MILTON,H.R.BOWMAN,S.G.THOMPSON)

TITLE PRECISE KINETIC ENERGY MEASUREMENTS AND FINE

STRUCTURE IN THE SPONTANEOUS FISSION OF CF252

ERR-ANALYS NO INFORMATION

STATUS (RIDER) REFERENCE 63FRA1

HISTORY (890512C) VM

ENDBIB 8

1. **Updated Cf-252**

ENTRY C 13067 20200207

SUBENT C 13067001 20200207

BIB 7 8

TITLE Precise kinetic energy measurements and fine

structure in the spontaneous fission of Cf252

AUTHOR (J.S.Fraser,J.C.D.Milton,H.R.Bowman,S.G.Thompson)

REFERENCE (J,CJP,41,2080,1963)

#doi:10.1139/p63-205

INSTITUTE (1CANCRC,1USALRL)

FACILITY (SFASS,1CANCRC)

1. **Original Cm-244**

ENTRY 13583 930330 20050926 0000

SUBENT 13583001 930330 20050926 0000

BIB 11 15

INSTITUTE (1USALRL)

REFERENCE (J,PR,99,183,5507)

AUTHOR (G.H.HIGGINS,W.W.T.CRANE,S.R.GUNN)

TITLE Average Number of Neutrons per Spontaneous Fission of

Cm244

SAMPLE Sample contains unspecified amount of 242Cm.

DETECTOR (SCIN) Large tank containg a saturated solution of

manganese sulphate.

DECAY-DATA Alpha decay energies and half-lives taken from

Hollander, et al., Rev.Mod.Phys. 25, 469 (1953).

CORRECTION Corrected for neutrons from spontaneous fission of

242Cm in sample using nu(bar)=3.0+-0.3.

ERR-ANALYS (DATA-ERR) No information on source of error given.

STATUS Data taken from article

HISTORY (930330C)

1. **Updated Cm-244**

ENTRY C 13583 20200207

SUBENT C 13583001 20200207

BIB 11 15

TITLE Average number of neutrons per spontaneous fission of

Cm244

AUTHOR (G.H.Higgins,W.W.T.Crane,S.R.Gunn)

REFERENCE (J,PR,99,183,1955)

#doi:10.1103/PhysRev.99.183

INSTITUTE (1USALRL)

FACILITY (SFASS,1USALRL)

**References**

1. B.C. Anderson, K.E. Holbert, H. Bowler, `` Design, Construction, and Modeling of a 252Cf Neutron Irradiator,” Science and Technology of Nuclear Installations 2016, 9012747 (2016).

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