USNDC-12
INDC/US-66 "G"
NEANDC/US-189"U"

THE MINUTES OF THE USNDC MEETING

23-24 SEPTEMBER 1974, LAWRENCE BERKELEY LABORATORY

BERKELEY, CALIFORNIA

C. D. Bowman, Secretary, USNDC

U. S. DEPARTMENT OF COMMERCE/National Bureau of Standards

FOREWORD :

The following constitutes the minutes of the meeting of the U. S. Nuclear Data Committee held September 23-24, 1974 at the Lawrence Berkeley Laboratory, Berkeley, California. Approximately one year had elapsed between this meeting and the previous one of the USNDC - the meeting for the Spring of 1974 having been canceled owing to an unresolvable conflict with federal laws regulating the operations of advisory committees to federal agencies.

Much of the meeting was therefore devoted to presentation and discussion of reports of the rather intense subcommittee activity of the past year. Other matters outside of the subcommittees' purview included a thoroughgoing discussion of the Table of Isotopes Project and the relationship between it and the Oak Ridge Nuclear Data Project, a detailed review of non-neutron nuclear data needs, a review of the role of the NEANDC, and a discussion of possible changes in the structure of the USNDC which would permit it to carry out its functions with less formal guidelines.

Attendance was as follows:

Parent Committee Members and Ex-officio members

1. John D. Anderson, LLL
2. Robert C. Block, RPI
3. Charles D. Bowman, NBS, Secretary
4. Robert E. Chrien, BNL
5. Herman Feshbach, MIT
6. L. Gevantman, NBS
7. William W. Havens, Jr., Columbia U.

Parent Committee Members and Ex-officio members cont'd:

8. Philip B. Hemmig, AEC (DRDT)
9. Daniel J. Horen , ORNL
10. David A. Lind, U. of Colorado
11. Michael S. Moore, LASL
12. Henry W. Newson, Duke U.
13. S. Pearlstein, BNL (NNCSC)
14. Francis G. J. Perey, ORNL
15. James S. Robertson, BNL
16. George L. Rogosa, AEC/DPR
17. A. B. Smith, ANL

Subcommittee Members

1. J. C. Browne, LLL
2. M. P. Fricke, SAInc
3. E. G. Fuller, NBS
4. D. Gardner, LLL
5. Robert C. Haight, LLL
6. L. Stewart, LLL

Speakers and Observers

1. E. M. Bernstein, Western Michigan U.
2. K. Campe, ORNL
3. B. Eubank, ORNL
4. R. L. Heath, ANL
5. E. K. Hyde, LBL
6. R. O. Lane, Ohio U.
7. M. Lederer, LBL
8. H. T. Motz, LASL
9. L. Petrie, ORNL
10. Enloe T. Ritter, AEC

AGENDA

I. ADMINISTRATIVE

A. Introductions

The Chairman of the USNDC, Dr. H. E. Jackson, welcomed all members to the meeting at 9:15 a.m. He then introduced a number of visiting subcommittee members and invited speakers who were in attendance. These included Dr. R. O. Lane of Ohio University, Dr. E. M. Bernstein of Western Michigan University, Dr. Robert Haight of Lawrence Livermore Laboratory reporting on behalf of the CTR Subcommittee for Dr. Don Steiner, Dr. Bruce Eubank of the Nuclear Data Project of Oak Ridge National Laboratory, Dr. Kazimieras Campe of the Regulatory Division of the U. S. Atomic Energy Commission, Dr. D. L.Smith of the Argonne National Laboratory, and Dr. John Browne of the Lawrence Livermore Laboratory--both members of the Neutron Data Applications Subcommittee, Dr. Lewis Gevantman of the National Bureau of Standards representing Dr. David R. Lide. Dr. M. Lederer of Lawrence Berkeley Laboratory and Dr. Lee Stewart of the Los Alamos Scientific Laboratory and member of the CTR Subcommittee. Dr. Enloe T. Ritter of the Division of Physical Research of the U. S. Atomic Energy Commission. The chairman then introduced Dr. Earl K. Hyde, Deputy Director of the Lawrence Berkeley Laboratory, who welcomed the committee to Berkeley and traced the long history at Berkeley in compilations and evaluations of nuclear data. The chairman then directed the committees attention to the agenda.

B. Agenda

Rogosa pointed out immediately a discrepancy in the agenda. He noted that the agenda previously circulated to the committee contained two items to be carried out in executive session.

Rogosa informed the committee that AEC's legal staff has advised him that Federal laws permit this committee to carry on business in executive session only under special arrangements which are extremely difficult to establish All deliberations of the committee are required to be open to the interested general public since these arrangements were not made in advance Pearlstein asked if there had been any public interest to the knowledge of any committee members in attending this meeting Rogosa said he knew of none

Minutes of the Previous Meeting and Past Actions

The chairman asked for comments on the minutes of the previous meeting Receiving none he proceeded to review the minutes of the previous meeting Action 1 of the previous meeting placed on the Subcommittee chairmen the responsibility to collect and forward to Goldstein recommendations for new entries to the list of outstanding cross section discrepancies The chairman commented that the response to this action had been good the many changes, deletions and additions to the list indicating significant progress in resolving discrepancies in the U S and indicating the strong endorsement of the committee in using this list as a vehicle for calling the attention of experimenters to these nuclear data problems .

ACTION 1
Subcommittee
Chairman

The chairman ended this discussion by placing an action on subcommittee chairmen to collect and forward to Goldstein on a continuing basis recommendations for new entries to the list of outstanding cross section discrepancies

Action 2 of the previous meeting on member Goldstein was to maintain a compilation of cross section discrepancies listed in order of importance to the nuclear energy program based on the recommendations

of the USNDC Subcommittees. In Goldstein's absence Havens distributed copies of the new discrepancy list to the committee. Chrien expressed concern that the discrepancy list is amounting to a "super" request list, in effect. He reminded the committee that the fact that some cross sections are discrepant does not make them more important than other priority 1 requests where no data or only very poor data are available. The chairman expressed his opinion that the discrepancy list was a good thing, that while calling attention to discrepant cross sections it was not meant to be and did not in his opinion amount to a super request list. However, Chrien responded that, in spite of disclaimers frequently voiced by the committee, it is in fact a super request list and that the committee should take action to assure that the items on the discrepancy list do not attract experimenter's attention to a greater degree than priority one nuclear data requests in the request compilations.

ACTION 2
Goldstein

The chairman continued the action of Goldstein to maintain a compilation of cross section discrepancies listed in order of importance to the Nuclear Energy Program based on recommendations of the USNDC Subcommittees.

Action 3 of the previous meeting was to prepare a report in collaboration with L. Love on the reassessment of calutron unit costs under full computer operation and report the results at this committee meeting. Discussion of this action was deferred to the isotope subcommittee report to follow later in the meeting.

ACTION 3
Subcommittee Chairmen

The chairman continued action 4 of the previous meeting, making it action 3 of this meeting which is for subcommittee chairmen to forward to USNDC chairmen suggestions for short reviews of programs supported by AEC contract which might be appropriate for presentation at future USNDC meetings.

Action 5 of the previous meeting on Havens was to seek the sponsorship of appropriate international organizations for the Conference on Neutron Cross Sections and Technology to be held in Washington, D. C. in 1975. Havens reported that support from IUPAP had been solicited, and that this organization had recommended to its executive council that the meeting be sponsored. Havens was optimistic that approval would be forthcoming soon.

Action 6 of the previous meeting on subcommittees was for each to develop a statement of needs for standards cross section data and enriched isotopes and forward this information to the chairmen of the standards and isotopes subcommittees. Rather than continue this responsibility as a specific action, the chairman asked that the subject of this action be a standing responsibility of the subcommittees which would not need to be spelled out in the future as a specific action.

Action 7 of the previous meeting imposed on the chairmen and A. Smith the responsibility to appoint an ad hoc committee chaired by Smith and made up of USNDC subcommittee chairmen to approach Professor B. Cohen on behalf of the USNDC to arrange a special program on applications of nuclear theory at the Fall 1974 meeting of the Division of Nuclear Physics of the APS. Jackson reported that this action had been discussed in depth by both the Basic Science and the Neutron Nuclear Data Subcommittee. While no strongly endorsed consensus was forthcoming from either subcommittee, it was decided in the Neutron Nuclear Data Subcommittee meeting that a session on the application of nuclear reaction

theory might be most appropriate. Gardner and Jackson developed a program which was approved by the USNDC and submitted to the Division of Nuclear Physics for joint sponsorship by the Division of Nuclear Physics (DNP) and the USNDC. The proposal was not accepted as the DNP did not want to establish a precedent of outside organizations sponsoring meetings in collaboration with the DNP. However, the DNP did endorse the concept of a session on applied nuclear theory to be included in the program for the meeting in Pittsburgh in the fall of 1974. The DNP appointed Jackson and John Schiffer of ANL to develop a program of applied nuclear theory for this meeting.

A session was developed including the following four papers:

H. H. Barschall	Intense Sources of Fast Neutrons
P. A. Moldauer	How and Why the Hauser-Feshbach Formula Works
F. G. J. Perey	Use of Nuclear Reaction Models in Evaluating Gamma-Ray Production Data
S. M. Grimes	Use of Nuclear Reaction Models in Cross Section Calculation

Newson expressed concern that the DNP was unwilling to accept cosponsorship of the session with the USNDC and suggested that such sessions in the future might better be presented at the American Nuclear Society meetings where he felt the reception might be more positive. The chairman responded that the content for the session, which the USNDC proposed, was in fact accepted and expressed his opinion that the DNP had legitimate justification for maintaining full authority over the organization of its meetings. Lind agreed, pointing out that the objective had been achieved and that we should be satisfied. The chairman declared this action completed.

Action 8 of the previous meeting on Steiner required a summary of the CTR subcommittee goals for the parent committee so that it could have a more definitive idea of the CTR subcommittee role. The chairman reported that these terms of reference had been prepared and circulated in accordance with the action and that the action had been completed.

Action 9 of the previous meeting on the chairman was to establish representation from the USNDC on the Transplutonium Committee (TPC). The chairman, Dr. Jackson, contacted Dr. Van Dyken, chairman of this committee, who agreed to this appointment of Mike Moore to represent the USNDC on that subcommittee. Moore expressed some concern about the future of the committee noting that Van Dyken was now undergoing a long convalescence from a serious illness. Rogosa reported that the next meeting is scheduled to be held at Argonne National Laboratory in November and that John Burnett will participate for the AEC since Van Dyken is ill. Rogosa reported that the committee in his opinion serves a useful function and would definitely continue. The chairman declared the action completed.

Action 10 of the previous meeting required the subcommittees to approve their terms-of-reference and forward them to the chairman by March 1, 1974. The chairman reported that this action had been completed by all subcommittees.

Action 11 of the previous meeting required the chairman to appoint an ad hoc subcommittee to prepare a brief document on energy initiatives outlining problem areas in nuclear data for which additional support would promote most effectively the solution of critical problems. A committee was appointed consisting of A. Smith, M. Moore, R. Chrien,

and H. Jackson, which prepared a report which was forwarded to the Division of Research. Rogosa commented that it was very valuable and was used extensively in the Division of Research deliberations on energy initiatives. In this context he noted that the total nuclear science program in the Division of Research is now considered energy-related within the AEC. Rogosa reported that for FY-75, within the total Nuclear Science appropriation, $7,6 M was appropriated for energy-related R & D.

However, next year all nuclear science will be considered energy related; including high energy physics*, material science, and also molecular science. The reaction of the committee was generally one of wonderment or astonishment. But Rogosa explained that the Division of Research had concluded that it was in the best interest of these programs to handle them this way for appropriations purposes.

Anderson asked whether the status of the committee would be affected by the formation of ERDA. Rogosa responded that the formation of ERDA is not expected to have a large impact on the existing nuclear science programs in the Division of Research - the present structures being carried over to ERDA without significant change.

Action 12 of the previous meeting on the subcommittees was to complete the RENDA review and forward to NNCSC by February 1. Pearlstein reported that the input had been received and that the material was forwarded in accordance with the action. The chairman declared the action completed.

Action 13 of the previous meeting was to include a discussion of the generalization of the request list on the agenda

*Since the meeting the policy has been changed so that DPR no longer carries high energy physics under its energy-related research.

of the next subcommittee meeting. A report on this action was deferred to a later time in the meeting when Heath was scheduled to present a proposal for the inclusion of non-cross sections nuclear data in the request list.

Action 14 of the previous meeting on subcommittees related to the preparation of guidelines covering contributions to the status report of the USNDC. The matter was deferred to a later part of the meeting.

Action 15 of the previous meeting on the chairman was to appoint an ad hoc subcommittee to review the U.S. distribution for CINDA and recommend addition or deletion of appropriate names. Rogosa and Jackson reviewed the list and forwarded a new list to Goldstein. Pearlstein has the complete listing which will be available for comment later in the meeting. The action was declared completed.

II. REPORTS OF SUBCOMMITTEES

A. Neutron Data Applications Subcommittee

Subcommittee chairman Smith reported that a meeting was held at Argonne National Laboratory in the Spring of 1974 with nearly the full subcommittee in attendance. A number of topics were addressed at the meeting and much was achieved. At this point L. Stewart asked that minutes of this subcommittee meeting be distributed to all subcommittee members as well as members of the USNDC. She emphasized that much of the work of a particular subcommittee bears heavily on that of another subcommittee and that full circulation of the minutes of the meeting would help considerably in coordinating the activities of the different subcommittees. After noting general agreement among the

committee members with this proposal, the chairman placed an action on all subcommittee chairmen to distribute minutes of all subcommittee meetings to all members of subcommittees.

ACTION 4
Subcommittee Chairmen

To facilitate this action the chairman further directed the secretary to distribute to all subcommittee chairmen a list of names and addresses of all members and members of subcommittees of the USNDC for use in preparing distribution for these minutes.

ACTION 5
Secretary

At this point Newson suggested that an oath of office might be in order requiring committee members to read all documents--catching the sentiments of some members that action 4 might increase the already burdensome amount of material circulating within the committee and subcommittees. Chrien's sympathy for Newson's position was expressed in his strong opposition to taking any oath with the "hope of eliminating hypocrisy insofar as possible". Actions 4 and 5 were permitted to stand with the expectation that members of the committee would probably not be bashful in expressing their reservations at the next meeting if the action proves too troublesome.

Moving on to the business of the subcommittee meeting Smith mentioned the continuing foil assaying problem. He pointed out that there is currently no complete set of standard foils with masses determined to accurately known uncertainties and which are available for intercalibration of foils which might be used in high accuracy cross sections or standards work. Bowman commented that the NBS is attempting to establish such a set of foils. He reported that a foil of ^{235}U and perhaps a couple of others had been measured with sufficient accuracy and with a sufficient variety of techniques to qualify them as standards. However, other priorities and funding limitations will not permit the NBS to pursue this problem actively in the near future. He

reported that the NBS is interested in and concerned about this problem and plans to propose a program in this area soon.

Smith next reported on the review of the request compilation which resulted in several hundred suggested changes. Smith commented that one of the biggest burdens in doing such a review was editing the comments section of the request list and making additions as appropriate. He suggested that requesters should make better use of CINDA rather than ask for details in the comments. He pointed out that CINDA is generally very up-to-date on existing work. Moore, however, pointed out that comments on planned activity or measurements programs underway were quite helpful and did not appear in CINDA. Pearlstein also pointed out that comments were necessary to distinguish requests for evaluation from requests for new data. The consensus of the committee was that future reviews should de-emphasize a detailed summary in the comments of measurements almost certainly already in CINDA.

Smith reported that considerable time of the subcommittee was given to a discussion of ideas for the neutron cross sections technology conference and to a discussion of the proposed APS session on applications of nuclear theory. He also reported that some time was made available for a "show and tell" session on new activities with neutrons. This partially successful experiment yielded some interesting ideas on the applications of neutrons to life science studies.

Smith next noted the role of the ANS in setting standards for nuclear data and expressed the subcommittee's concern that one of the primary results of ANS activities which was ANS Standard 19.1 was not realistic. Block, who was a member of the ANS panel which prepared

this standard, responded that the standard was not "cast in concrete," but rather it is supposed to be reworked every two years. Perey, however, expressed concern that this supposedly transient standard might be a de facto "in concrete" situation. Block recognized this concern and suggested that both the ANS and the AEC should keep this standard under active review.

Smith continued his report saying that an effort to get particular reviews was going forward, including an effort by Perey on a review article in the area of gamma ray production. He briefly mentioned a number of changes, resolutions, and additions to the discrepancy list which Havens had distributed earlier. Among the additional cross section requests he mentioned the subcommittee's endorsement of ^{6}Li (n,α) and ^{237}Np (n,f) cross sections as standards. The next meeting of the subcommittee is planned in conjunction with the APS meeting in Anaheim. He announced that an informal get-together of a number of members of the committee was being held on Wednesday, September 25, in Berkeley and that all members present at the USNDC were invited. The intent of the meeting is to review activities primarily at Lawrence Livermore Laboratory in measurement of nuclear data with a few reports from other parts of the U.S. effort as time permits. No decisions or recommendations will be made as a result of this informal meeting.

Smith closed his report with comments on the general effectiveness of the neutron nuclear data subcommittee. He explained that he had established ambitious objectives for the committee which would have required about 80 hours per year of effort from each committee member. He found that it simply was not possible to obtain that much effort from the average committee member and that the realistic

number is closer to 20 hours per year. Smith expressed his opinion that the scope of the Subcommittee was simply too broad. Members generally are willing to devote considerable time to activities closely related to their current areas of interest, concern and responsibility at their current laboratories. However, the effort required to do an excellent job in an area not closely related to their current activity discouraged most Subcommittee members from making the effort to contribute. Jackson commented that the productivity was perhaps disappointing only in view of the ambitious program which the Subcommittee chairman had set. He pointed out, that in fact, much was accomplished by the Subcommittee which almost certainly could not have been handled by the USNDC without the Subcommittees efforts. Havens concurred with Smith that it was only possible to get significant contributions from a Subcommittee member when the work relates closely to the work of his parent laboratory.

In the question period which followed for Smith, the major concern was better data for the neutron producing reactions used with monoenergetic charged particle accelerators. An action was placed on the Neutron Nuclear Data Subcommittee to enter requests for the source reactions Li (p,n), d(d,n), t(p,n) into the next addition of the nuclear data request list.

ACTION 6
Neutron Nuclear Data Subcommittee

B. Standards Subcommittee

Havens reported for the Standards Subcommittee chairman, R. Caswell, who could not be present since he was traveling outside of

the U. S. Havens began the report by giving a summary of activities of the Standards Subcommittee including a meeting at the National Bureau of Standards during the past winter. This meeting was well attended by members of the Committee and included a number of experimenters from NBS as visitors. He briefly reviewed the scope of the meeting and then began a consideration of each of the cross section standards in more detail. He began by mentioning the request by Richard Wilson from Harvard for greater accuracy in the n,p cross section for the purpose of basic science, that is the nucleon-nucleon force. The request involved improving the present better than $\pm$ 1% accuracy for (n,p) scattering at thermal energy to an even greater accuracy in the range of a small fraction of 1%. Since the Subcommittee was aware of no known justification in terms of applied nuclear data for improved standards at that energy, the request was referred to the Basic Science Subcommittee. At this point Perey commented that the needs for better (n,p) data for standards purposes is in the region above 10 MeV where this cross section is used almost exclusively as a standard. The present uncertainties in the angular distribution limit the accuracy in cross section obtainable by this technique to about $\pm$ 2% at 14 MeV and even greater uncertainties at higher energies. Havens acknowledged this higher energy region as an area of valid concern for the Standards Subcommittee.

Havens next moved on to a discussion of gold. He commented that the Subcommittee had concluded that there is no discrepancy in gold within the accuracy of measurements. Bowman commented that there were rumors that new efforts in Europe had resulted in large differences from ENDFB-4 of the order of 25% or more in the cross section in the fractions

of one-MeV range. Smith reported that Macklin has a new gold measurement and also said a new gold measurement at ANL had been carried out to an accuracy of better than 10%. He expressed the opinion that tanks will not get better than 5 to 6% accuracy but that activation measurements could be made more accurate. The general feeling seemed to be that the U.S. should not become further concerned about the gold cross section until a strong need was demonstrated or until the present evaluation of gold were demonstrated clearly to be in error. Chrien commented that at the EANDC meeting gold was discussed and that it was concluded that owing to structure in the cross section that gold is not a good standard below one or two hundred keV. Havens reported that, although the request had not been fulfilled, the Subcommittee downgraded it because it didn't seem to be that useful and good a standard at the time of the Subcommittee meeting. However, he reported that the Subcommittee would keep track of interest in gold as a standard. Jackson reported that in accordance with dwindling interest in the U. S., Europe is now off the gold standard.

Havens then moved on to a discussion of the ^{3}He (n,p) standards. He reported that as far as the Subcommittee was aware no one was using the standard and inquired of the Committee if anyone knew of its being used. The Committee response was negative, but it still will be kept on the list of needed standards.

Havens then reported that the ^{6}Li (n,α) cross section data of GRT is still discrepant in the peak of the resonance, being 25% higher than the ENDF/B-IV evaluation. Smith commented that it is a foil measurement and perhaps proper consideration was not given to anisotropy

effects. He also reported that dead times as high as 90% were present in the data and that large corrections therefore were necessary. Bowman reported that Schroder at NBS has preliminary data which indicates significant anisotropies in the angular distribution of reaction products from ^{6}Li at energies as low as 25 kV. The discussion which followed served to focus the committee's attention on the need for being exceedingly careful when working with foils of ^{6}Li to properly account for angular distribution effects. In this regard ^{6}Li glass was thought to be a much more suitable detector medium. Smith raised the question of whether ^{6}Li glass is a good standard owing to problems of composition of the glass. There were discrepant reports among committee members as to the reliability of the manufacturer's specifications regarding composition of the glass and it was generally agreed that while for most purposes the manufacturer's specifications might be adequate,for standards work it was absolutely necessary to independently check the manufacturer's specifications.

Havens then moved on to a discussion of the ^{10}B (n,α) cross section reporting that there are lots of R-matrix calculations being carried out in an attempt to improve the accuracy of the cross section. However, in terms of measurements,discrepancies of 15% exist between the measurements of Coates and Friesenhahn above 50 keV. Below that energy the agreement is satisfactory. Havens closed his report with a request that the chairmen attempt to insure that more experimentalists be made members of the Standards Subcommittee in the future. Of the six present members, only two are active experimenters.

In the question period which followed Jackson inquired as to the contact which the Standards Subcommittee has with the activities of the Mound program. Havens reported that Grundl is aware of the Mound work but is not a part of it and that the liaison with the Mound program was not strong. The chairman pointed out that a meeting to evaluate the progress of the Mound program had been held recently and that the results of this meeting would be of immediate concern to the committee. He placed an action on himself to obtain a copy of the proceedings of the Mound Laboratory symposium on actinide half-lives and distribute to the committee. The chairman further stated his concern that the committee be kept up-to-date on continuing progress in the Mound program and placed an action on the Secretary to solicit a status report from the Mound program on actinide half-lives for the inclusion in the USNDC semi-annual status report.

ACTION 7
The Chairman

ACTION 8
Secretary

Hemmig then returned the discussion to cross section standards by stating the DRDT's deep frustration at being unable to bring about any progress in improvement of cross section standards even though significant funds had been expended over the last several years. He expressed concern about the issues of the relative importance of standards and the program which could effectively lead to an improved set of standards. Havens responded that the Subcommittee would carry out this assessment. Hemmig emphasized the point further by urging that the Subcommittee state its goals more clearly. Havens was asked by Jackson to relay these feelings of concern for objectives to the Subcommittee. Havens closed the discussion with the report that Caswell will soon represent the Subcommittee in approaching Rogosa about better support for standards.

C. Basic Science Subcommittee

Basic Science Subcommittee Chairman, Lind, reported that the subcommittee had met twice since it had been formed. The first meeting involved the establishment of terms-of-reference for the subcommittee and the second meeting which took place on September 22, 1974 in Berkeley was the first meeting which could be devoted fully to the business of the committee. Lind reported to the committee that the major activity during the recent meeting was a review of the compilation and evaluation of basic nuclear data, most attention going to a review of the Berkeley compilation effort and the Oak Ridge nuclear data group. A report was also given from the Berkeley Particle Data Group which was considered valuable in view of the proposed intermediate energy data compilation effort which might be established in Los Alamos in the future. Lind presented four recommendations from his subcommittee to the USNDC.

1. That the Oak Ridge Nuclear Data Group and Berkeley Data Projects should both be continued after 1976 so long as strong coupling and collaboration is developed and maintained.
2. That Oak Ridge Nuclear Data Group and Berkeley Data Project should work to produce interchangeable data files with the eventual production of a standardized nuclear data base for the U. S.
3. That the Subcommittee recommends that ORNDG seeks support through the Office of International Programs of NSF to achieve international cooperation in compilation and evaluation of nuclear data.

4. That H. Feshbach, as a member of the program committee of the International Conference of High Energy Physics and Nuclear Structure, be asked to organize a panel to discuss the sharing of useful information on target material and data among the major international intermediate energy facilities such as SIN, CERN, TRIUMF, and LAMPF.

Lind then described to the committee some of the discussion and conclusions of the committee relating to each of the recommendations above. He reported that in making recommendation 1 the subcommittee felt that both efforts should be continued in parallel owing to the differences in viewpoint, emphasis, and technique which the two different groups would naturally generate. However, as reflected in both recommendations 1 and 2 it was felt valuable that there be strong coupling and collaboration such that both efforts would be contributing to the long-range objective of a standardized nuclear data base for the U. S.

The 3rd item related to the fact that the U. S. nuclear data efforts up to this point have not been able to collaborate successfully with the great amount of talent in the European community. Horen emphasized that there was a strong willingness on the part of individual European scientists to participate in the program but that there was no organized program in Europe to assist individual scientists. Efforts to work with individual European scientists from the U. S. had been lacking in effectiveness to some degree owing to the heavy load of additional liaison paper work, etc. which was required but which the ORNDG did not have the manpower to accomplish. The USNDC quickly reached

the consensus supporting recommendation three and the chairman placed an action on himself to recommend to DPR that ORNDG seek support through the Office of International Programs of NSF to cover incremental expenses necessary to achieve international cooperation in compilation and evaluation of nuclear data.

ACTION 9
Chairman

Moving on to recommendation 4, Lind pointed out that there were a number of major intermediate energy research facilities around the world now which would be moving into a very productive phase rather soon and that these facilities face many common problems in terms of target materials, production of data, quick dissemination of information useful to each program, avoidance of overlap of experiments where redundancy was not clearly necessary, etc. Recommendation 4 was, therefore, proposed with the objective of attempting to organize an effort to resolve some of these issues at the coming meeting in Santa Fe.

At this point Rogosa brought up a new subject related to international scientific collaboration. He expressed some concern and thoughts of his on the question of how responsive the U. S. should be for requests from other countries for separated isotopes. He pointed out that in times past the EANDC had played a central role in the exchange of isotopes. Such requests for loans of isotopes had to be approved by the EANDC. This worked out to be a very cumbersome apparatus. On occasion so much time had passed that the borrower was no longer interested in the experiment. At the last EANDC meeting Rogosa explained to the EANDC that there is no official U.S. regulation which requires an EANDC role in these decisions. He suggested to the EANDC membership at the last meeting

in Japan that they simply write his office for loans of separated isotopes and that a decision on programmatic requests should be forthcoming on a much shorter time schedule.

Rogosa then turned to the question of criteria for making a decision about whether or not a request should be granted. Rogosa had felt that these criteria might be: (1) does the measurement make sense; (2) is it in the request list; (3) would it be of assistance to U. S. programs - basic or applied; and finally (4) does it satisfy a programmatic objective. Rogosa is however, concerned now that these criteria might not be adequate. Large quantities of isotopes have been requested by European laboratories for what appear to be sensible and useful measurements and which generally satisfy the above criteria. In some cases one laboratory has requested large blocks of isotopes. His present policy is to review and perhaps approve each isotope application on a case-by-case basis thereby keeping the volume of isotopes abroad only a small fraction of our stockpile. He expressed an interest in hearing opinions of the membership of the USNDC on this subject.

The solicited opinions were highly varied ranging from one extreme which was to make available to Europeans any isotope which was not presently in use and otherwise sitting idle in storage to the other extreme of requiring the payment of a considerable rental fee. Several factors were expressed in the discussion relating to these two extremes. It was pointed out that the isotope inventory represented a major asset which had been established with the expenditure of significant funds and that the U. S. taxpayer had no obligation to support European science by providing these isotopes free. Rogosa pointed out that the

Europeans have some very nice experimental facilities and that the U. S. might wish to exchange isotopes for experimental time on these facilities. It was pointed out, however, that generally speaking experimental time was usually not so difficult to get on European facilities since American scientists were able to bring their ideas and their labor into a joint collaboration which justified the accelerator time ordinarily in the view of the European host; and therefore, this did not seem to be a very strong bargaining point. After a lively exchange during which no consensus was established, Rogosa expressed his thanks to the committee for their thoughts and concluded the discussion with the comment that the requests would continue on a case-by-case basis until some other policy could be recognized and implemented.

During the foregoing discussion the question had arisen as to what degree the U. S. supply would be depleted by heavy foreign usage and a specific example chosen was that of the heavy request which had come from the LAMPF facility. Ritter reminded the committee that at least for the initial round of measurements on LAMPF that the present pool is adequate citing a study by Chrien carried out for the USNDC in the recent past. Lind concluded the discussion relating to the Basic Science Subcommittee by saying that the Subcommittee felt that a request list for basic science data was inappropriate. It was felt that the committee could better initiate needed measurements informally rather than trying to promote them in a request list. Lind also reported that a basic science report on data of applied significance had been recommended at the first meeting but that the first attempt to prepare such a report had failed and that no further efforts in this direction would be made.

D. Materials Science Subcommittee

Dan Horen began his Subcommittee report by emphasizing the difficulty which the Subcommittee had experienced in conducting its work effectively. He felt that the area was very big and nebulous with many bits and pieces for which responsibility was being assumed by any number of different groups outside of the USNDC. He pointed out that the areas encompassed by this subcommittee were not subject to specific and compact little projects. He also emphasized that there are some areas where the Subcommittee probably cannot be terribly effective without devoting a considerable amount of effort. He commented that the Small Accelerator Conference scheduled for late October in Texas looks very good and, in his opinion will contribute significantly in the area of materials science.

Jackson asked about the needs expressed by the TVA. Horen responded that the Subcommittee would work with them if their needs are urgent. However, long term needs will be satisfied anyway by the Oak Ridge Nuclear Data Group (ORNDG) work on mass chains. Horen said that ORNDG would be able to respond in small ways to small requests such as this. However, he sees no big requests (other than the important current program which has existed for years) in the future and expects ORNDG to concentrate its attention on completing the mass chain work.

E. Controlled Thermonuclear Research Subcommittee

Dr. Robert Haight reported for the Subcommittee in the absence of the chairman, Dr. Steiner. He reported that a meeting had been held on April 15, 1974 at San Diego with essentially full subcommittee membership in attendance and a number of visitors. Terms-of-reference were approved. A compilation of reviews of evaluations of CTR materials was assembled and has since been printed as USNDC-CTR-1. The evaluations cover the energy range

from thermal neutron energy to 20 MeV. Tables of estimated accuracy of the evaluations are included in the reviews to provide some rough guidance to the user. They are not intended as error files, however. Haight asked for approval from the Committee of this document as a Subcommittee report. Since many Committee members had not had a chance to inspect the document, the chairman delayed the consideration of the document for approval.

Haight then turned to a consideration of the request list. He reported that the CTR office in the AEC has requested from users a list of requests which will be forwarded. Requests for evaluation will be included in the request list. If users aren't familiar with the accuracy with which a particular cross section is known, the requesters have been encouraged to request an evaluation rather than a measurement. Jackson responded that the request for evaluations certainly were in order and such requests have been accepted in the request list in the past. Continuing, Haight commented on the INDC request list for CTR data expressing the view of the Subcommittee that it is not of much value. For example, the McNally list has been included even though it had not been reviewed within the U. S. and it has been given high priority and much consideration by IAEA. Haight reported that there was other activity in the U. S. reviewing CTR nuclear data needs other than that of the CTR Subcommittee of the USNDC. The DCTR had appointed a panel to review atomic, molecular, and nuclear data needs for CTR. This was one of a number of panels convened by DCTR to review all aspects of the CTR program. This report was generally supportive of significant area in the nuclear data field but gave primary emphasis over the short run (two or three years) to atomic and molecular data. Haight closed his

report by announcing that the next meeting was scheduled for the Sunday, October 27, 1974, preceding the ANS meeting in Washington, D. C.

In the question and comment period which followed, Motz suggested that the request for data into the 20 to 50 MeV range really didn't make much sense. He pointed out that the only reason that data were needed in this energy range was because the most intense sources of neutrons readily available at the moment produced a neutron spectrum which extended that high in energy. Naturally, the availability of these cross sections would simplify the interpretation of the results of such experiments. However, the long term interests of CTR is to develop intense 14 MeV neutron sources for materials testing purposes which utilize solely 14 MeV neutrons from the d,t reaction or moderated neutrons from the source. He pointed out that a confined plasma would yield very few neutrons above 18 MeV and hardly any at all in the energy range of these very high energy requests. Bowman pointed out that in laser fusion where the plasma is a great deal more dense than the magnetically confined plasma, a significant number of neutrons would exist in the energy region above 14 MeV and up to energies as high as 28 MeV owing to the significant probability that neutrons will scatter off other neutrons before escaping the dense plasma. However he agreed with Motz that even this justification provided little support for an aggressive program in this higher energy range.

In Haight's report he had briefly mentioned the opinion of Dr. Price of DCTR that conventional materials might be used for construction in the earliest CTR reactor. Motz expressed surprise that conventional materials might be used for construction after hearing for so long about exotic materials such as tantalum, niobium, etc. He expressed concern that nuclear data measurers might have been

misled about the place for emphasis for CTR data.

Bowman commented on his impression that the DCTR was giving serious consideration to conservatism in all aspects of CTR design; that is, stainless steel for walls of the confinement vessel, non-cryogenic coils for magnetic fields, etc. The concern appears to be that the technology was sufficiently new just in the plasma burning aspects to make practical construction difficult and that the inclusion of advanced and high risk engineering techniques should be avoided unless absolutely necessary. Jackson asked Haight if a new body of CTR needs had been stated by CTR in line with the new emphasis. He pointed out that Price is now recommending efforts not in the recent request compilation. Haight responded that it was clear that the U. S. needs for CTR were not finalized at the moment--at least in regard to structural materials. However, there are some factors essential to the CTR program which would not change regardless of the construction materials. Such aspects include the need to breed tritium and the need for extracting energy from the neutrons. Both of these factors come together in the requirements of a lithium blanket surrounding the plasma and at least this part of CTR technology would not be influenced by changing engineering concepts. Perey added that well-justified high priority requests would have to await sensitivity studies which tell us which cross sections are important and how important they are. Smith expressed his concern that CTR nuclear data needs were not receiving sufficient attention from those funding the program. He felt that there was no doubt that a significant amount of new measurements would be required for that program but expressed serious concern that the capability to carry on these programs might disappear soon if DCTR could not commit itself to a measurements program. Perey responded that DCTR is assuming some long term responsibility and

that he understood that a number of laboratories probably would receive some DCTR funding in support of DCTR objectives. Moore asked Haight if the DCTR now felt that it couldn't fund experimental efforts until sensitivity studies were completed. Haight responded that some sensitivity studies have been done at ORNL and that a standard blanket has been evaluated at several laboratories. He also mentioned that he understands that there is a small budget for nuclear measurements this year.

Hemmig asked Haight for more information about the CTR data library expressing concern that this library was not coordinated with ENDF and his concern that proliferation of special libraries be avoided. Haight responded that DNA has a library so that contractors could have access to recently revised evaluations which would be used uniformly in their work. CTR also would like to make use of recent evaluations and not wait for ENDF versions over which it might have little control. Haight emphasized that the library was in the ENDF format and that there would be close interaction with the ENDF evaluation effort. Pearlstein closed this discussion in commenting that while the DCTR really doesn't know what data it needs yet, that the concepts of a special DCTR library does appear to be useful to them and that he foresees no problem ahead for ENDF owing to the DNA and DCTR special libraries.

F. Biomedical Applications Subcommittee

Robertson reported that the committee had met in February and attempted to determine its role in nuclear data in this area. The committee foresaw the need for concerning itself with isotope production cross sections which might be of value to the biomedical community. It also hoped to educate the biomedical community to the sources of nuclear data and the measurement laboratories which might be of assistance to them.

He mentioned that Horen and Caswell were working on a useful bibliography for nuclear interactions important in the cancer therapy energy range but that the effort is apparently suspended at the moment. He mentioned that the committee thought that it might also undertake the function of applications in agriculture. Moore asked who was taking requests for isotope production cross sections for the Brookhaven facility. Robertson responded that Powell Richards will do this. With this question the discussion of this subcommittee activity ended.

G. Separated Isotopes Subcommittee

Perey began by proposing that the contact with the transplutonium committee, Moore, be added to the Isotope Subcommittee owing to obvious common interests of the two committees. The last meeting was held on March 25, 1974 at ORNL. At this meeting Bill Good asked to be relieved of his role on the Subcommittee having served on it for several years running. The major purpose of the meeting was to evaluate the proposal for automation of the calutrons. Perey reported that a massive infusion of funds for calutron upgrading would reduce costs, but that the reduction in costs would only come with more tank hours. FY-76 yearly expenditures could be reduced by only $85,000. However, for FY-78 one could triple the present production and reduce costs per hour from $20 to $10 per hour for a $900,000 investment. The question is do we need this productive capacity--can we use this productive capacity.

In answer to these questions Perey reported that there appeared to be no present problem with the size or inventory of the research materials collection. The original objective when the isotope separation program was set up of one mole of each isotope is clearly too

much. Over the years this objective has been revised downward to a few grams for the small abundance isotopes. Perey proposes that the present list of needs for separated isotopes be reviewed carefully again with the knowledge that some stargazing would be required in terms of assessing possible new needs. Until such a review is completed he suggests that no recommendations at this point, with regard to automation, would be appropriate on the basis of the RMC requirements. But very likely a case could be made from the sales point of view.

Turning to the matter of isotope sales, Perey reported that, in real dollars, sales have been constant in the 1968-1972 period. Since 73-74 sales have pushed up some. Eighty percent of these sales go to medical use. The USSR is also providing many of these isotopes. For example, all molybdenum isotopes for medical use in the U.S. were bought from the USSR for a time. Motz and Jackson saw no problem with their underselling us so long as these isotopes were being purchased at a price below our cost. In effect this amount to a USSR subsidy of our medical research program which should not be rejected as long as it exists. Of course this viewpoint presupposes that the costs of the USSR isotopes actually are below the real cost of producing these isotopes in the U.S.

Perey reported that in an attempt to answer these and other questions regarding the isotope separation program, an internal ORNL review of the program in depth was carried out under the chairmanship of Don Ferguson. Perey reports that more R & D was urged for the program, that the pricing policies were assessed as not realistic in that the present pricing policy does not achieve full cost recovery. The review contains proposals to achieve cost recovery and this can only mean increased costs.

Perey pointed out that one difficulty is that the present price structure does not relate well to the purity. Perey reported that the inventory according to the present price structure is now valued at $40,000,000 and AEC auditors don't like that. Perey reported that in his view this was a tremendous opportunity for taking a fresh look at things and for bringing about significant changes in the program. Motz asked how much had been invested in calutron operation since the facility opened. Perey reported that about $60,000,000 had been spent. Comparing this with the $40,000,000 inventory, Motz observed that the inventory is near the operating cost permitting the conclusion that either only a small part of the inventory was sold or else the inventory was undervalued.

In recognition of the strong committee interest in the ORNL review document, the chairman placed an action on Perey to distribute the document on the ORNL review panel for the isotope program to the parent committee before the next USNDC committee meeting. Perey concluded his report with the opinion that the problems in this program come from adhering too closely to very specific rules. However, he felt that future needs were still sufficiently uncertain for the RMC that it would be difficult to resolve the problem by a new and better set. Chrien raised the question again of foreign loans of separated isotopes. Lind responded that this was still an open question and that the basic science subcommittee would discuss it further at the next meeting. Perey thinks that there should not be a waiving of charges to foreigners as had been suggested earlier in the meeting. Ritter explained again that DPR has the authority to provide isotopes to foreigners without EANDC approval and that for the time being approval will be granted on a case by case basis.

ACTION 10
Perey

III. PROGRAM REVIEWS

A. Cross Section Studies at Ohio University

Dr. R. Lane of Ohio University began his presentation by reporting that the program primarily emphasized neutron work. The accelerator is one of a kind. It is a T-configuration tandem designed for high currents and for holding a 5 MV potential on the terminal. It is fitted with large aperture accelerator tubes to enhance its high current acceleration capability. The accelerator operates comfortably at 9 MeV , readily at 9.5 MeV, but to get to 10 MeV the beam intensity must be reduced significantly. Currents as high as 95 μA of protons have been accelerated but normally the currents are about half of these values. Most of the neutron work is done with pulse beams at a base frequency of 5 MHz. The pulse width is 1 nsec and the accelerated current is 10 to 12 μA dc. The pulsed deuteron current is a little more than half of that for protons. The injector is capable of injecting 250 to 350 μA of H- beam.

The longest flight path for the neutron time-of-flight work is about 6.6 meters. These pulsed beams are used in studying polarization in neutron scattering. For charged-particle work a Brown-Buchner magnet from MIT has been set up with a wide aperture pole spacing. Lane feels that this system is at least as good as solid-state detectors when one considers the necessity to move the solid-state detector away from the target owing to neutron shielding and damage problems in the detector. In addition, the resolution is about a factor of two to three better. The present limit in these experiments is the neutron-energy spread rather than the charged-particle energy resolution. The system is still being set up and is not yet fully operational. However, the first nucleus which will be studied is the ^{19}F (n,α) reaction. The intent

is to get the angular and momentum distributions of the emitted charged particle.

Lane then went on to discuss the scattering of neutrons from ^{10}B. At Ohio an R-matrix fit to ^{10}B has been done and the 1/v cross section at low energy has been reproduced. The measurements have discovered a large d-wave state at 2.63 MeV with a $J^{\pi} = 11/2^{+}$. It is felt that by discovering and properly taking into account all states in the boron-10 nucleus that one can use R-matrix calculations to calculate with high accuracy the boron-10 cross sections. Lane emphasizes that the Ohio University role is to get the overall picture of the nucleus and its decay and excitation process. The detailed fitting or calculation of cross sections is more appropriate to a national laboratory such as LASL where Dr. G. M. Hale is following this problem from this viewpoint closely. There is a close collaboration between Ohio University and LASL on this ^{10}B question.

Another facet of this work is the encouragement of the development of nuclear models, Lane points out that in ^{12}C where isospin mixing is strong it is difficult to derive information on spin and parity of many states. It is far better to work with ^{12}B where isospin mixing is not important and the level structure is cleaner--that is all T = 1. The resulting spectroscopy on ^{12}B has permitted a considerable step forward in understanding the level structure of ^{12}C. In the same way ^{10}B is being studied through reactions leading to ^{10}Be.

Lane concluded his presentation by expressing his laboratory's strong interest in inelastic neutron scattering, particularly at high energies and mentioned that a proposal is now before NSF to pursue this

work. Anderson commented on the use of the magnetic spectrometer as opposed to the solid-state detector. He pointed out that one can increase the solid angle for the solid-state detector with a quadrupole thereby moving it further away to protect it from neutrons and also achieving enough target separation to permit background reduction by time-of-flight techniques.

B. Nuclear Research at Western Michigan University

Professor Bernstein began his report by describing the experimental facilities at Western Michigan. The major facility is a 12-million volt tandem Van de Graaff accelerator which has been in operation for four years. The facility is supported by a PDP 15 on-line computer. The associated laboratory space occupies 5700 square feet of area. The first major element in the experimental program was the accurate calibration of the proton energy from the accelerator. The method uses the acceleration of heavier mass ions onto a deuterium target and the detection of the resulting neutrons. Since the threshold for the inverse reaction has been measured accurately with deuteron beams at much lower energy, this method can be used to calibrate the accelerator at much higher energies owing to the much higher threshold for the oxygen-16 beam striking the deuterium target. By this means the energy calibration can be determined to an accuracy of about 1 kV in the energy region above 6 MeV. With the accelerator calibrated to high accuracy, it was possible to remeasure the mass of oxygen-15 by redetermining the threshold for reactions leading to this product. The resulting energy is 6 keV below the old value and this difference is of considerable importance in understanding nucleosynthesis problems in this mass range.

Bernstein described another experiment in which the reactions $^{12}C\ (\alpha,n)\ ^{15}O$ and $^{12}C\ (\alpha,p)^{15}N$ were studied to investigate these mirror nuclei as reaction products. The experiment is quite sensitive to isospin mixing. He also reported on measurements of the level structure of ^{56}Co through the $^{56}Fe(p,n\gamma)\ ^{56}Co$ reaction. The gamma ray spectra were stored in the on-line computer with half-kilovolt resolution. Experiments such as these and other charged particle experiments are carried out often in collaboration with the University of Florida and with Michigan State University.

Another major program at Western Michigan is the study of the effects of nuclear deformation on neutron cross sections. The measurements are carried out in the energy range from 1 to 15 MeV using neutrons from the p(t,n) reaction below 5 MeV and from the d(dn) reaction above 5 MeV. A series of Sm isotopes were chosen since this is a mass region where the nuclear shape is known to change drastically. The experiment was a measure of the total cross section using a stilbene crystal detector and sample masses typically of 40 grams. The system used pulsed shape discrimination to separate gamma rays from neutrons. The measurement took three hours per point to achieve high statistical accuracy and points were taken every 1/2 MeV. Backgrounds were less than 2% across the full energy region. The energy resolution was about 70 kV. Typical differences in the shape of the cross section were of the order of six to eight percent and were obtained with reference to ^{148}Sm which is thought to be spherical. The preliminary conclusion from these experiments is that adding protons to the nucleus changes the size while adding neutrons changes the deformation.

The chairman closed this section of the meeting by thanking both Professors Lane and Bernstein for well-presented talks on their interesting programs.

IV. REPORT ON THE NEANDC MEETING, TOKYO, MARCH 1974

Chrien reported to the committee on the latest meeting of the NEANDC which is the first meeting to be held outside of the European-American area. During the visit the committee was able to visit JAERI and other nuclear facilities and were much impressed by the depth and quality of the Japanese programs and the quality of their facilities. This meeting was a particularly important one since the U.S. felt it necessary to discuss questions which seriously affected the future of the NEANDC. The first proposal was the U.S. suggestion that the NEANDC expand its area of responsibility to include concern for non-reactor nuclear data. This suggestion was not received with enthusiasm, but it was overshadowed by a second suggestion that the NEANDC discuss the overlap in responsibility which had developed over the past years in the INDC and the NEANDC responsibility.

Chrien pointed out that the NEANDC had been organized around technical objectives and had been very effective in bringing about technical advances in the area of neutron nuclear data over the years. While the INDC had the same overall objective of promoting the measurement in the nuclear data field, its original organization was political in orientation and, in fact, it is still dominated significantly by political considerations. Chrien pointed out, however, that the INDC had, in the eyes of the U.S. delegation, become very similar in function and in accomplishments to the NEANDC. This had been brought about, to a

significant degree, because the INDC was able to provide funds for attendance at these INDC meetings, whereas the NEANDC had no such support. The introduction of this question by the U. S. delegation caused considerable concern among the membership of the committee and a subcommittee was established to consider this question. It asked for feedback from national committees. Among the Europeans, Dr. Story from the United Kingdom was particularly emphatic in support of the NEANDC. He felt that the NEANDC had been the group which had been most effective in conducting reviews of critical matters in the neutron cross section data, and that it had served effectively in coordinating activities in the European-American community which had produced the major part of the nuclear data now available. He felt the money that his country was spending in attendance and support of the NEANDC was well spent and that many instances could be cited which could demonstrate that the NEANDC has been mutually beneficial to Europe and to USA.

Chrien's discussion departed temporarily from the question of the future of the NEANDC to consideration of the role of NEANDC in considering loans for separated isotopes. The consensus of the NEANDC was to avoid any responsibility for loans in the basic science area. It chose to restrict its efforts to recommendations on requests related to applied measurements. However, it recognized that a faster review procedure was necessary.

A lengthy discussion at the NEANDC meeting was held on the WRENDA request list. The list was now felt to be so bulky and so filled with unimportant requests as to seriously affect its usefulness.

A shorter and more important request list was proposed and the NEANDC is anxious to receive input from the member countries on this possibility. In this context a discrepancy list came under review. Some members of the NEANDC felt that many of these discrepancies came about because of pressure on experimenters to have their data released too early. Sowerby, of the United Kingdom, felt that the most recent data is not always the best data; partly for this reason. Chrien closed his report by mentioning a proposal by Ribon that a panel on fission cross section measurements be held in 1976.

Rogosa then turned the discussion to the question of adequate representation at NEANDC meetings for the U. S. At the recent meeting he had proposed a reduction from the current four-member delegation to a three-member delegation from the U. S. He reported that the Europeans were extremely sensitive on this issue and felt very strongly that the U. S. should make no reduction at all in the size of representation to NEANDC pointing out that there were a large number of committees with overlapping responsibilities besides the NEANDC and the INDC and that some effort should be made to accomplish the work of these committees in a more orderly fashion. At this point Newson asked what specifically does NEANDC do. Jackson responded that it sponsors symposia, conducts reviews of data in specific areas, assesses needs for various kinds of new data, and many other very useful activities--much of which has been taken over by the INDC in recent years. Gevantman reported that on his last visit to Vienna, he obtained the impression that the ultimate goal was to merge NEANDC and the INDC.

Havens then gave his view of the responsibilities of INDC and NEANDC and the evolution which has taken place over the last few years. He began by saying that originally INDC was primarily a political

body and that most technical liaison having a significant impact was being carried out by the NEANDC. However, the IAEA had money and had begun supporting travel to INDC meetings. Merger of the two committees was impossible in 1968 since INDC had to encompass all countries and the political situation did not permit the kind of close cooperation as was possible with NEANDC where political considerations were less important. The NEANDC was capable of doing things which, in fact, were not possible through the INDC. Since that time the INDC has taken over many of the responsibilities of the NEANDC and demonstrated that it can handle them effectively. However, Havens felt that even today there are still things the NEANDC can do that INDC can't do. These things tend to be primarily matters related to political situations. Chrien added that the smaller countries felt particularly strongly that they would lose by the passing of the NEANDC. The INDC membership is set up on a rotating basis among the smaller countries; therefore, much of the time the smaller countries have no representation whatever. However, the smaller countries who are members of the NEANDC always have representation on that committee. The Swedes and the Swiss were particularly concerned about this.

Pearlstein asked the NEANDC members present to explain the benefit which the U. S. derived from close collaboration with the rest of the world and from both of the committees. Jackson responded commenting relative to the NEANDC that the needs for the reactor programs are diminishing and yet the European members of the NEANDC do not want to see the NEANDC move in to the area of materials safeguards or fusion research. As for the value to the U. S. of this last meeting in Japan,

Jackson felt that the meeting was redundant. Havens emphasized again that where information exchange is involved that the INDC is now superior. However, for experimental aspects and sample exchanges--that is, technical matters--the NEANDC still probably has a useful role.

Smith called attention to the fact that both international committees have standards subcommittees and wondered if two international standards committees were really necessary. Smith also asked if there are really any cooperative experiments going on now which are sponsored by NEANDC. The representatives present were not aware of any. Stewart reminded the committee that we now get NEANDC reports on activities in the European and Japanese community. She asked what would happen to these reports if the NEANDC were terminated. Rogosa responded that these documents nearly all carry both an INDC and an NEANDC number so presumably they would still be available. Speaking in favor of NEANDC, Hemmig pointed out that operations of the NEANDC could be much more streamlined. INDC symposia are more complicated in terms of arrangements, require expensive translators, and generally tend to be more cumbersome.

Pearlstein asked if INDC would be able to make its way now that INDC no longer pays the members' way to meetings. Jackson responded that if the NEANDC were killed, the INDC would clearly be strengthened. He suggested that the NEANDC should go ahead and explore the possibility of combining with INDC with the intent of strengthening INDC in coordinating international activities. Havens closed the discussion by commenting that politically we are obligated to stay in the INDC.

Chrien then continued his report by describing new facilities which were discussed at the recent NEANDC meeting. He reported that the Geel linac is undergoing a modernization to achieve 12 A currents in 3 nsec bursts at an energy of 120 MeV. The average power on targets

under these conditions is 12 kW. When one takes into account the enhanced neutron production arising from the use of the mercury cooled uranium target the facility is competitive with the large linacs in the U. S. in terms of neutron production capability. The Louvaine University has acquired a 7 MeV CN Van de Graaff. Ghent State University is acquiring a linac similar to that at BCNM and a photofission program will be started on that facility. At Saclay a heavy ion facility called "GANIL" is under consideration which would operate with one cyclotron injecting into another. The facility design objective is 30 MeV per nucleon for light ions and 7 MeV per nucleon for heavy ions with an intensity of 10^{11} to 10^{13} ions per second. The linac at Saclay will close down nearly all its operations with the only remaining program being that of photonuclear analysis. A 10 megawatt reactor will be built at Saclay for solid state studies.

In Japan at Tsukuba University a 12-MV pelletron electrostatic accelerator will be built. At Tohoku a 4.5 MeV dynamatron with pulsing for neutron work is being installed and at Osaka University an isochronous cyclotron is under construction. In the United Kingdom a 30-MV terminal voltage heavy ion electrostatic accelerator is being built at Daresbury. At Harwell a photofission program at and below "threshold" is being initiated.

The committee returned after adjournment for lunch and the chairman read a proposed statement representing the USNDC viewpoint on the role of NEANDC and INDC. The proposal contained two main points: (1) reduce the frequency of meetings to only one per year for both NEANDC and INDC; (2) urge the committees to work together to define their roles more clearly. After some discussion it became clear that a significant portion of the USNDC members felt that such a proposal was somewhat

hasty and was concerned about a "baby-bath water" situation developing. Smith proposed that an ad hoc subcommittee be appointed to recommend a position for the USNDC within sixty days. The chairman accepted this proposal and restated it as an action on the chairman as follows:

ACTION 11
Chairman

Appoint and charge an ad hoc panel to draft an appropriate statement of recommendations on the future status of the NEANDC for circulation to the USNDC committee within sixty days for their comments.

Hemmig urged that the committee make a listing of the unique advantages of the two groups before making any decision and then make certain that any new proposed operations be established in such a way as not to lose any of the valued functions.

V. REVIEW OF THE TABLE OF ISOTOPES

The chairman introduced Dr. Lederer of the Lawrence Berkeley Laboratory explaining that one of the reasons for the USNDC wishing to meet in Berkeley was to hear at first hand a report on this program. Lederer began by tracing the history of the table of isotopes beginning in 1940 with a table prepared by Seaborg. The table went through five editions--the 1966 edition selling over 10,000 copies. The authors had no way of knowing who received these copies but it is estimated that about half went to basic science and half to applied science personnel. By that time the field had gotten too big to be handled by just one or two people. In 1968 a new effort was proposed with the following goals: (1) to produce a seventh edition of the table, (2) to arrange the information file so that future editions could be made much more easily, and (3) to provide data serv ices which could be based on the computer. Owing to a lack of funding an effort for the seventh edition was not mounted at that time but a smaller effort on nuclear moment compilation was undertaken

and completed. The proposed project finally did receive funding in 1971. Presently the group consists of five compilers--four full-time and two half-time. The group has worked through all the isotopes once. The data file now includes experimental uncertainties on all numbers. The group has developed special methods to deal with level schemes. The computer is used to find errors and this has paid great dividends. Even the most careful of compilers was found to make numerous errors which the system was able to detect. The computer is now capable of drawing all level schemes automatically. Lederer reported that by 1976 the next table will be completed. This will be the seventh edition. He hedged somewhat on this date pointing out that the level of support would make this date difficult to achieve although it was considered a reasonable objective by the program members.

Lederer then described an additional project now underway which is an interactive on-line program package. It can be used by any Government-funded laboratory by using a telephone interconnection. Billing is handled on a recharge basis for the Lawrence Berkeley Laboratory computer. Interested individuals at other laboratories must get a purchase account for the Lawrence Berkeley Laboratory computer. At this point Motz inquired how often the data file in the computer was updated. Lederer responded that at the moment there is no data accessible by this technique. Only programs generally useful for physics research such as for calculations of Clebsch-Gordon coefficients etc. However, it will include nuclear data in the future after the new edition is completed in 1976. Bowman asked how much the program would cost the Lawrence Berkeley Laboratory if the service were supplied free to outside users. Lederer estimated about $6,000 and commented that such an arrangement would be very desirable greatly simplifying the bookkeeping operations

on both ends and generally encouraging the use of the system, Perey cautioned that one can easily underestimate the cost of these programs. He predicted that such a program might run into problems owing to the tieing up of the computer peripherals with the large amount of input-output activity. The chairman thanked Dr. Lederer for a very interesting report and deferred any further discussion on this program to the recommendations portion of the agenda near the end of the meeting.

VI. U. S. NUCLEAR DATA NEEDS

A. Non-Neutron Data Needs

Dr. Heath of the Idaho National Engineering Laboratory began his presentation by stating three objectives of his talk. The first was to review the experimental quantities which are of interest to applied users. The second was to discuss several examples of data needs with precision requirements, and the third purpose was to discuss techniques of recognition of data needs.

Dr. Heath emphasized the importance of nuclear decay data explaining that in his opinion this data had the greatest applied impact of all nuclear data with the exception of neutron data. He explained that a typical decay scheme requires 25 to 30 measurements and illustrated this with a decay scheme of ^{103}Rh. The decay data can be applied in many ways. These include decay heat, nuclide assay, biomedical nuclide transport mechanisms, and basic physics. He explained that often the basic nuclear physicist doesn't need high accuracy to understand spins, mixing ratios, etc. which he is after. However, applied data needs often require considerably higher accuracy and often these data do not exist to the accuracy required. Citing a number of examples, the accuracy required he explained may be less than 1% whereas nuclear physics usually requires no better than 10 to 20%. Smith asked

if one really needs absolute gamma ray intensity. Heath responded that often it is absolutely necessary but not always.

Heath went on to emphasize that currently the radioactive effluent from nuclear power plants are of special importance. He pointed out that a 1000 MW electric power plant is a 500 to 800 million dollar investment which could be idled by improper monitoring of these effluents. He speculated that gamma ray spectrometers probably would be located at many critical points in the reactor where radioactive material might be released or transferred to keep track of the emissions. The concept, he feels is practical, but it must have a good data base to interpret the measured spectra. Bowman raised the question of accuracy again explaining that it was clear that an accurate knowledge of the gamma ray line spectrum for a complete set of nuclides is important to unravel a complex germanium detector spectrum. However, he expressed reservations about the need for such accurate half-lives. Heath responded that the accuracy for most of the half-lives etc. is in the 5 to 10% range and only a part of the data exists. He commented that if a very high accuracy set of data is not available at least an agreed upon set of data needs to be established which could be used uniformly for measurements in this field. Rogosa asked, "Isn't this a criticism of the Oak Ridge data center, shouldn't their statement of the data represent the best data in hand?" Heath responded, "Yes, but the best data might still not be sufficiently good." Rogosa asked, "When you are approached about improved data for a special radionuclide, don't you redo the Oak Ridge evaluation?" Heath replied that his usual response is either that the data is now adequate or that new measurements should be made.

After some discussion along this vein, Heath went on to his second point regarding the mechanism for identifying data needs and to see that they are satisfied. He cited a problem of two years ago from the Regulatory Division in which he was asked to characterize the radioactivity source term of possible radioactive effluent from nuclear power plants. He explained that this meant that he was asked to assess the inventory of all radioactivity in reactors. With this information one could do modeling calculations for effluent, prescribe in detail techniques for measurement of effluents including calibration techniques for detectors and the nuclear data properties for the radionuclides of concern. As a result a guideline was issued covering this whole spectrum of problems containing nuclear decay properties based on the Oak Ridge nuclear data tables. This guideline will be used for assessment in the future by Regulatory.

He cited as another example a fission product file for calculating decay heat. He pointed out that information on about 500 nuclides is needed, and that we have measurements only on about one third of these. Only the half-lives are known on about one third of the remainder, and the final one third have never been observed but have been calculated from fission theory. Hemmig emphasized that DRDT is much concerned about fast fission product yields. At thermal energy he explained that an accuracy of about 3% in fission product yields is now obtainable but at higher energies the yields are uncertain to the extent of 30 to 50%. Heath agreed and continued that in spite of the serious need that the USNDC had not taken active responsibility for nuclear decay data, Jackson and Perey immediately disagreed referring specifically to activity of the committee during the past two years to

promote compilation and evaluation efforts. This then led into a rather lengthy discussion on activity relating to safeguards, biomedical applications, activation analysis, etc. involving primarily Horen, Heath, and Perey. Heath, however, successfully pressed the point that there is now no effective mechanism for generating requests lists and setting priorities for measurements of decay data or comparing the priority in needs of decay data with other kinds of data such as neutron induced reactions. The chairman thanked Dr. Heath for one of the most comprehensive reviews which the committee had heard on the applications of decay data.

At this point the chairman interrupted the planned proceedings of the meeting in order to permit Dr. Rogosa, who was departing early from the meeting, to make a few comments about the future of the USNDC. He informed the committee that it is his intention to continue the committee but probably not as a formal advisory committee to the AEC. The functions of the committee can therefore be performed without the cumbersome machinery and restrictions now imposed by the Federal Advisory Act. No final decision has been made regarding the precise nature of the committee but Federal law does permit a Federal agency to operate with an informal advisory committee consisting of Government employees or contracting laboratories--universities, or otherwise. However, the AEC cannot provide funding to a university simply for the purpose of providing the expenses of a desired advisor to attend committee meetings.

Rogosa continued, pointing out that there were now 75 to 80 names of active participants in the USNDC including subcommittees. He explained that current AEC thinking is that there should be a major reduction in the number of participants. Subcommittees will be reviewed

and some may be reduced in size or even eliminated. In the planned new structure a subcommittee member would be welcome at USNDC meetings as an observer and as a participant in discussions. However, final recommendations would be voted on only by the designated members. The present authorization for membership runs out on February 1, 1975 and at that time notices of changes would be distributed. The chairman then returned the committee to the planned agenda and introduced the next presentation.

B. Waste Transport and Thermal Data Sets

Dr. Petrie of Oak Ridge National Laboratory and of the Division of Waste Management and Transportation began a presentation on the need for improvements in thermal data sets for use in the area of transportation. He reminded the committee that the transportation of nuclear materials must be carried out in such a way as to avoid nuclear criticality both for normal transportation and also for accident possibilities. He emphasized that shipping casks designs are, of course, obviously different from reactors so that data which might be satisfactory for reactor design is not necessarily adequate for shipping casks design. He feels that his program needs to obtain the best set of data possible and compare this with validation experiments. The calculations from the nuclear data will require the establishment of a special group structure suitable for shipping problems. The result will be a library of nuclear data specially suited to calculations of problems involving shipping casks.

Newson asked incredulously why the present data is not adequate. Hemmig responded that, in his opinion, the data is not the limitation rather the procedures and methods of calculation would provide the limitation on accuracy. Petrie continued his

presentation and described a series of Monte Carlo calculations of arrays of critical materials. The results of the calculation averaged an error of 5% from the experimental value for k-eff. Petrie on this basis requested better thermal data. The committee was not strongly convinced that new thermal data was needed. However, Pearlstein pointed out that more new thermal data is probably on the way as the result of an EPRI-funded program.

When Petrie's presentation had been completed, Moore asked the chairman for some background information on the presentation. The chairman responded that the Regulatory Division and the Waste Management and Transportation Division of AEC, as a result of joint discussions, felt that they had recognized a need for better thermal data and had approached the DPR about funding new measurements or evaluation. The presentation was made to inform the committee of the program.

C. The 1975 Edition of the USNDC Request Compilation

Pearlstein began the discussion by reporting that Charles Dunford will handle the request list this year. He will provide retrievals for subcommittees. At the time of the meeting no response had been received from several agencies for information on new requests for nuclear data. These agencies included DMA, DSNS, the Safeguards Request from Bramblett at IRT, and DBER. Moore reported that DMA will submit lists very shortly including requests from both LASL and LLL.

Pearlstein reported that the new request list will be about the same size with about 212 new requests and about the same number deleted. However, Moore pointed out, that the DMA lists were not now included and this might increase the size to some degree. At this point Jackson proposed that the status comments in the requests lists be eliminated. Jackson explained that people like Hemmig carry

out an intensive review of proposed requests ahead of time before requesting new information so that the requesters themselves at least know the status of the request before it is submitted. Furthermore, since the review is done annually there is very little time for such information to get out of date and thus status comments are not particularly helpful. In his view the status reports serve as much better lists of U. S. activities in regard to data requests--particularly since the CINDA-Type Index is now included in the status report.

Moore, however, felt that comments are certainly helpful to measurers even though they may not be helpful to requesters. Jackson responded that he felt that the present effort going into improving the status comments might be better directed if one were to select a smaller subset of requests and go into detail on the present status, the techniques presently used or available, etc. and communicate this to people who can do these measurements. Jackson's comment raised the question of how one selects the subset and Smith commented that the committee could expect to achieve progress on requests which were of high priority and which could be attacked with present techniques. Chrien raised the point of the disposition of the request that cannot be measured with existing techniques. Several members of the committee responded that it was probably best to carry such requests in the request list since it was possible to cite several instances where seemingly impossible requests were satisfied owing to the development of new techniques. Jackson expressed his opinion that while the comments are O.K. they should not be viewed as essential.

Chrien then made a motion that in carrying out the review of the request list that the subcommittees refrain from including status comments relating to existing data and include only matters relating to samples, existing effort, or other in-head knowledge. Smith seconded this motion and it was passed by the committee without debate.

The chairman then placed an action on the subcommittee chairmen to complete a review of the request list by January 1 and forward a report to the USNDC Chairman including recommendations for special samples and a selection of special high priority requests.

ACTION 12
Subcommittee Chairmen

The chairman then asked Pearlstein for a retrieval to the subcommittees sorted according to the subcommittee's area of interest. Pearlstein agreed and in response to some concerns of committee members about the clarity of retrievals circulated at the USNDC meetings stated that the retrievals for the subcommittee would be printed more clearly.

In response to a question by Motz, the chairman placed an action on Pearlstein to forward to Anderson and Motz two copies each a retrieval of the DMA requests in the USNDC request lists.

ACTION 13
Pearlstein

Several committee members expressed an interest in seeing the complete request list and Pearlstein promised to send the whole request list to the full committee before the end of September 1974. Pearlstein also stated that he needed information from DNA and DMA on what should be deleted for forwarding to Vienna. DMA said that it would supply this information.

VII. COMPILATION AND EVALUATION

A. CINDA REPORT

In Goldstein's absence the CINDA report was presented by Havens. Havens summarized the comments of an informal memo which is included in the minutes as Appendix C. Goldstein had two primary points. First, since the distribution list now needs review, he has suggested to Dunford that 70 additional names should be receiving the CINDA distribution list. He's also much concerned that many of the copies are going to administrative individuals who are unlikely to use it for the purpose of discovering existing data or planning new measurements. The second major point is made regarding the size of CINDA. CINDA continues to grow as more and more measurements are made and it appears likely that the '75 edition will have to be published in three volumes. He suggests possibilities for reducing the size of CINDA in subsequent years also. Finally, Goldstein was somewhat critical of the present computerized format for CINDA and expressed the hope that new, more flexible, and simpler computer systems could be devised which would be less lavish in space and less error prone. Pearlstein circulated copies of the changes suggested in the request list for CINDA and asked for comments on the proposed deletions and for suggestions for names to be added to the list.

B. NNCSC Report

Pearlstein began his report on the NNCSC with comments directed to BNL-325. He informed the committee that in the future the lists of resonance parameters will include only the recommended values stating that the results from individual experimenters would be available on request. Pearlstein emphasized the problem of allocation of pages in the book of neutron cross section curves. The NNCSC has

concluded that it is most appropriate to allocate the number of pages to a particular isotope in accordance with the size of the associated bibliography of measurements. Some committee members expressed reservations about this procedure, but no better proposal was forthcoming. Pearlstein emphasized that this criterion was used only as a general guide and that the NNCSC would exercise flexibility where it seemed appropriate on particular isotopes. He reported that the page size would be 9 inches by 12 inches with matter on both sides. The pages would contain no grid lines, the philosophy being not to expect people to derive values from the curve since the detailed data could be ordered from the NNCSC. A lengthy discussion followed on whether to use gridded paper or not. Newson was joined by many others in saying that one of the greatest values of BNL-325 is to get quickly a fairly accurate cross section at any particular energy. While recognizing Pearlstein's point that a book full of lines might tend towards the unsightly, the committee generally felt that the ready access to fairly accurate information on cross sections, resonance energies, valley energies, etc. was valuable without the need to resort to rulers for reading the graph. A suggestion was made that since the graphs were all uniform in size, a transparency with the grid lines printed on it might be included in BNL-325 to aid those who wanted information of limited accuracy quickly. However, no formal recommendations were made by the committee to NNCSC on this subject.

Pearlstein then turned his attention to the activities of the CSEWG. He reported that a meeting of a small group of members of the CSEWG was held at BNL on September 12 and 13 to plan the future program for ENDFB-5. The various activities required to produce ENDFB-5 were divided into four groups and the attendees were divided up into

four committees to deal with each of these areas. A calendar schedule was made up for ENDFB-5 which includes the scheduled publishing of ENDFB-5 in January 1977. The next CSEWG meeting is planned for October. The plans scheduled for ENDFB-5 and the review of the recent CSEWG meeting are included in the minutes as Appendix C. Haight brought up again the suggestion of the CTR subcommittee that the status reports be indexed to program needs. The consensus of the Committee was that several laboratories do index their reports in this way and that further indexing was not necessary.

VIII. STATUS REPORTS

Only a short period of time was devoted to this agenda item. The subject came up again of the degree of editing which was appropriate for the status reports. Newson expressed concern again that some of his report might be deleted. Bowman responded that all of the Duke report was included in the last status report and that the volume was presently still manageable in size. Some felt that the guidelines for editing the status reports were not being followed rigorously enough but no consensus of the committee on the subject was evident.

The discussion next turned to the question of when the next set of status reports would be issued. After much discussion it was decided that March 1, 1975, which would be close to a meeting date, would be an appropriate date for the next report. The chairman then directed the

ACTION 14
Secretary

Secretary to call for preparation of USNDC status reports for distribution by March 1.

The committee next discussed the role and function of the status reports, and as a result of this discussion the chairman placed an

ACTION 15
Secretary

action on the Secretary to recompose the preface to the status reports to include a statement of the relationship to the request compilation and an additional subject category covering techniques for measurement, evaluation, and facilities.

IX. MEETINGS

A. Plans for the 4th Conference on Nuclear Cross Sections and Technology, 1975

Havens reported that organization for this meeting was essentially completed. The meeting appeared to be getting strong support from the international community. Dr. Schmidt of IAEA has interacted strongly with the program planning and nearly everyone in foreign countries who was asked has suggested invited speakers. He, therefore, feels justified in expecting a strong conference with a significant international attendance.

B. Review of Future Meetings

An International Conference on Neutron Physics is presently scheduled for July 6, or 7, 1976 at Lowell, Massachusetts. The committee organizing the conference met for the first time three months ago. The meeting is to be organized along the same lines as the Antwerp Conference.

Chrien reported that another of the series of conferences on neutron capture gamma ray spectroscopy, similar to the one recently held in Petten, is tentatively scheduled for October 1977 at Brookhaven National Laboratory and attendance of about 150 scientists would be expected. The primary objective would be the basic science.

It was also suggested that an NEA panel on fission measurements might be appropriate in late 1976. Brookhaven was mentioned as a good location for such a meeting owing to its proximity to NNCSC.

X. RECOMMENDATIONS

Smith began this portion of the meeting by recommending the four basic science recommendations contained in Appendix B be accepted. The motion was seconded by Havens and was passed unanimously.

The question of the policy on loans to foreign countries of separated isotopes came up briefly but no resolution of this issue was reached owing to insufficient time for discussion. The chairman proposed that the next meeting be held in the Spring at Brookhaven and Chrien expressed his willingness to host the meeting. The chairman adjourned the meeting.

APPENDIX A

Preliminary Edition

A CHECK LIST OF
NEUTRON CROSS SECTION DISCREPANCIES

2nd Edition

Sept. 1974

Compiled by

H. Goldstein

Introduction

The following list of cross section discrepancies is offered to draw attention to the existence of the discrepancies, primarily in the hope of stimulating additional measurements to resolve them.

By "neutron cross section" is meant any piece of microscopic neutron data characteristic of neutron interaction with a single target unit, e.g. nucleus or molecule. Thus, "cross section" is meant to include multiplicities (ν, η, etc.), spectra of emitted particles, infinite-dilution resonance integrals, etc., in addition to actual cross section quantities.

A "discrepancy" is said to exist when two or more direct measurements of the microscopic quantity differ among themselves by substantially more than their combined errors. Integral measurements are usually included only when they are felt to lead unambiguously to microscopic quantities, e.g. infinite-dilution resonance integrals from pile-oscillator studies, or absorption cross sections from thermal die-away experiments with small bucklings. In general, discrepancies between experimental values and theoretical predictions are excluded.

Two aspects of compiling a discrepancy list such as this deserve to be noted. The first is to emphasize that a set of measurements of accuracy lower than desired do not in themselves indicate a discrepancy in the sense used above. Two measurements with ±10% accuracy that differ by, say, 12% cannot be considered discrepant just because there is an urgent need to know the cross section in question to better

than 2%. This discrepancy list should not be construed as a "super-request list".

The second aspect, which seems to require particular emphasis at the present time, it that the documentation for some of the discrepancies is highly inadequate. In far too many cases, the only available references appear to be informal private communications, "corridor conversations", and just plain rumors -- "somebody says so-and-so is correcting his data for the X-effect, and the new numbers he's getting contradict the unpublished results they're measuring in laboratory Y." Perhaps there should be some cutoff as to the level of reporting considered to establish the existence of a discrepancy.

In so broad a field an exhaustive compilation is impossible. Indeed it is intended to list only those of major interest in the various fields of nuclear technology. Frequently the significance of a discrepancy for technology derives not so much from the actual values involved as from the doubt cast on the validity of the measurement techniques. The uncertainties about the variation of $\bar{\nu}$ with E for ^{235}U is a case in point. The sequence of listing is in rough decreasing order of the current degree of alarm and concern over the discrepancy. Necessarily such a ranking is subjective and the order given here represents the opinion of the compiler.

The compiler wishes to express his gratitude for the assistance of many members of the USNDC, especially the members of the Neutron Data Applications Subcommittee. Much of the latest "scoop" contained in the list came from these sources. Particular thanks are due to A.B. Smith,

W.W. Havens Jr. and M.S. Moore for many detailed and thoughtful comments.

Finally, it should be noted for the record that this is probably one of the few current compilations that has not been put on a computer.

9/16/74

Short - Title Listing

1. σ_f for ^{235}U
2. Inelastic excitation of the 45 keV state in ^{238}U
3. σ_γ for ^{238}U
4. $\bar{\nu}$ for ^{252}Cf
5. α at thermal for ^{235}U, and ^{233}U
6. $\bar{\nu}$ vs E for ^{235}U, possibly ^{239}Pu and other fissionable nuclei
7. σ_f ratio $^{238}U/^{235}U$
8. σ_f ratio $^{239}Pu/^{235}U$
9. σ_f ratio $^{233}U/^{235}U$
10. Delayed fission neutron yield, ^{238}U
11. Γ_γ for ^{23}Na, 2.85 keV resonance
12. Neutron fission spectrum for ^{235}U
13. $\sigma_{n,t\alpha}$ for ^{6}Li
14. $\sigma_{n,\alpha}$ and $\sigma_{n,\alpha\gamma}$ for ^{10}B
15. Neutron widths for ^{238}U
16. $\sigma_{n,p}$ for ^{58}Ni
17. σ_n for Nb
18. $\sigma_{n,2n}$ for ^{27}Al

List of resolved discrepancies

Discrepancies of Major Significance to Nuclear Technology

1. Quantity and Nucleus: σ_f for ^{235}U

   Energy Range: 100 eV to 1.5 MeV

   Magnitude of Discrepancy: Not clear, probably < 10%, see comments

   Reason for Interest: Fundamental in fast reactor physics; reference standard for many fast cross section measurements.

   Comments and References: The situation has improved significantly in the last few years, and it is not even clear that a discrepancy according to the strict definition still exists. In view of the technological importance of this cross-section it is felt it still deserves "topbilling" until final uncertainties about the resolution of the discrepancies are dissipated. Poenitz (N.S. & E 53, 370, April 1974) claims that all post-1965 measurements now agree to within the ±3% errors of the experiments up to about 2 MeV, with the possible exception of values found by White and By Kaeppeler. The LASL data of Hansen et al. (USNDC-9, p. 114) from 1 to 6 MeV seem to be of very high quality. Where they overlap with Poenitz they are a bit higher on the average, but the difference is mostly within the combined errors. The Russians still seem to favor higher values, however. Through the years the literature on this cross section has grown voluminously. For a summary of the situation about four years ago see:

   Moore, M. Summary on "Fission and Capture Standards," p. 508 ff of 70 ANL* (Many individual papers in this EANDC Standards Symposium bear on this particular discrepancy.)

   Two widely used evaluations contain many references:

   Konshin et al. INDC (CCP)-26 Sept., 1972
   Sowerby et al. AERE-R-7273 Feb., 1973

   See also: Proceedings of the 2nd IAEA Panel on Neutron Standard Reference Data, Nov., 1972, Kaeppeler, KFK-1772 April, 1973, and Perez et al. ORNL-TM-4390

*See appendix for bibliographic details of these conference proceedings.

2. Quantity and Nucleus: ^{238}U, inelastic excitation of the 2+, 45 keV state

Energy Range: Threshold to about 500 keV

Magnitude of Discrepancy: Recent measurements show rapid rise from threshold to high values, differing in shape and magnitude from earlier data.

Reason for Interest: Inelastic scattering in ^{238}U of vital concern for design of fast breeder reactors.

Reference: A.B. Smith: "The Inelastic Neutron Scattering Cross Section of ^{238}U." Preprint, Sept. 24, 1973

---

3. Quantity and Nucleus: σ_γ for ^{238}U

Energy Range: 1 keV to 1 MeV

Magnitude of Discrepancy: ORNL and AERE data differ in normalization up to 10% below 30 keV. GRT data above 100 keV seem lower than older data. Recent UK data (Ryves et al., Moxon & Pearlstein et al., priv. comm. 1973) support lower values. Two sets of ORNL data (Silver et al.) agree within errors when normalized to the same ^{235}U fission data.

Reason for Interest: Fundamental for fast breeders.

References: The literature is voluminous, but the following references will point the way to the most important papers.

71 KNOX. Papers by M.P. Fricke et al. and E.G. Silver et al.

NCSAC-33 (EANDC(US)-150U), Fricke et al., p. 69ff, and de Saussure, p. 182ff.

70 ANL, Paper 27 by W.P. Poenitz.

See also

Abagyan, L.P., et al., "Cross sections for radiative capture by U-238 nuclei," INDC(CCP)-11/U, 3/71

---

4. Quantity and Nucleus: $\bar{\nu}$ for ^{252}Cf

Energy Range: Spontaneous

Magnitude of Discrepancy: Data divides into two groups (according to method of measurement) about 2.5% apart.

Reason for Interest: Vital standard; especially important for thermal constants of fissile nuclei.

References: De Volpi, A.: "Absolute source determinations using both techniques" 70 ANL. See also the summary discussion of Session VI in the proceedings of the same meeting.

F. Manero & V.A. Konshin, Atomic Energy Review 10 (4), 637 (1972)

---

5. Quantity and Nuclei: α, ^{233}U and ^{235}U

Energy Range: Thermal (maxwellian)

Magnitude of Discrepancy: Values derived from irradiation experiments are higher than those from all other methods by 3 - 4 times the combined error.

Reason for Interest: Basic data for thermal reactors.

References: B.R. Leonard, Jr.: "Report of the CSEWG Task Force on Thermal Data" Dec., 1973

---

6. Quantity and Nuclei: $\bar{\nu}$ vs E for fissile nuclei, particularly ^{235}U and possibley ^{239}Pu

Energy Range: keV to 14 MeV

Magnitude of Discrepancy: Chief area of discrepancy appears to center on the existence of structure in the ν vs E curve for ^{235}U and to a lesser extent in ^{239}Pu

Comments and References: Experimenters either claim there is structure or say there is only a smooth

variation. The situation up to Oct. 1972 is best summarized in:

F. Manero & V.A. Konshin: Stomic Energy Review 10 (4), 637 (1972)

Somewhat later references are:

Ribon, P., ed. Proceedings of EANDC topical conference on $\bar{\nu}$, held Nov. 1972. EANDC(E)-154U(1973)

M.V. Savin et al. Yadern. Fiz. 16, 1161 (1972)

K.E. Volodin et al. Atomnaya Energiya 33, 901 (1972)
[Sov. At. Energy 33, 1042(1973)]

---

7. Quantity and Nuclei: σ_f ratio $^{238}U/^{235}U$

Energy Range: 1.3 - 3 MeV

Magnitude of Discrepancy: Up to 4% among recent microscopic measurements above 3 MeV; up to 10% in cross section averaged over fission spectrum.

Reason for Interest: Important for fast reactor physics, vital item in standardization of fast neutron cross section standards.

Comments and References: (The following is quoted verbatim from a brief report prepared by J.C. Browne)

"The request for this quantity is for 5% accuracy below 1.3 MeV and 1% accuracy above 1.3 MeV. The main difficulties arise in the "plateau" region between 2 and 3 MeV. There appear to be three groups of values in this energy region. Stein et al.[1] are approximately 3% lower than White and Warner,[2] Jarvis,[3] Poenitz and Armani[4] and Meadows[5] while Lamphere[6] is approximately 3-4% higher than these latter four measurements. In the region between 1.3 and 1.9 MeV there is also a discrepancy between the recent measurements of Meadows[5] and those of Lamphere[6]

and those of Stein et al.[1] which approaches 15% near 1.5 MeV. Although the recent evaluations of Davey[7] and Sowerby et al.[8] indicate reasonable agreement or consistency between the ^{238}U fission cross section from both absolute and ratio measurements they note that there is a 10% discrepancy between a calculation of the integral of the ^{238}U fission cross section in a fission spectrum and direct measurements of this quantity by Leachman and Schmitt,[9] Richmond[10] and Nikolaev et al.[11] In light of the above discrepancies, it seems justified to have the $^{238}U/^{235}U$ σ_f ratio remain on the discrepancy list until further measurements (both differential & integral) become available. White-source results of Coates et al.[12] and Behrens[13] should be available in the near future which might help this situation.

1. W.E. Stein, R.K. Smith and H.L. Smith, Proc. Wash. Conf. Neutron Cross Sections and Technology (1968) p. 627.

2. P.H. White and D.P. Warner, J. Nucl. Engr. 21, 671 (1967)

3. G.A. Jarvis, Univ. of California Los Alamos Scientific Laboratory Report No. LA-1571 (1953)

4. W.P. Poenitz and R.J. Armani, J. Nucl. Energy 26, 483 (1972)

5. J.W. Meadows, Nucl. Sci. Eng. 49, 310 (1972)

6. R.W. Lamphere, Phys. Rev. 104, 1654 (1956)

7. W.G. Davey, Nucl. Sci. Eng. 32, 35 (1968).

8. M.G. Sowerby, B.H. Patrick and D.S. Mather, AERE-R7273 (1973)

9. R.B. Leachman and M.W. Schmitt, J. Nucl. Energy 4, 38 (1957)

10. R. Richmond, in Progress in Nuclear Energy (Pergamon Press, New York, 1957) p. 1-50

11. M.N. Nikolaev et al., J. Expt. Theoret. Phys. 7, 517 (1958)

12. M.S. Coates et al., EANDC(UK) 151L, INDC(UK)-20L, p.27 (1973)

13. J.W. Behrens, Univ. of California Lawrence Livermore Laboratory Report No. UCID-16395 (1973) p.2.

---

8. Quantity and Nuclei: σ_f ratio $^{239}Pu/^{235}U$

Energy Range: 15 keV to 100 keV

Magnitude of Discrepancy: Up to 20% in measurements expected to be good to 5%

Reason for Interest: Important for fast reactor physics

Comments and References: There are two groups of measurements with recent data appearing to converge on the higher set. A good comparison is provided in:

W. P. Poenitz, N.S. & E. 47 228N (1972)

More recent Orela data (private communication) appears also to be agreeing with the higher set. The discrepancy may therefore be on the verge of resolution.

---

9. Quantity and Nuclei: σ_f ratio $^{233}U/^{235}U$

Energy Range: 100 keV - 10 MeV

Magnitude of Discrepancy: 6-10%; several times stated errors of individual measurements.

Comments and References: The situation through 1970 is summarized in:

E. Pfletschinger and F. Kappeler, N.S. & E. 40, 375 (1970)

W. Poenitz, "Recent Experimental Data for Heavy Nuclei," 70 Helsinki, Vol. II, p. 15.

Recent measurements by Meadows show the discrepancy has been exacerbated:

J.W. Meadows: "The Ratio of the Uranium-238 to Uranium-235 fission cross section," Preprint, 1973.

---

10. Quantity and Nucleus: Delayed fission neutron yield, ^{238}U

Energy Range: 2-3 MeV

Magnitude of Discrepancy: Two groups of data (e.g. Keepin, Cox (private comm.) vs. Masters) differ by several times combined error.

Reasons for Interest: Safeguards and fast reactors.

References: The situation has been ably summarized by S.A. Cox in ANL/NDM-5, "Delayed neutron data -- review and evaluation," April 1974, p. 11. Masters, C.M. et al., (N.S. & E. 36 202 (1969)), as revised by Evans et al. (USNDC-3), p. 127) give a high value in agreement with McTaggart's revision of Clifford's measurements (UKNDC(73), p. 53; EANDC(UK) 151L, p. 45). Cox on the other agrees almost exactly with Keepin's old value. The discrepancy is about 14% in measurements quoted at about 5% error.

---

11. Quantity and Nucleus: Γ_γ for ^{23}Na

Energy Range: 2.85 keV resonance

Magnitude of Discrepancy: Values of Γ_γ reported differ by almost a factor of two

Reason for Interest: Coolant in fast breeder reactor

Comments and References: Published values, briefly listed, are:

GGA Γ_γ = 0.35 eV
PRI 0.47 eV
Harwell 0.60 eV

Preliminary data from ORNL (Macklin, priv. comm.) suggests a Γ_γ consistent with the thermal cross section (~0.34 eV). Measurements of the spectrum: BNL data (Chrien) indicate a resonance spectrum different from thermal capture. Harwell (Rae) and ANL (Jackson) find much greater similarity with the thermal spectrum. The published situation is best summed up in:

1. Yamamuro, N. et al. N.S. & E. 41, 445 (1970)

2. Schatz, B., "Status of neutron nuclear data for important fast reactor structural and coolant materials" KFK-1668 Aug. 1972

---

12. Quantity and Nuclei: $N_f(E_n)$ for fissionable nuclei, particularly ^{235}U and ^{238}U

Energy Range: Mainly for incident neutrons of 2 MeV or less

Magnitude of Discrepancy: Earlier discrepancies appear to have been resolved; what remains stems from UK-Swedish measurements which indicate a higher tail > 10 MeV than others find, and from discrepant measurements of shape vs Z and A.

Reason for Interest: Almost every application of neutron physics is influenced by the fission neutron spectrum.

References: Earlier literature is for the most part not pertinent; summaries can be found in

A.B. Smith, N.S. & E. 44, 439N (1971), and

IAEA consultants Meeting on Prompt Fission Neutron Spectra, Vienna 25-27 Aug. 1971. STI/PUB/329 1972

Possible references for the discrepancy on the "tail" are:

Johansson et al. EANDC(OR) 115L, July 1972,

Adams & Rose in EANDC(UK) 151L, p. 1; UKNDC(73), p.53

Auchampaugh at LASL finds no evidence for such a tail in the ^{252}Cf spectrum (private communication from M.S. Moore)

---

13. Quantity and Nucleus: $\sigma_{n,t\alpha}$ for ^{6}Li

Energy Range: 100 keV to 3 MeV

Magnitude of Discrepancy: New Friesenhahn data are 25% higher than other measurements in the 250 keV resonance; Michigan data (apparently unpublished) ~1 MeV are similarly discrepant on the high side

Reason for Interest: Has been frequently used as flux standard, of importance for CTR

Comments and References: As of the Summer of 1974 the situation concerning this cross section is concealed in foggy rumors of unpublished data and undocumented experiments. One gathers that most recent measurements are in agreement to ~ 3-4% at the resonance peak. This includes:

Poenitz, USNDC-9, p.13, to be published in Zeits. f. Physik; Coates et al. IAEA Standards Panel 1972 (still unpublished) and EANDC(UK)151L, p. 10; Fort & Marquette, EANDC(E) 148U, but reputed by Ribon to be in process of revision.

On the high side (by 20-25%) are

Friesenhahn, USNDC-9, p. 73 (no data given) and a Michigan measurement noted in C.M. Bartle BAPS 19, No. 1, Abstract KI-12 (1974)

---

14. Quantity and Nucleus: $\sigma_{n,\alpha}$ and $\sigma_{n,\alpha\gamma}$ for ^{10}B

Energy Range: 100 keV to 1 MeV

Magnitude of Discrepancy: Unpublished revision of Friesenhahn data and UK (Coates) data increase discrepancy to several times presumed error. Friesenhahn values on the branching ratio are discrepant with other data, but NBS work may have found source of error.

Reason for Interest: Standard for flux measurement

References: Current situation appears to be unpublished; the earlier state of affairs can be gleaned from

1. S.J. Friesenhahn et al. "Measurements of the $^{10}B(n,\alpha,\gamma)$ and $^{10}B(n,\alpha)$ cross sections" Gulf-RT-A12210, Oct. 1972 (see also USNDC-3, p. 84ff., Oct. 1972)

2. Coates in AERE-PR/NP18, March 1972

3. G. Lamaze et al. in USNDC-7, p. 148, June 1973

---

15. Quantity and Nucleus: Γ°_{n}, ^{238}U

Energy Range: 0-4 keV

Reason for Interest: Important in fast reactors. Particularly involved in determination of Γ_{γ} and σ_{γ}

Magnitude of Discrepancy: Widths of individual resonances as measured at Geel and Columbia differ by considerably more than combined error. Average widths are in reasonable agreement, especially considering the large errors assigned at Columbia. It is possible that Columbia's estimate of errors is more realistic and applies to all measurements, in which case the discrepancy disappears.

References:

G. Rohr et al. [Geel] 70 Helsinki, Vol. 1, p. 413

F. Rahn et al. PR 6C 1854 (1972)

F. Rahn & W.W. Havens, Jr. "A review of the total radiation widths of the neutron resonances of ^{238}U." EANDC(US)-179/U, INDC(US)-53/U 1972

---

16. Quantity and Nucleus: $\sigma_{n,p}$ for ^{58}Ni

Energy Range: 2-4 MeV

Magnitude of Discrepancy: Earlier Swedish data shows structure with large fluctuations, whereas recent work at ANL and Geel agree in a smooth excitation function. Perhaps this agreement between two modern measurements can be considered to have removed the discrepancy.

References: The earlier state of affairs is summarized in:

A.M. Bresesti et al. N.S. & E. 40, 331N (1970)

Recent measurements are partially reported in:

J.W. Meadows & D.L. Smith, USNDC-3, p. 16, Oct. 1972

A. Paulsen & R. Widera, in EANDC(E) 150U, May 1972

---

17. Quantity and Nucleus: σ_n(14 MeV) for Nb

Energy Range: 14 MeV

Reason for Interest: Nonelastic reaction cross section in Nb determined by subtraction of elastic from total cross section. Resultant discrepancy of considerable interest for T breeding and other aspects of CTR neutronics designs.

Magnitude of Discrepancy: 10-20%

Comments and References: The situation is described in AP/CTR/TM-4. Subsequently notice was taken of a measurement of the angular distribution for elastic scattering by J. Kammerdiener (UCRL-51232). On closer examination it appears that the extrapolation from 0° to the first measurement point at 25° is too uncertain to completely clear up the discrepancy. More measurements at smaller angles of scattering are needed.

---

18. Quantity and Nucleus: $\sigma_{n,2n}$ for $^{27}A\ell$

Energy Range: 13.8-15 MeV

Reason for Interest: Radiation damage in CTR applications

Magnitude of Discrepancy: Measurements by Arnold are some twenty (20) times smaller than earlier data!

References: D.M. Arnold, Thesis, U. of Texas, 1965 (cf Dissertation Abstracts 26, 3523 (1965))

Earlier references are in BNL 325, 2nd Ed., Supplement 2, p. 13-0-15

Discrepancies in Previous Compilations and Lists That Appear to Have Been Resolved

Fe	σ_T in minima	Resolved by new ORNL measurements
^{239}Pu	α	Measurements above 20 keV are not discrepant within the rather large errors of the data. The evaluation of Sowerby and Konshin (Atomic Energy Review 10, 453 (1972)) appears to represent the experimental results quite well.
^{239}Pu	J and $\bar{\nu}$ correlation in resonances	Further measurements do not verify any of previously reported correlations. Remaining question of J and Γ_f correlation does not seem significant.
^{197}Au	Γ_γ	All recent data (ORNL, CEA, etc.) now converge nicely.
^{1}H	Γ_γ at thermal	New theoretical calculations remove the discrepancy with experiment. Cf. M. Gari & A.H. Huffman, PR 7C 994 (1973)

Bibliographical Appendix

69 VIENNA: "Physics and Chemistry of Fission." Proceedings of the Second IAEA Symposium, Vienna 28 July - 1 August 1969, IAEA Publication STI/PUB/234, 2 volumes, Vienna 1970.

70 HELSINKI: "Nuclear Data for Reactors." Proceedings of the Second International Conference, Helsinki 15-19 June 1970, IAEA Publication STI/PUB/259, 2 volumes, Vienna 1970.

70 ANL: EANDC Sumposium on Neutron Standards and Flux Normalization, Argonne National Laboratory, 21-23 October 1970 (CONF 701002). Proceedings to be published by the USAEC.

71 KNOX: Third Conference on Neutron Cross Sections and Technology, Knoxville, 15-17 March 1971. Proceedings to be published by the USAEC.

APPENDIX B

22 September 1974
Berkeley: LBL

RECOMMENDATIONS FROM BASIC SCIENCES SUBCOMMITTEE TO U.S.N.D.C.

1. ORNDG and Berkeley Data Projects should be continued after 1976 so long as strong coupling and collaboration is maintained.
2. ORNDG and Berkeley Data Projects should work to produce interchangeable data files with the eventual production of a standardized nuclear data base for the U.S.
3. Recommend that ORNDG seek support through Office of International Programs of NSF to achieve international cooperation in compilation and evaluation of nuclear data.
4. H. Feshbach as a member of program committee of the International Conference on High Energy Physics and Nuclear Structure be asked to organize a panel to discuss sharing of useful information, target materials and data among the major international facilities, such as SIN, CERN, Triumph and LAMPF.

APPENDIX C

Notes on CINDA Operations

With the help of various lists of NNCSC & TIC I have had a first look at the distribution list for CINDA. The original intention was that CINDA should be a tool immediately available (i.e. on desk or personal bookshelf) to those directly working with neutron cross sections, primarily evaluators and cross section measurers. I strongly believe that this principle remains necessary today as then if CINDA is to fulfill its functions. In line with this intention I have suggested to C. Dunford some 70 additional names for the CINDA distribution list. Most belong to the above two categories of evaluators or or measurers. A few are included because it would be valuable if the easy availability of CINDA were to turn their attention even minutely more toward neutron induced reactions (e.g. H. Newson & J. Huizenga). At the same time, the existing distribution list needs pruning; too many administrative types have gotten on it. Still, I believe the optimum size of the list should be substantially more than the present 212.

CINDA is growing beyond the present 2-volume size. The growing publishing costs also make a review of publication procedures urgent. Various possibilities have been suggested -- a more-or-less permanent publication of the early references only, every-other-year publication of the complete cumulation, etc. Its not possible for someone outside the operations to make firm recommendations, especially without access to statistics about the various kinds of entries. But it seems to me

that the cleaning-up of earlier entries and insertion of data references is still so inadequate that the only possibility for CINDA75 is a complete cumulation, probably in 3 volumes. For 1976, however it might be possible to issue a listing of earlier references ($\lesssim$ 1966?) to be left unrevised for, say, 5 years. At the same time there would be cumulative supplements listing only the additions to CINDA75. In 1977, CINDA77 would then be a cumulation of only the later references.

The shift of the U.S. center to NNCSC means, among other things, that at least temporarily all CINDA computer operations are centralized at CCDN in Saclay. Both TIC and CCDN had just completed an orgy of revising the computer programs and schemes when the shift was made. Nonetheless, the U.S. move and the imminence of a new computer at CCDN suggest that it may be timely to look at the computer operations once again. It seems to me that the recently completed scheme is unduly lavish in space devoted to superseded and data references, has a cumbersome and error-prone "blocking" method, and is generally enclosed in a straight-jacket of complicated computer procedures. Perhaps with the wisdom gained from experience, a new, flexible and simple computer system can be devised. To achieve this it is vital that the CINDA centers not involved in the computer operation exhibit patience and forbearance.

H. Goldstein
Sept. 16, 1974

APPENDIX D

LAWRENCE LIVERMORE LABORATORY

The purpose of this addendum to the LLL status report to the USNDC is to update information concerning the ^{235}U fission cross-section measurements and the fission cross-section ratio measurements currently being performed at the LLL linac.

A. STANDARDS

1. ^{235}U Fission Cross-Section Measurement.
(J.B. Czirr and G.S. Sidhu)

A measurement of the ^{235}U fission cross section has been completed for the 3- to 20-MeV range. Analysis of the data is complete and the results are described in a report UCRL-76041. The abstract from this report is listed below.

"The energy dependence of the ^{235}U fission cross section has been measured relative to the n,p scattering reaction for neutron energies from 3 to 20 MeV. The LLL Linac provided a pulsed source of neutrons, and energies were measured by neutron time-of-flight. The flux monitor consisted of an annular polyethylene proton radiator with a shielded recoil detector. The total error in the relative $^{235}U(n,f)$ cross section is $\pm$ 1% from 3 to 7 MeV and increases to $\pm$ 2% at 14 MeV."

B. NEUTRON DATA APPLICATIONS

1. Fission Cross-Section Ratios.
(J. W. Behrens and G. W. Carlson)

A report (UCID-16548) has been prepared which discusses preliminary results for fission cross-section ratios involving ^{233}U, ^{235}U, ^{238}U and ^{239}Pu. The abstract from this report is listed below.

"Fission cross-section measurements for a wide collection of uranium and plutonium isotopes are being conducted at LLL using the 100-MeV electron linear accelerator (Linac) as a pulsed neutron source. The cross-section ratios are measured as a function of neutron energy from 1 keV to 30 MeV using the time-of-flight technique.

To obtain fission cross-section ratios above 1 MeV, we used the threshhold cross-section method. This method allows us to obtain the ratios without depending on normalizations to absolute cross-section measurements. Knowledge of neither the amount of fissionable mass nor the efficiency for detecting fissions in the fission chambers is required for the analysis. This advantage eliminates a potentially large uncertainty in our ratio measurements.

Preliminary results for the fission cross-section ratios $^{238}U/^{233}U$, $^{238}U/^{235}U$, and $^{238}U/^{239}Pu$ extend from 1 to 30 MeV with an energy resolution of at least 5% and counting uncertainties less than 5% over most of the energy range. Additional preliminary measurements of the fission cross-section ratios $^{233}U/^{235}U$ from 1 keV to 30 MeV, $^{238}U/^{235}U$ from 750 keV to 30 MeV, and $^{239}Pu/^{235}U$ from 10 keV to 30 MeV are reported with an energy resolution of at least 5% and counting uncertainties less than 3% over most of the energy range. These ratios were normalized using the threshold cross-section method.

APPENDIX E

ACTION ITEMS

Action 1 Subcommittee Chairmen	On a continuing basis, collect and forward to H. Goldstein recommendations for new entries to the list of outstanding Cross Section Discrepancies.
Action 2 Goldstein	Maintain a compilation of cross section discrepancies listed in order of importance to the Nuclear Energy Program based on recommendations of the USNDC subcommittees.
Action 3 Subcommittee Chairmen	Forward to the USNDC Chairman suggestions for short reviews of programs supported by AEC contracts appropriate for presentation at future USNDC meetings.
Action 4 Subcommittee Chairmen	Distribute minutes of subcommittee meetings to all members and subcommittee members of USNDC
Action 5 Secretary	Distribute to all subcommittee chairmen a complete address list of all committee and subcommittee members.
Action 6 Neutron-Application Data Subcommittee	Enter requests for the source reactions ^{7}Li(p, n), D(d, n), T(p, n) and T(d, n) into the next edition of the Nuclear Data Request list.
Action 7 Chairman	Obtain a copy of the proceedings of the Mound Laboratory Symposium on actinide half-lives and distribute to the committee.
Action 8 Secretary	Solicit a status report from the Mound program on actinide half-lives.

ACTION ITEMS (Continued)

Action 9 Chairman	Recommend to DPR that ORNDG seek support through the Office of International Programs of NSF to cover incremental expenses necessary to achieve international cooperation in compilation and evaluation of nuclear data.
Action 10 Perey	Distribute the document on the ORNL review panel for the Isotope Program to the parent committee before the next USNDC committee meeting.
Action 11 Chairman	Appoint and charge an ad hoc panel to draft an appropriate statement of recommendations on the future status of the NEANDC for circulation to the USNDC committee within 60 days for their comments.
Action 12 Subcommittee Chairmen	Complete a review of the Request list by January 1 and forward a report to USNDC Chairman including recommendations for special samples and specifications for special high-priority requests.
Action 13 Pearlstein	Forward to Anderson and Motz two copies each of a retrieval of the DMA requests in the USNDC Request list.
Action 14 Secretary	Call for preparation of USNDC status reports for distribution by March 1.
Action 15 Secretary	Recompose the preface to the status reports to include a statement of the relationship to the request compilation and an additional subject category covering techniques for measurement and evaluation and facilities.

668