2
COD-3368-7

NATIONAL RESEARCH COUNCIL
ASSEMBLY OF MATHEMATICAL AND PHYSICAL SCIENCES

2101 Constitution Avenue Washington, D.C. 20418

COMMITTEE ON NUCLEAR SCIENCE

March 19, 1976

Dr. George L. Rogosa
Assistant Director for Nuclear Science
Division of Physical Research
Energy Research and Development Administration
Washington, D.C. 20545

Dear George:

Enclosed in response to your request is the critique
of the BNL Study made by the Ad Hoc Panel on Basic Nuclear Data
Compilations.

It will be noted that the Panel recommends the establish-
ment of a standing panel to monitor and advise on the implementation
of the proposed new organizational arrangement for carrying out basic
data compilations. I believe it of paramount importance that this
panel be established and that it have among its objectives the de-
velopment of: 1) a cogent justification of the needs for basic nuclear
data compilations; 2) a concise statement of the character, nature,
and scope of the product desired from compilation activities; and
3) guidance with regard to the relative priorities involved in filling
the needs of the basic nuclear science community, specific applied
physics communities, and nuclear medicine groups.

Sincerely,

C. Huizenga
John Huizenga
Chairman

Enclosure

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of 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. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

NATIONAL RESEARCH COUNCIL
ASSEMBLY OF MATHEMATICAL AND PHYSICAL SCIENCES

2101 Constitution Avenue Washington, D.C. 20418

March 19, 1976

TO: Committee on Nuclear Science, National Research Council

FROM: *Ad Hoc* Panel on Basic Nuclear Data Compilations

SUBJECT: *Recommendations on the NNCSC-BNL Study**

On April 24, 1975, D. R. Miller, Acting Director, Division of Physical Research, Energy Research and Development Administration (ERDA), wrote to G. R. Vineyard, Director of Brookhaven National Laboratory (BNL), asking approval to have the National Neutron Cross Section Center at BNL** under S. Pearlstein "carry out a study of the nuclear structure and charged particle reaction data compilation and evaluation efforts in the United States with a view to establishing at NNCSC responsibility for a fully coordinated effort involving measurers, compilers, evaluators and users whose activities would result in the creation and maintenance of a master file for nuclear structure and charged particle reaction data." He went on to say that the forms of the outputs from this master file should serve all the many and varied needs of the nuclear science community. He asked that the study look at both the advantages and disadvantages of a merger of neutron, nuclear structure, and charged particle data into a single center at Brookhaven and the advantages and disadvantages of increased international participation in the non-neutron areas. In a letter dated May 2, 1975, Vineyard agreed that the Center should carry out this study.

The principal basic nuclear data compilation and evaluation efforts presently in existence are as follows:

1. NDP-ORNL,*** *Nuclear Data Sheets A* ≥ 45 (Ewbank)
2. University of Pennsylvania, similar to above $5 \leq A \leq 20$ (Ajzenberg-Selove)
3. Utrecht, Netherlands, similar to above, $21 \leq A \leq 44$ (Endt and Van der Leun)
4. Stanford, similar to above, $A = 3$ and 4 (Hanna-Meyerhof, Fiarman)

* Hereinafter referred to as the BNL Study
** Hereinafter referred to as the Center
*** Nuclear Data Project-Oak Ridge National Laboratory

ERDA Report No. C00-3368-7

5. Lawrence Berkeley Laboratory, *Table of Isotopes* (Lederer)
6. Knolls Atomic Power Laboratory, Chart of the Nuclides (Holden and Walker)
7. Idaho National Engineering Laboratory, Table of Isotopes (*Handbook of Chemistry and Physics*) (Heath) *Gamma Ray Spectrum Catalogue* (Heath)
8. Amsterdam, Netherlands, Atomic Masses (Wapstra)
9. NBS*-Photo Nuclear Data Center (E. G. Fuller)
10. Research Center Karlsruhe (Münzel)

A number of other efforts are under way in the USSR and in Western Europe. There is also a publication used in nuclear medicine--a Medical Internal Radiation Dose Committee pamphlet, "Radionuclide Decay Schemes and Nuclear Parameters for Use in Radiation-Dose Estimate" (NM/MIRD Pamphlet No. 10).

The key effort in the field is that of the Nuclear Data Project at Oak Ridge. Until recently this effort was falling badly behind in terms of the cycle time** for producing new A-chain evaluations. In 1971, a three-year program called NIRA (Nuclear Information Research Associates) was funded the first year by the Physics Division and the second two years by the Information Division of the National Science Foundation (NSF) under the direction of the NRC Committee on Nuclear Science, and in close cooperation with the NDP-ORNL, to attempt to bring these A-chain compilations and evaluations (*Nuclear Data Sheets*) up to date. This program was reasonably successful in that by 1975 only 20 percent of the mass chains were last revised prior to 1970. The cycle time, however, is still six to seven years. The study by the Center, initiated by ERDA, was designed to produce a system that would, among other things, reduce the mass chain evaluation cycle time to a level acceptable to the nuclear science community (four years in the Panel's opinion).

The *Ad Hoc* Panel on Basic Nuclear Data Compilations was officially appointed on July 3, 1975, and the membership is listed in Appendix I. The first order of business of the Panel involved the BNL Study. In a letter dated August 15, 1975, to the Panel, George Rogosa stated: "Specifically, I propose to refer the NNCSC report to your Panel for evaluation when it is completed. I would hope that your panel would study it thoroughly and tell us whether in its view the BNL conclusions are good or bad from the point of view of the basic nuclear research community." He went on to say that he would appreciate the Panel's views on an integrated center vs. a number of independent efforts, output time schedules for compilations, locations of compilation centers, etc. He also felt that the Panel's involvement while the study was under way, and then the Panel's judging of it afterward, was probably advantageous.

* National Bureau of Standards

** Cycle time is defined as the time interval between successive publications of a particular A-chain or of any specific nuclear data compilation.

The Panel has now met on three occasions. The first meeting on September 4, 1975, at Rochester was mainly to define the immediate goals of the Panel and to examine as much information as could be obtained by the time of the meeting concerning the BNL Study. As a result of that one-day meeting, the Panel submitted to the NNCSC-BNL Study Group* a series of preliminary recommendations on September 15, 1975, under the general categories:

1. The central organization
2. Community participation in the United States
3. Specific recommendations concerning compilations, including priorities
4. Other considerations

Summarizing these, the Panel recognized the need for a central organization and recommended that it should involve national U.S. laboratories as at present, individual scientists both in and outside the United States, and participation by organizations outside the United States. The Panel stressed first that mass chain evaluations--or more exactly, the nuclear structure information for individual isotopes are absolutely basic to the whole compilation effort and, second, that whatever reorganization takes place, it should be done with minimal disruption of present efforts. The Panel recommended that individual nuclear scientists, at both large and small institutions throughout the United States, should be encouraged to participate in the compilation and evaluation process. The Panel gave the highest priority to the mass chain compilations, i.e., *Nuclear Data Sheets*, with a cycle time of four years. Equal, but lower, priority, was assigned to the *Table of Isotopes* (cycle time four years) and the *Wall Chart of the Nuclides* (the BNL Study's proposed cycle time of two years was considered more than adequate). The Panel also commented on several other compilation areas, such as charged particle cross sections, range-energy tables, charge-state distributions, and horizontal compilations in general. The Panel's report also asked for further clarification of several points in the document supplied to the Panel by the BNL Study Group, dated August 25, 1975, and titled "Preliminary Summary of Recommendations on the Compilation and Evaluation of Nuclear Structure and Charged Particle Reaction Data."

The second meeting of the Panel was held jointly with the Nuclear Physics Division of the American Physical Society (APS) committee on nuclear data compilation at Massachusetts Institute of Technology on October 3, 1975. The two groups have three members in common (H. Feshbach, J. Schiffer, and H. Gove). At this meeting S. Pearlstein and his staff presented a detailed account of their proposed recommendations to ERDA, which included some of the inputs provided by the Panel. The first draft of that study dated September 30, 1975, was available to the committees. Much discussion by members of both committees ensued, including many suggestions for modifications and changes in the proposal.

* Hereinafter referred to as the BNL Study Group

The final report of the BNL Study Group was published as BNL-NCS-20573 on October 15, 1975, and submitted to ERDA. The following is the summary from this report: "This study was undertaken in answer to a request by the Division of Physical Research of the U.S. Energy Research and Development Administration to review the compilation and evaluation of nuclear structure and charged particle reaction data. The main objectives of the study are recommendations that, if implemented, should provide the research community with data compilations and evaluations that are updated at a reasonable frequency and with specialized data services. To accomplish the objectives of the study in a cost-effective manner, the study recommends that (1) an evaluation network be established, (2) unnecessary duplication of evaluation effort be eliminated, (3) supporting services be centralized, and (4) international cooperation be used to share evaluation tasks."

A summary of recommendations taken directly from the BNL Study is given in Appendix II. The report was officially transmitted to the Nuclear Science Committee and to our *Ad Hoc* Panel on October 31, 1975.

The third meeting of the Panel was held in Washington, D.C., on December 17 and 18, 1975. Present at the first day of the meeting in addition to the panel members (Feshbach was absent on the first day) were representatives of the compiler community as follows: F. Ajzenberg-Selove (University of Pennsylvania), F. Bertrand (NP-ORNL), B. Ewbank (NDP-ORNL), E. Fuller (NBS), R. Heath (Idaho National Engineering Laboratory), C. M. Lederer (LBL), and L. Gevantman (OSRD*-NBS). The ERDA and NSF representatives were invited to attend the first day, but only G. Crawley (NSF) was able to do so. At this meeting each of the invited participants commented in detail on the BNL Study, and a general discussion ensued. These inputs were valuable to the Panel, and we express our appreciation for the very thoughtful responses by these representatives of the compiler community.

During fall 1975, the Panel also received communications from a number of other people concerned with basic nuclear data evaluation and compilations. These include D. R. Lide, Jr. (OSRD-NBS), H. G. Pugh (NSF), H. H. Barschall (University of Wisconsin), D. A. Shirley (LBL), D. Horen (ORNL), A. H. Wapstra (IKO-Netherlands), K. Way (Atomic Data and Nuclear Tables), A. Zucker (ORNL), F. K. McGowan (ORNL), W. B. Mann (NBS), G. D. O'Kelley (ORNL), H. Münzel (Technische Hochschule, Darmstadt), and C. Van der Leun, Utrecht. We also received written comments from F. Ajzenberg-Selove, B. Ewbank (NDP-ORNL), E. Fuller (NBS), and C. M. Lederer (LBL), in addition to their oral presentations on December 17, 1975.

The full Panel then met on December 18, 1975, to formulate its recommendations on the BNL Study to the Committee on Nuclear Science for transmission to ERDA. These recommendations are discussed below.

It is clear to the Panel that there have been a number of problems in the past with the compilation and evaluation of basic nuclear data.

* Office of Standard Reference Data

These include:

1. Unacceptably slow cycle times for virtually all A-chain compilations
2. An inordinately large fraction of the effort carried by groups in the United States
3. Some duplication of effort in the United States
4. Insufficient specialized horizontal compilations to meet many applied user needs
5. Lack of overall coordination of effort
6. Lack of wide nuclear science community participation in the field
7. Until fairly recently, insufficient use of computer assisted techniques in the compilation and evaluation of data and in the production of photo-ready copy

The Nuclear Data Project--Oak Ridge National Laboratory

As mentioned above, the key effort in the field is that by the Nuclear Data Project at ORNL. This group has been working on adapting computers to the compilation task for several years; in the last few months these efforts have borne fruit quite dramatically. The group is currently in a strong position to give excellent service in both the A-chain compilation field, except for cycle time (about six or seven years), and the area of recent references.

The degree of support for and supervision of this group by ORNL management in the past has not been clear to the Panel. However, the group now has a new director, and evidence for management support is clearer, as evidenced by a letter dated November 13, 1975, to the Panel from A. Zucker. In this letter Zucker endorses the proposal that "the BNL Center coordinates all data compilations within the U.S. and other countries," in particular that it "develop relations with other countries which will result in a more even-handed distribution of tasks between the U.S. and other nations." He also agrees that the Center should assume responsibility for the charged particle reaction list and for horizontal compilations of an applied nature. He recommends, however, that "the ORNL Nuclear Data Group remains responsible for the compilation of a major part of the A-chains in the U.S." and that its function include "maintaining a computerized file of evaluated data and literature scanning and the resulting index reference system. The data file is transmitted to the BNL Center as it is updated, and the BNL Center would be responsible for the dissemination of the file." He also proposes that A-chains continue to be published by Academic Press, with authorship of (and thus responsibility for) the compilations clearly indicated. The Center would involve other U.S. laboratories and those in other countries in the compilation of mass chains. He suggests that "as BNL is able to involve other U.S. laboratories and foreign participants in this endeavor, ORNL will reduce the range of its A-chain coverage." (The Panel's recommendations concerning the compilation efforts at ORNL appear in a later section of this report.)

The Lawrence Berkeley Laboratory

The compilation at LBL will complete the seventh edition of the *Table of Isotopes* in 1977. They have stated that they will then "be free to seek new directions for the resources currently devoted to that project." They also state that "the massive independent compiling effort required for the Table can no longer be justified." The proposed Handbook of the Isotopes to be produced at Brookhaven is acceptable to them. The Nuclear Science Division of LBL concurs with these conclusions. This Panel agrees that the seventh edition should end LBL's involvement in the *Table of Isotopes*.

We strongly urge that the LBL effort or its equivalent in resources continue to be available in the nuclear data compilation field.

The University of Pennsylvania

The efforts of many years by F. Ajzenberg-Selove in the $A = 5$ to 20 compilation field have been of exceptional importance to the nuclear science community. The Panel commends this work highly and hopes that it will continue unabated. It hopes further that the proposed reorganization will assist in achieving Ajzenberg-Selove's expressed desire to reduce the present five-year cycle time to four years.

The Netherlands

The work at Utrecht in the $A = 21$ to 44 region of Endt and Van der Leun, as well as the atomic mass work of Wapstra in the Netherlands, represents the most important contributions to the field outside the United States. Any additional support to these groups that can be provided under the proposed reorganization should be supplied. Expanded efforts like these by other groups in Europe, Canada, Japan, Australia, etc. should be actively solicited and encouraged.

Idaho National Engineering Laboratory, National Bureau of Standards, and Stanford University

The more specialized compilation work of Heath at INEL and Fuller at NBS, as well as the light element A-chain compilation efforts at Stanford, are all important components in the general basic nuclear data compilation field and they should be encouraged to continue.

Specific Recommendations

We emphasize that, in what follows, we are discussing initial parameters of a proposed new organization for the compilation and evaluation of nuclear data. In the longer term there will be an evolutionary

development of the organization, and we leave the details of this evolution to the permanent panel that we recommend be created to monitor and advise in this whole area of nuclear data compilations. We are in general agreement with the BNL Study, that the Center should coordinate all basic nuclear data compilations within the United States and with other countries. We do, however, disagree with various details of its proposal. Specifically, we urge that the main responsibility for A-chain compilations continue at the NDP-ORNL. This would include its present operation of compiling and evaluating a major fraction of the mass chains, of scanning and reference indexing, and possibly also preparation of A-chains for publication in *Nuclear Data Sheets*. It should also continue to maintain its computerized file of evaluated data covering all masses. Present and future groups outside of the NDP would work closely with it in terms of providing the NDP with completed A-chains in a standardized computer format. The NDP would also continue its work on *Recent References*--published three times a year with the third issue cumulative to the last published *Nuclear Data Sheet*. The NDP should continue to maintain its present library. Clearly the necessary support personnel for all these functions will need to continue at ORNL.

In this connection, the Panel believes that the BNL Study recommendations for manpower distribution between BNL and ORNL must be modified to meet its recommendations. The suggested manpower level at ORNL is too low and that at BNL is too high. Indeed, a substantial increase in the present compilation staff at ORNL would be required to achieve a four-year cycle time for mass-chain compilations. This could be avoided, of course, if greater participation in this work could be initiated outside the United States and in the U.S. nuclear science community itself. Every effort should be made to obtain this participation and thus to obviate substantial increases in agency funding to present compilation groups.

We feel that the problems of future development of computer systems for maintaining the evaluated data file should be the responsibility of the Center, as discussed below. If and when, ultimately, the master file resides in a computer at the Center, with fast access terminals available at ORNL (and possibly at other centers working on A-chain compilations), the NDP-ORNL group would continue its functions as described above, but with whatever staff changes are required as a result of the computer facility being remotely located. Responsibility for charged particle cross sections and the interface with applied users by and large should also be that of the Center, as should horizontal compilations, particularly in applied areas.

The present Center possesses virtually no expertise in basic nuclear data compilations and evaluations. Clearly it is a highly competent group, as its reputation in the neutron compilation field testifies. It can undoubtedly quickly become expert in the vastly larger and more complex nuclear structure field. Nonetheless, for it to effectively manage, coordinate, and direct the basic nuclear data

compilation and evaluation field within the United States and to coordinate efforts in cooperating foreign countries (and our Panel agrees that it should), it must have both visibility and credibility in the field. This requires at a minimum that a senior top-level nuclear science expert be added to the staff of the Center, and the Panel strongly urges that this be done as soon as practicable. Such a recommendation was not made in the BNL Study. The Panel, however, does not recommend that the Center become immediately involved in a major way in the area of A-chain compilations but rather, as described above, that this continue to be the responsibility of the NDP-ORNL, with coordination provided by the Center. We recommend that the Center study the whole question of data management and the feasibility of a centralized computer facility and master data file at the Center with fast and easy access from remote terminals. In this connection, we are concerned, however, about the practicality of basing such a system on the small computer presently in use at the Center. In this study, advantage should be taken of the expertise in the field available at the NDP-ORNL. Because this study will require a sophisticated understanding of the manifold problems associated with the compilation and evaluation of basic nuclear data, the Panel recommends that the Center commence a *limited* involvement in mass chain compilations. Two or three people, preferably combining computer data management expertise with nuclear structure data compilation and evaluation experience, should be added to the Center's staff. It should not be necessary to add additional evaluators to the staff of the Center at this time. This group, along with the senior person whose appointment we recommend, could serve both to study the whole master file question and to commence a modest effort in A-chain compilation. It would be the responsibility of the Center to increase participation in mass chain evaluations of groups in Europe, Canada, Japan, Australia, etc., *as well as to expand the effort much more widely in the U.S. nuclear science community than is presently the case.* The two areas at least, to which the Panel believes the Center brings special skills, are data management and international cooperation.

Other areas of responsibility for the Center would include (a) the definition and production of specialized horizontal compilations especially for applied users as discussed below, (b) the maintenance of a bibliography on charged particle cross sections, (c) communication to users in both applied and basic research of details of the nature of services available in all areas of nuclear structure data evaluations and compilations, and (d) providing all other interfaces with users, i.e., user requests for information, compiled data, etc.

To assist in providing advice and consultation in all these areas, a working group should be appointed by the Director of the Center, comprising compilers, users, and producers of nuclear structure data. In addition, a permanent panel of research scientists with direct nuclear interests similar to the present *Ad Hoc* Panel on Basic Nuclear Data

Compilations should be established to "monitor nuclear data compilations and evaluations and to interact where appropriate with funding agencies, data centers, professional societies and the research community" (a recommendation of the BNL Study Group). The Panel strongly endorses the formation of this latter group, with responsibilities for recommending changes in the compilation effort to both the Center and funding agencies.

In the area of specialized horizontal compilations, the Panel suggests higher priority be given to those of radionuclide production cross sections and cross sections of importance in controlled thermonuclear reactions. Other compilations of importance, but of somewhat lower priority, are in astrophysics, medium energy physics, electron scattering, heavy-ion physics, and other areas of nuclear structure. The Center should study the needs in these various fields and actively organize for the production of such compilations either at BNL or other U.S. and foreign establishments.

The Panel believes that when a steady-state operation is achieved, the above plan should not increase present U.S. expenditures in the basic nuclear data compilation field by more than 20 percent, excluding inflation. Such an increase is reasonable in view of the expected increase in output. Increased foreign participation will mitigate this increase in costs to U.S. agencies.

We summarize here the Panel's recommendations concerning the BNL Study:

1. The Center should manage, coordinate, and direct the basic nuclear data compilation efforts in the United States and coordinate efforts in other countries participating in this endeavor.
2. A senior top-level nuclear science expert should be added to the Center as soon as possible.
3. The main responsibility for mass-chain compilations and evaluations should continue at the NDP-ORNL. This includes present computer and library operations and possibly also the preparation of mass chains for publication. Sufficient staff should be provided for this work; the numbers recommended in the BNL Study are insufficient.
4. Present and future mass-chain compilation groups outside the NDP would work closely with the NDP in terms of providing them with completed A-chains in standardized computer format. The Center should coordinate this.
5. The NDP would continue its present work on *Recent References*, to be published three times a year with the third issue cumulative to the last published *Nuclear Data Sheet*.
6. The Center should study the question of data management and the feasibility of a centralized computer facility and master data file at the Center with fast and easy access remote terminals. Two or three people with appropriate expertise should be hired for this purpose. These people, plus the senior person mentioned in 2 above, should be sufficient.

7. The Center should commence a limited involvement in mass-chain compilations mainly to gain experience in the problems involved.

8. The Center should actively move to increase participation in mass-chain evaluations in countries outside the United States.

9. The Center should actively move to expand the effort in mass-chain evaluations much more widely in the U.S. nuclear science community than is presently the case.

10. A four-year cycle time for mass-chain compilations should be achieved.

11. Present efforts in mass-chain evaluations at the University of Pennsylvania, at the Rijksuniversiteit, Utrecht, and at Stanford University should be encouraged to continue and should be assisted in whatever ways possible to decrease cycle times. The evaluated outputs of all these groups, as well as of future groups inside and outside the United States, should reside in a master file containing all the mass chains.

12. The responsibility for charged particle cross sections and the interface with users, as well as horizontal compilations for applied users, should be that of the Center. The Center also would be responsible for communicating the nature of its services to users in both applied and basic research.

13. The Center should produce a Handbook of the Isotopes on a four-year cycle time. The Panel agrees that the seventh edition of the *Table of Isotopes* should end the LBL compilation group's involvement in this compilation area. However, the LBL effort, or its equivalent in resources, should continue to be available in the nuclear data compilation field.

14. The present compilation efforts at INEL (Heath) and NBS (Fuller) should be encouraged to continue.

15. The *Wall Chart of the Nuclides* should be produced by the Center.

16. The highest immediate priority for specialized horizontal compilations should be isotope production cross sections and cross sections of importance in controlled thermonuclear reactions. The Center should study the needs in other areas as well.

17. A working group comprising compilers, users, and producers of nuclear structure data should be appointed by the Center to provide advice and consultation in all the areas of nuclear structure and charged particle data compilations.

18. A permanent panel of research scientists, with direct nuclear interests similar to those of the present *Ad Hoc* Panel on Basic Nuclear Data Compilations, should be established to monitor nuclear data compilation and evaluation efforts and to interact with funding agencies, data centers, professional societies, and the research community. It should be the responsibility of this group to recommend changes to both the Center and funding agencies. It should monitor and advise on the evolutionary changes in the organization for nuclear data compilations.

Specific Panel comments on each of the BNL Study recommendations (in Appendix II) are listed in Appendix III.

The Panel warmly commends the BNL Study Group on its report, and gratefully acknowledges the advice, assistance, and communications from representatives of the U.S. nuclear data compilation community, whose cooperation and interest were essential to the Panel's work and the development of this report.

APPENDIX I: Ad Hoc Panel on Basic Nuclear Data Compilations, of the
Committee on Nuclear Science, National Research Council

Harry E. Gove (*Chairman*)
Nuclear Structure Research Laboratory
University of Rochester
Rochester, New York 14627

Monte Blau
Department of Nuclear Medicine
Roswell Park, Memorial Institute
666 Elm Street
Buffalo, New York 14203

Robert L. Burman
MP-Division
Los Alamos Scientific Laboratory
Los Alamos, New Mexico 87544

Herman Feshbach
Department of Physics
Massachusetts Institute of Technology
Cambridge, Massachusetts 02139

William C. McHarris
Department of Chemistry
Michigan State University
East Lansing, Michigan 48823

J. Rand McNally, Jr.
Thermonuclear Division
Oak Ridge National Laboratory
Oak Ridge, Tennessee 37830

John P. Schiffer
Physics Division
Argonne National Laboratory
9700 South Cass Avenue
Argonne, Illinois 60439

APPENDIX II: Summary of Recommendations from the *Study on the Compilation and Evaluation of Nuclear Structure and Charged Particle Reaction Data*, BNL Study Group (BNL NCS 20473), October 15, 1975 (Section III.A, pages 4-6)

1. The United States activity in the compilation and evaluation of nuclear structure data should be a coordinated effort of several national laboratories and research groups. Existing groups such as the Nuclear Data Project (NDP), Table of Isotopes Project (TI), Aerojet Nuclear Corporation (ANC), and the University of Pennsylvania (UP) group should be integrated into an evaluation network. The scope of the BNL Center should be expanded and it should be given overall responsibility for this activity.
2. Evaluators would be added to the BNL Center staff.
3. An evaluation network should be established with adequate manpower to perform mass chain evaluations on a time scale of four years or less. These evaluation groups will be responsible for providing recommended values, associated documentation, and selected experimental data for a master nuclear data file established at the BNL Center.
4. Measurers and users of nuclear data would join the evaluator network forming a working group to help set priorities, recommend output formats, and discuss data discrepancies.
5. The charged particle reaction data compilation activity should be transferred to the BNL Center, which would participate in the recently established international network of charged particle data centers.
6. The BNL Center should provide bibliographic and other data center services to the evaluation groups and to the general user community on request.
7. The research community in the U.S. should be invited to participate in the evaluation effort to share the evaluation load, to shorten the evaluation cycle time, and to assist in the prompt review of recently completed evaluations.
8. Participation by evaluators outside the U.S. should be encouraged with the aid of the IAEA's Nuclear Data Section.
9. Reorganization of compilation and evaluation efforts should not be disruptive of present efforts.
10. A complete bibliographic file, a file of selected experimental data (see Section VI.C.3), and a file of recommended data called the Nuclear Data Review File should be maintained at the BNL Center. These data files should be complete for all nuclear masses and made available to everyone without restriction.
11. The data files mentioned above should be the source for the several publications recommended below and other special user oriented publications.

a. *Recent References*

The complete bibliographic file will be utilized in the publication of *Recent References* three times a year. The last issue for the year will be cumulative from the last published Nuclear Data Sheets for a particular mass chain.

b. *Wall Chart*

The Wall Chart of Nuclides, a quick reference and initial source of information on ground state and isomeric state properties of all nuclides, will be updated and published every two years.

c. *Handbook of Isotopes*

The Handbook of Isotopes, similar in scope to *Table of Isotopes* (Le68), and in a format similar to *Radioactive Atoms* (Ma70), would be updated and published every four years. It would provide, in one book, recommended radioactive decay schemes and radiations, energies, and intensities with their associated uncertainties.

d. *Nuclear Data Sheets*

The Nuclear Data Sheets would be updated and published on a continuing basis, with a maximum 4-year cycle on any particular mass chain but would be extended in scope to cover all mass chains. Recommended values, uncertainties and major arguments for selection would be included, together with a relevant reference list.

12. Special "horizontal" evaluations of quantities such as half-lives, isotope abundances, fission yields, spins measured by direct means, cross sections, and resonance integrals would be encouraged and incorporated into the Nuclear Data Review File. The completion of horizontal valuations should be timed to benefit other evaluations in progress.

13. The priorities for compilation and evaluation of nuclear structure and charged particle data should be determined by the needs of the research community as well as the needs of user-oriented data libraries (Pe75). The user files for applications are to be derived wherever possible from files of evaluated basic data. Thus the data files for applications will be directly related to the evaluated data files useful to basic research. The relationship between evaluations of basic nuclear data and user-oriented libraries is described in Appendix B but is not discussed in this study.

14. A permanent panel of research scientists similar to the Ad Hoc Panel on Nuclear Data Compilations of the National Academy of Sciences should be established to monitor nuclear data compilations and evaluations and to interact where appropriate with funding agencies, data centers, professional societies, and the research community.

APPENDIX III: Specific Comments by the Panel on BNL Study
Recommendations Listed in Appendix II

(The numbers used are the same as those for the BNL recommendations.)

1. We agree in general.
2. As stated in the Panel report, we believe that a senior person, with strong experience in both nuclear science and nuclear data compilations, should be added to the staff of the Center. In addition, two or three other persons who combine computer data management expertise with nuclear structure data compilation and evaluation experience should be hired. No additional evaluators should be hired at this time for this purpose.
3. We agree, but we recommend that the Center carefully study and evaluate the feasibility and need for establishing the master nuclear data file at the Center. The Panel believes that such a system, with fast remote terminals at other centers, is a reasonable objective. Until it is achieved, the file and system at the NDP-ORNL should be maintained.
4. We agree.
5. We agree.
6. We agree, but believe that providing these services to the general user community should receive lower priority; otherwise the Center could become overloaded by this single operation.
7. We agree.
8. Working only through the IAEA's Nuclear Data Section may not be sufficient to increase the participation in this effort of groups and centers outside the United States; direct contacts with appropriate people and groups should also be initiated.
9. We agree.
10. See item 3. We question both the feasibility of and need for establishing a file of "selected experimental data."
11. We agree in general; however, it may not be necessary to have as many as three editions of *Recent References* per year. It seems unnecessary to have a two-year cycle for the *Chart of the Nuclides*. A four-year cycle for *Nuclear Data Sheets* and a "Handbook of Isotopes" is essential.
12. Special applied horizontal compilations should not have high initial priority at the Center in view of the many other responsibilities that the Center will have during the reorganization process. (See main body of report for further comments.)
13. In connection with this recommendation, the Panel points out that files of evaluated basic nuclear data do not, in general, contain the information necessary for the specialized horizontal compilations that we recommend in this report.
14. We agree.