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Publication Date
1973-02-01

Presented at the IAEA Symp.
on Application of Nuclear Data
in Science and Technology,
Paris, France, March 12-16, 1973

LBL-1262
c.1

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Prepared for the U.S. Atomic Energy Commission
under Contract W-7405-ENG-48

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DISCLAIMER

A SURVEY OF NUCLEAR DATA USE IN APPLIED FIELDS*†

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February 1973

Abstract

In connection with compilation activities for the Table of Isotopes, we are conducting a survey of nuclear data needs outside the field of basic nuclear science, principally among users of radioisotopes. Questionnaires are being mailed to people in such diverse fields as medicine, environmental studies, and oceanography. The questions are intended to ascertain what sources of data are used, what specific types of data are required, to what extent existing compilations fill these needs, and what changes are needed or desired. Several questions at the end of the list concern specifically the use of the Table of Isotopes. A preliminary summary of the response to date to the survey is discussed.

*Work performed under the auspices of the U. S. Atomic Energy Commission.

†Presented at the IAEA Symposium on Application of Nuclear Data in Science and Technology, No. IAEA/SM-170/46.

In order to plan compilation work for the Table of Isotopes, and to coordinate our activities with those of other groups, we are undertaking a survey of the requirements for nuclear data of data-users outside the field of basic nuclear physics. Since the spirit of our survey is very close to the purpose of this entire symposium, I hope you will excuse our presumption, or as we say, chutzpa, in telling you about our modest effort. It is certainly not our intent to preempt the work of the symposium! We should simply like to describe the questionnaire that we are distributing, and to inform you of the preliminary response we have received.

Figures 1-5 show the actual questionnaire. Questions 1-3 (page 1) cover general data on the respondent's type of work and his reasons for using nuclear data. Question 4 (pages 2-3) defines the specific data that he uses. Question 5 concerns the user's preference for best values or measured data, and the number of such values he wants to see. Question 6 (page 4) deals with the frequency of use of different data sources. Questions 7 and 8 (page 5) are an attempt to determine the extent to which the user is satisfied with these sources, and the reasons for his dissatisfaction, if any. Question 9 is intended to enlarge on the answers to the previous questions, and to explore the possibility of additional interest in non-printed forms of the data - magnetic tapes or direct, on-line retrieval. In addition to these questions, we have enclosed a sample format for the 7th edition of the Table of Isotopes and invited the respondent to comment on it.

We have at this time a partial response to the first mailing of the questionnaire, and we wish to report on it here. Part of the purpose of the

first mailing was to determine whether the questions are adequate to obtain the desired information, so I will comment on the problems we have encountered in interpreting the answers as I describe the results. For any statisticians among you, I should tell you about my qualifications in this field. I have read the book How to Lie with Statistics, by D. Huff and I. Geis [1].

The preliminary mailing was to 66 members of the Society of Nuclear Medicine. The names were selected from the entire membership list by a manufacturer and distributor of radioisotopes, and are presumed to represent an active and sophisticated group of data users in the medical field.

To date, we have received 34 responses. A majority (23) of the respondents work in universities. All of them use radioisotopes, and a large number also use accelerators (17) and reactors (12). They are heavy users of nuclear data: 24 claim to use data frequently, 10 occasionally.

The range of types of data required was broader than we had anticipated, even for a select group of medical users. Figure 6 summarizes the responses to question 4. It is noteworthy that a significant number of respondents expressed a need for such specialized data as detailed neutron and charged particle cross-sections.

The response to question 5 (fig. 7) was mixed. Since a number of people indicated a need for both the best reported values and an adopted best value, while some specifically indicated that either was satisfactory, we have tabulated these responses separately from the requests for only one of these. Obviously, the question needs to be stated more precisely. The present results do, however, indicate a divided opinion about the desirability of giving best values vs. measured values.

The sources of data that the respondents claim to use are summarized in fig. 8. It is noteworthy that five people indicated frequent use of the MIRD (Medical Internal Radiation Dose) pamphlets.

The response to questions 7 and 8 was most illuminating, and also most difficult to interpret. Most of the respondents (26) indicated that the data fulfill their needs "quite well", 2 people said "completely", and 6 indicated "only partially". More important, the reasons for dissatisfaction indicate a general malaise concerning the difficulty of interpreting the available data, often on the part of people who also indicated a need for very specialized data, and who even claimed that the existing compilations did not cover enough categories of data.

In some such cases, there appears to be a desire for more highly reduced or evaluated data, such as electron energies and absolute intensities, and this need is also reflected in a frequent use of the MIRD pamphlets.

One further comment concerning the degree of satisfaction with and complaints about the data: a number of respondents appeared to direct their responses to these questions specifically at the Table of Isotopes, rather than at all the data compilations they use, which was not the intent of the question. This question will be rephrased for our next mailing.

Aside from cold statistics, the responses contained some intelligent comments, and a few that were highly enlightening. We were pleased with the response, and believe that the results of the survey will be quite useful. We plan to continue the survey, and we shall make a more extensive report on responses to it at a later date.

References

[1] D. Huff and I. Geis, How to Lie with Statistics, W. W. Norton and Co., New York (1954).

Figure Captions

Figs. 1-5. Survey Questionnaire, as sent in first mailing. One additional page (not shown) requested comments on the proposed content and format of the 7th edition of the Table of Isotopes.

Fig. 6. Responses to question 4 ("What type of data do you require?").

Fig. 7. Responses to question 5 ("How complete a listing of a given quantity do you require?"). Respondents who checked both "The one most precise ... reported value" and "A weighted average or adopted best value" are represented by the next to last bar; respondents who inserted "or" between these two choices are represented by the last bar.

Fig. 8. Responses to question 8 ("What source of nuclear data do you consult ... ?"). Actual numbers of responses in each of the useage categories "frequent", "occasional", and "rare" are given in the bars. The height of the bar segments are proportional to 3, 2, and 1 times the number of responses for frequent, occasional, or rare use, respectively. Write-in responses are included, except for a few data sources cited only once.

1. Personal Data

Name:_____(optional)

Occupation:_____

Name of Employer:_____(optional)

Employer is a : ☐ Private Corporation
☐ Government operated installation
☐ Government contract installation
☐ University_____(name of dept. or college)
☐ Other_____

2. (a) Do you use or encounter radioisotopes, nuclear reactors, or charged-particle accelerators, or deal with nuclear properties in your work?

☐ radioisotopes ☐ reactors
☐ accelerators ☐ nuclear properties

(b) For what purpose? (Type of application, e.g.: tracers in chemical studies, medical diagnostics, abrasion studies, monitoring radioactive pollution, applications in cosmology, etc.)

3. How often do you use sources of nuclear <u>data</u> in your work (compilations, wall charts, original publications, journals, etc.)?

☐ Frequently ☐ Occasionally ☐ Rarely ☐ Never

(IF THE ANSWER TO QUESTION 3 IS "NEVER", IT IS NOT NECESSARY TO ANSWER THE FOLLOWING QUESTIONS.)

Fig. 1

4. What types of data do you require? (check any which you use).

Type of data

☐ (a) Half-lives of radioactive substances

☐ (b) Isotopic abundances

☐ (c) Nuclear masses

☐ (d) Nuclear spins and moments

☐ (e) Neutron capture or fission cross-sections

☐ (f) Nuclear decay modes and genetic (parent-daughter) relationships

☐ (g) Means of producing radioisotopes

(h) Energies and intensities of radiations:

- ☐ gamma rays
- ☐ X-rays
- ☐ beta particles
- ☐ conversion electrons
- ☐ alpha particles
- ☐ other radiations (specify)

_____

_____

_____

_____

☐ (i) Detailed neutron reaction data (energy-dependent cross sections, resonance parameters)

(question 4 continued on next page)

Fig. 2

☐ (j) Neutron capture gamma spectra

(k) Charged-particle or photo-induced reaction data:

- ☐ Gross cross sections (Excitation functions)
- ☐ Cross-sections for specific levels
- ☐ Angular distributions
- ☐ Gamma-ray spectra

☐ (l) Nuclear level schemes

☐ (m) Other types of data (specify)

_____

_____

_____

5. How complete a listing of a given quantity do you require? (Check one or more.)

- ☐ All reported values
- ☐ A few of the best reported values
- ☐ The one most precise or accurate reported value
- ☐ A weighted average or adopted "best" value
- ☐ Other (specify)

_____

_____

_____

Fig. 3

6. What sources of nuclear data do you consult and how frequently do you use them? (Check appropriate boxes for any sources that you use.)

Compilation	Amount of Use: Frequent	Occasional	Rare
(a) Table of Isotopes, 6th edition (1967)	☐	☐	☐
(b) Table of Isotopes, earlier editions	☐	☐	☐
(c) Nuclear Data Sheets (the journal Nuclear Data B and earlier loose-leaf sheets)	☐	☐	☐
(d) Nuclide "wall" charts (GE, Batelle N.W., or other versions)	☐	☐	☐
(e) BNL-325 (the "Barn Book")	☐	☐	☐
(f) "Light-element" compilations (by F. Ajzenberg-Selove or Endt and van der Leun, published in the journal Nuclear Physics, or other (specify)	☐	☐	☐
(g) Any "specialized" tables of specific properties, such as nuclear moments, nuclear masses, fundamental constants, electron binding energies, etc. (specify)			
_____	☐	☐	☐
_____	☐	☐	☐
_____	☐	☐	☐
_____	☐	☐	☐
(h) Data supplied by manufacturer or distributor of radioisotopes.	☐	☐	☐
(i) Other (specify)			
_____	☐	☐	☐
_____	☐	☐	☐
_____	☐	☐	☐
_____	☐	☐	☐

Fig. 4

7. How well do the sources of data you use fulfill your requirements?

☐ Completely ☐ Quite well ☐ Only partially ☐ Poorly

8. In what ways do you find them inadequate? (Check any answers which are applicable.)

☐ Do not cover some of the required categories of data

☐ Cover too many categories of data

☐ Not enough detail

☐ Too much detail

☐ Too difficult to interpret

☐ Too far out of date

☐ Other (specify)

_____

_____

9. Would you like to have the data in different forms, such as:

☐ Another type of printed compilation (specify)

_____

☐ A magnetic tape

☐ Retrievable on-line at a computer terminal (such as a teletype connected to a computer data bank via telephone lines)?

☐ Other (specify)

_____

_____

Fig. 5

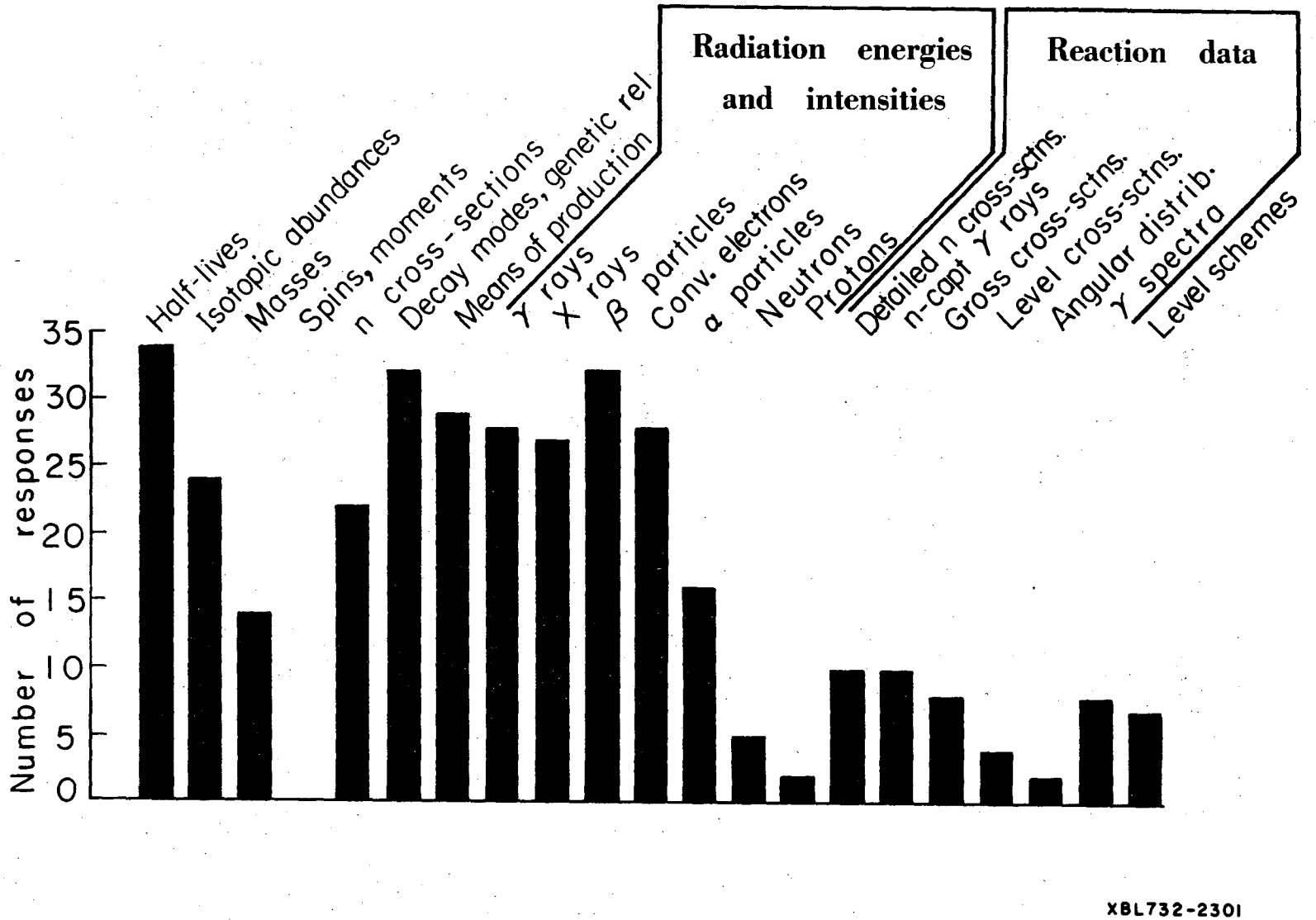
TYPE OF DATA
Radiation energies and intensities
Reaction data
Half-lives
Isotopic abundances
Masses
Spins, moments
n cross-sections
Decay modes, genetic rel
Means of production
γ rays
X rays
β particles
Conv. electrons
α particles
Neutrons
Protons
Detailed n cross-sctns.
n-capt γ rays
Gross cross-sctns.
Level cross-sctns.
Angular distrib.
γ spectra
Level schemes
Number of responses
0
5
10
15
20
25
30
35
XBL732-2301

Fig. 6

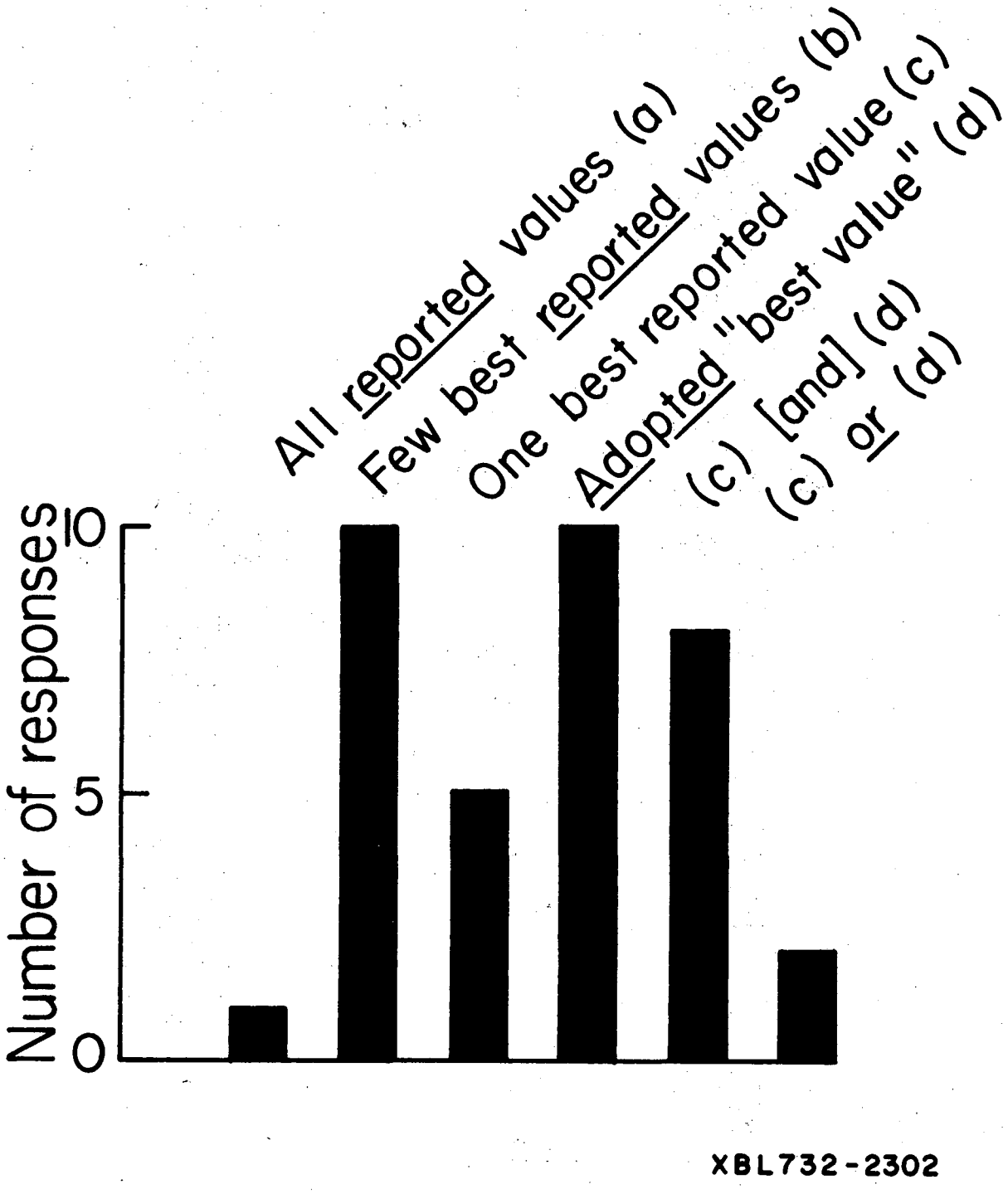
All reported values (a)
Few best reported values (b)
One best reported value (c)
Adopted "best value" (d)
(c) [and] (d)
(c) or (d)
Number of responses
10
5
0
XBL732-2302

Fig. 7

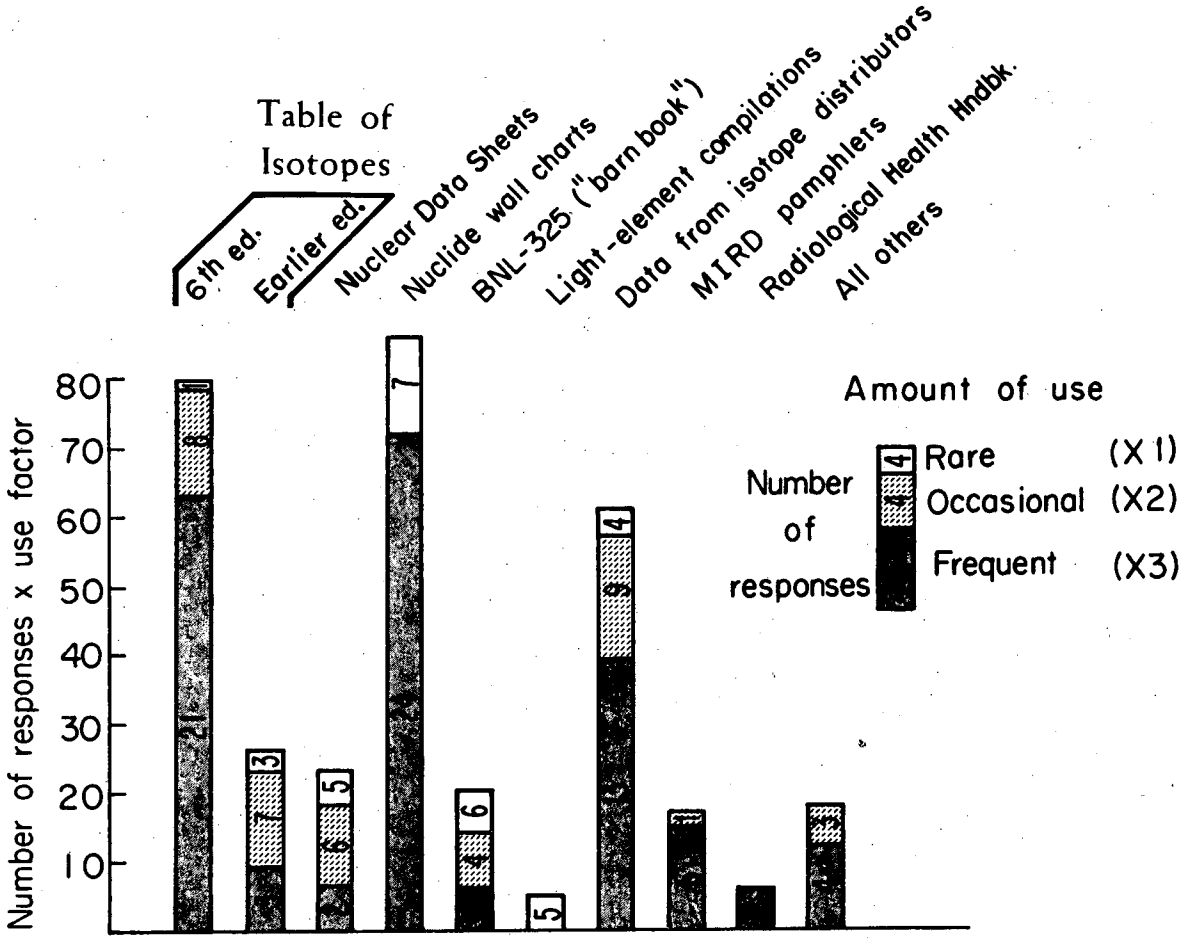
Table of Isotopes
6th ed.
Earlier ed.
Nuclear Data Sheets
Nuclide wall charts
BNL-325 ("barn book")
Light-element compilations
Data from isotope distributors
MIRD pamphlets
Radiological Health Hndbk.
All others
Number of responses x use factor
80
70
60
50
40
30
20
10
Amount of use
Number of responses
Rare (X1)
Occasional (X2)
Frequent (X3)

Fig. 8

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