

NUCLEAR ENERGY AGENCY NUCLEAR DATA COMMITTEE

SUMMARY RECORD OF THE
TWENTY-EIGHTH MEETING
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(TECHNICAL SESSIONS)

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B. TECHNICAL SESSIONS

1) Relations with other Committees

1.1) NEACRP: Reports of observers

Two meetings of NEACRP were held since the last NEANDC meeting. At the first one in 1988 S. Igarasi served as NEANDC observer. As he has left the committee he sent a written report to our committee, which is added to this report as Appendix 2. The second meeting in 1989 was attended by A.B. Smith on behalf of our committee. He submitted the following report to the committee:

"The 32nd NEACRP meeting was held at Argonne, chaired by K. Shirakata, with F. McDonnell serving as scientific secretary. In addition to the normal NEA representation, two USSR observers were present.

There were approximately 140 technical papers, discussed individually and/or collectively. The major technical issues were:

- I) Safety,
- II) Waste management,
- III) Na-void effects,
- IV) Advanced reactors
(e.g., metal and nitride fuels, high-temperature gas cooled,
etc.) and
- V) The fuel cycle (burnup).

The discussion was primarily of an engineering nature dealing with various design compromises to obtain the sought after objectives. For example, Na-void effects can be made small or even negative if other engineering aspects of the systems are compromised. The large majority of the discussion dealt with fission-energy concepts. Basic data needs were not dealt with in any detail, and there was no specific discussion of the high-priority request list, etc..

There was considerable interest in burnup and fuel-cycle problems, and there are data needs in this area. Several new fission-product evaluated files were cited, and the results of integral tests were said to support them.

Basic data for the heavy actinides remains a concern in fuel-cycle and waste-disposal contexts. The Japanese OMEGA project is perhaps best illustrative of such issues, with specific data needs, some extending to medium energies as a spallation waste burner is contemplated.

Delayed neutron properties remain a concern, particularly in the interpretation of integral criticality studies. Integral benchmark delayed-neutron studies are underway or planned.

There was some discussion of fusion integral studies, particularly tritium breeding in engineering blankets. The problems cited appear to be primarily of an engineering or interpretative nature, and not directly associated with the basic cross sections. There was comment as to the uncertainty in the $\text{Be}(n,2n)$ multiplication.

There was some brief comment dealing with therapy (boron loading of tissue), safeguards techniques, etc., but no detailed discussion.

Considerable attention was given to integral computational problems. One interesting aspect of this is the success in using small computer work stations for large-scale calculations.

The work of the NEANDC task forces was well received, particularly that dealing with the U-238 and Fe-56 problems. The matter of improved guidance of the decay-heat task force was brought to the attention of the NEACRP, with no particular response.

The cooperative international evaluation effort was very well received. The evaluation working group met at Brookhaven just prior to the NEACRP meeting, and held further discussions at Argonne. The program was described in considerable detail by the working group chairman, J. Rowlands. The NEACRP gave very strong support to this initiative.

The potential of coincident NEACRP and NEANDC meetings with some common technical sessions was again brought to the attention of the NEACRP. The latter took no action on the matter.

There was some discussion of past and future conferences, and the scheduling and scope of the 1991 Jülich Conference was brought to the attention of the NEACRP. It was not clear how much interest there was.

Concern was expressed for the availability of skilled professional manpower in the future. It is the same issue that faces the microscopic data field. Apparently the NEA has become aware of this pending crisis, and has started to study the problem in a broad context."

Salvatores, observer of NEACRP, made some comments on the attitude of NEACRP towards the work of our committee. He pointed out that the present emphasis of NEACRP is on special high accuracy data to answer high accuracy needs of reactor physics. As examples he mentioned the problem of temperature coefficients and of void coefficients in high conversion light water reactors, position dependence of C/E values for central rod worth and fission product validation for thermal reactors and the problem of positive Na void coefficients in large fast reactors.

Concerning a question of K.H. Böckhoff on the validity of the present request lists, M. Salvatores pointed out that the NEACRP wanted to await the results of the new data evaluations (ENDF/B-VI, JENDL-3, JEF-2) before an update of the request lists.

Concerning the removal of items from the present request list it was agreed that this could be done either on a suggestion of the NEANDC followed by approval of NEACRP or on request of NEACRP.

1.2) Other NEA Committees

C. Philis reported on a recent meeting of the NEA Data Bank management committee. A paper summarizing the conclusions of that meeting was distributed to the committee members and is documented as SEN/DATA/(90)4. It describes some thoughts on long-term-orientation of Data Bank.

C. Nordborg informed the Committee on the NEA connections to the Japanese OMEGA (Options Making Extra Gains of Actinides) project. An Expert

Group meeting had been held at NEA, where a Japanese delegation presented their project and invited other countries to cooperate. The NEA Nuclear Development Committee decided later to devote about two man-months a year to coordinate the international cooperation within the OMEGA project.

The Japanese authorities had also given a separate contribution to the NEA to perform special tasks within the frame of the OMEGA project. The NEA Data Bank had, with the help of consultants, been involved in two such projects, one in the field of thermochemical data and one in the fission yield and delayed neutron data. The results of these studies will be published later in 1990.

1.3) National and Regional Committees

M.G. Sowerby reported that the U.K. Chemical Nuclear Data Committee has made a new request list which will be issued in the middle of 1990.

1.4) International Committees (e.g. INDC): status and future trends

A report of J. Schmidt on the work of INDC (Appendix 3) and a report of Kapoor giving the opinion of INDC on the work of NDS were distributed to the committee members.

J. Schmidt points out that two of the meetings proposed by NDS (s. p. 10 of Appendix 3) might rather belong to the domain of NEANDC/NEACRP, these meetings being:

- 1) Consultants Meeting on Nuclear Data for Fission Reactor Decommissioning, scheduled for Dec. 1991.
- 2) Advisory Group Meeting on Nuclear Data for Advanced Thermal and Fast Reactors, scheduled for June 1992.

M. Salvatores agreed to this and expressed the opinion that the need for meetings concerning nuclear data for fission reactors should be checked by NEACRP.

After some discussion an action was put on C. Nordborg to contact NEACRP (E. Sartori) on the two discussed meetings and report to J. Schmidt (IAEA) on the possibilities of NEA to cooperate in the organisation of these meetings.

2) Data Centres (NNDC, JAERI, NDS, NEADB) and the 4-Center Network

Written reports on the activities of the 4 centers were distributed and are included in the minutes as Appendices 3-6.

2.1) Neutron data: - bibliography (CINDA), compilation (EXFOR)

Patrick pointed out that the system of neutron data compilation which has worked successfully for more than 25 years is now threatened seriously. As he also pointed out in his letter to the committee that lack of funding has already resulted in the closing of a number of accelerators which reduced the production of nuclear data as seen in the statistics of EXFOR entries. This puts pressure on the data centers to reduce their manpower in the data compilation area with the danger that in each of the centers the manpower may "fall below a critical mass" needed to maintain professional competence over the whole data field. As first example of this dangerous development he noted the reduction of CINDA coverage by NNDC and pointed out that also NDS and the NEADB are much under pressure to accept new tasks at constant manpower. There was an extensive discussion on this topic.

J. Schmidt did not quite agree with B.H. Patrick on the decreasing rate of nuclear data production. Based on a study by Lemmel he pointed out that the decrease in the rate of EXFOR entries is restricted to the U.S. contribution and did not occur in the other service areas and also that changes in the compilation system which allow a more compact compilation of data lead to a reduction of the number of EXFOR entries compared to amount of data compiled.

S.L. Whetstone reported that the mentioned reduction of CINDA coverage by NNDC was decided in a meeting with representatives of ANL, LANL and ORNL as the least damaging solution to handle the manpower cut at NNDC and stressed that EXFOR compilation, which was considered more important will continue without any cuts.

N. Tubbs pointed out that all data centers are in close contact and will try to minimize the damage caused by the discussed manpower cut at NNDC.

It was generally felt, that in the present situation the actions taken by the data centers were unavoidable and although the committee remained concerned about the future of neutron data compilation no specific actions were decided upon.

2.2) Structure and decay data: - bibliography and compilation

S.L. Whetstone reported on a letter by R. Chrien on the situation of A-Chain compilation. A serious problem has come up with the announcement of the Fachinformationszentrum Karlsruhe to discontinue its evaluation work because of shifted priorities within the FIZ. Up to now the FIZ has provided about 10% of the A-chain work. This will probably lead to a corresponding reduction in the rate of A-chain updating and may also have negative consequences for the continuation of the work at other places.

J. Schmidt expressed the opinion that the gap arising from the decision of the FRG could in principle be closed by other countries.

M.G. Sowerby states that the U.K. considers the situation of the existing decay data as sufficient for most applied purposes, so that a short updating cycle is not really needed.

In general, however, the committee is concerned about the situation and wishes to take all possible steps to change the decision of the FIZ. Accordingly an action is put on the chairman to write letters to the INDC chairman and to V. Konshin, director of Physics at IAEA, expressing concern about the new situation in A-chain evaluation and send copies to Rittberger and Behrens at FIZ Karlsruhe.

2.3) Charged particle nuclear data (CPND)

The charged particle reaction CINDA type bibliography which had been annually produced by NNDC has been discontinued in 1989 because of lack of manpower as reported in Appendix 3, page 4. Therefore J. Schmidt asked whether NEADB could participate in charged particle nuclear data work; Tubbs answered that there is also no manpower available. Schmidt further mentioned that there is still some Russian work on CPND. Qaim suggests that the Russian compilation work on charged particle nuclear data should be combined with intensified evaluation at IAEA/NDS.

2.4) Medium energy data

J. Schmidt reported about the forthcoming IAEA Advisory Group Meeting on Intermediate Energy Nuclear Data on 8-12 Oct. 1990 at Vienna and distributed a memorandum of Kocherov on this subject.

A number of scientists were suggested who should be included in the distribution list for the information on the meeting:

Watanabe (Japan), Rapaport, Finlay (Athens, U.S.), D. Gray (ISIS), Haight (LANL), Condé (TSL), Brady (U.C. Davies), Cierjacks (KfK).

It was also suggested to include Radioisotope production and cosmology into the scope of the meeting.

It was also proposed to announce the IAEA meeting in the medium energy nuclear data newsletter.

2.5) Computer codes

C. Nordborg reports on the respective activities of the NEADB which are described in Appendix 4.

3) Evaluations

3.1) JEF/EFF

C. Nordborg presented a report on the status of the JEF-2 library which is included as Appendix 7. In addition Nordborg announced that the next JEF/EFF meeting will be held in May; no test of results for JEF-2 will, however, be available at that time. A.B. Smith asked whether JEF-2 would be better than JEF-1; Nordborg replied that this is not yet known. In reply to a question of J.J. Schmidt H. Gruppelaar gave a description on the most important differences between JEF-1 and JEF-2.

3.2) ENDF/B-VI

Ph. Young referred to the written report which is included as Appendix 5. Kikuchi expressed the opinion that structure in the unresolved resonance region (up to 400 keV) neglected in ENDF/B may cause problems.

3.3) JENDL-3

Y. Kikuchi presented a written report which is included as Appendix 8.

F.G. Perey pointed out that it may become necessary also to have elemental cross-sections for several structural materials.

3.4) NDS

J. Schmidt reported on the present status of FENDL especially on various recent additions to FENDL and announced that the next FENDL Meeting will be held in June 1990 in Vienna.

3.5) International Cooperation in Evaluation

H. Vonach reports on the work of the NEANDC/NEACRP task force on evaluation cooperation. A report of J. Rowlands and C. Nordborg on this subject (from Oct. 1989) is distributed to the members.

At its second meeting in Oct. 1989 the task force formed six subgroups for work on specific problems (see report NEANDC-A-257) and a working group to which the subgroups are to report on their work. A.B. Smith and M.G. Sowerby were tentatively nominated as NEANDC members of the working group at the task force meeting in Oct. 1989.

As M.G. Sowerby also acts as representative of JEF/EFF the committee decided that instead of him E. Fort should serve as NEANDC member of the working group.

The subgroups have as yet just started to organize themselves (coordinators have been found for most of the groups) and the actual work will hopefully start

within the next months. H. Vonach will act as coordinator for the subgroup on generation of covariance files for ^{56}Fe and $^{\text{nat}}\text{Fe}$.

The first meeting of the working group will be on April 30/May 1st, 1990 in Marseille. Smith pointed out that it will not be possible for him to come to Europe so soon after the NEANDC meeting and H. Vonach agreed to attend instead of him in this particular working group meeting.

4) Task forces and cooperative endeavors

4.1) Task force on ^{56}Fe 1.15 keV resonance

An action is put on F.G. Perey to complete the task force report by July 1, 1990 and distribute it to task force members for final considerations and a second action was put on C. Nordborg to produce a suitable introduction to ^{56}Fe task force report for a broad-scale NEA publication.

4.2) Task force on ^{238}U resonances

M. Sowerby gave a brief presentation on the status of the work of the task force.

An action was put on M.G. Sowerby to produce a final report of the specific ^{238}U work until January 1991. A second action was put on C. Nordborg to write an introduction to the above report for a broad scale NEA publication.

4.3) Task Force on decay heat predictions

C. Nordborg referred to the reports NEACRP-A-1039 and NEANDC-A-260 and summarized the situation as follows.

1. Still existing discrepancies cannot be solved by evaluation.
2. Only largely improved measurements will improve the present situation.

The comparison of codes used in the calculations of decay heat, which was initiated at the 1987 Studsvik Specialists' Meeting has been completed and summarized in a report by Duchemin and Nordborg (NEACRP-319"L"-NEANDC-275-"U"). Its main conclusion is that all codes (with one exception) are in good agreement after a few minor modifications have been made. Thus the still existing differences in decay heat calculations must come from discrepant nuclear data. The NEADB spent about 1-2 man-weeks on the discussed code comparison.

In the following discussion E. Fort pointed out that improved measurements for ^{239}Pu should be done by calorimetric methods plus suitable means of spectral measurements. This work may need a reactor and cost between 0.5 and 1 Million U.S.\$.

F.G. Perey expressed his opinion that the present level of accuracy is completely acceptable to the nuclear industry. Sowerby did not quite agree to this statement. According to his view considerable savings would be possible if additional "safety" cooling time can be avoided. Finally Nordborg announced that the task force group will again meet after the new files ENDF/B-VI and JEF-2 are released.

4.4) Working group on activation cross-sections

A.B. Smith presented the report of D.L. Smith, Chairman of the working group. Two project groups have as yet been formed and started their work. An experimental group will work on cross-section measurements in the 8-14 MeV region with special emphasis on the comparison of results obtained with different neutron source reactions and an intercomparison of the predictions of nuclear model codes for the calculation of cross-sections for a case which cannot be measured (excitation function for the $^{60}\text{Co}(n,p)^{60}\text{Fe}$ reaction) has been started.

On behalf of the Committee the Chairman expressed its thanks to D.L. Smith for his excellent organisation of this working group.

4.5) Working group on $^{10}\text{B}(n,\alpha)$ standard cross-sections

K.H. Böckhoff summarized the results of the meeting of the working group at NIST. He reported that there is a renewed interest in the $^{10}\text{B}(n,\alpha)$ cross-section. In the following discussion several participants expressed their opinion that the observed discrepancies may be caused by sample problems (e.g. water or oxygen contents, etc.).

5) Meetings

Considerable time was devoted to a discussion of the scientific programme of the International Conference on Nuclear Data for Science and Technology to be held in May 1991 at Jülich.

Regarding the past Specialists' meetings the Chairman made two general remarks. On one hand he expressed his appreciation for the excellent preparation of the meeting on Activation Cross Sections held at Argonne, on the other hand he mentioned that several members complained about some shortcomings in the preparation of the Specialists' meeting on Level Densities at Bologna. The speakers and participants were informed rather late and there had been difficulties in the coordination between the NEA-Secretariat and the local organizers. The NEA Secretariat has taken steps to avoid future difficulties of this type. In general it is felt that both the Argonne and Bologna meetings were successful. Brief reports on the Argonne meeting were given by A.B. Smith and Qaim. Vonach gave a report on the Bologna meeting. Chairman expressed his thanks to the organisers of both the meetings, especially D.L. Smith at Argonne and G. Reffo at Bologna.

6) Manpower

K.H. Böckhoff expressed again his concern about the situation; He stressed that this is especially serious at the larger nuclear research centers, which in the past have been the main source of high-quality nuclear data for applications. As a typical example he mentioned the situation at CBNM Geel. A number of nuclear data experts have retired during the last years and only part of these positions may be re-occupied. Also in those cases where a replacement is authorised specific expertise accumulated over decennia is definitely lost because the timing of the recruitment procedures is such that a know-how transfer is not possible. Moreover it is difficult to find suitable candidates. M.G. Sowerby confirmed that a similar situation exists in Harwell. There was a general agreement that the manpower situation is very serious and may become critical for the whole Nuclear Data System in the near future.

7) Brief summaries of national programmes

Because of time limitations it was not possible to review in detail the various national activities in the nuclear data area. Instead the members referred to the national progress reports and described only the highlights. Additionally committee members were asked to provide the Scientific Secretary with short summaries of the nuclear data activities in their laboratories, or countries, if they wished to do so. The contributions received up to 30 June 1990 are included below.

CBNM Geel

K.H. Böckhoff reported as follows:

- The subthermal/thermal fission cross section and Westcott-factor of Pu-241 has been determined at GELINA using a liquid methane moderator. This measurement concludes the series of low energy experiments during which also the corresponding quantities of U-233, U-235 and Pu-239 were determined.
- The GELINA measurements on η of U-235 at subthermal and thermal energies were repeated at ILL under improved conditions. The results of these experiments show that η is decreasing between thermal and subthermal energies. The effect is 2% between 25 and 5 meV.
- 1.15 keV resonance of Fe-56 (Task Force):
The (p, gamma) studies for the determination of the response functions and efficiencies of the C₆D₆ detector have been continued with an improved set-up which simulates in a better way the set-up used at GELINA for the neutron capture measurements. The discrepancy between the experimental weighting function determined from these (p, gamma)-measurements and that one calculated with the EGS and ACCEPT codes remain.
- The neutron capture and transmission cross section of ⁵²Cr data obtained previously have been analysed between 1 keV and 500 keV and 1 keV and 1 MeV respectively. They have been published. (Phys.Rev.C 39,2,426.)
- A second measurement series on the ⁹Be(n,2n) cross section has been performed. The data are being analysed.

F.R. Germany

Cierjacks briefly reported on some recent nuclear data activities at the Kernforschungszentrum Karlsruhe (KfK), the Institut für Kernphysik of the Forschungszentrum Jülich (IKP/KFA), Forschungszentrum Geesthacht (GKSS), and Physikalisch-Technische Bundesanstalt Braunschweig (PTB). At the Institut für Kernphysik III of KfK the experimental program for astrophysical application was continued. Major activities concerned (1) the measurement of the $^{22}\text{Ne}(n,\gamma)$ cross section at $kT = 25$ keV, (2) the stellar neutron capture cross sections of ^{94}Zr and ^{96}Zr , and (3) first measurements for verifying the overall performance data of the new 4π BaF_2 detector by an $^{197}\text{Au}(n,\gamma)$ cross section determination. In the Institut für Material- und Festkörperforschung II of KfK nuclear data activities referring to low-activation materials development for fusion needs have been started. Special work was performed on (1) the study of element activation by sequential (x,n) reactions, (2) preparation of experimental benchmark data testing at the Karlsruhe Isochronous Cyclotron, and (3) studies of a high-performance neutron source for materials testing based on the $^1\text{H}(t,n)^3\text{He}$ source reaction.

At IKP/KFA experimental and theoretical studies of spallation reactions in the medium energy range were continued with (1) measurements of (p,xn) reactions at 300, 600, and 800 MeV, (2) measurements of proton-induced double differential cross sections at 800 MeV, and (3) calculations of transmutation products from proton-induced reactions in the range $200 \leq E_p \leq 5000$ MeV. At GKSS 14 MeV neutron activation cross sections for a large number of reactions in nuclides between ^{65}Cu and ^{176}Yb have been measured with the KORONA source. At PTB Braunschweig recent measurements concentrated on neutron reactions in the energy range from 8-19 MeV. New results were obtained for (1) the $^{27}\text{Al}(n,\alpha)$ and the $^{24}\text{Mg}(n,p)$ reactions (8-15 MeV), (2) the $^{54}\text{Fe}(n,\alpha)$ reaction (9-15 MeV), (3) some neutron-induced reaction cross sections on carbon (11-19 MeV), and (4) neutron Kerma factors for several materials (20-60 MeV).

F.R. Germany
(continued)

Qaim reported that at the Institut für Nuklearchemie of KFA Jülich work is progressing, as in last years, in three directions:

- a) Measurements of relevance to fundamental studies. In continuation of investigations on (n,t) and $(n,^3\text{He})$ reactions, work is now underway on $(n,^7\text{Be})$ and $(p,^7\text{Be})$ reactions. Furthermore, effort has been intensified towards measurements of isomeric cross section ratios as a function of projectile energy. Model calculations in this direction are performed in collaboration with IRK Vienna.
- b) Cross section measurements in the neutron energy range of 4 to 10 MeV, especially for fusion reactor technology. The major emphasis presently is on the formation cross sections of long-lived transmutation products.
- c) Excitation functions of charged particle induced nuclear reactions, of special interest to medical radioisotope production. The main interest is on data for isotopes used in emission tomography.

The groups at Köln and Hannover are primarily interested in medium energy data, especially for applications in Cosmic research.

The Netherlands

H. Gruppelaar reported that in the Netherlands most of the nuclear data activities related to neutron-induced reactions is performed at the Netherlands Energy Research Foundation (ECN) at Petten.

Experimental nuclear physics activities with neutron beams of the High Flux Reactor at Petten are shrinking. During the last year the (n, γ) reactions on light nuclei (H,D, 3 He) were studied with different techniques, including oriented targets, polarized neutrons and polarized γ -rays. The results are of fundamental interest: it has been shown that exchange currents influence spin interfering amplitudes for capture γ -ray polarization and angular distribution from a polarized deuteron target. Furthermore, the single photon cross-section for s-wave capture in 3 He has been measured accurately.

The neutron evaluation work at ECN is directed to contribute to three data files: the Joint Evaluated File (JEF-2), the European Fusion File (EFF-2) and the European Activation File (EAF). To support this work new approaches were studied to calculate photon-production data and neutron emission data, by introducing modified γ -ray strength functions and new multi-step direct reaction models, respectively.

The ECN contribution to JEF-2 consisted of a revision of the fission-product nuclear data file, with emphasis on the improvement of the thermal and resolved-resonance ranges, including corrections for missed resonances. This work was a joint activity of ECN and the NEA Data Bank.

The work for EFF-2, sponsored by the European Community's Fusion Technology Programme, included new evaluations for the structural materials, Li-7, Be, Al and Si. Various European laboratories contribute to this work. The file is maintained at ECN Petten. The Dutch contribution was the completion of the evaluations for Ni-58 and Ni-60, by introducing the high-energy evaluation of Dr. M. Uhl (IRK, Vienna). Similar work is underway for Cr-52 and Fe-56. Some results are underway with respect to sample calculations of the uncertainty in the heating of superconducting coils of the NET reactor.

Good progress has been made with respect to the EAF. This file contains a very large number of stable and unstable targets with almost all possible activation reactions. Current work is directed to the low energy range, with emphasis of improving the capture cross sections. The work is done in collaboration with Harwell and other laboratories.

Sweden

Condé referred to the Swedish Progress Report for 1989 (NEANDC(OR)-162/U) and highlighted the status of new facilities in Sweden.

The MAX accelerator at the Lund University is a combination of a 100 MeV pulsed racetrack microtron and a pulse stretcher ring. During the last year, MAX has delivered synchrotron radiation and energetic electrons. An electron tagging system allows measurements on gamma induced reactions with monoenergetic photons in the energy range 30-100 MeV. The CRYRING project at the Manne Siegbahn Institute consists of an electron beam ion source (CRYSIS) with an isotope separator INIS as injector, a RFQ accelerator and a synchrotron and storage ring with electron cooler. The research will cover atomic and heavy ion physics with max energy/nucleon of about 50 MeV. The present time plan aims at a first injection test during 1990. The CELSIUS facility at the The Svedberg Laboratory is a storage ring with acceleration and cooling capacity on line a 200 MeV cyclotron. The maximum proton energy in the ring will be 1.3 GeV. So far a proton energy of 1 GeV has been reached and 10^{10} particles has been stored. The electron cooling equipment is being installed. Gas-jet and fibre targets has been built and a pellet target system is being developed. An ECR heavy ion source has been installed and a polarized ion source will be set up during 1991. Pion physics, heavy ion physics and nuclear physics research is planned for the CELSIUS ring.

Olsson informed about the neutron scattering studies in the 20 MeV region performed at Studsvik, using the rebuilt high-resolution, low-background time-of-flight facility. A time resolution of better than 1 ns, corresponding to an energy resolution of 0.7 MeV, was used throughout the experiments. The spectra of scattered neutrons were measured in steps of 2.5° or 5° in the angular range $10^\circ - 160^\circ$. The work, which contains in total about 2200 new differential cross sections, has now been finalized and published.

The material includes angular distributions for scattering from the ground state as well as from the 2^+ (4.44 MeV), 0^+ (7.65 MeV) and 3^- (9.64 MeV) excited states of carbon at the incident neutron energies 16.5, 17.6, 18.7, 19.8, 20.9, 21.6, and 22.0 MeV. The results have been treated in terms of a phenomenological spherical optical model, using the distorted-wave Born approximation to describe the inelastic cross sections. The data were also analyzed in the framework of the coupled-channels formalism with a deformed optical model potential.

Elastic scattering angular distributions have also been measured for the natural elements Be, N, O, Mg, Al, Si, S, Ca, Cr, Fe, Co, Ni, Y, Ce, Pb (radio-genic) and Bi at 21.6 MeV. For the elements ranging from Mg to Bi the experimental data were analysed in terms of a standard phenomenological spherical optical model, and also with three different microscopic folding

Sweden (continued)

models for the optical potential. For the lighter elements Be, N and O the results for elastic scattering have as well been treated in terms of a phenomenological spherical optical model, while inelastic scattering cross sections for ^{14}N and ^{16}O were calculated using the distorted-wave Born approximation. The coupled-channels formalism for rotational and vibrational nuclei was also used in the analysis of scattering data from ^9Be and ^{16}O .

In addition, angular distributions for inelastic scattering from some low-lying strongly excited states in a few of the even-even nuclei studied, i.e. ^{24}Mg , ^{28}Si , ^{32}S , ^{40}Ca , ^{52}Cr , ^{56}Fe and $^{58,60}\text{Ni}$ have been determined. The results have been analysed in terms of rotational, vibrational or rotation-vibrational models using the coupled-channels formalism.

UK

M.C. Moxon, R.A. Forrest and M.G. Sowerby reported on the activities.

At Harwell measurements made with HELIOS include (i) transmission measurements on Na, C, Ar and Al in the neutron energy range a few keV to 5 MeV (ii) a measurement of the ^{238}U capture cross-section between approximately 6 eV and 100 keV (iii) measurements of the capture gamma-ray spectra from ^{54}Fe and ^{52}Cr and (iv) a measurement of the photo-fission and photo-neutron cross-sections of ^{241}Am . Other work includes a measurement of the response of C_6D_6 detectors to 6.13 MeV gamma-rays for the ^{56}Fe Task Force (a paper is in draft form) and a measurement in cooperation with ORNL using ORELA of the shape of η for ^{235}U in the thermal energy range. Resonance analysis using the shape analysis technique and the code REFIT is continuing on transmission and capture data for both ^{238}U and natural Fe. A paper on the "International Comparison of Fast Neutron Fluence-Rate Measurements using Fission Chamber Transfer Instruments" has been submitted to Metrologia. Papers on the Na and C total cross-section measurements and the ^{238}U resonance analysis will be presented to PHYSOR'90. Work related to fusion activation includes improvements to the cross-section, decay and biological hazard data bases used with the UK code FISPACT, improvements to FISPACT and the application of the code. In particular a study of the environmental impact of fusion has been performed (AERE R 13708) and a report giving activation data on 30 elements relevant to fusion reactors produced (AERE R 13402).

At the National Physical Laboratory a measurement of the n-p cross-section at 14.5 MeV has been performed as well as measurements of 14 MeV activation cross-sections which previously had appeared to be discrepant (eg $^{165}\text{Ho}(n,p)$ and (n,α) , $^{204}\text{Pb}(n,n')$ and $(n,2n)$, $^{206}\text{Pb}(n,p)$ and $^{209}\text{Bi}(n,p)$ and (n,α)). Decay data continues to be measured at the NPL, Imperial College and Harwell and evaluated at Winfrith. Evaluations of Fission Yields are being done jointly by Winfrith and the University of Birmingham, while the latter are doing modelling of light element neutron cross-sections for the EFF (eg ^7Li and ^9Be). Hodgson at the University of Oxford continues with his theoretical work on the calculation of neutron cross-sections.

France

E. Fort reported that the activity on nuclear data in France is essentially an evaluation activity directed towards JEF2 file completion. Within this program the most important activities have been:

- **239Pu:**
Revision in the resolved range by including OAK-RIDGE high resolution transmission data. New set of resonance parameters derived up to 2 keV. Also derived a total cross section from 1 keV to 500 keV by accounting for self shielding effects (works performed in cooperation with OAK-RIDGE).
- **235U:**
Evaluation of ν_p, ν_d, ν_t from 10^{-5} to 20 MeV. Cross section reevaluation in the thermal and subthermal ranges to account for recent results on eta obtained at GEEL.
- Important participation to the JEF2 decay data file.
- Participation to the validation of the processing in view of JEF 2.0 version benchmarking in the thermal and fast ranges.

8) Presentation of Reports of Subcommittees

8.1) Standards

Condé read a written subcommittee report which was approved and is given in Appendix 9. He also presented the scope of a NEANDC Specialists' Meeting on standards for the neutron energy range above 20 MeV, to be held in May 1991 at Uppsala. It was approved and is given in Appendix 10. The Committee proposed the following persons as members of the Programme Committee: Condé (Chairman), Arndt, Brady, Dietze, Haight, Paul, Kocherov, Nakahava, Nordborg, Vonach, Cierjacks.

8.2) Data of Special Interest

The written subcommittee report was read by M.G. Sowerby and was approved by the committee. It is included as Appendix 11. The NEANDC Chairman thanked M.G. Sowerby for his long and outstanding service as Chairman of this subcommittee.

8.3) Technical Activities

K.H. Böckhoff read the written subcommittee report, which was approved by the committee. It is included as Appendix 12. The NEANDC Chairman thanked K.H. Böckhoff for his painstaking service as Chairman of the subcommittee over many years.

8.4) Monographs

A.B. Smith read the written subcommittee report which was approved by the committee. It is included as Appendix 13. N. Tubbs urges that the next monograph by D.L. Smith should be finished earlier than the end of 1990.

8.5) Meetings

S. Whetstone read the written subcommittee report: Both the report and the proposed Specialists' Meeting were approved by the committee.

8.6) Mandate and the future

A.B. Smith read the written subcommittee report which was approved by the committee. Members were urged to communicate to the Chairman any new ideas regarding the future work of the Committee.

APPENDIX 1

Statement made by the Chairmain NEANDC during the Meeting of the Bureaux of NEA Standing Committees in Paris on 27/28 February 1990

The major direction of work of the Committee has hitherto been oriented towards nuclear data requirements of fission reactors. Recently there have been some thoughts on new orientations. The lesser public acceptance of nuclear power in recent years, due to wrong apprehensions regarding the safety and reliability of nuclear reactors, demands that the safety and radioactive waste disposal aspects are considered more critically. The Committee would naturally focus more attention on data needs in those areas.

It is strongly felt that several "spin off" areas of nuclear power should be given more attention than in the past. There is considerable need of data for understanding problems related to radiation damage in materials, radiotherapy and diagnostic nuclear medicine. The available information on neutron data above 20 MeV is scarce. Such data are of prime importance for neutron therapy, shielding calculations relevant to accelerator programmes, and for spallation applications. The charged particle data up to about 50 MeV are of key importance in optimizing production routes of medically important radioisotopes, especially those applied in emission tomographic studies.

The realization of fusion power appears to be rather remote. However, a search of radiation-resistant low-activation materials poses data demands which have to be met in the near future. The Committee would therefore intensify its efforts in this direction. Since all the data needs could possibly not be met through experimental work (because of limited resources), calculational capabilities will have to be given more attention, covering even low yield and secondary reactions.

The Committee has often initiated, propagated and encouraged intellectually oriented activities with a view to maintaining and furthering a technical base necessary for future orientations. The discussions on interdisciplinary areas of work, consideration of fundamental nuclear theories of relevance to nuclear data problems, and publication of books in the Nuclear Data Series are some of the examples. Organization of specialists' meetings, symposia and large nuclear data conferences also constitute important activities in this direction. Such activities should be pursued further to attract younger people to the nuclear data field.

**Statement made by the Chairmain NEANDC during the
Meeting of the Bureaux of NEA Standing Committees
in Paris on 27/28 February 1990 (continued)**

The Committee has always propagated and strongly supported close cooperation, on the one hand with other NEA-committees and, on the other, among the various technical working groups in the NEA-member countries. It has also maintained links with the IAEA-NDC. With the decreasing resources for nuclear data research and the imminent lean years ahead, the cooperative efforts will have to be intensified. In the field of data evaluation good cooperation is being developed between Europe, North America and Japan, and it is imperative that this cooperation continues. In the experimental field, in the past only some coordination work was done. If a cooperation existed, it was mainly on a bilateral basis. The Committee is now stepping up its efforts to promote cooperation in a few important experimental areas.

The Committee has a full programme of work but has some strong feelings of concern. The discontinuation of supply of isotopically enriched materials and samples for nuclear data measurements on a loan basis, as contemplated presently, would jeopardise many experimental programmes. The closing down of several experimental facilities would curtail the activities further. The manpower situation in the field of nuclear data is precarious. Apart from the unhealthy age structure, it is in the danger of falling below a critical level. It is timely that the NEA gives due consideration to these concerns of the Committee.

The NEA may consider establishing a limited number of coordinated research projects (similar to IAEA) on timely nuclear data needs. The prestige value of such a project at the home laboratory cannot be overestimated.

The Committee's approach has all along been forward-looking and over the years several new activities have evolved. In the coming years the work will be difficult and more challenging but in view of the existing sense of flexibility and the strength of self-criticism, I am sure the Committee will continue to fulfil its mandate and advise the NEA objectively on matters pertaining to nuclear data for newer applications and programmes.

Syed M. Qaim
Chairman, NEA-NDC

27 February 1990

APPENDIX 2

Report of the NEACRP observer S. Igarasi to the NEANDC Chairman

JAPAN ATOMIC ENERGY RESEARCH INSTITUTE

TOKAI RESEARCH ESTABLISHMENT

TOKAI-MURA, NAKA-GUN, IBARAKI-KEN

NDC/88/77

October 26, 1988

Dr. A.B. Smith
Applied Physics Division
Building 316
Argonne National Laboratory
9700 South Cass Avenue
Argonne, Illinois 60439
U.S.A.

Dear Mr. Chairman:

This is my prompt report on the Thirty-first Meeting of NEACRP which was held at O-arai Engineering Center of PNC, from 17th to 21st October. First of all, I have to apologize to you for being unable to attend the meetings on the last two days, because I had another meeting in Tokyo on Friday in which I had to take the chair. Hence the following is the report from the discussions made in the meeting of the first three days.

On the first day of the NEACRP meeting, Matters related to the NEANDC were discussed, following presentation of my report enclosed herewith. The NEACRP approved setting up the NEANDC-NEACRP Task Force for Nuclear Data Evaluation Cooperation. Candidates of the Task Force member from the NEACRP were Drs. H. Küsters and R.D. McKnight. Dr. H. Gruppelaar was also nominated, but I claimed that he was an appropriate member from JEF or EFF. A proposal that the NEACRP will invite the Task Force chairman in the next NEACRP meeting to hear his interim report of the progress was approved. Dr. Shirakata will write a letter on this matter to you.

Concerning the Decay Heat Problems, the NEACRP thought that the sensitivity analysis was needed to solve the discrepancies between the data of ORNL and LANL. They agreed to setting up the Task Force, and nominated Drs. J. Blachot, B. Duchemin and G. Rudstam as the candidates of the Task Force leader. Detailed answer on this matter to you will be made by the NEACRP secretariat.

A proposal for a benchmark integral experiment on β_{eff} was made by the representative of France. I have enclosed herewith his proposal. The NEACRP supported this proposal, and agreed to retention of the item on delayed neutron in the NEANDC List of the Data of Special Interests.

Report of the NEACRP observer S. Igarasi to the NEANDC Chairman (continued)

Dr. A.B. Smith

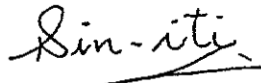
- 2 -

October 26, 1988

There was no special reaction to my report on screening the High Priority Request List. Some new requests of the photon-production data will be submitted directly to the NEANDC subcommittee co-chairman.

The NEACRP supports the preservation of the barn, and the chairman, Dr. Shirakata, will write a letter to Professor R.C. Barber.

Sincerely yours,



Sin-iti Igarasi
General Manager,
Nuclear Data Center

cc: P.G. Young
J.L. Rowlands
M.G. Sowerby

SI:si

Report of the NEACRP observer S. Igarasi to the NEANDC Chairman (continued)

A proposal for a benchmark β_{eff} integral experiment of MASURCA

(M. Salvatores)

There is the intention to perform integral β_{eff} measurements at Cadarache on the MASURCA facility. The motivation for such experiments is to contribute to the solution of present discrepancies on β_{eff} calculation / experiment comparisons, and to validate the new set of delayed neutron data which have been made available in the very recent years. These data are given with tight accuracies, which should indicate very limited uncertainties on integral β_{eff} values.

The proposed experiments will be made in the framework of the CONRAD program which is a common program of the countries participating to the European Fast Reactor cooperation, but there is the intention to extend the participation to other countries for these particular experiments, to make them international experimental benchmarks.

The critical configuration will be as far as possible a clean configuration (PuO₂-UO₂ fueled). If this committee shows interest in the benchmark experiment proposal, Cadarache will provide a preliminary proposal to be discussed. As far as experimental techniques, the use of different techniques in the same core will be encouraged (noise technique, Cf-252 source technique etc)

Report of the NEACRP observer S. Igarasi to the NEANDC Chairman (continued)

Report on NEANDC Meeting

NEACRP, Oarai

Oct. 17 - 21, 1988

The twenty seventh NEANDC meeting was held at Los Alamos, USA, from Sept. 26 to 30, 1988.

1. Task Force for Nuclear Data Evaluation Cooperation

The NEANDC expressed in the last meeting in Rome that it was deeply interested in international cooperation in evaluation, and the Chairman wrote a letter to the head of the three evaluation groups (JEF, ENDF, JENDL) asking their suggestions, views, interests as well as policy on international cooperation.

The three groups made the favorable answers to the international cooperation in the nuclear data evaluation, though individual positions were rather different. On the opportunity of the Mito Conference on the nuclear data, the Chairman convened a small meeting to discuss this matter. Three groups roughly agreed to foster the cooperation.

Taking these circumstances into account, the Chairman proposed in the NEANDC meeting that a NEANDC Subcommittee on Evaluation Cooperation would be convened to consider how a closer collaboration might be arranged. The Subcommittee met on the evening of Sept. 26 (Monday), and made a proposal (see attachment 1) that a joint NEANDC-NEACRP Task Force should be set up to consider ways of improving cooperation between the three groups.

The NEANDC accepted the proposal, and intends to invite the three groups as well as the NEACRP to join the Task Force. Hence, the NEANDC would like to request the NEACRP to approve the proposal and to nominate a NEACRP representative to the Task Force.

2. In the last meeting of NEACRP, the NEANDC proposed to set up a new Task Force jointly with the NEACRP on the Nuclear Data for Decay Heat Problems which was requested in the specialists' meeting held at Studsvik, Sept. 7 - 10, 1987, and it was endorsed by the NEACRP.

Report of the NEACRP observer S. Igarasi to the NEANDC Chairman (continued)

The recommendation made in the specialists' meeting was very broad, from the separate beta and gamma components to the sensitivity studies. Hence, the Task Force should make the problems to be solved clear. In this context, the NEANDC would like to know the NEACRP's interest in the problems concerning integral data as well as users' needs, data requirements, etc. Besides, the NEANDC would like to hear the idea of the NEACRP about the leadership of the Task Force.

Attachment 2 shows "General Conclusion" of the Working Groups in the Specialists' Meeting at Studsvik, and a report on Pu-239 Decay Power Discrepancy by T.R. England and P.G. Young.

3. The Task Force on 1.15 keV resonance parameters of Fe-56 will be terminated after a final report is written by Jan. 1, 1989. The report will give numerical results and conclusions regarding the nature of the problem.

The Task Force on the resonance parameters of U-238 will write a final report before the next NEANDC meeting. Reanalysis of the data is now in progress, and will finish by the end of this year. Status of this Task Force is reported in Attachment 3.

4. Concerning Data of Special Interest, a small informal Working Group was formed, in the last meeting in Rome, to make a recommendation as to whether or not additional experimental data were needed to meet the requirements for the $\text{Li-7}(n,n't)$ reaction cross section. The working group felt that although there were still problems on the data, the current generation of measurements appears to represent the state of the art. Hence, the Working Group concluded that the users should utilize the data and assess whether their needs have been met.

5. In the last NEANDC meeting, the item on "Delayed Neutrons from Fission" was dropped from the List of the Data of Special Interest. However, there are still requests to retain this item in the List (see Attachment 4). Hence, the NEANDC would like to know whether there are still problems when they are used for reactor purposes, especially the data of U-238 and Pu-239.

Report of the NEACRP observer S. Igarasi to the NEANDC Chairman (continued)

Recent measurements of delayed neutron spectra at University of Lowell showed some discrepancy between experiments and evaluation of Pu-239 in its group 2 spectrum.

6. To enhance collaboration between the different neutron data measurers in the OECD area as a means to counteract the present manpower problems, a Subcommittee on Establishment of Interlaboratory Working Groups was set up. The Subcommittee discussed domain of the Working Groups, aim of the work, subjects and fields of the work, etc., and decided to launch the following two Working Groups:

- 1) Capture cross section data (resonance parameters) of Fe, Cr and Ni.
- 2) Activation cross-section data for fusion reactors.

7. The High Priority Measurement Request List was screened by the NEANDC Subcommittee on Technical Activities. Results are shown in Attachment 5. The Subcommittee would like to recommend that the NEACRP should propose that the related national committees should review the results.

8. The NEANDC and INDC have been interested in the preservation of the barn as a nuclear unit to be used in the SI system, and have requested the retention of the barn to CIPM and IUPAP.

Although IUPAP supports the position of the NEANDC, there is still concern about this matter, because of the directive by the EEC to abolish the use of barn. Hence, the NEANDC Chairman wrote a letter (see attachment 6) to the IUPAP SUS-AMCO Commission to request support for retention of the barn.

The NEANDC would like to hear the opinion of the NEACRP, and to ask the NEACRP to second the NEANDC to preserve the barn.

APPENDIX 3

Progress Report of the IAEA Nuclear Data Section (NDS)

28th NEANDC Meeting
Harwell, United Kingdom, 26-30 March 1990

PROGRESS REPORT
September 1988 - March 1990

IAEA Nuclear Data Section (NDS)

1. Data Assessment and Research Coordination

1.1. Scientific Meetings

- Review of the REAL-88 Programme, Meeting held on 4-6 October 1988 in Petten, the Netherlands (INDC(NDS)-212).
- Second Meeting on the Fusion Evaluated Nuclear Data Library (FENDL) and Benchmark Calculation, held on 8-11 May 1989 in Vienna, Austria (INDC(NDS)-223).
- 17th Meeting of the International Nuclear Data Committee, held on 26-30 June 1989 in Vienna, Austria. Meeting report under preparation.
- Status and Requirements of Nuclear Data for Radiation Damage and Related Safety Aspects, Advisory Group Meeting held on 19-22 September 1989 in Vienna, Austria (INDC(NDS)-231).
- Status and Requirements of Transactinium Isotope Decay Data, Consultants' Meeting held on 7-9 November 1989 in Vienna, Austria. Meeting report under preparation.
- Measurement, Calculation and Evaluation of Photon-production Cross-sections, held on 5-7 February 1990 in Smolenice, Czechoslovakia (INDC(NDS)-233).

1.2. Research Coordination

The following nuclear data Coordinated Research Programmes (CRP) were completed during the review period:

- CRP on Gamma Ray Standards for Detector Calibration (1986-1990). Final meeting: 31 May - 2 June 1989, Braunschweig, FRG (INDC(NDS)-221). Technical Report on the results of the CRP is under preparation.
- CRP on the Measurement and Analysis of Neutron Emission Spectra in (p,n) and (α ,n) Reactions (1986-1990). Final meeting: 13-15 November 1989, Bologna, Italy, adjacent to NEANDC level-density meeting (INDC(NDS)-230). Technical Report on the results of the CRP is under preparation.

Progress Report of the IAEA Nuclear Data Section (NDS) (continued)

The following nuclear data Coordinated Research Programmes are currently active:

- CRP on Measurement and Analysis of 14 MeV Neutron-Induced Double Differential Neutron Emission Cross Sections (1987-1992). Second CRP Meeting: 20-22 April 1988, Vienna, Austria (INDC(NDS)-207). Third CRP Meeting: 18-20 June 1990, Vienna, Austria, adjacent to third methods of calculation CRP meeting and to FENDL meeting, 25-28 June 1990.
- CRP on the Methods for the Calculation of Fast Neutron Nuclear Data for Structural Materials (1986-1991). Second CRP Meeting: 15-17 February 1988, Vienna, Austria (INDC(NDS)-214 and 215). Third and Final CRP Meeting: 20-22 June 1990, Vienna, Austria. Follow-up Consultants' Meeting planned: November 1991, Vienna, Austria.
- CRP on Nuclear Data Needed for Neutron Therapy (1987-1992). Second CRP Meeting: 24-27 January 1989, Vienna, Austria (INDC(NDS)-216). Third and Final Meeting is planned for January 1991, Brussels, Belgium.
- CRP on Compilation and Evaluation of Fission Yield Nuclear Data (1990-1993). Preparatory Consultants' Meeting was held 27-29 September 1989 in Vienna, Austria. INDC Summary Report in preparation. First CRP Meeting: March 1991, Vienna, Austria; second CRP Meeting: October 1992, Vienna, Austria.
- CRP on the Measurement and Calculation of Activation Cross Sections for the Generation of Long-Lived Radionuclides (1989-1993). Preparatory Consultants' Meeting: 11-12 September 1989, adjacent to the NEANDC Activation Cross Section Meeting at Argonne, U.S.A. (INDC(NDS)-232). First CRP Meeting planned for October 1991.

The following CRP is planned for the future:

- CRP on Nuclear Data for Neutron Emission in the Fission Process (planned for 1991-1994). Preparatory Consultants' Meeting will be held in Vienna, Austria, 22-24 October 1990, after the 18th INDC Meeting, Vienna, Austria, 15-19 October 1990.

1.3. Electronic Data Communication

An important recent trend in the NDS has been the increased use of electronic mail for incoming and outgoing transmission of messages and numerical data to and from data users and cooperating data centers. The EARN-BITNET address "RNDS@IAEAI", which is monitored twice daily by a local NDS "postmaster", should be used for most routine messages to NDS personnel.

Progress Report of the IAEA Nuclear Data Section (NDS) (continued)

We are also actively exploring the next higher level of computer connectivity, namely, the use of packet switching networks (such as DATEX-P in Austria and Germany) for remote login to computers outside the Agency. For example, during our preparations for several of the computer exercises for the ICTP training course (Item 4.3 below), our remote connection to the ICTP CONVEX computer proved extremely useful. Another recent development is a working connection to VAX computers at the International Experimental Thermonuclear Reactor (ITER) Design Center at Garching, FRG. This new connection should accelerate the development of the Fusion Evaluated Nuclear Data Library (FENDL), described in the document INDC(NDS)-223/GF, and assist in the timely dissemination of processed FENDL data to fusion-project personnel.

2. Data Center Activities

2.1. Data Center Coordination:

- Nuclear Reaction Data:

Nine data centers participate in the network:

- CAJaD, Center for Atomic Nuclear Data, Moscow: charged-particle data;
- CDFE, Photonuclear Data Center, Moscow: photonuclear data;
- CJD, Nuclear Data Center, Obninsk: neutron data
- CNDC, Chinese Nuclear Data Center, Beijing: charged-particle data and neutron data
- Hokkaido University, Japan: charged-particle data;
- NEA Data Bank: neutron data
- NNDC, National Nuclear Data Center, Brookhaven: all nuclear reaction data
- RIKEN Nuclear Data Group, Japan: charged-particle data for medical applications
- IAEA/NDS: all nuclear reaction data

Center co-ordination meetings are held at annual intervals: in odd years "full" meetings with center heads plus technical staff, in even years "technical" meetings with technical staff only.

A technical meeting of staff of the "Nuclear Reaction Data Centers" was held at the IAEA in Vienna, 4 - 6 October 1988. For the conclusions see the informal report CP-D/190=INDC/P(89)-9.

A "full" meeting was held at the IAEA in Vienna, 2 - 4 October 1989. The minutes are being prepared as an INDC report.

- CINDA Book Publication:

IAEA/NDS will publish in 1990 a complete "archival" issue of CINDA. Due to a unique budget situation this publication is possible in 1990 only. It will consist of

Progress Report of the IAEA Nuclear Data Section (NDS) (continued)

CINDA-A (1935 - 1987)

- vol. 1: Introduction, Explanations, Dictionaries,
ca. 130 pages
- vol. 2: Elements 01-30, ca. 920 pages
- vol. 3: Elements 31-54, ca. 670 pages
- vol. 4: Elements 55-89, ca. 680 pages
- vol. 5: Elements 90 and up, (plus "Many" entries, etc.),
ca. 720 pages

CINDA-90 (1988 - 1990), ca. 350 pages

- Status of Neutron Reaction Data Files:

Neutron data compilations in CINDA/EXFOR are satisfactory with following exceptions:

- Systematic CINDA compilation in the U.S. has been discontinued as of 1 January 1990 due to lack of manpower in the NNDC. This will affect not only the NNDC itself but also the other centers because U.S. journals and conference proceedings contain publications by authors from the service areas of all centers.
- Certain neutron data types for which requests have been expressed repeatedly, continue not to be compiled systematically, i.e., neutron-induced gamma-spectra data, data involving polarized neutrons, optical model parameters, and some others.

The CINDA/EXFOR compilation for the NDS service area ("area 3") is up to date. The number of new data to be compiled is decreasing. Exfor compilation is partly done by external co-workers in China and Cuba. The CINDA compilation for U.S.S.R. ("area 4") has been transferred to the U.S.S.R. data center at Obninsk; however, NDS remains responsible for the CINDA compilation of the English translations of Russian (and other) papers.

Evaluated neutron reaction data appear to be quite satisfactory now after the release of BROND, ENDF/B-6 and JENDL-3, although not all of the evaluations contain all of the required data types (e.g., gamma production data, double differential data). Further work is required for fission-product data (IAEA CRP on F.P. yields) and on neutron activation data (for fusion and other applications), plus the task of finding out which of several competing evaluations is preferable (FENDL project).

- Status of Charged-Particle Reaction Data Files:

- The charged-particle reaction CINDA type bibliography which had been produced annually by NNDC, has been discontinued in 1989 due to lack of manpower, despite a requested distribution similar to that of the CINDA books for neutron data.

Progress Report of the IAEA Nuclear Data Section (NDS) (continued)

- Manpower for charged-particle reaction data compilation in EXFOR is less than adequate. Not even the most important data such as neutron-source reactions or "priority 1" monitor reactions have been compiled to a satisfactory degree of completeness. Joint projects for systematic compilation of excitation functions for radioisotope production for medical purposes do not proceed forward due to lack of manpower.
- Production of evaluated data for even the most urgently needed charged-particle reaction data cannot be started as long as the experimental data base is incomplete.

- Photon Reaction Data:

Some EXFOR compilation work is done at CDFE Moscow. U.S. activities do not contribute to the EXFOR database, except for the old Berman photoneutron cross-section file which has been included in EXFOR. Some evaluated photon reaction data from U.S. are available.

- Nuclear Structure and Decay Data (NSDD):

IAEA/NDS work in this field is restricted to

- holding the network co-ordination meetings in two-year intervals, and
- acting as a distribution center for ENSDF/NSR data and some related specialized data files.

The last NSDD network meeting was held in Kuwait, 10 - 14 March 1990. The minutes will be issued as an INDC report.

The active NSDD evaluation centers are in U.S. (5 groups), U.S.S.R. (2), China (2), Canada, France, Kuwait, Netherlands, Sweden. Additional groups in F.R. of Germany, India, Taiwan, U.K. participated for some time. The "mass-chain evaluations" are published either in Nuclear Physics (light masses) or in Nuclear Data Sheets ($A > 45$). Various files and publications derived from ENSDF/NSR exist, in particular the Berkeley handbook of "Table of Isotopes", and a Swedish PC version for the more important gamma-ray data. As the ENSDF/NSR files are not easy to use, additional subfiles for specific applied user groups will be needed as handbooks or PC files.

3. Data Centre Services

3.1. Request Statistics for 1988

In 1988 NDS received 907 requests. Statistics for each of the considered categories for that year are given below, along with a breakdown by service area (area 1 + area 2 + area 3 + area 4):

Progress Report of the IAEA Nuclear Data Section (NDS) (continued)

Experimental data : 34 requests (1 + 8 + 24 + 1)
Evaluated data : 110 requests (5 + 13 + 89 + 3)
Bibliographic data : 5 requests (0 + 2 + 2 + 1)
Publications/reports : 681 requests (80 + 183 + 409 + 9)
Data processing codes: 77 requests (5 + 15 + 56 + 1)

In response to these requests, the following information has been sent out during 1988:

Experimental data : 2.572 x 10⁶ records
Evaluated data : 9.929 x 10⁶ records

3.2. Request Statistics for 1989

In 1989 NDS received 765 requests. Statistics for each of the considered categories for that year are as follows:

Experimental data : 32 requests (0 + 9 + 18 + 5)
Evaluated data : 95 requests (4 + 17 + 59 + 15)
Bibliographic data : 10 requests (1 + 2 + 6 + 1)
Publications/reports : 566 requests (65 + 158 + 328 + 15)
Data processing codes: 62 requests (4 + 11 + 42 + 5)

In response to these requests, the following information has been sent out during 1989:

Experimental data : 1.114 x 10⁶ records
Evaluated data : 1.616 x 10⁷ records

3.3. Other Important Publications

<u>Series and No.</u>	<u>Title</u>
Monograph published by World Scientific Publishing Co.	Applied nuclear theory and nuclear model calculations for nuclear technology applications, lectures presented at Joint IAEA/ICTP Workshop with same title, 1988
INDC(NDS)-220/L	Physics of neutron emission in fission: proceedings of an IAEA Consultants Meeting held at Nito, Japan, May 1988
INDC(NDS)-223/GF	Fusion evaluated nuclear data library (FENDL): proceedings of an IAEA Specialists' Meeting held in Vienna, Austria, May 1989
IAEA-TECDOC-491	Nuclear data for the calculation of thermal reactor reactivity coefficients: proceedings of an IAEA Advisory Group meeting held in Vienna, Austria, December 1987

Progress Report of the IAEA Nuclear Data Section (NDS) (continued)

<u>Series and No.</u>	<u>Title</u>
IAEA(NDS)-218/GZ+	Status report on cross sections of monitor reactions for radioisotope production, 1989
IAEA Nuclear Data Newsletter	Published in about annual intervals whenever important new data files or documents were received that must be announced to customers. The distribution exceeds 3000 in the NDS service area. About 500 copies are sent to scientists in OECD countries and U.S.S.R. upon explicit request.

4. Technology Transfer

4.1. IAEA Technical Co-operation Interregional Training Course on Nuclear Measurements and Methods in Nuclear and Personal Neutron Dosimetry, Riga, U.S.S.R., 15 May - 9 June 1989

This Training Course was jointly organized by the IAEA and the U.S.S.R. State Committee on the Utilization of Atomic Energy. It was convened at the P. Stucka Latvian State University in Riga and attended by twenty scientists from nineteen developing countries (Argentina, Bangladesh, Brazil, China, Cuba, Czechoslovakia, Egypt, India, Indonesia, Iran, Iraq, Libya, Malaysia, Poland, Romania, Sudan, Thailand, Zaire and Zambia).

The objectives of the Training Course were to train scientists from developing countries in the field of nuclear measurements at research reactors, neutron generators and isotopic neutron sources, with special attention to the determination of neutron field characteristics including neutron flux and energy spectra, and neutron personal dosimetry.

During the Training Course, thirty lectures were given on neutron spectra measurements in reactors, unfolding programs of neutron spectra, detectors for the monitoring and spectroscopy of neutron fluxes, personal reactor dosimetry problems, methods and results in personal dosimetry, neutron dosimetry in pressure vessels of VVER nuclear power stations, neutron transport and neutron dosimetry problems, and application of theoretical models for the evaluation of neutron activation cross sections for reactor dosimetry. The practical exercises covered unfolding programs of neutron spectra and were arranged in small groups. Visits to research reactor and dosimetry laboratories were also arranged.

4.2. IAEA Technical Co-operation Interregional Training Course on the Technology and Applications of Neutron Generators, Leningrad, U.S.S.R., 25 September - 27 October 1988

This Training Course was also jointly organized by the IAEA and the U.S.S.R. State Committee on the Utilization of Atomic Energy. It was convened at the D.V. Efremov Scientific Research Institute of Electrophysical Apparatus in Leningrad and attended by fifteen scientists from fourteen developing countries (Algeria, Bolivia, Bulgaria, China, Egypt, India, Iran, Libya, Morocco, Nigeria, Pakistan, Poland, Turkey and Vietnam).

Progress Report of the IAEA Nuclear Data Section (NDS) (continued)

The objectives of the Training Course were to train senior technicians and scientists from developing countries in the technology and applications of neutron generators, with special attention to the practical understanding of all parts of neutron generator facilities and fast neutron activation analysis.

During the Training Course, twenty-five lectures were given on ion source, high voltage generator, ion optical system, vacuum system, acceleration tube, control system and rotation tritium target device, and the main properties of the D-D and D-T reactions, cyclic activation analysis and typical applications of fast neutrons in elemental analysis for agriculture, geology/mining and industry. Practical demonstrations of neutron generators were arranged. Scientific visits were organized to the Institute of Nuclear Physics in Leningrad and the All-Union Scientific Research Institute of Radiation Techniques in Moscow.

4.3. Workshop on Reactor Physics Calculations for Applications in Nuclear Technology, ICTP, Trieste, 12 February - 16 March 1990

This Workshop was organized jointly by the IAEA Nuclear Data and Physics Sections and the International Centre for Theoretical Physics (ICTP), Trieste, Italy and was held at the ICTP, Trieste from 12 February - 16 March 1990.

As a part of the continuing series of Winter Colleges and Workshops on Nuclear Physics Applications and Nuclear Technology held at the ICTP biennially since 1978, and as a follow-up of the earlier Workshop on "Applications in Nuclear Data and Reactor Physics" held at the ICTP in 1986, this Workshop was designed to familiarize participants with nuclear data files and computer codes used in nuclear data processing and reactor physics calculations and to provide them with "hands-on" experience by performing related computer exercises using a few selected widely used computer codes. The Workshop gave ample opportunity to the participants to discuss their experience and problems in the use of computer codes for nuclear data processing and reactor physics calculations.

The workshop included lectures in the morning sessions on the following topics: Basic reactor physics and nuclear data processing for reactor calculations, lattice cell calculations, core design and management, multigroup diffusion theory and reactor neutron dosimetry. These lectures provided the participants with the necessary theoretical background and details of selected computer codes which were used in well-defined computation exercises carried out during the afternoon sessions.

The Workshop was attended by a very active and largely well qualified group of 51 reactor physicists and engineers from 25 developing and two advanced countries. The lectures will be published by World Scientific Publishing Co., Singapore.

Progress Report of the IAEA Nuclear Data Section (NDS) (continued)

5. Forthcoming IAEA/NDS Meetings 1990/1992
(subject to revisions!)

AG = Advisory Group Meeting
 CM = Consultants Meeting
 RCM = Research Coordination Meeting
 SPM = Specialists Meeting
 TC = Technical Committee Meeting

1990

<u>Type</u>	<u>Date</u>	<u>Location</u>	<u>Title</u>	<u>NDS Staff</u>
RCM	18-20/06	Vienna, Austria	Double Differential Neutron Emission Measurement and Analysis (3rd RCM)	Wang
RCM	20-22/06	Vienna, Austria	Methods of Calculation of Fast Neutron Nuclear Data for Structural Materials (3rd RCM)	Muir
CM	25-28/06	Vienna, Austria	Results of FENDL-1 Testing and Start of FENDL-2	Pashchenko
AGM	09-12/10	Vienna, Austria	Intermediate Energy Nuclear Data for Applications	Kocherov
TCM	15-19/10	Vienna, Austria	18th Meeting of the International Nuclear Data Committee	Schmidt
CM	22-24/10	Vienna, Austria	Nuclear Data for Neutron Emission in the Fission Process	Ganesan
SPM	13-15/11	Vienna, Austria	Technical Aspects of Nuclear Data Processing and Exchange (NRDC)	Lemmel
AGM	20-22/11	Chengdu, China (location tentative)	Nuclear Data for Neutron Multiplication in Fusion Reactor First Wall and Blanket Materials	Muir

1991

<u>Type</u>	<u>Date</u>	<u>Location</u>	<u>Title</u>	<u>NDS Staff</u>
RCM	January	Brussels, Belgium	Nuclear Data Needed for Neutron Therapy (3rd RCM)	Kocherov
RCM	January	Brussels, Belgium	Atomic and Molecular Data for Radiotherapy (2nd RCM)	Kocherov
RCM	March	Vienna, Austria	Compilation and Evaluation of Fission Yield Nuclear Data (1st RCM)	Lammer

Progress Report of the IAEA Nuclear Data Section (NDS) (continued)

1991

<u>Type</u>	<u>Date</u>	<u>Location</u>	<u>Title</u>	<u>NDS Staff</u>
TC	Summer	Leningrad, USSR	Targets and Samples for Nuclear Applications	Kocherov/ Wang
AGM	May	Juelich, FRG	Recent Developments and Advances in Nuclear Radiation Detection Systems	Kocherov
AGM	June	Vienna, Austria	FENDL-2 and Associated Benchmark Calculations	Pashchenko
CM	October	Moscow/Obninsk/ USSR	11th Nuclear Reaction Data Centers Meeting	Lemmel
RCM	October	Vienna, Austria	Activation Cross Sections for the Generation of Long-lived Radionuclides (1st RCM)	Wang
CM	November	Vienna, Austria	Methods of Calculation of Fast Neutron Nuclear Data for Structural Materials (replacing 4th RCM)	Muir
CM	December	Vienna, Austria	Nuclear Data for Fission Reactor Decommissioning	Kocherov

1992

<u>Type</u>	<u>Date</u>	<u>Location</u>	<u>Title</u>	<u>NDS Staff</u>
NDW	Feb/Mar	ICTP Trieste, Italy	Workshop on Computation and Analysis of Nuclear Data Relevant to Nuclear Energy and Safety	Schmidt/ Muir
RCM	April	Vienna, Austria	Double Differential Neutron Emission data Measurement and Analysis (4th RCM)	Wang
CM	May	Vienna, Austria	Fission Cross Section Calculations and Barrier Transition States	Ganesan
CM	May	To be decided	Meeting of the NSDD Evaluators' Network	Lemmel
CM	May	Vienna, Austria	Benchmark Calculations for FENDL-2	Muir/ Pashchenko
AGM	June	To be decided	Nuclear Data for Advanced Thermal and Fast Reactors	NDS head
TCM	June	To be decided	19th Meeting of the International Nuclear Data Committee	NDS head

Progress Report of the IAEA Nuclear Data Section (NDS) (continued)

1992

<u>Type</u>	<u>Date</u>	<u>Location</u>	<u>Title</u>	<u>NDS Staff</u>
TC	Summer	Minsk, USSR	Measurements in Applied Gamma-Spectroscopy and Low-level Counting	Kocherov/ Wang
RCM	October	Vienna, Austria	Compilation and Evaluation of Fission Yield Nuclear Data (2nd RCM)	Lammer
SPM	October	Vienna, Austria	Technical Aspects of Nuclear Data Processing and Exchange	Lammel
CM	November	Vienna, Austria	Finalization of FENDL-2	Pashchenko

APPENDIX 4

NEA Data Bank Progress Report to the 28th Meeting of NEANDC

NUCLEAR DATA SERVICES

CINDA

The CINDA data bases at the different Nuclear Data Centers were compared during the last year and differences were discussed and corrected. A master-copy of each center's area of responsibility were then transmitted to the other centers for loading. There should now in principle not be any differences between the centers data bases.

The publication of the CINDA books has been extensively discussed during the last two years. At the 4-Center meeting in the autumn of 1988 it was decided that each center should take care of its own distribution of CINDA information after 1989. The planned common archive publication was considered too expensive and was therefore abandoned.

At the 4-Center meeting in Vienna in the autumn of 1989, the NNDC announced that they were facing budget cuts and might have to reduce the personnel. It has since then been confirmed that the person responsible for the CINDA coverage in US area would be transferred to another post and that there would be no complete CINDA coverage in the future. The present situation is very unsatisfactory, as the usefulness of the CINDA system depends on a full coverage of all areas and a high proportion of the new neutron data measurements are still carried out in the United States.

Experimental data compilation and Customer service

36 new publications were entered in the EXFOR system, in addition to the 41 re-transmission distributed to the other centers in 1989. There is no backlog for the EXFOR compilation, but only a few articles waiting to be compiled as the Data Bank has not yet received the tabulated data from the authors.

A total number of 151 requests for data and documents were answered in 1989. This does not include the on-line services. The main items asked for were JEF data (27%), other evaluated data (23%) and EXFOR data (23%). About 30 percent of these requests were answered via computer network, which is a major increase compared to previous years.

The trend of increased use of computer networks could also be seen in the on-line customer service. There are now about a total of 100 authorized users of the services. The Evaluated Nuclear Structure Data File (ENSDF) and the Nuclear Structure References (NSR) are the most popular data bases with 733 accesses during 1989. The Evaluated data base (EVA) was

NEA Data Bank Progress Report to the 28th Meeting of NEANDC (continued)

investigated 64 times, the EXFOR data base 91 times and the CINDA data base 14 times. A large majority of all out on-line request came from France, followed by F.R. Germany, Switzerland, UK and the Netherlands.

Joint Evaluated File (JEF)

Following the summary presentation of the benchmark testing of the JEF-1 file at the ANS Reactor Physics Meeting in Jackson Hole, USA, in September 1988, the work on the JEF project has been concentrated in finalising the new evaluations for the JEF-2 library. The re-evaluation work has taken longer than expected, probably due to shortage of manpower available for this kind of work, a situation that it is hoped to improve with the new International Evaluation Cooperation.

The Data Bank has been specially active in the translation to ENDF-6 format of those files taken over from the JEF-1 file, in the updating of the resonance region of the fission product files in cooperation with ECN, Petten, and in the compilation of the Radioactive Decay Data file. This last file has taken a long time to compile as it contains more than 2200 isotopes with all possible decay information, such as half-life, average energies, and radiation spectra. The Data Bank has also been part of the cooperation in the evaluation of the JEF-2 U-238 file. Support in testing and processing of preliminary files has been given to evaluators in participating laboratories, a work which is difficult to quantify but which uses a considerable manpower.

The preliminary version of the JEF-2 library had been compiled and briefly checked at the Data Bank at the end of 1989. Two iron isotopes were still missing and the radioactive decay data file needed to be updated with the latest available delayed neutron data. The files were sent out to participating laboratories for processing and testing in early 1990, and it is expected that feedback from this exercise will lead to minor modification to some of the files before the JEF-2 library is released for general use later in the year.

Validation of Computer Codes and Data

A nuclear mode code comparison covering the Weisskopf-Ewing and the Hauser-Feshbach theories was started in 1987. Some contributions have been received, but the analysis has not yet been completed partly because of lack of manpower.

A new blind inter-comparison of nuclear model cross section calculations was suggested at the NEANDC Specialists' Meeting on Activation data for Fission and Fusion Energy Applications. It concerns the Co-60 (n,p) reaction and S. Cierjacks was designated as coordinator. The Data Bank would be asked to help with preparing graphs and tables for the final report.

Following the NEANDC Specialists' Meeting on Decay Heat Predictions in 1987, it was decided to verify the codes used in decay heat calculations. The Data Bank has together with B. Duchemin, Saclay, conducted this benchmark study, and the final report will be sent out in April 1990.

NEA Data Bank Progress Report to the 28th Meeting of NEANDC (continued)

COMPUTER PROGRAM SERVICES

Program Acquisition

During 1989, a total of 162 new computer codes were acquired. Much effort has been invested in acquiring improved and extended versions of nuclear data processing codes in view of the release of new libraries of evaluated data (JEF-2, JENDL-3, ENDF/B-VI). Established group cross section libraries based on JEF-1 were collected. An important set of new safety related codes or revised versions were also acquired.

Following an increased interest in computer codes for waste management applications and dispersion of radioactivity into the environment, the Data Bank has collected programs relevant to these areas. The master-files contain at present 73 codes specific to waste management.

Testing and Master-filing

In all, 129 new computer code packages were master-filed in 1989, of which 119 were fully tested and 10 were only screened.

The Data Bank received an increasing number of programs, which had either been developed on PCs or were mainframe programs adapted to run on PC. They are normally tested on PC. To master-file them on the in-house VAX computer, they are transferred by DECNET using MSDOS service utilities offered by DEC.

Program Distribution

A slightly higher number of computer programs (1,404) was distributed in 1989 than in the previous year (1,365). Seventeen percent of these were distributed to non-OECD establishments.

About half of the requests are made by organisations operated mostly with public funding. One quarter of the requests goes to universities, while the other quarter goes to industries or other privately funded engineering companies, public utilities and other users.

Users have in general shown increased interest in codes designed for computer systems at the two extremes of performance: personal computers and super-computers. This trend is expected to continue in the years to come.

The on-line service of computer programs was extended. Since 1988, the Data Bank has offered an on-line facility, by which authorized users may log into the Data Bank's VAX computer system and search the data base of computer program abstracts. Results can be displayed on the remote terminal screen and/or saved on disk. In 1989, further options were added. Users may now also look up the status of their establishment's request profile or may ask for new programs. Lists can be displayed of programs, which have been dispatched in the past, and of programs, which still wait to be sent out. Each user can only access information for his own establishment. In order to request new programs, search aids are included which

NEA Data Bank Progress Report to the 28th Meeting of NEANDC (continued)

allow the user to exactly identify the program he needs. The dispatch mode may also be specified, such as tape writing formats, or network addresses in cases where the material is to be transmitted electronically. After the request has been formulated, an electronic mail message is automatically sent to the Data Bank's dispatch service.

A document describing the network services was sent out to all liaison officers. An additional announcement was made in the September issue of "NEWS from the DATA BANK".

MEETINGS AND SEMINARS

The following meeting or seminars were organised during 1989:

- NEANDC Specialists' Meeting on Activation Data For Fission and Fusion Energy Applications, Argonne Nat. Lab., USA.
- NEANDC Specialists' Meeting on Nuclear Level Densities, Bologna, Italy.
- Data Bank seminar on the use and future development of the NJOY-89 and THEMIS data processing codes, was held in June 1989. 30 physicists from NEADB member countries participated. Both NJOY-89 and THEMIS have been adopted as the standard processing codes for the JEF-2 file. The processing of ENDF/B-VI files requires also these programs. About 20 requests for this code were placed after the workshop.

PUBLICATIONS IN 1989

The following publications and reports were prepared and distributed:

- Nuclear Program Abstracts (NEA) Full Revision,
- Nuclear Program Abstracts (IAEA) Full Revision,
- INDEX to Nuclear Program Abstracts,
- News from the NEA Data Bank (two issues, no 8 and 9);
- Newsletter No. 34: Blind inter-comparison, An International Nuclear Model and Code Comparison,
- Neutron Nuclear Data Evaluation Newsletter (two issues, no 42 and 43),
- Reports on modelling exercises for the inter-comparison of Probabilistic Systems Assessment Codes, were prepared in 1989 for publication by NEA,
- Proceedings of the Seminar on NJOY and THEMIS (Evaluated Nuclear Data processing Codes)

NEA Data Bank Progress Report to the 28th Meeting of NEANDC (continued)

IN-HOUSE COMPUTER INSTALLATION

The VAX-8810 acquired in the end of 1988 performed very well during the whole of 1989. A new Vaxstation-3100 was added to the cluster in September 1989 to liberate the Vaxstation-2000 for the publishing software Interleaf (selected as the OECD standard), and intended for use particularly in producing the reports for the Thermochemical Data Base Project.

The VAX-11/780 computer was installed in 1983, and many breakdowns were registered during 1989 giving rise to long periods of maintenance, where the computer was not available for users. As almost all of the network communication is on this computer, program testing and on-line users were affected by these interruptions. It is intended to improve communication links during 1990.

ACTIVITIES IN NUCLEAR WASTE MANAGEMENT

Thermochemical Data Base (TDB)

The TDB Project consists of a compilation of fundamental thermodynamic values, and it is intended to make available a comprehensive, internally consistent, and internationally recognised and quality-assured chemical thermodynamic data base of generic application, meeting in particular modelling requirements for the safety assessment of radioactive waste disposal systems. Compilation of all available experimentally determined thermodynamic data for selected key elements is being undertaken, and other elements will possibly be considered in the future. These data are being critically reviewed internationally and a selected set of "best" data will be provided for each element considered in due course.

The NEA Radioactive Waste Management Committee assigned a high priority to five key elements : Uranium, Americium, Technetium, Neptunium, and Plutonium.

ACTIVITIES IN NUCLEAR SAFETY

CSNI Code Validation Matrix (CCVM)

The CSNI Code Validation Matrix (CCVM) consists of a set of thermal hydraulics transient experiments which attempt to model the conditions in both PWR and BWR plants during plant transients. The CCVM Pilot Project contained six experiments selected from the approximately 120 experiments in the complete matrix.

The data base management system at the NEA Data Bank was modified to include the abstracts of the CCVM. During 1989 the CSNI Code Validation Matrix pilot project was completed. Data and reports for six reactor transient thermal-hydraulic experiment have been received and entered into the database system at the Data Bank.

NEA Data Bank Progress Report to the 28th Meeting of NEANDC (continued)

Incident Reporting System (IRS)

During 1989 a database retrieval system for the PC version of the Incident Reporting System (IRS) was developed and distributed to project Coordinators. The retrieval system allows the user to quickly search for incident reports which meet a user-specified combination of conditions and then either examine the reports on the display screen or print the reports.

APPENDIX 5

Progress Report from the National Nuclear Data Center

E. National Nuclear Data Center

1. Cross Section Evaluation Working Group (CSEWG)

CSEWG held two meetings in 1989, its 23rd year of activity. The major emphasis of these two meetings was the review of evaluations for ENDF/B-VI and the plans for benchmark testing of ENDF/B-VI. It was decided that most of the new evaluations and all carryover evaluations which had been converted to ENDF-6 format and corrected would be released in the first three months of 1990. Ten "tapes" have already been released and five more will be released shortly. The evaluations for ^{235}U , ^{238}U and ^{239}Pu will be released in June after preliminary data testing has been completed as will several material evaluations which still require revision or may be re-evaluated this spring. The entire library is available without restrictions.

In addition, the photon interaction library (LLNL) and a converted thermal scattering law library (LANL) will be ready for release after review. Part of the decay data library has been received with the remainder expected in May. A charged particle library will be completed in May. Two high energy evaluations for Fe^{56} extending to 1 GeV have been distributed (BNL). The last ENDF/B-VI sublibrary released will be the fission product yield data in the Fall of 1990.

The NEANDC/NEACRP sponsored Working Group on International Evaluation Cooperation has been formed and held its first meeting at ANL in October 1989. The group consists of representatives of CSEWG, JEF/EFF and JENDL along with members from the parent committees. The members of the Working Group have agreed on a free exchange of their evaluated data files and supporting information. The group is now in the process of forming several subgroups to coordinate efforts to solve important evaluation problems.

Two other areas of international cooperation exist. CSEWG has been supporting the Fusion Evaluated Nuclear Data Library (FENDL) project of the IAEA. The ENDF/B-VI library is being sent to the IAEA for possible inclusion of its material evaluations. Recent approaches from the BROND community (USSR-East Germany) show promise for additional joint activities. We expect to have two evaluators from the USSR at the next CSEWG meeting.

2. Nuclear Data Sheets

The NNDC has been producing the Nuclear Data Sheets at the rate of about an issue a month. Of these, nine issues a year are devoted to nuclear structure evaluation and the remaining three to the publication of Recent References.

Progress Report from the National Nuclear Data Center (continued)

The Center evaluated A=50, 58, 66, 141 and 142 and submitted them for publication; A=45, 67, 143 and 150 are being evaluated.

The U.S. is a part of an international network of evaluators contributing recommended values of nuclear structure information to the Evaluated Nuclear Structure Data File (ENSDF). Publication of the Nuclear Data Sheets proceeds directly from this computerized file. In addition to the U.S., evaluations have been received or are anticipated from the Federal Republic of Germany, U.S.S.R., France, Japan, Belgium, Kuwait, Sweden, the People's Republic of China and Canada.

Use of the concise format for the published A-chains in the Nuclear Data Sheets is functioning smoothly. This format reduces the size of the publication without omitting essential information and improves its readability.

3. On-line Services

For approximately 4 1/2 years, the NNDC has offered on-line access to several of its nuclear data bases. This service is available on the NNDC's VAX-11/780 and 8820 computers via ESNET, INTERNET or over telephone lines. Approximately one-half of the queries have been to the NSR data base (see Table 1).

For users with ANSI-compatible video terminal (such as DEC's VT series) we have added video capability to the overall service control, and to the ENSDF and NSR retrieval programs. In this mode, forms and menus guide the user in generating his retrieval. We have also added a general plotting capability for ENSDF and the experimental reaction data file (CSISRS). The user can perform retrievals, plot the information in either PostScript or Tektronix mode and then send the output to his own computer for final plotting.

4. Reaction Data Activities

Insufficient funding has caused the NNDC staff to be further reduced by one senior staff member. This has led to the termination of the CINDA effort (except for experimental data entries) and charged particle data bibliography and evaluation activities. We will continue to give high priority to the compilation of experimental neutron data but we request that measurers take the initiative to inform us of the existence of compilable data and to provide it to us on a computer readable medium.

Progress Report from the National Nuclear Data Center (continued)

Table 1

On-line Access Statistics 1986-1989

<u>Year</u>	<u>Runs</u>	<u>Retrievals</u>	<u>NSR</u>	<u>ENSDF</u>	<u>NINDAT</u>	<u>CINDA</u>	<u>CSISES</u>	<u>ENDF</u>
1986	648	1621	814	142	536	129	—	—
1987	1275	4263	2521	863	815	60	—	4
1988	2264	8748	5022	1303	1492	285	459	187
1989	3374	8406	3253	850	1841	522	1649	150

APPENDIX 6

Progress Report on the Activities of the JAERI Nuclear Data Center and Japanese Nuclear Data Committee

Activities of JAERI Nuclear Data Center

and

Japanese Nuclear Data Committee

— September 1988 to March 1990 —

March 1990

1. The JAERI Nuclear Data Center (JAERI/NDC) has continued to work in cooperation with the Working Group of the Japanese Nuclear Data Committee (JNDC). Most of their efforts during this period have been devoted to finalize JENDL-3. Considering results of benchmark tests on fast reactors, thermal reactors, fusion neutronics, shielding calculation, γ -ray spectra etc., slight modification was made on the evaluated data of JENDL-3. Thus the compilation of JENDL-3 general purpose files was completed in October 1989. JENDL-3 was released in December 1989 to open use to all the world. The benchmark tests of the final JENDL-3 data are still going on.

After the completion of the JENDL-3 general purpose files, the JAERI/NDC is shifting their activities mainly to the following two directions. One is development of modular evaluation code system and of databases of various parameters which have been collected and used in the evaluation for JENDL-3. Another is evaluation of the JENDL-3 special purpose files, such as activation data, charged particle data, photonuclear data, PKA spectrum and radiation damage data, high energy neutron data etc. The evaluation of (α, n) reaction data for Li, B, C, and O were nearly finished.

The JAERI/NDC has served users with the experimental and

**Progress Report on the Activities of the JAERI Nuclear Data Center
and Japanese Nuclear Data Committee (continued)**

evaluated nuclear data. In this period, there was 34 requests for the evaluated neutron data libraries, 13 requests for the experimental data and 3 requests for the ENSDF. The JAERI/NDC received 128 thousand records of the the experimental data from the NEA/DB and Osaka Univ., about a million records of the evaluated neutron data from the NEA/DB and 150 thousand records of the ENSDF from BNL/NNDC.

Under the Scientists Exchange Program of the STA, Dr. Cai Shao-hui, Institute of Applied Physics and Computational Mathematics, the People's Republic of China joined the JAERI/NDC from 18th November 1988 to 15th April 1989. He made benchmark tests of the gamma-ray production data of JENDL-3.

2. The JNDC was convened once in this period. The Steering Committee met ten times to discuss future activities of the JNDC, to examine the JENDL-3 activity, to advise the JAERI/NDC, etc. In particular, they discussed how to complete the JENDL-3. The working group structure of JNDC is attached.

The second version of JNDC FP Decay Data Library was completed. Calculated data with this Library showed good agreement with the experimental data of ORNL and Tokyo University.

Mass chain evaluation for $A=119$ and 121 and 177 were almost finished. Evaluation for $A=123$ will be completed in this December.

A Seminar on Nuclear Data was held on December 1988 and November 1989 at the Tokai Research Establishment of JAERI. The main theme of the Seminar was again JENDL-3. Some review papers on interesting themes for post-JENDL-3 were also presented. The Proceedings was published as JAERI-M 89-026 and JAERI-M 90-025, respectively.

APPENDIX 7

Progress Report on the Status of the JEF-2 Library

STATUS OF THE JEF-2 LIBRARY

20th March 1990

M. Salvatores and C. Nordborg

At the last meeting of the JEF Working Groups on Evaluation and Benchmark Testing in December 1989, the status of the JEF-2 library was reviewed and almost all of the new evaluations for the JEF-2 library had been sent to the NEA Data Bank for assembling and checking. Since then, the general purpose file was distributed to laboratories involved in the benchmark testing of the library. The covariance information has not yet been included, but should be available in the Spring of 1990. The current status of the different parts of the library is described below.

Actinides

- U -235: A preliminary version of the U -235 evaluation, based on the JEF-1 evaluation and complemented with new resonance parameters by G. De Saussure and the ENDF/B-VI standard data has been compiled. Recent experimental data from Geel and Grenoble indicate a non-flat energy variation of η below the first resonance. It is proposed that the capture cross section have to be slightly modified, as v is flat and the fission cross section has a $1/v$ shape according to recent experimental information from Geel.
- U -238: A first version of the file is ready. Some minor modifications to the resonance parameters might still be performed.
- Pu-239: The new JEF-2 evaluation has been completed.
- Pu-241: The re-evaluated file has been completed.

Structural materials

- Fe: Work on the resonance region of the iron isotopes are well advanced, and the Fe-56 and -58 are ready. Evaluations for Fe-54 and -57 are still being worked on but are close to completion.
- Cr: The second version of the isotopic evaluations have been completed.
- Ni: The isotopes -58 and -60 have been finalised, whereas some work still remains on including photon production data for the other stable isotopes. This work should be finished at the end of March 1990.

Progress Report on the Status of the JEF-2 Library (continued)

Fission products

The work to update the resolved resonance parameters of the major part of the fission product file has been completed. The data are undergoing final checking. The work to include missing (n,charge particle) data from the RCN activation library has been finished, whereas the re-evaluation of the inelastic cross sections would be performed at a later stage.

Thermal scattering law data

The data for JEF-2 have been translated to the ENDF-6 format and thoroughly checked. The data have also been processed with the NJOY/THEMIS code system and pointwise data have been obtained. One new element (Be) have been added to the file.

Radioactive Decay Data

The JEF-2 file will contain about 2250 isotopes. The new file will be based on parts of JEF-1, ENSDF, experimental and compiled data from Sweden and theoretical data from F.R. Germany. The compilation of the data is ongoing and the file should be ready at the beginning of May 1990.

Fission Yield Data

A new adjusted library, containing 34 fissioning systems for 21 different nuclides has been completed. The library contains data for both independent and cumulative yields.

JEF-2 Benchmark testing

Some preliminary testing of certain preliminary files have already been started, but the coordinated benchmark testing of the JEF-2 file was recently started with the generation of group cross section libraries. It was agreed that E. Fort, Cadarache, France, would coordinate the activity in cooperation with the NEA Data Bank. The aim would be to cover as wide an area as possible and to avoid unnecessary duplication of work. The latest versions of the NJOY/THEMIS code systems will be used in the preparatory group cross section calculations, but some code problems have been already been encountered when starting the data processing.

APPENDIX 8

Progress Report on the Japanese Evaluated Nuclear Data Library, Version-3; JENDL-3

Japanese Evaluated Nuclear Data Library, Version-3

- JENDL-3 -

Nuclear Data Center, JAERI

1. Introduction

The JAERI Nuclear Data Center and Japanese Nuclear Data Committee started evaluation and compilation work for JENDL-3 in April 1982. Main purpose for making JENDL-3 is to remedy the defects of JENDL-2 as pointed out in benchmark tests, to add gamma-ray production cross sections, to evaluate nuclear data in higher energy region as precisely as possible, and to make it a large general purpose nuclear data library which is applicable to fusion neutronics calculation as well as fast reactor, thermal reactor and shielding calculation. In 1987, a temporary version, JENDL-3T, was offered for use in the various benchmark tests to check its applicability. The defects pointed out in the benchmark tests were carefully examined and a slight modification was made. The general purpose file of JENDL-3 was finally compiled in October 1989, and released without any restriction in December 1989. The fission product file will be made available by the end of May, 1990.

2. General Purpose File

The general purpose file includes the data for 171 nuclides, as shown in Table 1.

a) Light nuclides

The R-matrix theory was applied to evaluate the cross sections of many nuclides such as $^3,^4\text{He}$, ^6Li , ^9Be , $^{10,11}\text{B}$, ^{12}C and ^{16}O .

The tritium-production cross section of ^7Li was evaluated on the basis of experimental data, and its 14-MeV value was found to be by 10% smaller than that of ENDF/B-IV.

The 14-MeV cross section for the $^9\text{Be}(n,2n)$ reaction was obtained from the measurements of Osaka and Tohoku Universities.

b) Medium-heavy nuclides

Nuclear model calculation has been widely performed. The data in

**Progress Report on the Japanese Evaluated Nuclear Data Library,
Version-3; JENDL-3 (continued)**

the high energy region were much improved by considering the precompound process, DWBA and coupled-channel methods. The evaluated data reproduce the measured neutron emission spectra very well. As for the gamma-ray spectra, the evaluated data are in good agreement with the measurements at ORNL.

c) Heavy nuclides

Important cross sections of fissile and fertile nuclides were simultaneously evaluated by taking account of the ratio measurements as well as the absolute ones in the energy region above 50 keV. The cross sections obtained in the simultaneous evaluation are the fission cross sections of ^{235}U , ^{238}U , ^{239}Pu , ^{240}Pu and ^{241}Pu and the capture cross section of ^{238}U . The capture cross section of ^{238}U was, however, re-evaluated with much weight on the data of Kazakov et al.

3. Fission Product File

The fission product file includes the data for 172 nuclides, as shown in Table 2.

a) Threshold reaction cross sections

Theoretical calculation was performed by using the evaporation model code PEGASUS, which considered preequilibrium effects, and normalization was made by taking account of measurements or systematics.

b) Total, capture, elastic and inelastic scattering cross sections

These cross sections were obtained from the calculation using the statistical model code CASTHY. The threshold reaction cross sections calculated with PEGASUS were considered as the competing processes. The direct reaction was taken into account for the inelastic scattering.

c) Resolved resonance parameters

Recent measurements were taken into account as much as possible.

d) Unresolved resonance parameters

The parameters were searched for with the ASREP code so as to fit to the calculated or measured capture cross section.

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Table 1 Nuclides contained in the general purpose file

¹ H*	²⁸ Si*	⁴⁷ Ti	⁶⁴ Ni	Cd*	²⁰⁶ Pb*	²³³ U	²⁴⁴ Cm
² H	³⁰ Si*	⁴⁸ Ti	Cu*	Sb	²⁰⁷ Pb*	²³⁴ U	²⁴⁵ Cm
³ He	³¹ P	⁴⁹ Ti	⁶³ Cu*	¹²¹ Sb	²⁰⁸ Pb*	²³⁵ U*	²⁴⁶ Cm
⁴ He	S	⁵⁰ Ti	⁶⁵ Cu*	¹²³ Sb	²⁰⁹ Bi*	²³⁶ U	²⁴⁷ Cm
⁶ Li*	³² S	⁵¹ V	Zr*	Eu*	²²³ Ra	²³⁸ U*	²⁴⁸ Cm
⁷ Li*	³³ S	Cr*	⁹⁰ Zr	¹⁵¹ Eu	²²⁴ Ra	²³⁷ Np	²⁴⁹ Cm
⁹ Be*	³⁴ S	⁵⁰ Cr	⁹¹ Zr	¹⁵³ Eu	²²⁵ Ra	²³⁹ Np	²⁵⁰ Cm
¹⁰ B*	³⁶ S	⁵² Cr	⁹² Zr	Hf*	²²⁶ Ra	²³⁶ Pu	²⁴⁹ Bk
¹¹ B*	K	⁵³ Cr	⁹⁴ Zr	¹⁷⁴ Hf*	²²⁵ Ac	²³⁸ Pu	²⁵⁰ Bk
¹² C*	³⁹ K	⁵⁴ Cr	⁹⁶ Zr	¹⁷⁶ Hf*	²²⁶ Ac	²³⁹ Pu*	²⁴⁹ Cf
¹⁴ N*	⁴⁰ K	⁵⁵ Mn*	⁹³ Nb*	¹⁷⁷ Hf*	²²⁷ Ac	²⁴⁰ Pu	²⁵⁰ Cf
¹⁵ N*	⁴¹ K	Fe*	Mo*	¹⁷⁸ Hf*	²²⁷ Th	²⁴¹ Pu	²⁵¹ Cf
¹⁶ O*	Ca*	⁵⁴ Fe*	⁹² Mo	¹⁷⁹ Hf*	²²⁸ Th	²⁴² Pu	²⁵² Cf
¹⁹ F	⁴⁰ Ca*	⁵⁶ Fe*	⁹⁴ Mo	¹⁸⁰ Hf*	²²⁹ Th	²⁴¹ Am	²⁵⁴ Cf
²³ Na*	⁴² Ca	⁵⁷ Fe*	⁹⁵ Mo	¹⁸¹ Ta*	²³⁰ Th	^{242^a} Am	²⁵⁴ Es
Mg*	⁴³ Ca	⁵⁹ Fe*	⁹⁶ Mo	W*	²³² Th	^{242^m} Am	²⁵⁵ Es
²⁴ Mg	⁴⁴ Ca	⁵⁹ Co	⁹⁷ Mo	¹⁸² W	²³³ Th	²⁴³ Am	²⁵⁵ Fm
²⁵ Mg	⁴⁶ Ca	Ni*	⁹⁸ Mo	¹⁸³ W	²³⁴ Th	^{244^a} Am	
²⁶ Mg	⁴⁸ Ca	⁵⁸ Ni*	¹⁰⁰ Mo	¹⁸⁴ W	²³¹ Pa	^{244^m} Am	
²⁷ Al*	⁴⁵ Sc	⁶⁰ Ni*	Ag*	¹⁸⁶ W	²³² Pa	²⁴¹ Cm	
Si*	Ti*	⁶¹ Ni	¹⁰⁷ Ag*	Pb*	²³³ Pa	²⁴² Cm	
²⁸ Si*	⁴⁶ Ti	⁶² Ni	¹⁰⁹ Ag*	²⁰⁴ Pb*	²³² U	²⁴³ Cm	

*: Gamma-ray production data included.

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Version-3; JENDL-3 (continued)

Table 2 Nuclides contained in the fission product file

75As	89Sr	99Tc	106Cd	121Sb	131Xe	141Ce	151Sm
74Se	90Sr	96Ru	108Cd	123Sb	132Xe	142Ce	152Sm
76Se	89Y	98Ru	110Cd	124Sb	133Xe	144Ce	153Sm
77Se	91Y	99Ru	111Cd	125Sb	134Xe	141Pr	154Sm
78Se	90Zr	100Ru	112Cd	120Te	135Xe	143Pr	151Eu
79Se	91Zr	101Ru	113Cd	122Te	136Xe	142Nd	152Eu
80Se	92Zr	102Ru	114Cd	123Te	133Cs	143Nd	153Eu
82Se	93Zr	103Ru	116Cd	124Te	134Cs	144Nd	154Eu
79Br	94Zr	104Ru	113In	125Te	135Cs	145Nd	155Eu
81Br	95Zr	106Ru	115In	126Te	136Cs	146Nd	156Eu
78Kr	96Zr	103Rh	112Sn	127mTe	137Cs	147Nd	152Gd
80Kr	93Nb	105Rh	114Sn	128Te	130Ba	148Nd	154Gd
82Kr	94Nb	102Pd	115Sn	129mTe	132Ba	150Nd	155Gd
83Kr	95Nb	104Pd	116Sn	130Te	134Ba	147Pm	156Gd
84Kr	92Mo	105Pd	117Sn	127I	135Ba	148mPm	157Gd
85Kr	94Mo	106Pd	118Sn	129I	136Ba	148mPm	158Gd
86Kr	95Mo	107Pd	119Sn	131I	137Ba	149Pm	160Gd
85Rb	96Mo	108Pd	120Sn	124Xe	138Ba	144Sm	159Tb
87Rb	97Mo	110Pd	122Sn	126Xe	140Ba	147Sm	
86Sr	98Mo	107Ag	123Sn	128Xe	138La	148Sm	
87Sr	99Mo	109Ag	124Sn	129Xe	139La	149Sm	
88Sr	100Mo	110mAg	126Sn	130Xe	140Ce	150Sm	

APPENDIX 9

REPORT OF THE SUB-COMMITTEE ON STANDARDS to the 28th NEANDC Meeting

1. Attendance

The Standards Sub-committee matters were discussed in a plenary session on March 27, 1990.

2 Actions from the 27th Meeting

The Standards Sub-committee actions listed in Appendix 8 of the Summary Record of the 27th Meeting were reviewed, as follows:

- 1) Vonach distributed at the meeting a written report on "Double-differential Cross-section Measurements and Evaluation Work on Pb"
- 2) Fulfilled
- 3) A status report on $^{238}\text{U}(n,f)$ from prof Kanda was distributed at the meeting
- 4) Fulfilled
- 5) Evaluations on $^{27}\text{Al}(n,\alpha)$ and $^{93}\text{Nb}(n,2n)$ were published at the ANL Meeting on Activation Cross Sections and were sent to P Young
- 6) Fulfilled
- 7) Evaluations on $^{27}\text{Al}(n,\alpha)$, $^{93}\text{Nb}(n,2n)$ and $^{59}\text{Co}(n,2n)$ were distributed at the meeting
- 8) The result of the ^{238}U transmission measurement by J Harvey is not yet final. Data will be sent by Perey to Coceva (Action 1).
- 9) Action remain (Action 2)
- 10) Fulfilled. Poenitz will not be able to take over the review responsibility of the $^{197}\text{Au}(n,\gamma)$ cross-section from Corvi.
- 11) Fulfilled

Report of the Subcommittee on Standards to the 28th NEANDC Meeting (continued)

3. New measurements

Vonach reported about plans at IRK for new measurements of the $^{235}\text{U}(n,f)/^{27}\text{Al}(n,\alpha)$ cross-section ratio at 14 MeV. Discrepancies exist in the earlier ratio measurements.

Condé informed about new measurements reported to the INDC Standards Sub-committee by Blinov, Khlopin Radium Institute, Leningrad on the $^{238}\text{U}(n,f)$ cross-section at 5, 8.4 and 18.8 MeV and revised values of earlier measurements of the $^{235}\text{U}(n,f)$ cross-section at 2.56, 4.45, 8.46, 14.7 and 18.8 MeV by the time-correlated associated particle method. New measurements were also reported from the same institute on the capture cross-section on ^{197}Au in the energy range 160 keV - 1.4 MeV and on the $^{27}\text{Al}(n,\alpha)$ cross-sections with high energy resolution, ~ 50 keV, in the energy range 6-9 MeV.

4. Working Group on the $^{10}\text{B}(n,\alpha)$ cross-section standards

A report by A.D. Carlson, the Chairman of the NEANDC endorsed working group on the $^{10}\text{B}(n,\alpha)$ cross-section standards, was presented to the Committee in conjunction with the discussion of the High Priority List within the Sub-committee of Technical Activities.

An Inter-Laboratory working group has been formed at a meeting held at NIST on April 25, 1989 to provide a mechanism for improving the $^{10}\text{B}(n,\alpha)$ cross-sections.

Measurements have been completed by Weston (ORNL) on the ratio of the $^{10}\text{B}(n,\alpha_0)$ to the $^{10}\text{B}(n,\alpha_1\gamma)$ cross-sections up to one MeV neutron energy. The preliminary results disagree with the ENDF/B-VI evaluation from about 100 keV to 600 keV by as much as 20-25%.

Measurements are in progress in a NIST-ORNL collaboration of the $^{10}\text{B}(n,\alpha_1\gamma)$ cross-section above 100 keV. Furthermore, new measurements of the differential cross-sections for the $^{10}\text{B}(n,\alpha)^7\text{Li}$ reaction are planned at the WNR facility at LANL by Haight in the energy region from about 100 keV to many MeV.

Report of the Subcommittee on Standards to the 28th NEANDC Meeting (continued)

5. Standard Fission Foils

A B Smith informed the Committee of the situation concerning the control of standard reference fission foils. The matter was discussed at the 27th NEANDC Meeting and Smith had sent letters to IAEA/NDS expressing the NEANDC concern about the future availability of highly accurate ^{235}U standard fission foils for cross-section measurements.

J Schmidt replied that no further action had yet been taken by IAEA on the recommendation from INDC that IAEA/NDS should act as a post-box for fission foil exchange and CBMN would produce, store and assay the foils.

A B Smith accepted an action to draft a letter by 1 June 1990 and send it to the Chairman expressing the concern of NEANDC regarding the future availability of highly accurate ^{235}U standard fission foils for cross-section measurements (Action 3)

The Chairman would subsequently send the letter to NIST, PTB, CBMN, NPL, Electrotechnical Research Institute (Japan) and ICRM asking about the willingness of finding a solution to the problem (Action 4).

6. ENDF/B-VI Standards Data Evaluations

F Perey informed the Committee on the status of the ENDF/B-VI Standards Evaluations:

"The evaluation of the standard neutron cross-sections for ENDF/B-VI has been completed. These standards have been accepted for use in ENDF/B-VI by the Cross Section Evaluation Working Group (CSEWG). The uncertainties for these standard cross-sections obtained from the combination of the simultaneous and R-matrix evaluations are still being investigated. The rather small values of some of these uncertainties were a concern expressed in the phase I review of these standards. It should be noted that the uncertainties for the output from the simultaneous and R-matrix evaluations had been increased by the square root of chi squared per degree of freedom before these results were combined in order to take into account the spread of the experimental input values and thus produce more realistic uncertainties. This is a step in the right direction but the assumption is too simplistic. For example, for a cross-section, most of the contribution to chi squared may be from one small region in energy, but the chi squared per degree of freedom factor will be applied to all energies. A general method to properly handle this is very difficult. For the subset of the boron and lithium cross-sections it may be possible to solve this problem. An effort is now underway towards this end. It may be necessary to attach a statement to the standards cautioning the user that the uncertainties obtained from the evaluation process may be

Report of the Subcommittee on Standards to the 28th NEANDC Meeting (continued)

underestimated due to effects such as unrecognised correlations between data sets having high weight. It has been suggested that in addition to the uncertainties obtained from the evaluation process, the CSWEG standards sub-committee should provide another set of uncertainties, with generally more acceptable values which may have been obtained by a less rigorous process. Work is now underway to provide those uncertainties. The documentation of the standards evaluation process is nearly completed."

The Committee discussed the timing of the publication procedure of the INDC/NEANDC Standards File with the ENDF/B-VI standards evaluation effort. It was decided to continue the compilation and updating of the status reports while waiting for the release of the error file for the ENDF/B-VI.

7. INDC/NEANDC Standards Data File

The Committee screened the status and the review responsibilities of the File. The following comments were made:

H(n,n)H A status report by G Hale/P Young was distributed at the meeting

${}^6\text{Li}(n,\alpha)$ The status report by G Hale is delayed due to the problems with the error estimates of the ENDF/B-VI standards

C(n,n) An action was placed on Perey to ask C Y Fu to send comments on his revision of the C(n,n) standard evaluation to A B Smith (Action 5)

${}^{197}\text{Au}(n,\gamma)$ Cierjacks was asked to see if Kaeppler could replace Corvi as a reviewer for the ${}^{197}\text{Au}(n,\gamma)$ cross-section and report back to the S.C. Chairman (Action 6). The reviewer should be asked to include also the cross-section at thermal energy as a standard.

${}^{235}\text{U}$ fission fragment anisotropy K Böckhoff accepted an action to investigate if Hamsch could replace H Knitter as a reviewer for the ${}^{235}\text{U}$ fission fragment anisotropy and to report back to the S.C. Chairman (Action 7).

Actinides Half-lives J Schmidt informed that H Lemmel had replaced A Lorenz as the reviewer from IAEA.

Thermal parameters E Fort accepted an action to ask H Tellier to be a reviewer of the thermal parameters in parallel with H Lemmel/IAEA and report back to the S.C. Chairman (Action 8).

H Condé will compile the status reports and distribute them after some editing work to the reviewers for updating and comments (Action 9).

8. Future Meetings

Condé presented a proposal for a NEANDC Specialists Meeting on "Neutron Standard Cross-sections in the Energy Region above 20 MeV". The meeting would be held at Uppsala, Sweden, covering 2-3 days, in conjunction with the Nuclear Data Conference at Jülich, May 1991.

Schmidt informed that IAEA/NDS will convene an AGM meeting on Intermediate Energy Nuclear Data in conjunction with the INDC meeting in October 1990. The aim of this meeting is to review the needs and status of intermediate energy nuclear data in a broad frame. Schmidt expressed the opinion that a separate meeting on standards would be favourable in that enough time could be available to thoroughly discuss and establish the status and needs in this particular field. The Committee recommended to have the Intermediate Energy Neutron Standard Cross-section Meeting in Uppsala on May 21-23 1991.

A draft of the scope for the meeting prepared by Condé, Vonach and Young is attached to the S.C. report.

Report of the Subcommittee on Standards to the 28th NEANDC Meeting (continued)

STANDARDS S.C. ACTIONS

1. Perey Send the results of the ^{238}U transmission measurements by Harvey to Coceva
2. Condé Ask Boldeman to include information on the correlation between fission fragment direction and multiplicity in the review of the ^{252}Cf nubar.
3. Smith Draft a letter by 1 June 1990 and send it to the Chairman expressing the concern of the NEANDC regarding the future availability of highly accurate ^{235}U standard fission foils.
4. Qaim Send letter from Smith (Action 3) to NIST, PTB, CBMN, NPL, Electrotechnical Research Institute (Japan) and ICRM asking about the willingness of finding a solution to the problem of the availability of standard fission foils.
5. Perey Ask C Y Fu to send comments about his revision of the ENDF/B C(n,n) standard evaluation to Smith.
6. Cierjacks Enquire if Kaeppler could replace Corvi as reviewer for the $^{197}\text{Au}(n,\gamma)$ cross-section and report to the S.C. Chairman.
7. Böckhoff Enquire if Hamsch could replace Knitter as reviewer for the ^{235}U fission fragment anisotropy and report to the S.C. Chairman
8. Fort Enquire if Tellier could act as a reviewer for the thermal constants in parallel with Lemmel/IAEA and report to the S.C. Chairman.
9. Condé Compile the status reports and distribute to reviewers for updating.

APPENDIX 10

PROPOSED SCOPE FOR THE NEANDC SPECIALISTS MEETING ON NEUTRON CROSS SECTION STANDARDS FOR THE ENERGY REGION ABOVE 20 MeV

H Condé, H Vonach and P Young

SCOPE

Measurements are underway or planned at several laboratories within the NEA member countries of neutron cross-sections in the energy range above 20 MeV for both basic and applied research. The existence of accurate standard reference data is of utmost importance for the quality of the measured data.

The OECD/NEA Nuclear Data Committee (NEANDC) has approved to hold a specialists meeting to identify candidates for neutron standard cross-sections in the intermediate energy range to summarise the status of those data and to give recommendations for further work to improve the existing data base. An obvious choice of a primary standard is the neutron-proton differential scattering cross-section. The main emphasis will be put to a review of experimental and theoretical work done on this basic cross-section. One should also review the instruments used to apply the H(n,n) cross-section standard to actual neutron fluence measurements. Other candidates for cross-section standards will also be discussed in particular the ^{235}U and $^{238}\text{U}(n,f)$ cross-sections.

Proposed topics

1. Status of the data base for n-p scattering
2. Status of nucleon-nucleon phase-shift calculations.
3. Recent and planned experimental work and facilities.
4. Instruments for utilising the H(n,n) standard for neutron fluence measurements.
5. Proposals for other neutron cross-section standards.
6. Summary and recommendations for further work.

Participation

The meeting will gather 20-25 experts active in the field of relevant experimental and theoretical work in the intermediate energy range.

Cooperation will be explored with IAEA/NDS to allow invitation of experts from non-OECD member countries.

**Proposed Scope for the NEANDC Specialists' Meeting on Neutron Cross
Section Standards for the Energy Region above 20 MeV (continued)**

Time, place and local arrangements

The meeting will be held at the The Svedberg Laboratory (TSL), Uppsala on May 21-23, 1991.

Responsible for the organisation and local arrangements will be H Condé and N Olsson, Department of Neutron Research, Uppsala University, Box 535, S-751 21 Uppsala.

A first announcement will be sent out in June 1990.

Programme Committee

APPENDIX 11

Report of the Subcommittee on Data of Special Interest

The Sub-committee met on the morning of the 27th March 1990 and the following people attended:

K. H. Böckhoff	F. G. Perey
S. W. Cierjacks	C. Philis
C. Coceva	S. M. Qaim
H. Condé	J. J. Schmidt
R. A. Forrest	A. B. Smith
E. Fort	M. G. Sowerby (Chairman)
Y. Kikuchi	N. Tubbs
M. A. Lone	H. Vonach
M. C. Moxon	S. L. Whetstone
C. Nordborg	P. G. Young
N. Olsson	

- (A) The Sub-committee reviewed the actions listed in Appendix 7 of the Summary Record of the 27th Meeting (NEANDC-A-272) as follows:
- (1) Schmidt had improved documentation on the resonance analyses of U-235 and Pu-239 performed in the USSR and Eastern Europe but these were in Russian. In view of the much superior data available for the analyses in the USA for ENDF/B-VI and JEF-2 the value of this documentation was now considered to be small. The action was therefore dropped.
 - (2) Completed, a status report on delayed neutrons has been produced by Rudstam.
 - (3) Following the NEACRP meeting in Japan in October 1988. Igarasi had informed the Committee that there still exists a problem with β_{eff} which implies discrepancies in delayed neutron data.
 - (4) A status report on Li-7(n,n' α)t had not been produced by Qaim but a comprehensive review of the data has been published by Young (Fusion Technology 15 440 (1989)).
 - (5) A status report on Nb-93(n,n')Nb-93m had not been produced by Vonach but having recently completed an evaluation this could now be done if needed. The Sub-committee agreed with Vonach's recommendation that this item should now be dropped from the List of Data of Special Interest.
 - (6) Fort circulated to the Committee a paper ("Impact of Integral Information from SUPER PHENIX start-up experiments on the Evaluation of Pu-239" by E. Fort, J. C. Cabrillat and M. Salvatores) containing information on the Pu-239 fission cross-section arising from SUPER PHENIX. Action completed.
 - (7) Not completed. A status report on U-235 alpha in resonances has not been produced. Gwin, who was to make measurements with a BaF detector at Oak Ridge, has retired and at present there is nobody to do the work. A paper on U-235 resonance analysis will be presented by De Saussure at PHYSOR '90.

Report of the Subcommittee on Data of Special Interest (continued)

- (8) Completed. Igarasi has circulated a note on the neutron multiplication in Be to the Committee.
- (9) Completed. Sowerby has written to Patrick, Chairman of the INDC Discrepancy Sub-committee, explaining the views of the NEANDC on the value of the planned publication of the INDC/NEANDC Discrepancy and Data of Special Interest File as discussed at the 27th NEANDC meeting.
- (B) Sowerby described the present position on the publication of the INDC/NEANDC Discrepancy and Data of Special Interest File. Patrick had sent the available entries to the NDS in January 1990 requesting their views as to whether the publication should proceed as approximately half of the entries were missing. Schmidt said that they still wished to publish and it was agreed that status reports received by the IAEA before the 1st July could be included. The Sub-committee recommended that where no status reports were available reference to previous status reports might be appropriate. Sowerby agreed to cooperate with Patrick on the production of the document and inform him of the current views of the NEANDC.
- (C) The Sub-committee considered its future role. Many items on the List of Data of Special Interest are now considered by Working Groups and Task Forces organised by the NEANDC and it is not efficient for the Sub-committee to duplicate this work which will be reported regularly to the Committee. However, it was agreed that there was a continuing need for the NEANDC to consider data items which were not on the High Priority Request List but were either too inaccurate or unsatisfactory. It was agreed that these items would be considered in future by the Sub-committee on Technical Activities.
- (D) The Sub-committee reviewed the items on the present list of Data of Special Interest and the following additional comments were made.

Pu-239 Resonance Parameters

Using new fission cross-section and transmission data produced by Weston and Harvey respectively Derrien and de Saussure have produced at Oak Ridge a new set of resonance parameters between 300 eV and 2 keV.

U-235 Resonance Parameters

The work at Oak Ridge to produce these has been completed.

Nb-93(n,n')Nb-93m

The new comprehensive evaluation by Vonach will be published in Physics Data.

U-238 Capture Cross-section

There was some discussion as to whether or not the evaluation of this cross-section produced as a part of the ENDF/B-VI standards evaluation would be affected by "Peelle's Pertinent Puzzle". It was considered that the low values obtained were probably not in error because Fröhner's unresolved resonance region evaluation performed by a completely independent method is broadly in excellent agreement with it. It was noted that a new measurement by Moxon at Harwell was currently being analysed.

Report of the Subcommittee on Data of Special Interest (continued)

Cs-137 and Sr-90 Half Lives

It was noted that new measurements by Taylor had been made at Chalk River which were not considered in the present status reports on these items.

(E) Additional Items on the List of Data of Special Interest

Smith reported two problems which it was agreed should be added to the List.

- (i) The elastic scattering cross-section of U-238 in the energy range above 1 MeV. The data for this are sparse particularly above 3 MeV and some of the measurements are of 1960's vintage (e.g. Batchelor et al and Knitter et al) and are not of high accuracy. Data are needed to produce a good evaluation for U-238 cross-sections.
- (ii) There are no facilities available in the world to produce (n,2n) cross-sections for elements (or isotopes) by neutron counting. Examples where data are needed are:
 - (a) Zr(n,2n) for the element where there are currently only 2 measurements
 - and (b) Nb-93(n,2n) where there are 10 to 15% discrepancies.

(F) A current List of Topics on Data of Special Interest is given below.

List of Topics on Data of Special Interest at the end of the 28th Meeting of the NEANDC

Topic

U-235 resolved resonance parameters
Pu-239 resolved resonance parameters
U-235 alpha in resonances
B-10 He production
Li-6 He production at 14 MeV
Sr-90 and Cs-137 half lives
Cf-252 half life
U-238 elastic scattering >1 MeV
Lack of facilities for making (n,2n) measurements by neutron counting
Zr(n,2n)
Nb-93(n,2n)

M. G. Sowerby

APPENDIX 12

Report of the Subcommittee on Technical Activities

Participants: K.H. Böckhoff (Chairman), S. Cierjacks, C. Coceva, H. Condé, R. Forrest, E. Fort, Y. Kikuchi, A. Lone, M. Moxon, C. Nordborg, N. Olsson, F. Perey, C. Philis, S. Qaim, A.B. Smith, M. Sowerby, N. Tubbs, H. Vonach, S. Whetstone, P. Young

1. Actions from the previous meeting

All actions have been fulfilled or are nearly fulfilled. The Summary Record on Intense Neutron Sources (Action 4 - Cierjacks) has been distributed as an A-document. The U-distribution will follow after final corrections have been made.

2. Supply of stable isotopes

The Committee was informed about the impending jeopardy of the distribution of stable enriched isotopes. The program of enriching and distributing stable and some radioactive isotopes at ORNL has been combined and assigned to the Office of Nuclear Energy at DOE and put under the direction of Donald Erb, as of October 1, 1989 who had to write his DOE mission statement for the Isotope programme within 90 days after his assignment. This decision implies a new strategy of the USA which is entirely business oriented. It is to be expected that:

- a) The Research Material Collection Pool of stable isotopes will be combined with the normal Sales Pool into one collection available for sales or for loan. This means that material from the RMC can now be purchased.
- b) The stable isotopes can be borrowed from that common pool and the cost may be 1 per cent over the prime interest rate per year in the USA during the duration of that loan. That would at present mean a charge of about 10% of the assigned value of the isotopes.

The reason seems to be that the traditional 1 to 2 million \$ annual DOE research funding contribution to the isotopes program of ORNL has disappeared as a result of structural changes at DOE.

Report of the Subcommittee on Technical Activities (continued)

The Committee was much concerned about the possible consequences which the implementation of this new philosophy would have on the research programs within the NEA community. The Committee was informed by Whetstone that Mr. Erb has not much choice. He has to find revenues to cover the financial gap. The only chance for changing the new policy was seen in interventions at higher political levels in Washington. A number of actions were decided which are quoted below.

3. Intense neutron sources

The relevant report of Cierjacks has been distributed as an A-document together with an invitation to the members for final corrections. The report will be then distributed as a U-document.

4. Facilities, Techniques

The Committee noted with regret that Harwell, the NIST(NBS) and the JAERI linacs are not any longer used for a neutron data program. The last 6 sections of the Harwell linac have been mothballed and the NIST (NBS) linac is shut down. Also the Bologna linac based (γ, n)-facility (Coceva) has been closed down. At Uppsala a variable energy (50-200 MeV) cyclotron has been put into operation at which neutron beams are produced via the ${}^7\text{Li}(p, n)$ reaction. 4 ns pulses are available and there are plans for 1 ns pulses.

5. High Priority Lists

The Committee reviewed progress with the high priority requests on the base of the corresponding compilation assembled by Böckhoff. Apparently the overall experimental effort has decreased further, being still relatively high for structural materials data and for those of interest for fusion. New activities can be observed in the standards field, i.e. for the ${}^{10}\text{B}$ cross-sections.

The Committee discussed the problem of deleting requests which have been fulfilled. The proposal of Salvatores was endorsed to wait for the results of the evaluations which are underway and the benchmarking of these evaluations. The responsibility for the deletion of high priority requests should rest with the NEACRP.

Report of the Subcommittee on Technical Activities (continued)

Salvatores informed the Committee on the rising concern of many NEACRP members about differential data. New data needs are showing up in the data relevant fields: fuel cycle, reactor operation and safety. High accuracy data are needed to answer the requirements. The recently established new evaluation subgroups reflect the new priorities. About one year of evaluation work and one year of benchmark tests would be necessary before the new requirements could enter a revised high priority list.

Kikuchi informed the Committee on the Japanese OMEGA project which aims at developing innovative methods for nuclear waste incineration based on a high energy, high current proton accelerator or an actinide transmutation reactor. He presented a paper in which the nuclear data needs for the project are specified in detail. The Committee took with interest note of this challenging project and asked Kikuchi to report at the forthcoming meetings of NEANDC on its progress.

Subgroup actions

- 1) Böckhoff Explore the possibilities for a CEC intervention at the political levels of the Washington Administration to avoid an increase of the loan charges for the stable isotopes.
- 2) Qaim Explore the possibilities for a NEA intervention at the political levels of the Washington Administration to avoid an increase of the loan charges for the stable isotopes.
- 3) All Inform the appropriate authorities in the own country on the projected new US loan and sales policy for stable isotopes, aiming at an intervention to avoid an increase of the loan charges.
- 4) Böckhoff (Gruppelaar), Sowerby, Kikuchi, Young Obtain for Europe, the UK, Japan and the USA the respective contributions for a high priority list for fusion data measurements and evaluations before the next NEANDC meeting.

Report of the Subcommittee on Technical Activities (continued)

- 5) Cierjacks Distribute the finalised version of the report on intense neutron sources as a NEANDC U-document.
- 6) Kikuchi Monitor the progress of the OMEGA project and report hereon at the following NEANDC meetings.
- 7) To whom it may concern Send the still missing contributions to the report "Progress with High Priority Requests" to Böckhoff before June 1, 1990.

APPENDIX 13

Report of the Subcommittee on Monographs, 28th NEANDC Meeting

Report of the Subcommittee on

MONOGRAPHS

28th NEANDC Meeting, 3/26/90

I. Actions of Previous Meeting

All actions of the previous meeting were completed.

II. Publishing Arrangements

Formal contractual agreements between the NEA and ANS have been completed. The ANS will publish the monographs with fiscal support from the NEA. Costs to the purchaser will be about \$25.00 (U.S.) for volumes of approximately 200 pages. The publication rate will be approximately one volume per year, with the next three (volumes 4, 5, and 6) in active preparation. Copies of the formal NEA-ANS agreement are available to subcommittee (SC) members.

ACTION - 1: C. Nordborg. Provide SC members with copies of the NEA-ANS agreement.

It is not certain that all the present authors are fully aware of the publishing agreement. Therefore

ACTION - 2: SC Chairman. Informally notify all present authors and editors of the NEA-ANS agreement.

III. Status of the Three Volumes Now in Progress

The current status of the three endeavors was reviewed by the SC, as follows:

1. "Nuclear Data Uncertainties". Author-editor: D. L. Smith (Vol. 4 of the series).

This volume is a practical guide to uncertainties in nuclear-data applications and contains a strong tutorial element. Extensive examples of the various concepts are given.

The original draft was completed 12/89, including a total of 13 chapters. This first draft is now being transferred to a computer format consistent with ANS and NEANDC guidelines. Eight of the chapters have been converted to this new format and were available for inspection by the SC. The remaining five chapters should be transcribed to the publisher's format by 6/90. At that time, draft copies will be made available to selected technical reviewers, the SC, and the NEA (Tubbs). Various technical reviewers were suggested, and will be brought to the attention of the author who already has a list.

Report of the Subcommittee on Monographs, 28th NEANDC Meeting (continued)

It is hoped that technical and editorial review will be completed about 9/90, with camera-ready copy by late 1990. Such a schedule implies publication in early 1991. Throughout the work, there have been detailed discussions with ANS publication people so as to avoid undue publication delays.

2. "Practitioner's Guide to the Neutron Optical Model". Authors: Rapaport, Dietrich, Delaroche, and Smith. Editor: J. Rapaport. (Vol. 5 of the series)

The first draft of the text is about 2/3 complete, with the major remaining section having to do with applications. The first complete draft should be finished 9/90. Since there are four authors, some detailed compromises will be necessary. These should be complete by late 1990, with a final draft finished 2-3/91. This must include a major upgrading of numerous figures now in crude form. The goal is editorial and technical review by 3-6/91, with preparation of the final form thereafter. The SC suggested several technical reviewers. If the schedule can be adhered to, the volume should go to press late 1991 or early 1992.

ACTION - 3: A. Smith. Distribute optical-model index to SC members.

3. "Neutron-Induced Charged-Particle Emission". Authors: S. Qaim, S. Grimes, and R. Haight. Editor: S. Qaim (Vol. 6 of the series)

The authors of this volume started work in late 1989. Individual draft sections should be completed by late 1990. The respective outlines have been completed. It is hoped to have a rough draft of the entire volume by mid-1991. Reviews should be completed by the end of 1991 and a final manuscript ready for publication by 6-12/92.

IV. Discussion

The SC was satisfied with the above status that indicates that the next three volumes in the series will appear at approximately yearly intervals, starting in early 1991. Such a schedule appears manageable from the point of view of NEA budgeting. It is desirable that early drafts of each volume be provided to the NEA administration.

ACTION - 4: A. Smith. Ask D. Smith to provide the NEA (Tubbs) with a draft as early as possible.

The SC emphasizes the need for excellent quality, responsiveness to the applied and student market, and as low a selling price as possible. The arrangements with the publisher appear to be working well.

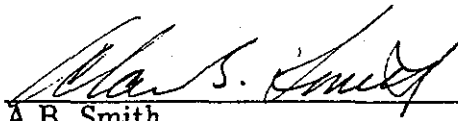
Continuation of the series will hinge on the success of the above three volumes. The trends cannot be assayed for several years, including a reasonable marketing period.

Report of the Subcommittee on Monographs, 28th NEANDC Meeting (continued)

Therefore, specific consideration of further volumes can easily await the next NEANDC meeting. Meanwhile, SC members should keep in mind possible new topics.

Participants:

C. Cierjacks
C. Nordborg
S. Qaim
A. Smith
N. Tubbs
H. Vonach



A.B. Smith
Acting Chairman

A. Michaudon
Chairman

APPENDIX 14

Report of the Subcommittee on Meetings

The meeting took place on Thursday, March 29, 1990. The following were in attendance:

C. Nordborg	N. Olsson	P. Young
J. Schmidt	Y. Kikuchi	S. Whetstone (Chairman)
H. Gruppelaar	M. Sowerby	
C. Coceva	F. Perey	

AGENDA:

1. Overview of Report of last meeting - Actions/Recent Specialists' Meetings
2. International Nuclear Data Conferences
3. Future Specialists' Meetings

1. Overview:

- All eight actions from the previous meeting were fulfilled.
- Both Specialists Meetings approved at the last NEANDC meeting were successfully held:
 - (1) "Nuclear Level Densities"
at Bologna (November 1989)
 - (2) "Neutron Activation Cross Sections for Fission and Fusion Energy Applications"
at ANL (September 1989)
- Three of the five Candidate Specialist Meetings have been folded into the Interlaboratory Working Groups:
 - (1) "Evaluation Procedures for the ENDF-6 Standards"
 - (2) " $^{10}\text{B}(n,\alpha)$ Standard Cross Section"
 - (3) "Thermal Values for the Actinides"
- The fourth candidate is proposed for approval at the present NEANDC meeting, to be held in 1991.
- The fifth candidate, "Neutron Induced Charged Particle Emission," will be considered at the next NEANDC meeting.

2. Next International Nuclear Data Conference:

- The next international nuclear data conference (Jülich, May 1991) was not discussed in the subcommittee since considerable time had been devoted to it during plenary sessions on Wednesday.
- It was noted that a proposal for the 1994 Conference (to be held in North America) has been received from ORNL. The subcommittee felt that it was premature to consider this later Conference at this time.

Report of the Subcommittee on Meetings (continued)

3. Future Specialists' Meetings: The following are proposed by the Subcommittee:

- (1) For 1991: "Neutron Cross Section Standards for the Energy Region Above 20 MeV,"

at the Svedberg Laboratory, Uppsala, Sweden, May 21-23, 1991.
A draft proposal was submitted by Condé, Vonach, and Young, which includes:

a definition of the Scope, Topics, Participation, and Local Arrangements. Suggested program committee and/or participant members include:

Arndt, Brady, Haight, Vonach, Cierjacks, Nakahara, Kocherov, Nordborg, Dietze, Condé. (This proposal had been discussed by the Committee previously in plenary session.)

- (2) For 1992: "Evaluation and Processing of Covariance Data."
at either ORNL or Vienna.

- Suggested program committee and/or participant members include: Nordborg (Secretariat), Gruppelaar, Perey, Muir, Peelle, Vonach, D. L. Smith, Kanda, Fröhner, Ponyaev.

- (3) For 1993: "Fission Product Cross Sections."
in Japan

- Suggested people: Nordborg (Secretariat), Kikuchi, Kawai, Nakagawa, Gruppelaar, Schenter, Salvatores, Vonach, A. B. Smith, E. Menapace, M. Lammel.

- (4) For 1994: "Gamma-Ray Production Calculations and Measurements."

- Is a follow-on to the meeting at Smolenice held in February 1990.
- see ACTIONS on next page !
- Suggested people: Nordborg (Secretariat), Mengoni, Maino, Obložinsky, Wender, Kocherov, D. Larson, Kitazawa, R. Nelson.

Report of the Subcommittee on Meetings (continued)

ACTIONS:

1. Condé Organise the Specialists' Meeting on "Neutron Cross Section Standards for Energy Region above 20 MeV" in Sweden in 1991.
2. Nordborg/
Vonach Explore the possibility of organising a Specialists' Meeting on "Evaluation and Processing of Covariance Data" at ORNL or Vienna in 1992.
3. Nordborg/
Kikuchi Explore the possibility of organising a Specialists' Meeting on "Fission Product Cross Sections" in Japan in 1993.
4. Coceva Carry out preliminary planning and prepare a proposal for a Specialists' Meeting on "Gamma Ray Production Calculations and Measurements". Present the proposal at the next Subcommittee meeting.

APPENDIX 15

Report on the Mandate and Future Subcommittee

ARGONNE NATIONAL LABORATORY

9700 SOUTH CASS AVENUE, ARGONNE, ILLINOIS 60439

April 9, 1990

To: NEANDC Members
From: A. B. Smith
Subject: Report on the Mandate and Future Subcommittee
Reference: Discussions at the 28th Meeting

The Subcommittee (SC) was asked to consider renewal of the Mandate of the Committee for the four-year period 1991-1995. These considerations involve three policy documents: 1) The "Terms of Reference", 2) The Committee "Mandate," and 3) The Chairman's summary of recent accomplishments and future plans. These are extensive concepts, consideration of which requires far more time than is available at a simple SC meeting. This report sets forth concepts and mechanisms for addressing issues 1) and 3), and explicitly addresses issue 2).

1) Terms of Reference

This is the formal policy statement under which the Committee operates, as approved by the Steering Committee. Its general character dates back several decades, and it appears to have been last updated in 1987. The latter modification seems to have been confined to the inclusion of manpower considerations, and there seems to be a motivation to maintain as stable a Terms of Reference policy as possible. However, the exact statement of the presently applicable Terms of Reference is not explicitly clear. Therefore,

ACTION: N. Tubbs. Provide SC members with an explicit copy of the presently effective Terms of Reference.

SC members are encouraged to suggest changes to the Chairman, and

ACTION: S. Qaim and A. Smith. The Terms of Reference will be carefully reviewed and modified if desirable. Changes will be reviewed by the SC members.

2) Mandate

The previous version (1985) has been revised by the SC to the form given in the attachment. It is believed to be appropriate for the respective 1991-1995 period.

3) Chairman's Summary and Future Plans

The past version (1987) clearly needs updating. This is a considerable problem, with results that must reflect accomplishment during the prior four years, and that outlines

Report on the Mandate and Future Subcommittee (continued)

a plan for the coming four years. All SC members are encouraged to provide input to the Chairman, and

ACTION: S. Qaim and A. Smith. Prepare a revised summary and plan using available input and their own judgment. Circulate the result to SC members for comment.

The above three steps should be completed by approximately July 1990. At that time,

ACTION: S. Qaim. Distribute revised Terms of Reference, Mandate, and Summary/Plan to Committee members. Allow 90 days for comment, then forward to the NEA.

Participants:

K. Böckhoff
S. Cierjacks
H. Condé
E. Fort
A. Lone
S. Qaim
A. Smith (SC Chairman)
N. Tubbs

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Attachment

Distribution: NEANDC Members

Report on the Mandate and Future Subcommittee (continued)

MANDATE

NUCLEAR ENERGY AGENCY NUCLEAR DATA COMMITTEE (NEANDC)

SCOPE

The NEANDC is concerned with nuclear data required for the success of nuclear-energy programs in OECD countries, and with data requisite to other applications of nuclear processes. The NEANDC may also consider other activities related to its primary concern, or that may benefit from its expertise.

NEANDC concerns shall include:

- **MEASUREMENTS:** These are pursued in special and dedicated laboratories, staffed by skilled specialists.
- **CALCULATIONS:** These employ nuclear theory and models, and are implemented with proven computational systems and techniques.
- **EVALUATIONS:** These comprehensive physical representations for the user community are based upon measured and/or calculated physical quantities. They are presented in recognized formats, and verified by integral experimental testing.
- **INFORMATION COMPILATION AND DISSEMINATION:** These functions ensure that measured, calculated, and evaluated data are properly stored, disseminated, and ultimately used. Concurrently, the information is retained for future applications that at present may not be known.

Essential to the success of the above is knowledge and expertise in the underlying physics and metrology fields.

METHODOLOGY

The NEANDC will:

- Assess nuclear data needs in close coordination with the user community (for example, as represented by the NEACRP).
- Establish, in consort with users, the priority of data needs, and identify particular data issues warranting special attention. The results of these considerations are formulated in a manner that will guide data activities in the individual laboratories of member countries.

Report on the Mandate and Future Subcommittee (continued)

- Monitor and encourage progress in meeting the above-established nuclear-data needs.
- Initiate and encourage international cooperation in the data field, particularly including interdisciplinary activities and effective interactions with the user community.
- Effectively interact with relevant technical groups, particularly with those associated with the NEA and IAEA.
- Establish task forces necessary to resolve specific and important data issues in a timely manner.
- Identify generic data problem areas, and establish, encourage, and guide working groups so as to focus interlaboratory efforts on the respective broad technical issues.
- Initiate special documentation (reports) relevant to specific technical issues, and initiate and guide publications (e.g., monographs and tests) addressing broader technical aspects of the data field.
- Encourage and organize technical meetings, extending from very specialized meetings addressing specific topics to more general meetings addressing the data field at large.
- Maintain cognizance of fundamental nuclear physics, and of nuclear standards and metrology as relevant to the nuclear-data field.

The NEANDC shall continually monitor nuclear-data activities in OECD countries with the objective of assuring a capability commensurate with the needs. These considerations shall include: (i) human resources, (ii) facilities (e.g., instrumentation, neutron sources, accelerators, etc.), (iii) data banks, and (iv) the relation of data technology to other areas of basic and applied science. The results of these considerations are communicated to the NEA-OECD in a timely manner.

APPENDIX 16

List of Papers distributed during the 28th NEANDC Meeting - March 1990

- NEANDC-180-A Progress with High Priority requests for fission and fusion data (including NEANDC-207-A). Status March 1990.
- NEANDC-275-U Decay Heat Calculation, An International Nuclear Code Comparison; B. Duchemin and C. Nordborg (DRAFT)
- NEANDC-276-A Prompt Report on the 31st NEACRP Meeting (Letter from S. Igarasi to A.B. Smith).
- NEANDC-277-A Report by S.S. Kapoor to the IAEA. (Conclusions and recommendations from the 17th INDC Meeting.)
- NEANDC-278-A National Nuclear Data Center's Progress Report. (Extract from the US DOE progress report)
- NEANDC-279-A NEA Data Bank Progress Report to the 28th Meeting of NEANDC.
- NEANDC-280-A Progress Report by the IAEA Nuclear Data Section to the 28th NEANDC Meeting.
- NEANDC-281-A Activities of the JAERI Nuclear Data Center and the Japanese Nuclear Data Committee (March 1990).
- NEANDC-282-A Nuclear Data Activities at the National Institute of Standards and Technology, Gaithersburg, USA.
- NEANDC-283-A Nuclear Data Activities in the Netherlands; H. Gruppelaar.
- NEANDC-284-A Status of Nuclear Data Measurements in Japan. Brief progress report.
- NEANDC-285-A Japanese Evaluated Nuclear Data Library, Version-3.
- NEANDC-286-A Status of the JEF-2 Library; M. Salvatores and C. Nordborg.
- NEANDC-287-A Report on the NEANDC Specialists' Meeting on Nuclear Level Densities, H. Vonach.
- NEANDC-288-A Nuclear Data Needs concerning the OMEGA Project; T. Nishida et.al.
- NEANDC-289-A The Future of the Neutron Data Centre Network; B.H. Patrick.
- NEANDC-290-A Comments on the EXFOR statistics in the paper by Patrick; H.D. Lemmel.
- NEANDC-291-A Letter from R.E. Chrien to S.L. Whetstone concerning the status of the worldwide A-chain evaluation activity.
- NEANDC-292-A Letter from D.L. Smith to S.M. Qaim describing the status of NEANDC Working Group on Activation Cross Sections.

List of Papers distributed during the 28th NEANDC Meeting - March 1990 (continued)

Research Papers:

1. Impact of Integral Information from Super Phenix Start-up Experiments on the Evaluation of Pu-239; E. Fort, J.C. Cabrillat, M. Salvatores.
2. Information on Double-Differential Cross-Section Measurements and Evaluation work on Pb; H. Vonach.
3. The Reaction Co-59(n,2n)Co-58; M. Wagner et.al.
4. Status Report on the Reaction Nb-93(n,2n)Nb-93m; M. Wagner et.al.
5. The Reaction Al-27(n,alpha)Na-24; M. Wagner et.al.
6. The U-238(n,f) Cross-Section; Y. Kanda.
7. H(n,n)H; G,M Hale and P.G. Young.
8. First- and second-chance proton emission in the interactions of fast neutrons with Mo-92; S.M. Qaim et.al.
9. Excitation Functions of (n,p) and (n,alpha) Reactions on Molybdenum Isotopes; H. Liskien et.al.
10. Activation Cross Sections of Neutron Threshold Reactions on Some Zirconium Isotopes in the 5.4 to 10.6 MeV Energy Range; M. Ibn Majah and S.M. Qaim.

