LOCKHEED MARTIN ENERGY RESEARCH LIBRARIES

3 4456 0446625 4

ORNL-5114

Cy 5

Nuclear Decay Data for Selected Radionuclides

Edited by M. J. Martin

OAK RIDGE NATIONAL LABORATORY
CENTRAL RESEARCH LIBRARY
CIRCULATION SECTION
4500N ROOM 175
LIBRARY LOAN COPY
DO NOT TRANSFER TO ANOTHER PERSON.
if you wish someone else to see this report. send in name with report and the library will arrange a loan.
ORNL-118 (6-97)

OAK RIDGE NATIONAL LABORATORY
OPERATED BY UNION CARBIDE CORPORATION FOR THE ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

Printed in the United States of America. Available from
National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road, Springfield, Virginia 22161
Price: Printed Copy $5.50; Microfiche $2.25

This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the Energy Research and Development Administration, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately owned rights.

Errata to ORNL-5114

The footnote labeled by the symbol, *, appearing on the title page and page iii should be amended to read, "Prepared from the Evaluated Nuclear Structure Data File of the Nuclear Data Project. To be published in part in an NCRP report entitled A Manual of Radioactivity Measurements Procedures".

$T_{1/2}$ (^{203}Pb) on pages ~~xiii~~ XV and 49 should be 52.02 H, not 55.02 H.

Bottom made corrections

5.50

ORNL-5114
UC-34c — Nuclear Physics

Contract No. W-7405-eng-26

NUCLEAR DECAY DATA FOR SELECTED RADIONUCLIDES*

Edited by M. J. Martin

*Prepared from the Evaluated Nuclear Structure Data File of the Nuclear Data Project. To be published in part in an NCRP report entitled, A Manual of Radioactivity Procedures.

NUCLEAR DATA PROJECT

W. B. Ewbank, Director
F. E. Bertrand, Deputy Director
D. J. Horen, Director (1969-1975)

R. L. Auble	B. Harmatz	D. C. Kocher
Y. A. Ellis	H. J. Kim	M. J. Martin
R. L. Haese		M. R. Schmorak

Technical Assistants

S. J. Ball	F. W. Hurley	M. R. McGinnis
S. H. Dockery		J. T. Miller

March 1976

OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37830
operated by
UNION CARBIDE CORPORATION
for the
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

LOCKHEED MARTIN ENERGY RESEARCH LIBRARIES

3 4456 0446625 4

NUCLEAR DECAY DATA FOR SELECTED RADIONUCLIDES*

Edited by M. J. Martin

Contained in this report are tabulations of the atomic and nuclear radiations emitted by 194 radioactive nuclides. The nuclei included comprise most of those currently of interest in medical practice or research, health physics, industry, nuclear power, environmental impact studies, and as reference standards. Listed in tabular form are recommended values for half-lives, energies, intensities (probabilities per decay), and equilibrium absorbed-dose constants for each of the atomic and nuclear radiations emitted by these radioactive atoms. The data contained here supersede those in earlier publications by the editor (70MaBl, 73MaVR).

Space limitations do not permit the inclusion of references for the nuclear data appearing in this table. If documentation is required, it can be obtained by writing to the Nuclear Data Project.

CONTENTS

I. REVIEW OF RADIATION PROCESSES
II. COMPUTER PROGRAM, MEDLIST
III. EXPLANATION OF TABLE OF RADIATION DATA, POLICIES FOLLOWED
IV. PARENT–DAUGHTER ACTIVITY RATIOS
V. SYMBOLS AND DEFINITIONS
VI. INDEX TO TABLE
VII. TABLE OF RADIATION DATA
VIII. REFERENCES

*Prepared from the Evaluated Nuclear Structure Data File of the Nuclear Data Project. To be published in part in an NCRP report entitled, "A Manual of Radioactivity Procedures."

As in β^--decay (see above), the β^+-particles emitted in a transition to a particular level in the daughter nucleus have a continuous distribution of energies with a definite E_{max} and E_{av}. For positron decay, $E_{max} = Q^+ - 2mc^2 - E(\text{level})$, where Q^+ is the atomic mass difference between ground states of parent and daughter. Note that β^+-decay to a particular level cannot occur unless $Q^+ - E(\text{level}) > 2mc^2$ ($2mc^2 = 1022$ keV).

D. ϵ-Decay

In electron-capture decay, an atomic electron is captured by a nucleus and a neutrino is emitted as a result of the process $p + e^- \rightarrow n + \nu$. This decay decreases the nuclear charge by one unit and leaves the daughter nucleus with a vacancy in one of its atomic shells. K-shell electron capture, for example, refers to a capture process where the final-state vacancy is in the K-shell. For a K-shell electron-capture branch to a particular level, the energy released is given by $Q^+ - E(\text{level}) - E_K$, where E_K is the K-shell binding energy in the daughter atom.

The electron-capture process always competes with β^+-decay, but also can occur when the transition energy is too small to allow β^+-emission, that is when $Q^+ - E(\text{level}) <$ 1022 keV.

E. γ-Decay

Electromagnetic radiation is emitted by a nucleus in a transition from a higher to a lower energy state. A numeric index on γ, as in $\gamma 1$, denotes a γ-ray emitted in the transition between a particular pair of nuclear levels. The energy of this gamma, $E(\gamma 1)$, is equal to the energy difference between the two levels (except for a negligible amount of nuclear recoil energy, E_{recoil} (keV) $\simeq 5.4 \times 10^{-7}\, E^2(\gamma)/A$, where A is the mass number and $E(\gamma)$ is in keV).

F. Internal-Conversion-Electron Emission (ce)

An atomic electron can be emitted as an alternative to γ-ray emission in the transition of a nucleus from a higher to a lower energy state. In the internal-conversion process, the energy difference between these states is transferred directly to a bound atomic electron which is then ejected from the atom. An alphabetic index on ce refers to the shell from which the atomic electron is ejected. Thus, ce-K denotes K-shell conversion and ce-MNO denotes conversion in the M-, N-, and O-shells combined. A numeric index, as in ce-K-1, has a meaning analogous to that used above for γ-rays. For a transition with energy $E(\gamma 1)$, the K-shell internal-conversion electron is emitted

I. REVIEW OF RADIATION PROCESSES

A. α-Decay

In α-decay, a nucleus with atomic number Z and mass number A emits an α-particle (^{4}He nucleus, Z = 2, A = 4) and decays to a nucleus with atomic number Z - 2 and mass number A - 4.

For decay to a particular level in the daughter nucleus, the maximum energy available for the α-particle is

$$E_\alpha = Q_\alpha - E_R - E(\text{level}) = \frac{M}{M + M_\alpha}[Q_\alpha - E(\text{level})] = \frac{M}{M + M_\alpha} Q'_\alpha ,$$

where Q_α is the atomic mass difference between ground states of parent and daughter, M_α and M are the masses of the α-particle and daughter atom, respectively, and $E_R = M_\alpha Q'/(M_\alpha + M)$ is the energy carried off by the recoil of the daughter atom.

B. β^--Decay

In β^- decay, an antineutrino ($\bar{\nu}$) and a negative electron (β^-) are emitted from the nucleus as a result of the process $n \rightarrow p + \beta^- + \bar{\nu}$. The decay increases the nuclear charge by one unit.

The energy released in a single β-transition is divided between the β-particle and the antineutrino in a statistical manner so that, when a large number of transitions are considered, both the antineutrinos and β-particles are found to have energy distributions extending from zero up to some maximum value. For decay to a particular level in the daughter nucleus, the maximum energy available is $E_{max} = Q^- - E(\text{level})$, where Q^- is the atomic mass difference between ground states of parent and daughter. The average energy of a β-particle in this transition is given by

$$E_{av} = \int_0^{E_{max}} E \times N(E)dE / \int_0^{E_{max}} N(E)dE,$$

where N(E) is the number of β-particles with energy between E and E + dE. Thus, the β^--particles from a particular transition i, denoted in the main table by β^-i, constitute a "group" having a continuous distribution of energies with a definite E_{max} and E_{av}.

C. β^+-Decay

In β^+-decay, a neutrino (ν) and a positive electron (β^+) (positron) are emitted from the nucleus as a result of the process $p \rightarrow n + \beta^+ + \nu$. This decay decreases the nuclear charge by one unit.

with energy $E(ce\text{-}K\text{-}1) = E(\gamma 1) - E_K$, where E_K is the K-shell binding energy. The energy of an electron converted in one of the other shells is given by the same expression with the replacement of E_K by the binding energy appropriate to that shell.

For a particular transition, the ratio of the probability for emission of a K-conversion electron to that for emission of a γ-ray, $I(ce\text{-}K)/I(\gamma)$, is called the K-shell conversion coefficient for that transition. Conversion coefficients for the other shells are defined in an analogous manner.

G. X-Ray and Auger-Electron Emission (X, e_A)

Whenever a vacancy is produced in an inner electron shell of an atom, the filling of this vacancy is accompanied by either X-ray or Auger-electron emission. Vacancies created by the filling of the initial vacancy will in turn produce further X-rays or Auger electrons. This cascade of radiations continues until all vacancies have been transferred to the outermost electron shell. Inner-shell vacancies are always produced in two types of nuclear decay, electron capture and internal conversion. Other processes which produce electron vacancies following a nuclear decay, such as electron shakeoff (the ejection of one or more atomic electrons due to a sudden change in nuclear charge) or the ejection of atomic electrons by escaping α- or β-particles, are not discussed here because of the low probability of their occurrence.

1. Fluorescence yield (ω)

The fluorescence yield for a particular atomic shell (ω_K, $\bar{\omega}_L$, etc.) is defined as the probability that a vacancy in that shell will result in the emission of an X-ray. If n_K is the number of K-shell vacancies per disintegration, the number of K X-rays will be $n_K\omega_K$, and the number of K-Auger electrons will be $n_K(1 - \omega_K)$.

The most recent and thorough review of fluorescence yields is that of Bambynek et al. (72BaCr). The K-shell fluorescence yields, ω_K, adopted in the present work are the "fitted values" from Table III-V of the above reference. The average L-shell fluorescence yields, $\bar{\omega}_L$, with uncertainties, have been estimated by the editor from Fig. 4-34 of this same work.

2. X-Rays

X_K. An X-ray emitted as a result of the filling of a K-shell vacancy by an electron from a higher shell, for example the Y-shell, has an energy $E_K - E_Y$, where E_K and E_Y are the electron binding energies in the K- and Y-shells, respectively. This transition

can be denoted by K - Y. In order of decreasing intensity, the most important transitions are

$$K_{\alpha 1} = K - L_3 \qquad K_{\beta 3} = K - M_2$$
$$K_{\alpha 2} = K - L_2 \qquad K_{\beta 4} = K - N_2$$
$$K_{\beta 1} = K - M_3 \qquad K_{\beta 5} = K - M_4 .$$
$$K_{\beta 2} = K - N_3$$

Energies and intensities for the $K_{\alpha 1}$ and $K_{\alpha 2}$ lines and the $K_\beta = \Sigma K_{\beta i}$ group are given explicitly. The X-ray energies are taken from Bearden and Burr (67BeBu), and the intensity ratios K_β/K_α and $K_{\alpha 2}/K_{\alpha 1}$ are taken from Rao et al. (72Ra47).

As already mentioned, the number of K X-rays per disintegration is $n_K \omega_K$. Thus the number of $K_{\alpha 1}$ X-rays is

$$\frac{n_K \omega_K}{(1 + K_\beta/K_\alpha)(1 + K_{\alpha 2}/K_{\alpha 1})}$$

with similar expressions for $K_{\alpha 2}$ and K_β. The number of K-vacancies per disintegration is the sum of the vacancies produced by K capture and those produced by internal conversion in the K-shell. Thus

$$n_K = \epsilon_K + I(ce\text{-}K) ,$$

where ϵ_K is the total number of K-captures per disintegration, and I(ce-K) is the total number of K-shell internal-conversion electrons per disintegration.

$\underline{X_L}$. As in the case of the K-shell, many transitions contribute to the L X-ray spectrum. However, since the relative intensities of these transitions are not known for all Z-values and since the energy differences between the strong transitions are small ($\leq$3 keV), the total L X-ray radiation is treated here as a single group having the energy of the strongest transition, $L_{\alpha 1} = L_3 - M_5$. For Z < 37, the M_5-transitions have not been resolved experimentally from the M_4-transitions. In these cases, the energy given is that for the transition $L_{\alpha 1,\alpha 2} = L_3 - M_4, M_5$. See Figs. 4-8 and 4-11 of 72BaCr for examples of L X-ray spectra.

The calculation of the number of L X-rays per disintegration, $n_L \omega_L$, is similar to that for K X-rays except that, in addition to vacancies produced by direct L-shell capture and by L-shell conversion, those created by the transfer of L-shell electrons to K-shell vacancies must also be included. Thus,

$$n_L = \epsilon_L + I(ce\text{-}L) + n_{KL} \times n_K ,$$

where n_{KL} is the number of L-shell vacancies created per K-shell vacancy, and the other symbols have meanings analogous to those used above for the K-shell. Values of n_{KL} are taken from 72BaCr.

3. Auger Electrons (e_A)

The Auger process competes with the emission of X-rays as a means of carrying off the energy released in the filling of an inner-shell vacancy by an electron from an outer shell. In the Auger process, the filling of an inner-shell vacancy is accompanied by the simultaneous ejection to the continuum of an outer-shell electron. The resulting atom is left with two vacancies. The Auger-electron yield per disintegration of a particular atomic shell is $n_K(1 - \omega_K)$, $n_L(1 - \omega_L)$, etc. If the original vacancy is in the K-shell and if this vacancy is filled by an electron from shell X with the ejection of an electron from shell Y, the transition is denoted by KXY. The energy of the ejected electron is $E_K - E_X - E'_Y$, where E_K and E_X are neutral-atom K- and X-shell binding energies, respectively, and E'_Y is the binding energy of a Y-shell electron in an atom containing a vacancy in the X-shell. The most intense K-Auger transitions are of the type KLL. Since the relative intensities of the electrons in the KLL-group are not accurately known for all Z-values and since the energy difference between the transitions is small (≤ 5 keV), the K-Auger electrons are treated here as a single group having the energy of the strongest transition, KL_2L_3. The energy of this transition as a function of atomic number is taken from Table 1 of Bergstrom and Nordling (65Be37). See Fig. 3-5 of 72BaCr for an example of a K-Auger electron spectrum.

In the case of the L-Auger process, very little is known about the energies or relative intensities of the individual L-Auger electrons. For this compilation, the L-Auger electrons are treated as a single group having the energy appropriate to an $L_3M_4M_5$-transition. See Fig. 4-13 of 72BaCr for an example of an L-Auger electron spectrum.

H. Bremsstrahlung

In addition to any monoenergetic X-rays or γ-rays that may be present in radioactive decay, every β-decay produces continuous electromagnetic radiation called bremsstrahlung. Two processes contribute to this continuous spectrum.

1. "External" bremsstrahlung is produced by collisions between β's (and ce's) and the atoms of the material surrounding the radiating atoms. Since the intensity of the external bremsstrahlung depends on the atomic number, Z, of the surrounding material, this radiation is not included in the present tables. In many cases this radiation cannot

be neglected in dose calculations. An approximate value for the average energy of the external bremsstrahlung associated with a β-group of maximum energy E_β (keV) (thick target approximation) is given by (55Ev23, p. 619)

$$E_{av} \approx 1.4 \times 10^{-7}\ Z\ E_\beta^2 \quad \text{keV per } \beta .$$

In the decay of ^{32}P, where $E_\beta = 1711$ keV, the average energy per disintegration of the external bremsstrahlung is ≈ 0.4 Z keV.

2. "Internal" bremsstrahlung, originating within a decaying atom, is produced by the sudden change of nuclear charge which occurs in β^+-, β^--, or ϵ-decay. This radiation is not included here because of its low intensity and low average energy. The average energy of the internal bremsstrahlung associated with a β-group of maximum energy E_β (keV) is given for $E_\beta \gg mc^2$ (511 keV) by (66Sc35, pp. 76-84)

$$E_{av} \approx 1.5 \times 10^{-3}\ E_\beta \log(0.004\ E_\beta - 2.2) \text{ keV per } \beta.$$

In electron capture, the corresponding expression for a transition with energy E_ϵ (keV) is (66Sc35, pp. 76-84)

$$E_{av} \approx 1.5 \times 10^{-7}\ E_\epsilon^2 \text{ keV per capture.}$$

In the decay of ^{32}P, where $E_\beta = 1711$ keV, the average internal bremsstrahlung energy per disintegration is ≈ 1.7 keV.

II. COMPUTER PROGRAM, MEDLIST*

Based on the radioactive decay data sets in the Evaluated Nuclear Structure Data File and computerized tabulations of the relevant Z-dependent constants (ω_K, n_{KL}, etc.) discussed in the preceding section, the computer program, MEDLIST, calculates the energies and intensities of the atomic radiations (X-ray and Auger-electron transitions). The program then combines these radiations with the nuclear radiations, sorts them according to radiation type (i.e., α, β, γ, ce ...), and, within each type, arranges and numerically labels them in order of increasing energy.

*Written by W. B. Ewbank, Nuclear Data Project, and M. J. Kowalski, Great Lakes College Association — Oak Ridge Science Semester participant from Ohio Wesleyan University.

Uncertainties on all experimental quantities, including the atomic constants, are consistently carried through the calculations. A 3% uncertainty is assigned to all theoretical conversion coefficients and is propagated, within MEDLIST, along with the experimental uncertainties.

A variable low-intensity cutoff limit is built into MEDLIST. For the present tables this intensity limit is 0.1%. Immediately following the listing of each of the radiation types, α, β, and γ, MEDLIST prints a comment giving the number and the summed intensity of the radiations omitted because of the chosen cutoff limit, provided that this summed intensity is greater than 0.01%.

It should be noted that the numerical labels on the γ-radiations are based on all the radiations contained in the original data set on which MEDLIST operates. These labels are maintained throughout the MEDLIST calculations and are carried into the output. In particular, when low-intensity radiations are omitted, the remaining radiations are not relabelled. Thus, in the γ-listing there may appear the sequence $\gamma 1$, $\gamma 2$, $\gamma 4$, ..., which tells the reader that $\gamma 3$, with energy between that of $\gamma 2$ and $\gamma 4$, has been omitted because its intensity is below the cutoff limit. Note that there could still appear a conversion line associated with $\gamma 3$, say ce-K-3, if its conversion coefficient is large enough such that the intensity of ce-K-3 exceeds the cutoff limit.

For those nuclei which decay by positron emission, MEDLIST prints a comment at the end of the γ-ray list, giving the maximum possible intensity of the annihilation radiation ($\gamma\pm$), calculated from $I(\gamma\pm) = 2 \sum_i I(\beta_i^+)$.

III. EXPLANATION OF TABLE OF RADIATION DATA, POLICIES FOLLOWED

The table contains data on atomic and nuclear radiations of the type Auger (K-, L-shells); X-ray (L, $K_{\alpha 1}$, $K_{\alpha 2}$, K_β); β^-; β^+; α; γ; and ce (K-, L-, ... shells) emitted with intensity > 0.1 per 100 disintegrations of the parent nucleus (i.e., > 0.1%). Following the listing of α-, β-, and γ-radiations for each data set is a comment stating the number and total intensity of the observed radiations omitted because of this intensity cutoff.

Auger electrons and X-rays resulting from the filling of vacancies in the M-, N-, ... shells, although sometimes occurring with large intensities, are not included. These transitions have energies ranging from $\lesssim 2$ keV in ^{197}Hg decay to $\lesssim 0.6$ keV in ^{113}Sn decay. Their intensities, however, are not in general calculable since the contribution to the total number of, say, M-shell vacancies due to initial K- or L-shell vacancies has not been measured. However, theoretical estimates of some of these quantities are

available for limited Z-regions. For ^{83m}Kr, based on theoretical values of the required atomic constants (from 72BaCr), the editor estimates a yield of ≈300% M-shell Auger transitions (with energy ≈0.2 keV). As an additional example, for ^{125}I decay, where M-shell vacancies are produced both in electron-capture decay and the subsequent internal conversion process, the editor estimates a yield of ≈590% M-shell Auger transitions. The total energy emitted per decay by these low-energy Auger transitions (≈0.5 keV) is ≈3 keV.

The radiations are listed in the first column by type. For an explanation of the notation employed see Symbols and Definitions (Section V). Particle radiations (Auger, ce, α, β) are given first, followed by the electromagnetic radiations (X-ray, γ). In the case of β-decay, whenever more than one group is present, a separate entry (designated "total β") is made for the composite spectrum. The intensity given for the "total β" entry is the sum of the intensities of the individual groups. For β^--emitters with no alternate mode of decay, this intensity must be exactly 100%. However, it should be noted that, since the intensities of the individual β^--groups are usually determined from the γ-intensities which in turn are usually determined by the requirement that the total (β^- + γ)-feeding of the daughter ground state be 100%, the intensity of the total β -spectrum as calculated from the sum of the individual β^--intensities does not always come to exactly 100%. This summed value could be replaced by 100%, but has not been done so here.

Columns 2 and 3 contain, respectively, the energy (in keV) and intensity (particles or photons per 100 disintegrations of the parent nucleus). For the β-groups, both the maximum and the average energies are given.

In column 4, Δ, the value of energy emitted per disintegration, is presented in units of g-rad/μCi-h. For an infinite, homogeneous medium in which a source is uniformly dispersed with a concentration of 1 μCi-h/g, Δ gives the absorbed dose in rads. See also Symbols and Definitions (Section V).

The nuclei are listed in order of increasing mass number, A = N + Z. For nuclei with the same A, the order is by increasing Z.

Each decay mode of a given radionuclide is listed separately. In those cases where a nucleus decays by more than one mode, a cross reference is given to the alternate mode or modes. For example, ^{64}Cu decays by both β^-- and β^+-branches. A separate listing is given for each of these decay modes. Following the heading "64CU B- DECAY"

is the comment "SEE ALSO 64CU B+ DECAY", and following the heading "64CU B+ DECAY" is the comment "SEE ALSO 64CU B- DECAY". As another example, 154-d ^{121}Te decays by both electron-capture (EC) and isomeric transition (IT) branches. Following the heading "121TE EC DECAY" is the comment "SEE ALSO 121TE IT DECAY", and conversely. In such cases, the radiations in each data list should simply be combined to obtain all the radiations from the parent under consideration. In those cases where a parent decays to one or more radioactive descendants, the parent and each descendant are treated separately. If one of the daughters is an isomer, then for that isomer data listing, a comment is made giving the percentage feeding from the immediate parent. For example. ^{99}Mo decays to ^{99m}Tc. Following the heading "99MO B- DECAY" is the comment "SEE ALSO 99TC IT DECAY (6.02 H)", and following the heading "99TC IT DECAY" is the comment "FEEDING OF 99MTC IN 99MO DECAY = 86.8% 9". To correctly include all the contributions of such radioactive chains, the user must combine the radiations from each member of the chain using the standard equations for parent-descendant activity relations and the feeding of each member of the chain (given in the table only for isomers; otherwise feeding is 100%). (See Parent–Daughter Activity Ratios, Section IV.)

No separate entry is made in the γ-listing for the 511-keV annihilation radiation (γ±) accompanying positron decay. Instead, the intensity of this radiation, calculated from $I(\gamma\pm) = 2 \times \Sigma I(\beta_i^+)$, is given in a comment at the end of each data set. This intensity is presented separately, and as a "maximum" value, since the annihilation process takes place external to the decaying atom in the medium surrounding the atom. The fraction of the maximum which will be of importance in a given application therefore depends upon the extent of the region surrounding the decaying atom that is being considered in that application.

The following policy on the use of "B+" and "EC" in decay type headings should be noted. "EC" as in "... EC DECAY" is used to denote either EC or EC + B+ (if positrons are energetically allowed). "B+" as in "... B+ DECAY" is also sometimes used, especially if the positron decay dominates electron capture, or if "B+ DECAY" is a more common descriptor of a certain nucleus. Thus the use of "EC" as a heading does not preclude the possibility of positron decay.

IV. PARENT–DAUGHTER ACTIVITY RATIOS

A thorough discussion of the general case of activity relations among members of a radioactive decay chain is contained in 55Ev23. For the special case of a radioactive parent with one radioactive daughter, fed in a fraction, f, of the parent decays, the ratio of daughter activity to that of the parent is given as a function of time, t, by

$$\frac{f\,T_{1/2}(p)}{T_{1/2}(p) - T_{1/2}(d)}\,[1 - e^{-(\lambda d - \lambda p)\,t}], \qquad (1)$$

where $T_{1/2}(p)$, $T_{1/2}(d)$ are the half-lives, and λp, λd the decay constants ($\lambda = \ell n\ 2/T_{1/2} \equiv 0.693/T_{1/2}$) of the parent and daughter nuclides, respectively. The activity of the daughter is taken to be zero at time t = 0 (i.e., the parent source is initially pure).

A common case occurring in these tables is that in which the daughter half-life is shorter than the parent half life. In such cases, the ratio of parent-to-daughter activities first increases with time and then approaches a constant value. For time, t, large compared with $1/(\lambda d - \lambda p)$, Eq. (1) reduces to

$$\frac{f\,T_{1/2}(p)}{[T_{1/2}(p) - T_{1/2}(d)]}\,. \qquad (2)$$

An example of this case is the decay of ^{99}Mo to ^{99m}Tc where $T_{1/2}(p) = 66.0$ h 2, $T_{1/2}(d) = 6.02$ h 3, and f = 0.868 9. For large t ($t > 10\ T_{1/2}(d)$ is sufficient here), the ratio of ^{99m}Tc activity to that of ^{99}Mo is, from Eq. (2), (0.868 9) × (1.100 1) = 0.955 10. Thus, to correctly account for all the radiations from a ^{99}Mo source, the radiations from ^{99m}Tc should be multiplied by 0.955 10, and combined with those from ^{99}Mo.

V. SYMBOLS AND DEFINITIONS*

Auger-K, Auger-L	K-shell Auger electron, L-shell Auger electron
avg	Average
ce-K-1, ce-L-2, etc.	K-shell conversion electron for transition 1, L-shell conversion electron for transition 2, etc.
Ci	Curie
D	Day

*Many of these symbols are nonstandard (thus D rather than d for day, etc.). Their form is dictated by the symbols available on the computer print train used to prepare the table.

H	Hour
$K\alpha_1$, $K\alpha_2$, $K\beta$; L	K X-rays; L X-ray
M	Minute
max	Maximum
rad	Unit of absorbed dose, equal to 6.25×10^7 MeV/g
S	Second
Y	Year
$\alpha 1, \alpha 2, \ldots$	Alpha particle corresponding to transition 1, 2, etc.
$\beta 1, \beta 2, \ldots$	Beta particle corresponding to transition 1, 2, etc.
$\gamma 1, \gamma 2, \ldots$	Gamma ray corresponding to transition 1, 2, etc.
$\gamma\pm$	Annihilation radiation
Δ	Equilibrium absorbed-dose constant. See below
μCi-h	Microcurie-hour
3.624 12	3.624 ± 0.012
3.6 H 12	3.6 ± 1.2 H
2.1E5 Y 2	$(2.1 \pm 0.2) \times 10^5$ Y
108MAG	^{108m}Ag

Equilibrium Dose Constant (Δ). For a radioactive source distributed unformly throughout an infinite, homogeneous, absorbing material, the energy absorbed per gram is in equilibrium with the energy emitted per gram. Under these conditions the equilibrium absorbed dose, D_{eq}, is given by (68Lo14)

$$D_{eq} = C \times \Sigma_i \Delta_i \text{ rad},$$

where the cumulated concentration C (μCi-h/g) is constant, and $\Delta_i = 0.00213 \times I_i \times E_i$, g-rad/$\mu$Ci-h is the equilibrium (absorbed) dose constant for i-type radiation of average energy E_i (keV) and intensity per decay I_i. Thus Δ_i, the energy emitted per disintegration, depends only on the decay scheme of the radioactive nuclide from which the source is made. It may be interpreted as the equilibrium dose per unit cumulated concentration or as the equilibrium dose rate per unit concentration. The constant 0.00213 is the factor required to convert Δ_i from units of keV/dis to g-rad/μCi-h. (1 keV/disintegration = $3.7 \times 10^4 \times 3.6/6.25 \times 10^7 = 0.00213$ g-rad/μCi-h.)

VI. INDEX TO TABLE

3H B- DECAY (12.35 Y 1)
11C B+ DECAY (20.4 M 1)
13N B+ DECAY (9.97 M 2)
14C B- DECAY (5730 Y 40)
15O B+ DECAY (123 S 1)
16N B- DECAY (7.12 S 2)
18F B+ DECAY (109.74 M 4)
22NA B+ DECAY (2.602 Y 2)
24NA B- DECAY (15.00 H 4)
26AL B+ DECAY (7.16E5 Y 32)
27MG B- DECAY (9.462 M 11)
28MG B- DECAY (20.91 H 3)
28AL B- DECAY (2.240 M 1)
32SI B- DECAY (450 Y AP)
32P B- DECAY (14.29 D 3)
33P B- DECAY (25.4 D 2)
35S B- DECAY (87.44 D 7)
38CL B- DECAY (37.21 M 4)
41AR B- DECAY (1.827 H 7)
42K B- DECAY (12.36 H 1)
43K B- DECAY (22.6 H 2)
44SC B+ DECAY (3.927 H 8)
44TI EC DECAY (47.3 Y 12)
45CA B- DECAY (164 D 1)
46SC IT DECAY (18.67 S 9)
46SC B- DECAY (83.80 D 3)
47CA B- DECAY (4.536 D 2)
47SC B- DECAY (3.422 D 4)
48V EC DECAY (15.974 D 3)
51CR EC DECAY (27.704 D 2)
52MN EC DECAY (5.67 D 9)
52MN B+ DECAY (21.1 M 2)
52MN IT DECAY (21.1 M 2)
52FE B+ DECAY (8.275 H 8)
54MN EC DECAY (312.5 D 5)
55FE EC DECAY (2.7 Y 1)
56MN B- DECAY (2.5785 H 6)
57CO EC DECAY (270.9 D 6)
58CO EC DECAY (70.8 D 1)
59FE B- DECAY (44.6 D 4)
60CO B- DECAY (5.271 Y 1)
63NI B- DECAY (96 Y 4)
64CU B+ DECAY (12.701 H 2)
64CU B- DECAY (12.701 H 2)
65ZN EC DECAY (244.1 D 2)
66GA B+ DECAY (9.40 H 7)
67CU B- DECAY (61.86 H 12)
67GA EC DECAY (78.0 H 3)
68GA B+ DECAY (68.0 M)
68GE EC DECAY (288 D 6)
69ZN IT DECAY (13.76 H 3)
69ZN B- DECAY (57 M 1)
72AS EC DECAY (26.0 H 1)
72GA B- DECAY (14.1 H 2)
73AS EC DECAY (80.30 D 6)
73SE EC DECAY (7.1 H 1)
74AS B- DECAY (17.78 D 3)
74AS B+ DECAY (17.78 D 3)
75SE EC DECAY (120 D 1)
76AS B- DECAY (26.32 H 7)
77GE B- DECAY (11.30 H 1)
77AS B- DECAY (38.8 H 3)
77BR EC DECAY (56 H 2)
79KR B+ DECAY (35.04 H 10)
81KR EC DECAY (2.1E5 Y 2)
82BR B- DECAY (35.30 H 3)
84RB B+ DECAY (34 D 1)
84RB B- DECAY (34 D 1)
85KR B- DECAY (10.72 Y 1)
85KR IT DECAY (4.48 H 1)
85KR B- DECAY (4.48 H 1)
85SR EC DECAY (64.85 D 3)
86RB B- DECAY (18.66 D 2)
86Y B+ DECAY (14.74 H 2)
86ZR EC DECAY (16.5 H 1)
87KR B- DECAY (76.3 M 5)
87SR EC DECAY (2.805 H 3)
87SR IT DECAY (2.805 H 3)
87Y EC DECAY (80.3 H 3)
88KR B- DECAY (2.84 H 2)
88RB B- DECAY (17.8 M 1)
88Y EC DECAY (107 D 1)
89KR B- DECAY (3.17 M 2)
89RB B-DECAY (15.2 M 1)
89SR B-DECAY (50.5 D 1)
90SR B- DECAY (28.5 Y 8)
90Y B- DECAY (64.0 H 1)
94NB B- DECAY (2.03E4 Y 16)
94NB IT DECAY (6.26 M 1)
94NB B- DECAY (6.26 M 1)
97ZR B- DECAY (16.90 H 5)
97NB B- DECAY (72.1 M 7)
97NB IT DECAY (60 S 1)
97RU EC DECAY (2.9 D 1)
99MO B-DECAY (66.0 H 2)
99TC IT DECAY (6.02 H 3)
103RU B- DECAY (39.35 D 5)
103RH IT DECAY (56.12 M 1)
103PD EC DECAY (17.5 D 4)
108AG EC DECAY (127 Y 21)
108AG EC DECAY (2.37 M 1)
108AG IT DECAY (127 Y)
108AG B- DECAY (2.37 M 1)
109CD EC DECAY (453 D 2)
109PD B- DECAY (13.46 H 2)
110AG EC DECAY (24.6 S 2)
110AG B- DECAY (24.6 S 2)
110AG IT DECAY (250.8 D 3)
110AG B- DECAY (250.8 D 3)
111AG B- DECAY (7.45 D 1)
111IN EC DECAY (2.83 D 1)
113IN IT DECAY (1.658 H 1)
113SN EC DECAY (114.9 D 1)
115IN IT DECAY (4.3 H 1)
115IN B- DECAY (4.3 H 1)
116IN B- DECAY (54.15 M 6)
117SN IT DECAY (14.0 D 3)
117SB EC DECAY (2.82 H 5)
119SN IT DECAY (245 D 20)
121TE EC DECAY (17 D 1)
121TE EC DECAY (154 D 7)
121TE IT DECAY (154 D 7)
122SB EC DECAY (2.70 D 1)
122SB B- DECAY (2.70 D 1)
123I EC DECAY (13.2 H 1)
124SB B- DECAY (60.20 D 3)
124I B+ DECAY (4.18 D 2)
125I EC DECAY (60.14 D 11)
126I EC DECAY (13.02 D 7)
126I B- DECAY (13.02 D 7)
127XE EC DECAY (36.41 D 2)
129TE B- DECAY (69.6 M 2)
129TE IT DECAY (33.6 D 1)
129TE B- DECAY (33.6 D 1)
129I B- DECAY (1.57E7 Y 4)
129XE IT DECAY (8.0 D 2)
129CS EC DECAY (32.06 H 6)
130I B- DECAY (12.36 H 1)
131I B- DECAY (8.04 D 1)
131XE IT DECAY (11.9 D 1)
131CS EC DECAY (9.69 D 1)
131BA EC DECAY (11.8 D 2)
132TE B- DECAY (78.2 H 8)
132I B- DECAY (2.30 H 3)
132CS B+ DECAY (6.475 D 10)
133I B- DECAY (20.8 H 1)
133XE B- DECAY (5.245 D 6)
133XE IT DECAY (2.188 D 8)
133BA EC DECAY (10.5 Y 1)
133BA IT DECAY (38.9 H 1)
134TE B- DECAY (41.8 M 8)
134I B- DECAY (52.6 M 5)
134CS B- DECAY (2.062 Y 5)
135I B- DECAY (6.61 H 1)
135XE B- DECAY (9.09 H 1)
135XE IT DECAY (15.29 M 3)
135BA IT DECAY (28.7 H 2)
136CS B- DECAY (13.1 D 1)
137CS B- DECAY (30.0 Y 2)
137BA IT DECAY (2.552 M 2)
138XE B- DECAY (14.17 M 7)
138CS B- DECAY (32.2 M 1)
139BA B- DECAY (82.7 M 2)
139CE EC DECAY (137.65 D 5)
141CE B- DECAY (32.50 D 7)
142PR B- DECAY (19.13 H 4)
143PR B- DECAY (13.56 D 2)
144PR B- DECAY (17.28 M 3)
145PM EC DECAY (17.7 Y 4)
147ND B- DECAY (11.06 D 3)
149ND B- DECAY (1.73 H 1)
175YB B- DECAY (4.19 D 1)
177LU B- DECAY (6.71 D 1)
181HF B- DECAY (42.4 D 1)
181W EC DECAY (121.2 D 3)
185W B- DECAY (75.1 D 3)
191OS B- DECAY (15.4 D 2)
194IR B- DECAY (19.15 H 3)
197PT B- DECAY (20.00 H 12)
198AU B- DECAY (2.696 D 2)
199AU B- DECAY (3.139 D 7)
201TL EC DECAY (73.5 H 8)
203HG B- DECAY (46.59 D 5)
203PB EC DECAY (52.02 H 5)
207BI EC DECAY (38 Y 3)
239NP B- DECAY (2.355 D 4)

3H B- DECAY (12.35 Y 1) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	18.600 20		
avg	5.710 10	100	0.0122

11C B+ DECAY (20.4 M 1) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-K	0.17	0.230 10	≈0
β+ 1 max	960.0 14		
avg	385.5 6	99.760 10	0.819

Maximum γ±-intensity =199.52%

13N B+ DECAY (9.97 M 2) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-K	0.26	0.170 10	≈0
β+ 1 max	1198.5 9		
avg	491.8 4	99.820 10	1.05

Maximum γ±-intensity =199.64%

14C B- DECAY (5730 Y 40) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	156.08 24		
avg	49.30 10	100	0.105

15O B+ DECAY (123 S 1) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-K	0.38	0.107 6	≈0
β+ 1 max	1731.8 7		
avg	735.2 3	99.887 6	1.56

Maximum γ±-intensity =199.77%

16N B- DECAY (7.12 S 2) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	1546.9 24		
avg	630.5 11	1.00 20	0.0134
β- 2 max	3299.9 24		
avg	1460.6 12	4.9 4	0.152
β- 3 max	4287.9 23		
avg	1941.0 12	68.0 20	2.81
β- 4 max	10418.6 23		
avg	4979.2 12	26.0 20	2.76
total β- avg	2695.0 15	100 3	5.74

1 weak β's omitted (ΣIβ = 0.01%)

γ 3	1753.0 6	0.13 4	0.0049
γ 5	2741.0 6	0.76 15	0.0444
γ 8	6129.39 18	69.0 20	9.01
γ 10	7117.0 4	5.0 4	0.758

7 weak γ's omitted (ΣIγ = 0.16%)

18F B+ DECAY (109.74 M 4) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-K	0.52	2.88 20	≈0
β+ 1 max	634.0 10		
avg	249.6 5	96.90 17	0.515

Maximum γ±-intensity =193.80%

22NA B+ DECAY (2.602 Y 2) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-K	0.82	8.84 7	0.0002
β+ 1 max	545.8 6		
avg	215.7 3	90.23 4	0.415
1 weak β's omitted (ΣIβ = 0.06%)			
K X-ray	0.84	0.12 4	=0
γ 1	1274.540 20	99.940 20	2.71
Maximum γ±-intensity =180.58%			

24NA B- DECAY (15.00 H 4) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	1390.8 8		
avg	551.1 3	99.935 4	1.17
3 weak β's omitted (ΣIβ = 0.07%)			
γ 2	1368.53 5	100	2.91
γ 3	2754.09 5	99.863 5	5.86
4 weak γ's omitted (ΣIγ = 0.06%)			

26AL B+ DECAY (7.16E5 Y 32) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-K	1.18	16.19 23	0.0004
β+ 1 max	1174.0 5		
avg	543.8 23	81.80 20	0.947
K X-ray	1.25	0.44 6	=0
γ 1	1129.67 10	2.50 20	0.0602
γ 2	1808.65 7	99.76 4	3.84
γ 3	2938.24 13	0.240 20	0.0150
Maximum γ±-intensity =163.60%			

27MG B- DECAY (9.462 M 11) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	1595.8 12		
avg	646.2 5	29.0 4	0.399
β- 2 max	1766.5 12		
avg	724.7 6	71.0 4	1.10
total β- avg	701.9 6	100.0 6	1.50
γ 1	170.686 15	0.80 10	0.0029
γ 2	843.76 3	71.8 4	1.29
γ 3	1014.44 4	28.0 4	0.605

28MG B- DECAY (20.91 H 3) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-K	1.39	26 6	0.0008
ce-K- 1	29.080 20	27 7	0.0168
ce-L- 1	30.522 20	2.6 7	0.0017
β- 1 max	212.0 20		
avg	65.2 7	4.60 20	0.0064
β- 2 max	459.0 20		
avg	155.9 8	94.0 20	0.312
β- 3 max	860.0 20		
avg	319.3 9	1.40 20	0.0095
total β- avg	154.0 9	100.0 21	0.328
K X-ray	1.48	0.97 24	=0
γ 1	30.640 20	66 4	0.0431
γ 2	400.690 20	36.6 10	0.312
γ 5	941.45 3	38.3 10	0.768
γ 8	1342.25 3	52.6 16	1.50
γ 9	1372.89 6	4.70 20	0.137
γ 10	1589.36 3	4.20 20	0.142
γ 11	1620.00 15	0.30 10	0.0104
4 weak γ's omitted (ΣIγ = 0.13%)			

28AL B- DECAY (2.240 M 1) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	2862.9 9		
avg	1246.6 4	99.990 10	2.65
γ 1	1778.85 3	100	3.79

32SI B- DECAY (≈ 450 Y) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	213 7		
avg	64.7 22	100	0.138

32P B- DECAY (14.29 D 3) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	1711.0 12		
avg	695.2 5	100	1.48

33P B- DECAY (25.4 D 2) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	249.0 20		
avg	76.6 6	100	0.163

35S B- DECAY (87.44 D 7) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	167.36 20		
avg	48.80 10	100	0.104

38CL B- DECAY (37.21 M 4) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	1107.2 9		
avg	420.40 10	32.5 6	0.291
β- 2 max	2749.6 9		
avg	1181.5 4	11.4 8	0.287
β- 3 max	4917.2 9		
avg	2244.1 4	56.0 5	2.68
total β-			
avg	1529.5 4	99.9 12	3.25
γ 1	1642.42 6	32.5 6	1.14
γ 2	2167.51 5	44.0 5	2.03

1 weak γ's omitted (ΣIγ = 0.03%)

41AR B- DECAY (1.827 H 7) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	1198.1 8		
avg	459.3 3	99.170 20	0.970
β- 2 max	2491.8 8		
avg	1076.6 4	0.780 20	0.0179
total β-			
avg	464.0 3	100.00 3	0.988

1 weak β's omitted (ΣIβ = 0.05%)

γ 1	1293.64 4	99.160 20	2.73

1 weak γ's omitted (ΣIγ = 0.05%)

42K B- DECAY (12.36 H 1) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	1683.0 20		
avg	701.0 10	0.320 20	0.0048
β- 2 max	1996.0 20		
avg	822.0 10	17.5 5	0.306
β- 3 max	3520.0 20		
avg	1563.0 10	82.1 5	2.73
total β-			
avg	1429.0 11	100.0 7	3.04

2 weak β's omitted (ΣIβ = 0.12%)

γ 1	312.75 3	0.319 17	0.0021
γ 6	1524.665 20	17.9 5	0.581

6 weak γ's omitted (ΣIγ = 0.14%)

43K B- DECAY (22.6 H 2) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	423 10		
avg	137 4	2.24 9	0.0065
β- 2 max	827 10		
avg	298 4	92.1 13	0.585
β- 3 max	1224		
avg	469 5	3.7 4	0.0370
β- 4 max	1444 10		
avg	568 5	0.8 13	0.0097
β- 5 max	1817 10		
avg	762 5	1.3 3	0.0211
total β- avg	309 5	100.1 19	0.659
γ 1	184.00 20	0.27 6	0.0011
γ 2	220.608 18	4.11 22	0.0193
γ 3	372.763 15	87.3 5	0.693
γ 4	396.870 20	11.43 12	0.0966
γ 5	404.30 20	0.109 8	0.0009
γ 6	593.40 8	11.0 3	0.139
γ 7	617.494 25	80.5 14	1.06
γ 8	800.8 10	0.147 10	0.0025
γ 9	990.25 20	0.33 7	0.0069
γ 10	1015.1 10	0.16 7	0.0034
γ 11	1021.79 18	1.88 8	0.0409
γ 12	1394.2 7	0.102 12	0.0030

44SC B+ DECAY (3.927 H 8) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	0.3	8.48 23	=0
Auger-K	3.3	4.18 12	0.0003
β+ 1 max	1481 4		
avg	635.0 20	94.42 4	1.28
X-ray $K\alpha_2$	3.68809	0.242 25	=0
X-ray $K\alpha_1$	3.69168	0.48 5	=0
γ 2	1156.95 10	99.87 4	2.46
γ 3	1499.4 3	0.91 4	0.0291
γ 5	2656.30 20	0.13 4	0.0074

Maximum γ±-intensity =188.84%

44TI EC DECAY (47.3 Y 12) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	0.37	172 6	0.0014
Auger-K	3.64	83 3	0.0064
ce-K- 1	63.36 3	10.8 21	0.0146
ce-L- 1	67.35 3	1.1 3	0.0015
ce-MNO- 1	67.80 3	0.35 7	0.0005
ce-K- 2	73.91 6	2.9 5	0.0046
ce-L- 2	77.90 6	0.28 5	0.0005

*** continued ***

44TI EC DECAY (47.3 Y 12) (continued)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
X-ray L	0.4	0.34 12	=0
X-ray $K\alpha_2$	4.08610 2	5.8 6	0.0005
X-ray $K\alpha_1$	4.09060 2	11.5 11	0.0010
X-ray Kβ	4.46	2.26 21	0.0002
γ 1	67.85 3	87.7 15	0.127
γ 2	78.40 6	94.7 15	0.158
γ 3	147.0 15	0.10 3	0.0003

45CA B- DECAY (164 D 1) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	258.7 16		
avg	77.8 5	100	0.166

46SC IT DECAY (18.67 S 9) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	0.37	61 11	0.0005
Auger-K	3.64	32 6	0.0025
ce-K- 1	138.035 3	39 7	0.115
ce-MNO- 1	142.474 3	1.1 6	0.0034
X-ray L	0.4	0.12 5	=0
X-ray $K\alpha_2$	4.08610 2	2.2 5	0.0002
X-ray $K\alpha_1$	4.09060 2	4.4 9	0.0004
X-ray Kβ	4.46	0.86 18	=0
γ 1	142.528 3	56 6	0.170

46SC B- DECAY (83.80 D 3) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	357.3 11		
avg	112.0 4	100	0.239
γ 1	889.25 3	100	1.89
γ 2	1120.51 5	100.00 10	2.39

47CA B- DECAY (4.536 D 2) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	691.2 25		
avg	241.2 10	82.0 20	0.421
β- 2 max	1988.3 25		
avg	817.2 12	18.0 20	0.313
total β- avg	344.9 13	100 3	0.735
2 weak β's omitted (ΣIβ = 0.11%)			
γ 2	489.23 10	6.7 3	0.0702
γ 3	530.4 3	0.105 16	0.0012
γ 4	767.0 3	0.195 16	0.0032
γ 5	807.86 10	6.9 3	0.119
γ 6	1297.09 10	74.9 19	2.07
2 weak γ's omitted (ΣIγ = 0.03%)			

47SC B- DECAY (3.422 D 4) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	0.42	0.347 15	=0
Auger-K	4	0.175 8	=0
ce-K- 1	154.42 5	0.224 8	0.0007
β- 1 max	441.0 20		
avg	142.5 8	68.0 20	0.206
β- 2 max	600.0 20		
avg	203.8 8	32.0 20	0.139
total β- avg	162.1 9	100 3	0.345
γ 1	159.39 5	68.0 20	0.231

48V EC DECAY (15.974 D 3) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	0.42	16.7 8	0.0001
Auger-K	4	7.9 4	0.0007
β+ 1 max	699 4		
avg	292.0 20	50.1 5	0.312
total β+ avg	292.0 20	50.1 5	0.312
1 weak β's omitted (ΣIβ = 0.09%)			

*** continued ***

48V EC DECAY (15.974 D 3) (continued)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
X-ray Kα2	4.50486	0.65 6	=0
X-ray Kα1	4.51084	1.30 12	0.0001
X-ray Kβ	5	0.260 25	=0
γ 1	802.8 13	0.140 20	0.0024
γ 2	928.28 4	0.90 10	0.0178
γ 3	944.12 3	7.9 4	0.159
γ 4	983.50 3	100	2.09
γ 5	1312.04 3	97.40 20	2.72
γ 6	1436.80 10	0.12 3	0.0037
γ 7	2240.35 6	2.40 20	0.115
2 weak γ's omitted (ΣIγ = 0.02%)			
Maximum γ±-intensity =100.20%			

51CR EC DECAY (27.704 D 2) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	0.47	144.7 12	0.0014
Auger-K	4.38	66.9 7	0.0062
X-ray L	0.5	0.33 12	=0
X-ray Kα2	4.94464	6.59 21	0.0007
X-ray Kα1	4.95220	13.1 4	0.0014
X-ray Kβ	5.43	2.62 9	0.0003
γ 1	320.078 8	9.80 10	0.0668

52MN EC DECAY (5.67 D 9) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	0.54	98 3	0.0011
Auger-K	4.78	44.0 15	0.0045
β+ 1 max	573 5		
avg	240.6 21	28.3 11	0.145
X-ray L	0.57	0.25 9	=0
X-ray Kα2	5.40551	5.11 22	0.0006
X-ray Kα1	5.41472	10.1 5	0.0012
X-ray Kβ	6	2.03 9	0.0003
γ 1	346.06 5	1.10 10	0.0081
γ 2	399.2 4	0.34 5	0.0029
γ 3	502.17 10	0.22 4	0.0024
γ 4	600.22 5	0.53 3	0.0068
γ 5	647.53 5	0.41 3	0.0057
γ 6	744.18 3	87 3	1.38
γ 7	848.12 3	3.40 20	0.0614
γ 8	935.50 3	94 3	1.87
γ 9	1246.25 4	4.70 20	0.125
γ 10	1333.62 4	5.20 20	0.148
γ 11	1434.05 3	100	3.05
2 weak γ's omitted (ΣIγ = 0.09%)			
Maximum γ±-intensity = 56.60%			

52MN B+ DECAY (21.1 M 2) I(min)=0.10%

%(EC+B+)=97.8 4
SEE ALSO 52MN IT DECAY (21.1 M)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	0.54	2.34 5	≈0
Auger-K	4.78	1.057 23	0.0001
β+ 1 max	903 5		
avg	381.9 23	0.21 7	0.0017
β+ 2 max	2631 5		
avg	1172.8 24	96.0 4	2.40
total β+ avg	1170.6 24	96.3 4	2.40
1 weak β's omitted (ΣIβ = 0.06%)			
X-ray Kα2	5.40551	0.123 5	≈0
X-ray Kα1	5.41472	0.244 8	≈0
γ 1	1434.05 3	97.8 4	2.99
γ 3	1727.7 4	0.23 8	0.0086
2 weak γ's omitted (ΣIγ = 0.11%)			

Maximum γ±-intensity =192.54%

52MN IT DECAY (21.1 M 2) I(min)=0.10%

%IT=2.2 4
SEE ALSO 52MN B+ DECAY (21.1 M)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
γ 1	377.61 5	2.2 4	0.0177

52FE B+ DECAY (8.275 H 8) I(min)=0.10%

SEE ALSO 52MN IT DECAY (21.1 M)
SEE ALSO 52MN B+ DECAY (21.1 M)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	0.6	61.6 23	0.0008
Auger-K	5.19	26.9 12	0.0030
β+ 1 max	803 12		
avg	340 5	56.0 10	0.406
X-ray L	0.64	0.19 7	≈0
X-ray Kα2	5.88765	3.6 3	0.0005
X-ray Kα1	5.89875	7.2 6	0.0009
X-ray Kβ	6.49	1.45 12	0.0002
γ 1	168.770 20	100	0.359

Maximum γ±-intensity =112.00%

54MN EC DECAY (312.5 D 5) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	0.54	142.0 12	0.0016
Auger-K	4.78	63.8 7	0.0065
X-ray L	0.57	0.37 13	≈0
X-ray Kα2	5.40551	7.43 21	0.0009
X-ray Kα1	5.41472	14.7 4	0.0017
X-ray Kβ	6	2.94 10	0.0004
γ 1	834.827 21	99.9760 2	1.78

55FE EC DECAY (2.7 Y 1) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	0.6	139 4	0.0018
Auger-K	5.19	60.7 22	0.0067
X-ray L	0.64	0.42 14	≈0
X-ray Kα2	5.88765	8.2 7	0.0010
X-ray Kα1	5.89875	16.3 12	0.0020
X-ray Kβ	6.49	3.3 3	0.0005

56MN B- DECAY (2.5785 H 6) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	327.1 21		
avg	99.6 8	1.16 3	0.0025
β- 2 max	736.9 21		
avg	255.7 9	14.6 4	0.0795
β- 3 max	1039.3 21		
avg	382.5 9	27.9 8	0.227
β- 4 max	2850.0 21		
avg	1217.4 10	56.3 9	1.46
total β- avg	830.4 15	100.1 13	1.77
3 weak β's omitted (ΣIβ = 0.12%)			
γ 1	846.754 20	98.9 3	1.78
γ 4	1810.72 4	27.2 8	1.05
γ 5	2113.05 4	14.3 4	0.645
γ 6	2522.88 6	0.99 3	0.0531
γ 8	2657.45 5	0.653 20	0.0369
γ 9	2959.77 6	0.306 10	0.0193
γ 10	3369.60 7	0.168 10	0.0121
3 weak γ's omitted (ΣIγ = 0.16%)			

57CO EC DECAY (270.9 D 6) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	0.67	247 3	0.0035
Auger-K	5.62	104.5 13	0.0125
ce-K- 1	7.303 3	67.9 3	0.0106
ce-L- 1	13.569 3	7.61 21	0.0022
ce-MNO- 1	14.322 3	1.12 7	0.0003
ce-K- 2	114.951 4	1.87 10	0.0046
ce-L- 2	121.217 3	0.183 10	0.0005
ce-K- 3	129.364 4	1.40 13	0.0039
ce-L- 3	135.630 3	0.140 13	0.0004
X-ray L	0.7	0.77 25	≈0
X-ray $K\alpha_2$	6.39084	16.5 5	0.0022
X-ray $K\alpha_1$	6.40384	32.5 8	0.0044
X-ray Kβ	7	6.56 20	0.0010
γ 1	14.4147 25	9.54 13	0.0029
γ 2	122.063 3	85.59 19	0.223
γ 3	136.476 3	10.61 18	0.0309
γ 9	692.00 3	0.160 5	0.0024

6 weak γ's omitted (ΣIγ = 0.03%)

58CO EC DECAY (70.8 D 1) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	0.67	116.2 13	0.0017
Auger-K	5.62	49.2 6	0.0059
β+ 1 max	475 3		
avg	201.0 20	15.00 5	0.0642
X-ray L	0.7	0.36 12	≈0
X-ray $K\alpha_2$	6.39084	7.76 21	0.0011
X-ray $K\alpha_1$	6.40384	15.3 4	0.0021
X-ray Kβ	7	3.09 10	0.0005
γ 1	810.750 20	99.450 10	1.72
γ 2	863.940 20	0.680 10	0.0125
γ 3	1674.73 4	0.520 10	0.0185

Maximum γ±-intensity = 30.00%

59FE B- DECAY (44.6 D 4) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	131.0 20		
avg	35.8 6	1.27 3	0.0010
β- 2 max	273.0 20		
avg	80.8 6	45.6 8	0.0785
β- 3 max	466.0 20		
avg	149.3 7	52.8 12	0.168
β- 4 max	1565.0 20		
avg	635.8 8	0.18 4	0.0024
total β- avg	117.4 8	99.9 15	0.250

1 weak β's omitted (ΣIβ = 0.08%)

*** continued ***

59FE B- DECAY (44.6 D 4) (continued)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
γ 1	142.648 4	1.00 3	0.0030
γ 2	192.344 6	3.00 7	0.0123
γ 3	334.80 20	0.270 10	0.0019
γ 5	1099.224 25	56.1 12	1.31
γ 6	1291.56 3	43.6 8	1.20

2 weak γ's omitted (ΣIγ = 0.08%)

60CO B- DECAY (5.271 Y 1) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 2 max	317.88 10		
avg	95.80 10	99.920 20	0.204
total β- avg	96.22 10	100.000 20	0.205

2 weak β's omitted (ΣIβ = 0.09%)

γ 3	1173.208 25	99.900 20	2.50
γ 4	1332.46 3	100	2.84

4 weak γ's omitted (ΣIγ = 0.01%)

63NI B- DECAY (96 Y 4) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	65.87 15		
avg	17.13 4	100	0.0365

64CU B+ DECAY (12.701 H 2) I(min)=0.10%

%(EC+B+)=62.8 4
SEE ALSO 64CU B- DECAY

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	0.84	58.9 21	0.0011
Auger-K	6.54	23.3 12	0.0032
β+ 1 max	655.1 25		
avg	279.1 11	18.00 20	0.107
X-ray L	0.85	0.22 8	≈0
X-ray $K\alpha_2$	7.46089	4.9 4	0.0008
X-ray $K\alpha_1$	7.47815	9.6 7	0.0015
X-ray Kβ	8.26	1.96 14	0.0003
γ 1	1345.9 3	0.49 4	0.0140

Maximum γ±-intensity = 36.00%

64CU B- DECAY (12.701 H 2) I(min)=0.10%

%B-=37.2 4
SEE ALSO 64CU B+ DECAY

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	578.0 23		
avg	190.2 9	37.2 4	0.151

65ZN EC DECAY (244.1 D 2) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	0.92	126.7 18	0.0025
Auger-K	7	48.3 8	0.0072
β+ 1 max	328.8 11		
avg	142.5 5	1.460 20	0.0044
X-ray L	0.93	0.57 20	≈0
X-ray Kα2	8.027830	11.5 3	0.0020
X-ray Kα1	8.047780	22.6 5	0.0039
X-ray Kβ	9	4.61 13	0.0009
γ 3	1115.52 3	50.75 10	1.21

Maximum γ±-intensity = 2.92%

66GA B+ DECAY (9.40 H 7) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	0.99	56 3	0.0012
Auger-K	7.53	20.6 13	0.0033
β+ 1 max	362 3		
avg	157.0 13	1.00 10	0.0033
β+ 2 max	720 3		
avg	308.7 13	0.160 10	0.0011
β+ 3 max	772 3		
avg	330.9 13	0.70 10	0.0049
β+ 4 max	821 3		
avg	352.2 13	0.220 20	0.0017
β+ 5 max	924 3		
avg	397.1 13	4.10 20	0.0347
β+ 6 max	1780 3		
avg	781.6 13	0.37 3	0.0062
β+ 7 max	4153 3		
avg	1904.1 14	49.9 10	2.02
total β+ avg	1726.3 20	56.4 11	2.08
X-ray L	1	0.28 12	≈0
X-ray Kα2	8.61578	5.6 4	0.0010
X-ray Kα1	8.63886	11.0 8	0.0020
X-ray Kβ	9.57	2.25 16	0.0005
γ 4	448.90 10	0.111 5	0.0011
γ 7	686.28 10	0.261 10	0.0038
γ 8	833.56 10	6.12 15	0.109
γ 10	856.70 10	0.123 5	0.0022
γ 11	907.0 3	0.115 8	0.0022
γ 15	1039.29 10	38.4 8	0.850
γ 18	1190.36 10	0.134 12	0.0034
γ 20	1232.9	0.538 19	0.0141
γ 21	1333.20 20	1.25 3	0.0355
γ 22	1356.2	0.38 4	0.0109
γ 23	1356.6	0.127 20	0.0037
γ 24	1357	0.19 8	0.0055
γ 25	1418.88 10	0.645 16	0.0195
γ 27	1508.33 10	0.584 17	0.0188
γ 29	1899.18 10	0.434 15	0.0176
γ 30	1918.64 10	2.17 5	0.0887
γ 32	2173.90 20	0.12 3	0.0055
γ 33	2190.00 20	5.76 15	0.269
γ 34	2213.60 20	0.142 9	0.0067
γ 36	2393.30 20	0.253 10	0.0129
γ 37	2422.70 10	1.97 5	0.102
γ 40	2752.10 20	23.5 6	1.38
γ 41	2780.50 20	0.129 5	0.0076
γ 42	2934.30 20	0.219 6	0.0137
γ 46	3229.26 10	1.51 4	0.104
γ 48	3381.32 10	1.43 4	0.103
γ 49	3422.64 15	0.833 24	0.0607
γ 50	3433.00 15	0.284 7	0.0208
γ 53	3767.40 20	0.142 9	0.0114
γ 54	3791.47 10	1.025 25	0.0828
γ 58	4086.36 10	1.15 4	0.0999
γ 59	4295.70 20	3.53 9	0.323
γ 60	4462.01 15	0.718 17	0.0682
γ 61	4806.59 15	1.49 5	0.153

27 weak γ's omitted (ΣIγ = 1.24%)
Maximum γ±-intensity =112.90%

67CU B- DECAY (61.86 H 12) I(min)=0.10%

THE UNCERTAINTIES IN THE INTENSITIES FOR THE RADIATIONS FROM 67CU INCLUDE ONLY THE UNCERTAINTIES IN RELATIVE PHOTON AND INTERNAL CONVERSION DATA. THE ADDITIONAL UNCERTAINTY ARISING FROM THE CONVERSION OF RELATIVE INTENSITIES TO INTENSITIES PER 100 67CU DECAYS IS NOT KNOWN SINCE THE UNCERTAINTY IN THE GROUND STATE B- BRANCH, NEEDED FOR THIS CONVERSION, IS NOT KNOWN. NOTE THAT A 20% UNCERTAINTY IN THIS B- BRANCH WOULD RESULT IN A 5% UNCERTAINTY TO BE ADDED (IN QUADRATURE) TO THE INTENSITY UNCERTAINTIES GIVEN BELOW

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	0.99	20.0 14	0.0004
Auger-K	7.53	7.3 6	0.0012
ce-K- 1	81.614 17	0.56 4	0.0010
ce-K- 2	83.657 17	12.5 8	0.0223
ce-L- 2	92.122 17	1.54 10	0.0030
ce-M- 2	93.180 17	0.225 15	0.0004
ce-K- 3	174.908 20	0.91 10	0.0034
β- 1 max	180 8		
avg	50 3	1.20 20	0.0013
β- 2 max	389 8		
avg	120 3	57.0 20	0.146
β- 3 max	481 8		
avg	153 3	22.0 20	0.0717
β- 4 max	574 8		
avg	189 3	20	0.0805
total β- avg	140 4	100 3	0.299
X-ray L	1	0.10 4	≈0
X-ray Kα2	8.61578	1.99 17	0.0004
X-ray Kα1	8.63886	3.9 4	0.0007
X-ray Kβ	9.57	0.80 7	0.0002
γ 1	91.273 17	7.6 5	0.0148
γ 2	93.316 17	16.7 10	0.0332
γ 3	184.567 20	47.7 10	0.188
γ 4	208.966 20	0.114 10	0.0005
γ 5	300.232 25	0.76 5	0.0049
γ 6	393.502 20	0.215 20	0.0018

67GA EC DECAY (78.0 H 3) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	0.99	167 9	0.0035
Auger-K	7.53	61 4	0.0098
ce-K- 1	81.614 17	0.232 15	0.0004
ce-K- 2	83.657 17	28.3 16	0.0505
ce-L- 2	92.122 17	3.47 20	0.0068
ce-M- 2	93.180 17	0.51 3	0.0010
X-ray L	1	0.8 4	≈0
X-ray Kα2	8.61578	16.7 12	0.0031
X-ray Kα1	8.63886	32.7 24	0.0060
X-ray Kβ	9.57	6.7 5	0.0014
γ 1	91.273 17	3.18 17	0.0062
γ 2	93.316 17	37.8 20	0.0751
γ 3	184.567 20	23.7 12	0.0931
γ 4	208.966 20	2.34 12	0.0104
γ 5	300.232 25	16.00 20	0.102
γ 6	393.502 20	4.48 23	0.0375
γ 10	887.68 4	0.139 10	0.0026

3 weak γ's omitted (ΣIγ = 0.12%)

68GA B+ DECAY (68.0 M) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	0.99	14.3 7	0.0003
Auger-K	7.53	5.2 4	0.0008
β+ 1 max	820		
avg	352.0 10	1.10 10	0.0082
β+ 2 max	1897.0 10		
avg	835.0 10	88 3	1.57
total β+ avg	826.2 10	89 3	1.57
X-ray Kα2	8.61578	1.43 10	0.0003
X-ray Kα1	8.63886	2.81 20	0.0005
X-ray Kβ	9.57	0.57 4	0.0001
γ 3	1077.40 10	3.30 10	0.0757
γ 6	1883.20 10	0.143 6	0.0057

6 weak γ's omitted (ΣIγ = 0.24%)
Maximum γ±-intensity =178.82%

68GE EC DECAY (288 D 6) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	1	121.4 18	0.0028
Auger-K	8	42.4 7	0.0073
X-ray L	1	0.67 19	≈0
X-ray Kα2	9.22482	13.1 3	0.0026
X-ray Kα1	9.25174	25.6 5	0.0050
X-ray Kβ	10.3	5.45 14	0.0012

69ZN IT DECAY (13.76 H 3) I(min)=0.10%

13.76-H 69ZN ALSO DECAYS VIA A 0.033% 3 B- BRANCH

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	0.99	6.3 4	0.0001
Auger-K	7.53	2.28 16	0.0004
ce-K- 1	428.975 18	4.38 16	0.0401
ce-L- 1	437.440 18	0.512 21	0.0048
ce-MNO- 1	438.498 18	0.171 10	0.0016
X-ray Kα2	8.61578	0.62 5	0.0001
X-ray Kα1	8.63886	1.23 9	0.0002
X-ray Kβ	9.57	0.250 19	≈0
γ 1	438.634 18	94.90 16	0.887

69ZN B- DECAY (57 M 1) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	907 4		
avg	322.2 15	100	0.686

72AS EC DECAY (26.0 H 1) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	1.19	15.9 7	0.0004
Auger-K	8.56	5.5 4	0.0010
ce-K- 7	680.10 20	0.87 9	0.0125
β+ 3 max	814 7		
avg	351 3	0.450 20	0.0034
β+ 4 max	927 7		
avg	400 3	0.167 9	0.0014
β+ 5 max	1865 7		
avg	822 4	6.0 3	0.105
β+ 6 max	2495 7		
avg	1115 4	64.1 12	1.52
β+ 7 max	2638 7		
avg	1203 4	0.12 9	0.0031
β+ 8 max	3329 7		
avg	1526 4	16.5 14	0.536
total β+ avg	1165 5	87.6 19	2.17

6 weak β's omitted (ΣIβ = 0.23%)

X-ray Kα2	9.85532	1.91 10	0.0004
X-ray Kα1	9.88642	3.73 19	0.0008
X-ray Kβ	11	0.83 5	0.0002
γ 5	600.90 10	0.319 17	0.0041
γ 6	629.93 5	8.1 3	0.109
γ 9	786.43 5	0.430 18	0.0072
γ 10	834.00 3	79.7 14	1.42
γ 12	894.27 5	0.79 3	0.0150
γ 21	1050.76 5	0.98 4	0.0219
γ 25	1215.14 5	0.231 17	0.0060
γ 28	1390.44 5	0.239 9	0.0071
γ 29	1464.00 7	1.14 5	0.0355
γ 30	1475.91 7	0.502 19	0.0158
γ 32	1568.20 10	0.143 9	0.0048
γ 36	1680.70 10	0.120 9	0.0043
γ 37	1710.90 7	0.271 17	0.0099
γ 41	1991.14 8	0.383 18	0.0162
γ 43	2105.9 3	0.74 8	0.0332
γ 44	2109.8 3	0.223 25	0.0100
γ 46	2201.74 9	0.518 19	0.0243
γ 48	2248.50 10	0.335 17	0.0160
γ 53	2507.90 10	0.335 17	0.0179
γ 58	2621.50 10	0.391 18	0.0218
γ 64	2940.10 10	0.335 17	0.0210
γ 66	2982.10 20	0.191 25	0.0121
γ 67	3094.30 20	0.143 9	0.0095

56 weak γ's omitted (ΣIγ = 1.75%)
Maximum γ±-intensity =175.13%

72GA B- DECAY (14.1 H 2) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	1.19	0.56 4	≈0
Auger-K	8.56	0.204 15	≈0
ce-K- 20	680.10 20	0.443 19	0.0064
β- 1 max	235 3		
avg	67.1 10	0.112 19	0.0002
β- 2 max	315 3		
avg	93.7 10	0.78 3	0.0016
β- 3 max	427 3		
avg	133.0 11	0.247 10	0.0007
β- 4 max	538 3		
avg	173.9 11	0.350 20	0.0013
β- 5 max	554 3		
avg	179.9 11	0.340 20	0.0013
β- 6 max	651 3		
avg	217.6 11	14.9 4	0.0691
β- 7 max	668 3		
avg	224.2 11	22.0 4	0.105
β- 8 max	958 3		
avg	342.4 12	27.4 8	0.200
β- 9 max	1050 3		
avg	381.5 12	1.96 4	0.0159
β-10 max	1478 3		
avg	569.7 13	9.10 24	0.110
β-11 max	1529 3		
avg	592.6 13	0.14 4	0.0018
β-12 max	1591 3		
avg	620.5 13	0.33 6	0.0044
β-13 max	1928 3		
avg	774.7 13	2.90 20	0.0479
β-14 max	2265 3		
avg	931.3 14	0.7 5	0.0139
β-15 max	2529 3		
avg	1055.7 14	9.0 9	0.202
β-16 max	3159 3		
avg	1355.0 14	9.5 12	0.274
total β- avg	493.4 18	100.0 19	1.05

8 weak β's omitted (ΣIβ = 0.23%)

X-ray Kα1	9.88642	0.138 9	≈0
γ 2	112.52 3	0.11 5	0.0003
γ 6	289.3 3	0.172 10	0.0011
γ 9	336.3 3	0.105 10	0.0008
γ 10	381.20 20	0.268 10	0.0022
γ 12	428.3 3	0.220 10	0.0020
γ 13	449.6 3	0.153 20	0.0015
γ 14	479.1 3	0.105 10	0.0011
γ 17	587.9 4	0.105 10	0.0013
γ 18	600.85 3	5.45 20	0.0697
γ 19	629.86 4	25.2 8	0.339
γ 21	735.90 20	0.373 10	0.0058
γ 24	786.40 10	3.26 9	0.0546
γ 25	810.24 9	2.01 9	0.0346
γ 26	834.02 3	95.59 11	1.70
γ 27	861.11 5	0.92 3	0.0168
γ 29	894.22 5	9.9 3	0.189
γ 30	924.10 20	0.143 10	0.0028
γ 32	939.40 20	0.259 7	0.0052
γ 34	970.54 6	1.09 3	0.0225
γ 36	999.86 6	0.803 20	0.0171
γ 38	1050.69 6	6.88 20	0.154
γ 42	1215.16 8	0.784 20	0.0203
γ 43	1230.86 7	1.46 4	0.0383
γ 44	1260.10 8	1.10 3	0.0295
γ 45	1276.75 8	1.558 20	0.0424
γ 47	1464.00 10	3.54 10	0.110
γ 49	1567.9 4	0.20 4	0.0067
γ 50	1571.50 20	0.80 3	0.0269
γ 51	1596.65 9	4.3 4	0.146

*** continued ***

72GA B- DECAY (14.1 H 2) (continued)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
γ 54	1680.77 8	0.99 4	0.0356
γ 55	1710.90 20	0.411 20	0.0150
γ 57	1837.80 20	0.229 10	0.0090
γ 58	1861.09 8	5.26 10	0.208
γ 59	1878.0 3	0.229 20	0.0092
γ 60	1920.2 3	0.143 20	0.0059
γ 61	1991.3 3	0.112 3	0.0047
γ 63	2109.50 10	1.07 3	0.0481
γ 64	2201.67 8	25.6 8	1.20
γ 65	2214.5 8	0.153 20	0.0072
γ 68	2490.98 8	7.93 20	0.421
γ 69	2507.80 8	12.7 4	0.679
γ 70	2515.6 5	0.239 20	0.0128
γ 73	2621.0 4	0.143 20	0.0080
γ 76	2844.10 20	0.478 20	0.0290

40 weak γ's omitted (ΣIγ = 1.30%)

73AS EC DECAY (80.30 D 6) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	1.19	321 10	0.0081
ce-K- 1	2.160 17	27.8 6	0.0013
Auger-K	8.56	88 5	0.0161
ce-L- 1	11.849 15	60.3 7	0.0152
ce-M- 1	13.083 15	8.9 3	0.0025
ce-NOP- 1	13.263 15	3.00 10	0.0008
ce-K- 2	42.334 12	76.1 6	0.0686
ce-L- 2	52.023 9	11.1 4	0.0123
ce-M- 2	53.257 9	1.73 5	0.0020
ce-NOP- 2	53.437 9	0.580 10	0.0007
X-ray L	1.19	1.9 7	=0
X-ray $K\alpha_2$	9.85532	30.5 16	0.0064
X-ray $K\alpha_1$	9.88642	60 3	0.0125
X-ray Kβ	11	13.3 7	0.0031
γ 2	53.437 9	10.5 3	0.0120

1 weak γ's omitted (ΣIγ = 0.09%)

73SE EC DECAY (7.1 H 1) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	1.24	67 4	0.0018
Auger-K	9.1	21.8 17	0.0042
ce-K- 1	55.13 10	19.1 6	0.0224
ce-L- 1	65.47 10	2.10 8	0.0029
ce-MNO- 1	66.80 10	0.387 17	0.0006
ce-K- 2	349.23 10	1.1 6	0.0079
ce-L- 2	359.57 10	0.12 8	0.0009

*** continued ***

73SE EC DECAY (7.1 H 1) (continued)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β+ 4 max	1208 10		
avg	525 3	0.52	0.0058
β+ 5 max	1290 10		
avg	562 5	64.6 9	0.773
β+ 6 max	1651 10		
avg	725 5	0.52	0.0080
total β+			
avg	563 5	65.7 9	0.787

3 weak β's omitted (ΣIβ = 0.05%)

X-ray L	1.28	0.47 14	=0
X-ray $K\alpha_2$	10.507990	8.4 5	0.0019
X-ray $K\alpha_1$	10.54370 1	16.3 10	0.0037
X-ray Kβ	11.7	3.78 23	0.0009
γ 1	67.00 10	77.4 13	0.110
γ 2	361.10 10	96.7 10	0.744
γ 4	510	1.1 4	0.0116
γ 12	865.40 20	0.47 3	0.0087
γ 14	901.2 4	0.12 3	0.0022
γ 17	1111.0 4	0.17 5	0.0041
γ 19	1422.90 20	0.11 3	0.0032

14 weak γ's omitted (ΣIγ = 0.49%)
Maximum γ±-intensity =131.37%

74AS B- DECAY (17.78 D 3) I(min)=0.10%

%B-=33.7 37
SEE ALSO 74AS B+ DECAY

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	720 3		
avg	243.4 11	15.2 7	0.0788
β- 2 max	1354 3		
avg	531.5 12	18.5 17	0.209
total β-			
avg	401.1 14	33.7 19	0.288

1 weak β's omitted (ΣIβ = 0.04%)

γ 1	634.78 8	15.2 18	0.205

2 weak γ's omitted (ΣIγ = 0.04%)

74AS B+ DECAY (17.78 D 3) I(min)=0.10%

%(EC+B+)=66.3 37
SEE ALSO 74AS B- DECAY

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	1.19	42.5 19	0.0011
Auger-K	8.56	14.3 9	0.0026
β+ 2 max	944.3 18		
avg	407.9 8	26.7 11	0.232
β+ 3 max	1540.1 18		
avg	700.9 9	1.70 14	0.0254
total β+			
avg	425.3 9	28.4 11	0.257

1 weak β's omitted (ΣIβ = 0.02%)

X-ray L	1.19	0.26 9	*0
X-ray $K\alpha_2$	9.85532	5.0 3	0.0010
X-ray $K\alpha_1$	9.88642	9.7 6	0.0020
X-ray Kβ	11	2.17 13	0.0005
γ 1	595.80 8	60 4	0.766
γ 2	608.39 8	0.58 5	0.0075
γ 9	1204.34 8	0.271 22	0.0070

8 weak γ's omitted (ΣIγ = 0.10%)
Maximum γ±-intensity = 56.83%

75SE EC DECAY (120 D 1) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	1.24	131 7	0.0035
Auger-K	9.1	42 3	0.0082
ce-K- 1	12.53 20	4.4 3	0.0012
ce-L- 1	22.87 20	0.86 6	0.0004
ce-M- 1	24.20 20	0.138 10	*0
ce-K- 2	54.183 10	0.356 24	0.0004
ce-K- 4	84.8663 22	2.50 6	0.0045
ce-L- 4	95.2065 22	0.333 8	0.0007
ce-K- 5	109.248 3	0.624 13	0.0015
ce-K- 6	124.133 5	1.49 3	0.0040
ce-L- 6	134.473 5	0.155 4	0.0004
ce-K- 10	252.784 8	0.381 7	0.0021
ce-K- 11	267.661 8	0.178 13	0.0010
X-ray L	1.28	0.9 3	*0
X-ray $K\alpha_2$	10.507990	16.3 10	0.0036
X-ray $K\alpha_1$	10.54370 1	31.7 18	0.0071
X-ray Kβ	11.7	7.3 5	0.0018
γ 2	66.050 10	1.011 24	0.0014
γ 4	96.7330 20	3.20 6	0.0066
γ 5	121.115 3	16.72 19	0.0431
γ 6	136.000 5	56.8 7	0.165
γ 7	198.596 7	1.43 3	0.0060
γ 10	264.651 8	59.50 20	0.335
γ 11	279.528 8	25.1 3	0.149
γ 13	303.910 11	1.363 25	0.0088
γ 16	400.646 9	11.78 19	0.101

15 weak γ's omitted (ΣIγ = 0.09%)

76AS B- DECAY (26.32 H 7) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	299.3 19		
avg	88.0 7	0.61 4	0.0011
β- 2 max	313.7 19		
avg	92.8 7	1.14 7	0.0023
β- 3 max	540.2 19		
avg	173.8 8	1.81 12	0.0067
β- 4 max	1181.3 19		
avg	436.4 9	1.94 12	0.0180
β- 5 max	1752.9 19		
avg	691.7 9	7.3 5	0.108
β- 6 max	1846.7 19		
avg	749.3 9	0.75 6	0.0120
β- 7 max	2409.9 19		
avg	996.5 9	33.2 15	0.705
β- 8 max	2969.0 19		
avg	1267.1 9	53.0 20	1.43
total β-			
avg	1072.3 12	100 3	2.29

9 weak β's omitted (ΣIβ = 0.29%)

γ 6	559.10 5	42.9 19	0.511
γ 7	563.23 8	1.12 6	0.0135
γ 10	657.03 5	5.8 4	0.0817
γ 14	740.12 8	0.112 7	0.0018
γ 16	771.76 8	0.112 10	0.0018
γ 20	867.63 8	0.120 7	0.0022
γ 26	1129.87 7	0.137 11	0.0033
γ 28	1212.72 18	1.56 11	0.0403
γ 29	1216.02 7	3.69 24	0.0956
γ 31	1439.13 8	0.313 19	0.0096
γ 32	1453.60 8	0.124 11	0.0039
γ 41	2096.33 14	0.63 5	0.0284
γ 42	2110.79 15	0.378 24	0.0170

33 weak γ's omitted (ΣIγ = 0.59%)

77GE B- DECAY (11.30 H 1) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	162 10		
avg	45 3	0.101 6	*0
β- 2 max	193 10		
avg	54 4	0.221 8	0.0003
β- 3 max	282 10		
avg	82 4	0.156 6	0.0003
β- 4 max	352 10		
avg	106 4	1.04 4	0.0023
β- 5 max	364 10		
avg	110 4	2.28 8	0.0053
β- 6 max	595 10		
avg	195 4	2.25 8	0.0093
β- 7 max	706 10		
avg	238 4	8.1 5	0.0411
β- 8 max	735 10		
avg	250 4	2.52 8	0.0134
β- 9 max	1132 10		
avg	416 5	1.87 6	0.0166
β-10 max	1145 10		
avg	422 5	7.18 23	0.0645
β-11 max	1167 10		
avg	431 5	0.19 15	0.0017

*** continued ***

77GE B- DECAY (11.30 H 1) (continued)

Radiation Type		Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β-12	max	1178 10		
	avg	436 5	0.91 3	0.0085
β-13	max	1248 10		
	avg	467 5	4.0 4	0.0398
β-14	max	1307 10		
	avg	493 5	1.77 7	0.0186
β-15	max	1361 10		
	avg	516 5	0.153 5	0.0017
β-16	max	1386 10		
	avg	527 5	0.43 15	0.0048
β-17	max	1516 10		
	avg	586 5	19.3 7	0.241
β-18	max	1541 10		
	avg	597 5	0.140 5	0.0018
β-19	max	1647 10		
	avg	645 5	0.176 9	0.0024
β-20	max	1817 10		
	avg	722 5	0.307 19	0.0047
β-21	max	1831 10		
	avg	729 5	0.270 18	0.0042
β-22	max	1921 10		
	avg	770 5	0.69 7	0.0113
β-23	max	2072 10		
	avg	840 5	0.98 4	0.0175
β-24	max	2074 10		
	avg	841 5	20.8 9	0.373
β-25	max	2092 10		
	avg	849 5	0.83 7	0.0150
β-26	max	2231 10		
	avg	914 5	15.4 9	0.300
β-27	max	2442 10		
	avg	1013 5	2.5 8	0.0539
β-28	max	2491 10		
	avg	1036 5	5.3 8	0.117
β-29	max	2511 10		
	avg	1046 5	0.47 6	0.0105
total β-				
	avg	645 7	100.5 20	1.38

5 weak β's omitted (ΣIβ = 0.20%)

γ 2	156.36 3	0.81 5	0.0027
γ 3	159.11 15	0.232 11	0.0008
γ 4	177.28 3	0.181 8	0.0007
γ 5	194.762 20	1.79 8	0.0074
γ 6	208.98 6	0.95 4	0.0042
γ 7	211.031 19	31.1 13	0.140
γ 8	215.505 22	28.9 12	0.133
γ 9	219.1 3	0.15 15	0.0007
γ 10	254.74 16	0.213 8	0.0012
γ 11	264.440 17	54.4 17	0.306
γ 12	268.10 22	0.3 3	0.0017
γ 14	337.63 6	0.234 10	0.0017
γ 15	338.66 4	0.67 3	0.0049
γ 18	367.397 16	14.1 5	0.111
γ 20	416.328 14	22.0 8	0.195
γ 21	419.75 3	1.24 4	0.0111
γ 23	439.438 20	0.204 7	0.0019
γ 25	461.378 15	1.28 5	0.0126
γ 27	475.433 17	1.00 4	0.0101
γ 29	520	0.30 4	0.0033
γ 33	558.018 13	16.2 6	0.193
γ 36	582.537 14	0.787 25	0.0098
γ 38	614.39	0.51 6	0.0067
γ 40	624.76 9	0.184 6	0.0024
γ 41	631.823 13	7.03 23	0.0946
γ 42	634.389 15	2.10 7	0.0284
γ 47	673	0.54 6	0.0077
γ 48	673	0.134 15	0.0019
γ 52	698.538 25	0.231 8	0.0034
γ 53	705.24 8	0.108 4	0.0016

*** continued ***

77GE B- DECAY (11.30 H 1) (continued)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
γ 54	712.35 4	0.84 3	0.0127
γ 55	714.345 12	7.21 23	0.110
γ 57	743.649 25	0.179 6	0.0028
γ 58	745.748 12	0.97 3	0.0155
γ 59	749.861 12	0.89 3	0.0142
γ 60	766.715 13	0.79 3	0.0129
γ 62	781.261 13	1.02 4	0.0170
γ 63	784.770 12	1.33 5	0.0222
γ 65	794.328 18	0.279 9	0.0047
γ 68	810.352 12	2.29 8	0.0395
γ 69	813.36 8	0.133 5	0.0023
γ 70	823.13 4	0.606 20	0.0106
γ 71	843.173 17	0.210 7	0.0038
γ 73	875.191 17	0.789 25	0.0147
γ 76	896.51 5	0.123 4	0.0024
γ 77	900.97 11	0.122 4	0.0023
γ 78	906.986 13	0.96 3	0.0185
γ 79	913.805 20	0.369 12	0.0072
γ 81	923.143 20	0.696 22	0.0137
γ 83	925.473	0.72 8	0.0143
γ 85	928.853 12	1.05 4	0.0208
γ 86	939.350 15	0.287 10	0.0057
γ 93	996.55 3	0.106 4	0.0023
γ100	1061.699 23	0.152 5	0.0034
γ101	1080.82 8	0.243 8	0.0056
γ102	1085.188 13	6.10 20	0.141
γ104	1114.80 4	0.104 4	0.0025
γ105	1124.99 3	0.119 4	0.0028
γ108	1151.837 25	0.197 7	0.0048
γ112	1193.263 13	2.59 9	0.0659
γ114	1215.418 25	0.128 4	0.0033
γ116	1242.183 15	0.401 13	0.0106
γ117	1263.862 15	0.86 3	0.0230
γ118	1279.957 20	0.175 6	0.0048
γ121	1309.271 16	0.491 16	0.0137
γ122	1312.802 16	0.361 12	0.0101
γ123	1319.662 17	0.304 10	0.0085
γ130	1368	3.4 4	0.0983
γ134	1452.59 4	0.122 4	0.0038
γ138	1476.524 22	0.244 8	0.0077
γ139	1479	0.128 14	0.0040
γ141	1495.597 17	0.503 16	0.0160
γ143	1538.763 20	0.144 5	0.0047
γ146	1573.688 20	0.664 21	0.0222
γ151	1709.812 25	0.310 10	0.0113
γ152	1719.656 22	0.402 13	0.0147
γ154	1727.18 3	0.149 5	0.0055
γ162	1846.41 3	0.172 6	0.0068
γ168	2000.10 3	0.565 18	0.0241
γ170	2077.20 3	0.235 8	0.0104
γ171	2089.60 3	0.241 8	0.0107
γ172	2126.15 4	0.206 7	0.0093
γ176	2341.63 4	0.476 15	0.0237

94 weak γ's omitted (ΣIγ = 3.08%)

77AS B- DECAY (38.8 H 3) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	1.32	0.11 3	≈0
β- 1 max	163 9		
avg	45 3	0.70 20	0.0007
β- 2 max	434 9		
avg	135 4	0.70 20	0.0020
β- 3 max	445 9		
avg	139 4	1.6 4	0.0047
β- 4 max	684 9		
avg	229 4	97.1 8	0.474
total β- avg	226 4	100.1 10	0.481

2 weak β's omitted (ΣIβ = 0.03%)

γ 3	87.876 20	0.21 6	0.0004
γ 5	161.933 20	0.13 4	0.0004
γ 7	238.999 20	1.6 4	0.0081
γ 8	249.790 20	0.43 11	0.0023
γ 12	520.652 20	0.62 16	0.0069

7 weak γ's omitted (ΣIγ = 0.10%)

77BR EC DECAY (56 H 2) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	1.32	115 7	0.0032
Auger-K	9.67	36 3	0.0074
ce-K- 3	75.14 10	0.146 5	0.0002
ce-K- 8	149.17 8	0.79 3	0.0025
ce-L- 8	160.18 8	0.134 5	0.0005
ce-K- 14	226.32 7	0.213 6	0.0010
β+ 1 max	343 3		
avg	151.6 3	0.73 3	0.0024
X-ray L	1.38	1.05 24	≈0
X-ray Kα2	11.18140 2	15.4 10	0.0037
X-ray Kα1	11.22240 2	30.0 18	0.0072
X-ray Kβ	12.5	7.2 5	0.0019
γ 3	87.80 10	1.40 4	0.0026
γ 5	138.95 9	0.129 6	0.0004
γ 8	161.83 8	1.10 3	0.0038
γ 9	180.68 7	0.284 10	0.0011
γ 12	200.40 7	1.21 6	0.0052
γ 14	238.98 7	23.1 5	0.118
γ 16	249.77 7	2.98 10	0.0159
γ 17	270.83 7	0.321 14	0.0019
γ 19	281.65 7	2.29 7	0.0137
γ 20	297.23 8	4.16 21	0.0263
γ 21	303.76 9	1.18 4	0.0076
γ 27	384.99 8	0.84 3	0.0069
γ 32	439.47 6	1.56 5	0.0146
γ 34	484.57 7	1.00 4	0.0103
γ 36	517.9 4	0.16 5	0.0018
γ 37	520.69 6	22.4 6	0.249
γ 39	565.91 19	0.427 17	0.0052
γ 40	567.90 8	0.86 3	0.0104
γ 41	574.64 8	1.19 4	0.0145
γ 42	578.91 7	2.96 10	0.0365
γ 43	585.48 7	1.57 5	0.0196
γ 48	755.35 7	1.67 5	0.0268
γ 51	817.79 6	2.08 7	0.0362
γ 59	1005.05 6	0.92 3	0.0198

37 weak γ's omitted (ΣIγ = 0.77%)
Maximum γ±-intensity = 1.46%

79KR B+ DECAY (35.04 H 10) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	1.4	105 8	0.0032
Auger-K	10.2	31 4	0.0067
ce-K- 1	30.7 4	0.214 21	0.0001
β+ 3 max	343 6		
avg	152.3 22	0.171 3	0.0006
β+ 4 max	604 6		
avg	263.3 22	6.7 6	0.0376
total β+ avg	260.0 23	6.9 6	0.0382

2 weak β's omitted (ΣIβ = 0.02%)

X-ray L	1.48	1.1 4	≈0
X-ray Kα2	11.87760 2	14.9 12	0.0038
X-ray Kα1	11.92420 2	28.9 23	0.0073
X-ray Kβ	13.3	7.1 6	0.0020
γ 1	44.2 4	0.210 20	0.0002
γ 2	135.99 10	1.00 10	0.0029
γ 3	180.21 15	0.10 5	0.0004
γ 4	208.45 10	0.78 4	0.0035
γ 5	217.02 10	2.40 10	0.0111
γ 6	261.26 10	12.7 4	0.0707
γ 8	299.51 10	1.57 7	0.0100
γ 9	306.31 15	2.60 10	0.0170
γ 10	344.70 10	0.240 10	0.0018
γ 11	389.00 10	1.52 7	0.0126
γ 12	397.56 10	9.5 3	0.0804
γ 16	522.98 20	0.250 10	0.0028
γ 17	525.32 15	0.430 20	0.0048
γ 19	606.07 10	8.10 20	0.105
γ 25	832.04 10	1.26 6	0.0223
γ 30	934.81 15	0.126 7	0.0025
γ 31	1025.70 10	0.156 9	0.0034
γ 35	1115.1 3	0.370 20	0.0088
γ 39	1332.13 10	0.44 3	0.0125

22 weak γ's omitted (ΣIγ = 0.52%)
Maximum γ±-intensity = 13.79%

81KR EC DECAY (2.1E5 Y 2) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	1.4	111 6	0.0033
Auger-K	10.2	31 3	0.0068
X-ray L	1.48	1.1 4	≈0
X-ray Kα2	11.87760 2	15.1 9	0.0038
X-ray Kα1	11.92420 2	29.3 17	0.0075
X-ray Kβ	13.3	7.2 5	0.0021
γ 1	275.990 11	2.0 20	0.0118

82BR B- DECAY (35.30 H 3) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	259 5		
avg	74.0 20	1.40 10	0.0022
β- 2 max	439 5		
avg	136.0 20	98.60 10	0.286
total β- avg	135.1 21	100.00 15	0.288
γ 1	92.184 8	0.75 5	0.0015
γ 4	137.40 20	0.14 3	0.0004
γ 6	221.45 3	2.25 9	0.0106
γ 7	273.45 3	0.79 5	0.0046
γ 12	554.320 20	70.6 9	0.834
γ 14	606.30 10	1.17 9	0.0151
γ 15	619.070 20	43.1 7	0.569
γ 17	698.330 20	27.9 6	0.416
γ 19	776.49 3	83.4 9	1.38
γ 20	827.81 3	24.2 4	0.426
γ 23	952.10 20	0.37 3	0.0074
γ 24	1007.57 9	1.31 4	0.0281
γ 25	1043.97 3	27.4 5	0.608
γ 27	1081.40 20	0.63 4	0.0144
γ 30	1317.47 5	26.9 5	0.756
γ 32	1426	0.11 5	0.0033
γ 33	1474.82 8	16.60 25	0.521
γ 34	1650.30 10	0.79 5	0.0279
γ 35	1779.60 20	0.117 17	0.0044

18 weak γ's omitted (ΣIγ = 0.75%)

84RB B+ DECAY (34 D 1) I(min)=0.10%

%(EC+B+)=96.4 6
SEE ALSO 84RB B- DECAY

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	1.5	70 4	0.0022
Auger-K	10.8	19.8 17	0.0046
β+ 1 max	776 3		
avg	338.4 13	12.9 4	0.0930
β+ 2 max	1658 3		
avg	730.6 14	12.0 4	0.187
total β+ avg	527.4 16	24.9 6	0.280
X-ray L	1.59	0.9 4	*0
X-ray $K\alpha_2$	12.5980 20	10.5 6	0.0028
X-ray $K\alpha_1$	12.6490 20	20.4 10	0.0055
X-ray Kβ	14	5.2 3	0.0016
γ 1	881.50 10	71.0 20	1.33
γ 2	1015.90 10	0.43 7	0.0093
γ 3	1897.00 20	0.78 8	0.0315

Maximum γ±-intensity = 49.80%

84RB B- DECAY (34 D 1) I(min)=0.10%

%B-=3.6 6
SEE ALSO 84RB B+ DECAY

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	890 4		
avg	309.9 14	3.6 6	0.0238

85KR B- DECAY (10.72 Y 1) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	173.0 20		
avg	47.5 6	0.430 10	0.0004
β- 2 max	687.0 20		
avg	251.4 8	99.570 10	0.533
total β- avg	250.5 8	100.000 15	0.534
γ 1	513.990 10	0.430 10	0.0047

85KR IT DECAY (4.48 H 1) I(min)=0.10%

%IT=21.1 6
SEE ALSO 85KR B- DECAY (4.48 H)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	1.5	7.7 5	0.0002
Auger-K	10.8	2.14 20	0.0005
ce-K- 1	290.544 20	6.05 21	0.0374
ce-L- 1	302.949 20	0.90 3	0.0058
ce-MNO- 1	304.582 20	0.182 6	0.0012
X-ray L	1.59	0.10 4	*0
X-ray $K\alpha_2$	12.5980 20	1.14 7	0.0003
X-ray $K\alpha_1$	12.6490 20	2.21 13	0.0006
X-ray Kβ	14	0.56 4	0.0002
γ 1	304.870 20	14.0 4	0.0909

85KR B- DECAY (4.48 H 1) I(min)=0.10%

%B-=78.9 6
SEE ALSO 85KR IT DECAY (4.48 H)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	1.68	3.70 12	0.0001
Auger-K	11.4	1.00 4	0.0002
ce-K- 2	135.980 10	3.02 9	0.0087
ce-L- 2	149.115 10	0.340 17	0.0011
β- 1 max	711.0 20		
avg	238.3 7	0.290 10	0.0015
β- 2 max	841.0 20		
avg	290.4 7	78.6 6	0.486
total β-			
avg	290.2 7	78.9 6	0.488

1 weak β's omitted (ΣIβ = 0.02%)

X-ray Kα2	13.33580 2	0.587 20	0.0002
X-ray Kα1	13.39530 2	1.14 4	0.0003
X-ray Kβ	15	0.298 11	≈0
γ 1	129.850 20	0.300 10	0.0008
γ 2	151.180 10	75.5 6	0.243

2 weak γ's omitted (ΣIγ = 0.02%)

85SR EC DECAY (64.85 D 3) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	1.68	108.3 23	0.0039
Auger-K	11.4	29.1 9	0.0071
ce-K- 1	498.790 10	0.617 13	0.0066
X-ray L	1.69	1.6 6	≈0
X-ray Kα2	13.33580 2	17.1 4	0.0048
X-ray Kα1	13.39530 2	33.0 7	0.0094
X-ray Kβ	15	8.67 24	0.0028
γ 1	513.990 10	98.0 10	1.07

1 weak γ's omitted (ΣIγ = 0.01%)

86RB B- DECAY (18.66 D 2) I(min)=0.10%

86RB ALSO DECAYS
VIA A 0.0052% 5 EC BRANCH

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	695 3		
avg	231.5 11	8.76 8	0.0432
β- 2 max	1772 3		
avg	708.2 13	91.24 8	1.38
total β-			
avg	666.4 14	100.00 12	1.42
γ 1	1076.63 10	8.76 8	0.201

86Y B+ DECAY (14.74 H 2) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	1.79	69 4	0.0026
Auger-K	12	18.0 16	0.0046
β+ 1 max	420 10		
avg	187 4	0.30 4	0.0012
β+ 3 max	485 10		
avg	215 4	0.330 20	0.0015
β+ 5 max	606 10		
avg	267 5	0.37 3	0.0021
β+ 6 max	889 10		
avg	389 4	0.200 20	0.0017
β+ 7 max	933 10		
avg	408 5	1.3 3	0.0113
β+ 9 max	1066 10		
avg	467 5	2.0 5	0.0199
β+10 max	1195 10		
avg	524 4	1.40 20	0.0156
β+11 max	1254 10		
avg	550 4	12.4 5	0.145
β+12 max	1373 10		
avg	603 4	0.69 17	0.0089
β+13 max	1578 10		
avg	691 9	5.6 5	0.0824
β+14 max	1769 10		
avg	783 6	1.7 10	0.0284
β+15 max	2021 10		
avg	898 5	3.6 10	0.0689
β+16 max	2397 10		
avg	1093 5	0.9 9	0.0210
β+17 max	3174 10		
avg	1452 5	1.8 11	0.0557
total β+			
avg	666 6	32.9 23	0.466

6 weak β's omitted (ΣIβ = 0.24%)

X-ray L	1.8	1.1 4	≈0
X-ray Kα2	14.09790 2	11.7 6	0.0035
X-ray Kα1	14.16500 2	22.5 11	0.0068
X-ray Kβ	15.8	6.1 3	0.0020
γ 1	132.34 10	0.165 9	0.0005
γ 3	182.34 20	0.11 4	0.0004
γ 4	187.87 13	1.26 5	0.0051
γ 5	190.80 13	1.01 4	0.0041
γ 6	209.80 23	0.396 17	0.0018
γ 7	235.37 23	0.396 17	0.0020
γ 8	237.9 3	0.132 25	0.0007
γ 9	252.05 13	0.371 17	0.0020
γ 11	264.53 13	0.536 25	0.0030
γ 12	307.00 10	3.46 9	0.0227
γ 13	331.08 23	0.83 3	0.0059
γ 15	370.28 17	0.82 5	0.0065
γ 16	380.4 3	0.45 4	0.0037
γ 17	382.86 23	3.63 12	0.0296
γ 18	425.97 23	0.305 17	0.0028
γ 19	439.5 3	0.20 7	0.0019
γ 20	443.13 10	16.9 5	0.160
γ 21	444.18 23	0.64 17	0.0061
γ 23	469.24 25	0.297 25	0.0030
γ 26	515.18 20	4.89 15	0.0537
γ 27	580.57 10	4.78 15	0.0592
γ 28	608.29 10	2.01 15	0.0261
γ 29	618.2 4	0.21 4	0.0028
γ 30	627.72 10	32.6 10	0.436
γ 32	644.82	2.2 4	0.0300
γ 33	645.87	9.2 11	0.126
γ 35	689.29 25	0.17 4	0.0025
γ 36	702.2 6	0.25 9	0.0037
γ 37	703.33 10	15.4 5	0.231
γ 38	709.90 10	2.62 8	0.0397
γ 39	719.17 23	0.22 4	0.0034

*** continued ***

86Y B+ DECAY (14.74 H 2) (continued)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
γ 40	740.81 13	1.36 5	0.0215
γ 41	767.63 13	2.4 4	0.0391
γ 42	768.25	0.32 11	0.0053
γ 43	777.37 10	22.4 6	0.372
γ 44	783.6 3	0.26 4	0.0044
γ 45	826.02 13	3.30 9	0.0581
γ 46	833.72	1.5 4	0.0264
γ 47	835.67	4.4 6	0.0778
γ 48	882.96 17	0.25 9	0.0047
γ 49	887.40 17	0.44 5	0.0083
γ 50	955.35 20	1.04 5	0.0212
γ 51	971.43 18	0.27 4	0.0056
γ 52	1017.93 23	0.18 12	0.0039
γ 53	1024.04 10	3.79 17	0.0828
γ 54	1076.63 10	82.5 4	1.89
γ 56	1092.68 13	0.69 5	0.0161
γ 57	1102.02 23	0.198 25	0.0046
γ 58	1133.3 10	0.297 25	0.0072
γ 61	1153.05 10	30.5 10	0.750
γ 63	1163.03 10	1.18 5	0.0292
γ 64	1253.11 10	1.53 5	0.0410
γ 65	1270.16 13	0.65 10	0.0176
γ 66	1283.96 13	0.29 11	0.0079
γ 67	1294.9 3	0.29 9	0.0080
γ 68	1296.03 23	0.54 4	0.0150
γ 70	1349.15 10	2.95 10	0.0846
γ 71	1404.8 4	0.18 5	0.0054
γ 72	1415.20 23	0.33 9	0.0099
γ 73	1507.86 10	0.35 5	0.0114
γ 74	1533.19 13	0.22 4	0.0073
γ 75	1535.67 13	0.12 4	0.0038
γ 76	1564.4 5	0.18 5	0.0060
γ 77	1696.25 13	0.635 17	0.0230
γ 78	1711.6 7	0.17 4	0.0063
γ 79	1724.15 10	0.55 5	0.0203
γ 80	1790.90 10	1.00 5	0.0381
γ 81	1801.70 10	1.65 5	0.0633
γ 82	1854.38 13	17.2 5	0.678
γ 83	1920.72 13	20.8 7	0.851
γ 85	2017.1 6	0.132 17	0.0057
γ 86	2088.09 25	0.247 25	0.0110
γ 89	2291.8 5	0.124 9	0.0060
γ 90	2482.08 17	0.115 9	0.0061
γ 92	2567.97 18	2.25 11	0.123
γ 93	2610.11 20	1.24 8	0.0688
γ 94	2641.9 4	0.16 5	0.0093
γ 96	2794.9 4	0.206 17	0.0123
γ 99	2865.9 3	0.38 7	0.0232
γ101	3069.7 4	0.115 17	0.0076
γ102	3334.0 5	0.124 17	0.0088

23 weak γ's omitted (ΣIγ = 1.03%)
Maximum γ±-intensity = 65.77%

86ZR EC DECAY (16.5 H 1) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	2	188 10	0.0076
ce-K- 1	11.0 5	69.9 4	0.0163
Auger-K	12.7	46 5	0.0124
ce-L- 1	25.6 5	8.7 3	0.0047
ce-MNO- 1	27.6 5	2.00 10	0.0012
ce-K- 2	226.0 10	3.55 11	0.0171
ce-L- 2	240.6 10	0.440 10	0.0023
ce-MNO- 2	242.6 10	0.18	0.0009
X-ray L	2	4.2 14	0.0002
X-ray $K\alpha_2$	14.88290 2	32.5 16	0.0103
X-ray $K\alpha_1$	14.95840 2	63 3	0.0200
X-ray Kβ	16.7	17.2 9	0.0061
γ 1	28.0 5	19.4 6	0.0116
γ 2	243.0 10	95.80 10	0.496
γ 3	612.0 20	5.2 8	0.0678

87KR B- DECAY (76.3 M 5) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	1.68	0.218 10	*0
ce-K- 2	387.378 20	0.178 9	0.0015
β- 1 max	579 7		
avg	188 3	0.50 3	0.0020
β- 2 max	833 7		
avg	287 3	0.110 10	0.0007
β- 3 max	927 7		
avg	326 3	4.4 3	0.0306
β- 4 max	1077 7		
avg	389 3	0.58 3	0.0048
β- 5 max	1333 7		
avg	500 3	9.5 3	0.101
β- 6 max	1474 7		
avg	562 3	5.60 20	0.0670
β- 7 max	1510 7		
avg	579 3	0.42 6	0.0052
β- 8 max	2148 7		
avg	870 3	0.67 10	0.0124
β- 9 max	2310 7		
avg	946 3	0.16 6	0.0032
β-10 max	2498 7		
avg	1029 7	0.120 10	0.0026
β-11 max	3043 7		
avg	1294 4	6.9 4	0.190
β-12 max	3485 7		
avg	1501 3	40.8 14	1.30
β-13 max	3888 7		
avg	1694 3	30.5 22	1.10
total β-			
avg	1323 4	100 3	2.82

*** continued ***

87KR B- DECAY (76.3 M 5) (continued)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
γ 2	402.578 20	49.5 16	0.424
γ 6	673.87 4	1.91 10	0.0274
γ 7	814.25 7	0.168 12	0.0029
γ 8	836.37 6	0.75 4	0.0134
γ 9	845.43 4	7.3 4	0.131
γ 12	946.64 15	0.139 11	0.0028
γ 15	1175.40 8	1.12 6	0.0281
γ 16	1337.96 8	0.65 4	0.0185
γ 17	1382.53 7	0.287 18	0.0085
γ 18	1389.91 16	0.124 11	0.0037
γ 20	1531.2 4	0.36 6	0.0116
γ 21	1577.99 14	0.129 11	0.0043
γ 22	1611.16 16	0.104 20	0.0036
γ 23	1740.52 8	2.05 10	0.0760
γ 24	1842.61 24	0.139 11	0.0054
γ 25	2011.88 12	2.90 14	0.124
γ 27	2408.50 20	0.213 17	0.0109
γ 28	2554.80 20	9.3 6	0.506
γ 29	2558.10 20	3.9 3	0.213
γ 31	2811.40 20	0.317 23	0.0190
γ 34	3308.50 20	0.450 25	0.0317

13 weak γ's omitted (ΣIγ = 0.65%)

87SR EC DECAY (2.805 H 3) I(min)=0.10%

%EC=0.30 8
FEEDING OF 87MSR IN 87Y DECAY=100%
SEE ALSO 87SR IT DECAY (2.805 H)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	1.68	0.32 8	≈0

87SR IT DECAY (2.805 H 3) I(min)=0.10%

%IT=99.70 3
FEEDING OF 87MSR IN 87Y DECAY=100%
SEE ALSO 87SR EC DECAY (2.805 H)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	1.79	17.9 9	0.0007
Auger-K	12	4.5 4	0.0012
ce-K- 1	372.30 8	14.6 3	0.115
ce-L- 1	386.18 8	2.22 4	0.0183
ce-M- 1	388.04 8	0.337 6	0.0028
X-ray L	1.8	0.29 10	≈0
X-ray $K\alpha_2$	14.09790 2	2.92 13	0.0009
X-ray $K\alpha_1$	14.16500 2	5.63 24	0.0017
X-ray Kβ	15.8	1.51 7	0.0005
γ 1	388.40 8	82.26 15	0.681

87Y EC DECAY (80.3 H 3) I(min)=0.10%

SEE ALSO 87SR IT DECAY (2.805 H)
SEE ALSO 87SR EC DECAY (2.805 H)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	1.79	105 6	0.0040
Auger-K	12	27.0 23	0.0070
ce-K- 2	468.60 20	0.240 5	0.0024
β+ 1 max	450.6 14		
avg	200.0 6	0.160 20	0.0007
X-ray L	1.8	1.7 6	≈0
X-ray $K\alpha_2$	14.09790 2	17.5 8	0.0053
X-ray $K\alpha_1$	14.16500 2	33.8 14	0.0102
X-ray Kβ	15.8	9.1 4	0.0031
γ 2	484.70 20	92.2 10	0.952

Maximum γ±-intensity = 0.32%

88KR B- DECAY (2.84 H 2) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	1.68	14.8 4	0.0005
Auger-K	11.4	4.00 12	0.0010
ce-K- 1	12.313 14	10.72 14	0.0028
ce-L- 1	25.448 14	1.23 5	0.0007
ce-MNO- 1	27.191 14	0.214 15	0.0001
ce-K- 4	150.78 4	0.21 3	0.0007
ce-K- 7	181.120 15	1.14 12	0.0044
ce-L- 7	194.255 15	0.135 17	0.0006
β- 1 max	160 30		
avg	43 7	0.350 20	0.0003
β- 2 max	380 30		
avg	115 10	2.65 16	0.0065
β- 3 max	540 30		
avg	172 12	67 3	0.245
β- 4 max	700 30		
avg	233 13	9.1 5	0.0452
β- 5 max	840 30		
avg	290 13	0.14 3	0.0009
β- 6 max	1010 30		
avg	362 13	0.200 20	0.0015
β- 7 max	1220 30		
avg	448 13	1.92 11	0.0183
β- 8 max	1270 30		
avg	472 13	0.23 4	0.0023
β- 9 max	1490 30		
avg	569 14	0.22 3	0.0027
β-10 max	1750 30		
avg	686 14	0.90 6	0.0132
β-11 max	1790 30		
avg	704 14	0.10 6	0.0015
β-12 max	2070 30		
avg	833 14	1.31 25	0.0232
β-13 max	2570 30		
avg	1066 14	0.14 14	0.0032
β-14 max	2730 30		
avg	1144 14	1.80 25	0.0439
β-15 max	2930 30		
avg	1241 14	14 4	0.370
total β- avg	365 21	100 5	0.781

6 weak β's omitted (ΣIβ = 0.25%)

*** continued ***

88KR B- DECAY (2.84 H 2) (continued)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
X-ray L	1.69	0.23 8	≈0
X-ray $K\alpha_2$	13.33580 2	2.35 6	0.0007
X-ray $K\alpha_1$	13.39530 2	4.54 10	0.0013
X-ray Kβ	15	1.19 4	0.0004
γ 1	27.513 14	1.94 17	0.0011
γ 3	122.27 6	0.197 12	0.0005
γ 4	165.98 4	3.10 15	0.0110
γ 7	196.320 15	26.0 13	0.109
γ 8	240.71 4	0.253 14	0.0013
γ 9	311.69 3	0.107 9	0.0007
γ 10	334.71 3	0.145 10	0.0010
γ 12	362.226 13	2.25 12	0.0174
γ 14	390.543 11	0.64 6	0.0054
γ 16	421.70 18	0.128 25	0.0011
γ 17	471.80 3	0.73 4	0.0073
γ 25	677.34 5	0.235 18	0.0034
γ 30	788.28 4	0.53 3	0.0089
γ 31	790.32 7	0.125 12	0.0021
γ 34	834.830 3	13.0 7	0.231
γ 35	850.34 5	0.173 14	0.0031
γ 36	862.327 19	0.67 4	0.0123
γ 39	944.92 4	0.294 20	0.0059
γ 42	985.780 16	1.31 7	0.0276
γ 43	990.09 9	0.142 19	0.0030
γ 44	1039.59 3	0.48 3	0.0107
γ 45	1049.48 12	0.142 13	0.0032
γ 48	1141.33 6	1.28 7	0.0312
γ 49	1179.51 3	1.00 5	0.0250
γ 50	1184.95 4	0.69 5	0.0174
γ 51	1209.84 8	0.14 3	0.0037
γ 52	1212.73 17	0.14 5	0.0036
γ 53	1245.22 4	0.363 25	0.0096
γ 54	1250.67 4	1.12 6	0.0299
γ 57	1324.98 4	0.16 4	0.0045
γ 59	1352.32 11	0.159 22	0.0046
γ 60	1369.50 20	1.48 9	0.0431
γ 61	1406.94 10	0.218 20	0.0065
γ 62	1464.84 9	0.114 15	0.0036
γ 63	1518.39 3	2.15 12	0.0696
γ 64	1529.77 3	10.9 6	0.356
γ 65	1603.79 5	0.46 4	0.0156
γ 68	1685.6 4	0.66 8	0.0239
γ 72	1892.76 13	0.14 3	0.0056
γ 73	1908.7 4	0.100 15	0.0041
γ 74	2029.84 3	4.53 23	0.196
γ 75	2035.411 18	3.74 21	0.162
γ 76	2186.5 3	0.29 6	0.0134
γ 77	2195.842 7	13.2 7	0.617
γ 78	2231.772 21	3.39 17	0.161
γ 80	2352.08 4	0.73 4	0.0366
γ 82	2392.11 4	34.6 16	1.76
γ 83	2408.91 7	0.104 12	0.0053
γ 85	2548.40 3	0.62 3	0.0338
γ 86	2771.02 5	0.149 10	0.0088

36 weak γ's omitted (ΣIγ = 1.89%)

88RB B- DECAY (17.8 M 1) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	485 5		
avg	152.0 20	0.68 5	0.0022
β- 2 max	493 5		
avg	155.0 20	0.37 3	0.0012
β- 3 max	595 5		
avg	193.0 20	0.150 10	0.0006
β- 4 max	824 5		
avg	283.0 20	2.17 14	0.0131
β- 5 max	924 5		
avg	324.0 20	0.210 20	0.0014
β- 6 max	2120 5		
avg	855.0 20	1.00 7	0.0182
β- 7 max	2604 5		
avg	1081.0 20	13.6 9	0.313
β- 8 max	3502 4		
avg	1507.0 20	4.2 4	0.135
β- 9 max	5338 4		
avg	2384.0 20	76 3	3.86
total β-			
avg	2072 3	98 4	4.34

5 weak β's omitted (ΣIβ = 0.08%)

γ 5	898.03 4	14.4 10	0.275
γ 8	1366.26 12	0.105 15	0.0031
γ 9	1382.39 5	0.76 6	0.0224
γ 11	1779.83 7	0.221 20	0.0084
γ 13	1836.00 5	21.9 15	0.856
γ 14	2111.22 12	0.120 14	0.0054
γ 15	2118.85 7	0.43 4	0.0195
γ 17	2577.72 6	0.184 15	0.0101
γ 20	2677.86 5	2.00 14	0.114
γ 21	2734.03 7	0.112 10	0.0065
γ 22	3009.43 7	0.250 19	0.0160
γ 24	3218.48 8	0.219 16	0.0150
γ 25	3486.46 9	0.134 10	0.0099
γ 28	4742.69 11	0.147 12	0.0148

15 weak γ's omitted (ΣIγ = 0.39%)

88Y EC DECAY (107 D 1) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	1.79	105 6	0.0040
Auger-K	12	27.1 23	0.0070
β+ 1 max	761 4		
avg	358.0 20	0.200 10	0.0015
X-ray L	1.8	1.7 6	≈0
X-ray $K\alpha_2$	14.09790 2	17.6 8	0.0053
X-ray $K\alpha_1$	14.16500 2	33.9 14	0.0102
X-ray Kβ	15.8	9.1 4	0.0031
γ 2	898.020 20	93.4 7	1.79
γ 4	1836.040 20	99.35 3	3.89
γ 5	2734.03 7	0.64 3	0.0370

3 weak γ's omitted (ΣIγ = 0.10%)
Maximum γ±-intensity = 0.40%

89KR B- DECAY (3.17 M 2) I(min)=0.10%

Radiation Type		Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L		1.68	1.18 9	≈0
Auger-K		11.4	0.32 3	≈0
ce-K- 4		205.70 7	0.96 8	0.0042
ce-L- 4		218.83 7	0.116 10	0.0005
β- 1	max	300 30		
	avg	87 9	0.58 7	0.0011
β- 2	max	440 30		
	avg	137 10	0.56 5	0.0016
β- 3	max	450 30		
	avg	140 10	0.33 4	0.0010
β- 4	max	520 30		
	avg	167 10	0.18 3	0.0006
β- 5	max	560 30		
	avg	181 10	0.60 5	0.0023
β- 6	max	590 30		
	avg	191 10	0.220 20	0.0009
β- 7	max	590 30		
	avg	192 10	0.16 3	0.0007
β- 8	max	620 30		
	avg	204 10	0.14 3	0.0006
β- 9	max	700 30		
	avg	234 10	0.20 6	0.0010
β-10	max	710 30		
	avg	239 10	0.180 20	0.0009
β-11	max	790 30		
	avg	268 11	0.56 6	0.0032
β-12	max	850 30		
	avg	294 11	0.70 7	0.0044
β-13	max	880 30		
	avg	307 11	0.50 5	0.0033
β-14	max	950 30		
	avg	336 11	0.45 6	0.0032
β-15	max	960 30		
	avg	341 11	0.20 3	0.0015
β-16	max	1030 30		
	avg	370 11	0.17 3	0.0013
β-17	max	1210 30		
	avg	446 11	0.34 5	0.0032
β-18	max	1210 30		
	avg	447 11	2.40 20	0.0229
β-19	max	1400 30		
	avg	528 12	1.50 20	0.0169
β-20	max	1460 30		
	avg	558 12	0.32 4	0.0038
β-21	max	1560 30		
	avg	600 12	2.10 20	0.0268
β-22	max	1570 30		
	avg	605 12	1.60 20	0.0206
β-23	max	1600 30		
	avg	620 12	2.00 20	0.0264
β-24	max	1680 30		
	avg	655 12	0.27 4	0.0038
β-25	max	1910 30		
	avg	761 12	0.70 20	0.0113
β-26	max	2060 30		
	avg	831 12	4.0 3	0.0708
β-27	max	2140 30		
	avg	867 12	0.28 4	0.0052
β-28	max	2150 30		
	avg	870 12	1.50 10	0.0278
β-29	max	2330 30		
	avg	955 13	14.7 9	0.299
β-30	max	2530 30		
	avg	1048 13	5.7 4	0.127
β-31	max	2540 30		
	avg	1054 13	0.31 4	0.0070
β-32	max	2560 30		
	avg	1064 13	0.20 3	0.0045
β-33	max	2710 30		
	avg	1134 13	0.23 3	0.0056

*** continued ***

89KR B- DECAY (3.17 M 2) (continued)

Radiation Type		Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β-34	max	2770 30		
	avg	1161 13	3.2 3	0.0791
β-35	max	2930 30		
	avg	1238 13	2.60 20	0.0686
β-36	max	3060 30		
	avg	1301 13	0.48 6	0.0133
β-37	max	3110 30		
	avg	1322 13	0.18 9	0.0051
β-38	max	3240 30		
	avg	1383 13	10.3 9	0.303
β-39	max	3400 30		
	avg	1461 13	2.9 3	0.0902
β-40	max	3590 30		
	avg	1552 13	0.64 10	0.0212
β-41	max	3610 30		
	avg	1559 13	3.7 4	0.123
β-42	max	3730 30		
	avg	1621 13	0.2	0.0069
β-43	max	3930 30		
	avg	1716 13	1.3 3	0.0475
β-44	max	4000 30		
	avg	1748 13	0.50 20	0.0186
β-45	max	4060 30		
	avg	1778 13	0.2 4	0.0076
β-46	max	4340 30		
	avg	1913 14	2.20 10	0.0896
β-47	max	4350 30		
	avg	1918 14	4.5 5	0.184
β-48	max	4430 30		
	avg	1956 14	1.2 6	0.0500
β-49	max	4710 30		
	avg	2088 14	1.4	0.0623
β-50	max	4930 30		
	avg	2196 14	21 4	0.982
total β-				
	avg	1336 18	101 5	2.87

6 weak β's omitted (ΣIβ = 0.35%)

X-ray	$K\alpha_2$	13.33580 2	0.186 16	≈0
X-ray	$K\alpha_1$	13.39530 2	0.36 3	0.0001
γ 1		196.2 5	0.22 11	0.0009
γ 2		197.5 3	1.86 18	0.0078
γ 3		205.03 20	0.13 3	0.0006
γ 4		220.90 7	20.4 16	0.0960
γ 6		264.11 10	0.67 6	0.0038
γ 12		338.20 10	0.35 4	0.0025
γ 13		345.03 10	1.20 11	0.0088
γ 14		356.06 7	4.2 4	0.0320
γ 15		364.88 10	0.92 8	0.0071
γ 16		369.30 10	1.41 12	0.0111
γ 18		402.25 20	0.32 4	0.0028
γ 19		411.42 10	2.61 20	0.0229
γ 21		438.08 10	0.98 8	0.0091
γ 22		466.13 10	0.82 8	0.0081
γ 24		490.76 20	0.33 5	0.0034
γ 25		497.5 3	6.8 7	0.0718
γ 26		498.6 4	1.16 22	0.0123
γ 30		557.30 20	0.163 19	0.0019
γ 31		576.96 10	5.8 5	0.0707
γ 32		585.80 7	16.9 13	0.210
γ 35		626.20 10	0.61 6	0.0082
γ 36		629.75 20	0.35 4	0.0047
γ 40		665.72 20	0.116 18	0.0016
γ 42		671.40 20	0.108 22	0.0015
γ 43		674.11 20	0.24 3	0.0034
γ 45		696.24 10	1.82 16	0.0269
γ 46		707.01 20	0.51 5	0.0076
γ 47		710.05 20	0.80 8	0.0120
γ 48		729.63 20	0.30 4	0.0047
γ 49		738.39 7	4.3 4	0.0674

*** continued ***

89KR B- DECAY (3.17 M 2) (continued)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
γ 50	747.4 3	0.12 3	0.0019
γ 52	762.9 3	0.41 9	0.0066
γ 53	762.9 3	0.94 14	0.0152
γ 54	776.49 20	1.14 20	0.0189
γ 56	826.75 10	0.78 8	0.0137
γ 57	835.53 10	1.12 11	0.0200
γ 58	857.37 15	0.29 3	0.0053
γ 59	867.08 7	6.0 5	0.112
γ 60	870.42 20	0.163 21	0.0030
γ 61	904.27 7	7.3 6	0.141
γ 63	930.95 10	0.63 6	0.0125
γ 66	944.19 15	0.167 19	0.0034
γ 67	953.18 20	0.108 18	0.0022
γ 68	960.42 10	0.33 4	0.0067
γ 71	974.39 10	1.00 9	0.0207
γ 72	997.37 10	0.67 6	0.0143
γ 73	1010.84 20	0.110 16	0.0024
γ 75	1044.40 10	0.42 4	0.0093
γ 80	1076.48 20	0.24 3	0.0055
γ 81	1088.07 10	0.37 4	0.0085
γ 83	1103.18 20	0.92 8	0.0216
γ 84	1107.78 10	2.98 25	0.0703
γ 85	1116.61 7	1.69 14	0.0403
γ 86	1131.51 20	0.163 25	0.0039
γ 88	1162.50 10	0.218 24	0.0054
γ 90	1172.33 20	1.00 10	0.0250
γ 91	1182.38 20	0.169 25	0.0043
γ 92	1186.54 20	0.188 21	0.0047
γ 96	1228.8 3	0.147 20	0.0038
γ 97	1235.62 10	0.61 6	0.0159
γ101	1273.73 10	1.39 11	0.0376
γ104	1302.6 3	0.102 16	0.0028
γ106	1324.28 7	3.12 25	0.0880
γ107	1335.4 3	0.13 3	0.0038
γ108	1340.6 3	0.20 3	0.0057
γ109	1367.48 20	0.151 20	0.0044
γ110	1372.16 20	0.129 18	0.0038
γ112	1412.59 15	0.27 3	0.0081
γ113	1421.64 20	0.23 5	0.0069
γ117	1461.3 5	0.12 3	0.0039
γ118	1464.2 3	0.18 3	0.0057
γ119	1468.5 3	0.19 3	0.0060
γ120	1472.76 10	7.0 6	0.220
γ123	1500.96 10	1.35 13	0.0430
γ124	1506.1 3	0.114 22	0.0037
γ125	1530.04 15	3.4 3	0.110
γ126	1533.68 15	5.2 4	0.171
γ127	1555.28 20	0.155 21	0.0051
γ128	1573.78 20	0.194 22	0.0065
γ131	1634.06 10	0.84 8	0.0291
γ132	1643.82 10	0.34 4	0.0121
γ134	1667.51 20	0.131 16	0.0046
γ135	1676.9 3	0.143 24	0.0051
γ137	1683.8 4	0.13 3	0.0048
γ138	1692.0 12	0.26 11	0.0094
γ139	1693.70 10	4.5 4	0.161
γ142	1721.29 15	0.228 23	0.0084
γ146	1777.60 10	0.78 8	0.0294
γ147	1788.2 3	0.108 18	0.0041
γ150	1810.73 20	0.143 18	0.0055
γ154	1837.5 4	0.12 3	0.0047
γ155	1839.72 25	0.36 4	0.0140
γ158	1868.47 25	0.200 22	0.0080
γ159	1879.80 25	0.161 19	0.0065
γ162	1903.40 10	1.06 12	0.0430
γ165	1939.11 15	0.65 6	0.0270
γ166	1966.55 20	0.135 16	0.0056
γ168	1998.6 5	0.120 24	0.0051
γ170	2012.23 10	1.59 14	0.0682
γ171	2021.04 15	0.249 25	0.0107
γ173	2046.47 15	0.267 25	0.0116
γ176	2100.63 8	0.96 8	0.0429

*** continued ***

89KR B- DECAY (3.17 M 2) (continued)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
γ180	2160.02 9	0.54 5	0.0248
γ183	2195.8 4	0.13 6	0.0061
γ186	2280.2 3	0.21 5	0.0101
γ190	2377.4 9	0.82 8	0.0413
γ191	2400.99 9	0.73 8	0.0376
γ201	2597.92 20	0.110 18	0.0061
γ203	2645.26 15	0.43 4	0.0241
γ208	2750.9 3	0.126 16	0.0074
γ212	2782.11 10	0.78 8	0.0459
γ214	2793.75 20	0.69 6	0.0413
γ216	2819.58 25	0.135 18	0.0081
γ217	2853.3 3	0.24 4	0.0149
γ218	2866.23 10	1.77 14	0.108
γ220	2878.69 25	0.33 4	0.0203
γ224	3017.9 3	0.26 4	0.0167
γ225	3029.16 25	0.28 3	0.0178
γ228	3107.26 25	0.198 22	0.0131
γ229	3140.26 20	1.06 10	0.0710
γ232	3172.1 3	0.102 16	0.0069
γ234	3219.84 20	0.44 4	0.0299
γ243	3361.70 20	1.06 10	0.0760
γ244	3371.1 4	0.63 7	0.0454
γ245	3399.9 3	0.139 17	0.0100
γ249	3532.88 20	1.37 11	0.103
γ251	3583.9 3	0.263 25	0.0201
γ258	3717.8 4	0.86 8	0.0678
γ260	3732.5 6	0.14 6	0.0112
γ262	3781.4 4	0.135 15	0.0108
γ264	3827.4 4	0.141 18	0.0115
γ266	3842.7 4	0.112 14	0.0092
γ269	3901.7 4	0.137 22	0.0114
γ270	3923.0 4	0.42 4	0.0353
γ271	3965.5 4	0.212 20	0.0179
γ272	3977.5 4	0.28 6	0.0233
γ274	3996.0 4	0.145 15	0.0123
γ277	4048.0 5	0.118 14	0.0102
γ290	4341.1 6	0.106 12	0.0098
γ295	4489.2 8	0.137 15	0.0131

159 weak γ's omitted (ΣIγ = 7.26%)

89RB B-DECAY (15.2 M 1) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	978 12		
avg	346 5	1.55 13	0.0114
β- 2 max	1259 12		
avg	467 5	33 3	0.328
β- 3 max	1779 12		
avg	711 6	2.23 13	0.0338
β- 4 max	1916 12		
avg	761 5	3.1 9	0.0502
β- 5 max	2206 12		
avg	895 5	35 4	0.667
β- 6 max	2428 12		
avg	999 5	0.50 13	0.0106
β- 7 max	2479 12		
avg	1023 5	0.47 21	0.0102
β- 8 max	2546 12		
avg	1054 5	0.22 4	0.0049
β- 9 max	3013 12		
avg	1277 6	0.25 5	0.0068
β-10 max	3455 12		
avg	1485 5	1 4	0.0316
β-11 max	4486 12		
avg	1979 6	24 5	1.01
total β-			
avg	1001 7	102 9	2.17

7 weak β's omitted (ΣIβ = 0.38%)

γ 3	272.45 10	1.44 12	0.0084
γ 4	289.76 10	0.55 10	0.0034
γ 8	657.71 7	10.1 9	0.142
γ 10	766.79 15	0.165 21	0.0027
γ 14	947.69 7	9.4 8	0.189
γ 16	1025.3 5	0.23 9	0.0050
γ 17	1031.88 7	59 6	1.30
γ 23	1220.32 10	0.224 24	0.0058
γ 24	1228.40 15	0.124 20	0.0032
γ 26	1248.10 7	43 4	1.15
γ 29	1473.22 20	0.36 4	0.0113
γ 30	1501.07 20	0.201 23	0.0064
γ 31	1538.08 10	2.60 25	0.0850
γ 35	1940.2 3	0.34 4	0.0139
γ 37	2007.54 10	2.42 25	0.103
γ 38	2058.0 11	0.24 9	0.0103
γ 40	2196.00 15	13.6 13	0.635
γ 42	2280.06 10	0.183 22	0.0089
γ 45	2570.14 10	10.0 9	0.549
γ 48	2707.20 10	2.06 19	0.119
γ 57	3508.84 25	1.17 11	0.0873

41 weak γ's omitted (ΣIγ = 1.20%)

89SR B-DECAY (50.5 D 1) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	1488 4		
avg	581.5 15	99.985 5	1.24

1 weak β's omitted (ΣIβ = 0.02%)

1 weak γ's omitted (ΣIγ = 0.02%)

90SR B- DECAY (28.5 Y 8) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	546.0 20		
avg	195.8 8	100	0.417

90Y B- DECAY (64.0 H 1) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	2284 4		
avg	934.8 18	99.984 3	1.99

1 weak β's omitted (ΣIβ = 0.02%)

94NB B- DECAY (2.03E4 Y 16) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	471 3		
avg	145.6 10	100	0.310
γ 1	702.627 19	100	1.50
γ 2	871.099 18	100	1.86

94NB IT DECAY (6.26 M 1) I(min)=0.10%

%IT=99.52 10
SEE ALSO 94NB B- DECAY (6.26 M)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	2.15	91 4	0.0042
Auger-K	14	14.5 19	0.0043
ce-K- 1	22.5 5	57.622	0.0276
ce-L- 1	38.8 5	33.34	0.0276
ce-M- 1	41.0 5	6.37	0.0056
ce-NOP- 1	41.4 5	2	0.0018
X-ray L	2.17	2.8 10	0.0001
X-ray $K\alpha_2$	16.52100 2	12.4 6	0.0044
X-ray $K\alpha_1$	16.61510 2	23.8 11	0.0084
X-ray Kβ	18.6	6.9 4	0.0027

1 weak γ's omitted (ΣIγ = 0.08%)

94NB B- DECAY (6.26 M 1) I(min)=0.10%

%B-=0.48 10
SEE ALSO 94NB IT DECAY (6.26 M)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	1214 3		
avg	443.7 12	0.48 10	0.0045
γ 2	871.099 18	0.48 10	0.0089

97ZR B- DECAY (16.90 H 5) I(min)=0.10%

SEE ALSO 97NB IT DECAY

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	418 16		
avg	127 6	0.41 4	0.0011
β- 2 max	558 16		
avg	178 6	5.5 3	0.0209
β- 3 max	901 16		
avg	312 6	2.10 20	0.0140
β- 4 max	915 16		
avg	318 7	0.4 3	0.0027
β- 5 max	1012 16		
avg	359 7	0.120 20	0.0009
β- 6 max	1117 16		
avg	403 7	0.45 7	0.0039
β- 7 max	1117 16		
avg	403 7	0.65 7	0.0056
β- 8 max	1389 16		
avg	521 7	0.21 11	0.0023
β- 9 max	1414 16		
avg	532 7	4.1 5	0.0465
β-10 max	1922 16		
avg	760 8	86.0 7	1.39
total β-			
avg	700 9	99.9 10	1.49
γ 3	218.87 20	0.176 19	0.0008
γ 4	254.15 20	1.25 14	0.0068
γ 5	272.27 20	0.25 4	0.0015
γ 8	330.43 20	0.11 3	0.0008
γ 9	355.39 10	2.27 24	0.0172
γ 10	400.39 20	0.32 5	0.0028
γ 11	507.63 10	5.1 6	0.0547
γ 12	513.38 20	0.56 10	0.0061
γ 13	602.41 20	1.39 14	0.0179
γ 14	690.63 20	0.25 4	0.0037
γ 15	699.2 3	0.121 19	0.0018
γ 16	703.80 10	0.93 10	0.0139
γ 18	804.53 10	0.65 7	0.0111
γ 19	829.80 10	0.223 19	0.0039
γ 20	854.90 10	0.33 4	0.0061
γ 21	971.39 10	0.29 3	0.0059
γ 22	1021.3 3	1.34 14	0.0293
γ 23	1110.45 20	0.111 19	0.0026
γ 24	1147.95 10	2.6 3	0.0646
γ 25	1276.09 10	0.97 10	0.0265
γ 26	1362.66 10	1.34 14	0.0390
γ 27	1750.46 10	1.34 14	0.0501
γ 28	1851.55 10	0.35 4	0.0139

5 weak γ's omitted (ΣIγ = 0.21%)

97 NB B- DECAY (72.1 M 7) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	2.27	0.180 13	≈0
ce-K- 5	637.92 10	0.182 7	0.0025
β- 1 max	305 16		
avg	89 6	0.120 20	0.0002
β- 2 max	418 16		
avg	127 6	0.170 20	0.0005
β- 3 max	665 16		
avg	218 6	0.210 20	0.0010
β- 4 max	910 16		
avg	315 6	1.10 10	0.0074
β- 5 max	1276 16		
avg	470 7	98.30 10	0.984
total β-			
avg	467 7	99.99 15	0.994

1 weak β's omitted (ΣIβ = 0.09%)

γ 3	480.9	0.148 20	0.0015
γ 5	657.92 10	98.34 11	1.38
γ 12	1268.63 10	0.157 20	0.0043
γ 13	1515.64 20	0.118 20	0.0038

10 weak γ's omitted (ΣIγ = 0.49%)

97NB IT DECAY (60 S 1) I(min)=0.10%

FEEDING OF 97MNB IN 97ZR DECAY=94.6% 9

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	2.15	1.99 12	≈0
Auger-K	14	0.44 6	0.0001
ce-K- 1	724.37 10	1.74 5	0.0268
ce-L- 1	740.66 10	0.225 7	0.0035
X-ray $K\alpha_2$	16.52100 2	0.375 20	0.0001
X-ray $K\alpha_1$	16.61510 2	0.72 4	0.0003
X-ray Kβ	18.6	0.207 12	≈0
γ 1	743.36 10	97.95 6	1.55

97RU EC DECAY (2.9 D 1) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	2.17	97 6	0.0045
Auger-K	15.5	20 3	0.0065
ce-K- 5	194.64 4	2.94 10	0.0122
ce-L- 5	212.64 4	0.361 19	0.0016
ce-K- 6	303.51 7	0.173 8	0.0011
X-ray L	2.42	4.6 16	0.0002
X-ray $K\alpha_2$	18.2508 8	20.0 9	0.0078
X-ray $K\alpha_1$	18.3671 8	38.3 17	0.0150
X-ray Kβ	20.6	11.5 6	0.0050
γ 2	108.80 4	0.108 12	0.0003
γ 5	215.68 4	86.0 4	0.395
γ 6	324.55 7	10.2 4	0.0705
γ 7	460.55 5	0.117 5	0.0011
γ 11	569.27 5	0.89 4	0.0108

14 weak γ's omitted (ΣIγ = 0.34%)

99MO B-DECAY (66.0 H 2) I(min)=0.10%

SEE ALSO 99TC IT DECAY (6.02 H)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	2.17	6.2 5	0.0003
Auger-K	15.5	1.27 20	0.0004
ce-K- 2	19.5400 22	4.4 4	0.0018
ce-L- 2	37.5415 21	0.53 4	0.0004
ce-MNO- 2	40.0400 23	0.127 11	0.0001
ce-K- 3	119.465 3	0.57 5	0.0014
ce-K- 6	160.023 7	0.82 3	0.0028
ce-L- 6	178.024 7	0.123 5	0.0005
β- 1 max	215.2 10		
avg	59.9 3	0.113 5	0.0001
β- 2 max	352.9 10		
avg	104.3 4	0.142 6	0.0003
β- 3 max	436.4 10		
avg	133.1 4	17.6 5	0.0499
β- 4 max	847.9 10		
avg	289.7 4	1.33 6	0.0082
β- 5 max	1214.3 10		
avg	442.8 4	80.7 8	0.761
total β- avg	385.1 5	99.9 10	0.820

6 weak β's omitted (ΣIβ = 0.06%)

X-ray L	2.42	0.29 10	≈0
X-ray $K\alpha_2$	18.2508 8	1.29 9	0.0005
X-ray $K\alpha_1$	18.3671 8	2.46 17	0.0010
X-ray Kβ	20.6	0.74 6	0.0003
γ 2	40.5840 20	1.36 10	0.0012
γ 3	140.509 3	5.7 5	0.0171
γ 6	181.067 7	6.52 19	0.0252
γ 9	366.439 14	1.37 6	0.0107
γ 21	739.48 4	13.0 4	0.204
γ 23	777.88 3	4.62 19	0.0766
γ 24	822.98 3	0.140 6	0.0024
γ 26	960.69 3	0.101 5	0.0021

21 weak γ's omitted (ΣIγ = 0.15%)

99TC IT DECAY (6.02 H 3) I(min)=0.10%

FEEDING OF 99MTC IN 99MO DECAY=86.8% 9

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
ce-M- 1	1.630 5	86.82 16	0.0030
ce-NOP- 1	2.106 5	12.18 20	0.0005
Auger-L	2.17	10.4 7	0.0005
Auger-K	15.5	2.1 4	0.0007
ce-K- 2	119.465 3	8.8 3	0.0224
ce-K- 3	121.59 3	0.71 4	0.0018
ce-L- 2	137.466 3	1.06 4	0.0031
ce-L- 3	139.59 3	0.219 14	0.0007
ce-M- 2	139.965 4	0.196 10	0.0006
X-ray L	2.42	0.49 17	≈0
X-ray $K\alpha_2$	18.2508 8	2.13 12	0.0008
X-ray $K\alpha_1$	18.3671 8	4.06 22	0.0016
X-ray Kβ	20.6	1.22 7	0.0005
γ 2	140.509 3	88.96 24	0.266

2 weak γ's omitted (ΣIγ = 0.02%)

103RU B- DECAY (39.35 D 5) I(min)=0.10%

SEE ALSO 103RH IT DECAY (56.12 M)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	2.39	0.98 9	≈0
Auger-K	17	0.20 4	≈0
ce-K- 3	30.065 5	0.66 7	0.0004
ce-K- 13	473.860 10	0.397 13	0.0040
β- 1 max	112 4		
avg	29.5 10	6.0 3	0.0038
β- 2 max	225 4		
avg	62.8 11	87.1 15	0.117
β- 3 max	467 4		
avg	143.4 13	0.231 10	0.0007
β- 4 max	669 4		
avg	218.1 14	0.10	0.0005
β- 5 max	722 4		
avg	238.7 14	6 3	0.0325
total β- avg	72.4 13	100 4	0.154

3 weak β's omitted (ΣIβ = 0.10%)

X-ray $K\alpha_2$	20.07370 2	0.244 19	0.0001
X-ray $K\alpha_1$	20.21610 2	0.46 4	0.0002
X-ray Kβ	22.7	0.145 11	≈0
γ 3	53.285 5	0.36 4	0.0004
γ 9	294.980 10	0.242 11	0.0015
γ 12	443.800 10	0.311 11	0.0029
γ 13	497.080 10	86.4 24	0.915
γ 15	557.040 20	0.76 3	0.0090
γ 17	610.330 10	5.3 3	0.0685

13 weak γ's omitted (ΣIγ = 0.12%)

103RH IT DECAY (56.12 M 1) I(min)=0.10%

FEEDING OF 103MRH IN 103RU DECAY=99.75% 1
FEEDING OF 103MRH IN 103PD DECAY=99.975% 1

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	2.39	76.6 15	0.0039
ce-K- 1	16.530 7	9.5 3	0.0033
Auger-K	17	1.8 3	0.0007
ce-L- 1	36.338 7	71.290 10	0.0552
ce-M- 1	39.123 7	14.4 4	0.0120
ce-NOP- 1	39.669 7	4.70 20	0.0040
X-ray L	2.7	4.0 13	0.0002
X-ray $K\alpha_2$	20.07370 2	2.19 12	0.0009
X-ray $K\alpha_1$	20.21610 2	4.17 21	0.0018
X-ray Kβ	22.7	1.30 7	0.0006

1 weak γ's omitted (ΣIγ = 0.07%)

103PD EC DECAY (17.5 D 4) I(min)=0.10%

SEE ALSO 103RH IT DECAY (56.12 M)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	2.39	91 6	0.0046
Auger-K	17	17 3	0.0060
X-ray L	2.7	4.8 16	0.0003
X-ray $K\alpha_2$	20.07370 2	19.9 9	0.0085
X-ray $K\alpha_1$	20.21610 2	37.7 15	0.0163
X-ray Kβ	22.7	11.7 5	0.0057

9 weak γ's omitted (ΣIγ = 0.03%)

108AG EC DECAY (127 Y 21) I(min)=0.10%

%EC=91.1 6
SEE ALSO 108AG IT DECAY (127 Y)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	2.5	82 5	0.0043
Auger-K	17.7	14.2 24	0.0053
ce-K- 1	409.582 14	0.713 14	0.0062
ce-L- 1	430.328 14	0.144 3	0.0013
ce-K- 2	590.02 10	0.263 5	0.0033
ce-K- 3	698.60 8	0.173 4	0.0026
X-ray L	2.84	4.8 17	0.0003
X-ray $K\alpha_2$	21.02010 2	18.3 8	0.0082
X-ray $K\alpha_1$	21.17710 2	34.7 14	0.0157
X-ray Kβ	23.8	11.0 5	0.0056
γ 1	433.932 14	90.3 6	0.834
γ 2	614.37 10	90.8 6	1.19
γ 3	722.95 8	90.9 6	1.40

108AG EC DECAY (2.37 M 1) I(min)=0.10%

%(EC+B+)=2.35 32
SEE ALSO 108AG B- DECAY (2.37 M)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	2.5	1.74 15	≈0
Auger-K	17.7	0.31 6	0.0001
β+ 2 max	901 11		
avg	401 5	0.245 20	0.0021
total β+ avg	399 5	0.248 20	0.0021
X-ray L	2.84	0.10 4	≈0
X-ray $K\alpha_2$	21.02010 2	0.40 3	0.0002
X-ray $K\alpha_1$	21.17710 2	0.75 6	0.0003
X-ray Kβ	23.8	0.240 19	0.0001
γ 3	433.932 14	0.50 9	0.0046
γ 6	618.86 5	0.26 5	0.0035

10 weak γ's omitted (ΣIγ = 0.03%)
Maximum γ±-intensity = 0.50%

108AG IT DECAY (127 Y) I(min)=0.10%

%IT=8.9 6
SEE ALSO 108AG EC DECAY (127 Y)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	2.6	8.17 22	0.0005
ce-K- 1	4.87 6	0.231 9	≈0
Auger-K	18.5	0.35 6	0.0001
ce-L- 1	26.57 6	6.50 6	0.0037
ce-MNO- 1	29.66 6	2.16 5	0.0014
ce-K- 2	53.69 5	1.84 5	0.0021
ce-L- 2	75.39 5	0.231 9	0.0004
X-ray L	3	0.55 19	≈0
X-ray $K\alpha_2$	21.9903 3	0.491 20	0.0002
X-ray $K\alpha_1$	22.16290 1	0.93 4	0.0004
X-ray Kβ	24.9	0.300 13	0.0002
γ 2	79.20 5	6.8 5	0.0114

108AG B- DECAY (2.37 M 1) I(min)=0.10%

%B-=97.65 32
SEE ALSO 108AG EC DECAY (2.37 M)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	1017 8		
avg	356 4	1.75 10	0.0133
β- 2 max	1650 8		
avg	629 4	95.9 3	1.28
total β- avg	624 4	97.6 4	1.30
γ 1	632.98 5	1.75 17	0.0236

109CD EC DECAY (453 D 2) I(min)=0.10%

RADIATIONS FROM 39.6-S 109MAG
ARE INCLUDED IN THIS DATA SET

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	2.6	166 7	0.0092
Auger-K	18.5	21 3	0.0082
ce-K- 1	62.523 5	41.9	0.0558
ce-L- 1	84.231 5	44	0.0789
ce-M- 1	87.319 5	9.0 3	0.0167
ce-NOP- 1	87.942 5	1.60 5	0.0030
X-ray L	3	11 4	0.0007
X-ray $K\alpha_2$	21.9903 3	29.1 10	0.0136
X-ray $K\alpha_1$	22.16290 1	55.1 18	0.0260
X-ray $K\beta$	24.9	17.8 7	0.0094
γ 1	88.037 5	3.72 11	0.0070

109PD B- DECAY (13.46 H 2) I(min)=0.10%

RADIATIONS FROM 39.6-S 109MAG
ARE INCLUDED IN THIS DATA SET

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	2.6	79 3	0.0044
Auger-K	18.5	7.1 11	0.0028
ce-K- 2	62.523 5	41.878222	0.0558
ce-L- 2	84.231 5	44	0.0789
ce-M- 2	87.319 5	9.0 3	0.0167
ce-NOP- 2	87.942 5	1.60 5	0.0030
β- 1 max	1028.0 20		
avg	361.0 9	99.900 10	0.768

11 weak β's omitted (ΣIβ = 0.11%)

X-ray L	3	5.3 18	0.0003
X-ray $K\alpha_2$	21.9903 3	9.9 4	0.0046
X-ray $K\alpha_1$	22.16290 1	18.8 6	0.0089
X-ray $K\beta$	24.9	6.06 22	0.0032
γ 2	88.037 5	3.7 4	0.0070

29 weak γ's omitted (ΣIγ = 0.13%)

110AG EC DECAY (24.6 S 2) I(min)=0.10%

%EC=0.30 6
SEE ALSO 110AG B- DECAY (24.6 S)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	2.5	0.23 5	≈0
X-ray $K\alpha_1$	21.17710 2	0.115 24	≈0

110AG B- DECAY (24.6 S 2) I(min)=0.10%

%B-=99.70 6
SEE ALSO 110AG EC DECAY (24.6 S)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	2234.9 20		
avg	894.0 10	4.4 3	0.0838
β- 2 max	2892.7 20		
avg	1199.3 10	95.2 3	2.43
total β- avg	1185.1 10	99.7 5	2.52

9 weak β's omitted (ΣIβ = 0.09%)

γ 2	657.749 10	4.50 23	0.0630

12 weak γ's omitted (ΣIγ = 0.10%)

110AG IT DECAY (250.8 D 3) I(min)=0.10%

%IT=1.33 10
SEE ALSO 110AG B- DECAY (250.8 D)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
ce-M- 1	0.56 10	1.0	≈0
ce-NOP- 1	1.18 10	0.3325	≈0
Auger-L	2.6	1.11 5	≈0
Auger-K	18.5	0.141 21	≈0
ce-K- 2	90.97 5	0.827 10	0.0016
ce-L- 2	112.67 5	0.394 8	0.0009
X-ray $K\alpha_2$	21.9903 3	0.196 7	≈0
X-ray $K\alpha_1$	22.16290 1	0.371 13	0.0002
X-ray $K\beta$	24.9	0.120 5	≈0

110AG B- DECAY (250.8 D 3) I(min)=0.10%

%B-=98.67 10
SEE ALSO 110AG IT DECAY (250.8 D)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	82.5 20		
avg	21.5 6	67.5 9	0.0309
β- 2 max	132.4 20		
avg	35.3 6	0.408 12	0.0003
β- 3 max	529.3 20		
avg	165.1 8	30.7 8	0.108
total β- avg	66.3 14	98.8 12	0.140

4 weak β's omitted (ΣIβ = 0.18%)

*** continued ***

110AG B- DECAY (250.8 D 3) (continued)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
γ 12	365.441 15	0.106 9	0.0008
γ 17	446.797 8	3.69 9	0.0351
γ 23	620.346 11	2.79 8	0.0368
γ 24	626.246 10	0.235 7	0.0031
γ 26	657.749 10	94.65 16	1.33
γ 27	676.60 10	0.142 19	0.0020
γ 28	677.606 11	10.6 3	0.153
γ 29	686.988 11	6.47 14	0.0947
γ 30	706.670 13	16.4 4	0.247
γ 31	708.115 20	0.28 10	0.0043
γ 32	744.260 13	4.67 11	0.0740
γ 33	763.928 13	22.4 5	0.364
γ 35	818.016 12	7.30 17	0.127
γ 36	884.667 13	73.0 16	1.38
γ 37	937.478 13	34.4 8	0.687
γ 39	997.233 18	0.125 5	0.0027
γ 49	1334.304 17	0.133 10	0.0038
γ 50	1384.270 13	24.7 6	0.729
γ 52	1475.759 22	4.02 9	0.126
γ 53	1505.001 21	13.3 3	0.425
γ 54	1562.266 22	1.19 4	0.0397

40 weak γ's omitted (ΣIγ = 0.92%)

111AG B- DECAY (7.45 D 1) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	2.72	0.17 4	*0
β- 1 max	168.5 20		
avg	45.7 6	≈0.3	≈0.0003
β- 2 max	693.0 20		
avg	226.2 8	6.3 15	0.0304
β- 3 max	790.0 20		
avg	281.8 8	1.0 3	0.0060
β- 4 max	1035.0 20		
avg	363.3 9	92.0 20	0.712
total β- avg	352.8 10	100 3	0.749
γ 1	96.74 4	0.13 5	0.0003
γ 2	245.39 3	1.1 4	0.0056
γ 4	342.21 5	6.0 15	0.0437

5 weak γ's omitted (ΣIγ = 0.02%)

111IN EC DECAY (2.83 D 1) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	2.72	100 6	0.0058
Auger-K	19.3	16 3	0.0064
ce-K- 1	144.57 3	7.89 23	0.0243
ce-L- 1	167.26 3	0.96 4	0.0034
ce-MNO- 1	170.51 3	0.222 11	0.0008
ce-K- 2	218.68 3	4.94 11	0.0230
ce-L- 2	241.37 3	0.725 14	0.0037
ce-MNO- 2	244.62 3	0.158 8	0.0008
X-ray L	3.13	7.0 24	0.0005
X-ray $K\alpha_2$	22.98410 2	23.5 9	0.0115
X-ray $K\alpha_1$	23.17360 2	44.3 16	0.0219
X-ray Kβ	26	14.5 6	0.0081
γ 1	171.28 3	90.93 22	0.332
γ 2	245.39 3	94.17 11	0.492

113IN IT DECAY (1.658 H 1) I(min)=0.10%

FEEDING OF 113MIN IN 113SN DECAY=100%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	2.84	29.7 18	0.0018
Auger-K	20	4.2 9	0.0018
ce-K- 1	363.748 10	28.2 3	0.218
ce-L- 1	387.450 10	5.48 7	0.0452
ce-M- 1	390.862 10	1.100 10	0.0092
ce-NOP- 1	391.566 10	0.245 3	0.0020
X-ray L	3.29	2.3 8	0.0002
X-ray $K\alpha_2$	24.00200 2	6.8 3	0.0035
X-ray $K\alpha_1$	24.20970 2	12.9 5	0.0066
X-ray Kβ	27.3	4.27 18	0.0025
γ 1	391.688 10	64.90 20	0.541

113SN EC DECAY (114.9 D 1) I(min)=0.10%

SEE ALSO 113IN IT DECAY (1.658 H)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	2.84	85 6	0.0052
Auger-K	20	12.8 25	0.0055
X-ray L	3.29	6.7 23	0.0005
X-ray $K\alpha_2$	24.00200 2	20.7 8	0.0106
X-ray $K\alpha_1$	24.20970 2	39.0 14	0.0201
X-ray Kβ	27.3	13.0 5	0.0075
γ 1	255.115 15	2.12 7	0.0115

115IN IT DECAY (4.3 H 1) I(min)=0.10%

%IT=96.3 8
SEE ALSO 115IN B- DECAY (4.3 H)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	2.84	43 3	0.0026
Auger-K	20	6.0 12	0.0026
ce-K- 1	308.30 3	39.9 6	0.262
ce-L- 1	332.00 3	8.38 20	0.0592
ce-M- 1	335.42 3	1.70 5	0.0122
ce-NOP- 1	336.12 3	0.376 10	0.0027
X-ray L	3.29	3.3 12	0.0002
X-ray $K\alpha_2$	24.00200 2	9.7 4	0.0049
X-ray $K\alpha_1$	24.20970 2	18.2 7	0.0094
X-ray $K\beta$	27.3	6.0 3	0.0035
γ 1	336.241 25	46.7 6	0.335

115IN B- DECAY (4.3 H 1) I(min)=0.10%

%B-=3.7 8
SEE ALSO 115IN IT DECAY (4.3 H)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	829 9		
avg	290 3	3.7 8	0.0229

1 weak β's omitted (ΣIβ = 0.04%)

116IN B- DECAY (54.15 M 6) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3	0.73 10	*0
Auger-K	21	0.12 3	*0
ce-K- 4	109.126 8	0.86 11	0.0020
β- 1 max	174 8		
avg	87 3	0.33 4	0.0006
β- 2 max	224 8		
avg	103 3	2.71 10	0.0059
β- 3 max	470 8		
avg	189 3	10.2 4	0.0411
β- 4 max	742 8		
avg	294 4	33.6 15	0.210
β- 5 max	880 8		
avg	351 4	51.8 11	0.387
total β- avg	307 4	98.6 19	0.645

*** continued ***

116IN B- DECAY (54.15 M 6) (continued)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
X-ray $K\alpha_2$	25.04400 2	0.21 3	0.0001
X-ray $K\alpha_1$	25.27130 2	0.39 5	0.0002
X-ray $K\beta$	28.5	0.133 17	*0
γ 4	138.326 8	3.29 12	0.0097
γ 8	262.95 8	0.12 3	0.0007
γ 10	278.49 8	0.143 17	0.0009
γ 11	303.80 7	0.118 17	0.0008
γ 13	355.36 4	0.83 5	0.0063
γ 14	416.86 3	29.2 15	0.259
γ 17	463.14 12	0.83 5	0.0082
γ 22	655.7 4	0.11 5	0.0015
γ 24	689.0 3	0.16 3	0.0024
γ 25	705.7 3	0.17 3	0.0025
γ 28	781.1 8	0.110 21	0.0018
γ 29	818.70 20	11.5 5	0.200
γ 32	972.55 3	0.454 17	0.0094
γ 34	1097.30 20	56.2 12	1.31
γ 37	1293.54 4	84.4 18	2.33
γ 38	1507.40 20	10.0 4	0.320
γ 40	1753.8 6	2.46 8	0.0917
γ 42	2112.1 4	15.5 5	0.699

25 weak γ's omitted (ΣIγ = 1.02%)

117SN IT DECAY (14.0 D 3) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3	91 5	0.0057
Auger-K	21	10.8 22	0.0048
ce-K- 1	126.82 3	64.8 7	0.175
ce-K- 2	129.362 15	11.7 3	0.0322
ce-L- 1	151.56 3	26.1 11	0.0843
ce-L- 2	154.097 15	1.48 4	0.0049
ce-M- 1	155.14 3	5.7 3	0.0188
ce-NOP- 1	155.88 3	1.35 6	0.0045
ce-MNO- 2	157.678 15	0.350 10	0.0012
X-ray L	3.44	8 3	0.0006
X-ray $K\alpha_2$	25.04400 2	18.7 7	0.0100
X-ray $K\alpha_1$	25.27130 2	35.1 13	0.0189
X-ray $K\beta$	28.5	11.8 5	0.0072
γ 1	156.02 3	2.11 7	0.0070
γ 2	158.562 15	86.3 4	0.291

117SB EC DECAY (2.82 H 5) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3	12.1 7	0.0008
Auger-K	21	1.8 4	0.0008
ce-K- 1	129.362 15	11.68 21	0.0322
ce-L- 1	154.097 15	1.46 3	0.0048
ce-MNO- 1	157.678 15	0.4896 2	0.0016

*** continued ***

117SB EC DECAY (2.82 H 5) (continued)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β+ 1 max	564 18		
avg	258 8	1.7 3	0.0093
X-ray L	3.44	1.1 4	≈0
X-ray Kα2	25.04400 2	3.07 13	0.0016
X-ray Kα1	25.27130 2	5.75 22	0.0031
X-ray Kβ	28.5	1.94 8	0.0012
γ 1	158.562 15	85.9 4	0.290
γ 4	861.35 5	0.31 4	0.0057
γ 5	1004.51 15	0.21 3	0.0044
γ 6	1020.6 5	0.103 18	0.0022
γ 7	1021.0 5	0.112 18	0.0024

7 weak γ's omitted (ΣIγ = 0.26%)
Maximum γ±-intensity = 3.40%

119SN IT DECAY (245 D 20) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3	137 5	0.0086
ce-L- 1	19.410 10	67.4 7	0.0279
Auger-K	21	4.5 9	0.0020
ce-M- 1	22.991 10	13.2 4	0.0065
ce-NOP- 1	23.738 10	3.40 10	0.0017
ce-K- 2	36.460 10	32.0 6	0.0249
ce-L- 2	61.195 10	52.20 10	0.0680
ce-M- 2	64.776 10	12.8 3	0.0177
ce-NOP- 2	65.523 10	3.00 10	0.0042
X-ray L	3.44	12 4	0.0009
γ 1	23.875 10	16.2 4	0.0082
X-ray Kα2	25.04400 2	7.8 4	0.0042
X-ray Kα1	25.27130 2	14.7 6	0.0079
X-ray Kβ	28.5	4.96 21	0.0030

1 weak γ's omitted (ΣIγ = 0.06%)

121TE EC DECAY (17 D 1) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3	85 5	0.0055
ce-K- 1	6.659 20	1.3 3	0.0002
Auger-K	21.8	11.6 25	0.0054
ce-L- 1	32.452 20	0.17 4	0.0001
ce-K- 2	35.089 20	0.58 12	0.0004
ce-K- 4	477.05 5	0.140 10	0.0014
ce-K- 5	542.59 5	0.371 8	0.0043
X-ray L	3.6	8 3	0.0006
X-ray Kα2	26.11080 2	21.5 8	0.0119
X-ray Kα1	26.35910 2	40.2 14	0.0226
X-ray Kβ	29.7	13.8 6	0.0087
γ 1	37.150 20	0.14 3	0.0001
γ 2	65.580 20	0.31 6	0.0004
γ 3	470.39 5	1.5 3	0.0150
γ 4	507.54 5	19.4 10	0.210
γ 5	573.08 5	79.0 10	0.964

121TE EC DECAY (154 D 7) I(min)=0.10%

%EC=11 4
SEE ALSO 121TE IT DECAY (154 D)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3	17 3	0.0011
ce-K- 1	6.659 20	8.5 10	0.0012
Auger-K	21.8	2.4 7	0.0011
ce-L- 1	32.452 20	1.09 13	0.0008
ce-MNO- 1	36.206 20	0.30 4	0.0002
X-ray L	3.6	1.6 6	0.0001
X-ray Kα2	26.11080 2	4.4 8	0.0024
X-ray Kα1	26.35910 2	8.2 14	0.0046
X-ray Kβ	29.7	2.8 5	0.0018
γ 1	37.150 20	0.89 10	0.0007
γ 3	910.1 10	0.16 4	0.0031
γ 4	998.3 10	0.16 4	0.0034
γ 5	1102.1 10	2.70 10	0.0634

1 weak γ's omitted (ΣIγ = 0.02%)

121TE IT DECAY (154 D 7) I(min)=0.10%

%IT=89 4
SEE ALSO 121TE EC DECAY (154 D)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3.19	74 7	0.0050
Auger-K	22.7	5.3 13	0.0025
ce-K- 1	49.966 20	36 5	0.0381
ce-L- 1	76.841 20	42 5	0.0687
ce-MNO- 1	80.774 20	12.9 18	0.0222
ce-K- 2	180.40 3	6.2 4	0.0239
ce-L- 2	207.27 3	0.81 5	0.0036
ce-MNO- 2	211.20 3	0.22 3	0.0010
X-ray L	3.77	7 3	0.0006
X-ray Kα2	27.20170 2	10.5 12	0.0061
X-ray Kα1	27.47230 2	19.5 21	0.0114
X-ray Kβ	31	6.8 8	0.0045
γ 2	212.21 3	82 4	0.371

1 weak γ's omitted (ΣIγ = 0.06%)

122SB EC DECAY (2.70 D 1) I(min)=0.10%

%EC=2.4 2
SEE ALSO 122SB B- DECAY

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3	2.00 20	0.0001
Auger-K	21	0.29 7	0.0001
X-ray L	3.44	0.17 7	≈0
X-ray Kα2	25.04400 2	0.50 5	0.0003
X-ray Kα1	25.27130 2	0.93 10	0.0005
X-ray Kβ	28.5	0.32 4	0.0002
γ 1	1140.20 10	0.57 3	0.0138

122SB B- DECAY (2.70 D 1) I(min)=0.10%

%B-=97.6 2
SEE ALSO 122SB EC DECAY

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3.19	0.35 3	≈0
ce-K- 1	532.19 20	0.356 19	0.0040
β- 1 max	720		
avg	236.5 12	4.7 5	0.0237
β- 2 max	1400		
avg	522.2 14	67.3 3	0.749
β- 3 max	1981 4		
avg	772.0 15	25.6 3	0.421
total β-			
avg	573.9 15	97.6 7	1.19

2 weak β's omitted (ΣIβ = 0.02%)

X-ray Kα1	27.47230 2	0.171 11	0.0001
γ 1	564.00 20	71 4	0.855
γ 2	692.6	3.92 22	0.0578
γ 5	1257	0.78 4	0.0208

3 weak γ's omitted (ΣIγ = 0.02%)

123I EC DECAY (13.2 H 1) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3.19	95 6	0.0064
Auger-K	22.7	12 3	0.0060
ce-K- 1	127.19 3	14.1 5	0.0382
ce-L- 1	154.06 3	1.90 9	0.0062
ce-MNO- 1	157.99 3	0.41 5	0.0014
X-ray L	3.77	9 4	0.0008
X-ray Kα2	27.20170 2	24.7 9	0.0143
X-ray Kα1	27.47230 2	46.2 16	0.0270
X-ray Kβ	31	16.0 6	0.0106
γ 1	159.00 3	82.9 4	0.281
γ 7	440.4 5	0.348 17	0.0033
γ 8	505.6 6	0.26 5	0.0028
γ 9	529.0 4	1.05 10	0.0119
γ 10	538.5 5	0.265 17	0.0030

9 weak γ's omitted (ΣIγ = 0.45%)

124SB B- DECAY (60.20 D 3) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3.19	0.341 23	≈0
ce-K- 12	570.91 4	0.411 8	0.0050
β- 1 max	124.9 18		
avg	33.1 5	0.530 10	0.0004
β- 2 max	198.2 18		
avg	54.4 6	0.560 10	0.0006
β- 3 max	206.1 18		
avg	56.7 6	8.80 20	0.0106
β- 4 max	378.4 18		
avg	111.6 6	0.130 10	0.0003
β- 5 max	416.5 18		
avg	124.5 7	0.670 10	0.0018
β- 6 max	606.1 18		
avg	192.1 7	52.0 10	0.213
β- 7 max	675.4 18		
avg	218.0 7	0.110 10	0.0005
β- 8 max	717.2 18		
avg	234.0 7	0.260 10	0.0013
β- 9 max	808.0 18		
avg	269.2 7	0.680 10	0.0039
β-10 max	860.5 18		
avg	290.0 8	3.63 7	0.0224
β-11 max	942.0 18		
avg	322.6 8	2.0 4	0.0137
β-12 max	1574.3 18		
avg	591.1 8	5.39 11	0.0679
β-13 max	1651.3 18		
avg	625.0 8	2.45 5	0.0326
β-14 max	2297.1 18		
avg	916.3 9	22.6 5	0.441
total β-			
avg	380.5 14	100.0 13	0.811

7 weak β's omitted (ΣIβ = 0.21%)

X-ray Kα2	27.20170 2	0.102 4	≈0
X-ray Kα1	27.47230 2	0.191 8	0.0001
γ 5	400.03 6	0.53 4	0.0045
γ 6	443.99 5	0.35 3	0.0033
γ 11	525.50 10	0.313 20	0.0035
γ 12	602.72 4	97.92 5	1.26
γ 13	632.36 10	0.157 10	0.0021
γ 14	645.82 4	7.21 22	0.0991
γ 16	709.31 5	1.42 5	0.0215
γ 17	713.82 4	2.39 12	0.0363
γ 18	722.78 4	11.26 16	0.173
γ 19	735.85 15	0.127 10	0.0020
γ 20	735.85 15	0.127 10	0.0020
γ 22	790.78 6	0.744 10	0.0125
γ 26	968.25 6	1.83 5	0.0378
γ 29	1045.24 5	1.84 4	0.0410
γ 35	1325.49 7	1.41 3	0.0398
γ 36	1355.17 8	0.93 3	0.0269
γ 37	1368.23 6	2.35 5	0.0685
γ 38	1376.10 20	0.431 10	0.0126
γ 40	1436.66 9	1.02 3	0.0312
γ 41	1445.25 20	0.206 10	0.0063
γ 43	1489.03 20	0.55 3	0.0174
γ 44	1526.33 20	0.392 10	0.0127
γ 45	1579.90 20	0.196 10	0.0066
γ 47	1691.02 4	48.8 5	1.76
γ 53	2091.0 3	5.58 10	0.249

39 weak γ's omitted (ΣIγ = 1.23%)

124I B+ DECAY (4.18 D 2) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3.19	63 4	0.0043
Auger-K	22.7	8.4 19	0.0040
ce-K- 9	570.91 4	0.256 22	0.0031
β+ 2 max	813 10		
avg	367 5	0.298 20	0.0023
β+ 3 max	1535 10		
avg	687 5	11.4 6	0.167
β+ 4 max	2138 10		
avg	975 5	11.3 6	0.235
total β+ avg	824 6	23.0 9	0.404
X-ray L	3.77	6.2 21	0.0005
X-ray Kα2	27.20170 2	16.6 7	0.0096
X-ray Kα1	27.47230 2	31.1 13	0.0182
X-ray Kβ	31	10.8 5	0.0071
γ 6	541.20 10	0.189 17	0.0022
γ 9	602.72 4	61 5	0.783
γ 11	645.82 4	0.95 9	0.0131
γ 13	695.0 10	≈0.1	≈0.002
γ 16	713.80 20	0.110 16	0.0017
γ 17	722.78 4	10.1 9	0.155
γ 27	968.22 8	0.41 4	0.0086
γ 28	976.32 14	0.104 15	0.0022
γ 31	1045.00 10	0.43 5	0.0095
γ 32	1054.00 20	0.122 12	0.0027
γ 40	1325.50 4	1.45 12	0.0408
γ 42	1368.20 6	0.29 3	0.0084
γ 43	1376.00 10	1.68 14	0.0492
γ 48	1488.90 10	0.183 17	0.0058
γ 49	1509.49 4	3.01 25	0.0969
γ 50	1559.80 20	0.16 3	0.0055
γ 52	1637.7 5	0.195 21	0.0068
γ 54	1675.8 4	0.11 3	0.0039
γ 55	1691.02 4	10.5 9	0.378
γ 56	1720.37 14	0.171 19	0.0063
γ 58	1851.4 4	0.21 3	0.0082
γ 59	1918.58 4	0.159 23	0.0065
γ 60	2038.3 3	0.34 3	0.0149
γ 61	2078.86 7	0.35 4	0.0154
γ 62	2091.00 10	0.57 5	0.0255
γ 64	2099.09 9	0.140 13	0.0063
γ 65	2144.320 10	0.110 11	0.0050
γ 66	2232.25 7	0.57 5	0.0273
γ 67	2283.25 8	0.66 7	0.0323
γ 75	2746.90 10	0.46 5	0.0271

48 weak γ's omitted (ΣIγ = 1.24%)
Maximum γ±-intensity = 46.00%

125I EC DECAY (60.14 D 11) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3.19	156 9	0.0106
ce-K- 1	3.65 3	80.0 6	0.0062
Auger-K	22.7	20 5	0.0097
ce-L- 1	30.52 3	10.5 3	0.0068
ce-M- 1	34.45 3	2.20 20	0.0016
ce-NOP- 1	35.29 3	0.70 20	0.0005
X-ray L	3.77	15 6	0.0012
X-ray Kα2	27.20170 2	39.8 14	0.0230
X-ray Kα1	27.47230 2	74.2 25	0.0434
X-ray Kβ	31	25.8 10	0.0170
γ 1	35.46 3	6.67 22	0.0050

126I EC DECAY (13.02 D 7) I(min)=0.10%

%(EC+B+)=56 3
SEE ALSO 126I B- DECAY

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3.19	45 7	0.0030
Auger-K	22.7	5.9 16	0.0028
β+ 1 max	463 5		
avg	214.7 23	0.20 10	0.0009
β+ 2 max	1129 5		
avg	528 3	1.0 3	0.0112
total β+ avg	476 4	1.2 4	0.0122
X-ray L	3.77	4.4 16	0.0004
X-ray Kα2	27.20170 2	11.7 19	0.0068
X-ray Kα1	27.47230 2	22 4	0.0128
X-ray Kβ	31	7.6 12	0.0050
γ 1	656.0 10	≈1.3	≈0.02
γ 2	664.5 5	1.3 3	0.0190
γ 3	666.20 10	30 6	0.427
γ 5	730.0 10	≈1.3	≈0.02
γ 6	753.70 10	3.8 8	0.0616
γ 10	1420.1 3	0.28 7	0.0086

8 weak γ's omitted (ΣIγ = 0.26%)
Maximum γ±-intensity = 2.40%

126I B- DECAY (13.02 D 7) I(min)=0.10%

%B-=44 3
SEE ALSO 126I EC DECAY

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3.43	0.48 8	=0
ce-K- 1	353.94 10	0.50 10	0.0038
β- 1 max	385 5		
avg	108.7 14	2.7 5	0.0063
β- 2 max	865 5		
avg	289.8 17	31 6	0.191
β- 3 max	1251 5		
avg	459.0 20	9.9 19	0.0968
total β- avg	317.0 19	44 7	0.294
X-ray Kα2	29.4580 10	0.130 24	=0
X-ray Kα1	29.7790 10	0.24 5	0.0002
γ 1	388.50 10	32 6	0.265
γ 2	492.00 10	2.0 4	0.0208
γ 3	880.50 10	0.67 15	0.0126

127XE EC DECAY (36.41 D 2) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3.3	96 6	0.0068
Auger-K	23.6	12 3	0.0059
ce-K- 1	24.431 20	4.2 4	0.0022
ce-L- 1	52.412 20	0.59 7	0.0007
ce-M- 1	56.528 20	0.119 12	0.0001
ce-K- 2	112.05 3	1.48 9	0.0035
ce-K- 3	138.93 3	3.63 23	0.0107
ce-L- 2	140.03 3	0.375 23	0.0011
ce-L- 3	166.91 3	0.48 3	0.0017
ce-K- 4	169.67 3	6.6 4	0.0237
ce-L- 4	197.65 3	0.95 6	0.0040
ce-M- 4	201.77 3	0.196 12	0.0008
ce-K- 5	341.79 5	0.300 20	0.0022
X-ray L	4	10 4	0.0008
X-ray $K\alpha_2$	28.3172 4	25.0 11	0.0151
X-ray $K\alpha_1$	28.6120 3	46.6 19	0.0284
X-ray $K\beta$	32.3	16.3 8	0.0112
γ 1	57.600 20	1.29 11	0.0016
γ 2	145.22 3	4.12 24	0.0128
γ 3	172.10 3	25.4 15	0.0931
γ 4	202.84 3	68 4	0.292
γ 5	374.96 5	17.7 11	0.141

1 weak γ's omitted (ΣIγ = 0.01%)

129TE B- DECAY (69.6 M 2) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3.3	61 9	0.0043
ce-L- 1	22.582 20	68 10	0.0326
ce-MNO- 1	26.698 20	13.7 20	0.0078
β- 4 max	388 8		
avg	115 3	0.95	0.0023
β- 5 max	670 8		
avg	216 3	0.22	0.0010
β- 6 max	940 8		
avg	322 4	0.24	0.0016
β- 7 max	1013 8		
avg	351 3	8.6 9	0.0643
β- 8 max	1222 8		
avg	438 4	0.56	0.0052
β- 9 max	1472 8		
avg	545 4	89 9	1.04
total β- avg	522 4	100 9	1.11

3 weak β's omitted (ΣIβ = 0.05%)

X-ray L	4	6.4 24	0.0005
γ 1	27.770 20	16.4 24	0.0097
γ 2	208.98 5	0.186 20	0.0008
γ 3	250.65 5	0.40 5	0.0021
γ 5	278.43 5	0.57 7	0.0034
γ 6	281.16 5	0.150 17	0.0009
γ 9	459.60 5	7.1 8	0.0699
γ 10	487.39 5	1.36 14	0.0141
γ 19	802.17 5	0.195 22	0.0033
γ 26	1083.99 5	0.56 6	0.0130
γ 27	1111.74 5	0.221 24	0.0052

23 weak γ's omitted (ΣIγ = 0.38%)

129TE IT DECAY (33.6 D 1) I(min)=0.10%

%IT=64 4
SEE ALSO 129TE B- DECAY (33.6 D)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3.19	49.0 23	0.0033
Auger-K	22.7	4.0 9	0.0019
ce-K- 1	73.69 5	32.2 5	0.0505
ce-L- 1	100.56 5	24.5 5	0.0525
ce-MNO- 1	104.49 5	7.17 20	0.0160
X-ray L	3.77	4.8 17	0.0004
X-ray $K\alpha_2$	27.20170 2	8.0 3	0.0046
X-ray $K\alpha_1$	27.47230 2	15.0 6	0.0088
X-ray $K\beta$	31	5.19 21	0.0034
γ 1	105.50 5	0.147 12	0.0003

129TE B- DECAY (33.6 D 1) I(min)=0.10%

%B-=36 4
SEE ALSO 129TE IT DECAY (33.6 D)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	205 8		
avg	56 3	0.14	0.0002
β- 5 max	876 8		
avg	296 3	0.7	0.0045
β- 6 max	910 8		
avg	309 3	2.9 5	0.0191
β- 7 max	1606 8		
avg	608 4	33 4	0.422
total β- avg	578 4	36 4	0.446

3 weak β's omitted (ΣIβ = 0.08%)

γ 2	556.65 5	0.110 9	0.0013
γ 4	695.98 5	3.05 21	0.0453
γ 7	729.62 5	0.73 6	0.0113

12 weak γ's omitted (ΣIγ = 0.25%)

129I B- DECAY (1.57E7 Y 4) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3.43	74 4	0.0054
ce-K- 1	5.02 3	79.10 20	0.0085
Auger-K	24.6	8.8 16	0.0046
ce-L- 1	34.13 3	10.6 3	0.0077
ce-M- 1	38.44 3	2.10 10	0.0017
ce-NOP- 1	39.37 3	0.70 10	0.0006
β- 1 max	150 5		
avg	40 5	100	0.0852
X-ray L	4.1	8.2 25	0.0007
X-ray $K\alpha_2$	29.4580 10	20.0 6	0.0126
X-ray $K\alpha_1$	29.7790 10	37.1 9	0.0235
X-ray $K\beta$	33.6	13.2 4	0.0094
γ 1	39.58 3	7.50 20	0.0063

129XE IT DECAY (8.0 D 2) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3.43	147 8	0.0108
ce-K- 1	5.02 3	79.10 20	0.0085
Auger-K	24.6	16 3	0.0083
ce-L- 1	34.13 3	10.6 3	0.0077
ce-M- 1	38.44 3	2.10 10	0.0017
ce-NOP- 1	39.37 3	0.70 10	0.0006
ce-K- 2	162.00 3	63.90 10	0.220
ce-L- 2	191.11 3	24.4 7	0.0993
ce-M- 2	195.42 3	5.50 20	0.0229
ce-NOP- 2	196.35 3	1.50 10	0.0063
X-ray L	4.1	16 5	0.0014
X-ray $K\alpha_2$	29.4580 10	36.2 10	0.0227
X-ray $K\alpha_1$	29.7790 10	67.1 17	0.0426
X-ray $K\beta$	33.6	23.9 7	0.0171
γ 1	39.58 3	7.50 20	0.0063
γ 2	196.56 3	4.70 20	0.0197

129CS EC DECAY (32.06 H 6) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3.43	106 9	0.0077
ce-K- 1	5.020 15	31.4 20	0.0034
Auger-K	24.6	13.0 25	0.0068
ce-NOP- 1	39.373 15	1.02 7	0.0009
ce-K- 3	58.768 4	0.57 4	0.0007
ce-K- 14	337.3566 23	0.62 4	0.0044
ce-K- 16	376.9286 23	0.359 20	0.0029
X-ray L	4.1	12 4	0.0010
X-ray $K\alpha_2$	29.4580 10	29.7 21	0.0186
X-ray $K\alpha_1$	29.7790 10	55 4	0.0350
X-ray $K\beta$	33.6	19.6 14	0.0140
γ 1	39.581 15	2.99 18	0.0025
γ 3	93.329 3	0.66 4	0.0013
γ 4	177.036 10	0.271 15	0.0010
γ 5	266.820 7	0.274 15	0.0016
γ 6	270.352 5	0.214 12	0.0012
γ 7	278.614 4	1.33 8	0.0079
γ 8	282.131 6	0.243 13	0.0015
γ 10	318.1800 20	2.46 14	0.0167
γ 14	371.9180 20	30.8 16	0.244
γ 16	411.4900 20	22.5 12	0.197
γ 21	548.945 8	3.42 18	0.0400
γ 27	588.549 8	0.61 4	0.0076
γ 32	906.425 6	0.221 12	0.0043

20 weak γ's omitted (ΣIγ = 0.37%)

130I B- DECAY (12.36 H 1) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3.43	0.51 4	≈0
ce-K- 13	501.529 20	0.624 17	0.0067
β- 1 max	234 10		
avg	65 3	0.320 20	0.0004
β- 2 max	357 10		
avg	104 4	0.330 20	0.0007
β- 3 max	377 10		
avg	111 4	0.500 20	0.0012
β- 4 max	559 10		
avg	174 4	0.185 6	0.0007
β- 5 max	624 10		
avg	198 4	46.0 10	0.194
β- 6 max	814 10		
avg	271 4	2.14 5	0.0124
β- 7 max	904 10		
avg	306 4	0.175 16	0.0011
β- 8 max	1042 10		
avg	362 4	47.7 12	0.368
β- 9 max	1178 10		
avg	419 4	1.45 4	0.0129
β-10 max	1781 10		
avg	680 4	<1.4	<0.02
total β- avg	286 5	100.5 16	0.612

5 weak β's omitted (ΣIβ = 0.27%)

X-ray $K\alpha_2$	29.4580 10	0.158 6	≈0
X-ray $K\alpha_1$	29.7790 10	0.293 11	0.0002
X-ray $K\beta$	33.6	0.104 4	≈0
γ 9	418.010 20	34.2 7	0.304
γ 11	457.720 20	0.237 16	0.0023
γ 12	510.350 20	0.85 3	0.0093
γ 13	536.090 20	99.0 20	1.13
γ 14	539.10 3	1.40 3	0.0160
γ 15	553.900 10	0.662 21	0.0078
γ 16	586.050 20	1.69 4	0.0211
γ 17	603.530 10	0.615 25	0.0079
γ 19	668.540 10	96.1 21	1.37
γ 20	685.990 10	1.07 3	0.0156
γ 22	739.480 20	82.3 18	1.30
γ 25	800.23 3	0.101 6	0.0017
γ 26	808.290 20	0.236 8	0.0041
γ 31	877.35 4	0.191 9	0.0036
γ 34	967.020 20	0.877 22	0.0181
γ 38	1096.48 3	0.552 15	0.0129
γ 39	1122.15 3	0.253 10	0.0061
γ 40	1157.470 10	11.31 25	0.279
γ 41	1222.56 3	0.179 7	0.0047
γ 42	1272.120 20	0.748 19	0.0203
γ 44	1403.900 20	0.345 14	0.0103

31 weak γ's omitted (ΣIγ = 0.82%)

131I B- DECAY (8.04 D 1) I(min)=0.10%

SEE ALSO 131XE IT DECAY

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3.43	5.1 3	0.0004
Auger-K	24.6	0.60 11	0.0003
ce-K- 1	45.622 10	3.54 9	0.0034
ce-L- 1	74.730 10	0.472 12	0.0008
ce-MNO- 1	79.041 10	0.1310 2	0.0002
ce-K- 7	249.737 11	0.248 6	0.0013
ce-K- 14	329.919 11	1.54 4	0.0108
ce-L- 14	359.027 11	0.244 6	0.0019
β- 1 max	247.9 6		
avg	69.40 20	2.13 3	0.0031
β- 2 max	303.9 6		
avg	87.00 20	0.620 20	0.0011
β- 3 max	333.8 6		
avg	96.60 20	7.36 10	0.0151
β- 4 max	606.3 6		
avg	191.6 3	89.4 10	0.365
β- 5 max	806.9 6		
avg	283.2 3	0.420 20	0.0025
total β- avg	181.7 3	100.0 10	0.387

1 weak β's omitted (ΣIβ = 0.06%)

X-ray L	4.1	0.56 17	≈0
X-ray Kα2	29.4580 10	1.37 5	0.0009
X-ray Kα1	29.7790 10	2.54 8	0.0016
X-ray Kβ	33.6	0.90 3	0.0006
γ 1	80.183 10	2.62 5	0.0045
γ 4	177.210 10	0.265 4	0.0010
γ 7	284.298 11	6.06 9	0.0367
γ 12	325.781 11	0.251 6	0.0017
γ 14	364.480 11	81.2 12	0.631
γ 16	502.991 11	0.361 7	0.0039
γ 17	636.973 10	7.27 11	0.0986
γ 18	642.703 11	0.220 4	0.0030
γ 19	722.893 10	1.80 3	0.0278

10 weak γ's omitted (ΣIγ = 0.23%)

131XE IT DECAY (11.9 D 1) I(min)=0.10%

FEEDING OF 131MXE
IN 131I DECAY=1.086% 13

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3.43	75 4	0.0055
Auger-K	24.6	6.8 13	0.0036
ce-K- 1	129.369 8	61.2 7	0.169
ce-L- 1	158.477 8	28.6 6	0.0965
ce-M- 1	162.788 8	6.50 20	0.0225
ce-NOP- 1	163.722 8	1.78 6	0.0062
X-ray L	4.1	8 3	0.0007
X-ray Kα2	29.4580 10	15.5 5	0.0097
X-ray Kα1	29.7790 10	28.7 8	0.0182
X-ray Kβ	33.6	10.2 4	0.0073
γ 1	163.930 8	1.96 6	0.0068

131CS EC DECAY (9.69 D 1) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3.43	79 4	0.0058
Auger-K	24.6	9.3 17	0.0049
X-ray L	4.1	9 3	0.0008
X-ray Kα2	29.4580 10	21.1 6	0.0132
X-ray Kα1	29.7790 10	39.1 10	0.0248
X-ray Kβ	33.6	13.9 4	0.0100

131BA EC DECAY (11.8 D 2) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3.55	100 7	0.0076
ce-K- 1	18.98 6	0.61 7	0.0002
Auger-K	25.5	10.9 14	0.0059
ce-K- 2	42.770 13	1.23 9	0.0011
ce-L- 1	49.25 6	0.89 10	0.0009
ce-MNO- 1	53.74 6	0.220 15	0.0003
ce-K- 4	56.316 11	0.61 7	0.0007
ce-L- 2	73.041 13	0.153 13	0.0002
ce-K- 5	87.818 12	18.1 6	0.0339
ce-K- 7	97.622 14	0.81 6	0.0017
ce-L- 5	118.089 12	5.99 20	0.0151
ce-MNO- 5	122.586 12	1.66 5	0.0043
ce-L- 7	127.893 14	0.151 13	0.0004
ce-K- 10	180.11 3	1.79 7	0.0069
ce-K- 11	203.65 3	0.169 18	0.0007
ce-L- 10	210.38 3	0.239 21	0.0011
ce-K- 13	213.46 3	0.171 19	0.0008
ce-K- 18	337.27 3	0.27 4	0.0019
ce-K- 26	460.30 3	0.48 7	0.0047
X-ray L	4.29	12 4	0.0011
X-ray Kα2	30.6251 3	26.5 16	0.0173
X-ray Kα1	30.9728 3	49 3	0.0324
X-ray Kβ	35	17.6 11	0.0131
γ 2	78.755 13	0.75 3	0.0013
γ 4	92.301 11	0.64 5	0.0013
γ 5	123.803 12	29.1 9	0.0766
γ 7	133.607 14	2.19 9	0.0062
γ 9	157.15 3	0.199 21	0.0007
γ 10	216.09 3	19.9 4	0.0916
γ 11	239.63 3	2.41 8	0.0123
γ 12	246.92 6	0.60 5	0.0031
γ 13	249.44 3	2.81 10	0.0149
γ 14	294.54 4	0.159 21	0.0010
γ 16	351.15 4	0.119 20	0.0009
γ 18	373.25 3	13.3 15	0.106
γ 19	404.04 3	1.29 9	0.0111
γ 24	480.38 4	0.34 4	0.0035
γ 25	486.48 4	1.89 21	0.0196
γ 26	496.28 3	44 4	0.463
γ 29	572.66 4	0.159 11	0.0019
γ 30	585.02 3	1.23 9	0.0154
γ 31	620.05 3	1.57 9	0.0208
γ 32	674.41 4	0.129 9	0.0019
γ 33	696.46 4	0.147 11	0.0022
γ 37	831.63 5	0.219 21	0.0039
γ 40	923.86 4	0.70 7	0.0137
γ 43	1046.9	≈0.2	≈0.004
γ 44	1047.56 4	≈1.2	≈0.03

23 weak γ's omitted (ΣIγ = 0.68%)

132TE B- DECAY (78.2 H 8) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3.3	75 6	0.0053
ce-K- 1	16.551 10	70 5	0.0248
Auger-K	23.6	9.4 23	0.0047
ce-L- 1	44.532 10	9.3 7	0.0088
ce-MNO- 1	48.648 10	2.44 17	0.0025
ce-K- 2	83.13 8	0.89 16	0.0016
ce-K- 3	84.59 8	0.91 16	0.0016
ce-L- 2	111.11 8	0.19 4	0.0005
ce-L- 3	112.57 8	0.26 5	0.0006
ce-K- 4	194.99 6	7.14 13	0.0297
ce-L- 4	222.97 6	1.341 24	0.0064
ce-MNO- 4	227.09 6	0.2734	0.0013
β- 1 max	215 4		
avg	59.4 12	100	0.127
X-ray L	4	8 3	0.0007
X-ray $K\alpha_2$	28.3172 4	19.9 15	0.0120
X-ray $K\alpha_1$	28.6120 3	37 3	0.0226
X-ray Kβ	32.3	13.0 10	0.0089
γ 1	49.720 10	14.4 10	0.0152
γ 2	116.30 8	1.94 18	0.0048
γ 3	117.76 8	1.85 18	0.0046
γ 4	228.16 6	88.20 20	0.429

132I B- DECAY (2.30 H 3) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3.43	0.89 7	≈0
Auger-K	24.6	0.118 22	≈0
ce-K- 24	488.09 9	0.127 14	0.0013
ce-K- 34	633.13 8	0.35 3	0.0047
ce-K- 41	738.04 8	0.206 24	0.0032
β- 1 max	226 20		
avg	63 7	0.12 6	0.0002
β- 2 max	320 20		
avg	92 7	0.261 3	0.0005
β- 3 max	353 20		
avg	103 7	0.12 5	0.0003
β- 4 max	366 20		
avg	107 7	<0.19	≤0.0004
β- 5 max	425 20		
avg	127 7	0.21 4	0.0006
β- 6 max	458 20		
avg	138 7	<0.38	<0.0011
β- 7 max	504 20		
avg	154 8	0.24 6	0.0008
β- 8 max	522 20		
avg	161 8	0.34 7	0.0012
β- 9 max	689 20		
avg	223 8	≈0.9	≈0.004
β-10 max	740 20		
avg	242 8	1.81 10	0.0093
β-11 max	741 20		
avg	242 8	12.8 8	0.0660
β-12 max	826 20		
avg	275 8	0.37 6	0.0022
β-13 max	910 20		
avg	309 8	3.60 20	0.0237
β-14 max	967 20		
avg	331 9	8.1 4	0.0571

*** continued ***

132I B- DECAY (2.30 H 3) (continued)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β-15 max	996 20		
avg	344 9	3.79 16	0.0278
β-16 max	1155 20		
avg	409 9	2.11 7	0.0184
β-17 max	1185 20		
avg	422 9	19.0 7	0.171
β-18 max	1229 20		
avg	440 9	<0.9	<0.009
β-19 max	1413 20		
avg	519 9	1.7 6	0.0188
β-20 max	1468 20		
avg	543 9	1.9 8	0.0220
β-21 max	1470 20		
avg	543 9	10.2 10	0.118
β-22 max	1617 20		
avg	608 9	12.7 7	0.164
β-23 max	2140 20		
avg	841 9	17.6 22	0.315
total β-			
avg	486 11	100 3	1.03
11 weak β's omitted (ΣIβ = 0.53%)			
X-ray $K\alpha_2$	29.4580 10	0.269 15	0.0002
X-ray $K\alpha_1$	29.7790 10	0.50 3	0.0003
X-ray Kβ	33.6	0.177 10	0.0001
γ 2	147.20 10	0.237 20	0.0007
γ 3	183.3	0.1579	0.0006
γ 4	254.80 20	0.19 3	0.0010
γ 5	262.70 10	1.44 9	0.0081
γ 7	284.80 10	0.79 7	0.0048
γ 10	306.6 4	0.11 4	0.0007
γ 12	316.5 4	0.16 4	0.0011
γ 15	363.5 4	0.49 10	0.0038
γ 16	387.8 4	0.17 3	0.0014
γ 17	416.8 4	0.46 9	0.0041
γ 18	431.9 4	0.45 9	0.0042
γ 19	446.0 4	0.67 8	0.0064
γ 20	473.4 7	0.27 5	0.0027
γ 22	487.5 7	0.18 5	0.0018
γ 23	505.90 15	5.03 20	0.0542
γ 24	522.65 9	16.1 6	0.179
γ 25	535.5 4	0.52 8	0.0060
γ 26	547.10 20	1.25 9	0.0146
γ 30	620.8 10	≈0.4	≈0.005
γ 31	621.2 10	1.579 4	0.0209
γ 32	630.22 9	13.7 6	0.184
γ 33	650.60 20	2.66 20	0.0369
γ 34	667.69 8	98.70 20	1.40
γ 35	669.8 3	4.9 8	0.0704
γ 36	671.6 3	5.2 4	0.0748
γ 37	727	2.2 6	0.0336
γ 38	727.2 10	3.2 6	0.0489
γ 39	729.5 4	1.1 3	0.0169
γ 41	772.60 8	76.2 18	1.25
γ 42	780.2 3	1.23 6	0.0205
γ 43	784.5 4	0.42 5	0.0071
γ 45	809.80 20	2.9 3	0.0494
γ 46	812.20 20	5.6 5	0.0973
γ 47	863.30 20	0.59 5	0.0109
γ 48	876.80 20	1.08 5	0.0201
γ 50	910.30 20	0.92 5	0.0178
γ 51	927.6 3	0.44 8	0.0088
γ 53	954.55 9	18.1 6	0.367
γ 54	984.50 20	0.56 6	0.0118
γ 58	1034.70 20	0.57 5	0.0126
γ 64	1136.03 12	2.96 20	0.0716
γ 65	≈1138	≈0.3	≈0.007
γ 66	1143.40 20	1.38 10	0.0337
γ 67	1148.2 7	0.21 5	0.0051

*** continued ***

132I B- DECAY (2.30 H 3) (continued)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
γ 68	1173.20 20	1.09 10	0.0271
γ 71	1272.7 4	0.15 3	0.0040
γ 72	1290.7 3	1.14 6	0.0312
γ 73	1295.3 3	1.97 10	0.0545
γ 74	1298.2 5	0.89 10	0.0246
γ 76	1317.1 7	0.118 20	0.0033
γ 77	1372.07 13	2.47 10	0.0721
γ 78	1398.57 10	7.1 3	0.212
γ 80	1442.56 10	1.42 6	0.0437
γ 82	1476.80 20	0.138 20	0.0043
γ 94	1757.50 20	0.38 3	0.0140
γ101	1921.08 12	1.18 9	0.0485
γ103	2002.30 12	1.09 10	0.0463
γ104	2086.82 15	0.25 4	0.0110
γ105	2172.68 15	0.19 3	0.0087
γ107	2223.17 15	0.118 20	0.0056
γ110	2390.48 15	0.168 20	0.0085

58 weak γ's omitted (ΣIγ = 2.23%)

132CS B+ DECAY (6.475 D 10) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3.43	75 4	0.0055
Auger-K	24.6	8.9 16	0.0047
β+ 1 max	404 23		
avg	190 10	0.31 9	0.0013
X-ray L	4.1	8 3	0.0007
X-ray $K\alpha_2$	29.4580 10	20.3 6	0.0127
X-ray $K\alpha_1$	29.7790 10	37.6 9	0.0238
X-ray Kβ	33.6	13.4 4	0.0096
γ 2	505.90 15	0.82 10	0.0088
γ 3	630.22 9	1.03 8	0.0139
γ 4	667.67 6	99.5 5	1.42
γ 6	1136.03 12	0.52 4	0.0125
γ 8	1317.80 20	0.60 5	0.0168

4 weak γ's omitted (ΣIγ = 0.28%)
Maximum γ±-intensity = 0.62%

133I B- DECAY (20.8 H 1) I(min)=0.10%

SEE ALSO 133XF IT DECAY (2.25 D)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	170 30		
avg	46 9	0.47 5	0.0005
β- 2 max	350 30		
avg	104 11	0.5 3	0.0011
β- 3 max	370 30		
avg	110 11	1.29 7	0.0030
β- 4 max	410 30		
avg	122 11	0.290 20	0.0008
β- 5 max	460 30		
avg	140 11	3.52 8	0.0105
β- 6 max	520 30		
avg	162 12	3.11 8	0.0107
β- 7 max	710 30		
avg	230 12	0.58 6	0.0028
β- 8 max	880 30		
avg	299 12	3.8 5	0.0242
β- 9 max	1020 30		
avg	352 13	1.74 8	0.0130
β-10 max	1230 30		
avg	441 13	83.6 3	0.785
β-11 max	1530 30		
avg	573 13	1.10 10	0.0134
total β- avg	406 15	100.0 7	0.865
γ 3	262.67 8	0.375 18	0.0021
γ 4	267.18 8	0.122 18	0.0007
γ 5	345.7 5	0.43 7	0.0031
γ 6	360.9 3	0.20 5	0.0015
γ 7	417.50 20	0.140 18	0.0012
γ 8	422.90 6	0.27 3	0.0024
γ 11	510.565 20	1.84 6	0.0200
γ 13	529.889 18	87.30 20	0.985
γ 15	617.94 3	0.533 18	0.0070
γ 18	670	0.12 3	0.0017
γ 19	680.31 4	0.62 4	0.0090
γ 20	706.606 25	1.47 5	0.0221
γ 21	768.36 4	0.45 3	0.0073
γ 23	820.61 5	0.148 9	0.0026
γ 25	856.361 25	1.19 5	0.0217
γ 27	875.370 25	4.40 11	0.0820
γ 28	909.92 10	0.244 18	0.0047
γ 30	1052.37 3	0.541 18	0.0121
γ 31	1060.17 5	0.140 9	0.0032
γ 32	1236.56 4	1.44 5	0.0379
γ 33	1298.33 3	2.27 7	0.0628
γ 34	1350.54 8	0.140 9	0.0040

12 weak γ's omitted (ΣIγ = 0.25%)

133XE B- DECAY (5.245 D 6) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3.55	49.0 20	0.0037
Auger-K	25.5	5.5 7	0.0030
ce-K- 1	43.636 11	0.30 6	0.0003
ce-K- 2	45.0124 4	52.0 3	0.0498
ce-L- 2	75.2827 4	8.49 20	0.0136
ce-MNO- 2	79.7799 4	2.3 3	0.0039
β- 1 max	266 3		
avg	75.0 10	0.66 10	0.0011
β- 2 max	346 3		
avg	100.5 10	99.34 10	0.213
total β- avg	100.3 10	100.01 15	0.214
X-ray L	4.29	6.1 17	0.0006
X-ray $K\alpha_2$	30.6251 3	13.3 3	0.0087
X-ray $K\alpha_1$	30.9728 3	24.6 5	0.0163
X-ray Kβ	35	8.84 20	0.0066
γ 1	79.621 11	0.22 6	0.0004
γ 2	81	37.1 4	0.0640

4 weak γ's omitted (ΣIγ = 0.07%)

133XE IT DECAY (2.188 D 8) I(min)=0.10%

FEEDING OF 2.188-D 133MXE
IN 133I DECAY=2.9% 1

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3.43	70 4	0.0051
Auger-K	24.6	7.1 13	0.0037
ce-K- 1	198.62 4	63.7 8	0.269
ce-L- 1	227.73 4	20.8 6	0.101
ce-M- 1	232.04 4	4.16 13	0.0206
ce-NOP- 1	232.97 4	1.04 17	0.0052
X-ray L	4.1	7.8 24	0.0007
X-ray $K\alpha_2$	29.4580 10	16.1 5	0.0101
X-ray $K\alpha_1$	29.7790 10	29.9 8	0.0190
X-ray Kβ	33.6	10.6 4	0.0076
γ 1	233.18 4	10.3 3	0.0512

133BA EC DECAY (10.5 Y 1) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3.55	135 6	0.0102
ce-K- 1	17.170 16	10.8 7	0.0040
Auger-K	25.5	14.0 17	0.0076
ce-K- 2	43.636 11	3.41 21	0.0032
ce-K- 3	45.012 5	46.8 4	0.0449
ce-L- 1	47.441 16	1.61 10	0.0016
ce-MNO- 1	51.938 16	0.420 23	0.0005
ce-L- 2	73.907 11	0.54 11	0.0008
ce-L- 3	75.283 5	7.65 19	0.0123
ce-MNO- 3	79.780 5	2.1 3	0.0035
ce-K- 4	124.620 15	0.144 10	0.0004
ce-K- 6	240.412 12	0.337 14	0.0017
ce-K- 7	266.866 15	0.71 6	0.0040
ce-K- 8	320.020 17	1.32 5	0.0090
ce-K- 9	347.866 15	0.152 8	0.0011
ce-L- 8	350.291 17	0.218 8	0.0016
X-ray L	4.29	17 5	0.0015
X-ray $K\alpha_2$	30.6251 3	34.0 11	0.0222
X-ray $K\alpha_1$	30.9728 3	62.9 18	0.0415
X-ray Kβ	35	22.6 8	0.0168
γ 1	53.155 16	2.21 4	0.0025
γ 2	79.621 11	2.43 13	0.0041
γ 3	80.997 5	33.4 5	0.0577
γ 4	160.605 15	0.72 3	0.0025
γ 5	223.25 3	0.468 13	0.0022
γ 6	276.397 12	7.30 13	0.0430
γ 7	302.851 15	18.66 21	0.120
γ 8	356.005 17	62.4 3	0.473
γ 9	383.851 15	8.86 14	0.0724

133BA IT DECAY (38.9 H 1) I(min)=0.10%

38.9-H 133BA ALSO DECAYS
VIA A 0.0108% 6 EC BRANCH

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3.67	130 6	0.0102
ce-L- 1	6.30 4	77.6	0.0104
ce-M- 1	11.00 4	15.9 5	0.0037
ce-NOP- 1	12.04 4	5.20 20	0.0013
Auger-K	26.4	5.9 16	0.0033
ce-K- 2	238.65 15	59.2 3	0.301
ce-L- 2	270.10 15	18.0 6	0.104
ce-M- 2	274.80 15	4.00 10	0.0234
ce-NOP- 2	275.84 15	1.15 3	0.0068
X-ray L	4.47	18 5	0.0017
γ 1	12.29 4	1.39 4	0.0004
X-ray $K\alpha_2$	31.8171 3	15.2 5	0.0103
X-ray $K\alpha_1$	32.1936 3	28.0 9	0.0192
X-ray Kβ	36.4	10.2 4	0.0079
γ 2	276.09 15	18.0 5	0.106

134TE B- DECAY (41.8 M 8) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3.3	32.3 22	0.0023
Auger-K	23.6	4.0 10	0.0020
ce-K- 3	46.281 10	26.7 7	0.0263
ce-K- 4	68.25 3	0.30 12	0.0004
ce-L- 3	74.262 10	4.0 6	0.0063
ce-M- 3	78.378 10	0.79 11	0.0013
ce-NOP- 3	79.264 10	0.20 3	0.0003
ce-K- 6	147.72 3	3.21 19	0.0101
ce-K- 8	168.07 3	0.98 20	0.0035
ce-L- 6	175.70 3	0.69 4	0.0026
ce-K- 9	177.301 20	2.1 3	0.0080
ce-MNO- 6	179.82 3	0.175 10	0.0007
ce-K- 11	244.781 20	0.8 3	0.0041
β- 1 max	600 300		
avg	190 120	14.5 8	0.0587
β- 2 max	800 300		
avg	260 120	42.6 17	0.236
β- 3 max	900 300		
avg	290 130	43.5 14	0.269
total β-			
avg	260 130	100.6 24	0.563
X-ray L	4	3.4 12	0.0003
X-ray $K\alpha_2$	28.3172 4	8.6 4	0.0052
X-ray $K\alpha_1$	28.6120 3	16.0 7	0.0097
X-ray Kβ	32.3	5.59 25	0.0038
γ 2	76.230 20	0.29 3	0.0005
γ 3	79.450 10	20.9 8	0.0353
γ 4	101.42 3	0.34 7	0.0007
γ 5	131.05 20	0.15 3	0.0004
γ 6	180.89 3	18.4 11	0.0710
γ 7	183.05 13	0.6 3	0.0024
γ 8	201.24 3	8.9 7	0.0382
γ 9	210.470 20	22.4 11	0.100
γ 10	259.59 15	0.49 10	0.0027
γ 11	277.950 20	21.8 11	0.129
γ 12	435.06 5	19.0 13	0.176
γ 13	460.99 3	11.1 7	0.109
γ 14	464.64 6	5.22 25	0.0517
γ 15	565.99 3	19.3 11	0.233
γ 16	636.26 9	2.1 4	0.0291
γ 17	665.85	1.044 24	0.0148
γ 18	712.97 6	4.21 18	0.0639
γ 19	742.59 3	15.0 7	0.238
γ 20	767.20 3	30.7 10	0.502
γ 21	844.06 6	1.2 6	0.0221
γ 22	896.02 9	0.18 7	0.0035
γ 23	925.55 8	1.69 19	0.0333
γ 24	1027.00 10	0.46 13	0.0101

134I B- DECAY (52.6 M 5) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3.43	1.14 18	≈0
Auger-K	24.6	0.14 4	≈0
ce-K- 1	100.838 22	0.98 20	0.0021
ce-L- 1	129.946 22	0.12 3	0.0003
ce-K- 31	812.46 3	0.17 3	0.0030
ce-K- 34	849.53 3	0.12 3	0.0022

*** continued ***

134I B- DECAY (52.6 M 5) (continued)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	770 60		
avg	255 24	1.48 9	0.0080
β- 2 max	790 60		
avg	261 24	0.33 4	0.0018
β- 3 max	840 60		
avg	279 24	0.153 19	0.0009
β- 4 max	1070 60		
avg	372 25	1.22 7	0.0097
β- 5 max	1280 60		
avg	460 30	31.5 8	0.309
β- 6 max	1380 60		
avg	500 30	0.53 4	0.0056
β- 7 max	1500 60		
avg	550 30	7.6 5	0.0890
β- 8 max	1560 60		
avg	580 30	16.2 5	0.200
β- 9 max	1600 60		
avg	600 30	3.67 17	0.0469
β-10 max	1740 60		
avg	660 30	7.6 5	0.107
β-11 max	1800 60		
avg	690 30	11.2 7	0.165
β-12 max	1850 60		
avg	710 30	2.50 15	0.0378
β-13 max	1880 60		
avg	720 30	0.7 7	0.0107
β-14 max	2010 60		
avg	780 30	<0.7	<0.01
β-15 max	2230 60		
avg	880 30	3.7 9	0.0694
β-16 max	2420 60		
avg	970 30	11.9 15	0.246
total β-			
avg	610 40	101.2 24	1.32

4 weak β's omitted (ΣIβ = 0.23%)

X-ray L	4.1	0.13 5	≈0
X-ray $K\alpha_2$	29.4580 10	0.32 6	0.0002
X-ray $K\alpha_1$	29.7790 10	0.60 10	0.0004
X-ray Kβ	33.6	0.21 4	0.0002
γ 1	135.399 22	3.76 22	0.0108
γ 2	139.03 3	0.69 5	0.0020
γ 3	151.98 15	0.106 12	0.0003
γ 4	162.48 7	0.26 3	0.0009
γ 5	188.47 4	0.70 4	0.0028
γ 6	217.00 20	0.25 3	0.0011
γ 7	235.47 3	1.98 16	0.0100
γ 9	278.80 15	0.131 15	0.0008
γ 10	319.81 6	0.52 5	0.0035
γ 11	351.08 10	0.50 6	0.0037
γ 12	405.451 20	7.3 4	0.0634
γ 13	411.00 8	0.61 6	0.0053
γ 14	433.35 3	4.19 24	0.0387
γ 15	458.92 6	1.30 9	0.0127
γ 16	465.50 10	0.36 4	0.0036
γ 17	488.88 4	1.41 9	0.0147
γ 18	514.40 3	2.34 14	0.0256
γ 19	540.825 25	7.8 5	0.0901
γ 20	565.52 4	0.88 6	0.0106
γ 21	570.75 15	0.21 3	0.0026
γ 22	595.362 20	11.4 6	0.144
γ 23	621.790 25	10.6 6	0.140
γ 24	627.96 3	2.37 14	0.0316
γ 25	677.34 3	8.5 5	0.122
γ 26	706.65 10	0.83 6	0.0125
γ 27	730.74 4	1.91 12	0.0297
γ 28	739.18 8	0.76 8	0.0120
γ 29	766.68 4	4.1 3	0.0670
γ 30	816.38 7	0.52 5	0.0091
γ 31	847.025 25	95.4 3	1.72

*** continued ***

134I B- DECAY (52.6 M 5) (continued)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
γ 32	857.28 3	6.96 20	0.127
γ 33	864.0 3	0.19 3	0.0035
γ 34	884.09 3	65.3 10	1.23
γ 35	922.6 3	0.14 3	0.0028
γ 36	947.86 4	4.04 20	0.0815
γ 37	966.90 5	0.35 4	0.0073
γ 38	974.67 4	4.7 4	0.0970
γ 39	1040.25 10	1.91 19	0.0423
γ 43	1072.55 3	15.3 8	0.349
γ 45	1100.07 12	0.69 6	0.0161
γ 46	1103.18 12	0.73 6	0.0170
γ 47	1136.16 4	9.7 5	0.235
γ 48	1159.10 8	0.35 3	0.0087
γ 49	1164.0 3	0.13 3	0.0033
γ 51	1190.03 8	0.35 3	0.0089
γ 53	1239.0 3	0.21 6	0.0055
γ 55	1269.49 5	0.56 4	0.0152
γ 56	1322.4 3	0.10 4	0.0030
γ 57	1336.00 20	0.14 3	0.0041
γ 58	1352.62 8	0.45 4	0.0129
γ 61	1414.3 5	0.22 6	0.0066
γ 62	1428.2 3	0.17 4	0.0052
γ 63	1431.35 25	0.17 4	0.0052
γ 64	1455.24 5	2.29 15	0.0710
γ 65	1470.00 7	0.77 5	0.0242
γ 66	1505.5 4	0.11 4	0.0037
γ 67	1541.51 7	0.51 4	0.0166
γ 68	1613.80 5	4.36 24	0.150
γ 69	1629.24 8	0.26 4	0.0089
γ 70	1644.25 7	0.40 5	0.0140
γ 71	1655.19 10	0.23 3	0.0081
γ 72	1741.49 5	2.67 19	0.0991
γ 73	1806.84 4	5.7 4	0.220
γ 76	1925.88 10	0.181 19	0.0074
γ 78	2020.6 3	0.172 19	0.0074
γ 79	2159.9 3	0.21 3	0.0097
γ 82	2312.40 20	0.24 3	0.0117
γ 85	2467.4 3	0.153 19	0.0080

22 weak γ's omitted (ΣIγ = 1.33%)

134CS B- DECAY (2.062 Y 5) I(min)=0.10%

134CS ALSO DECAYS
VIA A 0.0003% EC BRANCH

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3.67	0.65 5	≈0
ce-K- 5	531.874 15	0.120 7	0.0014
ce-K- 6	567.258 15	0.488 9	0.0059
ce-K- 7	758.404 22	0.224 11	0.0036
β- 1 max	88.6 4		
avg	23.09 11	27.40 20	0.0135
β- 2 max	415.2 4		
avg	123.43 14	2.47 5	0.0065
β- 3 max	658.0 4		
avg	210.15 15	70.1 5	0.314
total β-			
avg	156.8 3	100.0 6	0.334

2 weak β's omitted (ΣIβ = 0.05%)

*** continued ***

134CS B- DECAY (2.062 Y 5) (continued)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
X-ray $K\alpha_2$	31.8171 3	0.213 8	0.0001
X-ray $K\alpha_1$	32.1936 3	0.393 14	0.0003
X-ray Kβ	36.4	0.143 6	0.0001
γ 3	475.35 5	1.46 4	0.0148
γ 4	563.227 15	8.38 5	0.101
γ 5	569.315 15	15.43 11	0.187
γ 6	604.699 15	97.6 3	1.26
γ 7	795.845 22	85.4 4	1.45
γ 8	801.932 22	8.73 4	0.149
γ 9	1038.57 3	1.000 10	0.0221
γ 10	1167.94 3	1.80 3	0.0448
γ 11	1365.15 3	3.04 4	0.0884

2 weak γ's omitted (ΣIγ = 0.04%)

135I B- DECAY (6.61 H 1) I(min)=0.10%

SEE ALSO 135MXE IT DECAY

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	230 40		
avg	65 10	0.14 3	0.0002
β- 2 max	240 40		
avg	68 10	0.130 20	0.0002
β- 3 max	260 40		
avg	74 10	0.14 3	0.0002
β- 4 max	300 40		
avg	86 11	1.03 5	0.0019
β- 5 max	340 40		
avg	98 11	0.91 4	0.0019
β- 6 max	350 40		
avg	103 11	1.39 5	0.0030
β- 7 max	450 40		
avg	137 12	4.73 15	0.0138
β- 8 max	480 40		
avg	145 12	7.33 20	0.0226
β- 9 max	620 40		
avg	196 12	1.57 7	0.0066
β-10 max	660 40		
avg	213 12	1.10 5	0.0050
β-11 max	740 40		
avg	243 13	7.9 3	0.0409
β-12 max	820 40		
avg	271 13	0.61 3	0.0035
β-13 max	920 40		
avg	312 13	8.7 3	0.0578
β-14 max	1032		
avg	358 14	21.5 5	0.164
β-15 max	1140 40		
avg	405 14	8.0 3	0.0690
β-16 max	1250 40		
avg	450 14	7.6 4	0.0728
β-17 max	1260 40		
avg	454 14	0.11 5	0.0011
β-18 max	1450 40		
avg	535 14	23.8 12	0.271
β-19 max	1580 40		
avg	591 14	1.1 9	0.0138
β-20 max	2180 40		
avg	857 15	1.8 7	0.0329
total β-			
avg	369 17	99.7 19	0.783

4 weak β's omitted (ΣIβ = 0.15%)

*** continued ***

135I B- DECAY (6.61 H 1) (continued)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
γ 7	220.502 15	1.75 6	0.0082
γ 8	229.72 3	0.232 9	0.0011
γ 11	264.26 9	0.184 7	0.0010
γ 12	288.451 16	3.09 12	0.0190
γ 13	290.27 4	0.303 21	0.0019
γ 20	361.85 14	0.19 3	0.0014
γ 21	403.03 4	0.232 9	0.0020
γ 22	414.83 3	0.301 18	0.0027
γ 23	417.63 3	3.52 12	0.0313
γ 24	429.93 3	0.303 24	0.0028
γ 25	433.741 19	0.553 24	0.0051
γ 26	451.63 3	0.315 18	0.0030
γ 29	546.557 16	7.13 25	0.0830
γ 30	575.97 8	0.129 23	0.0016
γ 33	649.85 4	0.46 3	0.0063
γ 37	690.13 6	0.129 15	0.0019
γ 38	707.92 5	0.66 6	0.0099
γ 39	785.48 5	0.152 21	0.0025
γ 41	797.71 8	0.17 3	0.0029
γ 43	836.304 16	6.67 24	0.119
γ 45	961.46	0.15 3	0.0030
γ 46	972	0.89 6	0.0184
γ 47	972.6	1.20 6	0.0249
γ 48	995.09 10	0.15 3	0.0033
γ 49	1038.760 21	7.9 3	0.175
γ 51	1101.58 4	1.60 6	0.0376
γ 52	1124.00 4	3.61 12	0.0864
γ 53	1131.511 18	22.5 8	0.543
γ 55	1159.90 20	0.103 23	0.0025
γ 56	1169.04 4	0.87 4	0.0217
γ 59	1240.470 20	0.90 4	0.0238
γ 61	1260.409 17	28.6 10	0.769
γ 67	1367.89 4	0.61 4	0.0177
γ 69	1448.35 10	0.31 3	0.0097
γ 70	1457.56 3	8.6 3	0.268
γ 71	1502.79 4	1.07 5	0.0344
γ 73	1566.41 3	1.29 6	0.0430
γ 74	1678.03 3	9.5 4	0.341
γ 75	1706.46 3	4.09 18	0.149
γ 77	1791.20 3	7.70 25	0.294
γ 78	1830.69 4	0.58 3	0.0226
γ 80	1927.30 3	0.295 15	0.0121
γ 83	2045.88 4	0.87 4	0.0379
γ 88	2255.46 3	0.61 3	0.0294
γ 90	2408.65 4	0.95 5	0.0489

47 weak γ's omitted (ΣIγ = 1.50%)

135XE B- DECAY (9.09 H 1) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3.55	5.12 22	0.0004
Auger-K	25.5	0.59 7	0.0003
ce-K- 3	213.809 15	5.63 10	0.0257
ce-L- 3	244.080 15	0.739 13	0.0038
β- 1 max	96 9		
avg	25.0 25	0.123 4	≈0
β- 2 max	550 9		
avg	171 4	3.12 10	0.0114
β- 3 max	750 9		
avg	245 4	0.68 3	0.0035
β- 4 max	908 9		
avg	307 4	95.98 3	0.628
total β- avg	302 4	99.98 11	0.643

1 weak β's omitted (ΣIβ = 0.08%)

X-ray L	4.29	0.63 18	≈0
X-ray $K\alpha_2$	30.6251 3	1.43 4	0.0009
X-ray $K\alpha_1$	30.9728 3	2.66 7	0.0018
X-ray Kβ	35	0.95 3	0.0007
γ 1	158.197 18	0.289 10	0.0010
γ 3	249.794 15	90.13 8	0.480
γ 4	358.39 4	0.221 9	0.0017
γ 6	407.990 20	0.359 13	0.0031
γ 9	608.185 16	2.90 9	0.0376

8 weak γ's omitted (ΣIγ = 0.21%)

135XE IT DECAY (15.29 M 3) I(min)=0.10%

135MXE ALSO DECAYS
VIA A 0.044% B- BRANCH
FEEDING OF 135MXE
IN 135I DECAY=16.6% 6

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3.43	14.9 8	0.0011
Auger-K	24.6	1.7 3	0.0009
ce-K- 1	492.010 17	15.2 3	0.159
ce-L- 1	521.118 17	2.88 9	0.0320
ce-M- 1	525.429 17	0.610 20	0.0068
ce-NOP- 1	526.363 17	0.200 10	0.0022
X-ray L	4.1	1.7 5	0.0001
X-ray $K\alpha_2$	29.4580 10	3.84 13	0.0024
X-ray $K\alpha_1$	29.7790 10	7.13 23	0.0045
X-ray Kβ	33.6	2.54 9	0.0018
γ 1	526.571 17	81.2 5	0.911

135BA IT DECAY (28.7 H 2) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3.67	63 4	0.0050
Auger-K	26.4	5.9 16	0.0033
ce-K- 1	230.797 10	59.9 7	0.294
ce-L- 1	262.249 10	18.7 5	0.104
ce-M- 1	266.945 10	4.19 12	0.0238
ce-NOP- 1	267.985 10	1.20 3	0.0068
X-ray L	4.47	8.6 22	0.0008
X-ray $K\alpha_2$	31.8171 3	15.3 6	0.0104
X-ray $K\alpha_1$	32.1936 3	28.3 10	0.0194
X-ray Kβ	36.4	10.3 4	0.0080
γ 1	268.238 10	16.0 5	0.0914

136CS B- DECAY (13.1 D 1) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3.67	20.4 13	0.0016
Auger-K	26.4	1.9 5	0.0011
ce-K- 1	29.47 5	7.3 7	0.0046
ce-K- 2	48.85 5	1.85 11	0.0019
ce-L- 1	60.92 5	1.05 10	0.0014
ce-MNO- 1	65.62 5	0.212 19	0.0003
ce-L- 2	80.30 5	0.253 15	0.0004
ce-K- 4	115.78 5	2.38 10	0.0059
ce-K- 5	126.45 5	5.17 21	0.0139
ce-K- 7	139.12 5	0.552 23	0.0016
ce-L- 4	147.23 5	0.67 3	0.0021
ce-MNO- 4	151.93 5	0.144 6	0.0005
ce-L- 5	157.90 5	4.11 17	0.0138
ce-M- 5	162.60 5	0.92 4	0.0032
ce-NOP- 5	163.64 5	0.240 10	0.0008
ce-K- 10	236.21 4	0.159 7	0.0008
ce-K- 14	303.13 5	1.17 5	0.0075
ce-L- 14	334.58 5	0.201 8	0.0014
ce-K- 18	781.06 4	0.241 9	0.0040
ce-K- 19	1010.63 7	0.112 4	0.0024
β- 1 max	173.8 20		
avg	47.1 6	2.29 10	0.0023
β- 2 max	191.0 20		
avg	52.1 6	0.21 3	0.0002
β- 3 max	340.4 20		
avg	98.6 7	94 3	0.197
β- 4 max	407.3 20		
avg	120.8 7	0.13 13	0.0003
β- 5 max	493.6 20		
avg	150.5 7	0.8 8	0.0026
β- 6 max	517.0 20		
avg	175.4 8	1.8 8	0.0067
β- 7 max	680.9 20		
avg	218.8 8	2.0 20	0.0093
total β- avg	101.5 8	101 4	0.219

*** continued ***

136CS B- DECAY (13.1 D 1) (continued)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
X-ray L	4.47	2.8 7	0.0003
X-ray $K\alpha_2$	31.8171 3	4.86 24	0.0033
X-ray $K\alpha_1$	32.1936 3	9.0 5	0.0061
X-ray Kβ	36.4	3.26 17	0.0025
γ 1	66.91 5	12.5 11	0.0178
γ 2	86.29 5	6.3 4	0.0116
γ 3	109.66 10	0.41 3	0.0010
γ 4	153.22 5	7.5 3	0.0244
γ 5	163.89 5	4.62 17	0.0161
γ 6	166.53 10	0.63 4	0.0022
γ 7	176.56 5	13.6 5	0.0511
γ 8	187.25 10	0.60 6	0.0024
γ 10	273.65 4	12.7 5	0.0740
γ 13	319.87 10	0.60 6	0.0041
γ 14	340.57 5	46.8 15	0.339
γ 16	507.21 10	0.98 6	0.0106
γ 18	818.50 4	100 3	1.74
γ 19	1048.07 7	79.7 25	1.78
γ 20	1235.34 5	19.8 7	0.520

8 weak γ's omitted (ΣIγ = 0.39%)

137CS B- DECAY (30.0 Y 2) I(min)=0.10%

SEE ALSO 137MBA IT DECAY

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	514.0 10		
avg	174.3 4	94.6 3	0.351
β- 2 max	1176.0 10		
avg	416.4 4	5.4 3	0.0479
total β- avg	187.4 5	100.0 5	0.399

137BA IT DECAY (2.552 M 2) I(min)=0.10%

FEEDING OF 137MBA
IN 137CS DECAY=94.6% 3

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3.67	7.8 5	0.0006
Auger-K	26.4	0.82 22	0.0005
ce-K- 1	624.204 9	8.24 5	0.110
ce-L- 1	655.656 9	1.50 [illegible]	0.0209
ce-MNO- 1	660.352 9	0.500 20	0.0070
X-ray L	4.47	1.1 3	0.0001
X-ray $K\alpha_2$	31.8171 3	2.11 7	0.0014
X-ray $K\alpha_1$	32.1936 3	3.90 12	0.0027
X-ray Kβ	36.4	1.42 5	0.0011
γ 1	661.645 9	89.9 4	1.27

138XE B- DECAY (14.17 M 7) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	3.55	50.0 17	0.0038
ce-M- 1	3.63 5	31 5	0.0024
ce-NOP- 1	4.62 5	10.5 15	0.0010
ce-L- 2	5.14 5	52	0.0057
ce-M- 2	9.63 5	10.38262	0.0021
ce-NOP- 2	10.62 5	2.54668	0.0006
Auger-K	25.5	0.42 6	0.0002
ce-K- 5	117.77 3	1.61 25	0.0040
ce-L- 5	148.04 3	0.36 18	0.0011
ce-K- 7	206.58 5	0.241 11	0.0011
ce-K- 8	222.33 5	1.80 10	0.0085
ce-L- 8	252.60 5	0.28 7	0.0015
ce-K- 14	360.45 5	0.107 14	0.0008
ce-K- 17	398.51 5	0.26 5	0.0022
β- 1 max	320 80		
avg	90 30	0.23 17	0.0004
β- 2 max	340 80		
avg	100 30	0.46 14	0.0010
β- 3 max	490 80		
avg	150 30	3.07 13	0.0098
β- 4 max	570 80		
avg	180 30	9.5 4	0.0364
β- 5 max	800 80		
avg	270 40	32.7 13	0.188
β- 6 max	810 80		
avg	270 40	0.28 3	0.0016
β- 7 max	1040 80		
avg	360 40	0.23 3	0.0018
β- 8 max	1460 80		
avg	540 40	0.16 3	0.0018
β- 9 max	1620 80		
avg	610 40	0.19 3	0.0025
β-10 max	1880 80		
avg	720 40	0.27 4	0.0041
β-11 max	2380 80		
avg	950 40	20.1 7	0.407
β-12 max	2420 80		
avg	970 40	13.4 5	0.277
β-13 max	2570 80		
avg	1040 40	5.6 21	0.124
β-14 max	2810 80		
avg	1150 40	9 6	0.220
β-15 max	2820 80		
avg	1150 40	5 5	0.122
total β-			
avg	660 70	100 9	1.40

5 weak β's omitted (ΣIβ = 0.28%)

X-ray L	4.29	6.2 17	0.0006
γ 1	4.85 5	0.19 3	≈0
γ 2	10.85 5	0.699 25	0.0002
X-ray $K\alpha_2$	30.6251 3	1.02 8	0.0007
X-ray $K\alpha_1$	30.9728 3	1.89 14	0.0012
X-ray Kβ	35	0.68 5	0.0005
γ 5	153.75 3	5.95 25	0.0195
γ 7	242.56 5	3.50 14	0.0181
γ 8	258.31 5	31.5 13	0.173
γ 9	282.51 6	0.428 20	0.0026
γ 12	335.28 9	0.107 11	0.0008
γ 13	371.44 5	0.50 3	0.0040
γ 14	396.43 5	6.3 3	0.0532
γ 15	401.36 5	2.17 13	0.0186
γ 17	434.49 5	20.3 9	0.188
γ 18	500.22 6	0.362 18	0.0039
γ 19	530.07 7	0.252 16	0.0028
γ 21	537.76 13	0.117 17	0.0013
γ 23	555.95 9	0.117 14	0.0014
γ 24	568.53 6	0.306 19	0.0037
γ 27	588.84 8	0.123 11	0.0015

*** continued ***

138XE B- DECAY (14.17 M 7) (continued)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
γ 30	654.08 8	0.145 14	0.0020
γ 47	865.82 7	0.296 22	0.0055
γ 49	869.35 6	0.62 4	0.0115
γ 50	896.87 12	0.132 14	0.0025
γ 52	912.51 7	0.328 22	0.0064
γ 53	917.13 6	0.92 4	0.0180
γ 54	936.36 11	0.135 14	0.0027
γ 55	941.25 8	0.230 18	0.0046
γ 60	1093.87 9	0.41 3	0.0095
γ 61	1098.77 11	0.214 18	0.0050
γ 62	1102.24 17	0.107 14	0.0025
γ 63	1114.29 10	1.47 9	0.0350
γ 64	1141.64 9	0.51 4	0.0125
γ 65	1145.44 18	0.132 20	0.0032
γ 80	1571.84 16	0.26 3	0.0089
γ 82	1614.57 18	0.24 3	0.0081
γ 84	1768.26 13	16.7 7	0.630
γ 87	1812.54 18	0.180 20	0.0069
γ 88	1850.86 13	1.42 7	0.0561
γ 90	1925.36 14	0.56 4	0.0231
γ 91	2004.75 14	5.35 23	0.229
γ 92	2015.82 14	12.3 5	0.526
γ 94	2079.17 14	1.44 7	0.0639
γ 95	2252.26 14	2.29 11	0.110
γ 97	2321.90 16	0.62 4	0.0307
γ 99	2475.26 16	0.312 20	0.0164
γ101	2497.56 17	0.173 14	0.0092

57 weak γ's omitted (ΣIγ = 2.66%)

138CS B- DECAY (32.2 M 1) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	660 70		
avg	210 30	0.26 3	0.0012
β- 2 max	780 70		
avg	260 30	0.160 20	0.0009
β- 3 max	1050 70		
avg	360 30	0.100 10	0.0008
β- 4 max	1210 70		
avg	430 30	0.18 3	0.0016
β- 5 max	1350 70		
avg	490 30	0.47 6	0.0049
β- 6 max	1370 70		
avg	500 30	0.21 3	0.0022
β- 7 max	1600 70		
avg	600 30	0.30 3	0.0038
β- 8 max	1640 70		
avg	620 30	0.43 8	0.0057
β- 9 max	1920 70		
avg	740 40	0.230 20	0.0036
β-10 max	1950 70		
avg	750 40	0.170 20	0.0027
β-11 max	2050 70		
avg	800 40	0.270 20	0.0046
β-12 max	2130 70		
avg	830 40	0.34 3	0.0060
β-13 max	2240 70		
avg	880 40	0.17 3	0.0032
β-14 max	2300 70		
avg	910 40	0.64 4	0.0124

*** continued ***

138CS B- DECAY (32.2 M 1) (continued)

Radiation Type		Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β-15	max	2360 70		
	avg	940 40	0.21 4	0.0042
β-16	max	2410 70		
	avg	960 40	0.37 20	0.0076
β-17	max	2440 70		
	avg	970 40	0.20 5	0.0041
β-18	max	2510 70		
	avg	1010 40	1.59 7	0.0342
β-19	max	2650 70		
	avg	1070 40	8.70 23	0.198
β-20	max	2710 70		
	avg	1100 40	1.67 8	0.0391
β-21	max	2840 70		
	avg	1160 40	43.0 7	1.06
β-22	max	2870 70		
	avg	1170 40	0.63 7	0.0157
β-23	max	2980 70		
	avg	1220 40	7.90 20	0.205
β-24	max	3070 70		
	avg	1270 40	13.0 3	0.352
β-25	max	3390 70		
	avg	1410 40	13.7 7	0.411
β-26	max	3850 70		
	avg	1630 40	4.6 18	0.160
total β-				
	avg	1200 40	99.8 22	2.55

6 weak β's omitted (ΣIβ = 0.29%)

γ 1	112.60 13	0.130 23	0.0003
γ 2	138.10 6	1.49 9	0.0044
γ 3	191.96 6	0.50 4	0.0021
γ 4	193.89 8	0.328 23	0.0014
γ 5	212.32 8	0.175 14	0.0008
γ 6	227.76 6	1.51 4	0.0073
γ 7	324.90 8	0.290 19	0.0020
γ 9	363.93 8	0.244 23	0.0019
γ 10	365.29 13	0.191 23	0.0015
γ 12	408.98 6	4.66 10	0.0406
γ 13	421.59 7	0.427 23	0.0038
γ 14	462.79 7	30.7 7	0.303
γ 15	516.74 12	0.43 5	0.0047
γ 16	546.94 7	10.76 24	0.125
γ 19	683.59 15	0.108 14	0.0016
γ 23	766.10 12	0.146 15	0.0024
γ 24	773.31 10	0.233 19	0.0038
γ 25	782.08 9	0.33 3	0.0055
γ 31	871.80 8	5.11 14	0.0949
γ 32	880.8 3	0.11 3	0.0021
γ 33	935.03 12	0.181 16	0.0036
γ 36	1009.78 8	29.8 7	0.642
γ 38	1054.32 15	0.159 19	0.0036
γ 39	1147.22 9	1.24 7	0.0304
γ 40	1199.15 24	0.17 3	0.0043
γ 41	1203.69 13	0.40 4	0.0102
γ 42	1264.94 16	0.137 17	0.0037
γ 43	1343.59 9	1.14 6	0.0328
γ 46	1415.68 13	0.37 3	0.0110
γ 47	1435.86 9	76.3 16	2.33
γ 48	1445.04 25	0.97 19	0.0298
γ 49	1495.63 23	0.18 4	0.0058
γ 50	1555.31 10	0.366 23	0.0121
γ 51	1614.09 20	0.137 23	0.0047
γ 52	1717.1 3	0.107 23	0.0039
γ 53	1727.68 18	0.111 13	0.0041
γ 55	1778.25 23	0.137 23	0.0052
γ 60	2023.93 20	0.118 16	0.0051
γ 61	2062.34 17	0.111 12	0.0049
γ 64	2210.7 4	0.21 7	0.0101
γ 65	2218.00 10	15.2 4	0.717

*** continued ***

138CS B- DECAY (32.2 M 1) (continued)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
γ 67	2499.4 3	0.17 5	0.0089
γ 69	2583.15 13	0.239 16	0.0131
γ 71	2639.59 13	7.63 23	0.429
γ 72	2731.12 15	0.120 8	0.0070
γ 78	3339.01 25	0.151 10	0.0107
γ 80	3366.98 25	0.227 13	0.0163

39 weak γ's omitted (ΣIγ = 1.62%)

139BA B- DECAY (82.7 M 2) I(min)=0.10%

Radiation Type		Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L		3.8	3.5 5	0.0003
Auger-K		27.4	0.38 12	0.0002
ce-K- 1		126.925 20	4.0 6	0.0108
ce-L- 1		159.584 20	0.52 7	0.0018
ce-MNO- 1		164.489 20	0.136 18	0.0005
β- 1	max	886 5		
	avg	297.8 20	0.3490 2	0.0022
β- 2	max	2141 5		
	avg	837.5 23	24 3	0.428
β- 3	max	2307 5		
	avg	912.5 23	75 3	1.46
total β-				
	avg	891.8 23	99 5	1.89

14 weak β's omitted (ΣIβ = 0.07%)

X-ray L	4.65	0.52 14	≈0
X-ray $K\alpha_2$	33.03410 2	1.03 14	0.0007
X-ray $K\alpha_1$	33.44180 2	1.89 25	0.0013
X-ray Kβ	37.8	0.70 10	0.0006
γ 1	165.850 20	18.8 24	0.0664
γ 12	1420.50 20	0.3	0.0091

26 weak γ's omitted (ΣIγ = 0.12%)

139CE EC DECAY (137.65 D 5) I(min)=0.10%

Radiation Type		Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L		3.8	89 6	0.0072
Auger-K		27.4	8.7 24	0.0050
ce-K- 1		126.928 7	17.05 16	0.0461
ce-L- 1		159.587 7	2.30 8	0.0078
ce-MNO- 1		164.492 7	0.61 3	0.0021
X-ray L		4.65	13 4	0.0013
X-ray $K\alpha_2$		33.03410 2	23.7 8	0.0167
X-ray $K\alpha_1$		33.44180 2	43.7 14	0.0311
X-ray Kβ		37.8	16.0 6	0.0129
γ 1		165.853 7	80.06 13	0.283

141CE B- DECAY (32.50 D 7) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	4	16.1 10	0.0014
Auger-K	29.4	1.6 5	0.0010
ce-K- 1	103.449 10	18.6 9	0.0410
ce-L- 1	138.605 10	2.54 13	0.0075
ce-MNO- 1	143.929 10	0.72 6	0.0022
β- 1 max	435.4 15		
avg	130.8 6	70 3	0.195
β- 2 max	580.8 15		
avg	181.0 6	30 3	0.116
total β-			
avg	145.9 7	100 5	0.311
X-ray L	5	2.6 4	0.0003
X-ray $K\alpha_2$	35.55020 2	4.8 3	0.0037
X-ray $K\alpha_1$	36.02630 2	8.9 5	0.0068
X-ray Kβ	40.7	3.33 19	0.0029
γ 1	145.440 10	48.0 20	0.149

142PR B- DECAY (19.13 H 4) I(min)=0.10%

142PR ALSO DECAYS
VIA A 0.0164% EC BRANCH

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	586 3		
avg	182.7 11	3.7 5	0.0144
β- 2 max	2162 3		
avg	834.2 13	96.3 5	1.71
total β-			
avg	809.9 14	100.0 7	1.73

1 weak β's omitted (ΣIβ = 0.02%)

γ 2	1575.75 5	3.7 5	0.124

1 weak γ's omitted (ΣIγ = 0.02%)

143PR B- DECAY (13.56 D 2) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	932.0 20		
avg	314.3 8	100	0.669

144PR B- DECAY (17.28 M 3) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	811 3		
avg	267.0 12	1.02 5	0.0058
β- 2 max	2301 3		
avg	894.8 14	1.10 5	0.0210
β- 3 max	2997 3		
avg	1221.8 14	97.80 10	2.55
total β-			
avg	1208.4 15	99.93 13	2.57
γ 3	696.490 20	1.48 6	0.0220
γ 7	1489.15 5	0.300 16	0.0095
γ 9	2185.70 6	0.77 5	0.0360

7 weak γ's omitted (ΣIγ = 0.02%)

145PM EC DECAY (17.7 Y 4) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	4.23	81 4	0.0073
ce-K- 1	23.63 10	2.19 10	0.0011
ce-K- 2	28.83 10	6.7 5	0.0041
Auger-K	30.5	6.5 20	0.0042
ce-L- 1	60.07 10	3.15 14	0.0040
ce-L- 2	65.27 10	1.78 16	0.0025
ce-M- 1	65.62 10	0.72 4	0.0010
ce-NOP- 1	66.88 10	0.193 9	0.0003
ce-M- 2	70.82 10	0.37 9	0.0006
ce-NOP- 2	72.08 10	0.111 24	0.0002
X-ray L	5.23	14.4 20	0.0016
X-ray $K\alpha_2$	36.8474 3	21.1 7	0.0166
X-ray $K\alpha_1$	37.3610 3	38.6 12	0.0307
X-ray Kβ	42.3	14.7 5	0.0132
γ 1	67.20 10	0.65 3	0.0009
γ 2	72.40 10	2.18 15	0.0034

147ND B- DECAY (11.06 D 3) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	4.38	41.1 21	0.0038
Auger-K	31.5	3.7 12	0.0025
ce-K- 3	45.9210 22	48.3 10	0.0473
ce-K- 4	75.30 5	0.31 4	0.0005
ce-L- 3	83.6771 22	7.10 14	0.0126
ce-MNO- 3	89.456 6	2.375 18	0.0045

*** continued ***

147ND B- DECAY (11.06 D 3) (continued)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	208.6 10		
avg	57.2 3	2.10 10	0.0026
β- 2 max	363.5 10		
avg	105.6 4	15.0 10	0.0337
β- 3 max	405.2 10		
avg	119.4 4	0.80 10	0.0020
β- 4 max	484.0 10		
avg	146.2 4	0.50 20	0.0016
β- 5 max	803.4 10		
avg	263.5 4	81.0 10	0.455
β- 6 max	894.5 10		
avg	299.0 4	0.2	0.0013
total β-			
avg	233.6 5	99.7 15	0.496
1 weak β's omitted (ΣIβ = 0.07%)			
X-ray L	5.43	7.8 11	0.0009
X-ray $K\alpha_2$	38.1712 5	12.8 5	0.0104
X-ray $K\alpha_1$	38.7247 5	23.2 8	0.0192
X-ray Kβ	43.8	8.9 4	0.0083
γ 3	91.1050 20	27.94 21	0.0542
γ 4	120.48 5	0.40 5	0.0010
γ 10	196.64 4	0.204 17	0.0009
γ 15	275.374 15	0.80 5	0.0047
γ 17	319.411 18	1.96 12	0.0133
γ 21	398.155 20	0.87 6	0.0074
γ 23	410.48 3	0.140 9	0.0012
γ 24	439.895 22	1.20 9	0.0113
γ 27	489.24 3	0.154 9	0.0016
γ 28	531.016 22	13.1 8	0.148
γ 30	594.803 3	0.265 17	0.0034
γ 33	685.90 4	0.81 5	0.0119
21 weak γ's omitted (ΣIγ = 0.07%)			

149ND B- DECAY (1.73 H 1) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	4.38	34.2 21	0.0032
ce-K- 2	13.699 20	1.42 7	0.0004
ce-L- 1	22.57 3	4.8 5	0.0023
ce-M- 1	28.35 3	1.10 10	0.0007
ce-K- 4	29.15 3	3.7 6	0.0023
ce-K- 5	29.48 10	0.49 16	0.0003
ce-NOP- 1	29.67 3	0.36 4	0.0002
ce-K- 6	30.56 4	0.9 4	0.0006
Auger-K	31.5	2.6 9	0.0018
ce-L- 2	51.455 20	0.224 11	0.0002
ce-K- 8	51.823 15	2.22 19	0.0024
ce-L- 4	66.90 3	1.7 4	0.0025
ce-K- 10	69.137 14	17.1 18	0.0252
ce-M- 4	72.68 3	0.39 8	0.0006
ce-NOP- 4	74.00 3	0.105 22	0.0002
ce-L- 8	89.579 15	0.35 5	0.0007
ce-K- 15	94.026 14	0.23 3	0.0005
ce-L- 10	106.893 14	2.6 3	0.0059
ce-K- 16	110.692 10	0.41 5	0.0010
ce-M- 10	112.672 15	0.55 6	0.0013
ce-NOP-10	113.991 15	0.158 17	0.0004
ce-K- 19	143.456 9	0.36 5	0.0011
ce-K- 21	153.744 9	0.28 3	0.0009
ce-K- 22	162.964 10	0.44 8	0.0015

*** continued ***

149ND B- DECAY (1.73 H 1) (continued)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
ce-K- 23	166.123 8	4.3 3	0.0154
ce-L- 19	181.212 9	0.108 13	0.0004
ce-K- 27	195.034 8	2.18 21	0.0090
ce-L- 23	203.879 8	0.67 5	0.0029
ce-MNO-23	209.658 10	0.183 13	0.0008
ce-K- 32	222.508 9	0.49 7	0.0023
ce-K- 33	224.981 8	0.170 18	0.0008
ce-L- 27	232.790 8	0.39 4	0.0019
β- 1 max	368 7		
avg	107.1 23	0.154 10	0.0004
β- 2 max	446 7		
avg	133.2 24	0.92 5	0.0026
β- 3 max	1025 7		
avg	351 3	19.5 13	0.146
β- 4 max	1142 7		
avg	399 3	24.1 18	0.205
β- 5 max	1218 7		
avg	430 3	0.6 10	0.0055
β- 6 max	1255 7		
avg	445 3	0.91 8	0.0086
β- 7 max	1283 7		
avg	457 3	3.8 5	0.0370
β- 8 max	1292 7		
avg	461 3	0.5 5	0.0049
β- 9 max	1320 7		
avg	473 3	0.53 13	0.0053
β-10 max	1392 7		
avg	503 3	0.8	0.0086
β-11 max	1410 7		
avg	511 3	19.1 16	0.208
β-12 max	1469 7		
avg	536 3	26.5 21	0.303
β-13 max	1491 7		
avg	546 3	2.9 13	0.0337
β-14 max	1566 7		
avg	578 3	≈1	≈0.0135
total β-			
avg	454 4	101 4	0.981
2 weak β's omitted (ΣIβ = 0.02%)			
X-ray L	5.43	6.5 9	0.0008
X-ray $K\alpha_2$	38.1712 5	9.1 6	0.0074
X-ray $K\alpha_1$	38.7247 5	16.6 11	0.0137
X-ray Kβ	43.8	6.4 4	0.0059
γ 2	58.883 20	1.52 7	0.0019
γ 4	74.33 3	1.26 20	0.0020
γ 5	74.66 10	1.0 3	0.0016
γ 6	75.74 4	0.33 11	0.0005
γ 8	97.007 15	1.53 13	0.0032
γ 10	114.321 14	18.8 20	0.0457
γ 11	116.93 3	0.117 23	0.0003
γ 12	122.416 14	0.232 24	0.0006
γ 13	126.630 19	0.115 12	0.0003
γ 15	139.210 14	0.48 5	0.0014
γ 16	155.876 10	6.1 6	0.0201
γ 17	177.831 19	0.164 13	0.0006
γ 19	188.640 9	1.99 24	0.0080
γ 20	192.027 9	0.60 6	0.0024
γ 21	198.928 9	1.46 16	0.0062
γ 22	208.148 10	2.9 4	0.0130
γ 23	211.307 8	27.3 18	0.123
γ 24	213.946 17	0.41 5	0.0019
γ 25	226.846 21	0.16 4	0.0008
γ 27	240.218 8	4.0 4	0.0203
γ 28	245.699 8	1.04 11	0.0054
γ 31	258.064 14	0.38 4	0.0021
γ 32	267.692 9	6.1 6	0.0346
γ 33	270.165 8	10.7 11	0.0617
γ 34	273.25 4	0.23 5	0.0014
γ 35	275.445 13	0.60 12	0.0035

*** continued ***

149ND B- DECAY (1.73 H 1) (continued)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
γ 36	276.960 19	0.32 7	0.0019
γ 37	282.455 11	0.62 6	0.0037
γ 38	288.192 12	0.68 7	0.0042
γ 39	294.807 12	0.58 6	0.0037
γ 40	301.133 16	0.38 4	0.0025
γ 41	310.982 14	0.52 5	0.0034
γ 42	326.556 11	4.7 5	0.0325
γ 44	347.833 23	0.19 9	0.0014
γ 45	349.233 10	1.48 16	0.0110
γ 48	360.055 20	0.164 13	0.0013
γ 49	366.637 15	0.66 8	0.0052
γ 51	384.691 18	0.34 4	0.0028
γ 53	423.554 10	9.4 10	0.0852
γ 55	443.550 12	1.50 15	0.0142
γ 63	538.15 7	0.11 4	0.0013
γ 64	540.510 10	7.7 8	0.0886
γ 65	556.43 5	1.2 5	0.0139
γ 70	630.238 21	0.221 24	0.0030
γ 71	635.482 25	0.112 12	0.0015
γ 72	654.831 14	7.3 8	0.102
γ 77	686.933 25	0.104 12	0.0015
γ 78	696.266 25	0.172 18	0.0026
γ 92	808.834 22	0.169 18	0.0029
γ107	923.876 25	0.115 12	0.0023
γ116	979.02 4	0.112 12	0.0023
γ119	1022.78 3	0.120 12	0.0026
γ139	1234.12 5	0.292 25	0.0077

100 weak γ's omitted (ΣIγ = 1.59%)

175YB B- DECAY (4.19 D 1) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	6	3.1 4	0.0004
Auger-K	43.5	0.19 9	0.0002
ce-K- 1	50.489 4	3.7 5	0.0039
ce-K- 2	74.342 6	0.131 19	0.0002
ce-L- 1	102.933 4	0.88 12	0.0019
ce-M- 1	111.312 4	0.20 3	0.0005
ce-K- 6	333.008 20	0.24 4	0.0017
β- 1 max	71.4 13		
avg	18.4 4	10.1 4	0.0040
β- 2 max	216.2 13		
avg	68.1 5	0.80 12	0.0012
β- 3 max	353.9 13		
avg	101.6 5	2.60 20	0.0056
β- 4 max	467.7 13		
avg	139.1 5	86.5 17	0.256
total β-			
avg	125.4 7	100.0 18	0.267
X-ray L	7.66	1.10 18	0.0002
X-ray $K\alpha_2$	52.9650 5	1.10 14	0.0012
X-ray $K\alpha_1$	54.0698 5	1.93 24	0.0022
X-ray Kβ	61.3	0.80 10	0.0010
γ 1	113.803 4	1.91 25	0.0046
γ 2	137.656 6	0.117 16	0.0003
γ 3	144.861 5	0.36 5	0.0011
γ 5	282.517 14	3.1 4	0.0184
γ 6	396.322 20	6.5 8	0.0549

1 weak γ's omitted (ΣIγ = 0.08%)

177LU B- DECAY (6.71 D 1) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	6.18	8.9 6	0.0012
ce-K- 1	6.2952 21	0.111 9	≈0
Auger-K	44.8	0.28 12	0.0003
ce-K- 2	47.601 3	5.2 4	0.0053
ce-L- 2	101.681 3	7.0 5	0.0152
ce-M- 2	110.351 3	1.74 13	0.0041
ce-NOP- 2	112.414 3	0.50 4	0.0012
ce-K- 4	143.008 10	0.59 8	0.0018
ce-L- 4	197.088 10	0.100 18	0.0004
β- 1 max	175.8 10		
avg	47.3 3	12.2 7	0.0123
β- 2 max	384.1 10		
avg	111.3 4	9.1 12	0.0216
β- 3 max	497.1 10		
avg	148.9 4	78.6 10	0.249
total β-			
avg	133.0 5	99.9 18	0.283

1 weak β's omitted (ΣIβ = 0.05%)

X-ray L	7.9	3.3 4	0.0006
X-ray $K\alpha_2$	54.6114 8	1.64 12	0.0019
X-ray $K\alpha_1$	55.7902 8	2.87 20	0.0034
X-ray Kβ	63.2	1.20 9	0.0016
γ 1	71.6460 20	0.154 10	0.0002
γ 2	112.952 3	6.4 4	0.0154
γ 4	208.359 10	11.0 8	0.0488
γ 5	249.686 25	0.212 14	0.0011
γ 6	321.33 4	0.219 14	0.0015

1 weak γ's omitted (ΣIγ = 0.05%)

181HF B- DECAY (42.4 D 1) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
ce-M- 1	1.19 10	2.64	≈0
ce-NOP- 1	3.33 10	1.36	≈0
ce-NOP- 2	5.64 3	0.120 10	≈0
Auger-L	6.35	40.3 23	0.0055
Auger-K	46.2	1.5 7	0.0015
ce-K- 3	65.604 20	21.4 12	0.0299
ce-K- 4	68.834 20	8.5 6	0.0124
ce-K- 5	69.44 4	2.5 4	0.0037
ce-L- 3	121.338 20	25.0 14	0.0647
ce-L- 4	124.568 20	1.71 12	0.0045
ce-L- 5	125.18 4	0.49 10	0.0013
ce-M- 3	130.312 20	6.2 4	0.0173
ce-NOP- 3	132.454 20	1.81 10	0.0051
ce-M- 4	133.542 20	0.40 3	0.0011
ce-M- 5	134.15 4	0.113 25	0.0003
ce-NOP- 4	135.684 20	0.118 9	0.0003
ce-K- 6	278.43 20	0.54 3	0.0032
ce-L- 6	334.17 20	0.169 9	0.0012
ce-K- 8	414.58 20	1.54 10	0.0136
ce-L- 8	470.32 20	0.353 22	0.0035

*** continued ***

181HF B- DECAY (42.4 D 1) (continued)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	404 4		
avg	117.7 14	7 3	0.0175
β- 2 max	408 4		
avg	118.9 14	93 3	0.236
total β-			
avg	118.8 14	100 5	0.253
X-ray L	8.15	15.7 18	0.0027
X-ray $K\alpha_2$	56.2770 10	9.5 5	0.0113
X-ray $K\alpha_1$	57.5320 10	16.5 8	0.0202
X-ray Kβ	65.2	7.0 4	0.0097
γ 3	133.020 20	43.0 22	0.122
γ 4	136.250 20	6.1 3	0.0177
γ 5	136.86 4	1.80 9	0.0052
γ 6	345.85 20	14.0 7	0.103
γ 7	476.00 20	0.43 10	0.0044
γ 8	482.00 20	86 5	0.883
γ 9	615.5 5	0.250 13	0.0033

3 weak γ's omitted (ΣIγ = 0.03%)

181W EC DECAY (121.2 D 3) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
ce-M- 1	3.50 3	25 6	0.0018
ce-NOP- 1	5.64 3	8.2 18	0.0010
Auger-L	6.35	58 6	0.0078
Auger-K	46.2	3.0 14	0.0030
ce-K- 3	85.1 3	0.107 12	0.0002
γ 1	6.21 3	0.97 22	0.0001
X-ray L	8.15	22 3	0.0039
X-ray $K\alpha_2$	56.2770 10	19.0 20	0.0228
X-ray $K\alpha_1$	57.5320 10	33 4	0.0407
X-ray Kβ	65.2	14.0 15	0.0194

2 weak γ's omitted (ΣIγ = 0.14%)

185W B- DECAY (75.1 D 3) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	432.5 10		
avg	126.8 4	100	0.270

1 weak β's omitted (ΣIβ = 0.08%)

1 weak γ's omitted (ΣIγ = 0.02%)

191 OS B- DECAY (15.4 D 2) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	7	101 9	0.0152
ce-L- 1	28.431 10	71 8	0.0428
ce-L- 2	33.63 3	0.29 4	0.0002
ce-MNO- 1	38.676 10	29 3	0.0237
ce-MNO- 2	43.88 3	0.100 12	≈0
Auger-K	49.6	3.0 15	0.0032
ce-K- 4	53.289 7	78 9	0.0890
ce-L- 4	115.981 7	16.6 20	0.0409
ce-MNO- 4	126.226 7	5.1 6	0.0137
β- 1 max	142 3		
avg	37.6 7	100	0.0801
X-ray L	9.18	50 6	0.0098
X-ray $K\alpha_2$	63.2867 7	22 3	0.0294
X-ray $K\alpha_1$	64.8956 7	38 5	0.0519
X-ray Kβ	73.6	16.2 20	0.0254
γ 4	129.400 7	35 4	0.0965

3 weak γ's omitted (ΣIγ = 0.03%)

194IR B- DECAY (19.15 H 3) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	7.24	0.66 8	0.0001
ce-K- 1	215.23 4	0.18 4	0.0008
ce-K- 3	250.15 4	0.64 10	0.0034
ce-L- 3	314.66 4	0.27 4	0.0018
β- 1 max	440 9		
avg	130 3	0.37 4	0.0010
β- 2 max	620 9		
avg	190 3	0.150 20	0.0006
β- 3 max	730 9		
avg	229 3	0.54 6	0.0026
β- 4 max	760 9		
avg	241 3	0.60 6	0.0031
β- 5 max	970 9		
avg	320 3	1.64 17	0.0112
β- 6 max	1320 9		
avg	456 3	0.26 4	0.0025
β- 7 max	1620 9		
avg	579 4	1.6 3	0.0197
β- 8 max	1910 9		
avg	703 4	9.0 9	0.135
β- 9 max	2240 9		
avg	843 4	85.5 20	1.53
total β-			
avg	804 4	99.9 23	1.71

11 weak β's omitted (ΣIβ = 0.29%)

*** continued ***

194IR B- DECAY (19.15 H 3) (continued)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
X-ray L	9.44	0.36 6	*0
X-ray $K\alpha_2$	65.1220 20	0.23 3	0.0003
X-ray $K\alpha_1$	66.8320 20	0.39 5	0.0006
X-ray Kβ	75.7	0.171 22	0.0003
γ 1	293.62 4	2.8 5	0.0176
γ 2	300.7 5	0.34 6	0.0022
γ 3	328.54 4	13.0 20	0.0910
γ 13	589.20 20	0.14 4	0.0018
γ 15	622.3 4	0.30 5	0.0040
γ 16	645.32 6	1.3 4	0.0179
γ 23	938.87 10	0.57 11	0.0114
γ 27	1151.10 20	0.60 11	0.0147
γ 29	1183.80 20	0.29 5	0.0072
γ 34	1469.2 3	0.18 4	0.0057

41 weak γ's omitted (ΣIγ = 1.12%)

197PT B- DECAY (20.00 H 12) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	7.42	38 4	0.0061
Auger-K	52.4	0.18 9	0.0002
ce-L- 1	62.997 10	55 4	0.0739
ce-M- 1	73.925 10	13.4 9	0.0210
ce-NOP- 1	76.591 10	4.2 3	0.0068
ce-K- 2	110.78 20	5.0 3	0.0118
ce-L- 2	177.15 20	0.85 6	0.0032
ce-MNO- 2	188.08 20	0.260 15	0.0010
β- 1 max	450.2 11		
avg	132.1 4	11.6 10	0.0326
β- 2 max	641.6 10		
avg	197.7 4	78 4	0.329
β- 3 max	719.0 10		
avg	225.3 4	10.4 19	0.0499
total β- avg	193.0 4	100 5	0.412
X-ray L	9.7	22 3	0.0045
X-ray $K\alpha_2$	66.9895 8	1.39 9	0.0020
X-ray $K\alpha_1$	68.8037 8	2.38 15	0.0035
γ 1	77.350 10	17.2 10	0.0283
X-ray Kβ	78	1.04 7	0.0017
γ 2	191.50 20	5.2 3	0.0212

198AU B- DECAY (2.696 D 2) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	7.6	2.10 16	0.0003
ce-K- 1	328.693 9	2.87 6	0.0201
ce-L- 1	396.956 9	1.03 3	0.0087
ce-M- 1	408.233 9	0.267 20	0.0023
ce-NOP- 1	410.995 9	0.101 7	0.0009
β- 1 max	285.3 6		
avg	79.60 20	1.3 3	0.0022
β- 2 max	961.2 6		
avg	314.80 20	98.7 3	0.662
total β- avg	311.78 21	100.0 5	0.664

1 weak β's omitted (ΣIβ = 0.03%)

X-ray L	10	1.29 15	0.0003
X-ray $K\alpha_2$	68.8950 20	0.81 3	0.0012
X-ray $K\alpha_1$	70.8190 20	1.38 5	0.0021
X-ray Kβ	80.3	0.607 21	0.0010
γ 1	411.795 9	95.47 8	0.837
γ 2	675.878 18	1.06 23	0.0153
γ 3	1087.69 3	0.23 6	0.0053

199AU B- DECAY (3.139 D 7) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	7.6	23.4 18	0.0038
ce-L- 1	34.989 5	2.8 3	0.0021
ce-MNO- 1	46.266 5	0.87 9	0.0009
Auger-K	53.8	0.6 4	0.0007
ce-K- 2	75.268 10	11.8 7	0.0190
ce-K- 3	125.0977 8	6.9 8	0.0183
ce-L- 2	143.531 10	18.4 10	0.0564
ce-MNO- 2	154.808 10	6.4 4	0.0211
ce-L- 3	193.3607 10	1.29 15	0.0053
ce-MNO- 3	204.6384 11	0.41 5	0.0018
β- 1 max	250.0 10		
avg	67.40 20	23.0 20	0.0330
β- 2 max	292.0 10		
avg	82.50 20	70 4	0.123
β- 3 max	453.0 10		
avg	133.0 10	7.0 10	0.0198
total β- avg	82.56 24	100 5	0.176
X-ray L	10	14.3 17	0.0030
γ 1	49.828 4	0.32 3	0.0003
X-ray $K\alpha_2$	68.8950 20	5.2 3	0.0077
X-ray $K\alpha_1$	70.8190 20	8.9 6	0.0134
X-ray Kβ	80.3	3.92 24	0.0067
γ 2	158.370 10	40.0 20	0.135
γ 3	208.2	9.1 10	0.0404

201TL EC DECAY (73.5 H 8) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	7.6	80 7	0.0129
ce-L- 2	15.76 3	10.4 12	0.0035
ce-L- 3	17.35 3	10.3 12	0.0038
ce-MNO- 2	27.04 3	3.3 4	0.0019
ce-MNO- 3	28.63 3	3.2 4	0.0020
ce-K- 4	52.24 4	10.3 11	0.0115
Auger-K	53.8	3.5 21	0.0040
ce-K- 5	82.78 7	0.30 5	0.0005
ce-K- 6	84.33 7	18.4 15	0.0331
ce-L- 4	120.50 4	1.75 19	0.0045
ce-MNO- 4	131.78 4	0.55 6	0.0015
ce-L- 6	152.59 7	3.12 25	0.0101
ce-MNO- 6	163.87 7	0.95 14	0.0033
X-ray L	10	49 6	0.0104
γ 2	30.60 3	0.28 3	0.0002
γ 3	32.19 3	0.32 4	0.0002
X-ray $K\alpha_2$	68.8950 20	28.9 18	0.0425
X-ray $K\alpha_1$	70.8190 20	49 3	0.0743
X-ray Kβ	80.3	21.7 13	0.0370
γ 4	135.34 4	3.7 4	0.0105
γ 5	165.88 7	0.19 3	0.0007
γ 6	167.43 7	11.9 9	0.0424

203HG B- DECAY (46.59 D 5) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	7.78	8.9 7	0.0015
Auger-K	55.2	0.44 20	0.0005
ce-K- 1	193.658 6	13.3 4	0.0548
ce-L- 1	263.841 6	4.01 12	0.0225
ce-MNO- 1	275.484 6	1.26 5	0.0074
β- 1 max	212.0 10		
avg	57.6 4	100	0.123
X-ray L	10.3	5.9 7	0.0013
X-ray $K\alpha_2$	70.8319 9	3.73 12	0.0056
X-ray $K\alpha_1$	72.8715 9	6.32 19	0.0098
X-ray Kβ	82.6	2.79 10	0.0049
γ 1	279.188 6	81.5 8	0.485

203PB EC DECAY (52.02 H 5) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	7.78	57 5	0.0094
Auger-K	55.2	3.0 14	0.0035
ce-K- 1	193.658 6	13.1 4	0.0539
ce-L- 1	263.841 6	3.95 12	0.0222
ce-MNO- 1	275.484 6	1.24 5	0.0072
ce-K- 2	315.785 13	0.51 4	0.0034
X-ray L	10.3	38 4	0.0083
X-ray $K\alpha_2$	70.8319 9	25.6 7	0.0386
X-ray $K\alpha_1$	72.8715 9	43.3 10	0.0673
X-ray Kβ	82.6	19.2 5	0.0337
γ 1	279.188 6	80.2 9	0.477
γ 2	401.315 13	3.53 17	0.0302
γ 3	680.495 17	0.67 6	0.0098

207BI EC DECAY (38 Y 3) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
Auger-L	8	51 4	0.0087
Auger-K	56.7	2.6 11	0.0031
ce-K- 1	481.665 20	1.56 3	0.0160
ce-L- 1	553.809 20	0.430 8	0.0051
ce-K- 3	975.615 20	7.2 4	0.150
ce-L- 3	1047.759 20	1.78 8	0.0398
ce-MNO- 3	1059.769 20	0.595 24	0.0134

1 weak β's omitted (ΣIβ = 0.01%)

X-ray L	10.6	35 4	0.0080
X-ray $K\alpha_2$	72.8042 9	22.8 5	0.0354
X-ray $K\alpha_1$	74.9694 9	38.6 7	0.0616
X-ray Kβ	84.9	17.1 4	0.0310
γ 1	569.670 20	97.8 5	1.19
γ 2	897.3 3	0.156 20	0.0030
γ 3	1063.620 20	74 3	1.68
γ 4	1442 10	0.147 20	0.0045
γ 5	1770.22 4	7.3 4	0.277

Maximum γ±-intensity = 0.02%

239NP B- DECAY (2.355 D 4) I(min)=0.10%

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
ce-M- 1	1.9171 14	7.0 6	0.0003
ce-NOP- 1	6.2914 8	2.33 18	0.0003
Auger-L	10.3	42 7	0.0091
ce-L- 2	21.553 20	7.0 18	0.0032
ce-L- 3	26.313 20	9.6 15	0.0054
ce-L- 4	34.163 20	25 7	0.0179
ce-L- 5	38.383 5	0.33 5	0.0003
ce-M- 2	38.717 20	1.6 4	0.0013
ce-NOP- 2	43.091 20	0.43 11	0.0004
ce-M- 3	43.477 20	2.9 5	0.0027
ce-L- 6	44.78 3	11 3	0.0102
ce-NOP- 3	47.851 20	1.22 19	0.0012
ce-M- 4	51.327 20	7.7 20	0.0084
ce-MNO- 5	55.547 5	0.105 16	0.0001
ce-NOP- 4	55.701 20	2.3 6	0.0027
ce-K- 11	59.89 8	0.33 7	0.0004
ce-M- 6	61.95 3	2.8 7	0.0037
ce-NOP- 6	66.32 3	1.0 3	0.0014
Auger-K	76	0.9 10	0.0015
ce-L- 8	83.033 11	4.3 8	0.0076
ce-L- 9	83.37 4	0.42 8	0.0007
ce-K- 12	87.93 5	7.8 9	0.0146
ce-M- 8	100.197 10	1.14 20	0.0024
ce-MNO- 9	100.54 4	0.139 25	0.0003
ce-NOP- 8	104.571 10	0.39 8	0.0009
ce-K- 13	104.60 10	0.43 9	0.0009
ce-K- 14	106.37 5	20.9 20	0.0473
ce-K- 15	132.59 10	0.18 5	0.0005
ce-K- 16	151.02 9	0.116 22	0.0004
ce-K- 17	155.78 6	17.2 6	0.0571
ce-L- 12	186.653 11	1.62 18	0.0064
ce-L- 14	205.093 11	4.4 5	0.0192
ce-MNO-14	222.257 10	1.50 9	0.0071
ce-L- 17	254.50 3	3.52 12	0.0191
ce-MNO-17	271.67 3	1.13 4	0.0065

*** continued ***

239NP B- DECAY (2.355 D 4) (continued)

Radiation Type	Energy (keV)	Intensity (%)	Δ(g-rad/ μCi-h)
β- 1 max	211 3		
avg	57.0 10	1.60 20	0.0019
β- 2 max	331 3		
avg	93.0 10	33.0 20	0.0654
β- 3 max	393 3		
avg	112.0 10	8.0 15	0.0191
β- 4 max	438 3		
avg	126.0 10	51 3	0.137
β- 6 max	666 3		
avg	201.0 10	2.0 10	0.0086
β- 7 max	715 3		
avg	219.0 10	4.0 20	0.0187
total β-			
avg	118.1 11	100 5	0.250
X-ray L	14.3	62 8	0.0190
γ 3	49.410 20	0.152 23	0.0002
γ 5	61.480 4	0.96 15	0.0013
X-ray $K\alpha_2$	99.55 5	13.7 8	0.0291
X-ray $K\alpha_1$	103.76 5	22.1 12	0.0487
γ 8	106.130 10	22.7 13	0.0513
X-ray Kβ	117	10.4 6	0.0259
γ 11	181.71 6	0.111 15	0.0004
γ 12	209.750 10	3.24 25	0.0145
γ 13	226.42 8	0.63 10	0.0031
γ 14	228.190 10	10.7 7	0.0521
γ 15	254.41 8	0.100 18	0.0005
γ 17	277.60 3	14.1 4	0.0834
γ 18	285.41 3	0.78 8	0.0047
γ 19	315.88 4	1.59 11	0.0107
γ 20	334.19 5	2.03 18	0.0145

8 weak γ's omitted ($\Sigma I\gamma$ = 0.42%)

REFERENCE LIST

55Ev23 R.D.Evans - The Atomic Nucleus, McGraw-Hill Book Co., Inc., New York (1955)

65Be37 I.Bergstrom, C.Nordling, A.H.Snell, R.Wilson, B.G.Pettersson - Alpha-, Beta- and Gamma-Ray Spectroscopy, Vol.2, K.Siegbahn, Ed., North-Holland Publishing Co., Amsterdam, p.1523 (1965)
Some 'Internal' Effects in Nuclear Decay

66Sc35 H.F.Schopper - Weak Interactions and Nucl.Beta Decay, North-Holland Publ.Co., Amsterdam (1966)

67BeBu J.A.Bearden, A.F.Burr - Rev.Mod.Phys. 39, 125(1967)
Reevaluation of X-Ray Atomic Energy Levels

68Lo14 R.Loevinger, M.Berman- J.Nucl.Med., Suppl.No. 1,7 (1968)
A Schema for Absorbed-Dose Calculations for Biologically-Distributed Radionuclides

70MaBl M.J.Martin, P.H.Blichert-Toft - Nucl.Data Tables A8, Nos.1-2 (1970)
Radioactive Atoms. Auger Electron, α-, β-, γ-, and X-Ray Data

72BaCr W.Bambynek, B.Crasemann, R.W.Fink, H.-U.Freund, H.Mark, C.D.Swift, R.E.Price, P.Venugopala Rao - Rev.Mod.Phys. 44, 716 (1972)
X-Ray Fluorescence Yields, Auger, and Coster-Kronig Transition Probabilities

72Ra47 P.V.Rao, M.S.Chen, B.Crasemann - Phys.Rev. A5, 997 (1972)
Atomic Vacancy Distributions Produced by Inner-Shell Ionization

73MaVR M.J.Martin - ORNL-4923 (1973)
Radioactive Atoms - Supplement I

ORNL-5114
UC-34c — Nuclear Physics

INTERNAL DISTRIBUTION

1. Biology Library
2-4. Central Research Library
5. ORNL – Y-12 Technical Library Document Reference Section
6-15. Laboratory Records Department
16. Laboratory Records, ORNL - RC
17. R. L. Auble
18-42. S. J. Ball
43. F. E. Bertrand
44. O. W. Burke
45. A. G. Croff
46. J. K. Dickens
47. J. S. Eldridge
48. Y. A. Ellis
49. J. F. Emery
50-74. W. B. Ewbank
75. T. A. Gabriel
76. B. Harmatz
77. O. W. Hermann
78. D. J. Horen
79. F. B. K. Kam
80. S. V. Kaye
81. C. W. Kee
82. H. T. Kerr
83. H. J. Kim
84. D. C. Kocher
85. A. S. Loebl
86-110. M. J. Martin
111. F. R. O'Donnell
112. H. A. Parker
113. J. W. Poston
114. S. A. Reynolds
115. P. S. Rohwer
116. R. W. Roussin
117. M. R. Schmorak
118. J. Shaboskie
119. M. J. Skinner
120. P. H. Stelson
121. D. K. Trubey
122. G. U. Ulrikson
123. C. R. Weisbin
124. A. Zucker

EXTERNAL DISTRIBUTION

125. Y. K. Agarwal, Tata Institute of Fundamental Research, Homi Bhabha Road, Bombay 5, India
126. F. Ajzenberg-Selove, Department of Physics, University of Pennsylvania, Philadelphia, Pennsylvania 19104
127. E. U. Baranger, Department of Physics, University of Pittsburgh, Pittsburgh, Pennsylvania 15213
128. D. Berenyi, Institute of Nuclear Research, Hungarian Academy of Sciences, 18/c Bem ter, Postafiok 51, H-4001 Debrecen 1, Hungary
129. M. J. Berger, Radiation Physics Section, National Bureau of Standards, Washington, D. C. 20234
130. V. M. Bermudez, Code 6440, Naval Research Laboratory, Washington, D. C. 20390
131. S. K. Bhattacharya, Tata Institute of Fundamental Research, Homi Bhabha Road, Bombay 5, India
132. H. Bichsel, Medical Radiation Physics, University of Washington, Nn 158 University Hospital Rc08, Seattle, Washington 98195
133. J. Blachot, Centre d'Etudes Nucleaires, B. P. 85, Centre de Tri, 38041 Grenoble-Cedex, France

134. M. E. Bunker, Los Alamos Scientific Laboratory, Post Office Box 1663, Los Alamos, New Mexico 87544
135. E. O. Case, Office of Nuclear Reactor Regulation, Nuclear Regulatory Commission, Washington, D. C. 20555
136. R. S. Caswell, Center for Radiation Research, National Bureau of Standards, Washington, D. C. 20234
137. L. Cavallo, Radioactivity Section, Building 245, Room C114, National Bureau of Standards, Washington, D. C. 20234
138. N. N. Das Gupta, University College of Science, 92, Acharya Prafulla Chandra Road, Calcutta 9, India
139. R. M. Diamond, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720
140. L. T. Dillman, Department of Physics, Ohio Wesleyan University, Delaware, Ohio 43015
141. J. Dubost, C. E. A., Centre de la Hague, B. P. 209, 50107 Cherbourg, France
142. K. F. Flynn, Chemistry Division, Building 200, Argonne National Laboratory, 9700 South Cass Avenue, Argonne, Illinois 60439
143. R. Gehrke, Idaho National Engineering Laboratory, Aerojet Nuclear Company, Post Office Box 1845, Idaho Falls, Idaho 83401
144. K. D. George, Sterling Forest Research Center, Union Carbide Corporation, Post Office Box 324, Tuxedo, New York 10987
145. G. I. Gleason, Oak Ridge Associated Universities, Post Office Box 117, Oak Ridge, Tennessee 37830
146. G. S. Goldhaber, Physics Division, Brookhaven National Laboratory, Upton, L. I., New York 11973
147. P. M. Grant, Group CNC-11, Los Alamos Scientific Laboratory, Post Office Box 1663, Los Alamos, New Mexico 87544
148. B. Grinberg, Commissariat a l'Energie Atomique, Centre d'Etudes Nucleaires de Saclay, B. P. 2, 91190 Gif-sur-Yvette, France
149. L. Grodzins, Laboratory for Nuclear Science, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139
150. J. H. Harley, Energy Research and Development Administration, Health and Safety Laboratory, 376 Hudson Street, New York, New York 10014
151. R. L. Heath, Idaho National Engineering Laboratory, Aerojet Nuclear Company, Post Office Box 1845, Idaho Falls, Idaho 83401
152. D. Hoppes, Radiation Physics, C112, National Bureau of Standards, Washington, D. C. 20234
153. S. T. Hsue, Department of Physics, University of Northern Iowa, Cedar Falls, Iowa 50613
154. V. Husak, University Hospital Olomouc, Olomouc, Czechoslovakia
155. J. M. R. Hutchinson, Radioactivity Section, National Bureau of Standards, Washington, D. C. 20234
156. B. Kahn, Office of Interdisciplinary Programs, Environmental Resources Center, 205 Old Civil Engineering Building, Atlanta, Georgia 30332
157. Y. Kato, National Institute of Radiological Sciences, 9-1, 4-Chome, Anagawa, Chiba-Shi, 280, Japan
158. H. J. Larsen, Office of Nuclear Material Safety and Safeguards, Nuclear Regulatory Commission, Washington, D. C. 20555

159. J. S. Laughlin, Division of Biophysics, Sloan-Kettering Cancer Center, 444 East 68 Street, New York, New York 10021
160. C. M. Lederer, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720
161. C. J. Maletskos, Bay View, Gloucester, Massachusetts 01930
162. W. B. Mann, Radioactivity Section, National Bureau of Standards, Washington, D. C. 20234
163. A. McCabe, Palisades Nuclear Plant, Route 2, Box 154, Covert, Michigan 49043
164. G. J. McCallum, Department of Scientific and Industrial Research, Institute of Nuclear Sciences, Private Bag, Lower Hutt, New Zealand
165. A. Mendonce, C. B. T. N., Instituto de Radioprotecao e Dosimetria, Caixa Postal 37025 — ZC-20, Rio de Janeiro, Brazil
166. R. Middleton, Tandem Accelerator Laboratory, University of Pennsylvania, Philadelphia, Pennsylvania 19104
167. J. W. Mihelich, Department of Physics, University of Notre Dame, Notre Dame, Indiana 46556
168. D. R. Miller, Division of Physical Research, Energy Research and Development Administration, Washington, D. C. 20545
169. A. Moghissi, Office of Interdisciplinary Programs, Georgia Institute of Technology, Atlanta, Georgia 30332
170. H. W. Morton, Nuclear Fuel Services, 6000 Executive Boulevard, Rockville, Maryland 20851
171. J. R. Nix, Los Alamos Scientific Laboratory, Post Office Box 1663, Los Alamos, New Mexico 87544
172. F. Patti, Burns and Rowe, Inc., 320 Fulton Avenue, Hempstead, New York 11550
173. S. Pearlstein, National Neutron Cross Section Center, Brookhaven National Laboratory, Upton, L. I., New York 11973
174. P. Richards, Brookhaven National Laboratory, Upton, L. I., New York 11973
175. J. S. Robertson, Nuclear Medicine, Mayo Clinic, Rochester, Minnesota 55901
176. G. L. Rogosa, Division of Physical Research, Energy Research and Development Administration, Washington, D. C. 20545
177. G. P. Russ, Department of Chemistry, University of California, San Diego, La Jolla, California 92037
178. J. P. Schiffer, Physics Division, Argonne National Laboratory, 9700 South Cass Avenue, Argonne, Illinois 60439
179. C. W. Seidel, Nuclides and Sources Division, New England Nuclear Corporation, 549 Albany Street, Boston, Massachusetts 02118
180. S. M. Seltzer, Code 682, Goddard Space Flight Center, Greenbelt, Maryland 20771
181. S. M. Shafroth, Department of Physics, University of North Carolina, Chapel Hill, North Carolina 27514
182. R. J. Shalek, Physics Department, M. D. Anderson Hospital, Houston, Texas 77025
183. E. M. Smith, MIRD Committee, Society of Nuclear Medicine, 404 Church Avenue, Maryville, Tennessee 37801
184. G. Sonia, C. B. T. N., Instituto de Radioprotecao e Dosimetria, Caixa Postal 37025 — ZC-20, Rio de Janeiro, Brazil

185. A. W. Sunyar, Physics Division, Brookhaven National Laboratory, Upton, L.I., New York 11973
186. W. L. Talbert, Ames Laboratory, Iowa State University, Ames, Iowa 50010
187. C. A. Tobias, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720
188. P. N. Trehan, Department of Physics, Panjab University, Chandigarh-14, India
189. J. Vervier, Institut de Physique Corpusculaire, 2, Chemin du Cyclotron, B-1348 Louvain-la-Neuve, Belgium
190. A. H. Wapstra, Instituut voor Kernphysisch Onderzoek, Ooster Ringdijk 18, Amsterdam, Netherlands
191. K. Way, Department of Physics - TUNL, Duke University, Durham, North Carolina 27706
192. H. E. Wegner, Physics Division, Brookhaven National Laboratory, Upton, L.I., New York 11973
193. B. Weiss, Office of Inspection and Enforcement, Nuclear Regulatory Commision, Washington, D. C. 20555
194. W. Whaling, Kellogg Radiation Laboratory, California Institute of Technology, Pasadena, California 91109
195. Y. Yoshida, Radiation Control Section, Division of Health Physics and Safety, Japan Atomic Energy Research Institute, Tokai Research Establishment, Tokai-mura, Naka-gun, Ibaraki-ken, Japan
196. J. C. Zerib, CEN/Saclay, B. P. 2, 91 Gif-sur-Yvette, France
197. L. Ziegler, Environmental Protection Agency, Post Office Box 15027, Las Vegas, Nevada 89114
198. W. Zobel, Tennessee Valley Authority, 204 Union Building, Knoxville, Tennessee 37902
199. Librarian, Institut des Sciences Nucleaires, B. P. 257, Centre de Tri, 38044 Grenoble-Cedex, France
200. Technical Research and Support Division, ERDA-ORO

201-313. Given distribution as shown in TID-4500 under Physics — Nuclear category (25 copies — NTIS)

☆ U.S. GOVERNMENT PRINTING OFFICE: 1976-748-189/260