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Activation Product Decay Data:

UKPADD-2 Data Files

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The file was revised to conform with ENDF/B format standards.. The merged file was corrected for format errors and processed through the code CHECKR to ensure, as far as possible, format compatibility.

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AEA REACTOR SERVICES AEA TECHNOLGY

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ACTIVATION PRODUCT DECAY DATA: UKPADD-2 DATA FILES

A L Nichols

Summary

The decay data of various radionuclides have been evaluated on the basis of a series of well defined specifications and the requirements of .the UK nuclear power, fuel reprocessing and waste management programmes. These radionucides are primarily activation products and standards that are commonly used in gamma-ray spectroscopy. Recommended data include half-life, branching fractions, alpha, beta and gamma-ray energies and emission probabilities, total decay energy, mean alpha, beta and gamma energies, internal conversion coefficients, and all associated uncertainties. Computer-based files have been generated in ENDF-6 format, including lists of the references used to produce the proposed decay scheme and comments that identify any inadequacies.

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(Task 1064)

AEA Reactor Services
Harwell Laboratory

1 March 1993

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TABLES

1 INTRODUCTION

The United Kingdom Chemical Nuclear Data Committee (UKCNDC) has for over 20 years identified specific nuclear data needs for the UK nuclear industry. The data that fall within the auspices of the UKCNDC are normally determined by standard chemical techniques in conjunction with mass spectrometry and alpha-particle and gamma-ray spectroscopy (eg fission yields and decay data) .All such measurements and evaluation programmes are co-ordinated to meet data requests identified by members of the committee. An important aim is to produce and maintain recommended libraries of relevant nuclear data. These data files have to be assembled in a suitable form for a wide range of applications, including reactor design, fuel handling, reprocessing, waste management, and shielding and transport. Such libraries need to be regularly updated so that the best data can be used with confidence.

The UK Activation Product Decay Data Library (UKPADD-1) was established in 1977, and ENDF-6 format was adopted (1) . Significant improvements have occurred as a consequence of a wide range of relevant decay-data measurements, including a multinational programme during the late 1980s which was carried out under the auspices of the IAEA Co-ordinated Research Programme on the Measurement and Evaluation of X-ray and Gamma-ray Standards for Detector Calibration (2) .It was judged appropriate to undertake a comprehensive evaluation of the decay data for 236 radionuclides as requested by various specialists within the UK nuclear industry (3), including calibrant standards as well as reactor-based activation products.

The new activation product decay data library (UKPADD-2) contains comprehensive decay scheme data for 236 nuclides. These radionuclides are listed by increasing ZA values:

ZA = ((atomic number x 1000) + mass number),

in which ground states precede metastable states. Material numbers cover the range 7000 to 7235.

2. DECAY DATA

UKPADD-2 contains recommended data for the following parameters (see also Section 4) :

(i) half-life,

(ii) total decay energies (Q-values),

(iii) branching fractions,

iv) alpha-particle energies and emission probabilities,

(v) beta-particle energies, emission probabilities and transition types,

(vi) gamma-ray energies, emission probabilities and internal-conversion coefficients,

(vii) spontaneous fission data including prompt and gamma-ray spectra.

The spin and parity of the decaying nuclide have been defined, and uncertainties are assigned to all evaluated data. Other data in UKPADD-2 (mean energies, discrete electrons and mean x rays) were derived from the above data by using the processing code COGEND(4, 5) .The component contributions to the average energies (beta, electromagnetic and heavy particle) are derived from the evaluated input data by COGEND, which has data libraries of fluorescence yields, Auger-electron energies, mean x-ray energies and electron-wave-function ratios from which capture ratios can be calculated.

The library has been generated in ENDF-6 format (6). There is a general information section for each nuclide which contains:

(i) name of the evaluator and date of the evaluation (month and year),

(ii) list of references used to construct the recommended data set,

(iii) detailed comments associated with the evaluation,

(iv) consistency check of the evaluated data.

The recommended decay data are contained within the main data section. Every effort has been made to produce consistent and comprehensive data sets. When necessary, the theoretical internal conversion coefficients tabulated by Band et al (7), Hager and Seltzer (8) and Rosel et al (9) have been used in conjunction with the evaluated gamma-ray data. Nuclear binding energies and Q-values were obtained from the tabulations of Wapstra et al (10, 11) .X-ray data were derived from improved energy and emission probability data (12, 13) .All of the energy data are in eV, and the absolute emission probabilities are expressed as' fractions of the decay (calculated from the spectral normalisation factor and relative emission probabilities) .These data in UKPADD-2 are listed as described in reference 6, and summaries of the contents of the updated library are given in Tables 1 and 2.

The consistency of the recommended data has been determined by calculating the percentage deviation between the effective Q-value and the calculated Q-value:

$$\text{(i)}\quad \text{effective Q-value} = \sum_{i=1}^{\text{all BF}} Q_i \, BF_i$$

where Q_i. and BF_i are the Q-value and branching faction of the i-th decay mode (ie weighted sum of the evaluated Q-values of the radionuclide),

$$\text{(ii)}\quad \text{calculated Q-value} = \sum_{i}^{\text{all }\alpha} E_{\alpha_i} P_{\alpha_i} + \sum_{j}^{\text{all }\beta} E_{\beta_j} P_{\beta_j} + \sum_{k}^{\text{all }\gamma} E_{\gamma_k} P_{\gamma_k} + \sum_{l}^{\text{all x rays}} E_{x_l} P_{x_l} + \text{etc.}$$

where E_{α_i}, E_{β_j}, E_{γ_k}, E_{x_l}, etc and P_{α_i}, P_{β_j}, P_{γ_k}, P_{x_l} etc

are the energies and emission probabilities of the i-th alpha particle, j-th beta particle, k-th gamma ray, l-th x ray etc of the individual decay process.

The percentage deviations of the data in the new library (UKPADD-2) are compared with equivalent values in the old library (UKPADD-l) in Table 3. Percentage deviations above 5% would be regarded as high and imply a poorly defined decay scheme; a value of less than 5% indicates the construction of a reasonably consistent decay scheme.

3 EVALUATION PROCEDURE

An initial decay scheme was constructed for each radionuclide from a suitable combination of the various data sources. The evaluation procedure was as follows:

(i) assess the status of the existing data,

(ii) identify data discrepancies,

(iii) evaluate and recommend decay data.

The emission probabilities have been expressed as the absolute probability of the transition (α, β, conversion electron, x ray or y ray) per decay. All available measurements were generally taken into account during an evaluation, including experimental data from laboratory reports and written private communications. Comprehensive statements of the

precise evaluation procedure were prepared after each assessment, as well as details of any changes made to the reported data. Under specific circumstances, the evaluations involved the determination of a weighted mean for each parameter. No individual measurement was allowed to contribute more than 50% to the sum of weights when more than one value of the same parameter was reported, and the uncertainty of the datum was increased if necessary. If the set of accepted experimental data proved to be inconsistent, one of several possibilities was adopted:

(i) recommend the unweighted mean,

(ii) reject some measured values on the basis of objective or subjective judgments (eg inappropriate calibration procedure or ill-defined measurement techniques employed by the metrologist),

(iii) change the weights.

An appropriate method of changing weights was preferred rather than outright rejection of data. Any serious problems encountered during an evaluation are described in the comments section associated with each nuclide in the library. If the resulting decay scheme has any outstanding problems, a statement was made to the effect that better measurements are required.

An evaluation strategy was adopted on the basis of a series of specific data manipulations:

(i) every effort was made to ensure that there was a reasonable balance between the population and de-excitation of all excited levels in the decay schemes;

(ii) all decay modes of each radioactive nuclide were specified in terms of both the branching fractions and the Q-values;

(iii) sum of all α, β^-, β^+ /electron-capture and isomeric gamma-emission probabilities were consistent with the corresponding branching fractions;

(iv) gamrna-emission probabilities must be the photon probabilities per disintegration;

(v) Internal-conversion coefficients for gamma-ray transitions were consistent with both the photon and total transition probabilities, ie (photon + conversion electron) emission probabilities = total transition probability;

(vi) when the internal conversion of a gamrna-ray transition was significant, theoretical internal-conversion coefficients were adopted if experimental data were unavailable;

(vii) type of beta transition had to be taken into account in the calculation of mean beta energies from the evaluated end points;

(viii) energies and emission probabilities of conversion electrons, Auger electrons, x rays and annihilation radiation were derived in a consistent manner.

Uncertainties were also estimated for all of the parameters incorporated into UKPADD-2.

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4 ACTIVATION PRODUCT DECAY DATA LIBRARY, UKPADD-2

The computer based library is based on standard 80-column card images, and is stored as 34960 lines (2.83 Mbytes) in ENDF-6 format. There is a general information/descriptive data section (MF=l, MT=451) for each nuclide containing the following information:

(i) radionuclide, date of evaluation, name of evaluator, date of distribution (month, year) and date of latest issue (year, month and day);

(ii) library name (UKPADD-2), file identifier (material number), date type (radioactive decay data) and format type (ENDF-6);

(iii) list of references used to determine the recommended data set;

(iv) detailed comments on the evaluation;

(v) specific decay data not contained in the main decay data section, including beta-particle transition parameters;

(vi) consistency check of the recommended data set.

The recommended decay data are contained within the primary data section (MF=8, MT=457) .These data are:

(i) spin and parity of the decaying radionuclide;

(ii) half-life;

(iii) average energy per disintegration for light particles, electromagnetic radiations and heavy particles;

(iv) decay modes, Q-values and branching fractions;

(v) radiation decay data, including gamma-ray, beta-particle, electron-capture, alpha-particle, neutron, discrete-electron and x-ray transitions;

(vi) spontaneous fission decay data.

The various decay parameters of the majority of radionuclides in UKPADD-2 have been reasonably well defined in the published literature, and were evaluated with good precision and confidence to produce consistent decay schemes. However, the relevant data for six of the 236 activation products proved insufficient to evaluate and recommend complete decay schemes. These troublesome radionuclides are discussed in detail below.

4.1 He-8

He-8 undergoes beta-particle and neutron decay. While a reasonably consistent decay scheme can be assembled, the neutron emissions are less well defined and constitute an incomplete decay scheme.

4.2 Li-9

Li-9 undergoes beta-particle and neutron decay. The latter emissions are relatively complex and poorly characterised, resulting in the formulation of an incomplete decay scheme

4.3 V-54

There are major difficulties in defining the population-depopulation transitions of the 834.8 and 3159.3 keV nuclear levels. Furthermore, it is assumed that no beta transitions occur to the nuclear levels at 834.8, 3159.3, 3222.2 and 3436.8 keV, despite contrary evidence from gamma-ray measurements.

4.4 Sb-129m

A significant number of gamma-ray transitions can not be satisfactorily incorporated into the proposed decay scheme, and the calculated normalisation factor for the gamma rays is judged to be a poor estimate.

4.5 Cs-136m

Cs-136m has only been detected from an analysis of Cs x-rays following the proton irradiation of lanthanum. No decay data have been reported, although this metastable level at 600 keV has been postulated on the basis of the equivalent observed decay of 1-136m. A decay scheme cannot be proposed with such a lack of information.

4.6 Au-198m

The significant 333 keV gamma ray observed in the decay of Au-198m cannot be satisfactorily placed in the proposed decay scheme. There is also a lack of gamma -ray data to produce a satisfactory decay scheme.

All of the remaining 230 radionuclides in UKPADD-2 have been evaluated to give reasonably consistent decay schemes that are suitable for a wide use of applications in the nuclear industry and research. The resulting data library is a considerable improvement on the earlier set of files (1) in terms of the overall consistency and re-definition of more substantial decay schemes. Even in those few instances where an increased percentage deviation occurs between the effective and calculated Q-value, the UKPADD-2 data are more comprehensive and reliable.

5 CONCLUSIONS

Sets of recommended emission probability data and decay schemes have been derived for a series of activation products and calibrant standards specified by members of the UK Chemical Nuclear Data Committee (UKCNDC) .The resulting evaluated data sets represent significant improvements in the quality of specific decay parameters. Several inconsistencies have been identified in the decay data, and further efforts are required to resolve these difficulties.

All of the data have been assembled to constitute the UK Activation Product Decay Data Library (UKPADD-2) .Users require a computer-based copy of these data files and a knowledge of the ENDF-6 format so that they can undertake necessary reactor and fuel cycle calculations. Enquiries concerning this library should be addressed to the author:

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following submission of the data files to the NEA Data Bank and possible usage in JEF (Joint Evaluated File) .Notification of any errors in the library should be directed to the author of this report.

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Table 1 Summary of Activation Product Decay Data in UKPADD-2 Library: Main Decay Modes and Number of Transitions

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Nuclide	Material Number	Half Life	Mean Decay Energies KeV Alpha	Beta	Gamma	NDK	NSP	SF	.....No. of Spectral Lines..... N-G	N-B	N-P	N-A	N-E	N-X	% Dev
1-H - 3	7000	12.33 y	0.0	5.7	0.0	1	1	0	0	1	0	0	0	0	0.00
2-He- 6	7001	0.81 s	0.0	1561.3	5.6	1	1	0	0	1	0	0	0	0	0.00
2-He- 8	7002	0.12 s	246.3	4448.6	885.0	2	3	0	1	2	0	0	0	1	
3-Li- 8	7003	0.84 s	3125.2	6204.6	33.0	1	2	0	0	1	0	1	0	0	0.04
3-Li- 9	7004	0.18 s	0.0	5696.2	29.9	2	1	0	0	5	0	0	0	0	
4-Be- 7	7005	53.24 d	0.0	0.0	49.3	1	2	0	1	0	2	0	0	0	0.01
4-Be- 8	7006	7.00E-17 s	91.9	0.0	0.0	1	1	0	0	0	0	1	0	0	0.00
4-Be- 10	7007	1.60E+06 y	0.0	252.2	0.0	1	1	0	0	1	0	0	0	0	0.00
4-Be- 11	7008	13.81 s	36.3	4647.3	1418.8	2	3	0	8	6	0	1	0	0	0.09
5-B - 12	7009	2.02E-02 s	6.6	6308.4	90.6	2	3	0	1	4	0	2	0	0	0.00
5-B - 13	7010	1.73E-02 s	13.0	6278.3	313.5	2	3	0	1	5	0	0	0	4	-0.02
6-C - 14	7011	5.73E+03 y	0.0	49.5	0.0	1	1	0	0	1	0	0	0	0	0.00
6-C - 15	7012	2.45 s	0.0	2856.2	3621.8	1	2	0	5	6	0	0	0	0	-0.07
7-N - 13	7013	9.97 m	0.0	491.1	1022.7	1	2	0	0	0	1	0	0	1	0.00
7-N - 16	7014	7.13 s	0.0	2679.4	4621.5	2	3	0	10	7	0	3	0	0	0.05
8-O - 19	7015	26.91 s	0.0	1709.6	1004.6	1	2	0	8	3	0	0	0	0	-0.16
9-F - 18	7016	1.83 h	0.0	250.0	1022.0	1	2	0	0	0	1	0	0	1	0.00
9-F - 20	7017	11.03 s	0.0	2467.3	1644.7	1	2	0	2	2	0	0	0	0	0.00
10-Ne- 23	7018	37.20 s	0.0	1890.1	172.8	1	2	0	5	4	0	0	0	0	0.01
11-Na- 22	7019	2.60 y	0.0	195.8	2198.9	1	4	0	1	0	2	0	4	2	0.00
11-Na- 24	7020	14.97 h	0.0	553.6	4122.2	1	4	0	6	3	0	0	5	2	0.00
11-Na- 24 m	7021	2.02E-02 s	0.0	13.8	470.0	2	2	0	1	1	0	0	0	0	0.00
11-Na- 25	7022	59.60 s	0.0	1496.5	436.9	1	2	0	10	5	0	0	0	0	0.16
11-Na- 26	7023	1.08 s	0.0	3329.4	2180.3	1	2	0	19	9	0	0	0	0	0.00
12-Mg- 27	7024	9.46 m	0.0	699.6	895.0	1	2	0	3	2	0	0	0	0	0.00
12-Mg- 28	7025	20.90 h	0.0	197.9	1380.0	1	4	0	8	3	0	0	5	3	0.15
13-Al- 26	7026	7.20E+05 y	0.0	446.4	2678.1	1	4	0	3	0	2	0	2	3	0.02
13-Al- 26 m	7027	6.34 s	0.0	1435.3	1026.9	1	2	0	0	0	1	0	0	1	0.00
13-Al- 28	7028	2.24 m	0.0	1237.6	1782.8	1	2	0	1	1	0	0	0	0	0.00
13-Al- 29	7029	6.56 m	0.0	972.8	1380.9	1	2	0	7	4	0	0	0	0	-0.02
13-Al- 30	7030	3.65 s	0.0	2290.2	3512.4	1	2	0	17	7	0	0	0	0	-0.06
14-Si- 31	7031	2.62 h	0.0	593.7	2.2	1	2	0	1	2	0	0	0	0	0.00
14-Si- 32	7032	330.00 y	0.0	64.7	0.0	1	1	0	0	1	0	0	0	0	0.00
15-P - 32	7033	14.27 d	0.0	692.9	1.7	1	1	0	0	1	0	0	0	0	0.00
15-P - 33	7034	25.40 d	0.0	76.6	0.0	1	1	0	0	1	0	0	0	0	0.00
15-P - 34	7035	12.40 s	0.0	2287.4	347.4	1	2	0	6	5	0	0	0	0	0.00
16-S - 35	7036	87.50 d	0.0	48.8	0.0	1	1	0	0	1	0	0	0	0	0.00
16-S - 37	7037	4.99 m	0.0	793.2	2936.9	1	2	0	4	4	0	0	0	0	-0.08
17-Cl- 34	7038	1.53 s	0.0	2045.7	1030.0	1	2	0	0	0	1	0	0	1	0.00
17-Cl- 34 m	7039	32.10 m	0.0	441.7	1978.8	2	4	0	9	0	5	0	8	7	-0.04
17-Cl- 36	7040	3.02E+05 y	0.0	273.5	0.0	2	4	0	0	1	1	0	2	4	0.00
17-Cl- 38	7041	37.20 m	0.0	1523.0	1493.7	1	2	0	3	3	0	0	0	0	0.00
17-Cl- 38 m	7042	0.71 s	0.0	0.4	671.3	1	3	0	1	0	0	0	5	3	-0.06
18-Ar- 37	7043	35.04 d	0.0	2.4	0.3	1	3	0	0	0	1	0	3	3	0.00

Nuclide	Material Number	Half Life	Mean Decay Energies KeV Alpha	Beta	Gamma	NDK	NSP	SF	.....No. of Spectral Lines..... N-G	N-B	N-P	N-A	N-E	N-X	% Dev
18-Ar- 39	7044	269.00 y	0.0	218.7	0.0	1	1	0	0	1	0	0	0	0	0.00
18-Ar- 41	7045	1.83 h	0.0	463.6	1284.5	1	4	0	2	3	0	0	6	3	-0.03
18-Ar- 42	7046	33.00 y	0.0	232.8	0.0	1	1	0	0	1	0	0	0	0	0.00
19-K - 38	7047	7.61 m	0.0	1207.7	3195.9	1	3	0	3	0	2	0	0	1	0.00
19-K - 38 m	7048	0.92 s	0.0	2314.3	1031.4	1	2	0	0	0	1	0	0	1	0.00
19-K - 40	7049	1.28E+09 y	0.0	521.8	157.2	2	5	0	1	1	2	0	3	4	0.00
19-K - 42	7050	12.37 h	0.0	1417.1	296.4	1	2	0	8	5	0	0	0	0	0.00
19-K - 43	7051	22.20 h	0.0	309.6	966.2	1	4	0	10	5	0	0	12	3	-0.04
19-K - 44	7052	22.13 m	0.0	1436.1	2391.3	1	4	0	122	33	0	0	72	3	0.12
20-Ca- 41	7053	1.03E+05 y	0.0	2.8	0.4	1	3	0	0	0	1	0	3	3	0.00
20-Ca- 45	7054	162.70 d	0.0	77.2	0.0	1	4	0	1	2	0	0	6	3	0.00
20-Ca- 47	7055	4.54 d	0.0	344.6	1060.4	1	4	0	7	4	0	0	6	3	0.12
20-Ca- 49	7056	8.72 m	0.0	869.5	3167.1	1	2	0	11	6	0	0	0	0	-0.02
21-Sc- 44	7057	3.93 h	0.0	595.6	2136.5	1	4	0	5	0	3	0	6	4	0.01
21-Sc- 44 m	7058	2.44 d	0.0	32.8	275.3	2	4	0	4	0	1	0	12	6	0.03
21-Sc- 46	7059	83.79 d	0.0	112.2	2009.5	1	4	0	3	2	0	0	9	3	0.00
21-Sc- 46 m	7060	18.70 s	0.0	58.9	83.0	1	3	0	1	0	0	0	6	3	0.47
21-Sc- 47	7061	3.35 d	0.0	162.5	108.5	1	4	0	1	2	0	0	6	3	0.00
21-Sc- 48	7062	1.82 d	0.0	219.6	3349.6	1	2	0	5	2	0	0	0	0	0.02
21-Sc- 49	7063	57.20 m	0.0	819.9	3.3	1	2	0	2	3	0	0	0	0	0.00
21-Sc- 50	7064	1.71 m	0.0	1624.1	3198.1	1	2	0	10	8	0	0	0	0	0.00
21-Sc- 50 m	7065	0.35 s	0.0	40.7	264.4	2	4	0	2	1	0	0	6	3	-0.02
22-Ti- 45	7066	3.08 h	0.0	373.3	871.8	1	4	0	15	0	6	0	6	4	0.00
22-Ti- 51	7067	5.80 m	0.0	868.9	364.6	1	4	0	3	2	0	0	6	3	0.00
23-V - 48	7068	15.97 d	0.0	149.3	2915.9	1	4	0	9	0	6	0	3	4	-0.21
23-V - 49	7069	330.00 d	0.0	3.6	0.9	1	3	0	0	0	1	0	3	3	0.00
23-V - 52	7070	3.74 m	0.0	1064.3	1448.4	1	4	0	14	8	0	0	15	3	0.00
23-V - 53	7071	1.62 m	0.0	1005.1	1041.6	1	2	0	7	3	0	0	0	0	-0.25
23-V - 54	7072	49.80 s	0.0	1357.5	4097.5	1	2	0	24	8	0	0	0	0	
24-Cr- 49	7073	41.90 m	0.0	596.5	1047.2	1	4	0	12	0	8	0	12	4	-0.01
24-Cr- 51	7074	27.71 d	0.0	3.9	32.8	1	4	0	1	0	2	0	6	3	0.00
24-Cr- 55	7075	3.54 m	0.0	1096.5	4.2	1	4	0	7	5	0	0	6	3	0.00
25-Mn- 54	7076	312.30 d	0.0	4.2	836.0	1	4	0	1	0	1	0	9	6	0.00
25-Mn- 56	7077	2.58 h	0.0	823.8	1700.7	1	2	0	10	7	0	0	0	0	-0.01
26-Fe- 53	7078	8.51 m	0.0	1107.0	1184.2	1	4	0	10	0	8	0	6	4	-0.20
26-Fe- 53 m	7079	2.58 m	0.0	0.0	3034.7	1	1	0	6	0	0	0	0	0	0.18
26-Fe- 55	7080	2.74 y	0.0	4.2	1.7	1	3	0	0	0	1	0	3	3	0.00
26-Fe- 59	7081	44.50 d	0.0	117.9	1189.2	1	4	0	8	5	0	0	18	3	-0.01
27-Co- 55	7082	17.53 h	0.0	436.6	2007.0	1	4	0	23	0	10	0	24	4	0.03
27-Co- 56	7083	77.30 d	0.0	121.0	3589.8	1	4	0	45	0	13	0	30	4	0.50
27-Co- 57	7084	271.79 d	0.0	20.0	124.0	1	4	0	10	0	2	0	33	3	0.00
27-Co- 58	7085	70.86 d	0.0	34.3	976.2	1	4	0	3	0	3	0	12	4	0.00
27-Co- 58 m	7086	8.94 h	0.0	23.1	1.8	1	3	0	1	0	0	0	6	3	-0.31
27-Co- 60	7087	5.27 y	0.0	96.7	2503.9	1	4	0	6	3	0	0	15	3	0.00

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27-Co- 60 m	7088	10.47 m	0.0	56.8	6.9	2	4	0	4	2	0	0	15	6	-0.29
28-Ni- 57	7089	1.49 d	0.0	162.1	1960.0	1	4	0	24	0	9	0	18	4	-0.03
28-Ni- 59	7090	7.60E+04 y	0.0	4.6	2.5	1	3	0	0	0	1	0	3	4	0.00
28-Ni- 63	7091	99.00 y	0.0	17.1	0.0	1	1	0	0	1	0	0	0	0	0.00
28-Ni- 65	7092	2.52 h	0.0	629.7	549.9	1	4	0	10	5	0	0	18	3	0.03
29-Cu- 62	7093	9.75 m	0.0	1282.9	1011.7	1	4	0	16	0	10	0	3	4	0.00
29-Cu- 64	7094	12.70 h	0.0	125.8	190.6	2	5	0	1	1	2	0	3	4	0.00
29-Cu- 66	7095	5.10 m	0.0	1070.6	81.9	1	2	0	3	4	0	0	0	0	0.01
30-Zn- 63	7096	38.40 m	0.0	916.7	1104.2	1	4	0	64	0	20	0	33	4	0.02
30-Zn- 65	7097	244.26 d	0.0	7.0	582.5	1	4	0	3	0	2	0	6	4	0.00
33-As- 74	7098	17.78 d	0.0	268.3	759.7	2	5	0	14	3	6	0	15	11	-0.29
34-Se- 75	7099	119.64 d	0.0	14.6	390.2	1	4	0	20	0	9	0	36	5	-0.10
35-Br- 79 m	7100	4.88 s	0.0	50.0	157.2	1	3	0	1	0	0	0	6	5	-0.02
35-Br- 80	7101	17.60 m	0.0	724.0	77.0	2	5	0	6	4	3	0	24	12	-0.01
35-Br- 80 m	7102	4.41 h	0.0	61.8	24.3	1	3	0	2	0	0	0	9	5	-0.19
35-Br- 82	7103	1.47 d	0.0	142.7	2638.0	1	4	0	34	6	0	0	60	6	0.07
35-Br- 82 m	7104	6.09 m	0.0	70.1	8.2	2	4	0	26	11	0	0	33	11	0.50
36-Kr- 79	7105	1.46 d	0.0	24.6	257.8	1	4	0	41	0	11	0	57	6	-0.04
36-Kr- 79 m	7106	50.00 s	0.0	90.1	39.8	1	3	0	1	0	0	0	6	6	-0.07
38-Sr- 85	7107	64.85 d	0.0	9.2	518.5	1	4	0	7	0	3	0	15	6	0.00
38-Sr- 85 m	7108	1.13 h	0.0	13.2	215.9	2	4	0	11	0	4	0	26	12	0.00
38-Sr- 89	7109	50.52 d	0.0	582.3	1.3	2	1	0	0	2	0	0	0	0	0.00
38-Sr- 90	7110	28.64 y	0.0	195.6	0.0	1	1	0	0	1	0	0	0	0	0.00
39-Y - 88	7111	106.63 d	0.0	6.8	2696.6	1	4	0	7	0	4	0	9	7	0.05
39-Y - 89 m	7112	16.05 s	0.0	7.7	901.4	1	3	0	1	0	0	0	6	6	0.00
39-Y - 90	7113	2.67 d	0.0	930.3	3.1	1	2	0	1	2	0	0	0	0	0.00
39-Y - 90 m	7114	3.19 h	0.0	48.5	633.7	1	3	0	3	0	0	0	9	6	-0.01
40-Zr- 89	7115	3.27 d	0.0	92.8	253.9	2	4	0	4	0	5	0	3	7	0.05
40-Zr- 89 m	7116	4.18 m	0.0	32.7	638.0	2	4	0	2	0	2	0	9	13	-0.03
40-Zr- 93	7117	1.53E+06 y	0.0	19.1	0.0	2	1	0	0	2	0	0	0	0	0.00
40-Zr- 95	7118	64.03 d	0.0	118.0	730.5	2	2	0	2	4	0	0	0	0	-0.01
41-Nb- 93 m	7119	16.13 y	0.0	29.0	2.0	1	3	0	1	0	0	0	6	6	-0.36
41-Nb- 94	7120	2.00E+04 y	0.0	168.3	1571.5	1	4	0	2	1	0	0	9	6	0.00
41-Nb- 94 m	7121	6.26 m	0.0	35.1	12.3	2	4	0	4	3	0	0	15	6	-0.02
41-Nb- 95	7122	34.97 d	0.0	44.6	764.3	1	4	0	3	3	0	0	12	6	0.00
41-Nb- 95 m	7123	3.61 d	0.0	173.6	71.7	2	4	0	5	4	0	0	12	12	-0.06
42-Mo- 93	7124	3.01E+03 y	0.0	5.6	10.9	2	3	0	0	0	2	0	3	6	0.00
42-Mo- 93 m	7125	6.85 h	0.0	107.2	2317.5	2	4	0	13	0	2	0	15	12	0.01
42-Mo- 99	7126	2.75 d	0.0	392.4	146.8	2	4	0	35	12	0	0	42	6	0.00
43-Tc- 99	7127	2.11E+05 y	0.0	101.0	0.0	1	4	0	1	2	0	0	6	6	0.00
43-Tc- 99 m	7128	6.01 h	0.0	16.1	126.5	2	4	0	6	3	0	0	22	12	0.04
44-Ru-103	7129	39.26 d	0.0	66.4	497.7	2	4	0	18	6	0	0	57	6	-0.09
45-Rh-102	7130	2.90 y	0.0	12.2	2122.1	1	4	0	16	0	2	0	33	6	-0.45
45-Rh-102 m	7131	208.00 d	0.0	173.6	493.2	3	5	0	30	2	7	0	57	19	0.07

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45-Rh-103 m	7132	56.11 m	0.0	38.2	1.7	1	3	0	1	0	0	0	6	6	-0.38
45-Rh-104	7133	42.30 s	0.0	980.5	15.0	2	5	0	17	7	3	0	30	13	0.02
45-Rh-104 m	7134	4.34 m	0.0	86.2	45.5	2	4	0	22	7	0	0	27	12	-0.18
47-Ag-107 m	7135	44.00 s	0.0	80.7	12.5	1	3	0	1	0	0	0	6	6	-0.05
47-Ag-108	7136	2.40 m	0.0	605.5	22.8	2	5	0	13	2	6	0	24	13	0.02
47-Ag-108 m	7137	418.00 y	0.0	16.0	1630.1	2	4	0	5	0	1	0	21	12	-0.01
47-Ag-109 m	7138	39.80 s	0.0	76.9	11.3	1	3	0	1	0	0	0	6	6	-0.18
47-Ag-110	7139	24.70 s	0.0	1174.8	34.8	2	5	0	15	11	2	0	24	12	0.00
47-Ag-110 m	7140	249.79 d	0.0	69.0	2760.6	2	4	0	61	9	0	0	46	12	-0.33
48-Cd-109	7141	1.27 y	0.0	5.7	15.1	1	3	0	0	0	1	0	3	6	0.03
48-Cd-111 m	7142	48.54 m	0.0	104.9	291.7	1	3	0	2	0	0	0	9	6	-0.08
48-Cd-113	7143	9.30E+15 y	0.0	136.2	0.0	1	1	0	0	1	0	0	0	0	0.00
48-Cd-113 m	7144	13.70 y	0.0	183.2	0.1	2	4	0	1	1	0	0	6	6	0.00
49-In-111	7145	2.80 d	0.0	33.5	406.5	2	4	0	2	0	2	0	9	6	0.03
49-In-111 m	7146	7.90 m	0.0	67.8	469.6	1	3	0	1	0	0	0	6	6	-0.05
49-In-113 m	7147	1.66 h	0.0	131.3	260.4	1	3	0	1	0	0	0	6	6	0.00
49-In-114	7148	1.20 m	0.0	769.2	4.4	2	5	0	3	2	2	0	3	7	0.00
49-In-114 m	7149	50.00 d	0.0	140.9	89.0	2	4	0	3	0	1	0	9	12	-0.18
49-In-114 n	7150	4.30E-02 s	0.0	34.0	277.7	1	3	0	1	0	0	0	6	6	0.00
49-In-115	7151	4.41E+14 y	0.0	207.9	0.0	1	1	0	0	1	0	0	0	0	0.00
49-In-115 m	7152	4.49 h	0.0	171.0	162.5	2	4	0	2	2	0	0	6	6	-0.06
49-In-116	7153	14.20 s	0.0	1356.7	5.3	1	4	0	11	8	0	0	21	6	0.62
49-In-116 m	7154	54.60 m	0.0	312.6	2490.8	1	4	0	40	7	0	0	114	6	0.19
49-In-116 n	7155	2.17 s	0.0	94.1	68.2	1	3	0	1	0	0	0	6	6	0.06
50-Sn-113	7156	115.09 d	0.0	6.3	23.3	2	4	0	3	0	3	0	6	6	0.02
50-Sn-113 m	7157	20.90 m	0.0	58.6	14.5	2	4	0	1	0	1	0	9	12	-0.21
50-Sn-117 m	7158	13.60 d	0.0	158.2	156.3	1	3	0	3	0	0	0	12	6	0.00
50-Sn-119 m	7159	293.00 d	0.0	78.3	11.4	1	3	0	2	0	0	0	8	6	-0.10
50-Sn-121	7160	1.12 d	0.0	115.2	0.0	1	1	0	0	1	0	0	0	0	0.00
50-Sn-121 m	7161	55.00 y	0.0	35.3	5.1	2	4	0	2	1	0	0	10	8	-0.08
50-Sn-123	7162	129.20 d	0.0	519.9	8.0	1	4	0	9	6	0	0	6	6	0.00
50-Sn-123 m	7163	40.10 m	0.0	475.5	141.2	1	4	0	5	3	0	0	6	6	-0.06
50-Sn-125	7164	9.64 d	0.0	805.0	316.1	1	4	0	49	15	0	0	60	6	-0.07
50-Sn-125 m	7165	9.52 m	0.0	796.8	347.0	1	4	0	23	8	0	0	21	6	0.14
50-Sn-126	7166	1.00E+05 y	0.0	120.5	57.6	2	4	0	6	1	0	0	19	6	0.07
51-Sb-122	7167	2.70 d	0.0	564.7	437.9	2	5	0	8	6	2	0	3	7	0.00
51-Sb-122 m	7168	4.19 m	0.0	93.1	70.5	1	3	0	3	0	0	0	11	6	-0.01
51-Sb-124	7169	60.24 d	0.0	381.7	1863.3	1	4	0	66	21	0	0	45	6	-0.04
51-Sb-124 m	7170	1.55 m	0.0	114.1	437.5	2	4	0	5	3	0	0	16	8	-0.34
51-Sb-124 n	7171	20.20 m	0.0	25.8	0.3	1	3	0	1	0	0	0	4	2	-0.49
51-Sb-125	7172	2.76 y	0.0	101.1	430.2	2	4	0	24	8	0	0	74	6	0.04
51-Sb-129	7173	4.36 h	0.0	354.8	1380.1	2	4	0	70	30	0	0	48	6	-0.66
51-Sb-129 m	7174	17.70 m	0.0	998.9	1478.0	3	4	0	37	8	0	0	42	12	
52-Te-125 m	7175	58.00 d	0.0	108.8	36.0	1	3	0	3	0	0	0	12	6	0.00

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52-Te-129	7176	1.16 h	0.0	543.0	60.5	1	4	0	58	11	0	0	71	6	-0.06
52-Te-129 m	7177	33.80 d	0.0	240.2	38.9	2	4	0	40	9	0	0	65	12	-0.22
53-I -125	7178	59.43 d	0.0	19.2	42.4	1	4	0	1	0	1	0	6	6	0.07
53-I -126	7179	12.98 d	0.0	143.8	435.6	2	5	0	10	3	6	0	21	13	0.06
54-Xe-125	7180	16.90 h	0.0	34.5	270.5	1	4	0	35	0	11	0	36	7	-0.02
54-Xe-125 m	7181	56.00 s	0.0	136.4	116.1	1	3	0	2	0	0	0	9	6	0.06
54-Xe-127	7182	36.44 d	0.0	32.5	280.7	1	4	0	6	0	3	0	21	6	-0.14
54-Xe-127 m	7183	1.16 m	0.0	128.7	168.5	1	3	0	2	0	0	0	9	6	-0.03
55-Cs-134	7184	2.07 y	0.0	163.4	1554.1	2	5	0	12	3	1	0	42	12	0.08
55-Cs-134 m	7185	2.91 h	0.0	111.8	27.1	1	3	0	3	0	0	0	11	6	-0.08
55-Cs-135	7186	2.40E+06 y	0.0	66.9	0.0	1	1	0	0	1	0	0	0	0	0.00
55-Cs-135 m	7187	53.00 m	0.0	36.9	1596.5	1	3	0	2	0	0	0	9	6	-0.02
55-Cs-136	7188	13.03 d	0.0	141.9	2145.6	1	4	0	23	7	0	0	60	6	-0.24
55-Cs-136 m	7189	19.00 s	0.0	616.7	616.7	2	0	0	0	0	0	0	0	0	
55-Cs-137	7190	30.17 y	0.0	186.5	0.0	2	1	0	0	2	0	0	0	0	0.00
56-Ba-133	7191	10.57 y	0.0	53.6	402.6	1	4	0	9	0	2	0	30	6	0.08
56-Ba-133 m	7192	1.59 d	0.0	221.6	66.9	2	4	0	4	0	1	0	17	12	-0.08
56-Ba-137 m	7193	2.55 m	0.0	62.9	598.6	1	3	0	1	0	0	0	6	6	0.01
58-Ce-139	7194	137.65 d	0.0	34.2	161.4	1	4	0	1	0	1	0	6	6	0.16
58-Ce-139 m	7195	56.10 s	0.0	55.1	699.1	1	3	0	1	0	0	0	6	6	0.00
61-Pm-145	7196	17.70 y	0.0	12.2	31.5	2	5	0	2	0	3	1	9	6	0.19
62-Sm-145	7197	340.00 d	0.0	29.5	63.0	1	4	0	3	0	3	0	6	6	0.06
62-Sm-146	7198	1.00E+08 y	2570.5	0.0	0.0	1	1	0	0	0	0	1	0	0	-0.01
62-Sm-151	7199	90.00 y	0.0	19.9	0.0	1	4	0	1	2	0	0	4	2	0.00
63-Eu-152	7200	13.52 y	0.0	129.1	1164.2	2	5	0	130	14	17	0	252	13	-0.15
63-Eu-152 m	7201	9.27 h	0.0	502.0	311.1	2	5	0	59	7	8	0	96	13	-0.67
63-Eu-152 n	7202	1.60 h	0.0	72.3	75.5	1	3	0	5	0	0	0	15	6	0.02
63-Eu-154	7203	8.59 y	0.0	274.5	1245.3	2	5	0	139	25	2	0	201	12	0.04
63-Eu-154 m	7204	46.40 m	0.0	82.5	74.4	1	3	0	16	0	0	0	36	6	0.09
63-Eu-155	7205	4.85 y	0.0	66.6	64.2	1	4	0	12	6	0	0	33	6	0.17
65-Tb-157	7206	99.00 y	0.0	5.7	10.4	1	4	0	1	0	2	0	6	6	1.22
66-Dy-157	7207	8.14 h	0.0	13.3	350.4	1	4	0	26	0	11	0	66	6	-0.02
66-Dy-159	7208	144.40 d	0.0	12.8	45.5	1	4	0	9	0	5	0	30	6	0.09
72-Hf-174	7209	2.00E+15 y	2503.6	0.0	0.0	1	1	0	0	0	0	1	0	0	0.01
72-Hf-175	7210	70.00 d	0.0	45.5	363.0	1	4	0	8	0	4	0	27	6	0.03
72-Hf-181	7211	42.38 d	0.0	204.4	530.5	1	4	0	10	2	0	0	29	6	0.09
73-Ta-179	7212	1.61 y	0.0	7.4	29.2	1	3	0	0	0	1	0	3	6	0.84
73-Ta-180	7213	8.08 h	0.0	64.1	45.9	2	5	0	2	2	2	0	12	12	0.03
73-Ta-180 m	7214	1.80E+15 y	0.0	125.9	562.5	2	5	0	6	1	1	0	24	12	0.16
73-Ta-182	7215	114.70 d	0.0	216.3	1283.3	1	4	0	43	10	0	0	128	6	0.00
73-Ta-182 m	7216	0.28 s	0.0	14.3	1.9	1	3	0	1	0	0	0	4	2	0.16
73-Ta-182 n	7217	15.84 m	0.0	244.4	254.6	1	3	0	5	0	0	0	18	6	0.85
74-W -181	7218	120.98 d	0.0	12.7	41.2	1	4	0	3	0	4	0	10	6	0.06
74-W -185	7219	75.10 d	0.0	126.8	0.1	1	4	0	1	2	0	0	6	6	0.00

Nuclide	Material Number	Half Life	Mean Decay Energies KeV Alpha	Beta	Gamma	NDK	NSP	SF	.....No. of Spectral Lines..... N-G	N-B	N-P	N-A	N-E	N-X	% Dev
74-W -185 m	7220	1.67 m	0.0	172.0	25.7	1	3	0	14	0	0	0	38	6	-0.15
74-W -187	7221	23.85 h	0.0	301.3	442.1	1	4	0	48	17	0	0	118	6	0.06
79-Au-198	7222	2.69 d	0.0	327.3	402.9	1	4	0	3	3	0	0	12	6	0.00
79-Au-198 m	7223	2.30 d	0.0	262.1	527.8	1	3	0	6	0	0	0	18	6	
80-Hg-197	7224	2.67 d	0.0	66.6	73.3	1	4	0	3	0	3	0	11	6	0.12
80-Hg-197 m	7225	23.90 h	0.0	215.1	93.7	2	4	0	7	0	1	0	26	12	0.63
80-Hg-203	7226	46.60 d	0.0	99.1	237.7	1	4	0	1	1	0	0	6	6	0.02
81-Tl-204	7227	3.79 y	0.0	236.2	1.1	2	4	0	0	1	1	0	3	6	0.00
82-Pb-204	7228	1.40E+17 y	1971.7	0.0	0.0	1	1	0	0	0	0	1	0	0	0.00
82-Pb-204 m	7229	1.12 h	0.0	103.3	2080.7	1	3	0	6	0	0	0	21	7	0.07
83-Bi-207	7230	31.76 y	0.0	118.5	1539.5	1	4	0	6	0	4	0	21	8	0.18
90-Th-228	7231	1.91 y	5494.5	21.7	3.2	1	4	0	14	0	0	9	40	7	0.01
90-Th-231	7232	1.06 d	0.0	164.9	25.8	1	4	0	47	13	0	0	122	7	-0.71
93-Np-239	7233	2.36 d	0.0	262.8	182.2	1	4	0	33	8	0	0	89	7	-0.13
95-Am-241	7234	432.70 y	5571.7	39.3	28.2	2	6	1	129	0	0	42	233	7	-0.02
95-Am-243	7235	7.36E+03 y	5359.0	23.9	57.0	2	6	1	18	0	0	12	34	7	-0.02

Data File Statistics :-

Total No. of Nuclides = 236
Radioactive Nuclides = 236
Ground State = 166
1st Excited State = 65
2nd Excited State = 5
Stable Nuclides = 0
Nuclides with Spectra = 236

Total No. of Gamma Lines = 2554
Total No. of Beta- Lines = 632
Total No. of Beta+ Lines = 320
Total No. of Alpha Lines = 81
Total No. of Electron Lines = 4155
Total No. of X-Ray Lines = 1110

Table 2 : Summary of Activation Product Decay Data in UKPADD-2 Library: Major Emissions

Nuclide	Half-life	Decay Modes	Major Radiations (keV) and Emission Probabilities	
1-H-3	12.33 y	β-		
2-He-6	0.8081 s	β-		
2-He-8	0.122 s	β-, β-n(0.12)	γ	980.8 (0.88)
3-Li-8	0.838 s	β-α	α	1566 (1.00)
3-Li-9	0.1783 s	β-, β-n(0.495)		
4-Be-7	53.24 d	EC	γ	477.60 (0.103)
4-Be-8	7 x 10⁻¹⁷ s	α	α	45.95 (1.00)
4-Be-10	1.6 x 10⁶ y	β-		
4-Be-11	13.81 s	β-, β-α(0.030)	α	770 (0.030)
			γ	2124.8 (0.33), 4666.3 (0.0200), 5851.8 (0.0213), 6790.5 (0.0451) and others
5-B-12	0.02020 s	β-, β-α(0.0158)	α	191 (0.015) and 1955 (0.0008)
			γ	4438.9 (0.0128)
5-B-13	0.01733 s	β-, β-n(0.00276)	γ	3683.9 (0.076)
6-C-14	5730 y	β-		
6-C-15	2.449 s	β-	γ	5297.86 (0.68) and others
7-N-13	9.965 m	EC		
7-N-16	7.13 s	β-, β-α(0.0000120)	γ	6129.17 (0.688), 7115.15 (0.050) and others
8-O-19	26.91 s	β-	γ	109.9 (0.030), 197.2 (0.958), 1357 (0.541), 1444 (0.030) and others
9-F-18	109.7 m	EC		
9-F-20	11.03 s	β-	γ	1633.7 (1.00)
10-Ne-23	37.2 s	β-	γ	439.9 (0.33), 1636.4 (0.0100) and others
11-Na-22	2.603 y	EC	γ	1274.54 (0.99935)
11-Na-24	14.965 h	β-	γ	1368.63 (0.999936), 2754.03 (0.99855) and others
11-Na-24m	0.0202 s	IT, β- (0.005)	γ	472.3 (0.995)
11-Na-25	59.6 s	β-	γ	389.7 (0.129), 585.1 (0.126), 974.8 (0.145), 1611.7 (0.095) and others
11-Na-26	1.08 s	β-	γ	1002 (0.012), 1129.7 (0.052), 1412 (0.020), 1808.7 (0.99), 1896 (0.022), 2523.2 (0.016), 2541 (0.025) and others
12-Mg-27	9.458 m	β-	γ	843.7 (0.718), 1014.4 (0.282) and others
12-Mg-28	20.90 h	β-	γ	30.64 (0.905), 400.6 (0.379), 941.5 (0.383), 1342.2 (0.521) and others
13-Al-26	7.2 x 10⁵ y	EC	γ	1129.6 (0.024), 1808.6 (0.997) and others
13-Al-26m	6.345 s	EC		
13-Al-28	2.241 m	β-	γ	1778.7 (1.00)
13-Al-29	6.56 m	β-	γ	1273.2 (0.906), 2028.1 (0.037), 2425.5 (0.057) and others
13-Al-30	3.56 s	β-	γ	1263.1 (0.401), 1311 (0.025), 1732 (0.020), 2235.3 (0.653), 2595.4 (0.061), 3498.5 (0.325), 4808.8 (0.021) and others
14-Si-31	2.62 h	β-	γ	1266.1 (0.0007)
14-Si-32	330 y	β-		

Table 2 : UKPADD-2 (Continued)

Nuclide	Half-life	Decay Modes	Major Radiations (keV) and Emission Probabilities
15-P-32	14.27 d	β^-	
15-P-33	25.4 d	β^-	
15-P-34	12.4 s	β^-	γ 2127.2 (0.152) and others
16-S-35	87.5 d	β^-	
16-S-37	4.99 m	β^-	γ 3103.3 (0.942) and others
17-Cl-34	1.526 s	EC	
17-Cl-34m	32.1 m	EC(0.52), IT(0.48)	γ 146.4 (0.417), 1176 (0.133), 2127.2 (0.413), 3303 (0.105) and others
17-Cl-36	3.02 x 10^5 y	β^-, EC(0.019)	
17-Cl-38	37.2 m	β^-	γ 1642.4 (0.325), 2167.5 (0.440) and others
17-Cl-38m	0.715 s	IT	γ 671.3 (1.00)
18-Ar-37	35.04 d	EC	
18-Ar-39	269 y	β^-	
18-Ar-41	109.6 m	β^-	γ 1293.7 (0.9916) and others
18-Ar-42	33 y	β^-	
19-K-38	7.61 m	EC	γ 2167.6 (0.9987) and others
19-K-38m	0.924 s	EC	
19-K-40	1.28 x 10^9 y	β^-, EC(0.107)	γ 1460.8 (0.107)
19-K-42	12.37 h	β^-	γ 1524.6 (0.189) and others
19-K-43	22.2 h	β^-	γ 220.6 (0.041), 372.8 (0.871), 396.9 (0.114), 593.4 (0.110), 617.5 (0.804), 1022 (0.0187) and others
19-K-44	22.13 m	β^-	γ 651.36 (0.0302), 726.49 (0.0377), 1024.7 (0.0667), 1126.1 (0.0760), 1157.02 (0.580), 1499.5 (0.0783), 1752.6 (0.0406), 2150.8 (0.227), 2519.0 (0.0969), 3661.5 (0.0609) and others
20-Ca-41	1.03 x 10^5 y	EC	
20-Ca-45	162.7 d	β^-	
20-Ca-47	4.538 d	β^-	γ 489.2 (0.065), 807.9 (0.065), 1297.1 (0.75) and others
20-Ca-49	8.72 m	β^-	γ 3084.4 (0.921), 4071.9 (0.070) and others
21-Sc-44	3.927 h	EC	γ 1157.0 (0.9986) and others
21-Sc-44m	58.6 h	IT, EC(0.0123)	γ 271.1 (0.866) and others
21-Sc-46	83.79 d	β^-	γ 889.28 (0.99984), 1120.55 (0.99987) and others
21-Sc-46m	18.70 s	IT	γ 142.53 (0.58)
21-Sc-47	3.346 d	β^-	γ 159.37 (0.681)
21-Sc-48	43.67 h	β^-	γ 175.35 (0.076), 983.50 (1.00), 1037.50 (0.975), 1212.85 (0.024) and 1312.10 (1.00)
21-Sc-49	57.2 m	β^-	γ 1622.6 (0.00010) and 1761.9 (0.0005)
21-Sc-50	102.5 s	β^-	γ 523.8 (0.887), 1121.1 (0.995), 1553.8 (1.00) and others
21-Sc-50m	0.35 s	IT, β^-(0.0125)	γ 256.9 (0.953)
22-Ti-45	3.08 h	EC	γ 720.1 (0.0015) and others
22-Ti-51	5.80 m	β^-	γ 320.1 (0.942) and others

Table 2 : UKPADD-2 (Continued)

Nuclide	Half-life	Decay Modes	Major Radiations (keV) and Emission Probabilities
23-V-48	15.974 d	EC	γ 944.10 (0.0776), 983.50 (0.9999), 1312.09 (0.975), 2240.34 (0.0241) and others
23-V-49	330 d	EC	
23-V-52	3.745 m	β-	γ 1434.09 (1.00) and others
23-V-53	1.62 m	β-	γ 1006.3 (0.896), 1289.5 (0.100) and others
23-V-54	49.8 s	β-	γ 834.8 (0.971), 989.1 (0.801), 1961.7 (0.100), 2259.3 (0.456) and others
24-Cr-49	41.9 m	EC	γ 62.30 (0.167), 90.63 (0.542), 152.93 (0.309) and others
24-Cr-51	27.706 d	EC	γ 320.08 (0.0986)
24-Cr-55	3.54 m	β-	γ 1528.4 (0.00037) and others
25-Mn-54	312.3 d	EC	γ 834.83 (0.999758)
25-Mn-56	2.579 h	β-	γ 846.75 (0.9887), 1810.8 (0.275), 2113.1 (0.143) and others
26-Fe-53	8.15 m	EC	γ 377.9 (0.42) and others
26-Fe-53m	2.58 m	IT	γ 701.2 (0.986), 1011.2 (0.848), 1328.0 (0.858) and others
26-Fe-55	999 d	EC	
26-Fe-59	44.502 d	β-	γ 142.65 (0.0102), 192.35 (0.0310), 1099.25 (0.567), 1291.60 (0.431) and others
27-Co-55	17.53 h	EC	γ 477.2 (0.204), 931.3 (0.75), 1316.5 (0.0701), 1408.5 (0.166) and others
27-Co-56	77.31 d	EC	γ 846.75 (0.99937), 1037.86 (0.141), 1238.29 (0.666), 1771.39 (0.155), 2598.5 (0.170) and others
27-Co-57	271.79 d	EC	γ 14.41 (0.097), 122.06 (0.847), 136.47 (0.104) and others
27-Co-58	70.86 d	EC	γ 810.77 (0.9945) and others
27-Co-58m	8.94 h	IT	γ 24.89 (0.000365)
27-Co-60	1925.5 d	β-	γ 1173.24 (0.99857), 1332.50 (0.99983) and others
27-Co-60m	10.47 m	IT, β-(0.0026)	γ 58.59 (0.0204) and others
28-Ni-57	35.70 h	EC	γ 127.2 (0.163), 1377.6 (0.802), 1757.5 (0.0591), 1919.4 (0.136) and others
28-Ni-59	7.6 x 10⁴ y	EC	
28-Ni-63	99 y	β-	
28-Ni-65	2.520 h	β-	γ 366.27 (0.0461), 1115.56 (0.148), 1481.83 (0.235) and others
29-Cu-62	9.75 m	EC	γ 1172.9 (0.0035) and others
29-Cu-64	12.702 h	EC, β-(0.3886)	γ 1345.79 (0.479)
29-Cu-66	5.10 m	β-	γ 1039.36 (0.074) and others
30-Zn-63	38.4 m	EC	γ 669.66 (0.0848), 962.10 (0.0666) and others
30-Zn-65	244.26 d	EC	γ 1115.55 (0.5060) and others
33-As-74	17.78 d	EC(0.66), β-(0.34)	γ 595.85 (0.59), 634.8 (0.15) and others
34-Se-75	119.64 d	EC	γ 96.73 (0.0341), 121.12 (0.171), 136.00 (0.588), 264.66 (0.590), 279.54 (0.250), 400.66 (0.115) and others
35-Br-79m	4.88 s	IT	γ 207.1 (0.752)
35-Br-80	17.60 m	β-, EC(0.083)	γ 616.6 (0.066) and others
35-Br-80m	4.41 h	IT	γ 37.05 (0.39) and 48.80 (0.0032)

Table 2 : UKPADD-2 (Continued)

Nuclide	Half-life	Decay Modes	Major Radiations (keV) and Emission Probabilities	
35-Br-82	35.32 h	β-	γ	554.35 (0.707), 619.11 (0.434), 698.37 (0.285), 776.52 (0.835), 827.83 (0.240), 1044.00 (0.272), 1317.48 (0.265), 1474.88 (0.163) and others
35-Br-82m	6.09 m	IT, β-(0.024)	γ	45.95 (0.00241), 776.52 (0.00258) and others
36-Kr-79	35.04 h	EC	γ	261.31 (0.127), 397.5 (0.093), 606.0 (0.081) and others
36-Kr-79m	50 s	IT	γ	129.77 (0.274)
38-Sr-85	64.849 d	EC	γ	514.00 (0.9927) and others
38-Sr-85m	67.61 m	IT, EC(0.134)	γ	151.16 (0.128), 231.67 (0.838) and others
38-Sr-89	50.52 d	β-		
38-Sr-90	10460 d	β-		
39-Y-88	106.630 d	EC	γ	898.04 (0.940), 1836.06 (0.9933) and others
39-Y-89m	16.05 s	IT	γ	909.1 (0.9914)
39-Y-90	64.11 h	β-	γ	1760.7 (0.000115)
39-Y-90m	3.19 h	IT	γ	202.51 (0.966), 479.53 (0.906) and others
40-Zr-89	78.4 h	EC	γ	1712.9 (0.0075) and others
40-Zr-89m	4.18 m	IT, EC(0.0666)	γ	587.8 (0.891) and 1507.3 (0.064)
40-Zr-93	1.53 x 10^6 y	β-		
40-Zr-95	64.03 d	β-	γ	724.20 (0.439) and 756.73 (0.545)
41-Nb-93m	5.89 x 10^3 d	IT		
41-Nb-94	7.3 x 10^6 d	β-	γ	702.62 (0.9982) and 871.09 (0.9989)
41-Nb-94m	6.26 m	IT, β-(0.0050)	γ	40.95 (0.00073), 871.09 (0.00495) and others
41-Nb-95	34.975 d	β-	γ	765.82 (0.9979) and others
41-Nb-95m	86.6 h	IT, β-(0.034)	γ	204.10 (0.0236), 235.68 (0.251) and others
42-Mo-93	1.1 x 10^4 d	EC		
42-Mo-93m	6.85 h	IT, EC(0.0012)	γ	263.06 (0.580), 684.67 (0.9968), 1477.19 (0.9908) and others
42-Mo-99	65.95 h	β-	γ	140.51 (0.0452), 181.1 (0.0596), 366.4 (0.0119), 739.6 (0.119), 778.0 (0.0420) and others
43-Tc-99	2.113 x 10^5 y	β-		
43-Tc-99m	6.01 h	IT, β-(0.000037)	γ	140.51 (0.890) and others
44-Ru-103	39.26 d	β-	γ	497.08 (0.913), 610.33 (0.058) and others
45-Rh-102	1060 d	EC	γ	475.1 (0.95), 631.3 (0.56), 697.5 (0.44), 766.8 (0.32), 1046.6 (0.32), 1112.8 (0.19) and others
45-Rh-102m	208 d	EC(0.75), β-(0.20), IT(0.05)	γ	468.6 (0.029), 475.1 (0.46), 556.5 (0.020), 628.1 (0.045), 1103.2 (0.029) and others
45-Rh-103m	56.11 m	IT	γ	39.76 (0.00069)
45-Rh-104	42.3 s	β-, EC(0.0045)	γ	555.81 (0.019) and others
45-Rh-104m	4.34 m	IT, β-(0.0013)	γ	51.42 (0.484), 77.53 (0.0213), 97.11 (0.0295), 555.81 (0.00128), 767.8 (0.00086) and others

Table 2 : UKPADD-2 (Continued)

Nuclide	Half-life	Decay Modes	Major Radiations (keV) and Emission Probabilities
47-Ag-107m	44.0 s	IT	γ 93.13 (0.0465)
47-Ag-108	2.40 m	β⁻, EC(0.029)	γ 433.94 (0.00565), 632.95 (0.021) and others
47-Ag-108m	418 y	EC, IT(0.087)	γ 433.94 (0.905), 614.28 (0.910), 722.94 (0.911) and others
47-Ag-109m	39.8 s	IT	γ 88.034 (0.0364)
47-Ag-110	24.7 s	β⁻, EC(0.0030)	γ 657.76 (0.0449) and others
47-Ag-110m	249.79 d	β⁻, IT(0.0127)	γ 446.81 (0.0384), 620.36 (0.0279), 657.76 (0.945), 677.62 (0.105), 687.01 (0.0671), 706.68 (0.164), 744.27 (0.0482), 763.94 (0.227), 818.03 (0.0733), 884.68 (0.747), 937.50 (0.343), 1384.30 (0.242), 1475.79 (0.0399), 1505.04 (0.130) and others
48-Cd-109	462.6 d	EC	
48-Cd-111m	48.54 m	IT	γ 150.80 (0.336) and 245.42 (0.942)
48-Cd-113	9.3 x 10^{15} y	β⁻	
48-Cd-113m	13.7 y	β⁻, IT(0.0012)	γ 263.6 (0.00023)
49-In-111	2.8047 d	EC	γ 171.28 (0.9079) and 245.42 (0.9415)
49-In-111m	7.9 m	IT	γ 537.2 (0.87)
49-In-113m	1.658 h	IT	γ 391.69 (0.6489)
49-In-114	71.9 s	β⁻, EC(0.0050)	γ 1299.92 (0.0015) and others
49-In-114m	50.0 d	IT, EC(0.035)	γ 190.34 (0.186), 558.46 (0.035) and 725.28 (0.035)
49-In-114n	0.043 s	IT	γ 311.6 (0.885)
49-In-115	4.41 x 10^{14} y	β⁻	
49-In-115m	4.486 h	IT, β⁻(0.050)	γ 336.24 (0.458) and others
49-In-116	14.2 s	β⁻	γ 1293.5 (0.00014) and others
49-In-116m	54.6 m	β⁻	γ 416.9 (0.280), 818.7 (0.116), 1097.3 (0.576), 1293.54 (0.847), 1508.2 (0.104), 2112.3 (0.152) and others
49-In-116n	2.17 s	IT	γ 162.4 (0.366)
50-Sn-113	115.09 d	EC	γ 255.07 (0.0191) and others
50-Sn-113m	20.9 m	IT, EC(0.089)	γ 77.39 (0.0052)
50-Sn-117m	13.60 d	IT	γ 156.02 (0.0211), 158.56 (0.864) and others
50-Sn-119m	293.0 d	IT	γ 23.87 (0.161)
50-Sn-121	26.9 h	β⁻	
50-Sn-121m	55 y	IT, β⁻(0.224)	γ 37.13 (0.0185)
50-Sn-123	129.2 d	β⁻	γ 1088.6 (0.006) and others
50-Sn-123m	40.1 m	β⁻	γ 160.33 (0.855) and others
50-Sn-125	9.64 d	β⁻	γ 332.09 (0.0130), 469.8 (0.0136), 800.3 (0.0099), 822.4 (0.0398), 915.5 (0.0398), 2001.8 (0.0190) and others
50-Sn-125m	9.52 m	β⁻	γ 332.09 (0.967) and others
50-Sn-126	1.0 x 10^{5} y	β⁻	γ 87.57 (0.40) and others
51-Sb-122	64.7 h	β⁻, EC(0.0237)	γ 564.12 (0.693), 692.8 (0.0378) and others

Table 2 : UKPADD-2 (Continued)

Nuclide	Half-life	Decay Modes	Major Radiations (keV) and Emission Probabilities	
51-Sb-122m	4.19 m	IT	γ	61.41 (0.575), 76.06 (0.185) and others
51-Sb-124	60.24 d	β-	γ	602.73 (0.978), 645.86 (0.0740), 722.78 (0.1097), 1691.0 (0.484), 2091.0 (0.0557) and others
51-Sb-124m	93 s	IT, β-(0.25)	γ	497.6 (0.24), 602.73 (0.25), 645.86 (0.25) and others
51-Sb-124n	20.2 m	IT		
51-Sb-125	1007.7 d	β-	γ	35.5 (0.042), 176.3 (0.068), 427.9 (0.293), 463.4 (0.104), 600.5 (0.176), 606.7 (0.050), 635.9 (0.112) and others
51-Sb-129	4.36 h	β-	γ	544.7 (0.181), 683.5 (0.057), 812.8 (0.476), 914.5 (0.209), 966.5 (0.081), 1030 (0.133), 1737.3 (0.059) and others
51-Sb-129m	17.7 m	β-, IT(0.15)	γ	433.8 (0.299), 657.8 (0.377), 762 (0.41) and others
52-Te-125m	58 d	IT	γ	35.50 (0.0666) and others
52-Te-129	69.6 m	β-	γ	27.79 (0.163), 459.6 (0.071), 487.38 (0.013) and others
52-Te-129m	33.8 d	IT, β-(0.31)	γ	695.9 (0.031), 729.6 (0.0072) and others
53-I-125	59.43 d	EC	γ	35.50 (0.0666)
53-I-126	12.98 d	EC(0.563), β-(0.437)	γ	388.6 (0.355), 491.2 (0.028), 666.3 (0.327), 753.8 (0.040) and others
54-Xe-125	16.9 h	EC	γ	54.97 (0.0596), 188.43 (0.552), 243.40 (0.289), 453.83 (0.0425) and others
54-Xe-125m	56 s	IT	γ	111.8 (0.617) and 140.8 (0.196)
54-Xe-127	36.44 d	EC	γ	57.61 (0.0131), 145.25 (0.0429), 172.13 (0.255), 202.86 (0.683), 374.99 (0.172) and others
54-Xe-127m	69.6 s	IT	γ	124.8 (0.690) and 172.3 (0.379)
55-Cs-134	754.28 d	β-, EC(0.000003)	γ	604.71 (0.976), 795.91 (0.853) and others
55-Cs-134m	2.908 h	IT	γ	127.50 (0.126) and others
55-Cs-135	2.4 x 10^6 y	β-		
55-Cs-135m	53 m	IT	γ	787.2 (0.9971) and 846.1 (0.958)
55-Cs-136	13.03 d	β-	γ	66.9 (0.048), 86.3 (0.056), 153.3 (0.058), 163.9 (0.041), 176.6 (0.100), 273.6 (0.111), 340.5 (0.46), 818.52 (1.00), 1048.1 (0.80), 1235.4 (0.198) and others
55-Cs-136m	19 s	β-(0.5), IT(0.5)		
55-Cs-137	11020 d	β-		
56-Ba-133	3862 d	EC	γ	80.99 (0.341), 356.01 (0.621) and others
56-Ba-133m	38.2 h	IT, EC(0.000101)	γ	275.9 (0.174) and others
56-Ba-137m	2.553 m	IT	γ	661.66 (0.901)
58-Ce-139	137.65 d	EC	γ	165.86 (0.799)
58-Ce-139m	56.1 s	IT	γ	754.2 (0.924)
61-Pm-145	17.7 y	EC, α(2.8 x 10^{-6})	γ	67.22 (0.00535) and 72.50 (0.0179)
62-Sm-145	340 d	EC	γ	61.25 (0.1215) and others
62-Sm-146	1.00 x 10^8 y	α	α	2500 (1.00)
62-Sm-151	90 y	β-	γ	21.54 (0.00031)

Table 2 : UKPADD-2 (Continued)

Nuclide	Half-life	Decay Modes	Major Radiations (keV) and Emission Probabilities	
63-Eu-152	4939 d	EC, β^-(0.280)	γ	121.78 (0.284), 244.70 (0.075), 344.28 (0.266), 411.13 (0.022), 443.96 (0.028), 778.90 (0.130), 867.39 (0.042), 964.06 (0.146), 1085.84 (0.101), 1112.09 (0.135), 1408.02 (0.2085) and others
63-Eu-152m	9.275 h	β^-, EC(0.28)	γ	121.78 (0.076), 841.58 (0.147), 963.38 (0.122) and others
63-Eu-152n	96 m	IT	γ	89.85 (0.702) and others
63-Eu-154	3138.5 d	β^-, EC(0.0002)	γ	123.07 (0.404), 247.94 (0.069), 591.81 (0.050), 723.43 (0.201), 756.92 (0.045), 873.24 (0.121), 996.00 (0.104), 1004.57 (0.179), 1274.69 (0.350) and others
63-Eu-154m	46.4 m	IT	γ	35.8 (0.121), 68.17 (0.367), 100.86 (0.268) and others
63-Eu-155	1.77 x 10^3 d	β^-	γ	26.54 (0.00332), 45.30 (0.0135), 60.01 (0.0132), 86.55 (0.322), 105.31 (0.214) and others
65-Tb-157	99 y	EC		
66-Dy-157	8.14 h	EC	γ	182.3 (0.0195), 326.1 (0.93) and others
66-Dy-159	144.4 d	EC	γ	58.00 (0.0229) and others
72-Hf-174	2.0 x 10^{15} y	α	α	2446 (1.00)
72-Hf-175	70 d	EC	γ	343.4 (0.868) and others
72-Hf-181	42.38 d	β^-	γ	133.0 (0.419), 482.2 (0.806) and others
73-Ta-179	588 d	EC		
73-Ta-180	8.08 h	EC, β^-(0.181)	γ	93.32 (0.043) and 103.56 (0.0078)
73-Ta-180m	1.8 x 10^{16} y	EC, β^-(0.20)	γ	93.32 (0.14), 103.56 (0.04), 215.26 (0.65), 233.98 (0.17), 332.27 (0.76) and 350.90 (0.19)
73-Ta-182	114.7 d	β^-	γ	67.75 (0.408), 100.11 (0.141), 1121.30 (0.346), 1189.05 (0.161), 1221.41 (0.268) and others
73-Ta-182m	0.283 s	IT		
73-Ta-182n	15.84 m	IT	γ	146.79 (0.35), 171.59 (0.46), 184.95 (0.23) and others
74-W-181	120.98 d	EC	γ	6.24 (0.0104) and others
74-W-185	75.1 d	β^-		
74-W-185m	100 s	IT	γ	65.88 (0.054), 131.55 (0.043), 173.74 (0.029) and others
74-W-187	23.85 h	β^-	γ	72.00 (0.110), 134.25 (0.087), 479.49 (0.217), 551.49 (0.050), 618.28 (0.062), 685.74 (0.27), 772.91 (0.041) and others
79-Au-198	2.6943 d	β^-	γ	411.80 (0.9557) and others
79-Au-198m	2.30 d	IT	γ	97.2 (0.692), 180.3 (0.500), 214.8 (0.769) and others
80-Hg-197	64.6 h	EC	γ	77.35 (0.179) and others
80-Hg-197m	23.9 h	IT, EC(0.069)	γ	133.96 (0.34), 279.0 (0.049) and others
80-Hg-203	46.595 d	β^-	γ	279.197 (0.8148)
81-Tl-204	3.79 y	β^-, EC(0.022)		
82-Pb-204	1.4 x 10^{17} y	α	α	1933 (1.00)

Table 2 : UKPADD-2 (Continued)

Nuclide	Half-life	Decay Modes	Major Radiations (keV) and Emission Probabilities	
82-Pb-204m	67.5 m	IT	γ	374.72 (0.94), 899.15 (0.99), 911.8 (0.91) and others
83-Bi-207	1.16 x 10^{4} d	EC	γ	569.70 (0.9774), 1063.66 (0.745) and others
90-Th-228	698.2 d	α	α	5340.40 (0.276), 5423.30 (0.717) and others
			γ	84.37 (0.0124) and others
90-Th-231	1.063 d	β^-	γ	25.64 (0.146), 84.21 (0.0671) and others
93-Np-239	2.355 d	β^-	γ	106.12 (0.272), 209.75 (0.034), 228.18 (0.113), 277.60 (0.144) and others
95-Am-241	432.7 y	α, SF(3.77 x 10^{-12})	α	5442.9 (0.128), 5485.6 (0.852) and others
			γ	59.54 (0.359) and others
95-Am-243	2.69 x 10^{4} d	α, SF(3.7 x 10^{-11})	α	5233.4 (0.106), 5275.7 (0.88) and others
			γ	43.5 (0.0594), 74.7 (0.674) and others

Table 3 : Data Consistency : Comparison of the Percentage Deviation Between Effective Q-value and Calculated Q-value for UKPADD-1 and 2

Nuclide	UKPADD-1	UKPADD-2	Nuclide	UKPADD-1	UKPADD-2
H-3	0.2199	0.0000	Cl-38	0.2634	-0.0079
He-6	not evaluated	0.0000	Cl-38m	0.0000	-0.0640
He-8	not evaluated	incomplete	Ar-37	not evaluated	-0.0007
Li-8	not evaluated	0.0419	Ar-39	0.0000	0.0000
Li-9	not evaluated	incomplete	Ar-41	0.0522	-0.0384
Be-7	not evaluated	0.0111	Ar-42	not evaluated	0.0000
Be-8	not evaluated	-0.0092	K-38	not evaluated	0.0000
Be-10	0.0000	0.0000	K-38m	not evaluated	0.0000
Be-11	not evaluated	0.0915	K-40	-0.1619	-0.0011
B-12	not evaluated	0.0002	K-42	-0.0476	0.0066
B-13	not evaluated	-0.0238	K-43	not evaluated	-0.0474
C-14	0.0001	0.0000	K-44	not evaluated	0.1283
C-15	-0.0776	-0.0733	Ca-41	0.0038	0.0035
N-13	not evaluated	0.0000	Ca-45	-0.0016	0.0000
N-16	0.6385	0.0589	Ca-47	not evaluated	0.1213
O-19	-0.1895	-0.1655	Ca-49	not evaluated	-0.0229
F-18	not evaluated	0.0000	Sc-44	not evaluated	0.0171
F-20	not evaluated	0.0051	Sc-44m	not evaluated	0.0391
Ne-23	not evaluated	0.0183	Sc-46	0.0007	-0.0028
Na-22	0.0012	0.0018	Sc-46m	-0.5007	0.4710
Na-24	0.2474	0.0068	Sc-47	-0.0666	0.0017
Na-24m	0.0000	0.0003	Sc-48	-0.1006	0.0226
Na-25	not evaluated	0.1602	Sc-49	not evaluated	0.0000
Na-26	not evaluated	-0.0077	Sc-50	not evaluated	-0.0075
Mg-27	0.3764	0.0001	Sc-50m	not evaluated	-0.0276
Mg-28	not evaluated	0.1597	Ti-45	not evaluated	0.0022
Al-26	not evaluated	0.0250	Ti-51	not evaluated	0.0073
Al-26m	not evaluated	0.0000	V-48	not evaluated	-0.2125
Al-28	not evaluated	0.0022	V-49	not evaluated	0.0029
Al-29	not evaluated	-0.0207	V-52	not evaluated	-0.0006
Al-30	not evaluated	-0.0638	V-53	not evaluated	-0.2563
Si-31	not evaluated	-0.0014	V-54	not evaluated	incomplete
Si-32	not evaluated	0.0000	Cr-49	not evaluated	-0.0171
P-32	not evaluated	0.0000	Cr-51	0.0274	0.0053
P-33	not evaluated	0.0000	Cr-55	not evaluated	0.0000
P-34	not evaluated	-0.0065	Mn-54	0.8868	-0.0001
S-35	-0.1792	0.0000	Mn-56	0.3581	-0.0179
S-37	not evaluated	-0.0801	Fe-53	not evaluated	-0.2021
Cl-34	not evaluated	0.0000	Fe-53m	not evaluated	0.1882
Cl-34m	not evaluated	-0.0441	Fe-55	-0.0011	-0.0020
Cl-36	-0.2000	0.0006	Fe-59	0.0433	-0.0172

Table 3 : (continued)

Nuclide	UKPADD-1	UKPADD-2	Nuclide	UKPADD-1	UKPADD-2
Co-55	not evaluated	0.0305	Nb-95m	not evaluated	-0.0661
Co-56	not evaluated	0.5072	Mo-93	0.1008	-0.0074
Co-57	-0.0027	0.0020	Mo-93m	1.6087	0.0162
Co-58	0.2051	-0.0023	Mo-99	not evaluated	-0.0098
Co-58m	-0.3947	-0.3171	Tc-99	not evaluated	0.0000
Co-60	0.0065	0.0053	Tc-99m	not evaluated	0.0470
Co-60m	0.2040	-0.2943	Ru-103	not evaluated	-0.0914
Ni-57	not evaluated	-0.0314	Rh-102	not evaluated	-0.4531
Ni-59	0.3022	-0.0056	Rh-102m	not evaluated	0.0748
Ni-63	0.0456	0.0000	Rh-103m	not evaluated	-0.3865
Ni-65	0.0249	0.0352	Rh-104	not evaluated	0.0233
Cu-62	not evaluated	0.0001	Rh-104m	not evaluated	-0.1843
Cu-64	-0.0019	-0.0007	Ag-107m	not evaluated	-0.0525
Cu-66	-0.1126	0.0166	Ag-108	not evaluated	0.0204
Zn-63	not evaluated	0.0286	Ag-108m	not evaluated	-0.0190
Zn-65	0.0061	-0.0075	Ag-109m	not evaluated	-0.1873
As-74	not evaluated	-0.2919	Ag-110	-0.2735	-0.0009
Se-75	not evaluated	-0.1033	Ag-110m	-1.0785	-0.3356
Br-79m	not evaluated	-0.0283	Cd-109	not evaluated	0.0330
Br-80	not evaluated	-0.0134	Cd-111m	not evaluated	-0.0834
Br-80m	not evaluated	-0.1960	Cd-113	not evaluated	0.0000
Br-82	0.0357	0.0729	Cd-113m	not evaluated	0.0012
Br-82m	-0.9768	0.5001	In-111	not evaluated	0.0372
Kr-79	not evaluated	-0.0466	In-111m	not evaluated	-0.0507
Kr-79m	not evaluated	-0.0728	In-113m	not evaluated	0.0014
Sr-85	not evaluated	-0.0051	In-114	not evaluated	-0.0031
Sr-85m	not evaluated	0.0031	In-114m	not evaluated	-0.1894
Sr-89	not evaluated	0.0000	In-114n	not evaluated	-0.0062
Sr-90	not evaluated	0.0000	In-115	0.2058	0.0000
Y-88	0.0001	0.0531	In-115m	1.1239	-0.0605
Y-89m	not evaluated	0.0024	In-116	-0.5528	0.6261
Y-90	not evaluated	0.0000	In-116m	0.5556	0.1921
Y-90m	not evaluated	-0.0151	In-116n	0.0957	0.0632
Zr-89	not evaluated	0.0513	Sn-113	not evaluated	0.0204
Zr-89m	not evaluated	-0.0317	Sn-113m	not evaluated	-0.2109
Zr-93	not evaluated	0.0000	Sn-117m	not evaluated	-0.0006
Zr-95	not evaluated	-0.0121	Sn-119m	not evaluated	-0.1028
Nb-93m	0.9029	-0.3676	Sn-121	0.0000	0.0000
Nb-94	-0.1075	-0.0014	Sn-121m	0.0214	-0.0800
Nb-94m	-0.2252	-0.0290	Sn-123	not evaluated	-0.0042
Nb-95	not evaluated	0.0025	Sn-123m	not evaluated	-0.0694

Table 3 :(continued)

Nuclide	UKPADD-1	UKPADD-2	Nuclide	UKPADD-1	UKPADD-2
Sn-125	not evaluated	-0.0725	Eu-155	not evaluated	0.1705
Sn-125m	not evaluated	0.1417	Tb-157	1.1573	1.2277
Sn-126	not evaluated	0.0784	Dy-157	not evaluated	-0.0226
Sb-122	-0.1631	0.0041	Dy-159	not evaluated	0.0906
Sb-122m	1.3024	-0.0135	Hf-174	not evaluated	0.0155
Sb-124	-0.3591	-0.0495	Hf-175	0.4561	0.0337
Sb-124m	-0.0442	-0.3407	Hf-181	0.1206	0.0975
Sb-124n	-0.2882	-0.4979	Ta-179	not evaluated	0.8418
Sb-125	not evaluated	0.0434	Ta-180	not evaluated	0.0321
Sb-129	not evaluated	-0.6673	Ta-180m	not evaluated	0.1639
Sb-129m	not evaluated	incomplete	Ta-182	0.5610	-0.0057
Te-125m	not evaluated	-0.0051	Ta-182m	-1.4951	0.1654
Te-129	not evaluated	-0.0619	Ta-182n	0.2796	0.8531
Te-129m	not evaluated	-0.2257	W-181	0.0463	0.0684
I-125	not evaluated	0.0709	W-185	-0.1033	0.0001
I-126	-0.4034	0.0678	W-185m	-0.0138	-0.1514
Xe-125	not evaluated	-0.0292	W-187	0.0174	0.0631
Xe-125m	not evaluated	0.0606	Au-198	-0.0800	0.0018
Xe-127	not evaluated	-0.1451	Au-198m	incomplete	incomplete
Xe-127m	not evaluated	-0.0383	Hg-197	0.1156	0.1285
Cs-134	0.0004	0.0823	Hg-197m	0.1415	0.6335
Cs-134m	incomplete	-0.0812	Hg-203	0.0067	0.0271
Cs-135	not evaluated	0.0000	Tl-204	not evaluated	0.0033
Cs-135m	not evaluated	-0.0280	Pb-204	not evaluated	-0.0097
Cs-136	0.1880	-0.2422	Pb-204m	not evaluated	0.0780
Cs-136m	incomplete	incomplete	Bi-207	not evaluated	0.1833
Cs-137	not evaluated	0.0000	Th-228	not evaluated	0.0122
Ba-133	-1.6779	0.0810	Th-231	not evaluated	-0.7156
Ba-133m	-1.2167	-0.0816	Np-239	not evaluated	-0.1364
Ba-137m	not evaluated	0.0176	Am-241	not evaluated	-0.0220
Ce-139	not evaluated	0.1622	Am-243	not evaluated	-0.0217
Ce-139m	not evaluated	0.0029			
Pm-145	0.0313	0.1990			
Sm-145	not evaluated	0.0659			
Sm-146	not evaluated	-0.0199			
Sm-151	not evaluated	-0.0006			
Eu-152	-0.7888	-0.1502			
Eu-152m	0.3645	-0.6753			
Eu-152n	incomplete	0.0207			
Eu-154	0.3257	0.0416			
Eu-154m	1.5263	0.0927			