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TECHNICAL MINUTES OF THE USNDC MEETING 18-20 JUNE 1973

OAK RIDGE NATIONAL LABORATORY
OAK RIDGE, TENNESSEE

H. E. Jackson, Secretary, USNDC

Argonne National Laboratory

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Held at

Oak Ridge National Laboratory
Oak Ridge, Tennessee

H. E. Jackson
Secretary, USNDC

ARGONNE NATIONAL LABORATORY
9700 South Cass Avenue
Argonne, Illinois 60439

FOREWORD

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SUMMARY

This was the first meeting of the USNDC in its new role as a formal advisory committee to the Division of Physical Research of the AEC.

U.S. capabilities for satisfying requests for nuclear data as outlined in the current request compilation, USNDC-6, were reviewed. Changes in the scope of request compilation and in the procedure for including requests in the list, consonant with the expanding role of the USNDC, were adopted. A new schedule, providing for a complete annual review of the compilation of requests for nuclear data, was proposed. The next complete review will begin in October, 1973, with a solicitation for new requests and be completed by January, 1975. An interim update of the current compilation will be completed by February, 1974. A proposal by Abramov for a generalization of CINDA to include nonneutron data was discussed. The NDC recommended that in view of services presently available, that DPR not support such an expansion of CINDA. Plans were begun for the Fourth Conference on Nuclear Cross Sections and Technology. The Committee recommended AEC sponsorship of the meeting, suggested that it be held in Washington, D.C., during March, 1975, and proposed that the IAEA be invited to combine the Third International Nuclear Data Conference with the U.S. conference. A comprehensive technical review of research activities at ORNL included reviews of Neutron Data Acquisition at ORNL, Nuclear Data Problems in Radiation Transport Applications, CTR Research at ORNL, and Data Compilation and Evaluation at ORNL.

Attendance was as follows:

Parent Committee Members

1. R. E. Chrien, BNL, Chairman
2. H. E. Jackson, ANL, Secretary
3. Harry Alter, AI
4. John D. Anderson, LLL
5. Robert C. Block, RPI
6. Charles D. Bowman, NBS
7. Randall S. Caswell, NBS
8. Herbert Goldstein, Columbia U.
9. William W. Havens, Jr., Columbia U.
10. Phillip B. Hemmig, AEC (DRDT)
11. Daniel J. Horen, ORNL (NDP)
12. Melvin H. Kalos, DOD (NYU)
13. George A. Kolstad, AEC (DPR)
14. David R. Lide, Jr., NBS
15. David A. Lind, U. of Colorado
16. H. T. Motz †, LASL
17. Henry W. Newson, Duke U.
18. S. Pearlstein, BNL (NNCSC)
19. Gerald C. Phillips, Rice U.
20. James S. Robertson, BNL
21. Alan B. Smith, ANL
22. Donald Steiner, ORNL

Subcommittee Members

1. R. L. Macklin, ORNL
2. L. Stewart, LASL

† Alternate for M. S. Moore

Speakers and Observers

1. J. D. Brandenberger, U. of Ky.
2. H. Gillette, ORNL
3. J. A. Harvey, ORNL
4. M. T. McEllistrem, U. of Ky.
5. F. R. Mynatt, ORNL
6. W. Parkinson, U. of Michigan
7. R. W. Peelle, ORNL
8. H. Postma, ORNL
9. R. W. Tickle, U. of Michigan
10. L. Whitehead, ORNL

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I. Administrative Items

A. Introductions

Dr. Alex Zucker, Associate Director of Oak Ridge National Laboratories, welcomed the USNDC and highlighted ORNL nuclear data activities of particular interest to the committee.

The Chairman thanked Dr. Zucker for his gracious welcome and observed that this meeting of the USNDC was a milestone. The NDC would now operate in a public atmosphere in a manner consistent with its status as a federal advisory committee. The committee would look to "the federal designated employee" for guidance in the procedures to be followed by the committee. New members, observers, and consultants were then introduced.

B. Previous Minutes

The Chairman called for corrections or comments to the previous minutes, USNDC-4. The minutes were approved without reading under a motion by Newson, seconded by Kalos. Kolstad proposed that the minutes of future meetings be approved prior to the subsequent USNDC meeting. The new terms of reference for the USNDC stipulate public display of the final minutes within 90 days of each meeting. Consequently, corrections and amendments should be made at the time of distribution of the draft minutes 30 days after the NDC meeting. Havens observed that the minutes are an interpretation of the meeting by the Chairman and Secretary rather than a transcript. As such, additions and corrections could be made later, in the form of an appendix to the minutes offered by the full committee.

C. Past Actions of USNDC (USNDC-4, P. 71)

A review of outstanding actions followed.

Action 1 - Subcommittee Chairmen

Forward to R. E. Chrien within 30 days a final subcommittee membership list for circulation among the NDC membership for final approval. This action had been superseded by the reorganization of the USNDC of May 1, 1973.

Action 2 - Goldstein, All NDC Members

Maintain a compilation of cross section discrepancies listed in order of importance to the nuclear energy program with the assistance of committee members and direct the attention of concerned parties to the list and solicit their comments. Goldstein indicated that he was experiencing increasing difficulty in keeping in touch with the situation. He noted that monitoring the discrepancy list requires someone actively attending meetings and constantly in touch with the measurement situation. In an effort to obtain such assistance, he suggested that the subcommittees be charged to generate new entries for the list. A new action 1 was adopted directing USNDC subcommittee chairmen to collect and forward to Herb Goldstein on a continuing basis recommendations for new entries to the List of Outstanding Cross Section Discrepancies.

ACTION 1
Subcommittee Chairmen

Goldstein requested that a publication schedule be specified for the outstanding discrepancy list. Kolstad suggested that it would be appropriate to issue the list annually prior to the EANDC meeting. In new action 2, Goldstein was directed to maintain a compilation of cross section discrepancies listed in the order of importance to the Nuclear Energy Program based on the recommendations of the USNDC subcommittees. The list should be issued annually prior to the EANDC meeting.

ACTION 2
Goldstein

Action 3 - Perey

Write a one-paragraph warning to be incorporated into the standard isotope request form with regard to activation and forward to George Rogosa. In response to action 3, Perey had contacted Gillette, ORNL Isotope Division Director, and determined that the intent of the action can be meant by inserting a single sentence - "Contamination includes induced radioactivity that exceeds one nanocurie of Cesium-137 equivalent (10^{-9} curies)," into the agreements which are signed prior to loan shipment to AEC contractors and non-contractors. This proposal was forwarded to Rogosa in a letter of May 31, 1973.

Action 4 - Perey

Forward to the Secretary the elemental sample inventory list presently held by the Isotope Subcommittee. The Secretary reported that he had contacted Perey and subsequent investigations indicated that no additional sample inventory list was in the possession of the Isotope Subcommittee beyond those materials already included either in the list of the previous USNDC technical minutes or the Battelle Northwest Inventory currently at ANL. A. Smith reported on the status of the latter material in the memo of June 13, 1973 (Appendix B). Because the inventory is not in good physical condition, he suggested that the samples be considered primarily as useful for qualitative work and as a source of material for fabrication of more precise samples.

Action 5 - Secretary

Include a list of elemental inventories and their locations in the technical minutes of USNDC meeting. As a continuing action this list had been incorporated into the previous technical minutes, USNDC-4a. Block requested that a national list of such material be made available. He observed that there must be material beyond the two lists included in the previous technical minutes. In response to the proposal that all members forward lists of elemental samples to the Secretary to be included in the technical minutes list, Kolstad replied that such an action would impose a major burden on the Secretary. He observed that it would be more appropriate for the Isotope Subcommittee Chairman to maintain an elemental sample list. A new action 3 was adopted directing the Isotope Subcommittee Chairman to collect and organize a list of elemental inventories and their locations and to forward this list to the Secretary for inclusion in the technical minutes of USNDC meetings.

ACTION 3
Isotope Subcommittee Chairman

Action 6 - Perey

Investigate the response of the Isotope Division to NDC Action 9 of May 19, 1972. This action concerned reconversion to inventory form of RMC isotopes which had been converted to elemental form for a specific use. In a memo to the Chairman, Perey indicated that he had

been assured that no such reconversions were ever made on a routine basis. Possibly on several occasions the material had been converted back to inventory form because of a specific need. In each case prior authorization had been secured from Dr. Rogosa's office. This is a well established policy in the Isotope Division at ORNL.

Action 7 - Chairman

Draft a consensus letter reflecting the response of the committee to the NAS-NRC recommendation by November 10. This action has been completed by the Chairman with the letter of November 8, 1972, to Dr. D. R. Miller, Acting Director, DPR.

Action 8 - Perey

Complete with L. Love a reassessment of calutron unit costs under full computer operation and report the result at the next committee meeting. In a memo from Perey read by the Chairman in his absence, Perey indicated that productivity in number of tank hours per year could be almost doubled under full computer operation of calutrons. Such a mode of operation would require an increase in the operating budget of approximately 10%. However, Perey indicated that substantial reduction in the cost/tank hour could be achieved without computer operation with less than a 20% increase in operating budget. Because of confusion as to what the objectives are to be, Perey requested that the Isotope Subcommittee receive guidance from USNDC in determining which variable should be optimized. Kolstad expressed concern that the cost per calutron hour had doubled since 1968. He requested that during the meeting the Committee receive a ten-minute briefing on current calutron operation from H. Gillette. The previous action 8 was carried over as a continuing action on the Isotope Subcommittee to complete with L. Love a reassessment of calutron unit cost under full computer operation and report the results at the next committee meeting. A status report on calutron automation was scheduled under agenda item IVA.

ACTION 4
Isotope Subcommittee

Action 9 - Perey

Circulate among the USNDC members a complete list of

the by-product isotopes in storage with the recommendation on how to make this inventory available, and also circulate a copy of the Soviet offer to sell ^{57}Fe to ORNL. In his memo to R. Chrien, Perey indicated that no accounting problem exists as far as pricing of the by-product isotopes is concerned; they are technically still unprocessed. With the distribution to committee members at the meeting of the Soviet offer and the by-product isotope inventory list this action was completed.

Action 10 - Isotope Subcommittee

Form a recommendation for the disposition of unprocessed calutron material so that this national resource can be made available to U. S. scientific programs. The Isotope Subcommittee had been unable to meet to discuss the subject. However, Perey had prepared a memo to be read before the USNDC. This memo stated that, "This stockpile exists because there is no demand for the separated isotopes in question. In some cases they are already so cheap in the catalog that changes in cost are unlikely to stimulate additional sales. However, in other cases the catalog price is so high that it is quite possible that a marked reduction in price would stimulate sales. One should try to ascertain for each one of these isotopes whether a reduction in price would stimulate sales and benefit the scientific community. In cases where this is true an arbitrary decision as to catalog price should be made. In the case of the isotopes for which a reduction in price would stimulate increased use because cost is not the limiting factor in use, every opportunity should be taken to advertise the fact that such large quantities of isotopes are available to be put to good use and that the USAEC will be very receptive to suggestions. Certainly these isotopes can be made available under the same conditions as the RMC. However, I feel we should go even one step further and try to see if some of the stock cannot be almost given away as seed money for promising applications. The area of biological and medical analysis certainly looks promising for some of these isotopes." In response, Kolstad indicated that the material cannot be given away. Newson proposed that the materials be carried on RMC with zero value attached. The

remaining cost would correspond to that needed to prepare a useable sample. In response, Kolstad indicated that the material cannot be given away, and suggested instead that the next RMC catalog should contain an inventory of the material. A new action was adopted directing the Secretary to advise G. Rogosa of the USNDC members' suggestion that unprocessed calutron material be included in the next RMC inventory.

ACTION 5
Secretary

Action 11 - Subcommittee Chairmen

Review and normalize status comments in the subcommittee reports to NCSAC-35 and forward the revised document within three weeks, by November 15, to the Chairman. This action has been completed.

Action 12 - Chairman

Transmit a formal letter to NNCSC expressing the consensus of the NDC on the possible publication format for the Request Compilation. Although such a letter has not been issued, the intent of this action has been effectively completed with the distribution of the minutes of the previous meeting.

Action 13 - Robertson

Provide for the NDC meeting a summary paper identifying the data problems in the biomedical area and outlining the current structure for funding the appropriate research. This action has been completed with distribution of Appendix E in the minutes of the previous USNDC meeting, USNDC-4.

Action 14 - E. Smith, R. Chrien

Prepare a proposal for a Nuclear Data in Medicine Symposium to be held in connection with the meeting of the Society for Nuclear Medicine, June 12 - 15, 1973, in Miami. This proposal is to be forwarded to the Chairman for transmittal to the Society for Nuclear Medicine. This action has been completed and was discussed under agenda item VIIB-9.

Action 15 - Newson

Proceed with formation of a charged particle subcommittee and where possible draw upon university researchers for membership.

This action was superseded by the USNDC reorganization.

Action 16 - Jackson

Obtain a translation of the Abramov document and circulate it together with a letter of comment. This action was completed.

Action 17 - INDC and EANDC Members

Provide to NDC members full background information and when possible insure adequate information exchange between USNDC and International Data Committees. This action is understood to be a continuing obligation on the part of the appropriate membership and would not be carried as a continuing USNDC action.

Action 18 - Caswell, Standards Subcommittee

Assist INDC members in implementation of INDC action 18 on non-neutron standard reference data. This action was completed.

Action 19 - Alter

Assist INDC members in implementation of INDC action 19 on reaction data needs for flux measurements and include a list of the relevant reactions in the next subcommittee report. This action has been completed with the letter of March 26, 1973, and the accompanying lists which are included in the minutes as Appendix B.

Action 20 - Alter

Assist INDC members in completing INDC action 40 by forwarding a report on the use of clean integral measurements for evaluating nuclear data files. This action has been completed with the report of the CSWEG data testing subcommittee of November 8, 1972.

Action 21 - CTR, NDMA, BA Subcommittees

Recommend appropriate screening procedures for data requests in the areas of CTR, materials analysis, and biomedical application. Discussion was deferred to agenda item IIIC.

Action 22 - All Members

Submit to Kolstad comments on a proposal for a high-intensity neutron source symposium. This action had been superseded by the Workshop on Intense Neutron Sources held at Brookhaven National

Laboratory, May 30, 1973. Chrien announced that a summary paper describing the findings of this workship would be distributed to USNDC members. In connection with this meeting a continuing committee had been appointed to consider developing a proposal for an intense neutron source to be submitted to the AEC. Further discussion was deferred until agenda item VIIB-7.

Action 23 - All Members

Forward comments on the proposed 1973 IAEA specialist meeting on fission product nuclear data by November 5. This action had been completed.

Action 24 - All Members

Forward comments on the agenda for the proposed Third IAEA Conference on Nuclear Data to the Chairman as soon as possible. This action was completed. Discussion was deferred to agenda item VIIB-3.

Action 25 - Rogosa

Furnish USNDC members with an announcement for the 1973 Rochester Fission Conference. This action was completed.

Action 26 - Secretary

Expand the request for contributions to the status report to reflect non-neutron nuclear data application and activities of the data compilation centers. This action was completed.

Action 27 - Secretary

Investigate the feasibility of a general indexing of the status reports according to discipline and application. Discussion was deferred to agenda item III C.

Action 28 - Chairman

Advise DPR of the USNDC recommendations on disposition of CTR requests for RENDA and deferral of a decision on the IFRC criteria for CTR priorities. This action was completed.

Action 29 - All Members

Review the NBS requests for DRDT filters and forward comments to the Chairman by November 15. This action had been

completed and the committee consensus summarized in a letter of December 12, 1972, to Dr. D. R. Miller, DPR, from R. E. Chrien. The scandium filters are in the process of transfer from DRRD to NBS.

II. Review of U. S. Capabilities for Satisfying Measurement Requests

A. Subcommittee Reports and Reviews

1. CTR Subcommittee

Steiner reported the results of the USNDC CTR subcommittee meeting held January 10 and 11, 1973, at ORNL. The full subcommittee and eight additional consultants had attended. The minutes of this meeting are included as appendix F. Topics discussed included CTR neutronics and neutron data which is relevant to the appropriate fuel cycles. Steiner stated that the committee is developing a statement of what the nuclear data needs in this area are. They expect in the next year to issue an interim request list covering cross sections not included in the current USNDC list. The question of interfacing CTR programs with CSWEG was discussed and the committee opinion was that such interfacing was as important as identifying nuclear data needs. The Subcommittee Chairman agreed to the circulation of memos of interest to the various parties and to serve as a clearing house for making data available to parties of interest. At this meeting Goldstein had raised the question of educating the USNDC to the needs of the program and what educational action should be taken. A one-day symposium on CTR data needs had been considered. Kolstad responded that the NDC could forego the customary host-laboratory

review, and in its place conduct appropriate reviews of subcommittee activities. Goldstein proposed that a technical symposium be planned for the next Nuclear Data Technology meeting. He observed that in the past when earlier counterparts of the NDC were called upon to make technical judgements and recommendations in new areas they had demanded appropriate presentation of the physical issues involved. He observed that the NDC will face this problem in fusion. Steiner observed that an educational meeting with the NDC could be conducted in the form of a two-hour session with perhaps two review papers. The Chairman observed that if a joint parent and subcommittee meeting was held an extra day could be allocated to run a tutorial subcommittee program. Steiner felt that a one-half day program for CTR would be appropriate.

2. Standards Subcommittee

Caswell distributed to the committee a table (appendix G) which was an update of the previous summary of measurement activity. The table indicates the status of measurements in progress, measurements planned, and proposals for measurement directed at specific USNDC-6 cross section requests. Caswell requested comments from committee members. In response to several questions, Caswell indicated that the resolution indicated on the table represents the experimental resolution and that the entry "need" in the column labeled "measurement under way" indicates that the subcommittee is soliciting a proposal. Pearlstein inquired as to the value of completing the cycles of some of the standards. He noted that the measurement of the ^{10}B cross section relative to ^{6}Li is not included on the table though it would complete the cycle of a series of relative fission measurements. Caswell replied that the subcommittee would endorse this approach. Block then questioned whether the committee had considered filtered beam experiments. Bowman replied that after the 2 keV Sc filtered beam had been characterized the NBS group intended to explore establishment of absolute 2 keV standards. Block commented further that the use of the neutron filters in time-of-flight measurements eliminates many background problems. Chrien noted that BNL had a

24 keV filter beam which also could be used in standard measurements. Smith reported that the ACRP had recommended a meeting on cross section errors. He observed that there are inconsistencies. For example, ^{10}B is requested to a 1% precision, while the fission cross section relative to ^{10}B is only specified to 2%, and yet the latter measurement is the easier. Stewart replied that the errors indicated do not include errors in the standard cross section, and Bowman added that different experimental techniques imply different errors. Kolstad asked Caswell if there is any plan to implement the letter of April 27, 1973, which outlined measurements which fall within the committee's sphere of responsibility. This memo had pointed out specifically that the responsibility of the subcommittee was measurement standards and not standard reference data, and had outlined further some of the neutron standards in which the USNDC committee is interested. Kolstad stated that he would like to have the memo of April 27, incorporated into the terms of reference of the standard subcommittee.

3. Biomedical Applications Subcommittee

Robertson reported that important nuclear data needs lie in the areas of activation analysis and dose calculations. He indicated that use of radiopharmaceuticals was under increasing scrutiny by the FDA. Improved communication with the nuclear data community was needed, as well as increased accuracy in the data available. Robertson indicated that production cross sections for radioisotopes continued to be of interest. Robertson mentioned two continuing problem areas. The first was the failure of physicists to include $E_\beta^{aver.}$ as opposed to $E_\beta^{max.}$ in reporting characteristics of nuclear beta decay. To some extent MIRD was fulfilling the needs in this area in decay scheme evaluation. A second area in which improved communication was needed was the availability of new nuclides for radioisotopic application. Robertson remarked that a panel had been held at the Miami meeting in which two users of nuclear data presented their views on present needs while Caswell and Horen discussed the availability of information. It

was Robertson's judgement that the meeting had been very successful. The title of the Miami seminar had been "The Requirements and Availability of Nuclear Information in Nuclear Medicine." Horen indicated that about 70 persons had attended, about 50 indicated that they had had a course in nuclear physics. In the discussion, Harper, from the Argonne Cancer Research Hospital, indicated that an accuracy required for basic nuclear data need only be of the order of 20% because of the much larger uncertainties in the biological data available. He was not alone in this view. More accurate data for the production of radionuclides was also requested by manufacturers. In particular, they wished to have data in a digested form as well as a more careful reportage of the details of the experimental measurements. Winchell, the author of these comments, was very happy to learn of the table of reactions cross sections compiled by Münsel.

Horen also commented on an American Nuclear Society meeting session on absolute gamma ray counting. He noted that the problems here were very similar to those of the area of nuclear medicine. The session was attended by about 40 persons including a few members of the AEC regulatory staff. Mann, of NBS, questioned the frequent use of the term "absolute measurement" in light of the uncertainties in the decay scheme and its implications for estimates of source strength. Three issues were hotly debated:

1. Why isn't an effort made to generate one set of data so that users will not be confronted by different numbers for the same quantities in different compilations?

2. Is there a need for standard reference data? To what accuracy?

3. Is there a need for standards of measurement? How should these be defined?

Caswell added that both he and Horen had prepared individual reference lists which they proposed combining for radionuclide and dosage calculations. Bowman requested an elaboration on the remarks concerning absolute standards. Horen replied that one manufacturer

remarked that production cross sections need be known only to about 20%, particularly in cases where the half-lives were so short. Caswell noted, however, that the FDA must use the standards appropriate to the U. S. pharmacopoeia and that the latter states that you must know activity to ±10% in applications of radiopharmaceuticals. Robertson noted that in therapeutic applications, large dosages are commonplace, but that in diagnostic applications, the dosage must be kept below the accepted normal population dosage limit. Phillips remarked that information available on clinical X-ray dosages for the general population already indicate reason for concern over the expanded use of radiopharmaceuticals.

Kolstad suggested that the subcommittee follow the FDA's standards in establishing a precision. He suggested that it is not the committee's interest to include instrumentation to the extent of establishing dosage standards. Robertson answered that the decay scheme is the primary factor on calculating the proper dosage. Caswell added that it is easy to measure curies and that the pharmaceutical company sells curies but to calculate dosage you must know with precision the intensity per disintegration. Robertson concluded that the interest in decay schemes comes about because of the objective of giving the patient as much medication as is consistent with the estimated absorbed dosage.

4. Isotope Subcommittee

In lieu of a subcommittee report Gillette and Degenhart presented successive reports on the progress in exploring automation of calutron operations. Gillette commented that he expected the total operating cost for the separation program to be about the same under automated operation, but that unit costs would be lower, and output higher. However, specific numbers for unit costs remain an open subject. At the present time adequate information is not available. With regard to Os separations, he indicated that ORNL had tried to obtain material from the Soviet program, but that the isotopes desired were not available. Consequently, an Os separation is scheduled. He added one general comment. During the current fiscal year, sales have been running at a

very high level, and because the Commission permits budgeting on a net basis, the Isotopes Program will have extra funds at its disposal.

Kolstad commented that unit costs have doubled since 1968, and inquired as to whether tank hour costs would go back to the old figure. Gillette replied that for current 16-tank, 24 hour-a-day, 5 day-a-week operation the cost is $20.00 per tank-hour as opposed to $10.00 to $12.00 per tank-hour in 1968. If eight additional tanks were placed in operation the hourly cost would decrease. Gillette stated that the Isotopes Division has authorization for $48,000.00 worth of equipment and $125,000.00 per year in the budget for FY 74 and FY 75 to be used to obtain information permitting an accurate assessment of the impact of automation. Block noted that the operation of 32 tanks on a 5 day-per-week, 24-hour basis would bring the cost down to $12.00 per calutron hour. The important impact on the operating costs appear to be the number of tanks rather than automation. Phillips noted, however, that automation will permit a larger number of tanks which would be beneficial as long as a market for the additional material exists. Gillette noted that sales are currently $150,000.00 above last year's level. Newson asked about the status of the Os separations. Gillette replied that regular facilities will be used with care and that the hazard presented in Os separations is similar to that associated with beryllium.

Degenhart described in detail the PDP-8 computer system under development for control of calutron operations. Initially, measurements are limited to the 180^0 sector separator, ORSIS. To make the transition to automation the hardware is being incorporated into the system to control each calutron parameter and to do some work with the arc. Primary emphasis is on quality control. In a Dy separation under computer control an enrichment factor of 400 had been achieved. It had been concluded that a five-second response time of the control system would insure the highest possible enrichment factor. Presently, the response time is much slower. The hardware problem is considered under control and current efforts are concentrated in the area of

programming. With the $48,000.00 in new equipment funds a monitor system will be installed which will control on an interrupt basis. The money is being used to add additional computer core which will permit the more elaborate line programming. At present the system is not a monitor-based system and a response time can be as much as two and one-half minutes.

Sixteen parameters are currently under control. A second calutron cubicle controlling a production calutron will be linked to the PDP 8 control precessor. This unit will serve as a prototype. In response to a question by Block, Degenhart indicated that for the initial conversion, $16,000.00 is required per calutron for hardware, but that for a larger number of conversions $8,000.00 to $9,000.00 is probably a more reasonable estimate. Phillips expressed concern about the cost effectiveness. He indicated that the numbers presented suggest that it might be less expensive to hire a larger number of people to run the calutron under normal operation. Gillette responded that a decision concerning these alternatives cannot be made until the data from the present automation study is available. Kolstad noted that the calutron effort involves repetitive operation and would seem a natural application for computer automation. He asked at what point would a cost-effective analysis be appropriate. Degenhart replied that he could attempt a projection and that his feeling was that labor cost going into automated separations would be a factor of two lower. Phillips observed that the important impact of automation may be the improvement in the quality of separations. Bowman asked if the control of 16 parameters presents a problem. Degenhart replied that the programming will be the important factor and that computer operation can be used to obtain better data on such questions. Motz agreed noting that the ORNL people are in a position to measure parameters which were not accessible before. Degenhart observed that with the proper program quality will not be degraded, but that at the present time they did not envision startup with computers. Operation in excess of 20 hours would be a problem in many cases because

of solid buildup in the calutron. For such reasons it would be important to study different levels of automation. In summarizing, he observed that operation of two calutrons simultaneously is planned. Complete operation of the prototype will be attempted to obtain a sample in hand and an assessment of automated operation. Prototype operation is expected under computer control in six months. Committee members suggested that the ORNL Isotopes Division staff be commended on their efforts and that their goal of tank-hour cost of $14.00 would be a remarkable achievement.

B. Individual Member's Reports and Commitments

The Chairman asked that individual committee members summarize the efforts at their laboratories planned during the next year to furnish cross section information requested in the current USNDC Request compilation, USNDC-6. A laboratory-by-laboratory summary is given below.

ANL -- Measurements directed at satisfying a priority one request for the cross section for the photodisintegration of the deuteron below 10 MeV will be attempted as part of the threshold photoneutron program. Measurements of the capture spectrum of sodium will be carried out at the ANL internal target facility at CP-5 using the average capture technique in an attempt to compare the capture spectrum for the 2.85 KeV resonance with the thernal spectrum. This is a priority one request from DRDT. In addition, exploratory measurements of charged particle cross sections relevant to the CPR program will begin during the summer. The program at the Fast Neutron Generator will continue to be directed specifically at problems on the USNDC request list. The current status is indicated in the ANL status report. Emphasis will continue to be on measurements complete to the evaluation stage including where possible all relevant partial and total cross sections.

BNL -- Fast chopper measurements at the HFBR will focus on two priority one requests for the resonance capture spectra of

^{238}U and ^{239}Pu during the next year. In addition, the 25 keV facility will be heavily exploited in measurements of the capture cross section of ^{198}Au and ^{238}U.

Columbia -- The first velocity selector run on the modified Columbia synchro-cyclotron is expected in January. An increase of a factor of 10 in neutron intensity is anticipated. Three flight-paths will be used: one <40 meters for fission study, and two from 40 to 100 meters for capture. Capture, fission and total cross section will be measured for a range of nuclei. Provided the new intensity is adequate, fission fragment measurements will be made on ^{233}U. Total cross section measurements will focus on light elements and analysis will be attempted in terms of R-matrix theory. Some very heavy element total cross section measurements will also be attempted.

LASL -- Measurements in the area of thermal standards will be continued. Simple measurements using NaI (tl) will be continued to meet requests for gamma ray production cross sections. In the past, such data has given remarkably good agreement with the high resolution work of magnetic spectrometers. Barr will continue the previous program of measurements of fast neutron reactions. Attention will be focused on some standard cross sections.

LLL -- A major effort of measurement of the fission cross section of ^{235}U in range of 1 KeV -- 20 MeV is in progress. Measurements of $\bar{\nu}$ are planned. In addition, measurements related to major fission cross section standards are planned.

NBS -- The measurement program at the Bureau will embrace the area of standards measurement described in the summary table of the standards subcommittee (appendix G).

ORNL -- ORELA will run at a level of 80% of fully funded operation. Total cross section measurements are planned for Pu^{239} and ^{241}Pu from 1 eV to several MeV with a precision of 1 - 3%. Polarized beam and target studies will continue on ^{235}U and ^{237}Np. DRRD is supporting certain experiments but not the operating cost of ORELA.

In lieu of these funds user charges will be levied for DRRD measurements. Capture studies of ^{238}U will continue. The total capture cross section will be studied in the range 4keV to 400 keV.

Rice University -- A comparison of the elastic (p,n) and the ^{235}U fission cross section will be attempted as a standard measurement. A particle by particle measurement of the Z and N of fission fragments will be attempted. Z will be obtained by X-ray measurements of k and l X-rays in conjunction with time-of-flight and de/dx measurements to obtain the fragment mass. This will be a one-arm measurement -- simultaneous measurement of Z and M.

RPI -- Measurements will be made of the capture cross sections for fission products including Pd and Eu. Use of the filtered beam technique in conjunction with time-of-flight will be explored and the lead slowing down spectrometer technique will be used to study subthreshold fission in a number of targets and to explore the feasibility of studying (n,α) reactions. The energy resolution of measurements using the latter technique are approximately 14% and because of the energy partition, the characteristic flux is four orders of magnitude greater than normal time-of-flight experiments.

Triangle Universities Nuclear Laboratory -- A neutron spectrograph recently received from a Wright-Patterson laboratory will be used in conjunction with the Triangle University tandem as a neutron source. Measurements will concentrate on neutron energies which are higher than those available at installations such as the FNG at ANL. Measurement of charged particle cross sections relevant to the CTR program will also be investigated, and use of polarized protons to produce polarized neutrons will be explored.

C. Proposed Revision to Request List Procedures

A series of revisions to the technical scope and mechanism for including requests in the USNDC compilation for requests for nuclear data proposed by Kolstad (included as appendix H) were reviewed by the Committee. The purpose of these revisions was to assure that the request

compilation served its broadened function effectively and to affect a better review and awareness of USNDC activities by other divisions and agencies. In the discussion which followed a review of the memo Stewart stated that only DRRD systematically monitors requests submitted to the compilation. She suggested that it would facilitate selection of requests if a status comment resulting from the subcommittee reviews was sent to the requester before the final assembling of the request list. Goldstein inquired if the USNDC would continue to be able to enter requests on the compilation. Kolstad noted that the new procedures would permit DPR requests, and that DPR would look to the USNDC for advice on appropriate requests. The new procedures would make the list more believable and other divisions and agencies more aware of the USNDC and the requests compilation. Bowman inquired about the role of organizations outside of the government and how they would be able to feed information into the system. Kolstad replied that as an example private power utilities could request measurements through DRRD. He pointed out that the USNDC is an advisory board and therefore, not permitted to deal directly with private parties. However, the USNDC could receive them and recommend them to DPR. In response to Phillip's inquiry concerning the priorities in one disciplinary area relative to another, the Chairman noted that the USNDC had avoided comparing priorities among differing fields. He summarized the sense of the discussion concerning requests from non-governmental organizations with the recommendation that such information be passed through the USNDC to DPR.

Kalos proposed a motion which was seconded by Phillips stating that external requests be directed to the DPR, and that with this modification the revisions proposed in the memo of April 20, to USNDC members be adopted by the USNDC. The motion was carried unanimously.

D. USNDC Request Compilation

Stewart reported that the new edition of the compilation of requests for nuclear data, USNDC-6, was being printed and should be distributed before the end of July. She noted that LASL had assumed

responsibility for the compilation eight years ago. Several factors had delayed completion of the current edition. Among them was the failure of the USNDC subcommittee to complete their reports on schedule and the unavailability of the MANIAC computer system which had been used for storage and retrieval of the list. The draft version of the compilation had been forwarded to committee members approximately one month previously. Stewart indicated that a substantial amount of editing of request lists comments had been necessary. Retrievals of the new list by a subcommittee category had been distributed to USNDC subcommittee chairmen. Chrien expressed the thanks of the USNDC and commended Stewart on an excellent job in the face of delays beyond her control. In response to a question concerning distribution Stewart announced copies of USNDC would be forwarded to the secretary for distribution according to USNDC lists.

Steiner requested guidance on the place of requests for re-evaluation of existing cross section data in the Request Compilation. Is it proper for the subcommittees to review data for re-evaluation and where appropriate to request such re-evaluation? Alder responded that in the past requests of this nature had been funneled to CSWEG. Pearlstein added that at present there is no international exchange of evaluated data, and that requests for re-evaluation can be directed to him. Havens stated that the role of the requests for re-evaluation had been discussed by the INDC. These groups had established the primary purpose of the request list as that of communicating needs to potential measurers. Because the evaluation community is much smaller, problems with communication are not as difficult. Havens suggested that requests for evaluation and measurements not be mixed. He noted that Britain had a separate evaluation request list.

The Chairman noted that it was the duty of the USNDC subcommittees to filter out requests which can be filled by evaluation. Kolstad observed that the title of the Compilation List does not indicate this. Phillips added that the list was generally interpreted as a request

for measurements. Kolstad then proposed that the title be made more definite, and Stewart noted that the present compilation does request evaluations in some cases. Kolstad requested that in future editions Pearlstein emphasize the proper title.

III. Status Reports

A. Highlights by Members

The cross section program at the University of Kentucky was reviewed briefly by McEllistrem. This program dating from the mid 60's emphasizes neutron scattering studies. Bunched Pulse time-of-flight techniques using a 6.5 MeV Van de Graaff accelerator are used to study neutron cross-sections for incident energies up to 9 MeV. Target considerations, involving D_2 gas cells, are the limitation on neutron intensity. On occasion the $(D, {}^9Be)$ reaction is used. Efforts have concentrated on nuclei in the 2s,d shell and nuclei near A=60. Measurements of inelastic neutron groups are made to a precision of 3%. General accuracies on inelastic cross sections are 5%. A large amount of data has been accumulated for eight isotopically enriched samples; five even Mo isotopes in the range from 1.0 to 9 MeV and 3 Zr isotopes from 1 to 3 MeV. The data for the Zr isotopes includes 100 elastic and inelastic groups. The Isotope Separation Program at ORNL has been a great asset. The ideal samples sizes for the Kentucky program are 0.3 to 0.5 moles. Measurements can be made with oxide samples, but metallic materials are preferred. Gamma ray production cross sections are routinely measured and converted when possible into inelastic neutron cross sections. McEllistrem noted that many groups measure either neutron inelastic scattering or gamma ray production, but few measure both as is done in the Kentucky program. A detailed comparison of gamma ray and neutron detection data is planned with the objective of obtaining consistency to 5 - 6%. The virtue of the University of Kentucky program is the flexibility gained by utilization of both detection methods. Most experiments performed to date appear on the recent USNDC request

list. Additional measurements of (p,n) reactions for nuclei near mass 90 particularly odd nuclei are also in progress. Future plans will emphasize an extension of 1 to 9 MeV measurements to other mass region and a search for the effects of nuclear deformation in the elastic scattering cross sections.

Kolstad noted that reviews such as that presented by McEllistrem are very useful to the USNDC and suggested that for future meetings one or two contractors as appropriate be invited to present a similar briefing. The Chairman concurred and noted that the DPR had a list of contractors who might be appropriate for such requests. USNDC members when aware of such programs should forward suggestions to the Chairman. A new action was adopted on the subcommittee chairmen directing them to forward to the USNDC Chairman suggestions for short reviews of programs supported by AEC contracts appropriate for presentation at future NDC meetings.

ACTION 6
Subcommittee Chairmen

In highlighting other recent developments, Motz reported that since the LASL-ORNL neutron polarization experiments reported in the LASL status report, additional measurements on ^{235}U had been made using neutron polarization, beam polarization techniques. Spin assignments were complete for thirty resonances below 57 eV and a comparison of the new results with those from other methods was available. Anderson reported that a recent compilation of photoneutron cross sections obtained with monoenergetic photons had been distributed at the Asilomar conference in March, 1973, and that the compilation was available to committee members. Bowman emphasized that the USNDC had previously requested such a compilation and that the LLL document represented a very comprehensive collection of photoneutron data and which is appropriate to present needs in this area. He expressed concern that the document receive sufficiently wide distribution. A new action was adopted on Anderson to distribute to USNDC members the atlas of photoneutron cross sections obtained with monoenergetic photons, UCRL-74622.

ACTION 7
Anderson

Bowman called attention to a very impressive result from Intelcom Rad Tech. In a series of integral photofission experiments near threshold on ^{238}U and ^{232}Th, Gozani had observed what appears to be a rapid increase in the neutron multiplicity for sub-threshold photofission in both ^{232}Th and ^{238}U. Bowman suggested that this change may be associated with the presence of isomeric fission in both of these isotopes.

ACTION 8
Secretary

At Newson's request, a new action was adopted directing the Secretary to include in future requests for contributions to the USNDC status report the document number for the forthcoming issue.

B. Future Procedures

Horen requested a redefinition of the criterion for contents of the USNDC status report. Kolstad stated that the report should include information relative to the interests of the various subcommittees. In the area of basic science, for example, material should be included which meets the need as outlined by the Basic Science community. Horen then noted that the status document serves one of two purposes, either that of informing people of current activities or of furnishing the results of new measurements. The former purpose could be served by simply furnishing the descriptive key words in lieu of the present extended abstracts.

Phillips observed that if the present document is intended for national distribution, and includes nuclear data beyond and above neutron cross sections then the present guidelines are not appropriate. In the past the objective of the status reports was to communicate results of important measurements quickly. With the broadened interest of the USNDC and the diversity of the agencies it serves, the corresponding document would be prohibitively large. Consequently, the committee must look to DPR for guidance concerning the correct policy. Anderson suggested that on the basis of conversations at LLL one policy would be to include responses to those items the committee specifies and include contributions in other areas that the laboratories judge important.

Motz noted that at present significant efforts in CTR are not reported. Kolstad responded that only those aspects relevant to nuclear data should be included in the status report.

Phillips inquired how strictly USNDC members should hold to the stipulation of relevance to national efforts and to nuclear data. Kolstad emphasized that these were absolute criteria. As an example, the basic science subcommittee had been added to the USNDC to reflect the interest of the basic science community in the area of nuclear data. Kolstad continued that the basic charge to the science subcommittee is to determine the appropriate needs for nuclear data and further what laboratories should be included on a list of institutions solicited for status reports.

Newson supported earlier remarks of Horen with the observation that a sufficient response would be an index of annual reports from various laboratories submitted in the form of a compilation of key words. As an example, he called the committee's attention to the current status report from the Triangle University Nuclear laboratory which included an extensive CINDA-type index. Kolstad did not feel that this would be an adequate replacement and suggested that instead each lab include basic information specified in the charges received from the subcommittees and include information beyond these areas in the form of a key word index.

In response to a suggestion that the status reports be broken down into the seven categories corresponding to the USNDC subcommittee structure, Caswell responded that such a breakdown did not appear feasible. For many contributions such categorization would imply multiple entries and in addition for some categories the number of entries would be small.

Havens suggested that the committee must first decide what audience it wished to reach. He noted that at present the Status Reports is a limited document of special interests. The Chairman stated that we should be vigilant for development of new technologies and that

the status reports could be instrumental in accomplishing this. Technology development might be a reasonable criterion for contributions to the status report. Bowman questioned whether a basic charge should be to restrict nuclear data to basic science problems with technological significance. The USNDC representative could edit contributions to meet this criterion.

The Chairman observed that at present the appropriate guidelines were not clearly defined, and furthermore, that the document has been useful to neutron workers as a metter of historical record. Consequently, he proposed that for the next issue, we continue present procedures. A new action proposed by Kolstad was adopted directing subcommittee chairmen in consultation with subcommittee members to prepare a brief statement of guidelines to be followed in collecting contributions to the status report submitted to the USNDC.

ACTION 9
Subcommittee Chairmen

IV. Survey of ORNL Activities

A. Neutron Data Acquisition at ORNL (R. Peelle)

Peelle discussed a wide range of neutron measurements chosen to illustrate some of the work being performed at the Oak Ridge Electron Linear Accelerator. Fast neutron as well as resonance studies at ORNL are now concentrated at ORELA. A summary furnished by Peelle is given below:

Transmission Tests to check the credibility of total cross section files were shown for Ca, Si, and Fe as obtained by Kinney, Love, and Perey. Many serious flaws were found particularly for energies below 500 keV where plastic scintillators have not previously worked well.

Total Cross Section Measurements: The work on the "windows" in the iron cross section was aided by Harvey, using a 20-in. sample. The correction for displaced air was significant! Fowler and Johnson studied calcium above 50 keV or so and obtained excellent data completely resolving the s-wave resonances, and showing many interesting interference effects and the gradual onset of p-wave potential scattering.

Capture measurements on ^{238}U by de Saussure and Perez

were shown to illustrate the clarity with which the resonance structure is seen and the important current differences among the Linac observations. Measurements using an independent technique should help resolve the current problems.

Some capture data of Macklin on ^{28}Si illustrated the importance of adequate resolution in showing what had earlier appeared [in $^{29}Si(\gamma,n)$] to be an asymmetric peak to be a compination of at least five resonances.

Capture measurements on ^{240}Pu and ^{241}Am as well as associated capture and fission measurements on $^{239,241}Pu$ and ^{235}U are being performed. In the case of ^{239}Pu, the scintillator tank work of Gwin was shown to give ratios of average capture and fission cross sections quite in agreement with the Weston and Todd work using low efficiency detectors with pulse height weighting. These experiments were designed to meet as well as possible the needs of the reactor programs, and have given important fission as well as capture cross sections.

Gamma Emission Spectra as a function of neutron energy up to 20 MeV have been obtained by Dickens, Love, and Morgan. These data, dominated by inelastic scattering, have been obtained for several nuclides -- N was shown. The data continue through the energy region difficult to reach with electrostatic accelerators.

Fission: Dabbs and James have observed a number of resonances in ^{249}Cf below the energy reached using nuclear explosions. These authors are now working on subthreshold fission. in ^{234}U.

Keyworth and Seibel of Los Alamos with Dabbs of ORNL have measured transmission and fission for ^{237}Np and ^{235}U using polarized neutrons on a polarized target to identify the spins of the resonances. Spins of very many resonances have been identified for the first time. The spins of all the levels seen through a second-well resonance of ^{237}Np had (as expected) the same spin, while both spin states were apparent in the total cross section in that energy region.

Inelastic Scattering is measured by Kinney and Perey

by observing the photon deexcitation of the first excited state. Resolution of about 1 keV at 1 MeV is seen. Data for iron were shown in comparison with that obtained by Cierjacks.

The importance of evaluation work was emphasized: to synthesize the knowledge about the cross sections of a nuclide. Evaluators will have to provide uncertainty estimates and correlations if uncertainties in computed parameters are to be knowable and if the most important experiments are to be given emphasis. To make this fully possible experiments will have to break apart their uncertainty estimates to make explicit the correlations among cross sections for various energy regions and nuclides. The committee's help is sought in encouraging experimenters to develop the necessary reporting habits.

B. Nuclear Data Problems in Radiation Transport Applications (F. R. Mynatt)

The radiation transport applications work at ORNL is focused on the direct support of analysis of current reactor design and weapons systems problems. As a result, the efforts in the group span the entire applied technology area bringing the output of base technology research to bear on current design problems. It is useful to identify the various disciplines which are involved in the nuclear data portion of this technology including cross section measurements, evaluations, processing, integral data testing measurements, transport analysis of specific radiation problems, and design engineering. Data improvements flow from the beginning to the end of this list and the impact of problem requirements flows back through the list. Communication between the various disciplines noted in this list has in the past been sporadic and ineffective; however, it has become increasingly apparent that the feedback paths conveying problem requirements for data measurement, evaluation, etc., must be more effective. A major first step has been achieved at ORNL by collecting a large group comprising the above mentioned disciplines in one administrative body and physical location

(an important aspect). From the problem solving experience of this group, quantative and systematic procedures are being developed to convey problem requirements back through the cross section data acquisition system.

Integral experiments continue to have a pivotal role in testing data for problem-dependent applications. The typical integral experiment is more or less prototypic of the design problem, thereby having "built-in" sensitivity to an important aspect of the cross section data. Under the DNA program, a new type of integral experiment is being pursued. These experiments are performed on ORELA in geometries very similar to a differential scattering cross section measurement, but the samples are thicker providing essentially optimum counting rates. For incident neutron energy bands determined by time-of-flight, neutron and secondary gamma-ray spectra are obtained as a function of scattering angle by unfolding pulse height spectra from liquid organic scintillators. These experiments must be calculated with a transport code and provide a rather global medium sensitivity ($\sim$10%) test of all the data in the form actually used by the transport codes in routine calculations.

A sensitivity analysis methodology is being developed at ORNL based primarily on perturbation theory methods. Sensitivity analysis has been found to be a very powerful tool for many aspects of radiation transport analysis and provides a direct means for establishing the problem dependency feedback mentioned earlier. As currently practiced, sensitivity analysis consists of two aspects, analytic and predictive. In the analytic function, the sensitivity function $S_i(E)$ is displayed graphically for various $i^{\underline{th}}$ reaction cross sections as a function of the energy of the incident particle. $S_i(E)$ is determined such that the product of $S_i(E)$ and the cross section errors properly integrated and summed over energy and reaction types gives an estimate of the error of a given problem. Plots of $S_i(E)$ provide qualitative and quantitative understanding of the portions of the cross section data which are important for a problem. The integration and summing process is termed the predictive

function, and the most difficult aspect of this process is the treatment of the correlations among the data errors or the covariant elements of the data error matrices and in setting up the analytical machinery to utilize these errors when provided.

Even at this point, the exact strategy is not fully developed for establishing the systematic problem-dependent feedback in the nuclear data system. It seems clear, however, that this feedback must be provided soon since it is increasingly difficult in project management to specify a priori which data or whether any data needs to be improved. Most of the sensitivity studies to date has been for the DNA nuclides in air and concrete, but the effort is now being extended to include LMFBR shielding and core physics.

C. CTR Research at ORNL (H. Postma)

The current Oak Ridge controlled fusion program includes an experimental effort which focuses on high density plasmas generated in Tokomak configurations. The objective of the chief ORNL experiment, ORMAK, is to study physical scaling laws and confinement laws which govern plasma behavior. In the ORMAK installation plasmas are generated and heated in order to study plasma physics and to obtain the parametric information on confinement and plasma heating. ORMAK is a toroidal geometry confinement configuration in which plasma heating is accomplished by means of a circulating electron current of as much as 250 kiloamps. This current heats a plasma of a density of $\sim 3 \times 10^{13}$ to a temperature of about 400 eV for confinement time of about 20 msec. In contrast, the comparable parameters for a practical fusion reactor is envisaged as a temperature of 10 kilovolts, a plasma density of $\sim 10^{14}$ and a confinement time of about one second. However, important physical principles can be established in studies of plasmas characterized by parameters intermediate between these two limits, e.g. ~ 3 keV, $\sim 3 \times 10^{13}$, and confinement times of the order of 100 msec. Recent Tokomak experiments indicate that scaling applies to much higher temperatures and densities than was previously considered possible.

A central objective of the ORMAK experiments is to study the extent of which "collisionlessness" can be achieved with a contained plasma. The present limit on the mean free path of a circulating plasma results from the cumulative effect of long-range coulombic collisions between ions. Current studies are concentrated on the trapping phenomenon occurring in the Tokomak configuration and appropriate tests of theoretical alternatives. There is a threshold for the trapping problem, and if these difficulties are not encountered at the intermediate physics stage of experimentation, a next generation confinement experiment will be proposed. Current efforts are focused on understanding the relationship between the collisionlessness parameter, ν, and the plasma thermal conductivity. There are two predictions of the relationship between these two parameters, a pessimistic pseudoclassic approximation and a simple classical theory due to Rosenbluth. The ultimate objective is to achieve as low a thermal conductivity as is possible under conditions which minimize the number of plasma collisions. The Rosenbluth theory is the more optimistic appraisal of the relationship between these two quantities. It is hoped as a result of the ORMAK experiment that 1) it will be possible to test between these two alternatives, 2) that the resulting information will permit a decision as to what direction future confinement experiments should take and 3) what cross sections will be necessary for the next phase of CTR development.

In response to committee questions Postma stated that the inner and outer radii of the ORMAK configuration are 23 and 79 cm, the mean confinement field is 25 kg and the electron pulse is 100 sec long. The ion and electron temperatures are not the same. In a Tokomak the electron temperature is three times the ion temperature and this relationship is achieved in the order of microseconds following excitation.

Steiner inquired about the possibility of introducing a D-T gas mixture into the plasma as a means of generating neutrons. Postma replied that about 1% of the energy will go into neutrons resulting in the generation of approximately 10^{14} neutrons over a relatively large

volume. He added that introducing D-T mixtures does not improve the understanding of the physics. Bowman remarked that plasma generation is of interest as an intense neutron source, and that perhaps support for the research could be obtained from appropriate interested groups. Postma replied that he did not believe that such a scheme was competitive with (d, ^{9}Be) neutron generation with charged particle accelerators. As a neutron source, a fifty-million dollar Tokomak would not give a competitive flux.

D. Data Compilation and Evaluation at ORNL (D. Horen)

There are four active nuclear data information centers at Oak Ridge: the CTR Data Center, and Information Center for Internal Exposure, the Radiation Shielding Information Center (RSIC), the Nuclear Data Project (NDP), and the Charged Particle Cross Section Data Center. Horen distributed a description of the activities of the Radiation Shielding Information Center which is included as appendix I. He confined his remarks to the activities of the NDP. The National Information Research Associate Project is scheduled to expire in October of 1975. At that time all mass chains from 45 to 257 should be current to within three to four years. The major problem faced by the NDP is how to keep the data files up to date. A proposal for a three to four year review cycle submitted in 1969 had not been funded. At that time it had been estimated that 14 compilers working 80% of the time on data activities would be required to keep the files updated.

In an effort to increase compilation efficiency, project efforts had been directed to developing computer input formats which the compiler can run through a series of analysis programs to generate a computer data file subject to retrieval. The end product should be a nuclear structure data file of general availability. Another development was the establishment of input formats for all types of nuclear data. However, the primary goal of the project remains to bring the data sheets to a current condition.

Goldstein asked what additional information could be

obtained from the NDP if the available published level structure of a given nucleus in the Nuclear Data Sheets is current to 1968. Horen replied that the project can furnish a post-compilation reference list which is current to within about one month. However, he emphasized that the project could not give a raw data file. Pearlstein inquired whether a counterpart of the USNDC outstanding discrepancies list existed for decay schemes. Horen responded that the project examines decay schemes, searches for the source of the discrepancies, and indicates in the data sheets if unresolved discrepancies remain. McEllistrem noted that the NDP staff does pursue measurers in an attempt to resolve discrepancies, and that they do indicate clearly on the sheets relevant data which is discrepant. He found the response and turn-around time to requests for data by the project to be excellent.

Chrien questioned whether the NDC wanted an outstanding discrepancy list for level schemes and suggested that perhaps the question should be referred to the Basic Science Subcommittee. Horen added that the project is considering a summary form of presentation in which entries would appear on approximately 45 pages per nuclide. A lot of information in the form of comment and backgrounds would be lost, but currency and detail can only be obtained at the expense of completeness. A decision on this question would be made soon.

Kolstad stated that the NIRA program is currently funded at a $900,000.00 level over a three year period. On this basis, an annual $200,000.00 funding increase would probably permit the project to remain up-to-date. Phillips observed that funds were originally raised through the Office of Science Information and Services of the NSF, and that the original agreement stipulated that there would be no renewal. Kolstad continued that the maintenance of the updated data files should be less than the original update cost, and announced, for the record, that $100,000.00 had been included in the FY--74 budget toward meeting the need to keep the nuclear data project up-to-date. Horen replied that the nuclear data project was very happy at this development and that for the

first time in FY--74 the project would be fully funded with the beginning of the fiscal year. In the past, funds had not been available to pay salaries for the full year, and DPR had made up the deficit each year for the previous three years.

V. Indexing, Compilation, and Evaluation

A. CINDA

Goldstein announced that a new edition of CINDA is in preparation. CINDA 73 will go to press shortly, the files having been closed since May 15. Photocomposition of the document would be made in Vienna from the masters forwarded from Saclay. The price in Austrian shillings remains the same, but as a result of devaluation the dollar price would be $15.00. 330 copies had been assigned to the U. S. Goldstein continued that this had been a difficult year because of the transition to a new computer system. The new system should be operational by September. There will be a concomitant change in the CINDA format. In a new mode of blocking all references for a given entry will be included in the same place. Blocking numbers will be associated with each experiment. An entry in each block will give the number of data points and where the data is located. The changes in the format were made in order to aid in the blocking process and to provide increased capabilities for computer retrieval. Goldstein emphasized that CINDA is a desk-top tool and that it is not necessary to utilize a computer. CINDA is linear-access kind of file which implies that a retrieval system appropriate to computers would not necessarily be satisfactory. However, eventual computer retrievals had always been envisaged and the retrieval programs have now been written at Saclay and shortly will be written in the U. S. Typical of the questions which can be asked of the Saclay retrieval system are the following: "What has been published in the fissile elements since 1970? What since the last issue of CINDA? What have certain experimenters reported in these last five years? The main reliance is on published data. For

special uses, computer retrievals are available. At present there are approximately 100,000 entries in CINDA, and of these about 20,000 are second cards replaced by later primary entries. This represents a doubling of the library since 1968.

Last spring, the complete CINDA tape was sent to NNCSC for comparison with BNL-325. Some errors were found, but they were mainly typographical errors. Only a few substantive errors were reported. Whitehead added that the internal blocking numbers will be different on the new edition of CINDA and that a new sorting by laboratory in each nucleus and isotope would be made. The new volume would be available by August and requests for retrievals would be handled through Whitehead at ORNL. In response to a question, he indicated that in Europe literature scans were performed by a network of readers, but that in the U. S. the 30 - 40 scanners for Nuclear Science Abstracts are used.

B. NNCSC

1. CSWEG/ENDF-B

Pearlstein announced that the ENDF/B -- IV would be issued by the end of the year. However, some compromises would be made in order to meet the schedule for the demonstration LMFBR plant. The center would look to DRRD for guidance. Two major tasks forces had taken part in preparation of this file. The first considered the fissile nuclei attempted the best evaluation for ^{235}U emphasizing cross section ratios and also established guidelines for new data sets. New data was considered for the unresolved regions for ^{239}Pu. Guidelines were also established for ^{238}Pu cross sections. The second task force was concerned with fission products. Twenty people participated and formats were established. French efforts to put decay data into the ENDF format will play an important role. 2200m/s cross sections are a problem. The 1969 IAEA review was used and the matter is still under debate in the IAEA. If their judgement proves unsatisfactory a task force may be set up to deal with thermal cross sections.

More generally the center is considering expansion of ENDF formats to include non-neutron type of data, particularly reactions in which the induced particles are not neutrons. In this case, most of the ENDF system can be carried over. Changes will be attempted to include charged particle reactions, neutron source reactions, and reciprocal reactions. Similar advances are occurring in data exchanges among the four data centers. With new format changes two-dimensional or multidimensional data will be tractable without mathematical obstacles. NNCSC is spending a substantial amount of time supporting this work.

2. BNL 325

Work has continued on preparation of the new edition of BNL 325. Volume 1 will contain data on the total cross section and the resonance parameters while Volume 2 will have a lengthy introduction followed by a compilation of recommended parameters and bibliography. Any special comments relevant to particular parameters will be made as appropriate, e.g. the result of analysis by single level or multiple level analysis. The book is intended as a desk-top aid. Users should contact the cross section center directly to obtain all the data used in determining the recommended parameters.

In comparison with the recent compilation prepared by Lawrence Livermore Laboratory the references in BNL 325 would be more complete. Pearlstein noted that the LLL compilation represents a sophisticated use of computer techniques and statistical analysis and the reaction of people to both compilations will be of interest. Preparation of Volume 1 will be complete by July 15, and available in final form by about September 1. Volume 2 should be available sometime during the next fiscal year. Both volumes will be of CINDA size. In response to several questions Pearlstein emphasized that the recommended parameters should be considered a starting point for evaluation, and that in the future the recommended values may be superseded by the ENDF data. In response to Caswell's question regarding the use of the ENDF files in Volume 2, Pearlstein stated that a book of ENDF curves does exist

but that it is not widely distributed and that it does not describe the current state of the data. He finished by emphasizing that the new volume will not be a simple update of the old BNL 325.

Pearlstein also reported that the center was working on programs for the permanent storage and maintenance of the USNDC request list for nuclear data. The list is on tape, and efforts are in progress to compare the taped version with the published list and to provide for updating on a continuing basis.

3. EXFOR

Pearlstein began with a report on the most recent Four-Center Nuclear Data Meeting held in the USSR at Obninsk. The level of activity at the Soviet center is impressive. The staff of 34 is roughly twice that of any western data center. The project has at its disposal a dedicated computer. The new head of the center is Dr. V. Manokhin.

On a related subject, the CSISR system at the NNCSC is completely updated with all of the contents of CSISR I and CSISR II in a single system. A readout format has been developed to increase the utility of the system and a description of the format is available for potential users. Contributors to the system will automatically receive author proofs plus curves of the information submitted. Pearlstein noted that the distribution of BNL 325 will be about 3,000. A new list for BNL 325 distribution has been prepared drawing in part from the distribution list for the center news letter.

4. Nuclear Data Project

Horen announced that a compilation of the figure sheets from the individual A-chains will be published by the Nuclear Data Project in a volume totaling about 700 pages and not numbered in order to permit reuse of the same plates used in preparing individual A-chains. This book of level schemes is intended to serve in the interim for the mass region $A > 44$ until the next issue of the Table of Isotopes is available in 1975. The document is intended mainly for nuclear structure scientists. It should

be understood that approximately 20% of the contents is out of date but limitations on resources did not permit an update prior to early publication. Nuclei below mass 45 were not included since the compilation of Endt and Van Der Leun though available was not directly compatible with the NDP system. The document will not be available as an ORNL report. The cost will be approximately $20.00 and the publication will be in the fall of 1973. Horen added that it will be possible to reproduce the document every two years. Kolstad criticized the NDP document as less readable than the Lederer and Hollander compilation while Caswell noted that the table of isotopes has much less useful imformation. Horen added that the NDP document has been generated for a specialized audience. Goldstein observed that leaving out nuclei with $A < 45$ impaired the usefulness of this document to applied people. Their interests in as much as half the cases is in this area. The additional effort of including such data would have greatly increased the usefulness of the document. Horen replied that the project simply does not have the resources to prepare such a document at this time. However, completeness will be considered in future issues.

Horen continued that the Nuclear Data Project is beginning use of key words in computer retrievals at ORNL. By combining selectors it is possible to do selections to the limit in the key word stream. The detail of the key word system must be limited at some point at which it is appropriate to ask for the data. A new reference list covering charged particle reactions has been incorporated into the recent reference section of the Nuclear Data Sheets. A remote terminal is on order for direct input of key words into the system. With the installation of this terminal the project hopes to be able to accomplish online entry and retrieval.

C. Abramov Proposal - Generalized Nuclear Data Indexing

Whitehead reviewed the Abramov proposal, a translation of which had been distributed to the committee. The proposal is for a generalization of the CINDA index to include other parameters of interest to people in non-neutron fields. Whitehead asserted that there is no

question that the proposal would work and Abramov makes clear the need for such an expansion. Whitehead continued that the CINDA had already to some extent been generalized and as a result of the currently used single-file maintenance program expansion of the parameters covered by the system would be easier than in the past. A partial expansion to include charged particle cross sections could be included. Such a limited parameter expansion could be accomplished with relatively minor expansion of the system dictionary. However, an expansion to new types of parameters would require a major programming effort. The question to be answered is whether the need for such an expansion exists and where the fiscal support for such an effort would be obtained.

Whitehead stated that size, range, and content is a mechanical problem not a problem in concept, and further, a generalized CINDA would eliminate redundant scans currently made by different data centers such as the Photonuclear Data Center at NBS, the Charged Particle Center at ORNL, and the Nuclear Data Project at ORNL. In response to committee questions Whitehead noted that the literature which is scanned for CINDA is a subset of that scanned for Nuclear Science Abstracts as is the scan for the Nuclear Data Project key words.

The Chairman noted that a number of people had contributed written comments on the proposal to the USNDC and that these comments were generally unfavorable. Pearlstein stated that Abramov had taken no further action toward implementing the proposal and that the Soviets wished the first to study efforts such as the photonuclear index. However, the evident Soviet consensus was that they would like to see its eventual implementation.

Goldstein expressed three points of concern. He first noted that CINDA entries should be self-contained and independent of other entries. The decision made regarding CINDA had been sound for neutron data with application orientation. An index for non-neutron areas should be carefully considered because such an expansion does present indexing difficulties. It was Goldstein's conviction that an index for

nuclear structure would be an elaborate and difficult extension of CINDA. Secondly, he expressed concern at the additional task and burden such an expansion would impose on the project. The dictionary can be expanded easily and one can expand the system further to a more universal format, but on the basis of his experience of the past three years he felt that quite possibly such an effort would jeopardize the present operation of CINDA. Finally, he noted that any very large compilation index center must attempt to do a lot of tasks in a universal fashion. This would not be a linear expansion of the CINDA operation. Several recent attempts of this type in recent years have failed, and Goldstein expressed the opinion that small specialized information systems work best.

Jackson suggested that CINDA was in danger of becoming obsolescent. The area of technology at which CINDA is directed is expanding in interest and data beyond strictly neutron-induced reactions is growing in importance. Good examples are photonuclear data and charged particle cross sections. It would seem that to service applied research in the nuclear power area, it would be appropriate to expand the CINDA to include at least these categories. Kolstad questioned whether or not a three-section CINDA index would be appropriate. Such a CINDA could be prepared on a trial basis. Now would be the appropriate time to coordinate the different compilation efforts into a coherent whole. Pearlstein added that a group somewhere should synthesize the three areas. Lind protested that a charged particle index would be ten times greater than the present CINDA. The committee was of the opinion that in the current fiscal climate no funds should be used in a re-organization of CINDA on a large scale. A motion to this effect was adopted with one member opposed and three abstaining, and an action was adopted directing the Chairman in a letter to DPR to express the consensus of the committee that no DPR funds be spent in implementation of the Abramov proposal.

ACTION 10
Chairman

D. Physical Systems of Nuclear Data Evaluation (A. B. Smith)

Smith had four comments on systems of data evaluation

he wished to call to the attention of the committee:

1. A basic and generalized physical evaluation system should be established founded upon the best available contemporary experimental and theoretical knowledge of microscopic nuclear data and specifically not tailored or limited to any particular application area. The scope should be of such breadth as to form the basic evaluated system for all applications needs.

2. Specific applications -- evaluation should be constructed on the basic physical set and as subsets thereof with adjustment as required at the subset or subsequent levels.

3. Research personnel should bear a major responsibility for the formulation of the physical evaluation system, its critical review and its maintenance at a high professional level. This responsibility should be in concert with similar participation on the part of application personnel.

4. The formalism appropriate to a general physical system should be carefully reviewed and established by both research and application oriented personnel so as to assure a long-range capability for proper physical content, utility and ease of usage.

Smith offered two additional comments. First, one of the reasons people never look at evaluated files is because the bookkeeping effort is so great. In the future, formats should be developed which are manageable and simple. Format difficulties are presently a major obstacle to basic understanding and application and to feedback from the user to the evaluator. An additional obstacle to proper evaluation is currently the lack of a single reference repository for experimental nuclear data.

Pearlstein described briefly the genesis of ENDF/B version III and asserted that in the file adjustment processes the differential values were only modified within their errors. He illustrated with a specific example that situations will arise when two independent nuclear data measurements, themselves irreconcilable, can be assessed on the

basis of a later integral experiment which may very well substantiate one over the other. In such cases, it is obvious that the consistent measurement should be used in the ENDF file. Kalos added that such a situation has arisen in connection with gamma ray production cross sections for nitrogen. Feedback from integral experiments can keep evaluation going until the data problem is solved at the differential level. It is important to keep this kind of feedback operative. In its absence such efforts as ENDF/B-IV on thermal reactors will not be able to advance. Kolstad added that he did not see a contradiction between the two expressed points of view. Rather, Smith is addressing long-term interest. Kalos responded that the thrust of Smith's proposal would be to isolate data from the very valuable user feedback. He expressed no objections to application-oriented cross sections, and felt that integral experiments can be very valuable in selecting accurate data. Goldstein added that there are methods of adjustment based on integral experiments as additional input that do not do violence to the original differential data.

Alter emphasized two points. While it is true that integral experiments are used to check the date, files are not distorted to meet the integral experiments. If ENDF files and differential data files are overlapped, one finds good agreement. With regard to the problems of handling data files, Alter suggested that users do not have any choice and must treat data files in a manner appropriate to their own needs. It behooves the user to develop his own procedures. Lide noted that at issue is a consideration of the relative weight to be given to the two points of view expressed. This was really a question for the evaluator. Smith emphasized that he did not believe the committee had addressed the question of whether the data represents a valid physical set. Hemmig responded that CSWEG is really trying to obtain the universal data file Smith wants. The system is not biased to fast reactors as is generally thought, and new basic measurements are the reason for switching from ENDF/III to ENDF/IV. In a sense, Smith

is talking about the same thing. In an interchange between Smith, Stewart and Caswell it was noted that ENDF/III had been used in a comparison with standard cross section data. The Chairman expressed pleasure at hearing that ENDF/III had been used as a standard. He summarized the committee discussion with the observation that the views of Smith and Pearlstein were not very divergent.

E. RENDA

Chrien noted that the schedule for review and publication of RENDA would modify that of the USNDC national review. He summarized the USNDC position on RENDA as follows: The U. S. point of contact for all information necessary for the publication of RENDA should be the Director of the NNCSC. The USNDC will undertake to provide to the NDS, through the NNCSC, adequate status reviews of all U. S. requests which have been provided to the NDS by the NNCSC. The USNDC endorses the one-year time schedule and considers it to be practical in view of the simplified review procedure. The NDC and the INDC are urged to place a continuing action on local data committees to maintain their efforts at culling out needless requests.

The IAEA will send out national sorts about November, 1973, in preparation for publication of RENDA, 1974, on a modified scale as opposed to full reissue. Chrien pointed out that the first question to be answered is whether the USNDC wishes to accept the sort and complete a review by February 1, 1974. Stewart asked what guidelines existed as to size of status comment and whether the comments should be returned in a RENDA format. Kolstad replied that size was a matter left to the local nuclear data sections. Pearlstein replied that the format would be a simple problem and that the NNCSC would attempt to respond in a RENDA format. Kolstad added that the RENDA format was more readable than the current USNDC format. Pearlstein noted that the NNCSC would like guidance on the question of the format. The next edition could be reproduced in the same way as BNL 325.

The Chairman emphasized that the NDC must develop

a mechanism for the 73 review of the U. S. compilation. He noted that we no longer have a disciplinary subcommittee structure. Smith responded that the next review will not be a major one and will involve only an update of the list just issued with a culling out of requests. It was understood that the retrieval of the U. S. list would be distributed to the appropriate new subcommittees in November and the reviews completed by February 1 of 1974. The Chairman emphasized that the data center will be the point of receipt and that the USNDC would be concerned only with the U. S. request list. The NNCSC will issue a retrieval of the previous list and they plan no change in the base which is currently USNDC-6. The resultant USNDC-6 prime will then serve as basis for the response by the NNCSC to the IAEA request for a national review.

Pearlstein noted that the NNCSC should respond to the IAEA with a screened version of USNDC-6 free of weapons requests. The NNCSC will carry out the screening if the guidelines are specified. Kolstad added that we would like to limit the committee action to the U. S. list and leave liaison with IAEA to the NNCSC. The NDC is not qualified in this area. In response to a request by Pearlstein, a new action was adopted directing Moore of LASL to transmit to the NNCSC a screened version of USNDC-6 or instructions as to how to produce one to be submitted to the IAEA.

ACTION 11
Moore

Committee discussion turned to the next full review of the compilation request list. Kolstad pointed out that the review of RENDA and the review of the NDC request compilation could be merged into one process. However, he emphasized that the NDC should concern itself only with the US list and leave the RENDA problem to the NNCSC. The latter is strictly an editorial problem. Kolstad continued that the committee's role in the review would be limited to making comments. Additions or deletions to the list could be made only through the process outlined in the earlier committee discussion under Agenda Item III-C involving the various AEC divisions. Phillips emphasized his understanding that the local data subcommittees would be responsible only to the

national document. The Chairman then restated his request that the schedule for the next NDC request compilation be linked to the next complete RENDA which was scheduled for 1975. This would imply that the new USNDC list would be available by March of 1975, and that national reviews would be completed each year by February or March. Kolstad observed that this would mean that new comments would be required by the previous fall meeting of the NDC or November of 1974 in the case of the next compilation. This would imply the distribution of request retrievals by the NNCSC in the spring of 74, a collation of comments in the fall of 74 followed by distribution of the final list by the NNCSC. Kolstad then inquired if the NNCSC could make the appropriate request sort for distribution to the NDC subcommittees according to the new organizational structure. Chrien anticipated no problem observing that the organizational keying will probably be adequate. The review would be annual and for that reason minimal. He noted that the list would be stored at the NNCSC as a continuing file, and that publication on an annual basis was not required. Bowman disagreed, observing that in his view the difference in effort required for an annual as opposed to a biannual review were minimal. He also questioned whether the list changes rapidly enough to justify an annual review. Hemmig responded that about 50 changes occur per year in reactor requests. He noted that from a user's point of view an update more often than DRDT updates its needs would not make sense. A review about every one to two years presently seems appropriate. Pearlstein stated that the publication of an annual list is so close to the responsibilities of the NNCSC that the expenses incurred would not be a major increment in the center's budget. Pearlstein pointed out that in view of decreased funding, there would be greater dependence on the request list and a yearly review would increase the probability that it would become a significant document. Bowman replied that the present document is not rapidly becoming out of date, requests are not completed in a short time, and a typical measurement required two years. He reiterated

that a review is a big job and that a review every two years would appear more appropriate and more likely to optimize the review efforts.

Steiner noted that the committee benefits from reviewing RENDA, but that in the applied area the NDC subcommittees may perform a redundant service, in as much as the requesters may be more familiar with the status of measurements than the reviewer. Block noted that in the last review, the subcommittees did provide a service to users and Stewart added that coordination of the review with requesters should be made to facilitate compilation of the appropriate cross sections. Hemmig assured the committee that the status comments are a service to the requester and the measurer. He continued that a freeze on schedule for the review would be very useful in as much as it would impel DRRD to "back-trace" its schedule for review in order to furnish and delete requests.

Smith then moved that complete retrievals be available for the subcommittees by the spring of 1974 and that a complete review be submitted to the USNDC for approval by the fall of 74. Alter seconded this motion emphasizing, however, that for the moment the committee should make no firm commitment on an annual schedule. In the subsequent discussion, the Chairman made it clear that it would be the responsibility of the committee to contact the contributing agencies. Kolstad then outlined the specific schedule to be followed in preparation of the next complete review. This schedule, approved, is as follows:

1. September, 1973 --- letter from Chairman to DPR announcing next request review.
2. October, 1973 --- DPR requests that relevant AEC Divisions and Federal Agencies submit requests for the next year's request list.
3. November, 1973 --- AEC Divisions and other Federal agencies solicit requests from their contractors.
4. January, 1974 --- Requests are received by AEC

Divisions and other Federal agencies and are reviewed and subsequently approved by agency advisory bodies.

5. March, 1974 --- Divisions and agencies transmit approved requests to DPR.

6. April, 1974 --- DPR transmits requests to NNCSC.

7. May, 1974 --- NNCSC sorts requests and sends them to appropriate USNDC subcommittees for review.

8. October, 1974 --- Subcommittee reviews are approved by USNDC. Status comments are transmitted to NNCSC.

9. January, 1975 --- Request List published.

10. February, 1975 --- Appropriate requests sent to IAEA for publication in RENDA.

ACTION 12
Chairman

A new action was adopted directing the Chairman in a letter to the AEC to request the formal adoption of the proposed schedule for generation of the next issue of the USNDC request compilation.

VI. Meetings

A. Plans for 4th Conference on Nuclear Cross Section Technology Meeting/International Conference on Nuclear Data/Specialist Meetings

In a memorandum of January 9, Havens had proposed that the U. S. plan an applied nuclear data conference to be held in spring of 1975: "The time and place of the next conference in the series on neutron cross sections and technology should be discussed at the next meeting of the USNDC. The U. S. has held three conferences on neutron cross sections and technology, the first and second being in Washington, March, 1966 and 1968 respectively, and the third being in Knoxville, in March, 1971. The IAEA has held two nuclear data conferences, the first in Paris in October, 1966, and the second in Helsinki in June, 1970. At the last INDC meeting in July, 1972, the committee proposed that a third international nuclear data conference

be held in the United States hosted by either Brookhaven or the National Bureau of Standards and be combined with the U. S. Neutron Cross Section and Technology Conference. The Scientific Advisory Committee (SAC) of the IAEA disapproved of the IAEA holding a nuclear data conference in 1974 probably because it was too close in time and subject matter to the Paris Symposium on Application of Nuclear Data in Science and Technology, 12-16 March, 1973. The International Nuclear Data Conference will therefore be delayed until at least 1975.

..... I suggest that the U. S. plan to hold an "applied nuclear data conference, hosted either by Brookhaven or the National Bureau of Standards, in the spring of 1975 and invite the IAEA to combine their international conference with the U. S. conference."

Havens continued that if the NDC agrees to support the meeting scheduling it for the spring of 1975 would provide an overriding reason for the IAEA to combine their meeting with it. He added that in the past these meetings had been sponsored by the Division of Nuclear Physics of the APS, two divisions of the ANS and NBS. Kolstad inquired about sponsorship from a biomedical organization, and Phillips replied that in his past chairmanship of the DNP he had written several biomedical societies, among them the Physicists in Medicine, and the response had been favorable with the request that they be contacted in the future should the appropriate occasion arise.

With regard to arrangements, Chrien noted that Brookhaven could support a meeting of about 300 during the month of March. Alternate proposals were Gaithersburg under the sponsorship of NBS, or the Shorem Hotel under NBS sponsorship. Kalos then made a motion that the committee adopt Haven's suggestion that the meeting be held at the BNL in March, 1975, and that an invitation be extended to the IAEA to combine the planned European meeting. Several members objected in subsequent discussion to the choice of Brookhaven noting the absence of appropriate areas for large informal discussions. Kolstad emphasized that it is important to decide on a place and date in order to

obtain AEC sponsorship and that in addition the host organization will have to prepare a proposal letter to Tape of the AEC to be forwarded to the IAEA. He suggested that the NDC prepare a specific proposal for the AEC to work with. Lind proposed the amendment to the motion that the place be Washington, D. C. The amendment was adopted, and the amended motion was carried. Caswell was appointed Chairman of the Arrangements Committee and Bowman was specified as his alternate. Caswell was directed to appoint members at his discretion. After subsequent discussion it was decided to appoint Havens as Chairman of the Program Committee and to request that the USNDC subcommittee chairmen serve as the U. S. members of the program committee. Full membership would depend on whether or not the meeting was merged with the planned IAEA conference. A new action was adopted directing the Chairman to write a letter to DPR recommending AEC sponsorship of the Fourth Conference on Nuclear Cross Sections and Technology and suggesting that it be held in Washington, D. C. during March or April of 1975.

ACTION 13
Chairman

B. Other Meetings, Past and Future

1. Panel on Neutron Standard Reference Data, Vienna, November, 1972

No discussion.

2. EANDC, Paris, November 1972

No discussion.

3. Symposium on Applications of Nuclear Data in Science and Technology, Paris, March 1973

Kolstad reported that this meeting had been more successful than expected, that attendance had been sustained at a high level, and that the meeting had met its objectives. A summary by Hjaerne and Schmidt had been distributed to USNDC members. Kolstad noted that an informal meeting of members of the INDC and the IWGNSRD had been held following the symposium. Following a recommendation of this group the IAEA will convene a "X-Centres" meeting at the appropriate

time in the beginning of 1974. The main aim of this and further such meetings will be to develop the necessary mechanism for an efficient international cooperation and exchange of nuclear structure and decay data. Bearing in mind the differences between this field and the neutron data field it will be valuable if the four neutron data centers participate in the meeting in order that their experiences in international data exchange be fully utilized. Commenting on the suggestion of the X-Centre meeting, Horen expressed the opinion that discussion should remain on a very simple level, i.e. should be restricted to indexing systems, and transmission of data by tape. It is important that the group avoid involvement in problems of internal manipulation and formating and emphasize the problems of a transmission of data. Kolstad suggested that the IAEA could act as a post office box for interchange of data. He noted that there has not been much cooperation in the non-neutron data field and that it was an appropriate subject for discussion.

4. Photonuclear Conference, Asilomar, March, 1973

Bowman reported that this meeting had a heavy applications orientation. The meeting had been successful, 450 people attended of which 200 were from foreign countries. There was an unprecedented number of papers, and the meeting ran for five days with three full sessions per day. The large number of attendees made the meeting a particularly effective occasion for communication among workers in the field. The primary objective had been to bring out applications, past, present and potential. Bowman commended the USNDC as a co-sponsor of the proceedings. In response to the Chairman's observation that the application papers had been uneven, Bowman agreed that this was the case, and that it served the purpose of laying some areas to rest and focusing interest on the new and important emerging areas.

5. Conference on Neutron Physics, Kiev, May 28, 1973

Pearlstein reported that the conference had been a very valuable experience. The translation service had been excellent, and

an extension bulletin from Obninsk on this year's conference is already available. Pearlstein requested a response from the USNDC to the question of whether the Kiev proceedings should be translated. Block responded that a list of titles might be appropriate. Jackson reported that he had received the original Russian version of the proceedings of the previous Kiev conference and had found them quite useful because of the english abstracts which accompanied most of the contributions. In most cases the abstract plus an inspection of the tables and figures provided sufficient information to assess the significance of the paper. Horen noted that the NDP routinely keywords the proceedings of the USSR All Union Conference on Nuclear Structure. The NDP usually finds that this, plus examination of the data in tables, proves sufficient for the user. Horen also stated that the communication with the Soviets had increased significantly since his attendance at the Kiev Conference in 1970. The Chairman suggested that BNL might provide a keyword summary of documents pertaining to the neutron data conferences.

6. 4-Center Meeting, Moscow, June 6-7, 1973

No discussion.

7. WINS, May 30, 1973

This meeting had been organized by the scientific staff of the HFIR and HFBR reactors. The predominant interest came from researchers in solid state studies and biological research. The purpose of the conference had been to determine the need for a next-generation intense neutron source and what mechanism should be developed for planning and constructing the source. The meeting was attended by 50 to 60 people and a conference summary will be issued and distributed to NDC members. An ongoing study group had been formed to prepare a proposal. A dichotomy of opinion split between an intense pulsed neutron source and the virtues of a steady state source energed from the conference discussion. This issue remained unresolved.

8. International Conference on Ion-Beam Surface Layer Analysis, Yorktown Heights, June 18-20, 1973

No discussion.

9. Society for Nuclear Medicine, Miami, June 12-15, 1973

This subject had been discussed under Agenda Item III-A.

10. 3rd Symposium on Physics and Chemistry of Fission, Rochester, August 13-17, 1973

A tentative program of the conference was read. There was no comment.

11. International Conference on Nuclear Physics, Munich, August 1973

No discussion.

12. EANDC Meeting, March 25-30, 1973

Kolstad announced that the next EANDC meeting would be held in March of 1974, in Tokyo, and that in connection with the meeting a topical discussion meeting would be held with the theme, "Critique of Nuclear Models and Their Validity in the Evaluation of Nuclear Data." A request for titles and abstracts of contribution to the topical discussion had already been distributed by Fuketa of the Japanese Atomic Energy Institute. The Chairman noted that the NNCSC would probably contribute several papers.

VII. Special Reviews and Future Plans

A. Low Energy Neutrons in Fast Critical Assemblies from the $(n,\gamma n')$ Reaction

Fricke and Neill have recently reported evidence for the $(n,\gamma n')$ reaction from experimental data on the neutron spectra of fast critical assemblies. In a memorandum of March 19, Batt proposed an experiment to confirm the existence of the reaction and to measure approximately its cross section. The proposed experiment involves measuring the time-of-flight spectrum of secondary neutrons in coincidence with the soft precursor gamma ray. Pearlstein added that the memorandum had not been so much a proposal as an indication of

the existence of the problem. Block stated that in his opinion it was a difficult experiment characterized by low counting rate. He noted that the characteristic resonance structure in the neutron spectrum which would be expected as a signature of the process would be shifted in energy by the kinematic effects of the intermediate gamma ray emission. He felt it would be more reasonable simply to search for a soft neutron continuum. Havens added that the normal $(n,\gamma n')$ process would result in a neutron spectrum characterized by very sharp neutron groups while the process in question should produce a broad spectrum. Stewart added that the theoretical effect is extremely small relative to the normal capture process. Pearlstein questioned whether the threshold photoneutron technique could be applied to the problem, Jackson responded that the process in question is a very small effect relative to the normal (γ,n) reaction and would be almost impossible to isolate relative to the direct (γ,n) neutron groups. Hemmig pointed out that the cross section according to Fricke and Neill is sufficiently large to give rise to an observable effect.

Bowman announced that an evaluation is in progress at NBS and that an experiment involving the use of a neutron beam Sc filter is being considered. Preliminary calculations suggest that resonance structure characteristic of ^{238}U should be observable. Motz announced that the LASL group planned to look at a very clean sample of ^{238}U in an attempt to isolate a continuum component in the Ge(Li) spectrum after analysis of the line structure.

B. New Directions for NNCSC

In a draft document entitled, "New Directions for NNCSC," dated May, 1973, an expansion of the scope of activities of the NNCSC to include technologies related to those presently serviced had been discussed. The memorandum suggested that other areas where the center's special talents could be fruitfully applied include: fusion, safeguards, trace elements analysis, medical physics, nucleo-synthesis, and Plowshare. Such an expansion would take advantage of the center's

expertise in data compilation and evaluation; its dedicated facilities including a computer and related data center resources; and its experience in convening data producer, evaluator and user groups. This document had been distributed to members of the NDC. The Chairman requested committee comments. Alter suggested that the center should consider non-neutron data and that it was important that the center become a focal point for such discussions. In noting the increasing importance of non-neutron data, Stewart observed that many evaluators use charged particle experiments in evaluating neutron-induced reaction data. Kolstad observed that the CSWEG program is oriented towards programmatic needs while the NNCSC is discipline-oriented. It is appropriate for the latter to continue to explore ways to meet the needs of the AEC programs. He noted that the NDP would continue to service the basic science community. Pearlstein responded that the center is definitely not program-oriented.

Horen noted that the ORNL data centers do indirectly and in some cases directly service applied programs. The RSIC is receiving funds from the society of medicine to service a medical area, the IID plans to reformulate the Nulcear Data Sheets to meet biomedical needs. He emphasized that someone must take an overview in evaluating the basic and applied needs for nuclear data. The central question is how much effort should go into an extensive compilation and evaluation program before assessing long-term needs. Kolstad agreed that the NDP does service nuclear data needs and he noted that a somewhat analogous situation exists at BNL where the CSWEG at BNL could be expanded to become a powerful tool for focusing center efforts in applied areas. Steiner suggested that it is the work of the USNDC to decide how to provide nuclear data to the various user groups.

Goldstein offered a note of caution, observing that such expansions in scope reflect a syndrome -- the flight from neutron data work in order to find new fields to conquer. He observed that this is parodoxical for it comes at a time when the need for neutron data is

greater than it has been since the earliest days. Calculational tools now exist, sensitivity tests such as were described earlier in the meeting, which have generated a valid need for such data. These developments have been sparked by the funding agencies. He offered a caveat in the form of a request that any expansion of NNCSC activities not be done at the expense of the neutron-related effort.

Peelle stated that needs depend upon the customer and that the center should be cautious in such an expansion. It is important to be sure that the method used is appropriate to the new application. Chrien stated that there had been no intent to down-grade neutron work. The origin of the document had been a suggestion by Dannels that the organization continue to review its procedures and goals. He suggested that the caveat of Goldstein be incorporated into the new directions document. Hemmig added that an expansion would require coordination and funding. The question of what agencies should sponsor such an effort will become a problem. Pearlstein added that the center can be ambitious and that the neutron physics effort was perhaps the most ambitious effort in the nuclear data area. It is the only one which has kept up with both compilation and evaluation, and it has been with the help of the funding agencies that the evaluation has been accomplished. The total effort in neutron data has been a united effort and any expansion would be approached in the same manner.

C. Effectiveness of USNDC -- A Proposed National Nuclear Data Measurement Program

In a memo entitles, A Proposed National Nuclear Cross Section Measurement Program, Lowell Wood and Thomas Weaver had expressed the point of view that "systematic nuclear data measurement and collection, while of fundamental importance to reactor technology advance, has seemingly been pursued both on an inadequate scale and often in a relatively inefficient or ineffective manner." In discussing the USNDC and its Cross Section Request List the authors observed, "A good measure of the effectiveness of the procedure is that of the

reactions given the highest priority rating, only about five percent have been measured since their request, and often this is the result of coincident activity in the scientific community. A member of the CTR subcommittee of the USNDC recently ventured that a USNDC recommendation has never actually hurt in obtaining funding for or acquiring a cross section measurement, but the subcommittee was unable to cite evidence that it helped significantly." The authors then outlined a national nuclear cross section measurement program which they feel would meet the needs of firm AEC program requirements in both fission and fusion. energy production.

Anderson stated that the opinions expressed in the proposal represented those of the authors and further that the only analogy he could observe to the proposed program is the NIRA project. Phillips expressed disagreement with the statement that only five percent of the requests had been measured since their issue. At least six percent had been measured in the last two years. Block added that in many cases the accuracy requested is simply beyond present experimental capability, and for that reason such requests remain on the list. Jackson stated that he did not believe the major premise of the proposal was true. He noted that in the area of CTR there was a great deal of confusion and inconsistency about what the data needs of the program are. He stated that at the last NDC meeting it had been decided that no priority could be assigned to requests from the CTR program and it had been stated that at the present time the program does not have the computational capability for using much of the data requested. He observed further that the present decrease in programmatic support of data procurement is inconsistent with the opinion of Wood and Weaver that major data needs are not being met. Kalos suggested that the committee should welcome the spirit which desires a richer data program and that the NDC should reply to the wilder exaggerations in the proposal in a constructive manner. In response to a suggestion of Kolstad, a new action was adopted directing the Chairman to draft a reply to the Wood-Weaver proposal for a national nuclear cross

ACTION 14
Chairman

section measurement program and to circulate the document to the USNDC for comment. Kolstad suggested that the reply be directed to Teem of DPR with copies to Gough of DCTR. Phillips added that to insure the effectiveness of the letter, it should be friendly in tone.

VIII. Formulation of Recommendations

The formulation of a recommendation to the DPR request for a statement of policy for nuclear data procurement for the applied energy program is included in these minutes under Agenda Item II-B.

Time did not permit a discussion of a proposal by the Secretary in response to Action 27 of the previous USNDC meeting to investigate the feasibility of a general indexing of the status report according to discipline and application. However, the Chairman noted that several actions had been adopted during the NDC discussion directing the subcommittees to consider the proper procedures and content for the status reports. In view of these actions it would be appropriate to defer discussion of indexing until the next meeting. Lind requested that the subcommittees consider whether status reports are needed for the USNDC meeting for whether they were more important as a means of communication to the various laboratories. He suggested it might be more efficient to forward contributions directly to the Secretary without distribution as presently required.

Kolstad noted that the various NDC subcommittees, particularly the Standards and Isotopes Subcommittees should receive input from NDC members in order to assess needs in their areas of responsibility. At his suggestion a new action was adopted directing subcommittee chairmen in consultation with respective subcommittees to develop a statement of needs in their areas of responsibility for standards cross section data and isotopically enriched targets to be forwarded to the chairmen of the standards and isotopes subcommittees.

ACTION 15
Subcommittee Chairmen

On behalf of the full USNDC Kolstad expressed a "vote of thanks" to Chrien for a job as Chairman well done. He announced

that the new officers for the next two years would be Jackson, who would serve as Chairman, and Bowman, who would serve as Secretary.

In a brief discussion of the time and place of the next USNDC meeting, it was suggested that a future meeting should be held at one of the universities represented on the committee. However, it was tentatively agreed that the next meeting would be held at Argonne National Laboratory, probably some time in November.

APPENDIX A

ACTION ITEMS

Action 1 USNDC 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 the recommendations of the USNDC subcommittees.
Action 3 Isotope Subcommittee Chairman	Collect and organize a list of elemental inventories and their location and forward to the Secretary for inclusion in the technical minutes of USNDC meetings.
Action 4 Perey	Complete with L. Love a reassessment of calutron unit costs under full computer operation and report the results at the next committee meeting.
Action 5 Secretary	Advise G. Rogosa of the USNDC members suggestion that unprocessed calutron material be included in the next R.M.C. inventory.
Action 6 Subcommittee Chairmen	Forward to the USNDC Chairman suggestions for short reviews of programs supported by AEC contract appropriate for presentation at future NDC meetings.

APPENDIX A

ACTION ITEMS (Continued)

Action 7 Anderson	Distribute to USNDC members the Atlas of Photoneutron Cross Sections obtained with Monoenergetic Photons, UCRL - 74622.
Action 8 Secretary	Include in future requests for contributions to the USNDC Status Reports the document number for the forthcoming issue.
Action 9 Subcommittee Chairmen	In consultation with Subcommittee Members prepare a brief statement of guidelines to be followed in collecting contributions to the Status Reports submitted to the USNDC.
Action 10 Chairman	In a letter to DPR, express the concensus of the committee that no DPR funds be spend in implementation of the Abramov proposal.
Action 11 Moore	Transmit to the NNCSC a screened version of USNDC-6 or instructions as to what changes are appropriate for response to the national review of RENDA.
Action 12 Chairman	In a letter to the AEC request the formal adoption of the proposed schedule for generation of the next issue of the USNDC Request Compilation.
Action 13 Chairman	Write a letter to DPR recommending AEC sponsorship of the 4th Conference of Nuclear Cross Section and Technology and suggesting that it be held in Washington, D. C. during March or April of 1975.

APPENDIX A

ACTION ITEMS (Continued)

Action 14 Chairman	Draft a reply to the Wood-Weaver proposal for a National Nuclear Cross Section Measurement Program and circulate to the USNDC for comment.
Action 15 Subcommittee Chairmen	In consultation with respective subcommittees develop a statement of needs in their areas of responsibility for standards cross section data and enriched isotopes to be forwarded to Chairmen of the Isotopes and Standards Subcommittees.

APPENDIX B

March 26, 1973

Dr. George A. Kolstad
Assistant Director for Physics and
Mathematics Programs
Division of Physical Research
United States Atomic Energy Commission
Washington, D.C. 20545

Dear George:

This letter is a response to Action No. 19 referred to in your memorandum of August 27, 1972.

I distributed the list, Reactions of High Priority, given in INDC (NDS)-47L to several people for comment and as you might expect comment was forthcoming. With few specific reservations, I will discuss those later, the list was favorably received. Generally reviewer comments were of the following: list is too short (I Note in the introduction to INDC (NDS)-47/L, a statement indicating a second list of reactions would be published in the near future); reactions are restricted to fission reactor application, (this is a good point and should be explored further, however I note that the list of reactions is for reactor radiation measurements); and finally a few chauvinistic comments about if it's good enough for inclusion in ENDF/B, it should be good enough for the IWGRRM (oh well, I did ask for comment).

Now to specifics, there were several negative comments about the utility of the $^{58}Ni(n,\alpha)^{55}Fe$ reaction. While this reaction was felt to be potentially useful, the reviewers state that routine use of the reaction was impractical. Specifically, the use of this reaction requires the counting of iron x-rays. This implies chemical separation and x-ray counting, the combination of which turns out to be too difficult to use routinely. The usefulness of the reaction $^{103}Rh(n,n')$ was questioned because of its short half life. Another comment suggested separating the list into primary and secondary standards. This seems like a reasonable approach to me, however, I foresee the need for considerable interaction prior to achieving the separate lists.

APPENDIX B

Dr. George A. Kolstad
Page 2

There were a number of suggestions concerning increasing the number of reactions. I include these for completeness only (I also include a listing of ENDF/B accepted or to be accepted reactions for the same reason) since it would be unfair to attack the number of reactions prior to reviewing the second list which will be available shortly. The various reaction sets are given separately.

Finally, I would like to consider the question of the application of the IWGRRM list of reactions. As stated in INDC (NDS)-47/L these reactions represent cross section data for reactor radiation measurements. One of the reviewers was unhappy and suggested the addition of reactions more appropriate to his application. Again, let me say that these comments do not bear directly on the Action, however I feel you should at least be aware of them. The reviewer suggests the addition of the reaction $^{58}Ni(n,np)^{57}Co$ which could be used to detect neutrons >8.3 Mev. His requirements involve the extension of dosimetry methods to characterize neutrons up to ~100 Mev which are produced at the LAMPF beam stop and the WNR. While it is not clear that such reactions are required for internal scope, I think it is worth bringing his comments to your attention.

I believe that this letter along with the enclosed lists of reactions satisfies Action No. 19.

Sincerely yours,

Harry Alter

cc: W/encl: Dr. R. E. Chrien, Chairman
USNDC, BNL

APPENDIX B

INDC(NDS) 47/L	SUGGESTED DELETIONS	SUGGESTED ADDITIONS	CURRENT ENDF/B DOSIMETRY FILE
$Li^{6}(n,\alpha)$*		$Na^{23}(n,\gamma)$[a]	$U^{238}(n,f)$
$Co^{59}(n,\gamma)$		$Sc^{45}(n,\gamma)$[a]	$B^{10}(n,\alpha)$
$Au^{197}(n,\gamma)$*		$Ti^{46}(n,p)$[b]	$Al^{27}(n,\alpha)$
$U^{235}(n,f)$ + $Pu^{239}(n,f)$*		$Ti^{47}(n,p)$[b]	$Ti^{46}(n,p)$
$U^{238}(n,\gamma)$*		$Ti^{48}(n,p)$[b]	$Co^{59}(n,\alpha)$
$Al^{27}(n,p)$*		$Mn^{55}(n,\gamma)$	$S^{32}(n,p)$
$Fe^{54}(n,p)$		$Mn^{55}(n,2n)$[a]	$Ti^{47}(n,p)$
$Ni^{58}(n,p)$		$Fe^{58}(n,\gamma)$[a]	$Ti^{48}(n,np)$
$Ni^{58}(n,\alpha)$	$Ni^{58}(n,\alpha)$	$Ni^{58}(n,np)$[c]	$Ti^{48}(n,p)$
$Cu^{63}(n,\alpha)$*		$Cu^{63}(n,\gamma)$[a]	$Fe^{56}(n,p)$
$Nb^{93}(n,n')$		$Ag^{109}(n,\gamma)$[e]	$Cu^{63}(n,\gamma)$
$Rh^{103}(n,n')$		$In^{115}(n,\gamma)$[a]	$Cu^{65}(n,2n)$
$In^{115}(n,n')$*		$I^{127}(n,2n)$[b]	$I^{127}(n,2n)$
$Th^{232}(n,f)$*		$Au^{197}(n,2n)$[d]	$Th^{232}(n,\gamma)$
$U^{238}(n,f)$*		$Th^{232}(n,\gamma)$[a]	
$Np^{237}(n,f)$			

* On current ENDF/B Dosimetry File

[a] Reactions useful for measuring thermal and resonance flux for short irradiation periods

[b] Reactions useful for measuring fast reactor fluxes

[c] Useful for detecting neutrons with energies > 8.3 MeV

[d] Useful for CTR type neutron spectra measurements

[e] Useful for resonance region neutron flux measurements

APPENDIX B

A comparison of this list of dosimetry application reactions with the request list for measurements revealed that there are no measurement requests for the following:

16 $S^{32}(n,p)$	45 $Rh^{103}(n,n')$
22 $Ti^{48}(n,np)$	49 $In^{115}(n,n')$
25 $Mn^{55}(n,2n)$	53 $I^{127}(n,2n)$
27 $Co^{59}(n,\alpha)$	79 $Au^{197}(n,2n)$
28 $Ni^{58}(n,np)$	90 $Th^{232}(n,f)$

If these reactions are truly important to dosimetry application, they should be added to the request list in appropriate places. I do not believe that the energy dependent cross sections for the above reactions are known to required accuracy, 10% or better.

APPENDIX C

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

MAY 9 1973

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Chairman Ray
Commissioner Ramey
Commissioner Larson
Commissioner Doub

THRU: General Manager RHJ 5/9/73

ESTABLISHMENT AND CHARTERING OF U.S. NUCLEAR DATA COMMITTEE (USNDC) AS AN ADVISORY COMMITTEE

We hereby request the Commission to continue the U.S. Nuclear Data Committee (USNDC) and to establish it as an advisory committee pursuant to section 161a of the Atomic Energy Act; determine that such establishment is in the public interest in connection with the performance of duties imposed on AEC by law, and concur in the selection of the membership listed in Attachment "A".

The USNDC evolved from a series of predecessors, starting with the Neutron Cross Section Advisory Committee in 1948. It is concerned with all nuclear data relevant to basic nuclear science and to the applied activities of the U.S. nuclear program (i.e., measurements, evaluation, instruments, standards, target materials, measurement techniques, nomenclature, compilations, conferences and other methods for information exchange). It interfaces with other Government agencies, professional societies, and other groups or committees, both foreign and domestic (e.g., the European-American Nuclear Data Committee and the International Nuclear Data Committee, both of which the U.S. supports).

Operating under the auspices of the Division of Physical Research, in consultation with other participating Federal agencies, membership is drawn from AEC staff, AEC contractors, and other participating Federal agencies (National Bureau of Standards, Department of Defense, National Science Foundation) and their contractors or grantees. The Committee provides long and short range guidance for the conduct of the U.S. nuclear data program by rendering advice and recommendations to the scientific community and to Federal agencies. In addition, the organizations represented on the Committee often implement Committee recommendations on their own initiative. Within AEC,

APPENDIX C

the USNDC serves the nuclear data interests of the following programs: Divisions of Physical Research, Reactor Development & Technology, Military Applications, Naval Reactors, Biomedical & Environmental Research, Applied Technology, Controlled Thermonuclear Research, Nuclear Materials Security, and the Office of the Director of Regulation.

Passage of the Federal Advisory Committee Act of 1972 has caused us to reexamine the question of continuing the USNDC without formally establishing it as an advisory committee. Staff has concluded that formal establishment as an advisory committee is necessary in view of the definition of "advisory committee" contained in the Advisory Committee Act and the implementing regulations of OMB and AEC. In our judgment, continuation of the USNDC is essential to the effective conduct of the AEC's applied nuclear data measurement efforts. Its operation should not be seriously impaired by the administrative requirements of the Act and we envisage that only a small portion of most meetings will require executive sessions closed to the public (e.g., discussion of advance budgetary information, review of proposals, classified or proprietary briefings).

The functions of the USNDC are spelled out in more detail in Attachment "B". The proposed charter is enclosed as Attachment "C".

The Divisions listed in paragraph 3 and the Office of the Director of Regulation have indicated that they find the Committee helpful to the conduct of their assigned functions. The Division of Personnel and the Office of the General Counsel concur in this memorandum.

John M. Teem

John M. Teem, Director
Division of Physical Research

Enclosures:
1. USNDC Membership - Attachment A
2. Terms of Reference for USNDC - Attachment B
3. Proposed Charter - Attachment C

MEMBERSHIP OF THE U.S. NUCLEAR DATA COMMITTEE (USNDC) - May 1, 1973-February 1, 1975

MEMBERS OF PARENT COMMITTEE

Robert E. Chrien, BNL, Chrm.
Harold E. Jackson, ANL, Sec.
Harry Alter, AI
John D. Anderson, LLL
Robert C. Block, RPI
Charles D. Bowman, NBS
Randall S. Caswell, NBS
Herman Feshbach, MIT
Herbert Goldstein, Columbia U.
John R. Huizenga, U. of Rochester
Malvin H. Kalos, DOD (NYU)
David A. Lind, U. of Colorado
Michael S. Moore, LASL
Henry W. Newson, Duke U.
Francis G. J. Perey, ORNL
Gerald C. Phillips, Rice U.
James S. Robertson, BNL
Edward M. Smith, U. of Miami
Donald Steiner, ORNL

EX-OFFICIO MEMBERS OF PARENT COM.

William Bartels, AEC (NUMS)
William C. Gough, AEC (DCTR)
William W. Havens, Jr., Columbia U.
Philip B. Hemmig, AEC (DRDT)
Daniel J. Horen, ORNL (NDP)
David R. Lide, Jr., NBS
S. Pearlstein, BNL (NNCSC)
William S. Rodney, NSF
Alan B. Smith, ANL
Richard F. Taschek, LASL
A. R. Van Dyken, AEC (DPR)
Robert W. Wood, AEC (DBER)
* George A. Kolstad, AEC (DPR)
** George L. Rogosa, AEC (DPR)

ALTERNATES

J. B. Ball, ORNL (for Dr. Horen)
G. T. Garvey, NSF (for Dr. Rodney)
L. Gevantman, NBS (for Dr. Lide)
Dean C. Kaul, USAF (for Dr. Kalos)
L. Price, AEC (DSNS) (for W. Gough)
R. W. Hockenbury, RPI (for R. Block)

SUBCOMMITTEES

Neutron Data Applications

A. B. Smith, ANL, Chrm.
H. Alter, AI
D. Barr, LASL
R. C. Block, RPI
C. D. Bowman, NBS
J. C. Brown, LLL
R. E. Chrien, BNL
W. G. Davey, ANL
M. P. Fricke, SA., Inc.
D. Gardner, LLL
H. Goldstein, Columbia U.
W. W. Havens, Columbia U.
J. R. Huizenga, U. of Rochester
H. E. Jackson, ANL
M. H. Kalos, DOD (NYU)
R. L. Macklin, ORNL
M. S. Moore, LASL
F. G. J. Perey, ORNL
D. L. Smith, ANL
* P. B. Hemmig, AEC (DRDT)
** R. B. Schwartz, NBS

Standards

* R. S. Caswell, NBS, Chrm.
W. W. Havens, Columbia U.
B. Leonard, PNL
W. Poenitz, ANL
L. Stewart, LASL

Basic Science

D. A. Lind, U. of Colo., Chrm.
B. L. Berman, LLL
C. D. Bowman, NBS
R. E. Chrien, BNL
D. Cochran, LASL
H. Feshbach, MIT
E. G. Fuller, NBS
B. Harvey, LBL
H. W. Newson, Duke U.
L. Northcliffe, Texas A&M
G. C. Phillips, Rice U.
P. Stelson, ORNL
H. Wegner, BNL
* G. L. Rogosa, AEC (DPR)
** W. S. Rodney, NSF

Nuclear Data for Materials Analysis, Safeguards and Environmental Matters

D. J. Horen, ORNL, Chrm.
T. Cahill, U. of Cal., Davis
G. Gordon, U. of Maryland
J. Mayer, Cal. Tech.
F. McGowan, ORNL
* A. Landgrebe, AEC (DPR)

Controlled Thermonuclear Research

D. Steiner, ORNL, Chrm.
C. F. Barnett, ORNL
D. Dudziak, LASL
H. Goldstein, Columbia U.
R. Haight, LLL
V. Orphan, GRT
L. Stewart, LASL
* W. Gough, AEC (CTR)

Biomedical Applications

J. S. Robertson, BNL, Chrm.
R. S. Caswell, NBS
J. Laughlin, Memorial Hosp., N.Y.
M. Lederer, LBL
R. J. Shalek, M.D. Anderson Hosp., Houston
E. M. Smith, U. of Miami
* R. W. Wood, AEC (DBER)

Separated Isotopes

F. Perey, ORNL, Chrm.
W. M. Good, ORNL
H. W. Newson, TUNL
R. C. Block, RPI
G. A. Cowan, LASL
E. M. Smith, U. of Miami
* G. L. Rogosa, AEC (DPR)

---

* "designated Federal employee"
** alternate "designated Federal employee"

ATTACHMENT A

APPENDIX C

TERMS OF REFERENCE FOR THE U.S. NUCLEAR DATA COMMITTEE

Consistent with the Atomic Energy Act of 1954, as amended, and the administrative policies and procedures of the Atomic Energy Commission (hereinafter referred to as AEC), there is established under the auspices of the Director of Physical Research of the AEC a Nuclear Data Committee (hereinafter referred to as the Committee), in order to assure maximum acquisition, expansion, and dissemination of nuclear data of general relevance to the U.S. nuclear program. Other Federal agencies shall be invited to participate in those activities of the Committee that fall within their interest and responsibility. The Committee shall have the following operational guidelines:

I. Scope

A. The Committee shall be concerned with all basic nuclear data, including but not limited to the measurement of nuclear cross sections and other nuclear data which are generally relevant to basic nuclear science and the applied activities of the U.S. nuclear program, and such cooperative international nuclear data activities in which the governmental agencies participating in the USNDC may from time to time become involved, the development of laboratory instruments, target materials and techniques related thereto and the compilation, evaluation and dissemination of such data.

ATTACHMENT "B"

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B. The responsibilities of the Committee include the following:

1. Measurements: Critical and continuous review of the existing state of knowledge of cross sections and other nuclear data and the requests for measurements of such nuclear data originating in the U.S. nuclear program. It shall establish priorities regarding the measurements most urgently needed stating how in the opinion of the Committee they may be most expeditiously obtained. The Committee shall also make suggestions and recommendations concerning those nuclear data measurements which should be included in short and long range planning for the U.S. nuclear data program.

2. Equipment and Techniques: Review the facilities, techniques and manpower available for the determination of nuclear data and consider present and future needs for techniques, equipment, research materials and facilities.

3. Research Materials: Keep the AEC Division of Physical Research informed of special materials required for research and make suggestions and recommendations regarding the procurement, handling and disposition of such samples.

4. Compilation and Evaluation of Nuclear Data: Critical and continuous review of the scope, manpower, facilities and techniques available for the compilation, evaluation and dissemination of nuclear data, consideration of present and future needs for such activities and appropriate suggestions and recommendations on the requirements for such

APPENDIX C

compilation and evaluation activities for nuclear data in all fields of science and technology.

5. Nomenclature: Continuous studies of the nomenclature used in this field and suggestions for appropriate methods of presentation of nuclear data and constants.

6. Technical Meetings: From time to time, in connection with its meetings, or at other occasions, the Committee will hold, or assist in the sponsorship of, specialized technical meetings or symposia.

7. Review of Proposals: Review and comment on proposals or such other matters of concern to the AEC or other Federal agencies as may be requested by the appropriate Federal agency member of the Parent Committee.

8. Liaison with Other U.S. Committees and Agencies: Establishment and maintenance of effective liaison with other U.S. Committees and Agencies in similar and over-lapping areas of interest through the Division of Physical Research of the AEC.

9. Liaison with Professional Societies, International Committees, Organizations or Groups: Keeping informed of the activities of interested professional societies, international committees, organizations or groups and providing appropriate assistance to USNDC participants actively involved in cooperative efforts in this field, working with or through, as appropriate, the AEC, or other Federal agencies in areas of mutual concern.

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II. Limitations

The Committee shall carry out its responsibilities consistent with the Atomic Energy Act of 1954, as amended, and the administrative policies and procedures of the AEC as they may be amended from time to time.

The Committee shall look to the Director of Physical Research of the AEC for such interpretation of the administrative policies and procedures as may be required.

III. Membership

The full Committee shall consist of a Parent Committee and its officially approved Subcommittees. The parent committee shall consist of no more than 20 members, designated by the Director of Physical Research of the U.S. Atomic Energy Commission in consultation with other participating Federal agencies, from AEC contractors and other Federal agencies and their contractors or grantees having a major interest in this field. Only technically trained individuals, preferably with broad responsibilities for the direction of the relevant program in their respective organizations, shall be designated. Selections shall be made in such a way as to provide reasonable continuity of membership and technical balance. In addition, ex-officio members shall be designated as appropriate. Such ex-officio members shall serve with particular reference to the reasons for their designation and shall not be assigned duties normally expected of members. Subcommittees may be designated from time to time by the Chairman, with the advice and consent of the Committee, and must include at least one member of the parent NDC and one Federal employee (the latter may be designated ex-officio and will require AEC approval).

APPENDIX C

IV. Chairman and Secretary

Except as otherwise specified in AEC regulations (10 CFR, part 7), the executive functions of the Committee shall be vested in the Chairman who shall hold office for a two-year term. The term of the Secretary shall coincide with that of the Chairman.

V. Meetings

Meetings of the Parent NDC and each subcommittee shall be held at least two times a year, generally in or adjacent to one of the laboratories conducting major activities in this field in the U.S. Although the bulk of the USNDC meetings, and those of its subcommittees, will be open to the public, provisions may be made in advance for executive sessions and for classified meetings where appropriate. All meetings will require advance AEC approval and the presence of a "designated Federal official" as specified in AEC regulations (10 CFR, part 7). The host organization may appoint a "Local Secretary" to assure appropriate arrangements for the meetings. A notice of the meeting and draft agenda shall be sent so as to be received by the members of the Parent Committee or Subcommittee at least forty (40) days in advance of the meeting, and will be published in the Federal Register at least seven (7) days in advance of the meeting. The final form of the agenda shall be concurred in prior to each meeting by the "designated Federal official" or his alternate. Documents for meetings should normally be sent so as to be received by the members of the Parent Committee or Subcommittee at least two weeks before meetings. Observers may be invited, with concurrence of the Chairman, to attend all or part of meetings of the Parent Committee or Subcommittees.

APPENDIX C

VI. Implementation of Committee's Comments and Conclusions

To the extent appropriate and feasible within existing programs, the individual members of the Parent Committee and Subcommittees should take the initiative to implement the Committee's suggestions, evaluations, and comments within their own organizations. In the event that an implementation requires a centralized or Federal agency action, the Parent Committee shall so inform the AEC Director of Physical Research.

VII. Minutes, Reports and Committee File

Minutes of each meeting of the Parent NDC and each Subcommittee shall be drafted by its Secretary and certified to by its chairman in accordance with Section 10c. of the Federal Advisory Committee Act, and an appropriate unclassified version provided which also will be publicly available. The Parent Committee shall issue appropriate scientific or technical reports and documents, consecutively numbered, assigned by the AEC to a distribution approved by AEC, in consultation with other participating and/or interested Federal agencies, which shall in all cases include the AEC and other participating Federal agencies. A continuing file of the Parent Committee shall be kept by the Chairman and by the Secretary for this purpose. In addition, the AEC shall be provided with copies of all correspondence between the Parent Committee and other committees, organizations or groups, domestic or international. The Chairman shall submit a report to the AEC Director of Physical Research on the activities of the full Committee at the termination of his term of office. Subcommittee reports will be issued only to the Parent Committee which may modify the report and authorize further distribution if deemed appropriate.

APPENDIX C

VIII. Amendments

These Terms of Reference may be modified or amended from time to time by the AEC Director of Physical Research. Recommendations for modifications or amendments may be made by the Chairman of the Committee to the Director of Physical Research of the U.S. Atomic Energy Commission upon approval of a majority of the members of the parent Committee. Modifications or amendments shall come into force on written notification to the Committee by the AEC Director of Physical Research.

APPENDIX C

UNITED STATES ATOMIC ENERGY COMMISSION
STANDARD CHARTER FOR AEC ADVISORY COMMITTEES
(Pursuant to Section 9 of Public Law 92-463)

1. U.S. Nuclear Data Committee (USNDC)
(Committee's Official Designation)

2. Committee's objectives and scope of activities and duties: see attachment.

3. The below named individual is the "designated Federal employee" as specified by P.L. 92-463, Section 10.(e) and (f), who is authorized to approve the agenda, to call or give advance approval of meetings, to chair or attend meetings, and, when in the public interest, to adjourn meetings of this Committee:

Dr. John M. Teem, Director
Division of Physical Research
U.S. Atomic Energy Commission

4. The below named individual is the alternate "designated Federal employee" who will perform all the duties of the designee, named above, during his absence:

Dr. George A. Kolstad, Assistant Director
for Physics & Mathematics Programs
Division of Physical Research
U.S. Atomic Energy Commission

5. Time period (duration) of this Committee: from May 1, 1973 to February 1, 1975.

6. Official to whom this Committee reports: same as 3., above.

7. Agency responsible for providing necessary support to this Committee: U.S. Atomic Energy Commission.

8. Estimated average annual direct costs of this Committee:

a. $3,000[1/]
b. Total man-years of support: less than one.

9. Estimated number of meetings per year: two.

ATTACHMENT "C"

APPENDIX C

10. The Committee's termination date, if less than two years from the date of establishment or renewal: February 1, 1975.

11. Subcommittees:

Neutron Data Applications (d.F.e., P. B. Hemmig, AEC; R. B. Schwartz, NBS, alternate)
Standards (d.F.e., R. S. Caswell, NBS)
Basic Science (d.F.e., G. L. Rogosa, AEC; W. S. Rodney, NSF, alternate)
Nuclear Data for Materials Analysis, Safeguards and Environmental Matters (d.F.e., A. Landgrebe, AEC)
Controlled Thermonuclear Research (d.F.e., W. Gough, AEC)
Biomedical Applications (d.F.e., R. W. Wood, AEC)
Separated Isotopes (d.F.e., G. L. Rogosa, AEC)

a. Estimated direct cost: less than $3,000[1/]
b. Estimated number of Subcommittee meetings/year: 2-3 each.
c. Duration of Subcommittees: Same as parent committee.
d. Designated Federal employee: as indicated above.

- - - - - - - - - -

This charter for the advisory committee named above is hereby approved on

_____.

_____

John V. Vinciguerra, Advisory Committee Management Officer

1/ Travel and per diem of AEC employee members.

APPENDIX C

Objectives and Scope of Activities and Duties of the U.S. Nuclear Data Committee (See Item 2 of Charter)

The USNDC members will exchange information among themselves and with other groups and organizations; and will provide guidance on a continuing basis to the Division of Physical Research and through that Division to other Divisions of the AEC, to other participating Federal agencies and to other groups or organizations in the nuclear data field, foreign and domestic, with respect to the U.S. nuclear data program. USNDC functions will include:

a. periodic review of the nuclear data needs for the U.S. nuclear program and recommendation of measurements to be undertaken on a priority basis;

b. review of facilities, techniques and manpower available for the determination of nuclear data and recommendations on needs for new or modified techniques, equipment, research materials, facilities and manpower;

c. review availability of special research materials for nuclear data measurements (e.g., separated isotopes) and recommend regarding procurement, handling and disposition of such materials;

d. continuous critical review of scope, manpower, facilities and techniques for compilation, evaluation and dissemination of nuclear data and recommend re present and future needs;

e. periodic examination of nomenclature employed in nuclear data field and recommendations for appropriate methods for presentation of nuclear data and constants.

f. review and recommend needs for specialized technical symposia in nuclear data field;

g. at request of AEC, review and comment on proposals for research and/or facilities;

h. establish and maintain liaison with other U.S. committees and agencies in similar and overlapping areas of interest through AEC Division of Physical Research or other participating Federal agencies;

i. keep informed of activities of interested professional societies, international committees, organizations or groups and provide assistance to USNDC participants actively involved in cooperative efforts in the nuclear data field.

APPENDIX D

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

JUN 7 1973

Robert E. Chrien, Chairman, USNDC
Harold E. Jackson, Secretary, USNDC
A. B. Smith, Chairman, Neutron Data Applications Subcommittee, USNDC
R. S. Caswell, Chairman, Standards Subcommittee, USNDC
D. A. Lind, Chairman, Basic Science Subcommittee, USNDC
D. J. Horen, Chairman, Nuclear Data for Materials Analysis, Safeguards and Environmental Matters Subcommittee, USNDC
D. Steiner, Chairman, Controlled Thermonuclear Research Subcommittee, USNDC
J. S. Robertson, Chairman, Biomedical Applications Subcommittee, USNDC
F. Perey, Chairman, Separated Isotopes Subcommittee, USNDC

PROCEDURAL GUIDELINES FOR MEETINGS

Establishment of the USNDC as an advisory committee under the Federal Advisory Committee Act of 1972 will require some modification in the ways in which the Committee has operated until now. Enclosed for your background information are a copy of

1. the Federal Advisory Committee Act of 1972
2. OMB Guidelines re implementation of the Act
3. a copy of the material approved by the Commission which establishes the USNDC as an advisory committee, including the revised Terms of Reference, the Charter and the list of members.
4. a copy of the memorandum to the AEC Advisory Committee Management Officer, including meeting notice and agenda.

In order to simplify the amount of wading through background material, I shall attempt to list here the basic changes involved in our "modus operandi" and the procedures to be followed by the Committee and Subcommittees in the future.

1. Public meetings. All meetings will be open to the public and will therefore be held in places accessible to the public. Closed sessions may be held if prior approval is obtained from the AEC for matters exempt from public disclosure as set forth in the Freedom of Information Act (5U.S.C. 552(b)), as specified in column 3, p 2309 of the OMB Guidelines, enclosed.

APPENDIX D

Addressees

2. Meeting Notice and Request for Closed Session. A notice of the meeting, draft agenda and covering memorandum to the AEC Advisory Committee Management Officer (AGMO) must be sent so as to be received in this office at least forty (40) days in advance of each meeting. The draft agenda should indicate the day and approximate time that each mainline agenda item will be taken up, which items are to be handled in closed or executive session. The covering memorandum to the AGMO should spell out the reasons for the executive session, as referred to under 1, above. After AEC approval, a notice of the meeting giving dates, time, place (exact) and tentative agenda will be published in the Federal Register and must appear at least seven days in advance of the meeting date. It is recognized that practical considerations may dictate alteration in the agenda or schedule.

3. "Designated Federal Employee". Each meeting will be attended by a "designated Federal employee" who is authorized, as specified in the Charter, "to approve the agenda, call or give advance approval of meetings and, when in the public interest, to adjourn meetings." Thus, the Chairman and the "designated Federal employee" must work together, and in cooperation with this office, in arranging in advance for the formalities associated with holding meetings. The "designated Federal employee," or his alternate, will initiate arrangements with the AGMO (AGMA-John Vinciguerra) for the conduct of all meetings for which he is responsible.

4. Minutes. Minutes shall be kept of each meeting and shall be available for public inspection and copying (upon payment of all charges required by law) at least 90 days after the close of the meeting at the AEC's Public Document Room, 1717 H St. N.W., Washington, D.C. This does not include minutes of executive sessions, which shall also be kept but not available for public inspection. Minutes of the meetings will be kept open for thirty (30) days for the receipt of written statements for the record.

5. Public Participation. Persons other than Committee or Subcommittee Members may submit written statements to the Secretary pertaining to agenda items. Those persons submitting a written statement, as referred to above, may request an opportunity to make oral statements concerning the written statement. Requests for the opportunity to make oral statements shall accompany the written statement and set forth reasons justifying the need for such an oral statement and shall be ruled on by the Chairman, who is empowered to apportion the time available among those selected by him to make oral statements.

ADDENDIX D

Addressees

6. Special Reports and Documents. Subcommittees will issue reports to the Parent Committee which may be modified prior to issuance as a Committee document. Until they are issued by the Parent Committee they are to be considered as draft documents and not made available to the public. Documents issued by the Parent Committee may or may not be made publicly available depending its nature (see 1, above).

George A. Kolstad
Assistant Director (for Physics
and Mathematics Programs)
Division of Physical Research

Enclosures:
As stated

cc: USNDC & Subcommittee Members

APPENDIX E

OAK RIDGE NATIONAL LABORATORY
OPERATED BY
UNION CARBIDE CORPORATION
NUCLEAR DIVISION

POST OFFICE BOX Y
OAK RIDGE, TENNESSEE 37830

March 2, 1973

To: Distribution

From: D. Steiner, Chairman, USNDC CTR Subcommittee

Subject: Minutes of the USNDC CTR Subcommittee Meeting, January 10 and 11, 1973, held at ORNL

1. Attachment # 1 is a list of the meeting attendees.

2. Attachment # 2 is a list of material distributed during the meeting.

3. The scope and composition of the CTR Subcommittee:

   a. The CTR Subcommittee will be concerned with all nuclear data needs of the CTR Program. The scope of these needs includes the understanding of plasma physics and confinement experiments, the evaluation of fusion fuel cycles, and the nuclear-engineering design of feasibility demonstrations and of reactors.

   b. H. Goldstein noted that one of the responsibilities of the CTR Subcommittee is to "educate" the USNDC regarding the needs of the CTR Program. (Note: At the October, 1972, meeting of the USNDC, D. Steiner presented a summary of CTR nuclear data needs.). D. Steiner will consult with R. E. Chrien (current Chairman of USNDC) regarding further "education" of USNDC.

   c. It was suggested that the CTR Subcommittee membership be expanded to include representatives from all CTR laboratories. For the present, such representation will be accomplished through the "Consultant Group" (see 7a.).

4. Priority Criteria for CTR Requests:

   a. It was agreed that two levels of priority would be sufficient for CTR requests. Top priority requests would be designated "Priority I", other acceptable requests would be designated "Priority II".

APPENDIX E

To: Distribution 2 March 2, 1973

b. No consensus was reached concerning the detailed definitions of Priority I and Priority II criteria, and all attendees were urged to give further thought to this point. D. Dudziak suggested that appropriate definitions might evolve during the course of request review, and therefore, that there was no immediate need for detailed criteria.

5. Review of Nuclear Data Requests:

a. There was considerable discussion concerning the data needs relevant to the evaluation of fusion fuel cycles. Presentations to this point were made by T. Weaver, J. R. McNally, Jr., and E. Norbeck. The major area of concern is data relating to nuclear elastic and inelastic events. Such processes are important in determining the magnitude of non-thermal effects in fusioning systems.

b. It was agreed that the current CTR contribution to the USNDC request list (soon to be issued from LASL) had several inadequacies. Moreover, it was noted that the next USNDC request list would probably not be issued before 1975. Therefore, it was suggested that the CTR Subcommittee issue an updated or interim request list in about one year. D. Steiner will pursue this matter with R. Chrien.

c. It was agreed that requestors be required to submit supportive information together with their requests.

d. D. Steiner noted that the sensitivity of tritium breeding to neutron cross section uncertainties was currently being examined at ORNL. These sensitivity tests will be useful in formulating requests for neutron cross section data. C. Maynard suggested that the specification of several blanket benchmark configurations would facilitate sensitivity testing. It was agreed that Maynard's suggestion should be considered by those individuals performing neutronics calculations.

e. A question was raised concerning the appropriate requesting agency for laser-fusion nuclear data requests, that is, should such requests be sponsored by DMA or by DCTR. D. Steiner will pursue this question with DCTR.

6. Interfacing DCTR with the Cross Section Evaluation Working Group (CSEWG):

a. It was agreed that DCTR should pursue formal representation on CSEWG. This representation might occur via the existing subcommittee structure of CSEWG or via the establishment of a new CSEWG Subcommittee. This recommendation will be forwarded to DCTR.

b. It was the consensus of those attendees who have participated in CSEWG activities that DCTR would have to fund its CSEWG representatives in order to accomplish specific objectives through CSEWG. A funding level of ~ $50,000 was suggested for FY 1974.

APPENDIX E

To: Distribution 3 March 2, 1973

c. L. Stewart noted that, at present, no agency was funding evaluations of the nuclides ^{6}Li, ^{7}Li, Nb and F for the next version of ENDF/B, ENDF/B-IV. These nuclides are of interest to DCTR, and the Subcommittee agreed that DCTR should consider supporting evaluations for such nuclides.

7. Miscellaneous:

a. The "Ad Hoc Group to Evaluate Cross Section Requirements for Fusion Reactor Design" will hereafter be designated the "Consultant Group to the USNDC CTR Subcommittee".

b. L. Stewart noted that, on the basis of her experience, ~ 5% of the Priority I requests receive funding.

c. ENDF/B-IV will cover an energy range of 10^{-5} eV up to 20 MeV.

d. It was agreed that memos concerning CTR nuclear data needs be circulated to a distribution list consisting of the CTR Subcommittee, the Consultant Group and other interested parties. Such circulation would be the responsibility of the individual initiating the memo. L. Stewart agreed to circulate a memo concerning deficiencies in the Be data on ENDF/B-III.

e. W. Price would like to see the evolution of standard multigroup cross section tapes for dissemination to groups performing CTR neutronics calculations. (Note: A coupled neutron and gamma-ray tape is being developed at ORNL. The group structure consists of 52 neutron groups and 21 gamma-ray groups).

8. Follow-up Actions:

a. If you wish to add names to the distribution list for CTR nuclear data memos, please forward these names to D. Steiner.

b. D. Dudziak and L. Stewart will consult with the LASL laser-fusion group in order to identify the nuclear data needs of this group.

c. Attendees will consult with their respective CTR groups in order to identify nuclear data needs for understanding plasma physics and confinement experiments.

d. Attendees will read the information distributed by the LLL laser-fusion group and will forward their suggestions regarding follow-up to D. Steiner.

e. D. Steiner will consult with DCTR and USNDC regarding E. Norbeck's concern about the future of the Li + Li nuclear measurement program at University of Iowa.

APPENDIX E

To: Distribution 4 March 2, 1973

9. The Next Meeting:

a. It was agreed that the Subcommittee and the Consultant Group should meet again in about six months.

b. D. Dudziak and L. Stewart suggested LASL as the next meeting place. While this offer was generally acceptable, it was deemed desirable to pursue the possibility of overlapping the next Subcommittee meeting with some other meeting of mutual interest, e.g., the ANS meeting in Chicago. D. Steiner will pursue this matter.

Sincerely,

D. Steiner

DS:ba

Attachments

Distribution - See Attachment 1

cc: R. E. Chrien - BNL
S. O. Dean - AEC
W. C. Gough - AEC
R. L. Hirsch - AEC
W. Rice - AEC
A. W. Trivelpiece - AEC

APPENDIX E

ATTACHMENT # 1

ATTENDEES AT THE USNDC SUBCOMMITTEE MEETING,
JANUARY 10 and 11, 1973, ORNL

NAME	AFFILIATION
Joseph D. Lee	LLL
Leona (Lee) Stewart*	LASL
Linn Draper	University of Texas at Austin
Paul J. Persiani	ANL
William G. Price	PPPL
Thomas A. Weaver	LLL
Charles W. Maynard	University of Wisconsin
Edwin Norbeck	University of Iowa
Vic Orphan*	Gulf Radiation Technology
Herbert Goldstein*	Columbia University
Donald J. Dudziak*	University of California, LASL
J. Rand McNally, Jr.	ORNL
John T. Kriese	ORNL
Melvin L. Tobias	ORNL
Masao Nozawa	ORNL
C. F. Barnett*	ORNL
D. Steiner*	ORNL

*Subcommittee Members

APPENDIX E

ATTACHMENT # 2

LIST OF MATERIAL DISTRIBUTED DURING
THE USNDC SUBCOMMITTEE MEETING,
JANUARY 10 and 11, 1973, ORNL

1. G. Lee, G. Zimmerman and L. Wood, "Concerning Electron-Ion Coupling and Charged Particle Energy Deposition During Vigorous Thermonuclear Burn," UCRL-74192 (November 1972).

2. T. Weaver, G. Zimmerman and L. Wood, "Prospects for Exotic Fuel Usage in CTR Systems $1.B^{11}$ (p, 2α) He^4: A Clean High Performance CTR Fuel," UCRL 74191/UCRL 74352 (November 1972).

3. Memo from L. Wood (UC-LLL) to the USNDC CTR Subcommittee. Subject: CTR Fuel Data Needs.

4. Note from E. Norbeck concerning Lithium + Lithium Nuclear Cross Sections.

5. J. R. McNally, Jr., "Nuclear Fusion Reactions of Possible CTR Interest," ORNL-TM-3233 (Revised) 1971, and galley proof of an article to be published in Encyclopedia of Chemistry, Third Edition, "Fusion, Nuclear".

6. Four Items Distributed by L. Stewart

   a. Agenda of the CSEWG Meeting, November 9-10, 1972, BNL; and List of CSEWG Subcommittees.

   b. Brief Summary of the CTR Request List for Measurements.

   c. Requested Format Changes in ENDF/B, the MT=700 Series.

   d. ENDF/B-IV Scope.

7. Two Items Distributed by D. Steiner

   a. Proposed Priority Criteria for Nuclear Data Requests in CTR (Developed by the International Fusion Research Council).

   b. List of USNDC Subcommittees.

SUMMARY OF ACTIVITY (INCLUDING PROPOSALS) FOR NEUTRON STANDARDS MEASUREMENTS

USNDC STANDARDS SUBCOMMITTEE

NUCLIDE	MEASUREMENT	ENERGY RANGE	RESOLUTION	EXPECTED ACCURACY	MEASUREMENTS UNDERWAY?	SCIENTIST CONTACT	ESTIMATED COMPLETION DATE	LABORATORY	USNDC-6 REQUEST NO.	PRIORITY
^{1}H	Elastic $\sigma(\theta n)$	7,10,20 MeV		2%	Proposal	Shamu	Proposal	WMU	1	I
^{6}Li	$\sigma(n,\alpha)$ (Linac)	1 KeV - 2 MeV		3%	No	Carlson	12/75	NBS	12	I
^{6}Li	$\sigma(n,\alpha)$ (Van de Graaff)	30 keV - 2 MeV		3%	No	Meier	12/75	NBS	12	I
^{6}Li	$\sigma(n,\alpha)$ rel to H	1 keV - 1.7 MeV	~ 2%	1%	Yes	Friesenhahn	12/73	IRT	12	I
^{6}Li	$\sigma(n,\alpha)$	90 keV-1500 keV		3%	Yes	Poenitz	12/73	ANL	12	I
^{10}B	$^{10}B(n,\alpha)^{7}Li$	1 keV - 1 MeV	~ 2%	1%	Yes	Friesenhahn	8/73	IRT	53	I
^{10}B	$^{10}B(n,\alpha_1\gamma)^{7}Li$	1 keV - 1 MeV	~ 2%	1%	Yes	Friesenhahn	8/73	IRT	54	I
^{10}B	$^{10}B(n,\alpha_1)/^{10}B(n,\alpha)$	800 keV		5%	Yes	Carlson	9/73	NBS	53,54	I
^{10}B	$^{10}B(n,\alpha)$ or $^{10}B(n,\alpha_1\gamma)$ (Linac)	1 keV - 2 MeV		3%	No	Schrack	12/75	NBS	53,54	I
^{10}B	$^{10}B(n,\alpha)$ or $^{10}B(n,\alpha_1\gamma)$ (Van de Graaff)	30 keV-1.5 MeV		3%	No	Lamaze	12/75	NBS	53,54	I
^{235}U	σ_f rel to H	1-6 MeV	3-6%	$\leq$ 2% *	Yes	Hansen	7/73	LASL	442	I
^{235}U	σ_f rel to H	2-20 MeV	< 3%	< 2%	Yes	Czirr	9/73	LLL	442	I
^{235}U	σ_f absolute	Th-2 MeV	< 3%	< 2%	No	Czirr		LLL	442	I
^{235}U	σ_f rel to H	20 keV - 1.5 MeV	1 nsec/m	3% *	No	Peelle	/75	ORNL	442	I
^{235}U	σ_f rel to H	6 MeV - 15 MeV	5%	$\leq$ 3% *	No	Diven	9/74	LASL	442	I
^{235}U	σ_f rel to H	0.5 - 20 MeV		3%	No	Carlson	12/74	NBS	442	I
				1.5%			12/75			

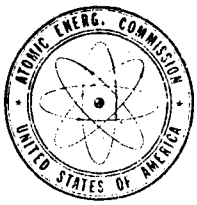
NUCLIDE	MEASUREMENT	ENERGY RANGE	RESOLUTION	EXPECTED ACCURACY	MEASUREMENTS UNDERWAY?	SCIENTIST CONTACT	ESTIMATED COMPLETION DATE	LABORATORY	USNDC-6 REQUEST NO.	PRIORITY
^{235}U	σ_f rel to $^{6}Li(n,\alpha)$	0.01 eV - 100 keV	< 3%	< 2%	Yes	Czirr		LLL	442	I
^{235}U	σ_f rel to $^{6}Li(n,\alpha)$	35-120, 250 keV	5-15 keV		Finished	Poenitz	12/72	ANL	442	I
^{235}U	σ_f rel to $^{6}Li(n,\alpha)$	Up to 400 keV	1 nsec/m	2% *	No	Peelle	12/74	ORNL	442	I
^{235}U	σ_f rel to $^{10}B(n,\alpha)$	Up to 100 keV	1 nsec/m	2%	Yes	Peelle	6/74	ORNL	443	I
^{235}U	σ_f rel to $^{10}B(n,\alpha)$	.01 eV - 200 keV	.5 nsec/m	4% *	Finished	Peelle	12/72	ORNL	443	I
^{235}U	σ_f rel to Grey Neutron Detector	35 keV - 3.5 MeV	15-150 keV	2-3%	Yes	Poenitz	6/73	ANL	442	I
^{235}U	σ_f rel and absolute with Black Neutron Detector	0.4 - 3.0 MeV	10-50 keV	2-3%	Finished	Poenitz	4/73	ANL	442	I
^{235}U	σ_f absolute ^{51}Cr	500 - 650 keV	80-100 keV	2%	Finished	Poenitz	12/72	ANL	442	I
^{235}U	σ_f absolute Na-Be	966 keV		2%	Finished	Gilliam	12/72	MICH	442	I
^{235}U	σ_f absolute ^{51}V bath	500 keV	50 keV	2-3%	Finished	Poenitz	12/72	ANL	442	I
^{235}U	σ_f absolute	Avg over ^{252}Cf spectrum		4%	Finished	Grundl	11/72	NBS	442	I
^{235}U	σ_f absolute	Avg over ^{252}Cf spectrum		2%	Yes	Grundl	12/73	NBS	442	I
^{235}U	σ_f absolute	Avg over $^{235}U(n,f)$ spectrum		4%	No	Grundl	12/74	NBS	442	I
^{235}U	η for monoenergetic neutrons	thermal, < 1 eV		< 1%	Need	Open	Need	Open	444	II
^{252}Cf	Neutron age in H_2O	Avg over ^{252}Cf spectrum		2%	Yes	Spiegel	8/73	NBS	581	I
^{252}Cf	$\bar{\nu}$ vs η msmt study	-		< 1%	Proposal	Smith	Proposal	INC	579	I
^{252}Cf	Fission spectrum	0 - 15 MeV			Need	Friesenhahn? Small univ?	Need	IRT? Open	581	I

KEY

ANL	Argonne National Laboratory
INC	Idaho Nuclear Corporation
IRT	Intelcom Radiation Technology
LLL	Lawrence Livermore Laboratory
LASL	Los Alamos Scientific Laboratory
MICH	University of Michigan
NBS	National Bureau of Standards
ORNL	Oak Ridge National Laboratory
WMU	Western Michigan University
*	does not include uncertainty in the standard cross section

The USNDC Standards Subcommittee would appreciate being informed of any corrections, changes, suggested additions or deletions to this list. Call R. Caswell 301-921-2551.

APPENDIX G



UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

APR 2 0 1973

USNDC Members

PROPOSED REVISION TO PROCEDURES FOR INCLUDING REQUESTS IN THE "COMPILATION OF REQUESTS FOR NUCLEAR DATA"

In view of the expanding role of the USNDC into nuclear data areas other than neutron cross sections, the impeding decision to convert the USNDC from an informal group to an AEC advisory committee (with the participation of other Federal agencies) and the need to assure that the Request Compilation serves its function most effectively, I would like to suggest a revision to the technical scope and mechanisms for including requests in this document. Specifically, I suggest:

1. Change the document name from "Compilation of Requests for Nuclear Cross Section Measurements" to "Compilation of Requests for Nuclear Data."

   This change will permit the inclusion of requests for nuclear data measurements other than cross sections, evaluations that may be needed or data that would be benefitted by further theoretical work. The document would be subdivided into categories which the Committee may wish to discuss before deciding how best to do the job but should also contain an index which identifies the numbered request in accordance with a user classification (e.g., fission reactors, fusion reactors, safeguards, medical, etc.).

2. No requests be included in the Request Compilation without the prior written approval of the AEC Division of Physical Research (DPR) or of the other participating Federal agency along with its assigned priority. DPR will undertake to carry out this filtering process within AEC. Thus DMA, DBER, DRDT, AT, etc. contractors of AEC will submit their requests for nuclear data (assuming the data is not available at one of the data centers) to the Division of AEC which supports their work who will, in turn, endorse requests to DPR with an appropriate priority assignment.

APPENDIX G

USNDC Members

This process should help to reduce the number of unnecessary requests for nuclear data work, assure a better screening than requests now receive, increase the awareness of USNDC activities by other Divisions and Agencies and increase the confidence of all involved that the requests are, indeed, justified.

Suggestions for items to be included in the Request List can, of course, be made by anyone but unless formally authorized as outlined above would not be included in the documents. The needs for such data for basic science can, of course, be handled in a like way by DPR, NSF or other Federal agencies concerned with basic nuclear science.

I suggest that this matter be discussed by the Committee at its next meeting under Agenda Item III-3.

George A. Kolstad
Assistant Director (for Physics
and Mathematics Programs)
Division of Physical Research

cc; S. Pearlstein, BNL
DRDT
DMA
NR
DBER
DAT
DCTR
NUMS
PMM
REG

APPENDIX H

NUCLEAR DATA ACTIVITIES OF THE RADIATION SHIELDING INFORMATION CENTER

Introduction

The Radiation Shielding Information Center (RSIC)[1] has a vital interest in nuclear data activities because it operates as an Information Analysis Center (IAC). Panel No. 6 (Information Analysis and Data Centers) of COSATI (Committee on Scientific and Technical Information of the Federal Council for Science and Technology) has adopted the following definition of an IAC.[2]

> *"An Information Analysis Center is a formally structured organizational unit specifically (but not necessarily exclusively) established for the purpose of acquiring, analyzing, and synthesizing a body of information in a clearly defined specialized field or pertaining to a specified mission with the intent of compiling, digesting, repackaging, or otherwise organizing and presenting pertinent information in a form most authoritative, timely, and useful to a society of peers and management."*

This is the mission of RSIC.

Our experience has revealed that this "body of information" must include computer programs and nuclear data in computer-readable form because of the reliance on high speed and large memory computers as indispensible tools of research and development programs vital to the future of this country.

In the discussion that follows, emphasis is placed on the data activities of the RSIC operation, which are one part of an integrated program to serve the radiation transport area. Past accomplishments will be described, recently initiated activities will be discussed,

APPENDIX H

and future plans will be outlined.

The success which RSIC has had operating as an IAC in the technology area of radiation transport is based on procedures which can easily be extended to serve other technology areas.

Funding and Technical Support

The RSIC began operating ten years ago as a group within the Neutron Physics Division at ORNL. It received funding from the AEC Division of Reactor Development and Technology (RDT), from the Defense Nuclear Agency (DNA), and from the National Aeronautics and Space Administration (NASA). The RDT and DNA funding continues to supply the basic financial support. Modest funding from the AEC Division of Controlled Thermonuclear Research (CTR) and from the Society for Nuclear Medicine (SNM) will be added in FY 1974.

The staff of RSIC benefits from its location at ORNL where advantage can be taken of the expertise in radiation transport development, cross section measurement, evaluation and sensitivity studies, nuclear and atomic data evaluation, CTR research, biomedical research, and the many other areas of excellence which exist at this laboratory.

The staff has an excellent reputation for the service it gives and perhaps the most important feature is the rapid response to inquiries of all types.

Accomplishments

Evaluated Neutron Cross Sections - ENDF/B

RSIC was seriously hampered in its early days by not having

APPENDIX H

available compilations of neutron cross section data in a form suitable for use in the many complex computer codes which were then available. Therefore, we supported the concept of a universal exchangeable data format from the beginning efforts toward ENDF.[3] An RSIC staff member has been a part of each planning committee and working group since 1964.

The early interests of the Cross Section Evaluation Working Group (CSEWG) centered around data needed by reactor core specialists, and RSIC felt it necessary to unite interested members of the shielding community through a Shielding Subcommittee. In early 1967, under the leadership of RSIC staff member Frank Clark, the Subcommittee was organized and has functioned until the present to guide the development of ENDF in aspects which make it especially useful to the shielding community.

In early 1968 the National Neutron Cross Section Center (NNCSC) Director asked that RSIC consider the possibility of playing a role in conjunction with NNCSC to coordinate and advance efforts to build ENDF data files of interest to the shielding community in order that these interests not be neglected. After much discussion, it was agreed that RSIC would accept responsibility (with the CSEWG Shielding Subcommittee) for checking of microscopic data which is primarily of shielding interest, with RSIC performing the clerical and mechanical services normally provided by NNCSC. This cooperative effort has worked well and progress has been made, particularly in the area of helping to provide the ENDF/B library evaluated data with gamma-ray production files.

Evaluated Neutron Cross Sections- DNA

The Radiation Shielding Information Center (RSIC) serves as a repository for the Defense Nuclear Agency (DNA) cross-section library.[4]

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This is a working library in ENDF format whose content can be modified and revised whenever the evaluator deems such changes to be necessary. Thus the data are apt to change with some frequency. The key to this approach is a selected evaluator, the person responsible for making the original evaluation for a particular element or elements. He is then responsible for authorizing changes in evaluations for those elements. The evaluated data are for those materials of interest to DNA, whose cross-section values are in a state of rapid flux, and emphasis is placed on neutron energies up to 20 MeV and on secondary gamma-ray production. Evaluations of interest to DNA which are not in a state of rapid change are found in the ENDF/B library, which is available from the NNCSC.

The clearinghouse for the program is RSIC. Initial versions of evaluations are received, processed through checking codes to eliminate obvious format errors, and modified as necessary in collaboration with the evaluator. Next, DNA Phase I data testing is performed whereby selected reviewers are provided with listings, output from checking codes, graphics, etc., and asked to review the data and feed back their comments. These are relayed to the evaluator and, upon his instruction, appropriate changes are made.

The data are available to U. S. requesters. In addition they are available as input to ENDF/B and provide an important source of evaluated data for that library.

The Data Library Collection

Data libraries are now being packaged and organized by RSIC in a manner analogous to the RSIC code collection. Each data set carries a

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Data Library Collection (DLC)[5] number and is packaged as a unit. A particular data package does not remain static, but is subject to revision, updating, and expansion as required. Such changes are announced in the monthly RSIC Newsletter.

This activity started near the end of 1968. At that time it became evident that a collection of data libraries would be an extremely helpful companion to the RSIC Computer Code Collection.[6] The main objective at that time was the interchange of technology among installations engaged in radiation transport research, development, and application. The scope of the DLC library is flexible and has expanded to include data for many applications. All DLC data sets are characterized by their availability on magnetic tape along with a retrieval program suitable for manipulating the data into useful forms.

The data library collection has been developed such that it can include not only input data, e.g., cross section libraries, but also calculational results. In some cases, the volume of data from a problem may be so great that it is not feasible to publish it all. One can then publish samples of the results but place the entire output on magnetic tape for distribution, as needed, by RSIC. Processing codes for performing editing, plotting, interpolation, and certain integrations would accompany the data.

Since its first release in 1968 RSIC has generated a 100 group library of multigroup neutron cross sections based on the official ENDF/B library. This has served as a standard reference library for use in multigroup discrete ordinates and Monte Carlo codes. The current version of this set was generated in 1972 and is based on the ENDF/B Version III.

Other useful multigroup neutron and secondary gamma-ray libraries have been packaged as well. Data sets tailored for neutron and secondary gamma-ray transport in nitrogen and sodium have been made available.

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Some recent acquisitions are nuclear data for other applications. These include a radionuclide gamma-ray energy and intensity compilation, X-ray and photon interaction libraries, nonelastic cross sections and particle emission spectra for various nucleon-nucleus collisions, and the tables of atomic masses evaluation originally published in Nuclear Data Tables.[7]

New Activities and Future Plans

Evaluated Neutron Cross Sections

RSIC will continue its activities in CSEWG and its collaboration with the NNCSC in helping to channel evaluated data into ENDF/B. This includes the DNA library elements whose evaluation effort is reduced as its status is improved and possibly the future work in CTR. A modest effort funded within the CTR program resulted in evaluated data for Vanadium which will be available for inclusion in ENDF/B-IV.

Multigroup Neutron and Secondary Gamma-Ray Cross Sections

Modular code systems for generating multigroup libraries for neutron and gamma-ray transport are just coming into production use. The DNA's code AMPX, developed at ORNL, will be used to generate general fine group libraries as well as specialized libraries tailored for use in specific types of problems. These will be available through RSIC. It is also expected that similar libraries for other applications, such as CTR, LMFBR, etc., will likewise become a part of RSIC's Data Library Collection.

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Biomedical Computing Technology

Under the sponsorship of the Society for Nuclear Medicine (SNM), ORNL has been participating over a 3-year period (with ORAU and Vanderbilt University) in studies leading to the establishment of a Biomedical Computing Technology Information Center (BCTIC) at ORNL.

The center is proposed as a national resource to serve and support the biomedical field by collecting, organizing, evaluating, packaging, and disseminating computer system-design and applications programs and associated technology, including computer-readable compilations of data. This goal will be achieved by: (a) providing technology transfer and services, thereby improving the interchange of information among research and medical groups; (b) focusing attention on outstanding problems of mutual concern in collaboration with appropriate members of the user community; (c) advancing the technology in the related computer software and data sets through cooperative activities ; and (d) providing training in the implementation and use of these specialized program and data packages.

Radioactive Decay Data

RSIC now makes available a number of computer codes which calculate biological dose and heating due to radiation. Many of these use computer-based nuclear data libraries to calculate isotope inventories taking into account time-dependence, geometry-dependence, activation, fission, radioactive decay, and burnup. The applications are principally in the areas of nuclear reactor safety and radiation hazard analysis and in environmental analysis.

Unfortunately each code has its own format and data definition. This makes it presently impossible to maintain up-to-date, comprehensive evaluated

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data.

The Cross Section Evaluation Working Group (CSEWG) is adopting a standard format for radioactive decay spectra which will be used by RSIC to maintain a standard reference library. The data will be based on the Nuclear Structure File maintained by the ORNL Nuclear Data Group. A processing code will produce the nuclear data needed for particular applications, e.g., the radiations above a certain energy intensity threshold including conversion and Auger electrons and X-rays. Translation routines will be used to translate data from a standard format to any desired format. Newly developed codes will read the standard format directly.

Neutron Kerma Factors

The facilities of ORNL and RSIC were used in conjunction with the University of Wisconsin CTR Program to develop a computer code to calculate neutron fluence-to-kerma factors from data in the ENDF format. The code[8] is available from RSIC. Kerma factors suitable for use in CTR heating and damage studies will be made available this summer. In addition, kerma factors for biological systems will be generated at RSIC and made available in suitable format.

Charged Particle Transport

Much work is being done at ORNL in charged particle transport for medical physics. The Monte Carlo codes and data for these types of radiation transport are available through RSIC.

Charged particle transport through plasmas is an area under development at ORNL. It is expected that the associated codes and data will be available

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through RSIC.

Conclusion

RSIC has successfully implemented the IAC concept. It has done so because it has been able to assist the technology development by having available the kind of information, computer codes, and associated nuclear data vital to a discipline which makes heavy use of computer calculations. One important characteristic of this success is RSIC's ability to respond rapidly to the needs of the technical community involved. This ability is enhanced by the wide variety of technical expertise available in the various research and development groups at ORNL.

In the future, RSIC expects to continue to expand the IAC concept into areas other than that which has traditionally been called "shielding". The scientific and technical expertise at ORNL in pertinent disciplines make it an ideal laboratory in which such IAC's can develop. The experience of RSIC over the past decade shows that it is vital to the IAC concept to pursue nuclear data activities which will permit the technology area to advance in an efficient and effective manner.

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