CSEWG & USNDP 2003

Summary of the
53rd Cross Section Evaluation Working Group Meeting

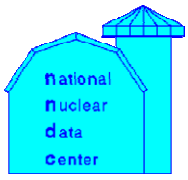
&

Minutes of the
U.S. Nuclear Data Program Meeting

with the Summary of Common Session on

Nuclear Data for Homeland Security

Held at
Brookhaven National Laboratory
Upton, NY 11973
November 4 - 7, 2003



Edited by: Pavel Oblozinsky
National Nuclear Data Center

BROOKHAVEN
NATIONAL LABORATORY

CSEWG & USNDP
2003

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Common Session CSEWG-USNDP

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Note

The present document along with many presentations and reports given at both the CSEWG and USNDP meetings can be found at

www.nndc.bnl.gov/nndc/proceedings/2003csewgusndp

Summary of the 53rd Cross Section Evaluation Working Group Meeting

Held at
National Nuclear Data Center, Brookhaven National Laboratory
November 4 - 6, 2003

Cross Section Evaluation Working Group

Chairman's Highlights

P. Oblozinsky
National Nuclear Data Center, BNL

The 53rd meeting of the Cross Section Evaluation Working Group was held at Brookhaven National Laboratory, November 4-6, 2003. A total of 43 participants attended the meeting. This included 39 individuals from 13 U.S. organizations and 5 foreign participants, from JAERI (Japan), NRG Petten (Netherlands), AEC Chalk River (Canada), IAEA Nuclear Data Section (Vienna) and University of Brussels (Belgium).

A central topic of the Agenda was development of a new version of the ENDF/B library, ENDF/B-VII.

The meeting was organized adjacent to the US Nuclear Data Program annual meeting, with a common session on nuclear data for homeland security, and on nuclear reaction modeling and astrophysics.

ENDF Manager

Mike Herman (NNDC) has become a new ENDF manager, he has replaced Vicki McLane (NNDC) in March 2003. CSEWG expressed appreciation to Vicki for her past work in managing the ENDF/B library.

Measurements and Basic Physics

Experimental reports were presented from 4 laboratories closely associated with the CSEWG (ANL, NIST, RPI, and LANL), along with an informal report from ORNL. It was noted that there exists a broad range of experimental assets available in the U.S. that could contribute to the area of applied nuclear data development if called upon to do so.

There were presentations on special topics of interest to CSEWG: progress on measurements for neutron standards; the use of fusion neutrons for transmutation of spent fuel; a demonstration of the origins of the lognormal probability function; a website for U.S. experimental resources for nuclear physics studies.

Formats and Processing

Proposals for new and revised ENDF-6 formats were discussed. Compact covariance matrix format proposed by N. Larson was approved as an interim ENDF/B-VII format, with full acceptance postponed until demonstration how the massive amounts of data can be actually used. Expanded Reich-Moore format proposed by N. Larson was also approved as an interim ENDF/B-VII format.

Out of 6 proposals submitted by international community, 3 were approved and 2 were accepted as corrections to ENDF manual. It was noted that all proposals were duly prepared and submitted on time.

Evaluation & Data Validation: ENDF/B-VII

Reaction Evaluation Committee and Data Evaluation Committee held a common session, focusing solely on ENDF/B-VII.

Preliminary ENDF/B-VII Web page was created by BNL with easy access to files, results of checking codes and numerous comparison plots.

Reviewed was number of evaluations, often including results of data testing. This work was largely driven by impressive effort of Los Alamos. Special attention was given to actinides, in particular 235-U and 238-U, along with a number of minor actinides. Furthermore, discussed were fission products, evaluations for criticality safety, light nuclei reactions with charged particles, and photonuclear data.

Specific attention was given to new cross section standards. The IAEA Coordinated Research Project on Cross Sections Standards should hold its last meeting in October 2004. Thus, new standards should be available, in a preliminary form, before next CSEWG meeting

Overall, significant progress has been achieved in the development of ENDF/B-VII library. The project is on schedule and the library should be released in 2005 as originally planned. Two more CSEWG meetings are needed to achieve this goal, allowing time for more work on validation, standards and fission products. The timetable is as follows:

- Review and validation, November 2004
- Final review, November 2005
- Release, December 2005

E-mail discussion list for CSEWG should be created, similar to highly successful 238-U evaluation (ueval) list run by WPEC. This would facilitate exchange of information and speed up validation work.

Nuclear Data for Homeland Security

The Task Force is in place, it includes nuclear data representatives from 4 national laboratories (LANL, LLNL, BNL and ANL), along with representatives from the homeland security community (LLNL, LANL). Chair of the Task Force is Dennis McNabb, LLNL and co-chair is Mark Chadwick, LANL.

The Committee noted with satisfaction that the first session of this new TF was held as a part of CSEWG and USNDP annual meetings.

Next Meeting

The next CSEWG meeting will be held at BNL on November 2-4, 2004 (Tuesday – Thursday). The format of the meeting will follow the 2003 pattern, it will be held adjacent to the USNDP meeting. The USNDP meeting will be held on November 4-5, 2004.

Cross Section Evaluation Working Group

Agenda

Nov 4, 2003 (Tuesday), Berkner B

08:30-08:45 **Opening,** P. Oblozinsky

08:45-12:00 **Formats and Processing (M. Greene, chair)**
(Parallel session, Berkner B)

- Format Proposals for ENDF/B-VII
  - Compact covariance matrix format, 30', Larson
  - R-matrix format, 20', Larson
  - WPEC format proposals, 60', Trkov
    - Energy-dependent decay constants
    - Increase limits on parameters
    - Expand options of the LCT flag
    - Clarify convention for NLIB parameters
    - Citation instructions
    - New format for unresolved resonance representation
- Processing Codes
  - LANL code NJOY, 15', MacFarlane
  - ORNL code AMPEX, 15', Greene
  - LLNL code, 10', McNabb
  - ANL code, 10', McKnight

08:45-11:45 **Measurement and Basic Physics (D. Smith, chair)**
(Parallel session, Berkner C)

- Laboratory experimental reports
  - ANL activities, 10', Kondev
  - NIST activities, 10', Carlson
  - RPI activities, 10', Danon
  - LANL activities, 10', Haight
  - Other lab reports
- Other activities
  - Progress on measurements for standards, 20', Carlson
  - Fusion neutron transmutation of spent fuel, 10', Cheng
  - On lognormal distribution of experimental data, 20', D.Smith
  - Website for US experimental resources in nuclear physics, 5', D.Smith

11:50-12:40 **Meetings and Conferences (D. Smith, chair)**
(Plenary session, Berkner B)

- Announcement of ND-2004 in Santa Fe, 5', Chadwick/Haight
- Report on WPEC-2003 in Coronado, 10', Oblozinsky/D.Smith

- Report on High Priority Request List meeting in Paris, 10', D.Smith
- Report on Transmutation Workshop in Darmstadt, 10', Cheng & Kawano

13:00-14:00 **Working Lunch of the CSEWG Executive Committee, Berkner A**

14:00-17:30 **Reaction Evaluation & Data Validation – ENDF/B-VII**
(Combined session of 2 committees, M. Chadwick, chair)

- General
  - Status report from ENDF manager, 15', Herman
  - Neutron cross section standards, 30', Carlson
  - Overview of data testing, 30', McKnight/Mosteller/Little
- Review of specific evaluations
  - Major actinides, Chadwick and Leal/Courcelle/Kahler
    - 235U, 238U

Nov 5, 2003 (Wednesday), Berkner B

08:30-12:30 **Reaction Evaluation & Data Validation – ENDF/B-VII ctn'd**
(Combined session of 2 committees, R. McKnight, chair)

- Review of specific evaluations ctn'd
  - Minor actinides
    - ^{233}U, Chadwick, Leal
    - $^{232, 234, 236, 237, 239, 240, 241}$U, Chadwick
    - $^{239, 240, 241}$Pu, Chadwick and Leal
  - Minor actinides ctn'd Chadwick
    - ^{241}Am, ^{237}Np
    - Future work on other Am, Pu and Cm isotopes
  - Fission products, Oblozinsky
    - 19 fission products by KAERI-BNL
    - Other fission products
  - New BNL-325 evaluations, Mughabghab

13:00-14:00 **Working Lunch of WPEC Subgroup A (Modlib Library), Berkner A**

14:000-17:30 **Reaction Evaluation & Data Validation – ENDF/B-VII ctn'd**
(Combined session of 2 committees, Chadwick, chair)

- Review of specific evaluations ctn'd
  - Evaluations for criticality safety
    - Cl, F and Gd isotopes, Leal
  - Other important evaluations
    - ^{16}O, ^{1}H
  - Evaluations for accelerator driven systems
    - New Pb,Si evaluations

        - New high-energy 150 MeV evaluations, Chadwick
        - European work on Pb and Bi, Koning
    - Light nuclei with charged particles, Hale/Chadwick
    - 160 photonuclear evaluations, MacFarlane
        - Photonuclear data testing, White (LANL)
        - Comments on photonuclear data testing, Brown (LLNL)
- ENDF/B-VII planning

Nov 6, 2003 (Thursday), Berkner B

08:30-08:45 **Opening of US Nuclear Data Program Meeting**, P. Oblozinsky

08:45-11:30 **Nuclear Data for Homeland Security (D.McNabb/M.Chadwick, chair)** (Common session of CSEWG Evaluation Committee & USNDP Reaction WG)

- External input
    - Comments from Dept of Homeland Security, 15', Sonya Bowyer
    - Nuclear data needs: LANL perspective, 15', Bill Johnson
    - Nuclear data needs: LLNL perspective, 15', Ken Sale

- Current nuclear data activities relevant to homeland security, 5' each
    - ^{237}Np data to asses non-proliferation threat, MacFarlane (LANL)
    - Nuclear data for DTRA, McKnight (ANL)
    - Americium data for post-event attribution, Chadwick (LANL)
    - Nuclear work for attribution, McNabb (LLNL)
    - F(alpha, gamma) data for nuclear interrogation, D.Smith (ANL)
    - Nuclear materials detection and photo-fission delayed neutrons, Little (LANL)
    - Nuclear structure and decay data for homeland security, Tuli (BNL)
    - Signature of fissile materials: High-energy gamma-rays following fission, Norman (LBNL)
    - Photo-resonance data for explosives detection, Oblozinsky (BNL)
    - Gamma production data for Ge detector simulations, Herman (BNL)

- Discussion

- Update to community on Task force on Nuclear Data for Homeland Security, 10', P. Oblozinsky

11:30-12:30 **Reaction Modeling and Astrophysics (M. Chadwick, chair)** (Common session of CSEWG Evaluation Committee & USNDP Reaction WG, Berkner B)

- Nuclear reaction model code development
  - TUNL code PRECO, 10', Kalbach
  - BNL code EMPIRE, 10', Herman
  - LANL code McGNASH, 10', Talou
  - European code TALYS, 10', Koning (Petten)

- Nuclear astrophysics
  - USNDP Astrophysics Task Force report, 15' M. Smith
  - Evaluation & modeling for astrophysics, 15', Demetriou (Brussels)

(Plenary session, Berkner B)

- Next meeting
- Other business

13:00 **Adjournment**

Cross Section Evaluation Working Group

List of Attendees

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Cross Section Evaluation Working Group

Executive Committee Summary

Pavel Oblozinsky, Chair
National Nuclear Data Center, BNL

The CSEWG Executive Committee met during lunch on November 4, 2003. Nine out of its 10 members attended the meeting. This included the CSEWG chair (P. Oblozinsky) and four CSEWG committee chairs (M. Chadwick, M. Greene, R. McKnight, D. Smith), along with A. Carlson, E. Cheng, L. Leal and D. McNabb, while R. Block did not attend.

Release of ENDF/B-VII

It was noted that initial ENDF/B-VI release had numerous problems, mostly related to processing and caused by limited testing. This should be avoided in ENDF/B-VII by performing consistent phase 1 review (checking and plotting), followed by phase 2 review (processing and validation). To speed up the process, LANL intends to organize a meeting for data testers in the middle of 2004 at Los Alamos.

Relation between new Standards and ENDF/B-VII evaluations poses another challenge due to the fact that in practice it is impossible to achieve their full consistency. One solution would be to separate Standards from ENDF/B-VII by adopting them as Standards 2006. Every effort should be made to make Standards as close as possible to ENDF/B-VII, though accepting the fact that there will be some differences. It was noted that the last meeting of Standards CRP should be held in October 2004, allowing review of the situation at the CSEWG Meeting in November 2004.

It was agreed that two more CSEWG meetings should be held (November 2004 and November 2005) before release of ENDF/B-VII in December 2005.

Task Force on Nuclear Data for Homeland Security

The Task Force is in place. It includes nuclear data representatives from several national laboratories (LANL, LLNL, BNL, ANL and LBNL) along with representatives from the homeland security community (LLNL, LANL). The Committee noted with satisfaction that the first session of this new TF is held as a part of CSEWG and USNDP annual meetings.

ND-2004 Conference in Santa Fe

Suggestions for invited talks were discussed. P. Oblozinsky should cover status of ENDF/B library, V. Pronyaev, IAEA Vienna was endorsed as a speaker for standards. Other important areas for CSEWG are WPEC activities, criticality safety and covariances.

WPEC Membership

Next annual meeting of the NEA Working Party on International Evaluation Cooperation will be held on May 26-28, 2004 in Aix en Provence, France. It will be preceded by the Modlib Workshop on May 25, 2004.

Pavel Oblozinsky has become new WPEC chair, for 2 years, replacing Akira Hasegawa, JAERI who stepped down. This makes it possible to put one additional member into US delegation for the next meeting. Thus, in addition to P. Oblozinsky (head), R. McKnight, M. Greene and Don Smith, the meeting should be attended by L. Leal. It is understood that other US members will attend in their capacities as Subgroups chairs, namely M. Chadwick (Subgroup A - modeling), A. Carlson (Standards) and T. Kawano (SG 20 – covariances).

US membership of newly created Subgroup C on High Priority Request List was discussed. It should include Don Smith, Dick McKnight and Luiz Leal.

Next Meeting

Next CSWEG annual meeting will be held on November 2-4, 2004 (Tuesday-Thursday) at BNL. The format of the meeting will follow the 2003 format, it will be held adjacent to USNDP Meeting. The USNDP Meeting will be held on November 4-5, 2004 (Thursday-Friday) at BNL.

Cross Section Evaluation Working Group

Measurement and Basic Physics Committee Report

Donald L. Smith, ANL
Committee Chairman

Executive Summary

Due to the requirements imposed by combined CSEWG and USNDP meetings during the week of 4-7 November 2003, the Measurement and Basic Physics Committee met in a separate session held on the morning of 4 November, parallel to the meeting of the Formats and Processing Committee, rather than in the usual plenary session of the past several years. In spite of this, the session was well attended, not only by presenters but also by observers.

During the session there were formal experimental reports presented from four laboratories that traditionally have been closely associated with the CSEWG community (ANL, NIST, RPI, and LANL) by representatives from these laboratories. Furthermore, a representative from ORNL who was in attendance at the session gave an informal report on relevant experimental work being done at that laboratory. The Chairman presented a special report on capabilities and facilities that are available at three other laboratories that normally are not involved with CSEWG. The objective of this presentation was to acquaint CSEWG with the fact that there exists a broad range of experimental assets available in the U.S. that could contribute to the area of applied nuclear data development if called upon to do so. In addition to these laboratory reports, there were four presentations on special topics of particular interest to CSEWG: progress on measurements for neutron standards; the use of fusion neutrons for transmutation of spent fuel; a demonstration of the origins of the lognormal probability function; a website for U.S. experimental resources for nuclear physics studies.

Laboratory Experimental Reports

Representatives from four laboratories (ANL, NIST, RPI, and LANL) presented formal reports on experimental work performed during the past year at their facilities. These presentations can be obtained from the NNDC either in Powerpoint or PDF format. In addition, a representative from ORNL who attended the session gave an informal report on work carried out at ORNL.

ANL

F. Kondev (ANL) presented the report on experimental activities and related projects at ANL. The emphasis was on measurements carried out at the ATLAS facility with particular attention to the issue of nuclear isomers that offer the potential for energy

conversion and storage for a variety of applications. Mention was also made of an ongoing collaboration with IRMM (Belgium) in the area of neutron activation experiments and nuclear-model parameter validation.

NIST

A. Carlson (NIST) presented the report on experimental activities at NIST. This report emphasized the work at NIST on measurements at very low neutron energies using cryogenic techniques, on measurements for H(n,n) at 15 MeV in collaboration with LANL and Ohio University, and on Fe spherical shell transmission studies performed at Ohio University.

RPI

D. Yanon (RPI) reported on the experimental program at RPI. The progress made during the past year in neutron transmission and capture measurements and data analysis for several isotopes at the RPI linac facility was described. The on-going program of maintenance and modernization of the RPI facility was reviewed. This included work on development of a new reaction fragment mass-analysis facility for angular distribution and total energy measurements.

LANL

R. Haight (LANL) reported on the extensive and varied experimental work at LANSCE. These experiments utilize a number of unique facilities for neutron and gamma-ray measurements (GEANIE, FIGARO, DANCE, N-Z Spectrometer, and Lead Slowing Down Spectrometer). The emphasis is on determining values for difficult neutron cross sections by measurement of partial cross sections coupled with the application of nuclear theory, particularly for actinides and other heavy nuclear isotopes. Measurements of (n,Z) cross sections have been carried out for various structural materials (Fe, Ni, Cr, etc.) using the LANL N-Z Spectrometer. A number of unique measurements have been made of (n,gamma) reactions on small samples (some radioactive) at the DANCE facility. Spallation target yields have been measured at several hundred MeV for several materials of interest for applications. Finally, the Lead Slowing Down Spectrometer was used in conjunction with ultra-small samples of actinide materials to measure fission cross sections for several isotopes.

ORNL

R. Westfall (ORNL) offered an overview of the status of the experimental program in applied nuclear data at ORNL. This work is being carried out primarily at the ORELA linac facility. Roughly 80% of the work at ORELA is performed in support of nuclear energy applications, largely directed toward criticality safety issues. The remaining experiments are related primarily to issues associated with nuclear astrophysics.

ATLAS (ANL), Notre Dame, and U. Kentucky Facilities

D. Smith (ANL) described the resources available at three laboratories that normally are not involved with CSEWG-related experimental activities. ATLAS (ANL) is a heavy ion facility involved primarily in complex nuclear reaction studies far from the line of stability. The capabilities of this laboratory in the area of accelerator mass spectrometry (AMS) and the potential value to CSEWG were stressed in this report. Notre Dame has three accelerators that currently are being used primarily for heavy –ion and nuclear astrophysics studies. Finally, the facilities available for nuclear measurements at U. Kentucky (Lexington) were described. The emphasis at this laboratory is in the area of gamma-ray production from neutron- and charged-particle-induced reactions.

Special Reports

Four special reports on topics of interest to CSEWG were presented at this session. These presentations can be obtained from the NNDC in either Powerpoint or PDF format.

Experimental Data for International Standards Evaluation

A. Carlson (NIST) presented a detailed review of the current status of nuclear data for the international standards evaluation project that is being carried out under the auspices of an IAEA CRP. New data are being considered for this project, but there is the question of when a moratorium should be imposed on consideration of new results in order to finalize the project. In addition, concerns over data discrepancies and data evaluation procedures are occupying the attention of participants in this project. It is hoped that this work will be finalized within the next two years if the major problems and issues can be resolved.

Fusion Neutron Transmutation of Spent Fuel

E. Cheng (TSI Research) presented a report on a study he conducted on the use of fusion neutrons to transmute nuclear waste. Monte Carlo calculations were performed with MCNP-4B using a simple 1-D blanket model of such a system that involves dissolving nuclear waste in molten salt (FLIBE). It is demonstrated that major actinide destruction occurs via fission reactions in Pu-239 and Pu-241. This approach offers an alternative to the more widely considered transmuting systems involving accelerator-driven sub-critical assemblies and more conventional reactor systems.

A Demonstration of the Lognormal Distribution

D. Smith (ANL) presented a demonstration of the origins of the lognormal probability distribution by using Monte Carlo simulation within the context of a simple model of measurement. All analysis was done in an EXCEL spreadsheet algorithm. It was found that even for rather large assumed experimental perturbations the empirical outcome probability distributions could be very well represented by lognormal functions. This

probability distribution is particularly useful in dealing with situations involving large uncertainties.

Website for U.S. Experimental Resources in Nuclear Physics

D. Smith (ANL) informed CSEWG that a website exists at Argonne, www.td.anl.gov/nrs/ that compiles links to a number of other websites in the U.S. that provide information on facilities and programs where nuclear data research can be or could be carried out, assuming that adequate funding and motivation were provided. The content of this site was recently revised: The URL for two links were corrected and twelve new links were added.

Cross Section Evaluation Working Group

Meetings and Conferences

Donald L. Smith, ANL
Chairman of Measurements and Basic Physics Committee

Executive Summary

Four summary reports were presented for meetings held during the past year that are of interest to the CSEWG community. A short report was offered on progress made in organizing an international conference to be held in Santa Fe, NM, September 26-October 1, 2004.

Announcement of ND-2004 in Santa Fe

M. Chadwick (LANL) and R. Haight (LANL) described progress at LANL in preparing for this major international conference to be held in Santa Fe, NM, September 26-October 1, 2004, which LANL will host. Both the Advisory Committee and Program Committee members have been appointed. A meeting website has been established and a procedure for submitting abstract via the Internet is in place.

Abstracts for contributed papers are due by December 15, 2003. Suggestions for invited speakers have been solicited. It was emphasized by the organizers that strong consideration will be given to selecting younger scientists as well as established investigators to present invited papers.

Workshop on Nuclear Data Needs for Generation IV Systems

P. Oblozinsky (BNL) reported on a workshop on data needs for Generation IV systems that was organized by T. Taiwo (ANL), chaired by H. Khalil (ANL), and hosted by P. Oblozinsky (BNL) at Brookhaven National Laboratory. The agenda addressed the following issues: data needs; processing, applications, and data validation; theory and data evaluation; nuclear data measurements. This meeting confirmed the important role of CSEWG in developing, validating, and making available reliable data for Generation IV applications.

A strong emphasis on the requirement for data uncertainties to be used in sensitivity analyses was expressed. The growing importance of nuclear data for transuranic elements in designs that will accommodate high burn-up operation will require reevaluation of these data for many of the materials. The consideration of systems involving fast-neutron spectra will lead to a need for new data for minor actinides. The importance of measurements in providing data to validate evaluations based on modeling was stressed. This suggests that renewed emphasis should be placed on maintaining US experimental capabilities. The growing need for covariance information for use in sensitivity studies

imposes a requirement for developing the evaluation tools needed to provide this information. In conjunction, it will be necessary for the existing processing codes to produce covariance information in a multi-group format that can be accommodated in the codes used by reactor designers. Valuable integral data that can be used in validating evaluated data of importance for Generation IV systems needs to be identified.

Finally, it was concluded that future workshops in this field would be valuable to the community, that a Generation IV Nuclear Data Advisory Group should be organized along the lines of the NDAG for DOE-NNSA, and that DOE-NE should provide stronger support for the Generation IV related activities of CSEWG.

WPEC Meeting

The annual WPEC meeting was held in Coronado (San Diego), California, on May 12-15, 2003, with D. Smith (ANL) and E. Cheng (TSI Research) acting as co-hosts. The first day was devoted to a meeting of Subgroup A (Nuclear Model Codes). The nuclear modelers who attended this meeting devoted their attention mainly to the issues of communication, standardization, and procedures for implementing the concept of a modular code library (ModLib).

The main WPEC meeting took place on May 13-14. There were reports from each of the data projects in both the measurement and evaluation areas. Considerable time was devoted to progress (or final) reports from the leaders of the short-term subgroups that had been organized previously to address a variety of technical issues. These included neutron standards (SG7), fission neutron spectra (SG9), Neutron activation (SG19), covariance information (SG20), neutron data for bulk fission products (SG21), and data for improved HEU-LWR reactivity predictions (SG22). A follow-up activity for SG21 to produce new fission-product evaluated files and to validate a subset of these was discussed. The possibility of encouraging a study of optimal methods for combining integral and differential data was mentioned but no formal conclusions were reached.

A. Hasegawa (JAERI, Japan) was appointed as the new chairman for WPEC for the next two years (in rotation). However, subsequent to the May meeting a change of his responsibilities at JAERI led to his stepping down and necessitated finding an alternative chairman. P. Oblozinsky agreed to accept this responsibility under these unanticipated circumstances. The final day of the meeting, on May 15, was devoted to technical tours. This included a visit to a US Navy ship and a tour of the fusion research facilities at General Atomics Corporation in La Jolla (near San Diego) as well as technical discussions with researchers at that facility.

High Priority Request List Meeting

A meeting was held at the OECD-NEA headquarters in Paris on October 9-10, 2003 in order to discuss methods to improve the quality and utility of the High Priority Request List for Nuclear Data (HPRL) that is maintained by the NEA Data Bank. Seven invited scientists plus a representative of the NEA attended this meeting. Four of the scientists

invited to this meeting also attended the present CSEWG meeting: D. Smith (ANL), R. McKnight (ANL), and A. Koning (NRG-Petten, Netherlands), and T. Fukahori (JAERI-Tokai, Japan).

The major conclusions reached by this ad hoc group were: the existing list is too long; two separate lists should be established (one for general requests and one for very high priority requests); the criteria for inclusion and retention of requests need to be elevated, especially those for high priority requests; Subgroup C of WPEC should be enlarged to include two representatives from each data project and this body should bear responsibility for the content of the lists; the NEA will continue to maintain the list infrastructure and would rely heavily on the Internet for posting the requests and receiving feedback from the data user and producer communities; solid justification and specification of impact, based on quantitative studies such as sensitivity analysis, would be required in order to consider a request as "high priority." The ad hoc group decided that transformation from the present system to the newly proposed system would take place prior to the next WPEC meeting in May 2004.

Workshop on Nuclear Data for the Transmutation of Nuclear Waste

A meeting was held at GSI-Darmstat, Germany, on September 1-5, 2003, dealing with the issue of nuclear data for the transmutation of nuclear waste. Three scientists who attended that meeting were also present at this CSEWG meeting: E. Cheng (TSI Research), A. Koning (NRG-Petten, Netherlands), and T. Kawano (LANL). Each of these scientists reported on their impressions of the Darmstadt meeting. Cheng and Kawano addressed the papers and discussions that dealt with the lower energy region (generally $E_n < 20$ MeV) while Koning discussed the higher energy region. It was agreed that this was a very successful meeting. It provided the opportunity for presentation of new results from facilities such as the CERN n-TOF that had not been reported previously. It was also a valuable forum for discussions that led to identifying areas where serious data deficiencies still exist.

Cross Section Evaluation Working Group

Evaluation Committee Report

and

Data Validation Committee Report

Mark Chadwick, LANL
Chairman of Evaluation Committee

***Note**: The Evaluation Committee Session (chairman M. Chadwick, LANL) was combined with Data Validation Committee Session (chairman R. McKnight, ANL), focusing on ENDF/B-VII. Thus, the present report covers both evaluation and validation activities.*

TO DO LIST

Carlson will study whether the hump in the 235U fission cross section below an MeV should be included into the IAEA evaluation (Barton data)

Carlson/Talou/Kawano/Chadwick will compare latest n+239Pu fission IAEA evaluation with LANL evaluation. Differences were noted in the 10-14 MeV range that need to be understood.

Kahler, MacFarlane, and Leal will resolve their discrepant results on the impact of new ORNL 238 resonances on 238U reactivity.

Hale will think about the 16O(n,a) cross section, since Lubitz would like to change it, to give a small improvement in the 238U LEU reactivity criticals.

Hale will look through the checking code outputs for his light-nucleus evaluations for B-VII; Herman has found a few clerical errors.

Chadwick will check the new 236U(n,g) capture x/s, since he thought it was larger than B-VI, but appears to be large only at higher energies (>0.1 MeV)

Chadwick will pass on a possible problem on 35,37Cl(n,xn) spectra. For 14 MeV in, spectra seem to be missing for Eout<6 MeV.

238U capture. Chadwick will ask MacFarlane to look at **Godiva** reaction rate measurements, as a test of the accuracy in the fast region. (And will ask Carlson to summarize the latest standard values).

Leal will look at 235U capture in the 1keV-1MeV region, and will give us feedback on why our ENDF data are ~ 10% different to JENDL, ie, why we follow one alpha measurement, and JENDL follows the Kappeler data instead.

Herman will fix the KAERI photonuclear mistakes in the upper energy.

REVIEW OF EVALUATIONS

Standards, Allan Carlson

Gold capture cross section is being worked on. Typically new changes < 3%. 238U capture cross section very well defined in the 0.1-1 MeV – differences up to 5%. Barton data gives a hump in 235U fission – LANL interim 2003 has the hump, but the IAEA evaluation doesn't – Allan will check. 238U fission - Nolte agrees with Lisowski for 238/235U fission ratio.

For 239Pu fission, values are higher than endf/b-vi in the fast region- presumably in large part because of the higher 235U fission cross section here. In the 10-14 MeV region, the new fission values appear to be much higher than endf/b-vi.

At high energies, again Lisowski and Scherbakov are discrepant though in the opposite direction to the 238U case. (Here, Staples at lower energies seems to better match Scherbakov data).

6Li(n,t): New IAEA evaluation is pointing to changes below 2% below an MeV, with changes increasing to ~6% at higher energies

U235 evaluation

MacFarlane recommended adopting the lower of the two energy regions from ORNL new unresolved evaluations, ie the one up to 25 keV. Bob MacFarlane indicated it made no difference to Godiva, BigTen etc, and had an increase in fission and capture at about a 1% level.

Leal gave the Weinmann viewgrahs on U235 endf6.8 data testing, focusing on above thermal leakage issues. High-enriched assemblies: Negligible slope against above thermal leakage – good agreement. (but this uses old Madland B-VI prompt thermal data, as opposed to Madland's most recent work). Weinmann did note an oxygen trend, possibly the (n,alpha) data – & suggests a possible modification (but apparently Hale is resisting this modification). Weinmann noted some bias seen for fluoride or nitride solution.

MacFarlane showed how the new LANL evaluations do a very good job on Godiva and Flattop criticals (and BigTen). He noted the deficiency in the calculated 235 inelastic spectrum possibly not quite right, based on spectral indices in Godiva.

MacFarlane noted Mosteller's concerns about 235 and 16O. Lubitz noted the difficulties associated with interpreting these results because of the presence of thorium.

We concluded that we may need to revert to the B-VI prompt thermal spectrum for B-VII. Madland is trying to arrange a new measurement, but this will take some time to arrange.

U238 evaluation

Leal talked about his new 238U resonance parameter analysis. This used B-VI parameters below 10 keV as a starting point. Extensions from 10-20 keV were then done. All using Reich Moore, using high-resolution Harvey data. Also used Olsen 1977 transmission data, and de Saussure data.

1-10 keV. Average scattering cross section increases by 2.8%. The average capture cross section increases by 3.6% in the 1-10 keV. A strange issue is that his new evaluation seems to show increase reactivity (which everyone likes!) though the capture cross section increases!

In the 10-20 keV region, they started from scratch (no existing parameters were available). Their average capture cross section agrees with the B-VI evaluation. The average elastic increases by 3.1% cf. B-VI.

Lubitz looked at LCT LEU-Comp-Thermal comparisons, using b-VI.5, with and without 238 resonances using new data in the 0-20 keV region. LCT6-1 through 13 benchmarks were studied. He obtained an average increase in reactivity of about 0.002.

When MacFarlane puts the new ORNL resonance parameters into his latest LANL file, sees an increase of about 0.0025 (a bit more than Leal). Using b-Vi prompt fission n spectrum, not Madland's latest, would increase k further a bit above 1, but would still look good.

Skip Kahler presented data testing for HEU and LEU assemblies:

U238, LEU. B-VI rel.8 is about at 0.994-0.995. 238U is too unreactive, and this has been the focus of the NEA subgroup for a few years. Using the new LANL 238U shows an improvement, about 2/10 percent improvement – this is due to the new inelastic scattering distributions. The BRC data set effect is very similar to LANL – same kind of improvements, but still both sets are still low on k-eff systematically –

say about 0.996-0.997 ish. With Luiz Leal's new 238U resonance parameters added in, he didn't see much effect - this is different to Luiz and Bob's conclusions, and needs to be resolved, though Skip noted that all data testers had to run their sets very quickly before the meeting and didn't have time to check results.

Lubitz report on the U238 NEA subgroup:

238U thermal capture value. Not crucial for fixing the 238U problem, because u238 is mainly a resonance absorber, but: Moxon: 2.74; csewg/standards value=2.719; Mughabghab recommends 2.68 (2002). 2.68=Trkov value (based on 5 most recent measurements. Trkov comments that 2.719 is an evaluation of all measurements without reevaluation. Lubitz noted that this 2.68 value will probably be adopted eventually. (2.68 also happens to be the value coming from Leal's latest resonances – possibly contrived to be so by adjusting negative energy resonances).

O16(n, alpha). Adjusting this would also slightly help the 238U underreactivity problem. Hale questions the validity of changing this, though.

- 3-10 MeV: Hale has ENDF/B-VI that was higher than older ENDF/B-V old data (probably also by Hale). Going back to B-V would give 80ppm on LEU reactivity. Check with Gerry – apparently Gerry noted that the measurements paper had a footnote indicating normalization uncertainties.

MacFarlane gave a summary of NRG/Petten data testing results: (Marck and Hogenbirk). Seemed to be similar to other data testing conclusions. Looked at a large set of benchmarks.

Mosteller provided a presentation, by Little. Looked at some new benchmarks created from old Bettis experimental work that has been recently put into the handbook benchmark project (but there were some uncertainties). Materials included 233, HEU fissile materials, and blankets included thorium, or 233U. Some Gd in as well.

We discussed that using the new LANL/ORNL 233U over rel.8 might help the underreactivity noticed (since Heinrich saw some of these effects in the low energy performance of the Leal 233 data).

Mosteller's observation – some cases C/E underpediction got worse to release-8. Also noted that ENDF/B-V does better than release 8! He thinks this is due to changes in 16O – also poorer performance for water reflected U and Pu spheres. About $1/10^{th}$ percent.

- Skip shows that HEU solutions are much better than the old b-v performance, that was k>1 with a strong slope.
- Thorium complicates Russ's conclusions. We agreed to ask Russ to also do the latest pre-VII evals (incl 233 and 235 etc), and also ask him to look at a modern Th eval from JENDL/Maslov.

We agreed that we would probably keep the present (higher) 235U thermal nubar in the B-VII library, rather than insist on using a lower standards value that compromises reactor performance.

232-241U isotopes
Chadwick presented U 232-241 isotope info.

241Pu, Leal
Looked at 241Pu capture, using Weston 1976 data, Wagemans 1991 data and Young & Smith total cross section data from 1968. Discrepancies between 0.01 eV – 1 eV required normalizations to Wagemans fission & Young total cross section data. The work was motivated by French reactor experiments on isotopic ratios in burn-up.

Np237
Chadwick mentioned the fission cross section change, and the LANL plans to study fission, inelastic, and nu cross section & spectra modifications in the next year.

Little: Composition known at the 99% level. 237Np was 98.8%; but 1% of the sample mass is missing. Russ estimated impact of this 1% missing. Answer from his analysis is about 1/10 percent k. Thus experimental uncertainty of the model can be increased to address this.

- Expt = 1.0026 for k-eff.
- 0.990 with endf release 8. Russ indicates we are about 9/10 of 1-percent low.

T-16 would like to re-look at 235U spectra, to get a harder 235U spectrum.

Fission products evaluations, Oblozinsky

- BNL-KAERI collaboration **(**19-submitted, some of them need reformatting)
- WPEC Subgroup 21 (assessment of bulk of FP evaluations)
- Mughabghab is reanalyzing BNL-325 resonance evaluations

200 FP in ENDF/B-VI, most are old and obsolete.

The 19 submitted includes 99Tc, 155,157Gd; low energy part is already in Rel. 8.

Remaining: Out of ~211 FP in the evaluated libraries, about 20-40 are high priority, and about 170 are lower priority (bulk of FP). So far, 107 FP have been reviewed. JENDL-3 performed very well generally, in both the thermal & resonance region and the fast region. To do:

- Review other materials (by Spring 2004, before next WPEC meeting)
- Final report
- We have recommendations; what are our plans with electronic files?

McKnight would ask Criticality Safety to fund evaluation file completion by BNL. Scattering is as important as absorption in fast reactor applications. We have proposed a follow up NEA subgroup to create files and do some validation. KAPL has some benchmark experience that could help test this. The handbook has many benchmarks relevant.

Status of new evaluations for BNL-325, Mughabghab
Last evaluation done in 1981-1984 time frame. New methodology consists of:
- Review of expt of thermal & resonance integrals, and normalize to standards.
- Review recent measurements of neutron resonance parameters.
- Run physics codes to check Porter-Thomas analysis and determine average parameters S0,1 D0,1 etc.

So far, 166 materials evaluated, files are available. New book assumed to be submitted for print in December 2004.

35, 37Cl, Leal
The ORNL analysis included total, capture, and (n,p) cross section data measurements, up to 1.2 MeV. A new ENDF format has been agreed to that allows the new (n,p) channel to be represented. Herman showed some problems with the emission neutron spectra, eg for 14 MeV incident, outgoing spectra below say 6 MeV are very odd (tiny values). Check with Phil Young.

19F, Leal
Three transmission data measurements of Larson were used, and one capture measurement, supported by the criticality safety program. Inelastic measurements from Obninsk (Broder) were also used, up to 1 MeV.

152-160Gd
ORNL have focused on developing new RM parameters for SAMMY, and then have generated covariances. Kawano has merged these data with high-energy covariance data from LANL, for 252Gd. ORNL has done some testing within the Tsunami uncertainty/sensitivity code, for criticality safety applications.

Pb and Bi isotopes, Arjan Koning

Pb and Bi isotopes from European work, motivated by ADS needs for Pb-Bi transmuters/coolants. The new first inelastic cross section level, from ECN looks similar to LANL's fix. Koning showed that a similar problem exists for the 2nd level, that needs to be fixed. Koning showed good agreement too with (n,2n) and (n.,n') data,a nd with Vonach (n,x gamma) data, as well as 14 MeV spectra.

For 207Pb, agreement is better with new Talys data and with experiment. 206Pb showed some odd ENDF/B-VI data for (n,alpha) – Peter Fu evaluation, based on old data. Bi (n,xn) looked good, as was the case for LANL's evaluation, compared to Kim data. The (n,n') inelastic evaluations look reasonable in ENDF/B-VI for Bi.

Photonuclear evaluations

MacFarlane went through the IAEA suite of photonuclear libraries, and noticed problems with the JENDL formats, and with some of the BROND and CENDL evaluations. Hale provided a g+D evaluation. For ENDF/B-VII, MacFarlane created a suite by using LANL data preferentially, the KAERI, as well as BROND for the actinides.

MacFarlane ran toy MCNP calculations for every evaluation.

MacFarlane also added nubar data into the Russian Obninsk evaluations. Chadwick noted that some other nubar data in the Russian libraries looked odd (discrepant with Caldwell LLNL nubar data, for example), and needs to be looked at.

Herman and Oblozinsky noticed that high-energy KAERI. 10^14 should be replaced by 10^8.

Recently, LANL has added delayed neutron data for 235, 238U and 39Pu.

Morgan White, Integral data testing for HEU detection. Morgan described experiments for pulsed electrons at 10 MeV incident on 5 and 20 kg uranium spheres, by Cal Moss. Neutrons were detected with He3 detectors. T-16 added photonuclear data into the BOFOD evaluations. The benchmark simulations predicted a factor of 10 increase in neutron production for the large and small HEU spheres, and this was reproduced by our simulations, and absolute comparisons suggest a beam current of 5.3 microamps.

David Heinrich (LLNL), with Ed Lent, Photonuclear data testing. Lent included photonuclear transport capabilities into COG. The electron brem package in the COG package is different to the MCNP calculations. In some cases COG is above MCNP, in better agreement with expt. Showed data for C, Al, Cu, Ta. In the case of Ta at 10 MeV near threshold, there is a big discrepancy. 238U looked good. This was not tested by White, so this is encouraging news. We underpredicted the neutron productions typically by up to 25% for these benchmarks.

Cross Section Evaluation Working Group

Formats and Processing Committee Report

N. Maurice Greene, ORNL
Committee Chairman

The Formats and Processing Committee meeting was held on Tuesday morning, November 4 from 8:45 till 11:30 a.m. The agenda was very compact relative to that of previous years, and is listed below:

Format Proposals for ENDF/B-VII		
	Compact Covariance Matrix Format, 30', Larson	
	Expanded Reich-Moore Format, 20', Larson	
	WPEC Format Proposals, 60', Trkov	
		Energy-dependent decay constants
		Increase limits on several arrays
		Expand options on the LCT flag
		Clarify convention for NLIB parameters
		Improve citations in evaluations
		New format for unresolved resonance representation
Processing Codes		
	LANL Processing Codes (NJOY), 15', MacFarlane	
	ORNL Processing Codes (AMPX), 15', Dunn	
	LLNL Processing Codes, 10', Brown	
	ANL Processing Codes (VIM), 10', McKnight	
Utility Codes, 10', Dunford		

The compact covariance format was discussed by Nancy Larson. At the conclusion of her discussion, Bob MacFarlane gave some pertinent observations regarding the magnitude of the number of values and calculations that are involved for processing covariance data for a nuclide with a large number of resonances (e.g., ^{235}U). Bob noted that it requires approximately 150,000 energy/value pairs for each of three nuclear processes to represent these data and further noted that there are 16,000 resonance parameters in the current evaluation. As a result, a full covariance matrix would contain 16,000 squared terms (or 2.16 x 10^8 terms). Bob further noted that Doppler broadening ^{235}U to 4 or 5 temperatures requires several hours on a 750Mhz computer. Some clever procedures are going to have to be developed before the new files can be employed in practical applications. Because of this discussion, the **format was approved as an "interim"** ENDF/B-VII format with full acceptance being withheld until someone demonstrates that the massive amounts of data can actually be used.

Subsequently, Nancy Larson then discussed the Expanded Reich-Moore format that makes it possible to include the effects of charged particle and inelastic scattering channels in the resolved resonance calculation. It was noted that the new format was

being tested in trial versions of NJOY and AMPX. The **format was approved as an interim** ENDF/B-VII format with the same requirements as for the previous format. Note that it is almost certain that a successful implementation for its processing will be completed in both NJOY and AMPX before the release of ENDF/B-VII.

Andrej Trkov discussed 6 formats items that originated from various WPEC contributors:

- In the first, a format to allow energy-dependent decay constants and abundances was proposed. This **format was approved** after it was noted that two of the four cases proposed would cover all situations; viz., the existing format that allows only energy-independent constants and abundances, and a format that allows both the decay constants and the abundances to vary with energy.

- The second WPEC proposal requested a change in MF6 to increase the number of angular points from 101 to 201 and the number of reaction products from 1000 to 2000. The **increase was approved**.

- The third proposal requested an expansion on the options used in the LCT flag to include LCT=4 to indicate that data are in the center-of-mass system for energy and angle for all particles. It was noted that this was the intent of LCT=2, and that the wording in ENDF-102 was unclear and needed to be changed to remove any confusion.

- The fourth proposal was not really a format proposal, but rather a request that the conventions used to define the NLIB number (the parameter used to identify the parent collection of data, such as ENDF/B, JEF, etc.) be specified according the usage of such identifiers by the IAEA and also in EXFOR Dictionary number 43. This **proposal was accepted**.

- The fifth proposal was also unrelated to formats, but suggested a practical procedure that could be used to reference an evaluation from a data collection, or the entire data collection. There was **no dissention concerning the suggestions**. It was also noted that **ENDF-102 contained numerous errors** and that a place is now available on the CSEWG website to post these, so that the corrections can be made to the manual.

- The final proposal related to a new format for the unresolved energy range that is based on the Reich-Moore formalism as opposed to the SLBW formalism used by the existing formats. This proposal suggested that exactly the same record structures could be used for the new format as are used for the old format, with the only difference one new parameter that indicates the data are to be used with the Reich-Moore formalism. A paper that demonstrated a method for using the new data was posted on the CSEWG website. The demonstration dealt with non-fissile nuclides with a cutoff on the unresolved region below the inelastic threshold. Concern was expressed over the fact that the format for SLBW did not allow a position for two fission channels, such as customary in the resolved resonance version of the Reich-Moore formalism and that the

method has not been demonstrated for a fissionable nuclide. The **format was tabled until a later meetin**g.

Bob MacFarlane reported that a small number of minor modifications were made to NJOY during the previous year. Current efforts are focused on the implementation of the expanded Reich-Moore formalism discussed earlier in this session.

Mike Dunn gave a status report on the ORNL-developed AMPX system. He reported that all ENDF/B-VI evaluations had been processed into a prototypic 238 energy group structure. Testing is underway and has yielded critical benchmark calculation results that agree very closely with expected values; however, some benchmark results are ~1-2% below critical. He also reported a number of results based on point Monte Carlo calculations that were in excellent agreement with expected results.

David Brown reported that LLNL codes use ENDF/B-VI data that have been converted to their in-house LENDL formats and were producing satisfactory results. He cited several ENDF/B-VI evaluations that contained flaws and suggested that users be urged to make use of the CSEWG website to report similar problems so as to prevent other users from having to independently discover and work around the problems.

Dick McKnight reported that the VIM program (and other associated ANL codes) were able to successfully process the sections of the ENDF/B-VI files that were needed for their applications.

Charlie Dunford gave a brief discussion regarding the status of the ENDF/B Utility codes, and, essentially reported that these codes were up-to-date in their capabilities.

Minutes of the
U.S. Nuclear Data Program Meeting

Held at
National Nuclear Data Center, Brookhaven National Laboratory
November 6 - 7, 2003

US Nuclear Data Program

Chairman's Summary

P. Oblozinsky
National Nuclear Data Center, BNL

The 6th meeting of the United States Nuclear Data Program (USNDP) was held at Brookhaven National Laboratory, November 6-7, 2003. The meeting, initially scheduled for McMaster, Canada, May 1-2, 2004, was postponed due to SARS problems in Toronto area and held adjacent with the CSEWG annual meeting at BNL.

The meeting was attended by 38 participants. Among them were 34 participants from 12 US organizations, including the USNDP program manager Sid Coon, Office of Nuclear Physics, DOE, and 3 foreign participants. The meeting was held adjacent to CSEWG Annual Meeting (November 4-6, 2003), with a common USNDP-CSEWG session on Nuclear Data for Homeland Security.

Structure

Reviewed was status of basic databases NSR, XUNDL and ENSDF. Concern was expressed on ENSDF where only 15 mass chains are in the production pipeline; the current estimate of manpower is 6.8 FTE (US and Canada) plus 1.75 FTE (internationally). An interesting report was given by Sonzogni on citation parameters of Nuclear Data Sheets.

Satisfaction was expressed with the NSDD training workshop held in Vienna in November 2002. Approximately half of the 12 participants are already involved in data evaluation.

Implementation of Band/Raman internal conversion coefficients (BRICC) was discussed to some depth. It was decided to proceed with implementation despite some remaining problems.

Reactions

Nuclear reaction code development was discussed, including two interesting presentations from Europe. TUNL is planning release of improved version of PRECO in 2004, BNL reported improvements in EMPIRE, including validation of Monte Carlo preequilibrium module, improved formatting and interactive plotting. LANL focused on width fluctuations in McGNASH. A. Koning, Petten is planning first release of his powerful TALYS in 2004.

Results of Task Force on Nuclear Data for Astrophysics were summarized by M. Smith. He showed examples from a half dozen of laboratories included in the US Nuclear Data

Program. V. Demetriou, University of Brussels informed about NACRE compilation of reaction rates and discussed microscopic approaches to derive various important ingredients for model calculations.

Dissemination

NNDC reviewed its database migration project, moving to a new relational database management system Sybase and Linux operating system. Structure databases are completed, their web interfaces are being tested, new NNDC web site should be ready in spring 2004, with reaction databases added by summer 2004.

User statistics of nuclear data retrievals provided by web continue to rise in all sites operated by USNDP laboratories. For example, the NNDC statistics in FY03 increased by 21% compared to FY02.

USNDP Organization

Coordinating Committee, chair Pavel Oblozinsky, BNL

Standing Working Groups

- Reactions Data WG, chair Mark Chadwick, LANL
- Structure and Decay Data WG, chair Coral Baglin, LBNL

Task Forces

- Nuclear Data for Astrophysics, chair Michael Smith, ORNL
- Nuclear Data for Rare Isotope Accelerators, chair Mark Chadwick, LANL
- Impact of Nuclear Data on Society, chair John Kelley, TUNL
- Nuclear Data for Homeland Security (new), chair Dennis McNabb, LLNL

Planning and Reporting

Annual Report for FY03 will be issued in a usual format in January 2004. In February, we should issue Workplan for 2005. Budget Briefing is assumed to be hold in March 2004 as preparation for FY06. Unless otherwise required by DOE the Budget Briefing team will include Pavel Oblozinsky and WG chairs (M. Chadwick and C. Baglin).

Next Meeting

The next USNDP meeting will be held at BNL on November 4-5, 2004 (Thursday - Friday). The format of the meeting will follow the 2003 pattern, it will be held adjacent to the CSEWG meeting. The CSEWG meeting should be held on November 2-4, 2004.

US Nuclear Data Program

Agenda

Nov 6, 2003 (Thursday), Berkner B and C

08:30-08:45 **Opening, P. Oblozinsky**

08:45-11:30 **Nuclear Data for Homeland Security (McNabb/Chadwick, chair)**
(Common session of CSEWG Evaluation Committee & USNDP Reaction WG, Berkner B)

- Current nuclear data activities relevant for homeland security
  - For details see CSEWG Agenda, p.9
- External input
  - For details see CSEWG Agenda, p.9
- Discussion

11:30-12:30 **Reaction Modeling and Astrophysics (M. Chadwick, chair)**
(Common session of CSEWG Evaluation Committee & USNDP Reaction WG)

- Nuclear reaction model code development
  - For details see CSEWG Agenda, p.9
- Nuclear astrophysics
  - For details see CSEWG Agenda, p.9

08:45-12:30 **Structure WG (C. Baglin, chair)**
(Parallel session, Berkner C

- Status reports, 5'-10' each
  - Nuclear Science Rerences (NSR), Winchell
  - Experimental structure data (XUNDL), Lee
  - Evaluated Nuclear Structure Data File (ENSDF), Tuli
  - Decay Data Evaluation Project (DDEP), Browne
  - IAEA project to develop (n,γ) database, Baglin
  - Updated Mass Table, Baglin
  - ENSDF analysis and utility codes, Burrows
  - New conversion coefficient table, 20', Burrows and Tuli
  - Citation parameters of Nuclear Data Sheets, 10', Sonzogni
- Evaluator recruitment and training efforts
  - November 2002 training session in Vienna, 5', Tuli
  - November 2003 training session in Trieste, 10', Tuli
  - Evaluations from scientists outside the Network, 5', Sonzogni
- Formats, Procedures and Jπ rules
  - Expansion of XREF column in Nuclear Data Sheets revisited
  - Legibility of band drawings in Nuclear Data Sheets

- Nuclear Data Sheets publication of single nuclide evaluations
- Jπ assignments in proton radioactivity
- Do recommended upper limits (RUL) need revision?
- Nomenclature for rotational bands and configurations

13:00-14:00 **Working Lunch of the Coordinating Committee, Berkner A**

14:00-17:30 **Dissemination and Laboratory Reports (C. Dunford, chair)**
(Plenary session, Berkner B)

- Data Dissemination
  - NNDC migration project, 20', Dunford
  - Web statistics using ANALOG code 15`, Burrows
  - Other dissemination activities
- Task Forces Reports
  - Nuclear Data for Astrophysics (already covered, see above)
  - Nuclear Data for Rare Isotope Accelerators, 15', Chadwick
  - Impact of Nuclear Data on Society, 15', Kelley
- Laboratory Reports for FY03, 10' each
  - NNDC report (P. Oblozinsky)
  - ANL report (F. Kondev)
  - Georgia Tech report (J. Wood)
  - Idaho report (R. Helmer)
  - LANL report (M. Chadwick)
  - LBNL report (C. Baglin)
  - LLNL report (D. McNabb)
  - NIST report (A. Carlson)
  - McMaster report (J. Cameron)
  - ORNL report (M. Smith)
  - TUNL report (J. Kelley)
  - University of Lowell (G. Kegel)

Nov 7, 2003 (Friday), Berkner B

08:30-13:00 Concluding Session (P. Oblozinsky, chair)

- Reporting, coordination and planning
  - Annual report FY03, Dunford
  - Workplan FY04, Dunford
  - Coordination: Reaction WG, Structure WG, Task Forces
- Budget briefing
  - Performance indicators, Oblozinsky
  - Initiatives, Oblozinsky
- Minutes of the present meeting, next meeting
- Other business

13:00 **Adjournment**

U.S. Nuclear Data Program Meeting

List of Attendees

Coral M. Baglin
Lawrence Berkeley National Laboratory
Berkeley, CA (USA)

Shamsuzzoha Basunia
Lawrence Berkeley National Laboratory
Berkeley, CA (USA)

Edgardo Browne
Lawrence Berkeley National Laboratory
Berkeley, CA (USA)

Thomas W. Burrows
Brookhaven National Laboratory
Upton, NY (USA)

Allan D. Carlson
National Institute of Standards & Technology
Gaithersburg, MD (USA)

John A. Cameron
M^{c}Master University
Hamilton, ON (Canada)

Mark B. Chadwick
Los Alamos National Laboratory
Los Alamos, NM (USA)

Alan A. Chen
M^{c}Master University
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Sidney A. Coon
Department of Energy
Washington, DC (USA)

Vivian Demetriou
Institut d'Astronomie et d'Astrophysique
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David J. DeSimone
University of Massachusetts, Lowell
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Charles L. Dunford
Brookhaven National Laboratory
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Tokio Fukahori
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Robert C. Haight
Los Alamos National Laboratory
Los Alamos, NM (USA)

Michal Herman
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US Nuclear Data Program

Coordinating Committee Summary

P. Oblozinsky, Chair
National Nuclear Data Center, BNL

The Coordinating Committee met at working lunchtime on Thursday, November 6, 2003. Eight out of its 10 members attended the meeting, including P. Oblozinsky, C. Baglin, A. Carlson, M. Chadwick, J. Kelley, F. Kondev, D. McNabb, J. Cameron (replacement for B. Singh), while R. Helmer and M. Smith did not attend.

Agenda

1. Reporting and Planning - Annual Report FY03, Workplan FY05
2. Budget Briefing - team, performance indicators, initiatives
3. ND'2004 Conference – suggestions for invited talks
4. Next meeting - format and dates
5. Other business

Reporting and Planning

Reporting and planning should be streamlined as much as possible. In this respect, November dates of annual meetings are very convenient. This allows to review past fiscal year at the meeting and makes it possible to harmonize reports prepared for the meeting with those provided for the Annual Report. Annual Report 2003 should be ready in January 2004, followed by Workplan 2005 in March 2004.

Budget Briefing

Next USNDP budget briefing is expected to be hold in March 2004. The USNDP team should include P. Oblozinsky along with two WG chairs (M. Chadwick – reactions, C. Baglin – structure). Aging of NSDD evaluators and related manpower decrease is continuing issue that should be brought up again at the briefing. A positive sign is that there is still lively research activity in nuclear structure. This contrasts with the situation in nuclear reactions, where research activity is very limited and pool of young people is small.

ND-2004 Conference

This major conference will be held on September 26 – October 1, 2004 at Santa Fe. The suggestion for a keynote talk on nuclear structure, speaker E. Norman, LBNL was discussed and endorsed.

Next Meeting

The next USNDP meeting will be held at BNL on November 4-5, 2004 (Thursday-Friday). The format of the meeting will follow the 2003 pattern, it will be held adjacent to the CSEWG meeting. The CSEWG meeting will be held on November 2-4, 2004.

In case that the Structure WG would need another day for discussions, it should meet on Wednesday, November 3, 2004.

It was noted that DNP meeting is scheduled for October 2004.

US Nuclear Data Program

Minutes of Structure and Decay Data Working Group Session

C. Baglin, LBNL
Working Group Chair

WG Session: 8:45am-12:45pm, Thursday 6 November 2003

Present: C. Baglin, S. Basunia, E. Browne, T. Burrows, J. Cameron, R. Helmer, A. Kahler, J. Kelley, F. Kondev, B. Peterson, A. Sonzogni, J. Tuli, D. Winchell, J. Wood. Also, S. Coon and P. Oblozinsky were present for short segments of the meeting.
Apologies: A. Akovali, R. Firestone, B. Singh, C. Reich.

The following **Status Reports** were received:

- NSR (D. Winchell): Of the roughly 173,000 entries in this database, 4261 were added during 2002, and the 2003 figure is expected to be similar. Entries are dominated by Physical Review C and Nuclear Physics A papers. All administrative functions of NSR were moved to the Linux/Sybase platform in Summer 2003. Email replaces ftp for most of the monthly database distributions.

- XUNDL (J. Cameron for B. Singh): This database now contains about 1100 datasets. 255 of these were added in the past year, and all but one of those were prepared at McMaster by Roy Zywina and Michelle Lee under the close supervision of Balraj Singh. Compilation of recent high-spin and low-spin papers is essentially current. Retrievals from XUNDL average about 400/month. Commercial software "FINEREADER" is now being used to create tabular text files of data from tables in journal web pages for subsequent processing by McMaster's TXT2ENS code. About 100 email communications between the McMaster compilers and authors have been sent to NNDC so evaluators can access any additional data or clarification of data contained therein.

- ENSDF (J. Tuli): Currently, there are only 15 mass chains in the production pipeline; this is lower than normal and lower than desirable. The current estimate of manpower is 6.8 FTE (US and Canada) plus 1.75 FTE (internationally).

- DDEP (E. Browne): Of the 259 radionuclides selected for evaluation by the Decay Data Evaluation Project, 99 have been evaluated and another 5 are in progress. So far, few of these have been included in ENSDF, primarily because of different data formats and the use of different theoretical conversion coefficients. However, development of new software is now well under way at Saclay to produce ENSDF files from DDEP evaluations. Also, if ENSDF were to adopt the recent Band *et al.* conversion coefficient calculations, DDEP would

probably do likewise, and DDEP evaluations could then be made available to evaluators via a new database (similar to XUNDL) created for that purpose.

- ENSDF Analysis and Utility Codes (T. Burrows): (see separate report for details). Both COMTRANS and ENSDAT have been converted to FORTRAN 95 and now use a direct access dictionary. A new ENSDAT option to invoke a PostScript viewer now replaces ENSWIN. Changes in progress or planned include: (1) GTOL – increase maximum number of levels and gammas to 500 and 2000, respectively; (2) HSICC – continue adapting the package so it can use the new Band *et al.* conversion coefficients; (3) LOGFT – a new version which includes 3rd and higher order unique forbidden transition calculations needs to be extensively tested and intercompared with LBNL codes, then updated to use the electron-capture data of Schönfeld, *et al.*; (4) GAMUT – has already been converted to MSWindows by Dr. Choi, but needs extensive testing, upgrading to current ENSDF formats and standards and porting to Linux; (5) RadList – needs to be converted to other platforms, then upgraded to include subshell calculations, etc. A proposal (B. Singh) to add an option to GTOL to add/modify/delete A/B/E records in its output file was discussed. Clearly, this would raise a number of questions about GTOL's treatment of normalization issues, uncertain placements and the use of intensity balance limits from Lyons method. Some concern was expressed that this was too great a degree of automation for records which often needed careful consideration on the part of the evaluator.

- IAEA-CRP for "Development of Database for Prompt Gamma-ray Neutron Activation Analysis" (C. Baglin): this international collaboration, led by R. Firestone (LBNL) has completed its work. It has produced the EGAF database of 35,000 prompt and decay gamma-ray cross sections for thermal neutron capture on all stable elements and U, prepared a TECDOC publication with CD-ROM (in press) and created a website (in press) and appropriate database search software. The evaluated data from this CRP will soon be available to ENSDF evaluators via ENSDF-format files to be stored at NNDC. These will provide recommended intensity normalizations for both primary and secondary transitions, and evaluators will also gain access to a large volume of unpublished energy and intensity data (some of it far superior to what has already been published) from the Budapest reactor group. However, these data will necessitate the reworking of all current thermal-neutron capture datasets in ENSDF.

- Mass Table Revision: C. Baglin reported that she had been in touch with Georges Audi and he had announced that the new mass table would be ready on November 15, 2003.

- Nuclear Data Sheets Citation Parameters (A. Sonzogni): A commonly used citation parameter is the Impact Factor which, for a given year, is the number of citations during that year for articles published in the prior two years divided by the total number of papers in those two prior years. For Nuclear Data Sheets, the average of this parameter over the last 4 years is 0.5, much lower than for major

nuclear physics journals. However, the cumulative average number of citations per paper compares very favorably with that for the major nuclear physics journals. 40% of NDS citations are from Physical Review C. In 2001, the average age of NDS articles cited was 8.6 years.

Evaluator Recruitment and Training Efforts:

1. J. Tuli reported on the structure and decay data training session held in Vienna in November 2002. This was very successful; approximately half of the 12 participants are currently involved in data evaluation. Last year's activity was a pilot program leading up to the November 2003 workshop at ICTP in Trieste which will accommodate twice as many participants. It was noted that ongoing mentoring of graduates from such programs requires time and effort but is extremely important. Both McMaster and LBNL have been involved in such mentoring, and BNL noted its willingness to host some workshop graduates in the future.

2. Evaluation assistance from outside the Network (A. Sonzogni): BNL plans to host a visit next Spring from an experimentalist with expertise in high-spin physics and proton-rich rare-earth nuclei who may provide useful guidance to the Network on handling data for highly-deformed bands or chiral-symmetry bands.

Implementation of Band/Raman Internal Conversion Coefficients (BRICC)? (T. Burrows):

1. Various changes to current software are required in order to accommodate the new coefficients. The new calculations extend to higher energy (2000 keV rather than 1500 keV), they include additional multipolarities (M5 and E5), more shells and subshells, total ICC and electron binding energies. However, for the L2 through M5 shells, the lowest energy calculation is for 21 keV compared with 20.7 to 4.3 keV for the Hager-Seltzer calculations. Most of these changes have been programmed, including a subroutine package to calculate the population fraction for valence electron subshells.

2. Work in progress or yet to be started includes: perform cubic spline fitting; modify report and output files (now much longer); probably add internal pair formation coefficients; investigate use of finer grid near "bumps" in curves.

The feasibility of changing over to BRICC part-way through the coming year does not appear to be an issue.

The critical question, discussed at some length, was whether we <u>should</u> make that change. At the 2002 Working Group meeting, that decision was deferred (at Raman's suggestion) pending the publication of his intercomparison of precise conversion coefficient measurements and various calculations; that paper was published last year, and the conclusion was that the new Dirac-Fock calculations (At. Dat. Nucl. Dat.

Tables 81, 1 (2002)) were clearly superior to the Hager-Seltzer ones now in use, reproducing at the 0-1% level on average the 100 experimental data points (uncertainty 5% or lower) used for comparison.

However, the published Dirac-Fock calculation does not take holes into account (neither does Rösel); values are larger (by ~1% on average but by 12% in the worst case) if the hole is considered, using either a self-consistent field potential or the frozen-orbital approximation for continuum wave functions. R. Helmer presented preliminary data from J. Hardy (Texas A&M) for the worst case transition, the 80.2-keV M4 K-conversion line from ^{193m}Ir decay whose energy is very close to the K-shell binding energy. Two earlier measurements were discrepant; the new one clearly favored the frozen-orbital calculation over the no-hole calculation under consideration for adoption. This is worrisome, even though this coefficient appears to be a special case, and we believe that critical assessment of the validity of the new no-hole calculations must be ongoing. However, for the majority of transitions in ENSDF, those calculations do appear to provide more reliable values than the Hager-Seltzer values currently in use.

The consensus was that we would indeed proceed with the change to BRICC despite the remaining problems. However, evaluators should watch for problems, especially at energies close to the binding energy, and comment on any large deviations of BRICC values from other calculations or from new precise measurements as they become available.

Beta-Decay Terminology (J. Cameron for Y. Akovali):

At the last NSDD meeting, Y. Akovali and B. Singh were requested to solicit expert opinion and prepare new "Introductory Material" clarifying the rules of classification of beta transitions. The resulting document was presented and accepted by the Working Group.

Calculation of r0 for Odd-A and Odd-Odd Nuclei (E. Browne for Y. Akovali):

It has recently become apparent that evaluators have been using different methods to deduce the r0 parameter required for alpha-decay hindrance factor calculations for odd-A and odd-odd nuclei. One method originated at ORNL, the other at LBNL prior to the 1978 Edition of the Table of Isotopes. It was agreed that a uniform approach should be used and that the ORNL approach was the appropriate one. The evaluator must use discretion when any of the required even-even r0 values is unreliable or unavailable but, in general, the formulae to be used are:
r0(even Z, odd N)= 1/2[r0(Z,N-1)+r0(Z,N+1)];
r0(odd Z, even N)=1/2[r0(Z+1,N)+r0(Z-1,N)];
r0(odd Z, odd N)=1/4[r0(Z+1, N+1)+r0(Z+1,N-1)+r0(Z-1,N+1)+r0(Z-1,N-1)].

Strong Rule for Jπ Assignment in Proton Decay (A. Sonzogni):

The following strong argument for Jπ assignments was proposed and adopted:

"The spin and parity of a level exhibiting proton radioactivity and belonging to a nearly-spherical odd-Z, even-N nucleus can be taken equal to a particular set of Jπ values of the emitted proton if a) the transition reaches the ground state of the daughter nucleus, b) the proton Jπ values are physically reasonable, i.e., supported by systematic studies / Shell Model calculations, c) the calculated proton radioactivity half-life for those Jπ values is smaller than the experimental value, and d) the calculated proton radioactivity half-lives for the other physically possible Jπ values are far larger or far smaller than the experimental value."

XREF Column Width in NDS (T. Burrows):

The default width is 15 characters. However, up to 26 characters (~24% of table line width) could be used in a specific 'Adopted' dataset if the evaluator requests NDS production to change the default.

Nomenclature for Rotational Bands and Configurations (F. Kondev):

F. Kondev will confer with B. Singh and present recommendations at a later Working Group meeting.

The meeting was adjourned at 12:45 pm.

US Nuclear Data Program

Minutes of Nuclear Reaction Working Group Session

Mark Chadwick, LANL
Working Group Chair

Many aspects of the nuclear reaction data evaluations completed last FY03 were discussed in detail at the CSEWG meeting prior to the USNDP meeting. See the CSEWG minutes for details.

Nuclear Reaction Modeling Code Development

We had two external guests who came to join our meeting from Europe – Arjan Koning (ECN Petten); and Vivian Demetriou (Brussels University). They both have strong skills in nuclear reaction theory.

Connie Kalbach summarized recent developments in her PRECO codes, which she aims to release at PREC02004 next year. She has looked at preequilibrium phenomenology for neutron reactions in the 26-65 MeV range, based on new measurements from Louvain-la-Neuve. These same measurements have allowed her to study complex particle emission from neutron emission. Kalbach has also further studied isospin conservation effects in preequibrium and equilibrium decay. If E< 4*symmetry energy, her results indicate that one should assume isospin conservation. Isospin is ~40% conserved on average at equilibrium. A paper has been submitted on this work.

Mike Herman summarized EMPIRE nuclear reaction code developments. This is a very general code for modeling reactions between a keV and 200 MeV, and also includes nuclear data formatting in ENDF-6 format. Interactive plotting capabilities have been added. A new feature added is the modeling is a 3-hump fission modeling.

Patrick Talou provided a presentation on developments in the McGNASH code, which is a replacement for the legacy GNASH code. A recent focus has been on width fluctuation corrections, and on Monte Carlo preequilibrium and fission models.

Arjan Koning described all the outstanding work that has gone into his TALYS nuclear reaction code system. This code has tremendous predictive capabilities, for a wide variety of nuclear reaction important in applications and in more academic arenas. Koning plans to release his code at the ND2004 conference.

Nuclear Astrophysics Task Force

Mike Smith summarized work done in the USNDP astrophysics task force. He showed examples from BNL, LANL, McMaster, ORNL, ANL, and TUNL. Mike also

talked about the development of some nuclear data evaluation tools, and pointed us to WWW sites that disseminate nuclear reaction rates for astrophysics. Nuclear theory advances relevant to r-process nucleosynthesis were shown.

Vivian Demetriou talked about nuclear astrophysics research on heavy-nucleus synthesis. Vivian describe the NACRE compilation of reaction rates, and all the nuclear physics properties needed, eg capture cross sections, beta decay properties, fission barriers, etc. A principal thrust is to apply microscopic nuclear theory models, and significant accomplishments have been made.

RIA task force

Chadwick summarized RIA-related work this last year. This included nuclear INC code development by Mashnik, with collaborations with Jerry Nolen at ANL for ISOL target design; Moller participation in the RIA nuclear theory committee headed by Ormand (Moller gave an invited talk at the Tuscon RIA meeting); ORNL Hollerfield RIA measurements, with theory analysis by Hale; and DANCE gamma-ray detector advances for neutron capture for s-process.

US Nuclear Data Program

Nuclear Astrophysics Data Task Force Report

M. Smith, ORNL
Task Force Chair

A number of efforts within the U.S. Nuclear Data Program (USNDP) either directly or indirectly help improve our understanding of a wide range of exciting astrophysical phenomena such as stellar explosions, the interior of our sun, Red Giant stars, and the early Universe. This work includes evaluations of particular nuclear reactions or the properties of specific nuclei, development of nuclear models to calculate unmeasured properties, and data processing and dissemination in formats requested by astrophysicists as well as in standard NNDC formats. There is also an effort to develop tools to facilitate evaluation processing and dissemination. The work done by members of the Nuclear Astrophysics Data Task Force spans the activities done within the USNDP Nuclear Reaction and Nuclear Structure Working Groups. A brief discussion of these research efforts is given below.

Compilations & Evaluations

At BNL, work continues on a project to compile and evaluate alpha-induced nuclear reaction cross sections, focusing on light- to medium-mass nuclei up to Z = 32 and alpha particles with energies up to ~ 20 MeV. A number of these reactions are of interest in astrophysics. This work is done in collaboration with scientists from the Former Soviet Union (Russian Federal Nuclear Center), and is funded by the US Civilian Research and Development Fund for the Former Soviet Union (CRDF).

At LANL, the n-p capture reaction – crucial for studies of the early Universe – is being investigated with R-matrix theory. Fits with accuracy of 0.2 – 2.5 % have been obtained by combining N-N scattering, capture, and photodisintegration data. Calculations have also been made for the TUNL Energy Levels of Light Nuclei (A=5-7) evaluation. Additionally, LANL is collaborating with ORNL on R-matrix calculations on ORNL measurements of the ^{17}F(p,p), ^{17}F(p,p'), and ^{17}F(p, α)^{14}O reactions to determine an improved stellar ^{14}O(α,p)^{17}F reaction rate. This reaction is crucial for energy generation in X-ray bursts.

At McMaster University, a brand new effort has been funded to perform evaluations of reactions on radioactive isotopes important in stellar explosions. The emphasis will be on reactions that will be measured at TRIUMF's ISAC radioactive ion beam facility. Reactions of interest include ^{13}N(p,α)^{14}O, ^{15}O(α,α)^{19}Ne, ^{19}Ne(p,α)^{20}Na, ^{18}Ne(α α)^{21}Na, ^{21}Na(p,α)^{22}Mg, and ^{25}Al(p,α)^{26}Si.

At ORNL, an evaluation of the ^{18}F(p,γ) and ^{18}F(p,α) reactions, important for understanding stellar explosions, has nearly been completed. A Ph.D. thesis was successfully defended on this work and a short paper published, with a longer paper in preparation. Recent results from an ORNL Hollifield Radioactive Ion Beam Facility

measurement of the $^{18}F(d,p)^{18}F$ reaction are being incorporated into this evaluation, as well as new Thomas-Ehrman level shift calculations and an improved non-resonant reaction rate calculation. The new reaction rates will be put into formats requested by astrophysicists and distributed over the Web. An evaluation is being made, in collaboration with LANL, of the $^{14}O(\alpha,p)^{17}F$ reaction via R-matrix calculations on ORNL measurements of $^{17}F(p,p)$, $^{17}F(p,p')$, and $^{17}F(p,\alpha)^{14}O$. Additionally, the levels in $^{34,35}Ar$ and ^{31}S relevant for proton capture reactions on $^{33,34}Cl$ and ^{30}P, respectively, are being assessed for studies of stellar explosions. This work is also coupled to future planned measurements with radioactive beams at ORNL.

At TUNL, the evaluation "Energy Levels of Light Nuclei: A=5-7" has been published in Nuclear Physics A, posted online, and incorporated into ENSDF. This work is important to astrophysics research because a number of reactions induced on light ions [e.g., $^{3}He(d,p)^{4}He$ and $t(d,n)^{4}He$] are dominated by individual resonances detailed in these evaluations. Additionally, a preliminary version of the A = 10 evaluation has been released.

Development of Evaluation and Processing Tools

At ANL, considerable effort was devoted to the issue of handling quantities that are positive definite and which have very large uncertainties – for example, the reaction rates used in calculations of stellar element synthesis. The lognormal distribution is the appropriate way to represent such quantities, and confidence intervals, rather than the traditional mean values and standard deviations, are employed. This work was done in collaboration with Hiram College. A collaboration led by ORNL is utilizing this new large-uncertainty formalism in simulations of the synthesis of nuclei in nova explosions.

At ORNL, a new computational infrastructure is being developed to facilitate the incorporation of nuclear physics evaluations into astrophysics models. The infrastructure consists of a suite of computer codes synthesized into an all-in-one, user-friendly, robust computational package accessible through a web browser. It will enable users, by a series of mouse clicks, to insert their latest evaluations into the reaction rate libraries used by astrophysicists. It will also enable users to create custom libraries tailored for their particular application, which can easily be reproduced by other users wishing to perform consistency checks on, for example, element synthesis calculations. Also at ORNL, a novel effort is underway to gauge the influence of nuclear reaction rate uncertainties (such as those determined from detailed cross section evaluations) on element synthesis predictions in stellar explosions. This work is done in collaboration with ANL and utilizes lognormal distributions of reaction rates in a Monte Carlo approach to element synthesis studies.

Dissemination

At ORNL, the **www.nucastrodata.org** site was developed to link together all datasets relevant for nuclear astrophysics studies. Additionally, this site features the **RATEPLOTTER** program, which gives users quick, user-friendly access to over 60,000

thermonuclear reaction rates in the REACLIB library via a web browser. This program, as well as the above website, will be integrated into the computational infrastructure (discussed above) being developed for nuclear astrophysics studies.

Nuclear Theory

At LANL, improved global microscopic - macroscopic predictions of α decay with first-forbidden transitions have been carried out. The inclusion of first-forbidden transitions significantly improves the global agreement with measured α-lifetimes. These new lifetime predictions were used in site-independent calculations of the rapid neutron capture process (r-process) believed to occur in supernovae, and resulted in a significant speed up of nuclear burning (matter flow) near the closed neutron shells. A collaborative study (with experimentalists) on the α-decays of neutron-rich unstable nuclei $^{94\text{-}99}$Kr and $^{142\text{-}147}$Xe was completed. Additionally, a new study of fission barriers far from stability was carried out using a multimillion-grid-point 5-dimensional deformation space. This new model will help improve predictions of the fission of heavy neutron rich nuclei in unmeasured mass regions. This work may also help influence estimates of the age of the Universe through studies of heavy element abundances – the so-called cosmochronometers – because fission is ignored in many previous cosmochronometry studies.

Laboratory Reports

Laboratory Reports

Laboratory reports were presented by:

- NNDC report (P. Oblozinsky)
- ANL report (F. Kondev)
- Georgia Tech report (J. Wood)
- Idaho report (R. Helmer) – presented in written form only
- LANL report (M. Chadwick)
- LBNL report (C. Baglin)
- LLNL report (D. McNabb)
- NIST report (A. Carlson)
- McMaster report (J. Cameron)
- ORNL report (M. Smith)
- TUNL report (J. Kelley)
- University of Lowell (G. Kegel)

Most of these reports can be found at
www.nndc.bnl.gov/nndc/proceedings/2003csewgusndp

Task Force Reports

- For report of the Task Force on Nuclear Data for Astrophysics, see p. 53.
- For report of the Task Force on Nuclear Data for Homeland Security, see p.59.
- Report of the Task Force on Impact of Evaluated Nuclear Data on Society is available at www.nndc.bnl.gov/nndc/proceedings/2003csewgusndp

Cross Section Evaluation Working Group & US Nuclear Data Program

Nuclear Data for Homeland Security

Dennis McNabb, LLNL
Task Force Chair

Nuclear Data Security for Homeland Security was held as a common session of the CSEWG Evaluation Committee & USNDP Reaction WG on November 6, 2004. D. McNabb, LLNL chaired the session, with M. Chadwick, LANL acting as co-chair.

Agenda

- External input
  - Comments from Dept of Homeland Security, Sonya Bowyer (see e-mail below)
  - Nuclear data needs: LANL perspective, 15', Bill Johnson (presented by MacFarlane)
  - Nuclear data needs for homeland security, 15', Ken Sale (LLNL)

- Current nuclear data activities relevant to homeland security, 5' each
  - Neptunium nuclear data and criticality, MacFarlane (LANL)
  - Nuclear data for DTRA, McKnight (ANL)
  - Americium nuclear data for attribution, Chadwick (LANL)
  - Nuclear data for attribution activities at LLNL, McNabb (LLNL)
  - FIGARO: Nuclear materials detection, D. Smith (ANL)
  - Active interrogation: Simulation of photo-fission delayed neutron SNM detection, Little (LANL)
  - Nuclear structure and decay data for homeland security, Tuli (BNL)
  - Active interrogation: Signature of fissile materials -- high-energy gamma rays following fission, Norman (LBNL), presented by E. Browne
  - Detection simulation: Photo-resonance data for explosives detection, Oblozinsky (BNL)
  - Gamma production data for Ge detector simulations, Herman (BNL)

- Discussion

- Update to community on Task force on Nuclear Data for Homeland Security, 10', P. Oblozinsky

Summary

Useful external input on nuclear data needs for homeland security was provided by representatives of DHS, LANL and LLNL. They identified data needs in several areas of importance for homeland security, including active interrogation using both neutrons and photons, attribution (such as neutron interaction with short-lived minor actinides). They

stressed importance of data for simulations, and provided several specific examples of data needs (such as lack of photon production for n+Ge).

Nuclear data community made 10 presentations of ongoing activities on nuclear data relevant for homeland security. These activities are primarily concerned with nuclear data for attribution, active interrogation, and detection of nuclear materials.

A specific suggestion came out of discussion, strongly supported by Peter Bond (BNL), to come forward and prepare a short version of Nuclear Wallet Cards targeted to needs of homeland security community. Other general suggestions included (1) DHS and NNSA should internally develop an integrated, prioritized list of data needs, (2) more interaction with the academic community should be initiated, and (3) the CSWEG community should work on addressing technical issues of integrating database into transport simulation codes.

Charge of Task Force (attached) was discussed and approved.

Comments from Department of Homeland Security

From: Bowyer, Sonya [Sonya.Bowyer@dhs.gov]
Sent: Monday, November 03, 2003 4:56 PM
To: Oblozinsky, Pavel
Cc: Burns, Michael; Kammeraad, Judith; Kreek, Steven
Subject: Nuclear Data for Homeland Security

Dear Pavel,

I am sorry to have to inform you that despite our best efforts, the appropriate representatives from the Radiological and Nuclear Countermeasures Portfolio of DHS S&T will not be able to speak on Thursday morning. Mike Burns had previously requested that one of the Rad/Nuc Portfolio members speak in his place since the portfolio is responsible for establishing the requirements and plans for the programs to be executed. Mike is unavailable this week due to a previous engagement.

Having said that, we have reviewed the presentation entitled "Nuclear Data for Homeland Security" that you and Mark Chadwick wrote. We were quite satisfied with what you put together and have only a few additional comments.

1. Active interrogation includes significant work in neutron interrogation as well as photon interrogation. We would like to see more discussion of missing cross section data and secondary reaction modeling for neutron induced fission.

2. For both neutron and photon interrogation methods, we need good cross section data over the relevant energy range (~14MeV to thermal) for materials in typical cargo

loads. These are materials that are typically not found in nuclear weapons (traditional emphasis) like wood, ice, water, etc.

3. These same cross sections are imperative for understanding the reactions and absorption of neutron emitted from fission or (gamma,n) reactions.

4. In general, one of the primary goals of our program is to thoroughly understand signal versus background for both active and passive detection techniques. This understanding and, ultimately the resulting predictions, can only be achieved through accurate modeling and precision data input.

Once, again, we are sorry that we are not able to attend and encourage you to continue interacting with us at every opportunity.

Thanks. -Sonya

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Charge of Task Force on Nuclear Data for Homeland Security

(Last update on October 21, 2003 by Pavel Oblozinsky, BNL)

Charge
Task Force on Nuclear Data for Homeland Security provides a mechanism for regular interaction between the U.S. nuclear data and homeland security communities.

The Task Force will focus on understanding the current nuclear data needs of homeland security programs and anticipating long-term nuclear data needs as these programs mature. Its most important function will be to help coordinate activities to meet those needs, including redirection of USNDP efforts as appropriate.

It is anticipated that the need for improved nuclear data will be driven by Monte Carlo simulation, materials detection, nonproliferation, nuclear interrogation and attribution technologies.

The Task Force operates within the current US nuclear data efforts, including both the Cross Section Evaluation Working Group (CSEWG) and US Nuclear Data Program (USNDP) coordinated by the National Nuclear Data Center, BNL.

The Task Force uses well-established US nuclear data efforts that integrate resources from various funding agencies, such as DOE Office of Science, NA-22, Nuclear Energy and others. It communicates the value of these efforts to DHS and NNSA, including the production of nuclear data, peer review processes, data testing and quality assurance, along with storage and archival of data for nuclear technology applications.

Methods of Work
The Task Force meets once a year in a special session held as a part of the Cross Section Evaluation Working Group and/or US Nuclear Data Program annual meeting.

Membership
The Task Force includes nuclear data researchers at the national laboratories who interact closely with the homeland security community, along with representatives of that community:

- Dennis McNabb, LLNL, chair
- Mark Chadwick, LANL, co-chair
- Ken Sale, LLNL
- Bill Johnson, LANL
- Bob Little, LANL
- Don Smith, ANL
- Richard McKnight, ANL
- Pavel Oblozinsky, BNL
- Mike Herman, BNL
- Jag Tuli, BNL
- Eric Norman, LBNL

Appendix: List of Presentations and Reports Available on Web

www.nndc.bnl.gov/nndc/proceedings/2003csewgusndp

CSEWG Meeting, November 4-6, 2003

Formats and Processing

- Compact Covariance Matrix Proposal (N.M. Larson, ORNL)
- R-Matrix Limited Format Proposal (N.M. Larson, ORNL)
- WPEC Format Proposals – 2003 (A. Trkov, IAEA Vienna)
- ORNL Cross-Section Processing Status (M.E. Dunn and M. Greene, ORNL)
- Update on ENDF/B-VI Translation (D. McNabb, LLNL)

Measurement and Basic Physics

- Experimental Activities Report ANL Nuclear Data Program (F.G. Kondev & D.L. Smith)
- National Institute of Standards and Technology (A.D. Carlson, NIST)
- Nuclear Data Experiments at LANSCE: A Brief Summary (B. Haight, LANL)
- Status of the Experimental Data for the International Standards Evaluation (A.D. Carlson, NIST)
- A Demonstration of the Lognormal Distribution (D.L. Smith, ANL)
- Experimental Resources Website (D.L. Smith and F.G. Kondev, ORNL)
- Potential Resources in USA for Applied Experimental Nuclear Data Studies (D.L. Smith, ANL
- Cross Section Measurements and Analysis at Rensselaer (D. Barry, R.C. Block, Y. Danon, et al, RPI)
- Recent Nuclear Data Activities at NIST (A.D. Carlson, NIST)
- Status of the Database for the New International Evaluation of the Neutron Cross Section Standards (A.D. Carlson, NIST)

Meetings and Conferences

- Report on the Workshop on Nuclear Data Needs for Generation-IV Systems (P.Oblozinsky, BNL)
- Report on WPEC Meeting 2003 (P. Oblozinsky, BNL)
- 2003 WPEC Meeting Overview (D.L. Smith, ANL and E.T. Cheng, TSI)
- Meeting on the OECD-NEA High Priority Nuclear Data Request List (D.L. Smith, ANL)
- Fusion Neutron Induced Transmutation of Spent Fuel Actinides (E. Cheng, TSI)
- TRAMU Workshop (T. Kawano, LANL)

- TRAMU Workshop: Nuclear Data for the Transmutation of Nuclear Waste (A.J. Koning, NRG Petten, Netherlands)

Reaction Evaluation & Data Validation

- Status of the ENDF/B-VII Library (M. Herman, BNL)
- Neutron Cross Section Standards (A.D. Carlson, NIST)
- The Evaluation of the Neutron Cross Section Standards (A.D. Carlson, NIST)
- ENDF/B-V and ENDF/B-VI Calculations for the LWBR SB Core Benchmarks with MCNP5 (R.D. Mosteller, LANL; presented by R. Little, LANL)
- Analysis of the Np Sphere Experiment with MCNP5 and ENDF/B-VI (R.D. Mosteller et, LANL; presented by R. Little, LANL)
- Progress report of the WPEC sub-group 22: Nuclear data for improved LEU-LWR reactivity prediction (A. Courcelle, CEA Cadarache; presented by C. Lubitz, KAPL)
- Monte Carlo Benchmark Calculations with Revised ^{235,238}U Evaluations (A.C. [Skip] Kahler, Bechtel Bettis)
- Evaluations of Fission Products (P. Oblozinsky, BNL)
- New BNL-325 Evaluations (S.F. Mughabghab, BNL)
- Data Evaluation for ^{19}F, ^{35}Cl, ^{37}Cl, ^{241}Pu, ^{238}U, and Gd Isotopes (L. Leal, H. Derrien, R. Sayer and N. Larson, ORNL)
- New nuclear data libraries for Pb and Bi (A.J. Koning et al, NRG Petten, Netherlands)
- Nuclear Data Needs for National Security Programs (M.B. Chadwick, LANL)
- Photofission Delayed Neutron Re-interrogation for Detecting SNM: Establish Simulation Capability (R.C. Little, M. White, S. Frankle, M.B. Chadwick et al, LANL)

Reaction Modeling and Astrophysics

- TUNL Program on Preequilibrium Phenomenology (D.Kalbach Walker)
- Advanced tool for nuclear reaction data evaluation (M. Herman, BNL)
- McGNASH Nuclear Reaction Code (P. Talou, M.B. Chadwick, LANL)
- Son of all reaction codes: TALYS (A. Koning et al, Bruyeres-le-Chatel)
- Astrophysics Task Force (M. Smith, ORNL)
- Reaction modeling and evaluation for astrophysics (P. Demetriou, Brussels, Belgium)

Nuclear Data for Homeland Security

- Nuclear Data for Homeland Security: Comments by DHS (S.M. Bowyer, DOE)
- Nuclear data needs: LANL perspective (B. Johnson, LANL)
- Nuclear Data Needs for Homeland Security (K. Sale, LLNL)
- Neptunium nuclear data & criticality (M. Chadwick, LANL)
- Americium nuclear data for attribution (M. Chadwick, LANL)
- Nuclear Data for Attribution Activities at LLNL (D. McNabb, LLNL)

- FIGARO: Nuclear Materials Detection (D.L. Smith, ANL)
- Active interrogation: Simulation of photo-fission delayed neutron SNM detection (R. Little, LANL)
- Nuclear structure and decay data for homeland security (J. Tuli, BNL)
- Active interrogation: Signature of fissile materials – high-energy gamma rays following fission (E. Norman, LBNL)
- Detection Simulation: Photo-Resonance Data for Explosives Detection (P. Oblozinsky, BNL)
- Gamma production data for Ge detector simulations (M. Herman, BNL)
- Update on Task Force on Nuclear Data for Homeland Security (P. Oblozinsky, BNL)

USNDP Meeting, November 6-7, 2003

Nuclear Data for Homeland Security

See CSEWG — All presentations listed under Nuclear Data for Homeland Security

Reaction WG

See CSEWG — All presentations listed under Reaction Modeling and Astrophysics

See CSEWG — Most presentations listed under Reaction Evaluation & Data Validation

Structure WG

- NSR Status (D.F. Winchell, BNL)
- XUNDL Status Report (Apr 1, 2002 – Sep 30, 2003) (B. Singh, McMaster, D. F. Winchell and T. Burrows, BNL)
- Decay Data Evaluation Project (DDEP) (E. Browne, LBNL)
- Status of the ENSDF Analysis & Utility Codes (T. Burrows, BNL)
- IAEA Coordinated Research Project: Development of Database for Prompt Gamma-Ray Neutron Activation Analysis (C.Baglin, LBNL)
- Nuclear Data Sheets Citation Parameters (A.A. Sonzogni, BNL) NSR Status (D. Winchell, BNL)
- Evaluation assistance from outside the Network (A.A. Sonzogni, BNL)
- Beta Transitions (β^-, β^+ and ε decays) (Y.A. Akovali, ORNL and B. Singh, McMaster)
- Implementation of Band-Raman Internal Conversion Coefficients (BRICC) (T. Burrows, BNL)
- Obtaining r_0 parameters for HF calculating of alpha's from odd-A and odd-odd nuclei (Y.Akovali, ORNL)
- Strong Rules for Proton Radioactivity (A. Sonzogni, BNL)
- Status of XREF in ENSDF and the Nuclear Data Sheets (T.W. Burrows, BNL)

Dissemination

- NNDC Database Migration Project (C. Dunford, T. W. Burrows, BNL)
- Web Statistics using Analog at NNDC (T.W. Burrows, BNL)

Task Force Reports

- Task Force on the Impact of Evaluated Nuclear Data on Society (J. Kelley, TUNL)
- Nuclear Data Astrophysics TF Report (M. Smith, ORNL) – see p. 53 of the present report

Laboratory Reports

- National Nuclear Data Center Report to USNDP Meeting 2003 (P. Oblozinsky, BNL)
- Nuclear Data Program at ANL (F.G. Kondev, D.L. Smith, ANL)
- GTNDSE: The GA Tech nuclear data search engine (W.D. Kulp, J.L. Wood, Georgia Institute of Technology)
- Nuclear Structure and Decay Data Evaluation (R. Helmer, Idaho)
- US Nuclear Data Program: LANL T-16 FY03 Progress (M. Chadwick, LANL)
- Isotopes Project (C.Baglin, S. Basunia, E. Browne, R. Firestone, LBNL)
- National Institute of Standards and Technology Nuclear Data Verification and Standardization Program – Progress Report (Carlson, NIST)
- Status Report of the Nuclear Data Project at McMaster University (B. Singh, McMaster University)
- Recent Activities & New Initiatives in the ORNL Nuclear Data Program (M. Smith, ORNL)
- Nuclear Data Project, Nuclear Structure and Decay data, Evaluation Activity Report (Y. Akovali, ORNL & Univ. of Tennessee)
- Pre-equilibrium Model & Code Development (C. Walker, TUNL), and Nuclear Structure Data Evaluation Program (J.H. Kelley et al, TUNL)
- Neutron Physics Group: Report from Univ. of Massachusetts (G. Kegel, Lowell)

Concluding Session

- USNDP 2003: Summary and Conclusions (P. Oblozinsky, BNL)