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THE MINUTES OF THE USNDC MEETING

28-29 NOVEMBER 1973, ARGONNE NATIONAL LABORATORY

ARGONNE, ILLINOIS

C. D. Bowman, Secretary, USNDC

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

FOREWORD:

The following constitutes the minutes of the meeting of the U.S. Nuclear Data Committee held 28 - 29 November at Argonne National Laboratory, Argonne, Illinois.

The primary task for this meeting was to promote the effective operation of the new task-oriented subcommittee structure of the USNDC. Most of the work formerly carried on in the predecessor committees of the USNDC is now carried on by USNDC subcommittees with the parent USNDC subcommittee providing liaison and approval for the subcommittees actions and activities. These new modes of operation plus complications in meeting arrangements brought about by new Federal laws are requiring a "shakedown" period which is now underway and which was monitored closely at this meeting.

A reassessment of the working relationship with the DPR was also brought about by the appointment of a new Designated Federal Employee, Dr. G. L. Rogosa, for the parent committee. Much progress in this regard was made at this meeting largely through discussions of the new energy programs about which the AEC headquarters has been heavily exercised during recent months. Through these discussions it appeared that a less formal or more candid relationship might be established between the Committee and the DPR. The committee carried on its well-established functions of coordinating and promoting the production of nuclear data needed for the nation's applied programs. These discussions were about equally balanced between proposals for new facilities, problems and successes in measurement of new nuclear data, the compilation and evaluation of nuclear data, and the international coordination of these efforts.

Attendance was as follows:

Parent Committee Members and Ex-officio members

1. Harold E. Jackson, ANL, Chairman
2. Charles D. Bowman, NBS, Secretary
3. John D. Anderson, LLL
4. J. B. Ball,† ORNL
5. William Bartels, AEC/NUMS
6. Randall S. Caswell, NBS
7. Robert E. Chrien, BNL
8. Herman Feshbach, MIT
9. Herbert Goldstein, Columbia U.
10. William W. Havens, Jr., Columbia U.
11. Philip B. Hemmig, AEC (DRDT)
12. Robert W. Hockenbury,† RPI
13. John R. Huizenga, Univ. of Rochester
14. Malvin H. Kalos, DOD (NYU)
15. David R. Lide, Jr., NBS
16. Michael S. Moore, LASL
17. Henry W. Newson, Duke U.
18. S. Pearlstein, BNL (NNCSC)
19. Francis G. J. Perey, ORNL
20. Gerald C. Phillips, Rice U.
21. James S. Robertson, BNL
22. George L. Rogosa, AEC/DPR

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†Alternate

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

23. Alan B. Smith, ANL

24. Donald Steiner, ORNL

25. Robert W. Wood, AEC/BER

Subcommittee Members

1. W. Poenitz, ANL

2. D. L. Smith, ANL

Speakers and Observers

1. A. Blair, AEC/DPR

2. L. M. Bollinger, ANL

3. R. Gunnick, LLL

4. P. Moldauer, ANL

5. H. T. Motz, LASL

6. P. Persiani, ANL

7. W. Strom, Mound

8. L. Whitehead, ORNL

AGENDA

Appendices

I. ADMINISTRATIVE

A. Introduction

The Chairman of the USNDC, Dr. H. E. Jackson, welcomed all members to the meeting and introduced new members Herman Feshbach from MIT and Dr. John Huizenga from the University of Rochester. He welcomed Dr. J. B. Ball from ORNL substituting for Dr. Horen, Dr. Malvin H. Kalos, NYU, substituting for Captain Dean C. Kaul and Dr. R. W. Hockenbury from RPI substituting for Professor R. C. Block. The chairman noted that the new "Designated Federal Employee" for the parent USNDC committee was Dr. George L. Rogosa, Acting Assistant Director for Nuclear Science in the Division of Physical Research of the USAEC. He replaces Dr. G. A. Kolstad who is now with the Office of Molecular Science of the USAEC. The chairman reminded the committee that it would hear from Dr. Rogosa on the impact of reorganization of the Division of Physical Research on the USNDC. He also requested that Dr. Rogosa inform the committee of any new operational guidelines which would be helpful in accomplishing its responsibilities for the U.S. AEC.

B. Agenda

With minor changes in ordering of the previously circulated agenda, the agenda was approved by the committee.

C. Previous Minutes

The chairman reminded the committee that the new terms-of-reference require public display of the final minutes within ninety days of each meeting. The members' comments and suggested changes of the minutes already received constitute official approval of the minutes; therefore no approval action of the minutes was required of the committee at this meeting. However, the chairman asked for comments on the minutes and received none.

D. Past Actions

A review of outstanding actions followed:

Action 1—Subcommittee Chairman

On a continuing basis collect and forward to H. Goldstein recommendations for new entries to the list of outstanding cross section discrepancies. The chairman commented that the Neutron Data Applications Subcommittee had responded well to this action and that the Standards Subcommittee also had provided updated input.

ACTION 1 Subcommittee Chairman

A new action 1 was adopted directing USNDC subcommittee chairmen to forward to Professor Goldstein by February 15 new additions to the list of outstanding cross section discrepancies. A new action 2 was adopted directing

ACTION 2 Goldstein

Professor Goldstein to distribute the new list of Outstanding Cross Section Discrepancies to the committee by March 15.

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. The chairman noted that the list had been prepared by Goldstein and distributed to the Neutron Data Applications Subcommittee which had provided feedback to Professor Goldstein with regard to priority.

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 the USNDC meetings. Perey expressed concern about himself and ORNL acting as a clearinghouse for samples owned by laboratories with membership on the USNDC. A. Smith pointed out that the action required Perey only to make these

lists available for inclusion in the technical minutes. The actual transfer of samples from one laboratory to another would be worked out by representatives of the two interacting laboratories under arrangements suitable to both.

ACTION 4

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. Perey responded to this action by presenting a review of procedures to reduce operating costs. The primary emphasis was on lower dollar per calutron hour costs achieved by higher production with any further decrease in operating costs almost certainly requiring an overall increase in total expenditures. The present cost of isotope separation is $22 per calutron hour. This figure is based on a study carried out two years ago for a production level of 95,000 hours per year. For an additional $235,000 of operating costs one can bring on-line eight more calutrons and thereby increase the number of operating hours to 150,000 per year. The cost per calutron hour would then drop to $17. Still further reductions in cost could be achieved by operation of six more calutrons at a cost of an additional $175,000, but further additional reductions from simply more operating calutrons would not be significant. With an additional infusion of funds which would permit seven-day-per week operation, costs as low as $10 per hour could be reached. This figure of course includes the seven-day week operation and the addition of the above-mentioned fourteen more operating calutrons.

Computer operation was not included in the above discussion of costs. Perey reported that the reduction in costs from computer operation would not be significant when compared with that achieved by the greater production possibilities outlined above. Newson inquired as to whether a serious effort had been made to control the calutrons by means of computers. The chairman

reminded Perey that the action related to a reassessment of calutron costs under full computer operation rather than simply by increased production. Perey responded that computer equipment was now installed on a second calutron. He stated that the Isotope Subcommittee would convene before the next USNDC meeting to study the computer problems specifically. Of prime concern would be the question "Can the computer run the calutron with no one in attendance?" Newson felt that this ought to be possible. He pointed out that accelerators are run overnight at Duke University by computer. The computer will attempt to correct a particular malfunction three times, and, if it meets with no success, shuts the accelerator off where it is left until the following morning. He felt strongly that such a system could be instituted with the calutron which would permit their operation without anyone in attendance.

Steiner inquired as to the projected demands on separation of isotopes. Perey responded that it is not clear that all the additional capacity could be used which would come with the cost reducing proposals which he presented earlier. The chairman commented that the main impact of the computer would likely be to improve the quality of separation but that significant reduction in the cost should not be expected. Perey agreed, however, Newson objected citing the studies carried out two years ago which indicated that significant cost reductions could come about and expressed to the committee his opinion that both improved quality and significant cost reduction would come about from computer automation. Havens expressed concern that some of Parkinson's laws were operating in the isotope separation program at Oak Ridge.

Phillips commented that the committee should be concerned about high purity material rather than achieving significant reduction in costs. He was pleased that the committee had fought successfully to keep the facility

going in the past and felt that the greatest benefit to the research program was that separated isotopes were made available and still are being produced. He felt that since the costs of isotope separation generally were a very small part of the total cost of carrying out an experiment, the chief concern of the committee should be with achieving higher isotopic purity which would result in better experiments. He felt that it was a mistake for the committee to encourage more production simply as a means of reducing costs. He reminded the committee that whatever costs are quoted are to a large degree unrealistic since the separation facilities are Government owned and operated and, therefore, true costs are not easy to ascertain. He asserted that realistic costing would only come from an approach modeled after that on which private industries operate whereby supply and demand, etc. are governing factors. Phillips expressed the opinion that such an operation was unlikely to occur as long as the static growth situation with respect to isotope use continued. Perey responded that sales are significantly higher than last year and that the trend in recent years has definitely been toward higher production. After some further discussion the chairman placed a new action on the Isotope Subcommittee chairman to prepare a response to old Action 4 (USNDC-8) at the next USNDC meeting.

ACTION 3 Isotope Sub-committee

Action 5—Secretary

Advise G. Rogosa of the USNDC suggestion that unprocessed calutron material be included in the next R.M.C. inventory. Action completed by the secretary.

Action 6—Chairman

Communicate to the Director of DPR the change in text of the terms of reference for the USNDC regarding frequency of subcommittee meetings recommended by USNDC members. The chairman reported that this action had been completed.

Action 7—Chairman

At least 30 days prior to the next USNDC meeting convene each USNDC subcommittee, establish the primary committee goals and formulate a set of terms of reference for operation of the respective committees. Prepare and distribute to parent committee members a final status report in time for consideration at the fall USNDC meeting. Owing to the rather lengthy discussion required by this action the chairman moved the discussion of this action to Agenda item 2.

Action 8—Subcommittee Chairman

On a continuing basis advise the Division of Nuclear Physics of the American Physical Society through J. Harvey of dates and agenda of subcommittee meetings. Action 8 was discussed in conjunction with action 9 which follows.

Action 9—Subcommittee Chairman

Prepare a statement on the chartering of the USNDC as a formal advisory committee including instructions to interested parties to write to the secretary for information on future meetings and submit this statement to Physics Today and other appropriate journals. These actions were not carried out on the advice of George Rogosa. He pointed out that the legal requirements are met by publication of the meeting announcements in the Federal Register and felt that the work of the committee would be significantly inhibited by actively soliciting participation by interested parties. Unsolicited visitors should be welcomed, but contact with the physics community could be maintained adequately through the USNDC committee members who have adequate contact in the course of their work.

Action 10—Designated persons

Forward a two-paragraph summary of individual technical responses to the Shaw-Miller memorandum to the chairman by June 28. The discussion of this action and the following one was combined with that of action 12.

Action 11—Chairman

Collate the summaries of the technical responses to the Shaw-Miller memorandum in the technical section of the summary letter to DPR.

Action 12—Chairman

With corrections and deletions made on the basis of committee's discussion and of letters of comment received from USNDC members before July 2, prepare a draft document representing the committee concensus on the responsibility of DPR for nuclear data procurement. Circulate the resultant document among NDC members for approval. Former chairman, Chrien, reported that all three actions had been completed and that John Teem had received all information referred to in the actions. The chairman reported that no written response had been received from Teem or his representative. The committee as a whole expressed concern about the lack of response in view of the seriousness of the subject and the great amount of work which had been done by the committee. Rogosa reported that the issues of the Shaw-Miller memorandum are a subject of continuing interest to the Research and Reactor Divisions of the AEC and that the issues have not been fully resolved at this point. He reported, however, that in FY-75 the ORELA facility will be deriving all its operational support from DPR of the USAEC. He reported that an intent exists to respond to the committee and expressed his personal appreciation for the great amount of work which the committee had done on the matter. A. Smith commented that the same problem may be emerging in the CTR

area. Rogosa agreed and reported that Teem recognizes this as a problem requiring consideration. He reported that Dr. S. G. English is now devoting considerable attention to the interface of DPR research with other divisions of the AEC. Also, the General Advisory Committee has discussed this matter and provided the AEC with its input. The chairman declared these actions completed.

Action 13—Subcommittee chairman

Forward to the USNDC chairman suggestions for short reviews of programs supported by AEC contract appropriate for presentation at future USNDC meetings. The chairman reported that this action was not implemented since a current list of contractors was unavailable and there was concern that some contractors might have been cut off from support. Rogosa expressed an intent to supply such a list of contractors to the subcommittee chairmen. In response to a question from the committee, the chairman reported that only DPR contractors were included in the list distributed to date. The chairman placed old action 13 as a continuing action on the subcommittee chairmen.

ACTION 4 Subcommittee Chairmen

Action 14—Anderson

Distribute to USNDC members the atlas of photoneutron cross sections obtained with monoenergetic photons, UCRL-74622. Anderson by memo to the secretary reported that this action had been completed.

Action 15—Secretary

Include in future requests for contribution to the USNDC Status reports the document number for the forthcoming issue. By oversight this information was not included in the request for contributions for the present meeting. The document numbers were read to the committee by the secretary. Moore asked who received the technical minutes in Europe. Chrien responded that the "A" distribution was used and that it should be adequate. The A

distribution includes only the members of the EANDC. Chrien felt that we should leave to the representative of the individual countries the responsibility for distributing the documents in whatever way and to whatever degree they feel is appropriate. Rogosa asked to have the committee's opinion on this matter. After a short discussion the committee concluded that no change was necessary.

Action 16—Subcommittee chairman

In consultation with subcommittee members prepare a brief statement of guidelines to be followed in collecting status reports to be submitted to the USNDC. Discussion of this action was deferred to the discussion of the status reports.

Action 17—Chairman

In a letter to DPR express the concensus of the committee that no DPR funds be spent in implementation of the Abramov proposal. This action was completed by the chairman.

Action 18—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 completed by Moore.

Action 19—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. Former chairman, Chrien, prepared the schedule and forwarded it to Rogosa.

Action 20—Chairman

Write a letter to DPR recommending AEC sponsorship of the Fourth Conference of Nuclear Cross Section and Technology and suggesting that it be held in Washington, D.C. during March or April of 1975. W. Havens reported to

the committee that a reply from AEC had been received saying that it would sponsor the meeting, but that at this time no financial commitment from them had been obtained. He also reported that NBS had responded favorably indicating its willingness to act as a sponsor and to provide facilities and support necessary to carry out some of the mechanical matters relating to the meeting. The IAEA had responded that a delay to at least 1977 would be necessary if they were to join in full support of the meeting; the meeting will therefore not have IAEA support. Havens reported that since the Nuclear Physics Division of the APS has approved the meeting, he expects the American Physical Society sponsorship to be communicated to him soon. The American Nuclear Society has not yet responded. Havens reported that the program committee feels that an international conference would be highly desirable and therefore believes that we should ask for IUPAP sponsorship. Havens then moved on to the details of the meeting. He reported that the organizing committee felt that a downtown hotel in Washington, D.C. should be used for the meeting and that the official host for the meeting should be the National Bureau of Standards. The meeting is tentatively scheduled for March 3-7, 1975 at the Shoreham Hotel. Havens expressed his feeling that the conference should be discipline oriented in its program rather than project oriented. By March 1974 the titles of sessions, etc. would be distributed to all interested participants. A motion was made and carried that the USNDC endorsed the meeting as international in participation both with regard to the organizing committee and with respect to invited papers. The motion was carried. In view of this consensus on the desire for international participation, the chairman placed an action on Havens to seek the sponsorship of appropriate international organizations for the Fourth Conference on Nuclear Cross Sections and Technology, 1975.

ACTION-5
Havens

CTR Charged Particle Data

Action 21—Chairman

Draft the reply to the Wood-Weaver proposal for a National Nuclear Cross Section Program and circulate to the USNDC for comments. Former chairman, Chrien, reported that this action had not been carried out in light of the reorganization of the AEC after consulting with Rogosa. Anderson reported that the official position of the LLL laser program is that there is no major need for the cross section (charged-particle-induced reactions) at this time. He communicated to the committee that the request regarded in the memo as high priority were primarily of conceptual interest, not of design interest, and that high priority was not warranted. Steiner, Chairman of the CTR subcommittee, stated that the request list has these cross sections listed, but that the CTR program office has not decided what it needs and how badly, nor has it decided on the ordering of priorities. He stated that these decisions probably won't be made for six months to one year. Newson pointed out that this policy is discouraging to measurers. He commented that there has been considerable discussion of these measurements both within and outside of the USNDC and that the measurers were getting the rather distinct impression that the CTR program has a strong interest in such measurements. Steiner responded that there is good reason for caution in strongly requesting this data. He pointed out that CTR facilities are now trying to achieve temperatures in the 1 to 10 keV range. The new reactions involving charged particles under discussion require temperatures in the 100 to 200 keV region and that is rather far in the future.

The chairman then asked whether a request list from the laser-induced fusion programs had been received by the CTR subcommittee. Steiner responded that nothing had been received from those attending the CTR subcommittee meetings. The chairman expressed to Steiner his appreciation for

the active role which the CTR subcommittee was playing in the nuclear data area, but expressed two reservations about its manner of operation. First, is the CTR subcommittee representative of the full CTR community? More specifically, is the subcommittee getting adequate representation from the laser-induced fusion program personnel? Second, from the minutes of the CTR meeting one gets the impression that the subcommittee advisory responsibility might be oriented more strongly towards the CTR (confined plasma portion of the program) than to the parent USNDC committee. Steiner reported that this orientation naturally grew from the committee's effort to attend to the actions which were placed upon it. The committee is representative of both the confined plasma and the laser-induced fusion program. However, the needs of the confined plasma program and the program itself are better defined in the case of the confined plasma effort, probably primarily because the confined plasma effort has been established longer and there is a specific Division of the AEC specifically set up to conduct and supervise this research. After further discussion the consensus of the committee appeared to be that the CTR subcommittee had aggressively attacked the nuclear data problems in CTR and was thereby responding in a strong way to its charge and that the concern about the dual advisory capacity to both DPR and DCTR should not be of serious concern until the laser fusion program is able to state its nuclear data needs more definitively.

Rogosa commented that the DCTR was more concerned now about materials cross section problems than reaction cross section measurements. This view was supported by those in attendance at the CTR's subcommittee meeting.

Anderson brought the discussion back to the main point of action-21. He reminded the committee that at the last meeting the general consensus was that the Wood-Weaver proposal had no merit. He inquired, in view of the

previous discussion, and the actions of the CTR subcommittee, if this feeling had in any way changed. The response of the committee was that the committee viewpoint on the matter was the same and that there should be no response to the proposal.

Action 22—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 the chairman of the Isotopes and Standards subcommittees. Since this action had not been completed by the subcommittees, the chairman continued old action 22 as new action 6 on subcommittee chairmen.

ACTION-6 Subcommittee Chairmen

An interlude in technical discussions followed during which Robertson commended the hosts for their careful attention to detailed information for attendees which made it particularly easy to make travel plans for this meeting. The committee heartily concurred.

E. Review of Terms-of-Reference of USNDC

G. Rogosa pointed out to the committee that the terms-of-reference document is not a formal requirement but is important to the operation of the subcommittee. The committee can adjust the language as experience is gained.

The chairman introduced the question of the degree to which new Federal laws will restrict the activities of the committee. He interpreted the section of the law on announcement of meetings to mean that the committee and subcommittees can continue informal meetings and phone meetings but that all actions and reports must be approved by the full committee meeting in full accordance with the law before distribution outside the committee is permitted. Rogosa then gave his interpretation of the Federal laws as related to the

announcement of meetings. He asked subcommittee chairmen in planning meetings to send the proposed agenda to him which he will then forward to the Federal Register where they will be published. He concurred with the chairman that subcommittees cannot issue reports without a formal meeting. Such reports must be approved in the parent committee formal meeting before they can be distributed. The amended terms-of-reference are included as Appendix B.

II. ORGANIZATION AND OBJECTIVES OF USNDC AND SUBCOMMITTEES

A. Impact of Reorganization of DPR on the USNDC

Rogosa discussed in some detail the impact of AEC reorganization on the USNDC. He reported to the committee that nuclear chemistry and nuclear physics programs have been merged into the Nuclear Sciences Program. He emphasized that the distinction between these two programs had been largely administrative and that significant distinguishing elements between them were very hard to find. He emphasized that there are now facilities such as the HIFR which are involved in the production of transplutonium nuclides which his program is now concerned with. He pointed out that there are about seven million dollars being spent in this area and invited the committee to comment on the scientific basis for this expenditure. He cited this as an example of the new kinds of input that he might expect from the committee. He continued his presentation with a more detailed discussion of the new organizational structure of the Division of Research. It has been broken into five entities including High Energy Physics, Nuclear Sciences, Material Sciences, Molecular Sciences, and Administration. Dr. John Teem is the Director of the aggregate of these program areas which make up the Division of Physical Research. He serves in this capacity in

addition to his responsibility as Assistant General Manager for Physical Research and Laboratory Coordination. There are presently two committees advising Teem; the USNDC and the High Energy Physics Advisory Panel. Rogosa conveyed Teem's strong support of the USNDC as an AEC advisory committee and expressed Teem's regrets at having had to cancel plans to attend this meeting. He was kept away by urgent preparations of the AEC energy package for the Energy Research and Development Agency (ERDA).

Rogosa next presented the FY-74 budget for the nuclear sciences area. He reported that the nuclear sciences have been broken into five areas for budgeting purposes which included (1) Medium Energy defined as experiments done with facilities capable of operating above the meson threshold, (2) Heavy Ion Research which includes all research using projectiles more massive than the alpha particle, (3) Low Energy Nuclear Science, (4) Nuclear Theory, and (5) Separated Isotope Production. Funding levels for these areas for FY-74 are, respectively: Medium energy—$19,000,000, Heavy Ion Research—$14.9 million, Low Energy Nuclear Science—$19.2 million, Nuclear Theory—$5.3 million, and Separated Isotopes Production—$7 million. In response to questions he further broke down the low energy nuclear science funding which was distributed as follows: charged particles—10.3 million, neutron and fission physics—7.6 million and heavy element research—1.3 million for a total of 19.2 million. Goldstein questioned the rationale behind Heavy Ion Research getting twice the support of neutron and fission physics when such a major portion of our energy technology such as the fast breeder reactor and the CTR program will be based to a significant degree on the data flowing from these research programs. Rogosa responded that the subject has come up repeatedly within the AEC and that possible changes in the distribution are under consideration. He stated that

by comparison with the past, support for medium energy research has increased, heavy ion energy research has increased, low energy research has decreased, and theory has remained at about the same level. In response to a question about funding for FY-75 he expressed optimism about increasing the expenditures for nuclear science. He commented that the AEC has undergone major changes in recent months and has simultaneously been greatly exercised over new energy programs being proposed. Within this milieu, however, he has had numerous opportunities to emphasize the importance of nuclear sciences and thereby feels optimistic about FY-75.

In summary, Rogosa stated that the committee is still an advisory committee to the Director of the Division of Physical Research. He felt that the committee should focus on nuclear data and should also continue to emphasize activities that will provide assistance to other parts of the AEC, such as DCTR, DRRD, etc. In his opinion, the reorganization of the AEC should not have a great impact on the previously established responsibilities of the committee. Several questions followed, among them a question from Pearlstein regarding the long and short range goals of AEC. Rogosa responded that Teem is now hard at work attempting to establish goals and objectives for the Division of Research. He felt that Teem would probably attempt to maintain a strong basic science base under the nation's technology but at the same time attempt to orient a significant part of this research toward programs with major impact on the welfare of the nation.

B. Reports of Subcommittees — Terms-of-reference and goals

1. Neutron Data Applications

Alan Smith, Chairman of the subcommittee, began by expressing concern on the means for obtaining efficient performance of the subcommittee

with a minimum of travel. He described an informal telephone meeting of the subcommittee held in early November in which about twelve participants gathered at five different telephone speaker-microphone hookups around the U.S. The conversation lasted for two hours, and the participants generally agreed that much was accomplished in this first attempt at this kind of meeting. Smith and other participants emphasized the larger amount of preparatory work required to carry on an effective meeting of this kind, but emphasized the great saving in travel expenditures by pointed out that the charges for this two-hour meeting amounted to less than $100. Smith reported that a formal meeting of the subcommittee will be held on February 8 at ANL, and that it will be followed with a working group session on February 9. This meeting is of course arranged to be contiguous with the Chicago APS meeting.

Continuing with his discussion of the means of carrying out committee business, Smith proposed that his committee and perhaps other subcommittees try to arrange topical discussions on matters important to the USNDC Subcommittees for presentation at nuclear physics division meetings of the American Physical Society. As an example, he proposed that his subcommittee acting through the USNDC propose an agenda of invited talks on nuclear models, the theory behind them and applied nuclear data which can be obtained from these sources. He proposed that such a topical session be arranged for the fall meeting at Pittsburgh. Havens strongly supported this proposal pointing out that travel funds for USNDC committee or subcommittee meetings are often hard to find and that this proposal would help resolve this question for committee members. It would serve the additional purpose of getting a larger audience for the kinds of topical presentations which are usually presented only to the USNDC or its subcommittees and it would probably be possible to persuade speakers

more easily to talk on matters of interest to the committee and to prepare more thoroughly since a larger audience can be reached. The chairman also pointed out that presentations of this kind organized by the committee would increase the visibility of the committee within the science community. Phillips moved that the chairman of each subcommittee be appointed as members of an ad hoc committee to approach Professor Cohen on behalf of the USNDC to arrange a special program on nuclear theory applications and proposed in addition that USNDC meet contiguously with the Pittsburgh meeting in the fall. The motion was seconded by Feshbach and carried unanimously. In response, the chairman placed an action on himself to appoint an ad hoc subcommittee chaired by Smith and made up of USNDC subcommittee chairmen to approach Professor B. Cohen on behalf of the USNDC to arrange a special program on applications of nuclear theory at the Fall 1974 meeting of the Division of Nuclear Physics of the APS. Smith concluded his report by reading the Neutron Data Applications Subcommittee terms of reference. These have not been officially adopted by the subcommittee although they were discussed in the telephone "meeting" and in an informal meeting immediately preceding the present USNDC meeting. Formal action on these terms of reference which are included in the minutes as Appendix C will be taken at the February 8 meeting of the subcommittee.

ACTION 7
Chairman
A. Smith

2. Standards

R. Caswell, Chairman of the subcommittee on standards, presented a report of the functions of the USNDC standards subcommittee. In summary, these functions included the intent to know the status of nuclear standards work in progress and planned, to originate nuclear standards requests for applied purposes and establish priority for them, to answer specific questions on nuclear standards referred by the USNDC, to supply current information on what

is being done and what needs to be done in the area of standards, to foster topical conferences or symposia in the area of standards, to be aware of instrumentation developments which might relate to standards, and to be cognizant of the activities of other standards working groups and subcommittees. A more detailed presentation of these functions is included in the minutes as Appendix D.

3. Basic Science Subcommittee

At the request of Subcommittee Chairman, Lind, who could not attend the meeting, R. Chrien reported for this subcommittee. Chrien reported that informal discussions at the Bloomington meeting of the APS were held which included about half of the members. Lind proposed terms of reference at this informal discussion and has circulated them to committee members. Discussions at Bloomington indicated significant uncertainties as to the role of the subcommittee. The subcommittee plans a formal meeting contiguous with the Chicago meeting of the American Physical Society in February 1974 at which time the terms of reference will be discussed more thoroughly and approved by the subcommittee. Feshbach expressed concern about one responsibility of the committee which related to the need to ferret out sources of data not immediately available. The subcommittee discussed the possibility of taking actions which could be helpful in obtaining data from measurers which had been obtained incidental to another measurement. While such data often is not felt to be of enough significance for publication it might nevertheless be valuable to others and might eliminate the need for repeating the same experiment by scientists attempting to do similar but not identical work. Feshbach was concerned that the gain might not be worth the cost in manpower and money required to accomplish this objective. Perey expressed concern about the lack of proper dosumentation of such data and felt

that "data in the drawer" might best be left there until the measurer himself has some need to document the experiment properly. Smith pointed out that an appropriate American Nuclear Society Subcommittee has advised against getting "muddy" and uncertain data circulating in the data pool. Chrien responded that Lind wanted to emphasize primarily the cataloging of the data or sources of data which users would then be free to consider at his own risk.

Turning to another matter discussed at the meeting, Chrien communicated Lind's concern about the balance of DPR's support of research, that is, heavy ion as opposed to charged-particle research etc. A discussion followed regarding the merits of setting specific research goals as opposed to broad overall capability in research. Feshbach expressed the opinion that these two approaches are not necessarily compatible and that attempts to do both at once might lead to unsatisfactory results. The committee did not attempt to resolve this issue since it was subject to further discussion by the subcommittee at its first formal meeting.

Chrien next introduced the subject of a detailed request list for basic science cross sections to be incorporated in the USNDC Request List. He communicated Lind's feelings that such a list would not be particularly useful. Lind felt that an informal list ought to be available, however, for getting needed basic science cross sections before the community. Chrien supported this view and then moved on to express another of Lind's concerns regarding the absence of interaction of the subcommittee with NSF laboratories. At this point the chairman asked if the terms of reference proposed for the Basic Science Subcommittee were adequate for the direction of the committee. Chrien responded that the work done thus far on Terms-of-Reference is just the beginning upon

which the committee will build in the future. Phillips referred back to the concern about NSF representation and supported the view that NSF support was needed both on the subcommittee and the parent committee. Jackson responded that in spite of repeated invitations and the appearance of representatives on our membership list that NSF appears to be uninterested in participation in the committee. Phillips responded that this is indeed unfortunate since the group as now constituted is just not representative of the full spectrum of contractors or funding agencies. Feshbach suggested that perhaps there is a severe bureaucratic problem in getting this participation. Rogosa responded that meetings between AEC and NSF funding personnel take place at least semiannually with satisfactory results in terms of cooperation and differentiation of areas of responsibility. The discussion ended with apparent committee consensus that there was little the committee itself could do to resolve this problem.

Smith directed the discussion to a new subject asking where the responsibilities for development of new technology should fall in the USNDC structure. Should it be a responsibility of the basic science subcommittee? Phillips asserted that it was important that the committee distinguish between whether it was to be a science committee or a data committee pointing out that science was a far broader term which was perhaps outside the scope of the committee. Feshbach commented that the committee has broad responsibilities and a difficult assignment just to successfully coordinate the data efforts in this country and expressed reservations about expansion beyond data. Phillips referring back to the basic science subcommittee commented that the charge to the subcommittee is already too broad and it should not be broadened further. Bowman concurred but pointed out that the basis for new science often is new data and that one of our strongest concerns should be data that might be useful for

developing new applications in nuclear science. He pointed out that the committee is presently not organized in such a way as to promote the development of new science applications. Feshbach commented that he did not understand why this should be a serious problem of committee concern pointing out that nuclear data per se is not necessarily an ingredient for development of new science. Phillips commented that in his opinion the country will suffer if this concern is not somehow met but still isn't sure that it should be in the basic science subcommittee. Feshbach responded that the USNDC might advise the USAEC that this problem which concerns us appears not to be in our purview, but that we urge the AEC to actively promote efforts in this area. Havens then addressed a question to Rogosa beginning by pointing out that the committee had been expanded to include other areas of nuclear science and inquired if we should continue in that direction. Rogosa responded that this committee is not the nuclear science advisory committee, and it should use nuclear data as its central focus. Bowman expressed concern that the development of new applications was being left to take care of itself. Feshbach commented that the basic science subcommittee should be concerned about data for nuclear models and data for applications; that is, new applications would just have to take care of itself. The chairman expressed concern that the needs of basic science should be met in some way by the committee and those other areas of nuclear data not falling to other subcommittees ought to be taken care of somewhere. Chrien expressed his objection to basic science taking over this latter responsibility.

4. Materials Analysis, Safeguards, and Environmental Matters

J. Ball, Alternate for Dan Horen, reported for this subcommittee. Ball reported that the subcommittee had established a statement of goals and

terms of reference for its operation. The goal of the subcommittee will be to serve as an information channel between those groups involved with measurement programs in the fields of material analysis, safeguards, environmental protection, and those groups of activities which produce information needed to maintain and expand the effectiveness of such measurements. This statement of goals and the terms of reference for subcommittee operation are included in the minutes as Appendix E. Ball reported that all contact to date had been carried out by mail and telephone and that this would continue to be the mode of operation owing to the scarcity of travel funds until such time as a general subcommittee meeting is required.

Ball commented that additional members would almost certainly be required to cover the rather broad areas of responsibility of the subcommittee. Jackson responded that the complex procedures involving the highest officials in the AEC would not permit any new appointments to committees or subcommittees before January 1975. However, he urged Ball to expand the membership of the committee in effect by inviting visitors.

Ball next presented to the committee for review a new compilation of decay schemes covering the mass range from A = 45 to A = 257. It is now available from Academic Press. Rogosa asked if there is an introduction in the front of the book which adequately explains the decay scheme presentations. He explained that many of the users of the volume probably would not be highly experienced in the measurement and presentation of nuclear data and that the array of lines, bars, arrows, etc. might prove to be a significant barrier to the use of the volume if the introduction does not fully explain the notation used. Ball responded that he felt that the introduction was adequate in this regard. He also responded to a number of other comments after which Feshbach called attention

to the contributions of the NIRA program to the information in this volume. He felt that the NIRA program had been a great success, that the evaluations and compilations carried out by this program were of high quality, that they had proceeded at a reasonable rate and that the program would probably be completed by next September which is the time for termination of the NIRA program. The program, therefore, is on schedule. Pearlstein commented that he was sure that the feedback from the committee on this volume was helpful to its originators and asked that the appropriate subcommittees comment on the value of compilation for their area of concern and get these comments back to the generators of the compilation.

A discussion followed leading to a question from Hemmig as to whether subcommittees may originate requests for nuclear data. The chairman answered affirmatively pointing out that the matter had come up at previous meetings and that this mode of operation was regarded as acceptable. Steiner felt that this was a bad idea and that the subcommittee should only screen requests which are certified by the responsible agency as being valid requests. Hemmig concurred pointing out that this is the way that the DRRD initiated its requests. However, Caswell commented that the standards committee felt obligated to originate requests since there was no particular agency looking after standards even though standards were at the foundation of a number of different nuclear technologies. The chairman commented that there might also be the need for originating requests within the basic science subcommittee pointing out for example the serious need for better measurements of the photo-disintegration cross section of deuterium. He pointed out that such a measurement could greatly improve the accuracy of a significant amount of photonuclear data. The general consensus of the committee was that one could make good

arguments on both sides of this issue and that the matter would be left to each subcommittee which should, however, use great discretion in originating their own requests.

5. Controlled Thermonuclear Research

Steiner presented no explicit goals in terms-of-reference of the subcommittee, commenting that the subcommittee agrees with and adopts the terms-of-reference of the parent committee. He explained that the goals were presented at the last meeting and appear in the minutes of that meeting. He further explained that the goals of the subcommittee would closely follow or be related to the goals of DCTR and that it would be helpful to the committee if Les Price of DCTR could visit the committee and set forth these goals. He explained that DCTR is undergoing changes now but that it is rather firmly established that there will be three major parts to the Division: (1) Office of Research, (2) Office of Confinement, and (3) Office of Development and Technology. L. Price is with the latter entity of DCTR.

In response to questions regarding the goals of the committee, Steiner expressed the need which he felt for more discussion at the parent meeting of what the role of the subcommittee is, and of what DCTR sees as its needs from the subcommittee. He stated that the committee now intends to review neutron and charged-particle cross sections for the full range of CTR applications. He informed the committee that the subcommittee had been asked to serve as an advisory committee to CTR also and that it had expanded its attendance to include the laser-fusion efforts.

The chairman expressed the concern that all subcommittees should have an explicit statement of goals and terms-of-reference both for the use of the subcommittee itself and for use of the parent committee, for example, in

deciding whether some new need or request should fall within the purview of a particular subcommittee. The chairman therefore placed an action on Steiner

ACTION 8
Steiner

to summarize the subcommittee goals for the parent committee so that it can have a clear understanding of the role of the CTR subcommittee.

Smith turned the discussion to the size of the nuclear data measurements efforts in the U.S. expressing great concern at the small amount being spent in this area. Apparently 80 to 90% of the money spent by DCTR in the field of nuclear data would be in the area of evaluation. Only the small remainder would be available for measurements and it would be spent only on highly specific needs. The rest of the cross sections would be left for DPR support. Steiner

commented that need for new nuclear data which the DCTR might be willing to fund will come forth as a result of sensitivity studies now underway. However, he felt it would be irresponsible to propose measurements or evaluations now even in the long term sense until a more detailed review has been finished. He felt that such a review was at least six months to one year away. P. Persiani agreed that it is too early to clearly establish these needs. The closing comment of this discussion was made by Smith who expressed fear that the laboratories with the capability to do the measurements are encountering very serious support problems and that DCTR might find that the country lacks the resources to do these measurements if it delays much longer in deciding what needs to be done. The minutes of the first meeting of the CCR Subcommittee are included in the minutes as Appendix F.

6. Biomedical Applications

Robertson briefly reported that the committee has not met yet and has carried on most of its work through telephone conversations among the members. He commented that processed nuclear data is now rather well supplied by MIRD of the Society of Nuclear Medicine. That committee also has summarized the sources of nuclear information for biomedical applications. He expressed concern that these already existing activities might make it more difficult to establish the working relationship between users and measurers that exists in other subcommittee disciplines.

7. Separated Isotopes

Perey reported that the new subcommittee has not met yet but that it intends to keep on doing what has been done in the past. Rogosa pointed out that the Nuclear Sciences part of the DPR now has responsibilities for the transplutonium production facilities for special heavy isotopes and that the

subcommittee should include responsibility for these within its purview. He also urged the committee particularly to stay on top of what future requirements are needed for separated isotopes for research purposes. He said the question keeps coming up and that a well thought out comprehensive statement would be valuable to the AEC. Rogosa commented that the AEC now gets input from the Transplutonium Committee on HIFR and the TRUE facilities but that he would be especially pleased to receive input from the isotope subcommittee. Perey agreed that these responsibilities were appropriate to the subcommittee and stated that the committee would not worry so much about data but that it would try to ride herd on these facilities. Smith commented that the subcommittee should also worry about sample fabrication and related problems which this committee has discussed extensively in the past. Rogosa suggested that the committee also might concern itself with the means by which isotopes reach the experimental user. As an example, he asked Huizenga how he obtains access to isotopes. Huizenga responded that his access is obtained by collaborating with national laboratory personnel who, while actively participating in the measurements, quite often make their greatest contribution simply by supplying samples. Rogosa expressed his feeling that we need more input on this subject to complement the Transplutonium Committee (TPC). Moore commented that better liaison with the TPC would be desirable and suggested that representation from USNDC should be involved with the TPC. This suggestion was adopted as an action on the chairman to establish representation from the USNDC on the Transplutonium Committee.

ACTION 9
Chairman

This completed all the subcommittee reports. The chairman expressed the feeling that the long term effectiveness of all the subcommittees would depend on their establishment of well-thought out terms of reference. He placed an action on all subcommittees to approve their terms of reference and

ACTION 10
Subcommittees

forward them to the chairman by March 1.

III. ANL TECHNICAL TOPICS

A. ANL-LASL Design Study of a Theta Pinch Fusion Reactor

Dr. Paul Persiani described a joint Argonne National Laboratory-Los Alamos Scientific Laboratory design study of a theta pinch fusion reactor operating at an average power level of 12,000 MW thermal and 5,000 MW electrical. The generation of power comes about from the fusion of a deuterium-tritium mixture in a 100 meter diameter torus. The facility operates in a pulsed mode with a cycle lasting three seconds. The first step in the cycle is the ionization of the gas in the torus which is accomplished in a high voltage-low energy mode. The plasma then undergoes compression in a low voltage-high energy mode. As it moves to the center of the toroidal cross section, it heats to temperatures sufficient for fusion to take place. The design gives careful consideration to energy in the plasma, energy released through work against the magnetic confinement field, energy released in neutrons, and gamma rays. A significant advantage of the theta pinch design over the tokomac concept is the absence of any need for cryogenically produced magnetic fields in the vicinity of the reaction volume. Cryogenic systems are required in the temporary facilities for storage of energy between pulses but this is located remotely from the reaction volume itself. A blanket of liquid lithium metal is located around the torus serving the dual purposes of slowing down and absorbing neutrons and thereby providing a means of extraction of energy from the facility, and of serving as breeder material for additional tritium. The lithium also cools the walls of the torus. The inner wall will be subjected to a flux of 3×10^{15} n/cm^2-sec of 14 MeV neutrons. A fluence of 2×10^{23} n/cm^2-sec will require replacement of the wall. A corrosion rate of 0.4 mils per year for the wall is

expected and a sputtering rate of 0.4 mils per year also. The transfer of energy from the reaction volume is being studied in detail so as to estimate actively the heat loads on different components and determine power peaks in the various parts of the facility. The design has resulted in a list of needed neutron cross sections. These relate partly to materials problems and partly to the question of tritium breeding ratios and doubling times. The construction uses very large amounts of materials not in abundant supply and only one such facility will tax the present availability of niobium, helium, etc.

The objective of the design efforts are to produce a plant design which is compatible with existing materials, capabilities, and engineering techniques, to evaluate the environmental impact of such a facility, and to isolate the R & D problems which need further study including feedback to the plasma research program. At present the design report for this study is now in galley proof. The environmental report has been drafted and the major R & D problems are identified. The general impression created by this presentation was that design studies for practical theta pinch fusion reactors has been brought up to the level of such studies for the Tokomac-like facilities.

B. Heavy Ion Superconducting Linac

Bollinger of the Argonne National Laboratory reported on the Argonne Heavy Ion Accelerator Facility. The objective of this facility is to accelerate ions as heavy as uranium to energies exceeding 10 MeV per nucleon. Using beams from this facility the laboratory expects to conduct research in the areas of materials research, nuclear structure and reaction mechanisms, heavy ion research, nuclear fission, and nuclear structure of the actinides. The planned research program will be a natural extension of presently existing

ANL activities in these five areas.

The facility consists of a tandem electrostatic accelerator with 20 MV on the terminal injecting into a superconducting linac 45 meters in length which will continue the acceleration to the desired energy. A 350 kV negative ion beam is injected into the tandem and accelerated to the terminal where it is stripped of 8 to 15 electrons and then accelerated to ground potential and directed by magnets into the linac. It is anticipated that a major variety of interesting experiments can be formed without acceleration in the linac. However, to achieve the main objective the beam is stripped further to an ionization state of perhaps 40+ and then injected into the linac.

The linac will run at a frequency of 100 MHz. Acceleration is by way of a standing wave induced in a helix waveguide structure. The power dissipation in each helix is about one watt. The energy gain per 12 cm is in the 100 to 300 kV range per electron charge. Between 150 to 200 of these units would be built. In actual practice these units probably would be ganged together in groups of five to ten to achieve a significant reduction in construction costs at little sacrifice in accelerator performance.

The ANL staff has made much progress in linac technology and sees no major technological problems in implementing the proposal. Accelerating systems have been cooled down for a total of 2000 hours. Adequate stability under rf fields has been achieved by anodizing structures and by conditioning. The problem of vibration of the helix structure was thought to be a major one since displacements as small as 5 Å caused the frequency to change and therefore dephase the accelerator sufficiently to destroy acceleration. While elimination of vibrations this small presently is not possible, a scheme has been developed permitting the modulation of the frequency in such a way that the average frequency

is phased properly to the beam and efficient acceleration takes place.

Bollinger answered the question often asked as to the comparison of this technology with other heavy ion technologies. He believes that construction for this accelerator can be less than for other accelerators for heavy ions. However, for lighter ions there probably would be no advantage. Operating costs might be somewhat smaller than other facilities although not to the extent that this would be a matter of major significance. The accelerator does have the capability of accelerating more than one charge state which will contribute to a higher current and permit the beam to be split into components of different charge dates so that two or more experiments can be carried out simultaneously. Bollinger reminded the committee that the proposed facility, which he feels is at least competitive with other existing concepts, is not based on a well developed technology where there might be little liklihood of future improvements as perhaps with competing systems. Rather it is a new technology which has already reached the stage of the older technology and from which we can expect significant advances in the future. He discussed a new heavy ion accelerating structure in a spiral form developed by Dick and Shephard at Cal.Tech. The spiral is less sensitive to vibrations and gives higher energy gain per unit length. These and perhaps other developments might permit extensions of the technology. This, together with the capability to accelerate all charge states have played a key role in ANL's adoption of this technology for heavy ion accelerators.

A short discussion followed this presentation. Rogosa referred back to questions about the increase in support for research into heavy ions. He asked Bollinger to comment on how he rationalizes personally his transfer to heavy ion research. Bollinger responded that heavy ions in his view is a

more fruitful source of new physics insight than neutron physics. He feels that a young man beginning a career in nuclear science research would find heavy ion physics much more attractive. Newson asked what these new physics insights might be, but his question was left unanswered.

C. Evaluation of Fast Neutron Cross Sections

Smith began his presentation by describing the balanced staffing situation now existing at ANL which included both theorists and experimentalists. He explained that the emphasis was on fast neutron processes for nuclides of a standards nature. He presented four examples of the group's work which gave ample evidence of a very comprehensive approach to the measurements-evaluation process of satisfying specific requests. The approach is to measure as many different reactions on a particular nucleus as is possible, without extraordinary effort to achieve moderate accuracy. The group then complements these measurements with theoretical predictions which can be used either to check for consistency between measurements or to predict cross sections which are extremely difficult to measure. The results of this program were dramatically emphasized by pointing out some cross sections which had changed by as much as a factor of five from earlier values. Smith reported that in doing the evaluations the group adheres to a policy of using only well-documented data from other laboratories. Some evaluators might find it disturbing that some data had been omitted from an evaluation performed by the group but Smith felt that an inclusion of undocumented data would be far more likely to lead the evaluation astray than to contribute significantly to a better data set.

Pearlstein asked Smith how the group assigns errors to their evaluations. Smith responded that this procedure is difficult and highly subjective. Perey quickly injected a comment that such attempts at assignment

of errors were nevertheless valuable. Pearlstein pursued the point further saying that as money tightens there will only be money for really crucial measurements and these estimates of accuracy will play an increasingly important role. Smith commented that there are occasions where his data are significantly different from other data and in many cases he has not included this data in his evaluation. Goldstein commented that all is fair in love, war, and evaluation. This discussion closed with the air of scientific uncertainty usually associated with questions of the accuracy of evaluations.

The second part of the discussion of evaluation was presented by Moldauer who talked on the use of theory in evaluation. He described a common situation in evaluation which often leads to satisfactory results in which a number of experiments are brought together in an evaluation which is carried out with significant interaction with theoretical considerations. However, he described a better approach in which the three elements of theory, measurement, and evaluation all relate directly to one another on a reciprocal basis; that is, evaluation influences theory and vice versa, measurement influences evaluation and vice versa, etc. The tools that he uses include the optical model, coupled channel model and the statistical model. The theoretical sources for these models range over a rather wide spectrum of time and authors and includes Hauser-Feshbach, Lane-Lynn, Ericson, Moldauer, Kawai-Kerman-Mcvoy, and Engelbrecht-Weidenmuller. Using these resources the theorists must decide on the choice of formula, the choice of parameters which will characterize the cross section or nuclear data, and the statistical dispersion of the parameters. He pointed out that optical model or coupled channels calculations plus statistical model results can be combined to give average cross sections, subject, however, to fluctuations whose magnitude (and therefore uncertainties in cross

section) can be evaluated both by theoretical formulas such as theoretical width distributions, etc. and by experimental results. This information can all be melded together for a cross section prediction. He illustrated the success of different models in treating different cross sections such as elastic, direct, etc. and showed examples of comparisons with experiment which give him a feel for how good his theoretical capability is. Such comparisons play a major role in arriving at the subjective error estimates which Smith described earlier.

Poenitz made the last presentation on evaluation and emphasized primarily work on standard cross sections; that is, hydrogen, ^{6}Li, ^{10}B, Au, ^{235}U, and ^{238}U. He emphasized their attempt to carry on measurements with as high an accuracy as possible and to complement them with pertinent theory. Bowman commented that aside from the hydrogen scattering cross section that he felt that theory would have little impact on future attempts to improve the accuracy of standards. He observed that the needs in accuracy of the standards were mostly below the 2% level and that while theory might be useful in attempting to push the accuracy of a standard down to perhaps the 5% level it seemed unlikely to him that much of value could be obtained for higher accuracies. Poenitz pointed out that some standards are not yet known to 5% and that theory probably still can play a role at least in those cases. This discussion ended the presentation of ANL technical topics.

IV. ENERGY INITIATIVES AND NUCLEAR DATA

For at least six months various agencies of the Federal Government have been attempting to assemble proposals for research and development efforts to help resolve the energy crisis which the Nation faces. These agencies were asked by the President's Office in August 1973 to prepare proposals for a total ten billion dollar expenditure in this area spread over five years. This funding

is expected to have a major impact on the funding level and research program of DPR. The committee was therefore highly interested in any information which DPR might be able to provide the committee on the types of proposals which might have been submitted by DPR and the liklihood of success in obtaining funding from this important new source. Rogosa initially deferred to Allan Blair on this subject. Blair is presently on assignment to DPR from Los Alamos.

Blair informed the committee of a recent announcement in Science under News and Comment (Vol. 182, pp. 898-900, Nov. 1973) which accurately described the way the package will be broken down. This package as presented is ready now to go to the Office of Management and Budget (OMB). Nuclear science has been omitted. In fact, the package includes nothing in basic physical research. A separate proposal for basic research amounting to 10^9 dollars spread over five years has also been included in the package for OMB. This support is broken down into three categories; environmental studies--$650,000,000, multidisciplinary research--$300,000,000, and manpower and development--$50,000,000. The environmental studies portion will be handled by DBER of AEC and similar enrironmental-related agencies. Nuclear science hopefully will be included in multidisciplinary research. This is a long range research proposal including physical, chemical, research on materials relating to coal, solar power etc. There also is a part for nuclear data for nuclear reactions. The package might also include cross sections for an alternate fission cycle. The details of this package might be known by sometime in December. The $50,000,000 is for manpower to carry the program through; that is, educational training of scientists, engineers, technicians, and managers needed to implement the energy initiative. In reality the proposed energy package does not contain ten billion dollars of new money. There is a six and half million dollar base already existing. Only three and a half billion dollars would be new money.

Rogosa then reported that he had put a package together for inclusion in the multidisciplinary research using input from AEC labs which were able to respond to him in less than the week he had to prepare his input. Teem had expressed to Rogosa his desire that the committee provide input also. Rogosa included in his package several proposals from ORNL on measurement of nuclear data, theoretical analysis, and sensitivity analysis. He included proposals from Brookhaven on capture gamma ray spectra from Los Alamos on the role of neutron polarization in reactor control and from Berkeley on actinide laser research. He commented that at this time changes in the funding picture are coming very rapidly and we might see further changes yet in terms of amounts of money and places where it might be spent. He emphasized that while he would like to have input from the committee very much, the input has to come fast; that is, the committee has to respond fast. He would expect to require information no more than ten days after it was requested. Six months would be too late. Chrien asked how the membership of USNDC could help if it hadn't seen other proposals. Rogosa responded that the membership should dream up what it felt should be done rather than be influenced too heavily by what had already been proposed. Havens pointed out that we have the Goldstein discrepancy list which could always be used on short notice to provide input. However, it was remarked that this is a list of discrepancies--not needed cross sections--and therefore represents only a small part of the major needs which we are now aware of. Smith expressed concern that, owing to short notice, he was given no chance at all to contribute to AEC's package. He also expressed even more concern about continuity of support. He emphasized the feast-to-famine cycle which has characterized so many nuclear data programs in past years which had been wasteful of manpower. No sooner are scientists properly trained than funding disappears and they are

reassigned to some other areas which they must learn all over. A new urgency appears for the data shortly afterwards and hiring and training must begin all over.

Phillips asked what the package which Rogosa sent to Teem contained. Rogosa responded that he put a package together based on telephone calls and existing information. He said that there is a liklihood that adjustments can be made. That which has been contributed already will serve as an indication to Teem as to where funds might go, but adjustments probably will be possible in the future. Newson suggested that the committee might recommend more money to satisfy the request list. It's readily available and the cross sections have been requested by users of data in the applied nuclear energy program. Chrien pointed out that the discrepancy list is not adequate since it includes no priority and also omits cross sections which are not discrepant but which are now either not known or known too poorly for the program in need. Rogosa suggested that the committee might contact various measurement laboratories and ask what they could do on the request list and money might be assigned accordingly.

The discussion then moved back to the question of criticality in timing. Rogosa responded to this question by saying there might be six more exercises. He has no way of knowing when he will be asked for further information. Smith proposed that in the interest of getting more information in the hands of Rogosa quickly that the subcommittee chairman contact their members to identify specific needs and any "motherhood" statements which might be valuable to the DPR. Rogosa commented that it might be better to take the time to do a little better job and perhaps prepare something by Christmas. Steiner commented that these actions are likely to be futile unless we can identify the key man making the decisions about how money will be spent. We have to get to the man who is influencing the money. Kalos recommended that we have something in hand which

proposes who will measure what and why.

Phillips then moved that the chairman appoint an ad hoc committee of three or four knowledgeable and experienced members who could prepare a document no more than a few pages in length which should reach Rogosa by December 31. This motion was seconded by Havens. Perey asked if this hadn't already been done. Rogosa responded that he had already broken out by laboratory how any money would be spent. Feshbach expressed his concern that instantaneous dealing with such funding crises permits no planning for the long term, and that basic science would likely suffer most in this kind of atmosphere since it is by its nature long-term research. Steiner asked the committee why we should generate a new document before we look at what has already been submitted by the AEC. Moore commented that perhaps Rogosa feels that his document might be unbalanced. Pearlstein commented that although there probably are already too many documents that what is really needed is a new document which is simpler and which isolates those things which prevent nuclear data from being more firmly established. He feels that the committee has not done this yet. He, therefore, offered an amendment to the motion to select those areas which will promote the solution to nuclear data problems most effectively.

Rogosa then reported to the subcommittee the broad outline of the proposal he submitted. The proposal was organized in four sections. The first was experimental nuclear data for nuclear energy systems which was then followed by a general statement outlining the needs in this area. A second category was theoretical analysis and data evaluation which was also followed by another general statement expanding on the role of these activities. A third heading was studies of neutron polarization effects with a statement following rather closely the LASL proposal in this area. And finally an investigation of

environmental problems followed by a statement of areas where nuclear science and data could play a significant role. The question was called, a vote was taken, and the motion carried. The question was implemented by an action on the chairman to appoint an ad hoc subcommittee of several knowledgeable members of the USNDC to prepare a brief document of no more than a few pages on energy initiatives outlining problem areas in nuclear data in which additional support will promote most effectively the solution of critical problems in the nuclear energy programs.

ACTION 11
Chairman

V. DATA NEEDS FOR NUCLEAR MATERIALS SECURITY

This presentation was made by representatives of the Division of Nuclear Materials Security (DNMS) represented by W. Bartels of the AEC, Germantown; R. Gunnick, LLL; and W. Strom, Mound Laboratories. Bartels started the presentation by emphasizing that the primary concern would be materials security related to power-reactor-produced plutonium. A new set of requirements which he said were recently published in the Federal Register have set, generally speaking, much stricter requirements on materials security; that is, smaller amount of material, more frequent reviews, and better physical protection.

The new requirements impose limits on the material unaccounted for (MUF) which cannot exceed 1% in a chemical processing plant, and must be less than 1/2% elsewhere. He then reviewed the present measurement capability using different techniques, pointing out that wet chemical techniques can achieve .1 to .2% accuracy using nuclear and non-nuclear techniques. Mass spectrometry in the 0.1 to 0.3% accuracy range also can be achieved on what comes in and goes out of a chemical plant. Non-destructive nuclear techniques are less accurate but are used for measurements where accuracy is less important such as measurements of waste, scrap, and also material stored in odd forms. Accuracy for

this type of measurement varies from a factor of two down to a few percent. The techniques used for this latter type of assay include spontaneous fission, gamma ray measurements, and neutron activation analysis.

Calorimetry is also a useful assay tool and can in real practice achieve accuracies at the 0.025% level. There are advantages to the use of calorimetry in addition to high precision. Sampling errors are eliminated by measuring entire containers. The heat measurements are traceable to NBS electrical standards. The equipment does not require a skilled operator. Such advantages have focused attention on this procedure as the most promising for plutonium assay. The problem presented by calorimetry in plutonium, which is made in power reactors, is that there is a broad spectrum of isotopes produced. The percentage of isotopes will vary from reactor to reactor and within a particular reactor according to the position of the fuel in the reactor and the length of time it has been irradiated.

Time after irradiation also plays an important role in calorimetry. If spent fuel is analyzed anywhere from a few weeks to a few months after extraction from the reactor, most heat will be produced by the decay of ^{238}Pu. However, if the fuel is allowed to sit for significantly longer periods, ^{241}Am grows in from ^{241}Pu decay and requires a careful correction. As a result of a recent symposium held at Mound laboratory, the AEC is attempting to get support for a program of sending identical samples of plutonium to various laboratories with analytical capability so as to compare analysis techniques within the U.S. Mound will assume the coordinating role. LLL also will play a leading role owing to its competence in counting alpha particles, gamma rays, etc. The focus of these measurements will be on determination of half-lives which is the other major source of uncertainty. The immediate goal is to reduce the uncertainty presently at 1% down to the 0.1 to 0.2% range for the half-lives of the critical plutonium isotopes involved. Pearlstein asked at the conclusion of this talk

why standard reference samples were not used as they have always been in the past. Bartels replied that the isotopic composition of the mixtures vary so much that this is no longer effective for this particular purpose.

Bartels then turned the floor over to W. Strom who continued the presentation. Strom emphasized again that calorimetric assay of plutonium is the main problem. This assay is performed after the fuel elements have been dissolved and after the fission products have been separated so as to leave the pure plutonium. To do this analysis properly one must be concerned about the half-life for all the plutonium isotopes. He cited some isotopes specifically. For ^{239}Pu he says there is a bias of 1.3% in the half-life according to the technique for half-life measurement. For ^{240}Pu he says the "counting" values for the half-life are different from the calorimetric values by 1-1/2%. For ^{241}Pu the errors between different techniques for measuring the half-life differ by 2 to 3%. Strom then went into more details on the comparison program. The intent he says is to get a number of laboratories together and organize a comparison set of procedures which will lead to a new and improved value of the half-life. He has requested permission for use of particular batches of AEC material in this study. The primary reasons for his presentation are to receive the committee's approval that the program is well-planned and receive its endorsement of the DNMS use of this material. The committee quickly reached a consensus that the proposal was meritorious and indicated to Rogosa its support for DNMS use of this material.

VI. USNDC REQUEST COMPILATION

A. RENDA Review of USNDC-6

The chairman reminded the committee that at the last meeting it agreed to a quick review of RENDA. The committee was to review the U.S. list

and send them to NNCSC who could then forward them to Vienna. All lists were sent out to subcommittee chairmen. The CTR requests were sent to CTR subcommittee, standards requests went to the standards subcommittee, and the remainder went to the subcommittee on neutron nuclear data. Since this action has not been completed yet, the chairman placed an action on the subcommittee chairmen to complete the RENDA review and forward to NNCSC by February 1. This should include a comment on the status of each entry and more detailed information if a request has been satisfied.

ACTION 12 Subcommittee Chairmen

Chrien complemented Pearlstein's group on the job done to get the request list on its computer files where it can be conveniently handled and arranged in such a form that retrievals can be had in a wide variety of forms. Jackson reminded the appropriate subcommittee chairmen that a full review is not expected of themmwith regard to Action 12.

B. 1974 Edition of the USNDC Request Compilation

Rogosa began the discussion by referring to a letter from Chrien showing the "game plan" for the review of the request list. His principal area of concern was that the USNDC had asked the DPR to act as a clearinghouse. Rogosa views some of these responsibilities as mainly "busy work" which he would like to dispense with. After much discussion it was proposed by Chrien that the committee modify the procedure as requested by DPR. To combine steps five and six in Chrien's memo so that requests are sent directly to NNCSC from the requesting laboratories. This motion was passed. To briefly summarize the impact of this motion, the DPR requests new additions to the request list through the major AEC divisions, but each division sends its request directly to NNCSC for incorporation into the request list.

C. Generalized Compilation of Requests for Nuclear Data

The chairman began the discussion by pointing out that at the last meeting we decided to include requests for evaluation in the request list and requests for data which is not cross section data. Heath commented that it would take time to learn how to generate requests for non-nuclear data. He predicted that DRRD would be generating requests for nuclear decay data possibly through CSEWG. He suggests that all subcommittees consider how to handle the non-neutron nuclear data requests. He predicted that half-lives, and problems related to decay heat might be typical of those required. He also predicted that standards for such requests might come to be one of the most significant sources of nuclear data requests.

Smith commented that one of the chief problems of the USNDC in getting these requests into the list is contacting the people concerned about these problems who can verbalize these requests. Chrien commented that for basic science it would be very hard to compile a request list and perhaps not worth the effort. Feshbach supported this view suggesting that it is perhaps not appropriate to attempt to relate the basic science needs to the request list or to state basic science needs in those terms. Newson reminded the committee that it has already expressed its willingness to accept requests for cross sections which provide a test of a nuclear model. Anderson commented that the basic science needs perhaps might not fit the computer format for the request list but nevertheless might specify in four lines how a particular request is relevant to the great amount of applied data. Feshbach pointed out that the present list is very specific and pointed whereas the basic science requests would likely be far more broad. Kalos supported the view that pure basic science requests should be included. The chairman brought this discussion to a close by placing an

ACTION 13 Sub-committee Chairmen — action on all subcommittees chairmen to include a discussion of the generalization of the request list on the agenda of the next subcommittee meeting.

D. Compilation Filing Problems

Owing to the excellent job that the NNCSC has done in placing the request list in the computer file the chairman deemed it unnecessary to devote the committee's time to a discussion of this now nonexistent problem.

VII. STATUS REPORTS

A. Highlights by Members

Chrien reported that a 25 keV neutron beam at the reactor is now operational. He also reported that the chopper flux has been improved by a factor of four by a less severe restriction of the neutron beam collimators in the reactor shield. The beam is now being permitted to expand in the vertical direction where before it was confined in both the horizontal and the vertical direction. Slit assemblies are available which will permit an increase in resolution by a factor of four so that the capability now exists for a factor of four better resolution over that previously with no sacrifice of intensity.

Newson reported that the installation of a neutron spectrometer recently acquired from another laboratory is well under way and that the laboratory expects to be able to get up to 30 MeV neutron energies with its Cyclo-Graaff facility. The laboratory also has stabilized the tandem beam such that at 15 MeV the resolution is 1/2 keV. This high resolution has been used to resolve the analog state in ^{92}Mo into its fine structure components.

Smith complemented the LLL sphere experiments on the careful experimental detail and the persistence with which the experiments have been carried out and the value which they have for testing data sets. He inquired specifically about the LLL results on nickel since the results of the experiment

on the LLL comparisons of data sets with the Tart code were strongly relevant to the ANL cross section program.

Anderson reported that at LLL the Livermore Cyclograff can now produce 300 keV proton beams at beam current levels of several microamps.

This capability has been used to study the reaction of ^{11}B plus proton going to 3 alpha particle proposed as a possible reaction of value for practical energy production. The cross section is a little less favorable than was at first thought.

Jackson reported that at ANL a sodium capture-gamma-ray experiment was underway at 2 keV. Statistics are poor but the lines appropriately shifted by the resonant energy are seen and the spectrum at first inspection looks similar to the thermal spectrum.

Moore reported that final results on the absolute cross section of ^{235}U are presented in the current LASL report. While the uncertainty may change a little from that reported the numbers themselves won't change. He also reported on measurements of the thermal capture in ^{6}Li and ^{7}Li. The results show that the cross section for ^{7}Li is actually 30% higher than previously reported.

Rogosa reported that a torrential downpour at ORNL has closed down ORELA for about three weeks. Immediately following the storm there was two feet of water in the accelerator and experimental area. This flooding occurred in spite of measures taken last year to prevent a reoccurrence of the previous "100 year" flooding that had taken place.

Ball reported that the data project is spending time processing the data coming out of the NIRA program. The group is now processing about one A-chain per week. Feshbach commented that the objectives of the NIRA programs are very nearly achieved and the program has been valuable and successful, concluding the comments on the status reports.

B. Status of the Weapons Neutron Research Facility (WNR)

Moore reported on the current funding situation for the facility. A total of 4.4 million dollars has been budgeted which includes 2.6 million for construction, 1.6 million for beam line and equipment; and .2 million for architectural fees. Since the original bidding cycle for construction of the facility failed because all bids were too high, the construction has been broken into pieces and the laboratory now plans on two target locations with associated flight tubes at each one and with the beam moving vertically downward in one and horizontally in the other. He expects to obtain 1 micropulse which is 80 picoseconds wide and wider pulses up to 5 μsec. The current presently being accelerated at LAMPF is 1 μA. The current will remain at that level until the end of the fiscal year. In July it is expected that the current will be increased to 10 μA and by January 1975 up to a 100 μA. The beam must be focused better inside of the accelerator before the accelerator can be operated at the 1 mA design current owing to problems of activation of the accelerator structure. He reported that a separate proposal was submitted by LASL for 4.2 million dollars for a storage ring, but that the AEC had not approved it yet.

C. New Guidelines for Contributions to Status Reports

Moore pointed out that many people follow the subcommittee structure in arranging the report and suggested that this might be an appropriate procedure for the committee to adopt. Smith presented his subcommittee's guidelines for contributions, which are contained in the minutes as Appendix G. These guidelines were received with little discussion. Chrien speaking for the basic science subcommittee didn't feel that basic science should be included in the sense of Moore's suggestion in the status report and, therefore, felt that the basic science subcommittee probably would not wish to comment on guidelines.

Steiner reported that the CTR subcommittee had no contribution to the guidelines since most committee members had not been getting the reports and they therefore had not been able to discuss it effectively. Robertson reporting for the Biomedical Subcommittee reported that the committee had not yet managed to develop pure guidelines as to what data or experiments should be reported. Feshbach raised the question--"Why have a status report?" Rogosa responded, "It gives the committee status." Feshbach said "I refuse to laugh," but smiled broadly anyway. Discussion continued and Feshbach continued to search for a rationale. He asked what is wrong with the professional society meetings and journals as a means of reporting the progress of the contributing laboratories. No compelling answers were immediately forthcoming but several members pointed out that the status reports were primarily progress reports which could not be quoted in the literature and which, therefore, enabled laboratories to communicate their results much faster than would otherwise be possible.

Other suggestions or questions were raised about present procedures such as why university laboratories besides Duke and Rice don't submit, why not have an annual report, how about a keyword identification system for contributions, etc. Chrien then moved that we retain present guidelines until such time as the subcommittee suggests changes, but no action was taken on this motion. Perey moved that the secretary, in communication with the chairman, prepare a draft of suitable guidelines for discussion at the next meeting. This motion was seconded by Steiner but it failed on the vote. The chairman ended the discussion by carrying over previous Action 16 relating to this subject. This new action on subcommittee chairmen requires that they with their subcommittee prepare a brief statement of guidelines covering their respective areas of committee responsibility to be followed in collecting contributions to the

ACTION 14 Subcommittees status report of the USNDC and forward to the chairman in time for presentation at the Spring meeting of the parent committee.

VIII. COMPILATION AND EVALUATION

A. CINDA

Rogosa reported that the number of U.S. copies has been reduced from about 400 to about 200. He thinks he could reduce the number by another 100 without serious effects although some committee members appeared to have reservations on that point. More specifically, he would like to see a new review of the address list for the U.S. with everyone receiving a copy who can use it. The chairman accordingly placed an action on himself to appoint an ad hoc subcommittee to review the U.S. distribution list for CINDA and recommend the addition or deletion of appropriate names.

ACTION 15 Chairman

At the recent INDC meeting in Vienna, Lemmel gave a report where he criticized the status of the U.S. entries in CINDA on the basis of several spot checks which indicated a number of omissions. Lemmel also had raised the question of why CINDA was not prepared at Brookhaven by the NNCSC since that is a major body in the U.S. involved in cross section compilation. Goldstein reported that ORNL had fallen somewhat behind in checking CINDA entries owing to a heavy burden of computer programming. However, he reminded the committee that the USNDC contributions were not meant to be complete in the sense of the European contributions. The Europeans are attempting to record in CINDA everything that was ever published on any particular experiment. He pointed out that around 1965 this committee went through an exercise in which it deleted redundant references where the data were considered by the experimenters to be unworthy of being carried in CINDA or were superseded by formal publications. Rogosa said that he would respond to Lemmel soon and would point out that at least half

of the "omissions" were carried in CINDA in another form and that of the one-half remaining many might have been deleted on purpose during the review which took place in the mid sixties.

Goldstein expressed concern that no entries be omitted for a particular experiment even when they were superseded by earlier data and that the important one should be flagged in some way. However, Bowman and Feshbach disagreed pointing out it just took up space and made the document harder to use. Smith commented on the great value of the CINDA document. He estimates the time involved in literature search is decreased by a factor of four by having the use of CINDA. He has never had the occasion to feel that there are gross omissions. Pearlstein commented that the Europeans think it also should be an index to the data file. However, some problem might arise since exchange tapes of neutron data tend to have more entries than exist in the CINDA format. Rogosa commented that he feels that no USNDC action on Lemmel's comments are needed. Goldstein commented that CINDA is not prepared at four centers but at two centers; ORNL and Saclay with input from the other centers. Between these two centers the communication is good. Vienna is voicing complaints about matters which they don't understand. He feels that Four-Center Meetings are not the proper forum for the evaluation of CINDA. With his comments the discussion was closed.

B. CINDA, Nuclear Data Liaison Officers, Publication Policies

Though a discussion of NNCSC, a proposal for nuclear data liaison officers, and publication policies and practices were included in the agenda, the discussion of all was very brief and no actions were taken as a result of the discussion.

IX. MEETINGS

A. Plans for Fourth Conference on Nuclear Cross Sections and Technology, 1975

See minutes on Action 20 above.

B. INDC Meeting - Vienna, October 1973

No report presented owing to the early departure of the principals.

C. Third Symposium on Physics and Chemistry of Fission, Rochester August 1973

Huizenga reported that 245 delegates attended this meeting; half from the U.S., but unfortunately none from the USSR. Strutinski was invited with all fees paid, but even so he was absent to the great disappointment of the delegates. He reported that the double-humped barrier concept had matured significantly. Spontaneous fission out of the right side of the well is now complemented by gamma decay back into the first. Rotational bands have been observed in the second well. The systematics of the inner and outer barrier are becoming well understood. In the lighter actinides the first barrier is lower than the second. In the heavier actinides the situation is reversed. Investigators now feel confident to talk about rotational, vibrational, and single-particle levels in the second well. Potential surface and the inertial parameters have both been included in theories of spontaneous fission.

A number of interesting experiments were reported; one in particular where the kinetic energy in spontaneous fission of ^{241}Pu was compared with the kinetic energy in the neutron-induced fission of ^{239}Pu. The excitation energy for these two processes is different by 6 MeV and the experiments show that 5 out of the 6 MeV goes into kinetic energy of fragments. This is an important result in relation to heavy-ion reactions. This is one example of the way in which the conference related heavy ion reactions to the fission process in a significant way. New details of light particle emission in fission were also reported. All in all it was a very fruitful conference with strong interaction between theory and experimentalists.

Ball announced that an international conference on reactions between complex nuclei is scheduled for June 10-14 at Vanderbilt University. It is one in a sequence of conferences held on this subject.

Motz and Smith asked Huizenga about neutron-related fission phenomena such as the variation of prompt nu-bar with energy. Huizenga reported that the fluctuations in nu-bar from resonance to resonance were small. They appeared to be measurable but appeared not to be correlated with the resonance spins but rather with the fission width of the resonances. One of the members commented that this might not be a real effect since the smaller resonances tended to lie on the wings of larger resonances and separation of the fission events in a particular small peak from the tail of the larger resonances was not something that could be done in a straightforward way.

D. EANDC and Petten Meetings

The remaining two meetings on the Agenda were not discussed owing to lack of time.

X. RECOMMENDATIONS

In a brief discussion of the location of the next meeting, it was suggested that it be held on the West Coast at perhaps Livermore or Berkeley. The suggestion seemed agreeable to the members present, but no definite plans were made.

APPENDIX A

ACTION ITEMS

Action 1 Subcommittee Chairmen	Forward to Professor Goldstein by February 15 new additions to the list of Outstanding Cross Section Discrepancies.
Action 2 Goldstein	Distribute the new list of outstanding cross section discrepancies to the committee by March 15.
Action 3 Isotope Subcommittee	Prepare a report on old Action 4 for presentation at the next USNDC meeting.
Action 4 Subcommittee Chairmen	Continue old Action 13 (USNDC-8).
Action 5 Havens	Seek the sponsorship of appropriate international organizations for the Conference on Nuclear Cross Sections and Technology, 1975.
Action 6 Subcommittees	Continue old Action 22 as new Action 6 on subcommittees.
Action 7 Chairman, A. Smith	Appoint an ad hoc committee chaired by Smith and made up of USNDC subcommittee chairmen to approach Professor B. Cohen on behalf of the USNDC to arrange a special program on applications of nuclear theory at the Fall 1974 meeting of the Division of Nuclear Physics of the APS.
Action 8 Steiner	Summarize the subcommittee goals for the parent committee so that it can have a more clear idea of the role of the CTR subcommittee.

APPENDIX A

ACTION ITEMS
(Continued)

Action 9 Chairman	Establish representation from the USNDC on the Transplutonium Committee (TPC).
Action 10 Subcommittees	Approve their terms-of-reference and forward them to the chairman by March 1.
Action 11 Chairman	Appoint an ad hoc subcommittee of several knowledgeable members of the USNDC to prepare a brief document of no more than a few pages on energy initiatives outlining problem areas in nuclear data in which additional support will promote most effectively the solution of critical problems in the nuclear energy programs.
Action 12 Subcommittees	Complete the RENDA review and forward to NNCSC by February 1. This should include a comment on the status of each entry and more detailed information if a request has been satisfied.
Action 13 Subcommittee Chairmen	Include a discussion of the generalization of the request list on the agenda of the next subcommittee meeting.
Action 14 Subcommittees	Prepare a brief statement of guidelines covering their respective areas of committees responsibility to be followed in collecting contributions to the status report of the USNDC and forward to the chairman in time for presentation at the Spring meeting of the parent committee.
Action 15 Chairman	Appoint an ad hoc subcommittee to review the U.S. distribution list for CINDA and recommend the addition or deletion of appropriate names.

APPENDIX B

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.

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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

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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 make 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. Subcommittee membership will also be designated by the U.S. Atomic Energy Commission 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).

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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 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., and the subcommittees shall meet at least once a year to insure effective coverage of their areas of responsibility. 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.

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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.

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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

TERMS-OF-REFERENCE

Neutron Data Applications Subcommittee of the USNDC[a]

I. Scope

The NDA Subcommittee shall be primarily concerned with neutron data (cross sections and associated microscopic parameters) relevant to applications of neutron associated phenomena. This includes: measurement, techniques, instrumentation, theory and evaluation. Major responsibilities are in existing and on-going application areas (e.g. fission reactors) and in the search for and development of new applications inclusive of new technological concepts. The Subcommittee is responsive to USNDC needs in pertinent areas and will properly interact with other USNDC subcommittees (e.g. Standards, Controlled Thermonuclear Research, etc.). The Subcommittee will give particular attention to satisfying formally recognized high-priority national needs for neutron data (as, for example, set forth in the Compilation of Requests for Nuclear Cross Sections). In doing so, it shall review and stimulate experimental, theoretical and evaluation efforts resulting in the provision of the requisite data in the most effective manner. The Subcommittee may sponsor technical symposia and reviews, encourage cooperative research endeavors and employ such other mechanisms as are judged suitable for meeting national neutron data needs.

II. Organization, Policies and Practices

The Subcommittee shall hold formal meetings as warranted by need (generally one or more per year). These meetings will conform to the Federal Advisory Committee Act of 1972. Formal minutes, file and records will be maintained. In addition, there shall be informal correspondence and/or discussions between two or several subcommittee members as required to meet subcommittee objectives. In depth, technical review of selected areas will be carried out from time-to-time. Such areas are, for example:

1. Resonance properties; total and capture cross sections and resonance integrals.

2. Fission cross sections and properties; resonance and energy-average regions.

3. (n;X) reactions; e.g. (n,p), (n,α), (n,2n), etc.

4. Gamma-ray production and capture cross sections in the energy-average region.

5. Neutron scattering and total cross sections in the energy-average region.

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6. Nuclear models and evaluation.

Ad-hoc working groups may be established in order to properly address such technical areas.

III. Programmatic and Administrative Responsibilities

The Subcommittee will have certain programmatic and administrative responsibilities primarily in response to the request of the parent committee. These may include: periodic review of the relevant portions of the Compilation of Requests for Nuclear Data (e.g. USNDC-6) and identification, compilation of outstanding discrepancies and such other responsibilities as may be assigned by the parent committee from time-to-time.

IV. Membership and Observers

The primary concerns of the Subcommittee are technical and membership will consist of technically qualified individuals so situated as to contribute to and implement Subcommittee activities. Furthermore, the membership may be assisted by observers and/or consultants as indicated by special technical interests.

APPENDIX D

I. FUNCTIONS OF THE USNDC STANDARDS SUBCOMMITTEE

1. To know the status of nuclear standards work in progress and planned, to review proposals submitted to the USNDC for standards measurements, and to try to foster meaningful standards studies.

2. To originate nuclear standards requests for applied purposes and to establish priorities for them and for other requests for nuclear standards submitted to the USNDC.

3. To answer specific questions on nuclear standards referred by the USNDC, in particular, to review requests for measurements of standards cross sections submitted for publication in the USNDC Request List.

4. To supply current information on what is being done and what needs to be done in the area of nuclear standards. In the past this has chiefly meant standard neutron cross section measurements, but the broadening scope of the USNDC requires the inclusion of other types of nuclear standards work.

5. To foster topical conferences or symposia in the area of nuclear standards such as the Symposium on Neutron Standards and Flux Normalization held at Argonne in October 1970 under EANDC sponsorship.

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6. To be aware of instrumentation developments which might relate to standards measurements.

7. To be cognizant of the activities of other standards working groups and subcommittees, especially within the United States.

APPENDIX E

The USNDC Subcommittee on Nuclear Data for Materials Analysis, Safeguards, and Environmental Matters

I. Statement of Goals

The goal of the subcommittee will be to serve as an information channel between those groups involved with measurement programs in the fields of material analysis, safeguards, and environmental protection, and those groups whose activities produce information needed to maintain and expand the effectiveness of such measurements.

II. Terms of Reference for Committee Operation

The first task of the committee will be to identify those groups involved in experimental and theoretical activities in these fields; to solicit their present sources of data, their current requirements for improved or additional data, and their projection of future information needs.

Another task of the committee will be to assess the utility of existing compilations and the need for special compilations and evaluations related to these specific fields.

The committee will also collect information on the utilization of new techniques and attempt to identify the critical data required to make such techniques applicable in the field. The committee should further try to identify possible areas where accepted nuclear techniques should be, but are not currently, employed in these fields.

A priority system for data needs will be established along the following lines:

Priority 1 — Critical data needed for immediate extension of field tested methods.

Priority 2 — Data needed for future upgrading of present techniques.

Priority 3 — Data of possible interest for techniques not now employed but of possible future use.

Priority 4 — All other.

November 26, 1973

APPENDIX F

MINUTES OF THE
USNDC CTR SUBCOMMITTEE MEETING
11-12 SEPTEMBER, 1973

LOS ALAMOS SCIENTIFIC LABORATORY
LOS ALAMOS, NEW MEXICO 87544

LEONA STEWART, LOCAL SECRETARY
LOS ALAMOS SCIENTIFIC LABORATORY

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MINUTES OF THE USNDC CTR SUBCOMMITTEE MEETING

11-12 SEPTEMBER, LOS ALAMOS SCIENTIFIC LABORATORY

LOS ALAMOS, NEW MEXICO

Leona Stewart, Local Secretary

ATTENDEES

Don Steiner* ORNL, Chairman

L. K. Price** AEC-DCTR

C. F. Barnett* ORNL

M. Bhat BNL

L. Draper U. of. Texas

D. Dudziak* LASL

R. Haight* LLL

G. Hopkins GGA

J. D. Lee LLL

B. R. Leonard, Jr. BNW

C. Maynard U. of. Wis.

V. Orphan* IRT

P. G. Persiani ANL

W. G. Price PPPL

L. Stewart* LASL

A. B. Smith ANL

D. W. Muir LASL

P. G. Young, Jr. LASL

R. J. LaBauve LASL

T. G. Frank LASL

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*Subcommittee Member

**Designated Federal Employee

Note: Herbert Goldstein, Columbia University, was unable to attend.

A. Administrative

Steiner briefly outlined the new terms of reference of the USNDC parent committee and mentioned its new subcommittee structure. The CTR Subcommittee has not been changed since the last meeting except for the addition of Bob Haight from LLL. It is planned, however, to extend the membership in order to include as many as possible of the participating laboratories. Since the USNDC is now an official advisory group of the AEC, appointments of new subcommittee members must be approved by the Commission; therefore additions cannot be made arbitrarily. For further details, please see attachment # 1.

Several actions were placed on the Subcommittee by the Parent Committee. These actions are summarized below:

USNDC Action 1 -- On a continuing basis, collect and forward to H. Goldstein recommendations for new entries to the list of outstanding Cross Section Discrepancies. — ACTION 1 All Members

USNDC Action 8 -- On a continuing basis advise the Division of Nuclear Physics of the American Physical Society through J. Harvey of dates and agenda of Subcommittee Meetings. — ACTION 2 on Chairman

(The Chairman noted that this was not accomplished for this meeting but would be done in the future. This group also recommended that the ANS should be notified, accordingly.)

USNDC Action 9 -- Prepare a statement on the chartering of the USNDC as a formal advisory committee including instructions to interested parties to write to the Secretary for information on future meetings; and submit this statement to Physics Today and other appropriate journals. — NO ACTION on this Subcommittee

USNDC Action 13 -- Forward to the USNDC Chairman suggestions for short reviews of programs supported by AEC contract appropriate for presentation at future USNDC meetings. — ACTION 3 All Members

USNDC Action 16 -- 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 4 on Chairman

USNDC Action 22 - 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 Chairman of the Isotopes and Standards Subcommittee. — ACTION 5 on Chairman

Other actions pertaining to the Parent Committee:

Advise the USNDC of additional recipients for the USNDC Status Reports. — ACTION 6 on Chairman

Provide some kind of input to the USNDC Parent Committee for indexing Status Reports. ACTION 7 All Members

For information purposes, all of the actions which took place at the last meeting of the USNDC Parent Committee are included as Attachment # 2.

Les Price summarized the DCTR organization structure; the AEC Division is now headed by R. L. Hirsch and it has grown considerably during the past year. At the present time, the Division is composed of three branches as follows:

1. Plasma Physics Research - headed by Al Trivelpiece with 3 Staffers;

2. Confinement Systems - headed by Steve Dean with 6 Staffers;

3. Development and Technology - headed by Bob Bussard with 6 Staffers (including Les Price).

Since the work of this Subcommittee will be concerned with the Development and Technology Branch, Price discussed more fully the responsibilities of this branch. For example, Development concerns work directed toward programs with a near-term time scale, such as major feasibility experiments, heating, energy storage, etc. Technology includes activities directed toward fusion reactors, on a longer time scale. Areas within Technology and the cognizant program managers in DCTR are:

Materials (Zwilsky and others)

Radiation Environment Simulation (Gavigan, Zwilsky)

Tritium Problems (Gavigan)

Coolants and Heat Transfer (Beard)

Plasma Engineering (Gough)

Energy Conversion (Beard)

Systems Studies (Gough and others)

Neutronics and Shielding (Price)

DCTR views the neutronics problems as important but not the most important; materials problems, for example, are viewed as critical. $200K is being spent for neutronics this year but this program is expected to grow. Also, coordination with DPR for funding basic research and cross sections needed by DCTR is planned.

There was considerable interest and discussion regarding the role of DPR in providing nuclear data pertinent to CTR needs. Price explained

that CTR Division planning assumed that DPR would provide the bulk of information and that the CTR office would only sponsor:

1. Those needs which were clearly specific to CTR application;

2. Those high priority needs which could not be included in the DPR program on the time scale required.

The questions as to detailed implementation of this plan and how to get DPR to sponsor the relevant research went unanswered since the mechanics have not yet been finalized.

B. CTR Nuclear Data Requests

In anticipation of this meeting, Les Price asked all CTR program users to provide their neutron cross-section needs. Copies of each response were provided to the attendees of the meeting. Each Laboratory presented a brief summary of the information provided in the written reports. Price felt that the results were too diffuse, so much so that they would provide little guidance in appropriating any monies which might become available for short- and/or long-term cross section needs. He specifically asked the help of this committee in correlating the needed information and this was brought up again at a later time.

At this time, Price outlined his views on and his expectations for the USNDC CTR Subcommittee. First, he would expect it to provide information which would enable the CTR office to structure its program wisely; second, to provide the CTR office with information to impress DPR with relevance to our needs; and third, he feels that only one committee is necessary to serve both the USNDC and the CSEWG, in line with his guidance in keeping down the number of committee meetings and reducing travel in general. He stressed that Development and Technology has many problems but not always the necessary experts in every area; therefore our recommendations should be clear and concise and easily understood by the nonexpert. Price stated that it was not up to this committee to determine whether the work would be done or who would do it--but rather to outline the needs, the correct association of needs, and the priorities.

C. Status Report on Requests, Including Recent Compilations and Evaluations

The new USNDC Request List (USNDC-6) has been published by LASL and copies were made available upon request to the attendees. The request lists are published about every two years with the next version the responsibility of the National Neutron Cross Section Center at BNL. Steiner mentioned a letter from G. Kolstad to the USNDC in which he discussed the procedures for submitting and reviewing requests, the inclusion of evaluated data, etc. Since CTR requests will be handled by this Subcommittee, the major topic for discussion was the decision that evaluated data would not appear in future editions of the request list. Although the concensus seemed to be that a mechanism should exist for requesting evaluated data, no action was taken.

Several people reported on recent experimental data which should be pertinent to the requests in USNDC-6. Following a suggestion by the local secretary that these comments be summarized in writing and submitted for inclusion in the final minutes, the suggestion was carried. (See attachment # 3.) ACTION 8 All Members

The recent evaluation of Nb submitted by Alan Smith was discussed. Stewart brought out the need for improvement of the (n,n') data at higher energies but all agreed that this evaluation is the best available and should be the starting point for the CTR library. Since the evaluation is lacking the γ-production files, it was suggested that LLL add their γ-production files and the file be submitted for Version IV of the ENDF/B library. LLL was also asked to attach their γ-production files on Ti and Mo to the ENDF/B in time for Version IV. BNL will have a complete reevaluation for Cr in time for Version IV. ACTION 9 LLL

D. Nuclear Data Applications

Many of the problem areas outlined in Les Price's memo were mentioned; others were addressed in more detail. Some people felt that many more cross sections were needed than appear in the list of Section E but everyone realized the limited budget and arrived at the following high-priority, near-term requests for evaluated data which are not expected to be met for Version IV:

1. ^{7}Li(n,n't) 10-15 MeV
2. ^{13}C(n,α)^{10}Be Activation Only
3. F (nonelastic)
4. Nb (gamma production)
5. Transport of neutrons (> 8 MeV) through Mn, Cr, Fe, Ni, and Pb

A table containing many more reactions and nuclides will be found in Section E.

Many questions were addressed to radiation damage, total helium production, long-term waste disposal, dosimetry, activation, etc., but the opinions and conclusions seemed diversified. Steiner did believe, however, that many of these cross sections could be calculated to within 25% using presently available model codes. Certainly, many of these problems should be discussed in more detail at future Subcommittee Meetings.

LASL was asked to circulate the list of activation cross sections which have been generated there. Explanatory information and the list are included in Attachment # 4; the data, themselves, are available upon request. ACTION 10 LASL

Price brought up the subject of integral experiments. The following experiments were mentioned with occasional comments:

1. Dudziak - Total helium production for Nb, Mo, and Stainless using different incident spectra, including LAMPF studies, are needed. It was generally agreed that present data are uncertain enough that measurements are needed.

2. Draper - More information is needed on 14-MeV neutron transport in graphite.

3. Integral experiments are needed which are especially designed to check the evaluated data files. It was pointed out by several people that various experiments have been performed at IRT, LLL, LASL, and ORNL which test specific aspects of the cross sections. These various techniques must be compared relative to the needs of the CTR program. This comparison should include the capabilities, limitations, and cost estimates for each program.

   ACTION 11
   IRT
   LASL
   LLL
   ORNL

4. Persiani - A variety of integral facility experiments designed for benchmark blanket studies to study analytical methods and cross-section set structure and, eventually, on a long-time scale, to test the total neutronics of engineered systems. The specific aspects to be tested in an integral experiment should be well defined since some experiments test the cross sections, others test the cross sections and the codes employed in the analysis, while still others may test the neutron transport but give no information on the specific capture processes involved.

5. Deep penetration in thick shields such as C and Li should be made using a 14-MeV neutron source.

During the above discussion, Bhat mentioned that some users had not been able to obtain the LLL sphere transmission tabular results in order to perform the calculations. Haight was asked to provide these data to BNL.

ACTION 12
LLL

E. Interfaces with the Cross Section Evaluation Working Group

Les Price again commented that in his opinion there needed to be only one group which would address neutronics and cross-section needs, such as measurements, processing, evaluation, etc. and he personally did not care which title it had, USNDC or CSEWG. Should a CSEWG Subcommittee be formed for CTR, it would be the same group of people already committed to the USNDC, therefore the USNDC Subcommittee for CTR could be responsible for CSEWG type activities. This was generally agreed to by the participants. It was noted that CTR interests could be represented by CTR Subcommittee members already in CSEWG.

It was generally concluded that a separate CTR library of evaluated data should be established and maintained. This library should be in ENDF/B format and processed by ENDF codes. An action was placed on the people present to try to obtain from the ENDF/B evaluators a short summary describing ills, pitfalls, and omissions in their evaluations with particular emphasis on fast neutrons (above 8 MeV) for the following nuclides:*

			ACTION 13
H (LASL)	^{6}Li (LASL)	^{7}Li (LASL)	Bhat
Be (LLL)	C (ORNL)	N (LASL)	Orphan
O (LASL)	F (ORNL)	Al (LASL)	Haight
Si (ORNL)	Ti (ANL,LLL)	Cu (SAI)	Steiner
V (ANL,ORNL)	Cr (BNL)	Mn (BNL)	Stewart
Fe (ORNL)	Ni (BNL)	Nb (ANL,LLL)	Smith
Mo (ANL,LLL)	Pb (ORNL)	Y(n,p) (LASL)	
Y(n,α) (LASL)			

In preparing the above critical reviews (which are requested within three months), it is important to note that the total and (n,2n) cross sections are important to all materials along with hydrogen and helium production and secondary neutron- and γ-production cross sections and spectra.

ENDF/B formats were mentioned on several occasions. While a few problem areas still exist, it was pointed out by Stewart that the proposal submitted to the CSEWG Codes and Formats Subcommittee by Pearlstein addressed the problem of neutrons in and charged-particle spectra and angular distributions out, in addition to the neutrons out. Also, the new format should be able to handle incident charged particles although this subject was not discussed at this meeting.

Orphan mentioned the possible need for creating a new format, ENDF/C, on a long time scale. Most people felt, however, that ENDF/B could handle most of the problems important to CTR and that a newly developed format would require additional funding for new processing and checking codes. Therefore, the CTR group would plan to stick with the ENDF/B until use should dictate a new system.

Multigroup cross-section sets were discussed and the decision was not to centralize the data processing but, if the data set were processed at any CTR organization, the multigroup set should be documented and made available to other CTR users. How the distribution of these multigroup sets would be handled was not decided.

A great deal of discussion was based on the need for evaluated data on the isotopes--not the elements (which are most often found in ENDF/B). Everyone seemed to agree that CTR requirements were based on the isotopic cross sections, and these needs should be made known to the evaluators and to funding agencies other than DCTR.

*Although the discussion centered around using the "DNA" library as a starting point, many of these evaluations are not funded by DNA.

Leonard expressed some concern that no responsible evaluator had been funded to update and correct some of the evaluated files he has needed for his studies of hybrid systems. Just who should be involved in blanket sensitivity studies was also discussed. Lee reported that Howerton would do complete evaluations on V, Cr, Hf, Re, Pa, and Np and the files should be ready in about three months.

Several people expressed interest in keeping appraised of CSEWG activities. Bhat was asked to make a list and request that these names be placed on the CSEWG distribution list. ACTION 14 Bhat

F. Future Meetings on CTR Data Needs

1. November 11-16 1973 - The ANS Winter Meeting in San Francisco. Several sessions on fusion technology are on the program.

2. January 1974 - IAEA Meeting at Culham, England on Fusion Reactor Technology. It will be a two to three week working group meeting with 10-12 people from the United States on the invitation list. The invitations should be out soon.

3. April 16-18 1974 - "First Topical Meeting on the Technology of Controlled Nuclear Fusion," in San Diego. George R. Hopkins is the General Chairman and the ANS Technical Group for CTR is one of the sponsors.

4. March 1975 - The United States is planning another conference to follow the Neutron Cross Section Conferences but this one will not be limited to cross sections or to neutron data. The meeting will be held at the Shoreham Hotel in Washington, D. C. The Program Chairman will be W. W. Havens, Jr. and the other Subcommittee Chairmen of the USNDC will serve on the Program Committee.

G. Summary of Conclusions and Required Actions; Future Plans

The Chairman summarized the actions which are noted in the minutes; therefore, they will not be included here. January, 1974, was suggested as the next meeting date for this Subcommittee but the specific time and place has not been determined. Les Price has indicated the need for very specific recommendations by the end of this calendar year.

The meeting was then adjourned.

ATTACHMENT 1

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 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

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 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 Chairman	Communicate to the Director of DPR the change in text of the terms of reference for the USNDC regarding frequency of Subcommittee Meetings recommended by NDC members.
Action 7 Chairman	At least 30 days prior to the next USNDC meeting convene each USNDC subcommittee, establish the primary committee goals, and formulate a set of terms of reference for

APPENDIX A

ACTION ITEMS (Continued)

Action 7 (Cont.) Chairman	operation of the respective committees. Prepare and distribute to parent committee members a final status report in time for consideration at the fall USNDC meeting.
Action 8 Subcommittee Chairmen	On a continuing basis advise the Division of Nuclear Physics of the American Physical Society through J. Harvey of dates and agenda of Subcommittee Meetings.
Action 9 Subcommittee Chairmen	Prepare a statement on the chartering of the USNDC as a formal advisory committee including instructions to interested parties to write to the Secretary for information on future meetings; and submit this statement to Physics Today and other appropriate journals.
Action 10 Designated Persons	Forward a two-paragraph summary of individual technical responses to the Shaw-Miller Memorandum to the Chairman by June 28.
Action 11 Chairman	Collate the summaries of the technical responses to the Shaw-Miller Memorandum in the technical section of a summary letter to DPR.
Action 12 Chairman	With corrections and deletions made on the basis of committee discussion and of letters of comment received from NDC members before July 2, prepare a draft document representing the committee concensus on the responsibilities of DPR for nuclear data procurement. Circulate the resulting document among NDC members for approval.
Action 13 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 14 Anderson	Distribute to USNDC members the Atlas of Photoneutron Cross Sections obtained with Monoenergetic Photons, UCRL - 74622.
Action 15 Secretary	Include in future requests for contributions to the USNDC Status Reports the document number for the forthcoming issue.
Action 16 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 17 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 18 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 19 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 20 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 21 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 22 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.

I. French experimental data on $^{93}Nb(n,n')$ (Review provided by D. W. Muir)

The cross section for the reaction $^{93}Nb(n,n')^{93m}Nb$ to the 12 year isomer has been measured recently by F. Hegedus,[1] using an activation comparison method. In an experiment by the SAPHIR fission reactor, foils of various threshold detectors were irradiated by neutrons having a variety of energy spectra. It was observed that the ratio of counts from the Nb foil to counts from a Rh foil [via the $^{103}Rh(n,n')^{103m}Rh$ reaction to the 56 min isomer] was essentially the same for all neutron spectra. From this, Hegedus concludes that the energy dependence is the same for the two reaction cross sections. He also made measurements of the K-electron conversion efficiency for the 30 keV (Nb) and 40 keV (Rh) isomeric transitions, in order to determine the ratio of the cross section magnitudes. From this ratio and the ^{103}Rh excitation data of Butler and Santry,[2] Hegedus constructs the cross section shown in the table below. The systematic errors are estimated to be less than 30%.

CROSS SECTION FOR $^{93}Nb(n,n')^{93m}Nb$

Energy (MeV)	σ (mb)	Energy (MeV)	σ (mb)	Energy (MeV)	σ (mb)
0.1-0.25	3.8	2.0-2.5	122.8	7-8	185.6
0.25-0.5	15.5	2.5-3.0	132.3	8-9	185.6
0.5-0.75	38.5	3.0-3.5	139.0	9-10	182.6
0.75-1.0	78.5	3.5-4.0	143.8	10-11	156.5
1.0-1.25	86.7	4-5	152.4	11-12	117.5
1.25-1.50	94.8	5-6	168.5	12-13	78.3
1.5-2.0	108.7	6-7	182.3	13-15	47.5

The sharp decline in the cross section above 10 MeV can be explained by competition from the (n,2n) reaction. The magnitude of this effect should be similar for Rh (Q = -9.31 MeV) and Nb (Q = -8.83 MeV). The total inelastic cross section for Nb has been recently reevaluated by Smith et al.[3] and indeed the shape they obtain above 10 MeV is very similar to that observed[2] for the Rh inelastic activation cross section. Thus, even though the Hegedus experiment is insensitive to high energy cross sections, his result at 14 MeV, for example, can be considered a reasonable estimate in the absence of more direct information.

References

1. F. Hegedus, "Detecteur de Fluence de Neutrons Rapides Utilisant la Reaction $^{93}Nb(n,n')^{93m}Nb$," Ph.D. Dissertation, L'Universite Louis Pasteur de Strasbourg, FRNC-TH-228 (1972).

2. J. P. Bulter and D. C. Santry, "The Neutron Inelastic Cross Section for the Production of ^{103m}Rh," Proceedings of the Second Conference on Neutron Cross Sections and Technology, National Bureau of Standards Special Publication 299, p 803 (1968).

3. A. Smith, P. Guenther, and J. Whalen, "Fast Neutron Processes in Niobium--Measurements and Evaluation," Argonne National Laboratory report AP/CTR Technical Memorandum No. 4 (1973).

II. AWRE Data on Nb(n,2n) and Mo(n,2n) (Ref. supplied by D. W. Muir)

D. S. Mather, P. F. Brampton, R. E. Coles, G. James, and P. J. Nind, "Measurement of (n,2n) Cross Sections for Incident Energies between 6 and 14 MeV," Atomic Weapons Research Establishment report AWREO 72/72 (1972).

III. ORNL - Work in Progress

F Francis Perey's group will do a reevaluation of fluorine which will include secondary gammas with particular emphasis on the incident neutron energy region above 10 MeV. The ORNL experimental data will be reduced and used in this evaluation.

Nb Perey has completed experimental measurements on the secondary gamma production cross sections for Nb over a wide range of incident neutron energies but the data reduction is not currently funded.

IV. BNL - Calculated Activation Cross Sections

Mulki Bhat provided the following list of nuclei for which he had calculated the various activation cross sections using an interim version of THRES2:

Ti 46-50	Fe 54-58	Zr 90-96	Sn 112,114-120, 122, 124
V 49-51	Co 57,60	Nb 92-94	Ta 181
Cr 50-54	Ni 58-64	Mo 92-100	W 182-184,186
Mn 53,54	Y 89-91	Tc 97-99	Pb 204,206-208

The results of these calculations along with their plots and other ENDF/A and ENDF/B retrievals were sent out in August. Anyone not on this mailing list who needs the data should contact Bhat.

V. LLL - Information provided by Haight and Lee

Memorandum from R. J. Howerton to J. D. Lee--this 27-page memo entitled "Comparison of ENDF/B-III and ENDL (LLL) Data Files," is being circulated by the local secretary.

Activation cross sections have been compiled by W. E. Alley and R. M. Lessler in Nuclear Data Tables 11, 622 (1973). The cutoff date was August, 1971. These cross sections could be made available by LLL in ENDF/B format if there is sufficient interest.

A comparison of the LLL pulsed sphere experiment for iron is shown in the paper by L. Hansen et al., Nucl. Sci. and Eng. 51, 278 (1973). Neutrons are observed with energies above approximately 2 MeV.

U of C-AUA-USAEC

ARGONNE NATIONAL LABORATORY

May 17, 1973

Mr. Don Dudziak
Los Alamos Scientific Laboratory
P.O. Box 1663
Los Alamos, New Mexico 87544

Dear Don:

Below are listed some of the isotopes we should consider in the initial activation analysis for the Nb-1%Zr structure and the lithium coolant. The isotopes were obtained from an estimate of the impurities contained in the structure and coolant, as given in the writeup for the θ-pinch report.

The selection process for the structural material (besides the Nb isotopes) was based on identifying isotopes having a half-life of greater than many days. The emphasis being mainly in years in order to assess the possible long-term environmental effects. Isotopes having half-lifes greater than 10^4y were not included. Some attempt was made to screen on the basis of competition between radiation energies.

For the lithium coolant, the selection of isotopes having a half-life in the order of many minutes or more is based on the need for estimating the shielding requirements of the coolant ducts downstream from the reactor proper.

The first listing of isotopes to consider is not optimized but it is a start and we can refine this selection in subsequent studies. The half-life of the daughter products for each isotope is also included on the list.

A much more effective screening can be made if the scope of "Environmental Impact" can be more clearly delineated. As an example, for the long-term impact (hundreds of years), the long half-life isotopes even for k-capture processes become significant if the infraction is radio-

Mr. Don Dudziak May 17, 1973

active contamination by ingestion. This means that the reaction $^{94}Mo(n,2n)^{93}Mo$ should be investigated in the activation analysis. Perhaps we can get the project staff at LASL and ANL to consider setting up some guidelines.

We can discuss the listing by phone.

Sincerely,

Paul

P. J. Persiani
Applied Physics Division

Distribution:

W/attachments: W. Loewenstein

W/O attachments: R. Avery
T. Coultas
R. Burke
J. Draley
A. Hatch
M. Petrick
A. Smith
W. Stacey
C. Till
PJP-CTR File

STRUCTURAL MATERIAL

Nb - 1% Zr

$^{182}W(n,2n)^{181}W$ (130 d)
$^{184}W(n,\gamma)^{185}W$ (74 d)
$^{184}W(n,\alpha)^{181}Hf$ (42 d)
$^{186}W(n,\gamma)^{187}W$ (24 hr)
$^{186}W(n,\alpha)^{183}Hf$ (91 d) isomeric state
$^{92}Mo(n,p)^{91}Nb$ (62 d; long) isomeric state
$^{94}Mo(n,p)^{94}Nb$ (2×10^4y) isomeric state
$^{94}Mo(n,2n)^{93}Mo$ (10^4y)
$^{96}Mo(n,\alpha)^{93}Zr$ (10^4y)
$^{98}Mo(n,\alpha)^{95}Zr$ (65 d)
$^{180}Ta(n,\alpha)^{177}Lu$ (155 d)
$^{180}Ta(n,2n)^{179}Ta$ (600 d) isomeric state
$^{181}Ta(n,\gamma)^{182}Ta$ (115 d)
$^{181}Ta(n,\alpha)^{178}Lu$ (minutes)
$^{174}Hf(n,\gamma)^{175}Hf$ (70 d)
$^{174}Hf(n,p)^{174}Lu$ (1300 d)
$^{176}Hf(n,2n)^{175}Hf$ (70 d)
$^{180}Hf(n,\gamma)^{181}Hf$ (43 d)
$^{177}Hf(n,p)^{177}Lu$ (155 d)
$^{54}Fe(n,p)^{54}Mn$ (312 d)
$^{54}Fe(n,\alpha)^{51}Cr$ (27.8 d)
$^{54}Fe(n,\gamma)^{55}Fe$ (2.7 y)
$^{56}Fe(n,2n)^{55}Fe$ (2.7 y)
$^{58}Fe(n,\gamma)^{59}Fe$ (45 d)
$^{58}Ni(n,\gamma)^{59}Ni$ (8×10^4y)
$^{58}Ni(n,\alpha)^{55}Fe$ (2.7 y)
$^{58}Ni(n,p)^{58}Co$ (71 d)
$^{60}Ni(n,p)^{60}Co$ (5.24 y)
$^{60}Ni(n,2n)^{59}Ni$ (8×10^4y)
$^{62}Ni(n,\alpha)^{59}Fe$ (45 d)
$^{62}Ni(n,\gamma)^{63}Ni$ (92 y)

$^{91}Zr(n,p)^{91}Y$ (59 d)
$^{91}Zr(n,\gamma)^{93}Zr$ (9.5 x 10^5y)
$^{92}Zr(n,\alpha)^{89}Sr$ (50.6 d)
$^{94}Zr(n,\gamma)^{95}Zr$ (65 d)
$^{17}O(n,\alpha)^{14}C$ (5730 y)
$^{14}N(n,p)^{14}C$ (5730 y)
$^{2}H(n,\gamma)^{3}H$ (12.3 y)

LITHIUM COOLANT IMPURITIES

$^{40}Ca(n,\gamma)^{41}Ca$ (7.7 x 10^4y)
$^{40}Ca(n,\alpha)^{37}Ar$ (35 d)
$^{42}Ca(n,\alpha)^{39}Ar$ (270 y)
$^{42}Ca(n,2n)^{41}Ca$ (7.7 x 10^4y)
$^{44}Ca(n,\gamma)^{45}Ca$ (163 d)
$^{46}Ca(n,\gamma)^{47}Ca$ (4.5 d)
$^{48}Ca(n,2n)^{47}Ca$ (4.5 d)
$^{23}Na(n,2n)^{22}Na$ (2.6 y)
$^{23}Na(n,\gamma)^{23}Na$ (15 h)
$^{50}Cr(n,\gamma)^{51}Cr$ (27.8 d)
$^{50}Cr(n,2n)^{49}Cr$ (42 m)
$^{52}Cr(n,2n)^{51}Cr$ (27.8 d)
$^{52}Cr(n,p)^{52}V$ (3 m)
$^{53}Cr(n,p)^{53}V$ (2 m)
$^{39}K(n,p)^{39}Ar$ (270 y)
$^{39}K(n,\alpha)^{36}Cl$ (3 x 10^5y)
$^{41}K(n,p)^{41}Ar$ (1.8 h)
$^{41}K(n,\gamma)^{42}K$ (12.4 h)
$^{35}Cl(n,\gamma)^{36}Cl$ (3 x 10^5y)
$^{35}Cl(n,2n)^{34}Cl$ (32 m)
$^{35}Cl(n,p)^{35}S$ (87 d)
$^{35}Cl(n,\alpha)^{32}P$ (14.3 d)
$^{37}Cl(n,2n)^{36}Cl$ (3 x 10^5y)
$^{37}Cl(n,p)^{37}S$ (5.1 m)

LASL/CTR ACTIVATION LIBRARY

D. W. Muir, T. R. England, and R. J. LaBauve

A multigroup library has been prepared for the 62 neutron activation cross sections specified in Paul Persiani's letter (attached). The nuclides involved are expected to be present as impurities in fusion reactor structural (Nb - 1% Zr) and coolant (Li) materials. Three additional reactions were considered to be of sufficient interest to add them to the list, namely, $^{94}Zr(n,n'\alpha)^{90}Sr$ (29 years), $^{174}Hf(n,2n)^{173}Hf$ (24 hours), and $^{181}Ta(n,3n)^{179}Ta$ (600 days).

The pointwise data for these 65 activation cross sections came primarily from three sources. First, where available, data were taken from ENDF/B-III; when not available, BNL-325 was consulted. If the thermal cross section only was known, a 1/v dependence was assumed for a rough estimate of the epithermal component. In the absence of other information, data were generated using a nuclear model code.[1] This code is thought to be accurate to within a factor of two in the region of atomic numbers from 20 to 50. However, for higher-mass nuclei, charged-particle production cross sections are seriously underpredicted by the version in use at LASL.

The cross sections derived from these three sources should be useful in identifying the reactions which will make major contributions to various radiological effects. However, it should be emphasized that accurate calculations of these effects will require better data for the more important reaction cross sections.

The pointwise cross section data obtained as described above were processed into multigroup form using ETOG. The 100-group neutron energy structure and weighting function used are the same as that used previously in preparing the LASL/CTR neutron/photon transport cross section library.[2] These multigroup libraries are available upon request.

References

1. S. Pearlstein, "Neutron-Induced Reactions in Medium Mass Nuclei," J. Nucl. Energy 27, 81-99 (1973).

2. D. W. Muir and R. J. LaBauve, "Neutron Cross Sections for Scyllac Reactor Studies," Los Alamos Scientific Laboratory internal memorandum, T-2-131 June 8, 1972.

APPENDIX G

U of C-AUA-USAEC

ARGONNE NATIONAL LABORATORY

November 27, 1973

TO: H. Jackson, Chr. USNDC

FROM: Neutron Data Applications Subcommittee

SUBJECT: Guidelines for USNDC Status Reports.

In the context of this Subcommittee, guidelines for USNDC status reports are applications oriented. Suggested criteria for contributions are:

1. Explicit and direct relevance to specific nuclear data requests as set forth in USNDC-6 and subsequent issues of the request compilation.

2. Nuclear data indirectly associated with explicit requests (e.g. (n;n'γ) measurements defining level structure requisite to meeting an explicit inelastic scattering request).

3. Nuclear data identified or associated with the development of new technological applications (e.g. neutron source and reaction data associated with developing bio-med technologies).

4. Nuclear data and associated basic understanding related to items 1) to 3), above, and/or directly associated with other areas of physics (e.g. systematics of heavy deformed nuclei, astro-physics and solid-state needs, etc. not exclusively defined in USNDC-6 and sequels).

5. Basic understanding of neutron associated processes in broad data areas of application importance (e.g. understanding of the fission process).

6. Methods and techniques for measurement, theory and evaluation as applied to the provision of user oriented data in the above classifications.

7. Facility developments related to the above endeavors.

The above considerations are limited to those processes where in the reaction involves an incident and/or emitted neutron and associated matters. The guidelines are consistent with other subcommittee interests (e.g. standards) but are not inclusive of entire USNDC interests.

9700 South Cass Avenue, Argonne, Illinois 60439 · Telephone 312-739-7711 · TWX 910-258-3285 · WUX LB, Argonne, Illinois