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Evaluated Nuclear Structure Data File (ENSDF) for Basic and Applied Research*

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Since 1948, the Nuclear Data Project has been a recognized center for the systematic collection and evaluation of data from nuclear structure experiments. The Data Project has helped consolidate the rapid advance of nuclear science, by identifying and publicizing conflicting results and by integrating each new measurement with those that preceded it. The process of organizing nuclear data for formal publication in Nuclear Data Sheets[1] has led to the development of formats for containing these data. In 1971, the staff of the Nuclear Data Project designed and developed a computer-based version of these formats,[2] which has been used since then to prepare, maintain, and edit a comprehensive Evaluated Nuclear Structure Data File (ENSDF). The file summarizes the state of experimental knowledge of nuclear structure for all nuclei, as determined from a systematic consideration of measurements reported from anywhere in the world. The ENSDF system has the ability to retrieve selected parts of the file and to format the data to meet the requirements of different users. For example, the drawings and tables used in

Nuclear Data Sheets are prepared automatically from ENSDF. Computer-readable files of selected data can also be prepared to be used as data libraries for complex nuclear calculations.

ENSDF is organized into "data sets", each of which summarizes the results obtained from a specific type of nuclear physics experiment. A recommended or "adopted" value is given for every measured quantity. (ENSDF does not contain cross section data, but does include those structure-related quantities which are derived from measured cross sections.) For each nucleus, the established level properties are further summarized in a data set labeled "Adopted Levels". The content of ENSDF is based mainly on the Nuclear Data Sheets, but for completeness data have also been adopted from similar compilations[3] in the low-A region.

Since ENSDF contains at least one data set for each distinct experiment which gives information about a nucleus, each radioactive decay mode is represented in the file by a data set, as is each nuclear reaction. A decay data set such as ^{131}I β^--decay includes the experimentally established properties of all nuclear radiations which accompany the decay, together with data on the ^{131}Xe levels inferred from the decay measurements.

The ^{107}Ag(n, γ) data set summarizes the properties of γ-rays which follow neutron capture in ^{107}Ag, and also data on the ^{108}Ag levels that have been inferred from the γ-rays. The data set labeled ^{90}Zr(d,p) contains the energy, angular-momentum transfer, and spectroscopic strength, where measured, for each ^{91}Zr level populated by deuteron-stripping reactions on ^{90}Zr.

As of January 1, 1977, the data file contained 5322 data sets based on the
most recent compilations:

1681	adopted levels
1443	decay schemes
2198	other (mostly nuclear reactions).

New experimental work through 1976 has been incorporated into ENSDF for a group
of 220 decay schemes which have special importance in the area of radiation
protection.

The extent and depth of ENSDF continues to improve as new and revised evalua-
tions are added to the file. During 1976, the U. S. Energy Research and Development
Administration moved to assure that all data sets in ENSDF would be reviewed at
intervals no greater than 4–5 years. In order to maintain the four-year cycle, evalua-
tions will be performed at several centers around the world. The evaluation centers
are joined into national and international networks for the exchange of references and
data and for the communication of common evaluation standards. Network activities are
coordinated for the U. S. through the National Neutron Cross Section Center (NNCSC);
reference and data files are maintained by the Nuclear Data Project, in support of the
principal U. S. evaluation effort.

A complete magnetic-tape copy of all data included in ENSDF is prepared regu-
larly from the master file at Oak Ridge for distribution to the data evaluation network.
Requests from any interested user for information from this tape may be directed to
NNCSC. Several collections of specific nuclear structure data have already been

prepared from ENSDF for special applications. For example, a collection[4] of decay data (half-life, radiation energies, absolute intensities, uncertainties) for 194 radioactive nuclei was extracted from ENSDF and formatted for users concerned with biological effects of radiation. An extended version of this report will be included as an appendix in a forthcoming publication.[5]

We welcome your participation in further refining the content and scope of ENSDF to better serve the nuclear community.

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1. Nuclear Data Sheets, published by Academic Press, Inc., New York. Subscription information available on request to Academic Press, Inc., 111 Fifth Avenue, New York, New York 10003.

2. W. B. Ewbank, M. R. Schmorak, F. E. Bertrand, M. Feliciano, and D. J. Horen, Nuclear Structure Data File — A Manual for Preparation of Data Sets, ORNL-5054 (June 1975).

3. For example: F. Ajzenberg-Selove, Nuclear Physics A248, 1 (1975); P. M. Endt and C. van der Leun, Nuclear Physics A214, 13 (1973).

4. Nuclear Decay Data for Selected Radionuclides, edited by M. J. Martin, ORNL-5114 (March 1976).

5. A Manual of Radioactivity Measurements Procedures, to be published by the National Council on Radiation Protection and Measurements, Washington, D. C.