

USNDP

U.S. Nuclear Data Program Work Plan for Fiscal Year 2006

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Introduction

The work plan described in this document has been developed to cover work to be done by the United States Nuclear Data Program (USNDP) during fiscal year 2006 that begins on October 1, 2005. Previously, six work plans have been prepared for the data program covering fiscal years 2000, 2001, 2002, 2003, 2004, and 2005. This plan has been prepared in consultation with the members of the Coordinating Committee who represent the organizations participating in the program. Each Coordinating Committee member prepared a draft plan for his or her organization. Each contribution was integrated into a unified work plan. The draft plan was then circulated to the Coordinating Committee for comments and corrections before the final document was submitted to the Department of Energy.

As was the case in the work plan for FY2005, the tasks proposed by the various organizations were reviewed internally according to the following criteria which were developed considering the mission and goals outlined in past review panel reports and oversight committee discussions, and in consultation with the DOE program manager.

1. A task should meet one of the three program priorities:
 - a) The maintenance and update of information in the USNDP nuclear physics databases;
 - b) The improvement of dissemination of the information contained in those databases to the user community;
 - c) The modernization of data evaluation software used by the program participants.
2. A task should be useful to more than a single user community.
3. A task should not duplicate effort within or outside the program.

The plan is divided into six major components. Specific tasks have been assigned to one of these components. They are as follows:

- NNDC Facility Operation
- Coordination
- Nuclear Physics Databases
- Information Dissemination
- Nuclear Structure Physics
- Nuclear Reaction Physics

The following section details the proposed work plan for FY2006, defining tasks, organizational responsibilities, and planned activities. It is envisioned that this document will serve as the basis for a performance review at the end of fiscal year 2006. For the first time, the

Idaho group (now at a .2 FTE level) that was supported by the NNDC has been included in the NNDC plan.

An effort table follows the detailed work plan. This effort table provides a summary of the total effort devoted to the defined tasks and the distribution of this effort by organization. The effort table shows a significant decrease in the level of effort as compared to the FY2005 plan. The DOE/Science supported scientific and professional effort has decreased by about 2.0 FTE. The most significant reductions are at BNL, LANL and TUNL. These decreases are partially offset by increases in staff at LBNL and ORNL. The major contributor to these decreases is an overall program decrease of slightly more than 5% in the FY2006 Presidential Budget. An approximately 47% cut in the funding in the "Universities" category that includes McMaster University, NIST and TUNL is not reflected in the following plan. However, given that compilation and evaluation have been given the highest priority in the President's FY2006 budget proposal, it seems clear that the nuclear modeling work at TUNL and the neutron reaction standards effort at NIST would not be carried out without additional funding. Furthermore, the nuclear astrophysics effort at McMaster would be discontinued when the three-contract terminates in FY2006.

For the third year, the effort table contains a complete reporting of the nuclear data effort supported by other organizations, largely NNSA, which again amounts to about 56% of the total U.S. nuclear data effort.

Work Plan Tasks and Planned Activities

I. NNDC Facility Operation

A. Management

This task includes planning, budgeting, personnel, interaction with BNL management, and interaction with funding authorities.

B. Library

NNDC maintains an archival collection of low- and intermediate-energy nuclear physics publications. This library supports the NNDC compilation activities and the U.S. nuclear reaction and nuclear structure data evaluation and international nuclear structure evaluation.

C. Computer Operation

The NNDC operates several servers running Red Hat Enterprise Linux in support of their compilation, evaluation, database maintenance, and information dissemination functions. In addition, each staff member has a PC that supports an interface to these Linux servers and supports administrative functions such as word processing and email. Furthermore, MS Windows servers provide centralized backup, printing and file serving for the PCs. This task includes software upgrades, hardware and software procurements, machine operations and internal user support for both the Linux and Windows platforms.

BNL Planned Activities:

- Scan and remediate regularly vulnerabilities on NNDC servers and clients to ensure compliance with DOE cyber security requirements
- Purchase and install a new and powerful EMPIRE server for faster processing of ENDF/B-VII data files
- Port EMPIRE codes and scripts from Linux to Windows platform.
- Develop an automatic failover system for the NNDC Web server.
- Make operational replication of nuclear database updates from NNDC to NDS/IAEA.

II. Coordination

A. National Coordination

ANL -- Chair the Measurement and Basic Physics Committee of the Cross Section Evaluation Working Group.

ANL Planned Activities:

Organize and chair the CSEWG Measurement and Basic Physics Committee.

BNL -- Chair USNDP Coordinating Committee, chair Cross Section Evaluation Working Group, develop USNDP work plan, and maintain its USNDP Web site.

BNL Planned Activities:

Prepare FY2007 work plan for USNDP in time for spring 2006 FWP submittals.

Organize and chair CSEWG Meeting at BNL in November 2005.

Organize and chair USNDP Meeting at BNL in November 2005.

Edit and publish summary reports of the CSEWG and USNDP meetings.

Edit and publish FY2005 USNDP Final Report.

Maintain CSEWG and USNDP Web sites.

LANL -- Chair U.S. Nuclear Data Program's Nuclear Reaction Working Group and help coordinate nuclear reaction data work at different labs to advance USNDP; chair Evaluation Committee of the Cross Section Evaluation Working Group.

LANL Planned Activities:

Organize and chair CSEWG Evaluation Committee meeting at BNL, November 2005.

Organize and chair Nuclear Reaction Working Group meeting at USNDP meeting in November 2005, and help coordinate Homeland Security, Astrophysics, and RIA Task Forces.

LBNL -- Serve as a member of the USNDP Coordinating Committee and chair the USNDP Nuclear Structure and Decay Data Working Group in addition to overseeing, coordinating, and directing the work of members of the Isotopes Project. The latter effort includes working with LBNL management, with other members of the USNDP, and with the program officers of the DOE.

LBNL Planned Activities:

Organize and chair Nuclear Structure and Decay Data Working Group meeting at USNDP meeting, November 2005.

ORNL -- Chair the Astrophysics Task Force, and help facilitate and coordinate nuclear astrophysics data work at different labs to advance USNDP goals; provide leadership in planning future activities in nuclear data for nuclear astrophysics

ORNL Planned Activities:

- Summarize USNDP efforts in nuclear data for nuclear astrophysics at USNDP Meeting in November 2005
- Communicate current efforts and future plans with researchers in nuclear astrophysics data
- Discuss future plans in nuclear astrophysics data with USNDP/NNDC and DOE

B. International Coordination

ANL – Represent ANL in the IAEA-sponsored International Nuclear Structure and Decay Data Network. Participate in IAEA-sponsored coordinated research programs (CRP) and training workshops. Participate in the NEA Working Party on International Evaluation Cooperation

ANL Planned Activities:

- Participate in IAEA-sponsored CRP on “Updated Data Library for Actinides”
- Participate in NEA WPEC annual meeting

BNL – – Represent the United States in IAEA-sponsored Nuclear Reaction Data Center Network (NRDC) and Nuclear Structure and Decay Data Network (NSDD). The NNDC center head is the U.S. member and vice-chair of the IAEA’s International Nuclear Data Committee (INDC), the lead US member of the NEA Working Party on International Evaluation Cooperation (WPEC) in his position as chair of CSEWG. Many of the NNDC staff participate in IAEA/ICTP-sponsored activities such as Workshops and Technical Meetings.

BNL Planned Activities:

- Participate in the IAEA-sponsored NRDC meeting in 2006.
- Participate in NEA WPEC annual meeting in 2006.
- Organize and lecture at IAEA-sponsored training workshop for new structure evaluators in 2006.
- Provide lecturer for the IAEA nuclear reactions training workshop in 2006.
- Participate in IAEA CRP meeting on Reference Input Parameter Library RIPL-3.

LANL -- Participate in and chair international nuclear reaction data collaborations. This insures that the U.S. benefits from breakthroughs around the world, and plays a leadership role in new developments. LANL staff members chair NEA/WPEC committees on covariance data, fission spectra and international model code development cooperation. LANL will host visits by foreign scientists with international reputations to benefit from the exchange of information and ideas.

LANL Planned Activities:

- Participate in NEA/WPEC April 2006 meeting.
- Participate in relevant IAEA CRP meetings (Th-U fuel cycle, and RIPL-3).

Make latest version of NJOY data processing code available to the international community.

Host a couple of international visitors to LANL to collaborate on the evaluation of reaction data.

LBL – Participate in IAEA-sponsored training workshops and coordinated research programs on nuclear structure and decay data.

LBL Planned Activities:

Provide lecturer(s) for structure and decay data evaluator-training workshop if one is scheduled during FY06.

III. Nuclear Physics Databases

A. Nuclear Science References (NSR)

The NNDC is responsible for NSR, the bibliographic database for nuclear physics research. This task includes quality control, file update and maintenance, and file distribution to collaborators. Updates are done on a continuing basis. The preparation of NSR entries is given under Nuclear Structure Physics.

BNL Planned Activities:

Database distributed to collaborators monthly.

B. Experimental Nuclear Structure Data (XUNDL)

The NNDC is responsible for maintaining and providing access to the XUNDL database. This database contains compilations (in ENSDF format) of recently published or completed level-structure data. While the emphasis remains on recent high-spin physics publications, many low-spin studies are also included. The compilation work is mainly carried out at McMaster University. The McMaster group also coordinates this work with that of other centers. The NNDC updates the database as new/revised data sets are received from McMaster.

BNL Planned Activities:

Update database as input is received from McMaster.

C. Evaluated Nuclear Structure Data File (ENSDF)

The NNDC is responsible for the ENSDF, a database of evaluated experimental nuclear structure and decay data. The NNDC is responsible for format and content checking, preparation of manuscript, and the quality control (review) of evaluations submitted for inclusion. The NNDC maintains the database, which includes database updates and distribution to collaborators. Corrections are implemented on a continuing basis.

BNL Planned Activities:

Database distributed to collaborators twice a year.

D. Numerical Nuclear Data File (NuDat)

The NNDC is responsible for NuDat, which consists of a database and a suite of codes that access it, allowing web users to search for level and γ -rays properties extracted from ENSDF, ground and metastable state properties (Wallet Cards), atomic and nuclear radiations derived from ENSDF, and thermal neutron cross sections and resonance integrals. Additionally, NuDat contains an interactive Chart of Nuclei and interactive level schemes.

BNL Planned Activities:

Distribute NuDat to the IAEA every time there is an upgrade, about 10 times a year.

E. Neutron Reaction Data Bibliography (CINDA)

The NNDC is responsible for the CINDA database that contains references to nuclear reaction data in the published and unpublished literature. Since 2004, CINDA also contains bibliography information on charged-particle and photonuclear reactions. The database serves as an index to the data contained in the experimental database, CSISRS. The database is updated regularly as references are received and checked.

BNL Planned Activities:

Update CINDA database with references from the cooperating centers (500 expected)

F. Experimental Reaction Data File (CSISRS)

The NNDC is responsible for maintaining the CSISRS database at BNL. This database contains measured nuclear reaction data from low to intermediate energy regions. Many groups worldwide compile experimental data and send it to the central database in Vienna in the EXFOR format. Each is then responsible to update his satellite database. The effort described here includes quality control, file update and data transfer activities. The NNDC database is updated, as compilations are exchanged and checked from the compiling centers. The compilation activity is given under Nuclear Reaction Physics.

BNL Planned Activities:

Update CSISRS with EXFOR compilations from cooperating centers (500 expected)

G. Evaluated Nuclear Data File (ENDF)

The NNDC is responsible for ENDF, a database of evaluated nuclear data required for many nuclear applications. The work is organized under the Cross Section Evaluation Working Group (CSEWG), coordinated by the NNDC. The ENDF file contains complete descriptions of nuclear reactions of neutrons with many nuclides and elements for energies up to 20 MeV and radiations from radioactive decay. A number of evaluations for energies up to 150 MeV and for incident charged particles and photons are also included. The data are stored in the ENDF format developed at NNDC about 35 years ago, and adopted as an international standard. In addition to the U.S. library, ENDF/B, the database contains evaluated data libraries from the European Union, Japan, Russia, and China. This activity includes the processing and quality control for the U.S. ENDF/B library, the distribution of this database in the United States and the exchange of libraries internationally. A new version of the library, ENDF/B-VII, will be assembled, tested and made available to users through a Web interface linked to the relational database.

BNL Planned Activities:

Maintain ENDF discussion list to facilitate validation of ENDF/B-VII.

Complete phase 1 testing of ENDF/B-VII.

Complete assembly and release of ENDF/B-VII library in the first quarter of FY2006.

H. Database Software Maintenance

This activity includes software bug fixes and enhancements for the six nuclear physics databases maintained by NNDC.

BNL Planned Activities:

Re-write the selector generation program for NSR.

I. Database Systems Development

The multi-year effort to migrate the USNDP databases to a LINUX/SYBASE environment was completed in FY2004. After completion of the migration and testing, several follow-up tasks should be performed.

A new web interface, complementary to the existing one, should be developed to facilitate the retrieval of experimental data in CSISRS by non-ENDF users, such as nuclear astrophysics. This interface should focus on the relevant experimental data, such as a full reference to the publication, a comprehensive reaction description and the experimental data. The existing interface, giving access to the complete compilation (with more details than the reference, reaction and data) will be retained and will still be accessible to users who need it.

BNL Planned Activities:

Development of journal tracking database in support of NSR compilation.

Begin development of java-based publication codes for ENSDF.

Develop new CSISRS web interface for non-ENDF users.

Investigate java-based stand-alone versions of some databases and products.

Investigate XML formats for data exchange.

IV. Information Dissemination

The goal of the dissemination activities of the USNDP is to provide scientists and engineers with nuclear data from the USNDP-maintained nuclear databases in a variety of user-friendly formats and media.

A. Web Site Maintenance

The NNDC provides electronic access to the nuclear physics databases that it maintains on behalf of the USNDP as well as access to other nuclear physics information through its web site. The NNDC web services are powered by four 2.8 GHz dual-processor Dell servers running on the Linux operating system and using the Apache Tomcat and Sybase server software. This solution was made public in April 2004 and has proven to be secure, fast and to have minimum downtime. Most of the databases were redeveloped to take advantage of the new hardware possibilities as well as new programming technologies, such as the use of the Java and Java scripts languages. In FY 2005 this system was upgraded from a single Web server to dual Web server system. This upgrade significantly increases reliability of the system. The NNDC also maintains the Atomic Mass Data Center Web site. Other USNDP members also offer nuclear physics information through their Web sites. These services require resources to maintain currency and improve performance.

ANL Planned Activities:

- Maintain electronic access to the ANL Nuclear Data Measurements (ANL/NDM) report series web site.
- Maintain and upgrade Experimental Resources for Nuclear Data Web site.
- Maintain and upgrade ANL Nuclear Data Information Web site.

BNL Planned Activities:

- Improve NSR and ENSDF Web interfaces.
- Maintain Web interface to the ENDF database.
- Develop new Web interfaces for Atomic Masses and B(E2).
- Replace Perl-based programs with a Java version.
- Improve reliability and cyber security of its Web services by installing the latest version of Apache/Tomcat servers and mod-jk2 connector software for a new dual Web server system.
- Maintain currency of the CSEWG, USNDP and the NNDC Web sites.

LANL Planned Activities:

- Include access to new reaction and structure data evaluations, supported by DOE/Nuclear Physics, via the T-16 Web site.
- Provide actinide ENDF/B-VII data via LANL's WWW site for criticality data testing, together with other LANL evaluations (e.g., light nucleus reactions).

LBL Planned Activities:

Maintain and update Active Server Pages enabling interactive searches of nuclear structure data, radioactive-decay data, neutron-capture γ -ray data, x-ray data, atomic-mass data and Nuclear Science References as needed. Maintain web pages for fission data, nuclear systematics and nuclear science education.

Support the Isotope Explorer 2 and 3 software previously developed by LBNL.

LLNL Planned Activities:

Maintain LLNL's Nuclear and Atomic Data Viewer.

Extend the Nuclear and Atomic Data Viewer as per user requests.

Maintain and upgrade LLNL's Computational Nuclear Physics web pages.

ORNL Planned Activities:

Development and maintenance of our WWW/FTP site providing the RadWare interface to ENSDF and XUNDL data sets will be terminated

Development and maintenance of our online software suite to convert nuclear data to astrophysical reaction rates and plot, manipulate, and share results online will be terminated

Efforts to regularly update nuastrodata.org html web pages will continue

TUNL Planned Activities:

Continue to improve the TUNL website and provide access to new information on $A = 3 - 20$ nuclei.

Continue to prepare new PDF and HTML documents of the most recent TUNL reviews.

Continue to provide PDF and HTML documents for FAS reviews for the $A = 3 - 20$ series;

Continue to provide General Tables to accompany the most recent TUNL reviews of the $A = 3 - 20$ series;

Continue to provide Energy Level Diagrams (in GIF, PDF and EPS/PS formats) to accompany the PDF and HTML documents for the most recent TUNL reviews and preliminary reports, and for the earlier FAS reviews.

B. Customer Services

This task accounts for the non-electronic services which the USNDP renders to customers. At the scientific staff level, this means direct assistance to users needing advice from nuclear data experts or advice on solving complex queries *via* electronic access to the database. The NNDC staff allocation at the support level is for maintaining a "help desk" and for administrative/clerical support of its customer services.

C. Publications

The USNDP provides some paper publications as well as electronic access to the nuclear physics databases that it maintains. This includes the Nuclear Data Sheets published by Elsevier and various versions of the Nuclear Wallet Cards.

BNL Planned Activities:

Prepare twelve issues of Nuclear Data Sheets for publication

Investigate a publication of adopted levels and gammas of all nuclides in ENSDF in electronic form (Web and CD-ROM).

LANL Planned Activities:

Issue the proceedings of international data conference on nuclear (Santa Fe, 2004), as AIP conference proceedings. The proceedings contain 393 papers including world-wide nuclear data activities. (This effort mainly supported from other sources.

V. Nuclear Structure Physics

A. NSR Abstract Preparation

The literature search and preparation of KEYWORD abstracts for publications included in NSR require scientific expertise.

BNL will be working with IAEA in Vienna to include them in the keywording effort. Eventually they will take over responsibility for several European journals (Nuclear Physics A, European Physics Journal A, and Physics Letters B; approx. 30% of keywording effort).

BNL Planned Activities:

Prepare entries for 4100 new references, and keyword abstracts for 3100 of them.

Train IAEA Nuclear Data Section staff in NSR keywording.

Transfer keywording of the European Journals (Nucl. Phys. A, Eur. Phys. J. A, and Phys. Lett. B) to IAEA Nuclear Data Section.

B. Compilation of Experimental Structure Data

This activity involves compilation of recently published or completed experimental nuclear structure data for inclusion in XUNDL.

BNL Planned Activities:

Compile BE(2) experimental data.

McMaster Planned Activities:

Compile data sets (in ENSDF format) for current publications with emphasis on high-spin physics, but many low-spin and decay data publications will also be compiled.

Review compiled data sets submitted by other data centers prior to inclusion in the XUNDL database.

Communicate with the authors of the original papers for data-related problems and to request additional details of unpublished data. On an annual basis send a copy of all such private communications to NNDC for archival and distribution purposes.

Train a new undergraduate student in early 2006 for XUNDL compilation work.

ORNL Planned Activities:

This activity will be terminated at ORNL.

C. Data Evaluation for ENSDF

The USNDP evaluates nuclear structure and decay data for inclusion in the ENSDF database. This effort includes the critical analysis of all available experimental nuclear structure and radioactive decay data for a nucleus or group of related nuclei to deduce recommended values from the measured data and prepare a file in ENSDF format that will be the basis for a publication in “*Nuclear Data Sheets*” and will be used to update the contents of the USNDP nuclear structure and decay database, ENSDF. The US effort is supplemented by foreign contributions prepared under the auspices of the IAEA-sponsored international Nuclear Structure and Decay Data network.

ANL Planned Activities:

- 1.5 equivalent mass chains will be evaluated and published.
- At least one mass chain will be reviewed.

BNL Planned Activities:

- Five equivalent mass chains will be evaluated.
- At least four mass chains will be reviewed.
- Continue monitoring of 3 or more new foreign ENSDF evaluators.

LBNL Planned Activities:

- Evaluate 4 mass chain equivalents, including a minimum of one from the actinide region and one from the $A=24-30$ region.
- Review mass-chain evaluations, as requested.
- Participate in training and/or mentoring of new structure evaluators, as needed.

McMaster Planned Activities:

- 1.5 equivalent mass chains (including the $A=31-44$ region) will be evaluated.
- Mass chains will be reviewed as requested.
- Update superdeformed-band data in ENSDF for new publications. All nuclides will be covered that do not require extensive updating and reevaluation for data sets involving low-spin or non-SD structures.
- Some collaboration with a new center/evaluator as part of training.

ORNL Planned Activities:

- Complete evaluation of structure information for nuclei with $A=241, 208,$ and 245
- Start evaluations of $A=248$ and 246 nuclei

TUNL Planned Activities:

- Prepare the ENSDF files for $A = 11-12$ nuclei corresponding with the *Nuclear Physics A* publication.
- Begin preparation of the ENSDF file for $A = 13$ nuclei corresponding to the *Nuclear Physics A* publication.

D. Ground and Metastable State Properties

NNDC maintains a database of nuclide properties for the Nuclear Wallet Cards.

BNL Planned Activities:

Update database as new information becomes available.

E. Radioactive Decay Data Evaluation

Decay data for nuclides of importance for metrology are evaluated in an international collaboration. When complete, these evaluations will be entered into the ENSDF format and merged into the ENSDF database. In the United States, LBNL coordinates this project.

ANL Planned Activities:

Evaluate decay data for one radionuclide.

Review decay data evaluation for one radionuclide.

LBNL Planned Activities:

Coordinate and plan activities of this international collaboration.

Review the evaluations of about five radionuclides.

Submit decay datasets for one radionuclide.

F. Neutron-Induced γ -Ray Data Evaluation

The EGAF (Evaluated Gamma-ray Activation File) database, disseminated by the IAEA, provides discrete-line γ -ray information from thermal (n, γ) reactions, tailored to suit the needs of the neutron activation analysis community. Statistical-model calculations can generate quasi-continuum photon cascade data to complement these experimental discrete-line data. Together, these data provide a valuable resource required for updating the ENDF database. The EGAF database also requires ongoing maintenance and development to make it more useful to the applied communities it serves.

LBNL Planned Activities:

Maintain and develop EGAF database (i) by adding any new (n, γ) data that become available from the Budapest reactor or elsewhere, along with any total radiative-capture cross-sections derived from them, (ii) by revising (in collaboration with IAEA) neutron-capture decay data in EGAF in order to serve the neutron activation analysis community better, and (iii) by extending EGAF (in collaboration with IAEA and LLNL) to include available neutron-reaction γ -ray data measured at reactor-neutron energies.

Continue collaboration with LLNL (see also Section VI.B) to perform statistical-model calculations of quasi-continuum γ -ray cascade information. This also includes (i) supervision of a doctoral student who will generate several new, complete ENDF-format capture γ -ray datasets for use with MCNP and other transport-code calculations and (ii) development of a utility code for the analysis of statistical γ -ray feedings

for (n, γ), β decay, and other reaction-gamma datasets to assist evaluators in the assignment of level $J\pi$ values and the normalization of decay data when the decay scheme is incomplete.

G. Evaluation of Light Nuclei for *Nuclear Physics A*.

TUNL evaluates additional data not included in ENSDF for publication in *Nuclear Physics A* and on its Web site

TUNL Planned Activities:

Distribute preliminary review of $A = 12$ nuclides for comments.

Prepare "*Energy Levels of Light Nuclei, A = 11 - 12*" for publication in *Nuclear Physics A*.

Publish evaluation of $A = 3$ nuclides in *Nuclear Physics A*.

Begin evaluation of $A = 13$ nuclei and prepare preliminary report to be distributed for comment.

H. Nuclear Structure Data Measurement

LANL/LANSCE maintains a small program to measure nuclear decay information.

LANL Planned Activities:

Examine prompt gamma-ray emission data from neutron reactions on ^{130}Te and ^{100}Mo to search for previously unobserved transitions in these and other, nearby residual nuclei.

Interact with mass chain evaluators on the nuclear structure of these nuclei.

I. ENSDF Physics and Checking Codes

The NNDC maintains ENSDF checking and physics programs on behalf of the national and international evaluator networks

BNL Planned Activities:

Maintenance and upgrades for format changes as required.

Upgrade LOGFT to properly treat higher-order (≥ 3) unique forbidden β^\pm transitions. Upgrade RADLIST to use the Schönfield electron-capture probabilities

Development of ENSDF editor as well as Java versions of LOGFT, BRICC, ALPHAD and FMTCHK.

VI. Nuclear Reaction Physics

A. Experimental Data Compilation

The NNDC, as part of a larger international cooperation, has responsibility for compiling experimental nuclear reaction data that have been produced in the U.S. and Canada.

Incident neutron reactions have been well covered historically. NNDC thus concentrates on new measurements only. In this fiscal year, ANL will contribute to this task.

Since incident charged particle data have not been completely compiled in the past, NNDC is compiling new charged-particle measurements. In addition, because of emerging needs such as astrophysics, the NNDC is compiling older data. Hence, there is a larger staff commitment to compiling this type of data.

NNDC is responsible for maintaining the manuals describing the EXFOR format and the methods for compiling different kinds of data.

ANL -- Prepare EXFOR files for experimental neutron activation data measured in collaboration with IRMM.

ANL Planned Activities:

Submit EXFOR files to the NEA Data Bank for those original data sets provided to ANL by IRMM for processing.

BNL Planned Activities:

Compile data from 200 charged-particle and neutron reaction publications.

B. ENDF Evaluations

Evaluated nuclear reaction data, for applications and for basic science needs, are stored in the ENDF database, which is maintained by BNL. As chair of the CSEWG evaluation committee, LANL staff works with BNL to insure quality control, particularly for new evaluations. New evaluations funded primarily from other sources are prepared for archival in the ENDF library. BNL, LANL, LLNL and ORNL provided neutron, proton and photonuclear reaction data evaluations for ENDF/B-VII released in FY2006. LLNL develops a computer code that translates LLNL evaluations in the internal ENDL format into ENDFB-6 formatted data so that LLNL evaluations can flow back into the nuclear data community.

ANL Planned Activities:

No work planned for FY2006.

BNL Planned Activities:

Respond to user needs for evaluated nuclear reaction data.

Collect and address users' feedback related to the ENDF library.

Work with LANL to complete upgraded evaluations for ENDF/B-VII, to be released in December 2005.

Develop methodology for providing covariance data, in the fast neutron energy region, to the next release of ENDF.

LANL Planned Activities: (work mostly supported from other sources)

Fix formatting issues reported by BNL, and submit the final version of LANL ENDF evaluations, for U, Pu, Am, Np isotopes that perform well in criticality benchmarks.

Provide upgraded ENDF evaluated data files for charged-particle reactions having $A \leq 10$, including covariance data.

Include covariance data for important actinides (this is supported by many projects including APCI, criticality safety, and also a WPEC collaboration).

Work with BNL to complete upgraded evaluations for new version of ENDF: ENDF/B-VII, for release at the end of CY'05.

Provide criticality data testing of the actinide evaluations, in fast, intermediate, and thermal assemblies, for validation of the new ENDF/B-VII evaluations.

LLNL Planned Activities: (work mostly supported from other sources)

Submit new improved evaluations for neutron induced reactions on nuclei in the $A=43-56$, $74-83$, and $123-158$ mass regions.

Review state of actinide evaluations and make improvements based on study of systematics in this mass range for DNEA program.

Validate surrogate reaction technique using $^{234,236}\text{U}(\alpha,\alpha'f)$ reactions as surrogates for $^{233,235}\text{U}(n,f)$ reactions, using Hauser-Feshbach calculations.

Submit new evaluations for $^{74,74}\text{As}$ for eventual inclusion in ENDF/B-VII.

LLNL - The Institute of Isotope and Surface Chemistry, Budapest has recently undertaken an extensive set of elemental measurements of capture gamma-ray energies and intensities as part of an IAEA CRP on "Development of a Database for Prompt Gamma-ray Neutron Activation Analysis (PGAA)," led by LBNL. The evaluated tables of prompt and delayed gamma-ray yields developed by this activity, called the Evaluated Gamma-ray Activation File (EGAF), are a significant improvement over previous work. LBNL and LLNL will collaborate to develop a set of ENDF files to be used to update the capture gamma-ray production information in the ENDF/B database. The availability of these data in coupled neutron-photon transport codes is very important to several national security programs. This project is leveraged by funding from these programs.

LLNL Planned Activities:

Work with graduate student to write paper on the significance of parity in the statistical model of gamma decay.

Simulate the gamma-ray cascade from resonance capture in order to add information on the quasi-continuum of gamma rays for $A = 40$ nuclei where level spacings become comparable to detector resolution. This

information is usually not available experimentally because the targets used were not typically mono-isotopic.

Extend the data files up to approximately $E_n = 100$ keV based on the results of the simulations.

Produce ENDF files with the discrete and quasi-continuum gamma-ray spectra.

C. ENDF Manuals and Documentation

NNDC is responsible for maintaining the format and procedures manual for the ENDF system. We also produce the documentation supporting the contents of the ENDF/B library.

BNL Planned Activities:

Maintain ENDF-6 formats manual that is available on the Web. This format is used for the ENDF/B-VII release.

D. Nuclear Reaction Standards

Nearly all nuclear reaction data measurements are made relative to some reaction standard such as the hydrogen elastic cross section. Maintaining accurate current values for the standard cross sections is the objective of this task, which can be accomplished only through international cooperation. A new international evaluation of the neutron cross section standards was initiated to provide the improved standards that are needed. This evaluation, which should be completed this year, has been largely performed by an IAEA Coordinated Research Project (CRP) with support, primarily experimental in nature, through the Working Party on International Evaluation Cooperation (WPEC) of the Nuclear Energy Agency and CSEWG.

ANL Planned Activities:

No work planned for FY2006.

LANL Planned Activities:

Participate in the international effort to reevaluate the light-element standard cross sections with LANL leadership for H and Li, and investigate the nature of output covariance data from R-matrix analyses of systems containing the light-element standard cross sections.

Incorporate the fission cross section standards (^{235}U , ^{239}Pu) into the new ENDF evaluations, and perform validation tests with integral measurements.

NIST Planned Activities:

Complete the work through the CRP providing the remaining standards and uncertainties for the ENDF/B-VII library.

Coordinate the nuclear data standards activity of the NEA Working Party on International Evaluation Cooperation) and chair the IAEA CRP on the Improvement of the Standard Cross Sections.

Participate in the IAEA data development project on maintenance of the neutron cross section standards.

Complete the work through the CRP of the understanding of the covariances/variances obtained from the standards evaluation.

Finish the documentation of the standards evaluation process.

Begin the documentation of changes to EXFOR files based on the corrections obtained from the files of Poenitz and new information obtained from the CRP investigations.

Continue to recommend new measurements and perform examinations of the data from them for use in future evaluations of the standards.

Continue the collaboration with Ohio University and LANL on the measurement of hydrogen elastic scattering angular distributions.

E. Nuclear Model Development

This task covers activities such as development and validation of nuclear reaction models used for prediction of nuclear reaction cross sections. The two major codes are GNASH (LANL) and EMPIRE (BNL). Measurements made by ANL and LANL along with other measurements made with DOE low-energy physics funds will play a crucial role in the validation of the models in these computer codes. BNL and LANL will also participate in the IAEA Coordinated Research Project RIPL-3 to improve accuracy and reliability of input parameters used in nuclear reaction calculations

ANL – Continue an ongoing collaboration with IRMM to utilize experimental neutron activation data for gaining an improved understanding of nuclear model parameters.

ANL Planned Activities:

Assist IRMM in preparing publications to document completed work.

BNL – We are active in nuclear reaction model development focusing on the BNL code EMPIRE. The work in this fiscal year will concentrate on further extensions and improvements of its capabilities, including a new version of the level densities with appropriate parameterization. The work on validation of the code will be actively pursued, in particular in relation to emerging requirements of homeland security applications. Close collaboration with LANL will continue focusing on validation of the fission models in EMPIRE and GNASH. Major effort will be dedicated to the development of capabilities for estimating covariance data for fast-neutron reaction cross sections.

In response to the needs from many user groups (such as Gen-IV reactors, criticality safety, Advanced Fuel Cycle Initiative), BNL will collaborate with LANL and ANL on a methodology for nuclear data covariances. To this end, a covariance module in EMPIRE for fast neutron energies should be developed and tested.

BNL Planned Activities:

Release new version of the code EMPIRE with above-mentioned improvements.

Develop the first version of covariance module in EMPIRE for fast neutrons.

LANL – Nuclear reaction theory calculations have played a crucial role in the evaluation of nuclear data, and will continue to play an important part in future evaluations due to the decrease in operating experimental facilities throughout the world. The LANL GNASH code has proved to be an important tool, and we will continue development of a new version of this code, McGNASH, to provide a state-of-the-art capability to predict reaction cross sections. This also involves a close collaboration with experimentalists at LANSCE to interpret new measurements using the GEANIE and DANCE gamma-ray detectors, as well as (n,charged-particle) data. These data will result in advances in our understanding of nuclear reaction mechanisms, and improvements in our modeling codes. Also, largely under DOE/DP support, we will continue modernization of our R-matrix EDA code (used for light nucleus calculations and data evaluations) and explore implementation of exact particle-exchange formalism.

LANL Planned Activities:

- Calculate and interpret gamma-ray reactions measured with GEANIE at LANSCE. A current area of research is understanding pre-equilibrium spin transfer physics, by studying residual nucleus gamma-ray decay cross sections as a “spin window”. We will complete the analysis of $n+^{90}\text{Zr}$ data by using a quantum mechanical pre-equilibrium process, and the same procedure will be applied to ^{48}Ti data.
- Collaborate with LANSCE experimentalists on the interpretation of new FIGARO measurements of prompt neutron spectra.
- Perform radiative capture calculations in support of new DANCE detector capture measurements (depends on what data are first reported by DANCE experimentalists).
- Obtain information on nuclear level densities on more fission product nuclei through (n,x γ) and (n,n') reactions to extend our present measurements on ^{130}Te and ^{99}Tc .
- Measure the fission neutron spectrum and $\bar{\nu}$ from neutron-induced fission of actinides with the FIGARO array for neutron energies from 1 to 100 MeV. The data will test the Los Alamos Model of neutron emission in fission.
- Measure neutron-capture cross sections on radioactive nuclei at DANCE with the goal of deriving nuclear level densities for nuclei off stability from neutron capture resonances.
- Develop a Monte Carlo method to calculate the fission neutron spectrum, taking account of sequential neutron evaporation from fission fragments. The calculation will be compared with the Los Alamos model that is widely used for the prompt fission neutron spectrum evaluations.

TUNL – Ongoing work involves the development of pre-equilibrium nuclear reaction models, as well as the improvement and benchmarking of the computer code PRECO. Specific tasks to be undertaken are difficult to predict because this is basic research where the amount of effort required and the direction that will result is unknown ahead of time. The current priority is to complete preparations for the new release of PRECO, but this may be delayed to allow for the resolution of one or more open issues with the models.

TUNL Planned Activities:

- New release of PRECO and its users manual (if not completed in FY05).
- Development of a simple phenomenological model for the breakup of complex projectiles.
- Possible revisions to the exciton model and/or global input set, and thus to the code.

F. Nuclear Reaction Data Measurements

The measurement of nuclear data is essential to provide data, which either cannot be calculated or cannot be calculated with sufficient accuracy for user applications. This activity is also essential to support and verify nuclear model development and application.

BNL – We are responsible for compilation of nuclear reaction data within the USNDP. It is very important for the compilers to maintain active contact with data producers so that they have up-to-date knowledge of measurement procedures and techniques, including their advantages and drawbacks, along with an understanding of data uncertainties. This goal can be best achieved by taking part in nuclear data measurements. BNL will do so by devoting a relatively small effort, 0.1 FTE, to collaboration primarily with the LANSCE data measurement program at LANL.

BNL Planned Activities:

- Participate in $(n,n'\gamma)$ and fission neutron spectrum measurements at FIGARO at LANSCE.
- Participate in the Lead-Slowing Down Spectrometer measurements on ultra-small targets, such as $^{235m}\text{U}(n,f)$, at LANSCE.
- Participate in measurements of fission yields from U and Pu isotopes with a mass spectrometer at ILL, France.

LANL Planned Activities:

- Measure and analyze prompt neutron emission following interactions of fast neutrons with fission products such as strontium and barium isotopes. These measurements are gated on gamma rays from $(n,n'\gamma)$ reactions.
 - Measure the fission neutron spectrum and $\bar{\nu}$ from neutron-induced fission of ^{239}Pu with the FIGARO array for neutron energies from 1 to 100 MeV. Collaborators include scientists from CEA (France).
 - Measure prompt gamma rays from neutron interactions with stable fission product nuclei, e.g. ^{124}Sn , with the goal of deducing partial reaction cross sections.
 - Measure the neutron capture cross section of $^{240,242}\text{Pu}$ at DANCE for neutron energies less than 200 keV.
 - Measure neutron capture cross section at DANCE on at least one radioactive isotope of importance to nuclear astrophysics.
- LBNL encourages members of the Isotopes Project to spend a portion of their time ($\leq 20\%$) working on experiments in the area of low-energy nuclear physics, with emphasis on experiments related to nuclear data needs.

LBLN Planned Activities:

LBLN encourages members of the Isotopes Project to spend a portion of their time ($\leq 20\%$) working on experiments in the area of low-energy nuclear physics, with emphasis on experiments related to nuclear data needs. Measurements of low-energy cross sections for (α, γ) reactions, of the half-life of ^{108m}Ag , and of total (n, γ) cross sections are ongoing. Other plans include PGAA elemental analyses in collaboration with researchers at the Budapest reactor, neutron activation analysis experiments using the 10^{10} n/s LBNL D+D neutron generator, and participation in an IAEA interlab comparison of the PGAA analysis of cement standards using the LBNL neutron generator. Other plans depend on the interests of new staff.

LLNL Planned Activities:

Neutron induced reaction measurements on one or more isomer targets.
Perform surrogate (n, n') , $(n, 2n)$, (n, γ) and (n, f) measurements on several nuclei with programmatic and/or astrophysical importance.

G. Evaluation of Data Needed for Astrophysics

The objective of this activity is to support the nuclear data needs of the increasingly sophisticated simulations of astrophysical phenomena. The Astrophysics Task Force of the USNDP, presently chaired by ORNL, serves to improve communication and coordination of nuclear data evaluation activities relevant for studies in astrophysics.

ANL Planned Activities:

No work planned for FY2006.

BNL Planned Activities

No activity planned in FY 2006.

LANL -- Participate in the USNDP effort to develop high-quality data for astrophysics calculations of nucleosynthesis. Make new calculated and evaluated results available to the wider astrophysics research community *via* the USNDP Astrophysics Task Force.

LANL Planned Activities:

Continue N-N analysis to energies above 50 MeV and provide evaluated n-p capture cross sections, rates, and covariance data.
Complete the re-analysis of $^{10}\text{B}+n$ reaction, using a re-constructed set of experimental data including covariance.
Complete neutron-rich fission barrier calculations, using new and improved multidimensional macro-micro fission model.
Improve neutron capture models to provide capture cross sections for nucleosynthesis network calculations.

McMaster University – Evaluate hydrogen and helium capture reactions on unstable proton-rich nuclei that are important for energy generation and element synthesis in stellar explosions, with a focus on reactions to be studied at radioactive beam facilities (e.g., TRIUMF-ISAC).

McMaster Planned Activities:

Evaluate the reaction rates of radiative proton capture on ^{26g}Al and ^{26m}Al .
Continue evaluations of rates of proton capture on ^{21}Na , ^{25}Al , ^{13}N , and the $^{18}\text{Ne}(\alpha,p)^{21}\text{Na}$ reaction, as experiments progress.

ORNL -- Evaluate capture reactions on radioactive proton-rich nuclei which are important for element synthesis and energy generation in stellar explosions.

ORNL Planned Activities:

Complete evaluations of proton capture on ^{18}F and the $^{14}\text{O}(\alpha,p)^{17}\text{F}$ reaction.
Continue assessments of capture reactions on p-rich unstable nuclides.
Extract spectroscopic information on N=51 nuclides ^{83}Ge and/or ^{85}Se from transfer reaction measurements.
Development of software suite to determine astrophysical reaction rates from cross sections, S-factors, and nuclear structure data will be terminated.

H. Reaction Data for RIA Target Design

Rare Isotope Accelerator facility design needs high-quality nuclear reaction data for target design. LANL will collaborate in order to provide key reaction cross-sections using theory calculations and measurements to evaluate the data.

LANL Planned Activities:

We aim to maintain important collaboration connections with the RIA community because of its importance in nuclear science, but effort is limited because of budget restrictions. However, we will continue to maintain a presence in the RIA planning community via participation in RIA meetings and workshops.

Nuclear Data Activities Funded from Sources Outside the Nuclear Data Program

BNL – Additional support for the nuclear data work at the National Nuclear Data comes from two sources:

1. **Academic Press.** Academic Press supports the production of computer-generated photo-ready copy of manuscripts for the Nuclear Data Sheets.
2. **Nuclear criticality safety.** Consultant services and technical work on neutron cross-section evaluation for fission products and assessment of their current evaluations for the DOE-NNSA Nuclear Criticality Safety program.

LANL – Most of the nuclear data work is supported from funds other than the nuclear data program. The effort is in support of the ENDF related work of nuclear model development, nuclear reaction evaluation and ENDF processing.

1. **Nuclear weapons (ASCI program).** This work supports the development of more accurate ENDF cross section databases for actinide fission fuels, light-nucleus thermonuclear fuels, and for reactions important on materials used for diagnostics (radiochemical reactions). Nuclear model code development, for both statistical and preequilibrium models, and for light R-matrix codes, is supported by this program, as is the development of the NJOY data processing code for providing data usable by Monte Carlo and deterministic transport codes in applications. The funding also supports physics research developments in nuclear reaction and structure theory (with a recent emphasis on nuclei and isomers away from stability), and fission theory. Data testing using integral benchmarks such as fast critical assemblies are used to validate the ENDF data.
2. **AFCI (Advanced Fuel Cycle Initiative).** This supports the development of improved nuclear data important for transmutation in the fast neutron energy region, as well as high-energy spallation models important for describing processes in the spallation target. Recent focuses have been improved ENDF data on minor actinides (ATW fuel), and lead and bismuth (target/coolant), as well as better intra-nuclear cascade codes for modeling neutron production and radionuclide production in the spallation target. This program also supports experimental nuclear reaction measurements at WNR.
3. **Nuclear criticality safety.** This funding supports improved nuclear data important in criticality safety studies, such as uranium isotopes, as well as data on chlorine, aluminum, etc. Data testing using critical assemblies and NJOY processing code development are also funded by the program.
4. **RIA R&D.** No recent support.

5. **LANL LDRD.** There are 3 LANL LDRD projects that support nuclear reaction data measurements. A new LDRD supports Am nuclear data work that includes evaluation, theory, and experiments.

LLNL – Most of the nuclear data work is supported from funds other than the nuclear data program (roughly 15 FTE). About one-third of this support goes to nuclear data evaluation, nuclear data processing and nuclear data validation. NNSA supports most of the LLNL nuclear data activities (70% of funding). Homeland Security (via NA-22) is a growing component of our funding profile and supports the actinide evaluation work for the Post Detonation Attribution project (20% of funding). A new component of our funding profile is the LDRD for the study of the surrogate reaction technique (10% of funding).

McMaster – The nuclear-structure data effort receives 0.5 FTE support from the Canadian research agency to evaluate A-chains/nuclides for ENSDF and to train/supervise summer students for compilation of experimental data from current papers for XUNDL.

NIST – A variety of sources support nuclear data activities.

1. **Commerce Department (NIST).** The Nuclear Data Verification and Standardization program has funding through the Commerce Department (NIST).
2. **NIST.** NIST provides 1 FTE for interferometry work, which has yielded coherent scattering lengths (which provide scattering data) needed for neutron cross section evaluations.
3. **NSF.** NSF provides 1 FTE for a graduate student to work on the interferometry experiments cited above.
4. **NIST.** NIST provides 1 FTE (75% experimental, 25% evaluation) for nuclear structure and decay data work. Much of this work also has applications in radioactivity standards and radio-pharmaceutical studies.

ORNL –The nuclear data work is partly funded by the Low Energy Nuclear Physics (LENP) program. A new Pilot Program in Nuclear Astrophysics Data has started with LENP funds to hire a postdoctoral fellow. This effort is tightly coupled with work in experimental and theoretical nuclear astrophysics at ORNL.

TUNL – The nuclear data work is partly funded by the Low Energy Nuclear Physics program through a TUNL/NCSU grant.

USNDP Staffing Table for October 2005 through September 2006

	ANL	BNL Sci/Pro	BNL Support	LANL	LBNL	LLNL
I. NNDC Facility Operation	0.00	1.45	0.75	0.00	0.00	0.00
Management		0.35				
Secretarial/Administrative Support			0.50			
Library			0.25			
Computer Operation		1.10				
II. Coordination	0.02	0.60	0.00	0.40	0.30	0.00
National Coordination	0.01	0.25		0.1	0.3	
International Coordination	0.01	0.35		0.3		
III. Nuclear Physics Databases	0.00	1.35	1.35	0.00	0.00	0.00
Nuclear Science References (NSR)		0.10	0.70			
Experimental Nuclear Structure Data (XUNDL)		0.05				
Evaluated Nuclear Structure Data (ENSDF)		0.15	0.65			
Numerical Nuclear Data (NuDat)		0.05				
Reaction Data Bibliography (CINDA)		0.05				
Experimental Reaction Data (CSIRS)		0.05				
Evaluated Nuclear Data File (ENDF)		0.15				
Database Software Maintenance		0.40				
Database System Development		0.35				
IV. Information Dissemination	0.01	1.35	0.20	0.10	0.15	0.00
Web Site Maintenance	0.01	0.55		0.10	0.15	
Customer Services		0.10	0.05			
Publications		0.70	0.15			

USNDP Staffing Table for October 2005 through September 2006

	McMaster	NIST	ORNL	TUNL	Program Total	
					Sci/Pro	Support
I. NNDC Facility Operation	0.00	0.00	0.00	0.00	1.45	0.75
Management					0.35	0.00
Secretarial/Administrative Support					0.00	0.50
Library					0.00	0.25
Computer Operation					1.10	0.00
II. Coordination	0.00	0.00	0.10	0.00	1.42	0.00
National Coordination			0.1		0.76	0.00
International Coordination					0.66	0.00
III. Nuclear Physics Databases	0.00	0.00	0.00	0.00	1.35	1.35
Nuclear Science References (NSR)					0.10	0.70
Experimental Nuclear Structure Data (XUNDL)					0.05	0.00
Evaluated Nuclear Structure Data (ENSDF)					0.15	0.65
Numerical Nuclear Data (NuDat)					0.05	0.00
Reaction Data Bibliography (CINDA)					0.05	0.00
Experimental Reaction Data (CSISRS)					0.05	0.00
Evaluated Nuclear Data File (ENDF)					0.15	0.00
Database Software Maintenance					0.40	0.00
Database System Development					0.35	0.00
IV. Information Dissemination	0.00	0.00	0.10	0.60	2.31	0.20
Web Site Maintenance			0.10	0.60	1.51	0.00
Customer Services					0.10	0.05
Publications					0.70	0.15

USNDP Staffing Table for October 2005 through September 2006

	ANL	BNL Sci/Pro	Support	LANL	LBNL	LLNL
V. Nuclear Structure Physics	0.78	3.30	0.00	0.10	2.48	0.00
NSR Abstract Preparation		0.50				
Compilation of Experimental Structure Data		0.05				
Evaluation of Mass Chains and Nuclides for ENSDF	0.68	2.40			2.05	
Ground and Metastable State Properties						
Radioactive Decay Data Evaluation	0.10				0.13	
Neutron-Induced γ -ray Data Evaluation					0.30	
Light Mass Evaluations for Nuclear Physics A.						
Nuclear Structure Data Measurement				0.10		
ENSDF Physics and Checking Codes		0.35				
VI. Nuclear Reaction Physics	0.02	1.10	0.00	1.10	0.50	0.40
Experimental Data Compilation	0.01	0.35				
Neutron Data	0.01	0.10				
Charged Particle Data		0.25				
EXFOR Manuals						
ENDF Evaluations		0.25		0.10		0.40
ENDF Manuals and Documentation		0.05				
Nuclear Reaction Standards				0.10		
Nuclear Model Development	0.01	0.35		0.20		
Nuclear Reaction Data Measurements		0.10		0.30	0.50	
Astrophysics Nuclear Data Needs				0.40		
Reaction Data for RIA Target Design						
DOE/Science Nuclear Data Funded Staff	0.83	9.15	2.30	1.70	3.43	0.40
Staff Supported by Other Funding	0.20	0.55	0.20	14.40		9.75
TOTAL STAFF	1.03	9.70	2.50	16.10	3.43	10.15

USNDP Staffing Table for October 2005 through September 2006

	McMaster	NIST	ORNL	TUNL	Program Total	
					Sci/Pro	Support
V. Nuclear Structure Physics						
NSR Abstract Preparation	0.50	0.00	0.50	0.90	8.56	0.00
Compilation of Experimental Structure Data	0.15				0.50	0.00
Evaluation of Mass Chains and Nuclides for ENSDF	0.35		0.50	0.45	0.20	0.00
Ground and Metastable State Properties					6.43	0.00
Radioactive Decay Data Evaluation					0.00	0.00
Neutron-Induced g-ray Data Evaluation					0.23	0.00
Light Mass Evaluations for Nuclear Physics A.				0.45	0.30	0.00
Nuclear Structure Data Measurement					0.45	0.00
ENSDF Physics and Checking Codes					0.10	0.00
					0.35	0.00
VI. Nuclear Reaction Physics						
Experimental Data Compilation	0.50	0.20	1.05	0.40	5.27	0.00
Neutron Data					0.36	0.00
Charged Particle Data					0.11	0.00
EXFOR Manuals					0.25	0.00
ENDF Evaluations					0.00	0.00
ENDF Manuals and Documentation					0.75	0.00
Nuclear Reaction Standards		0.20			0.05	0.00
Nuclear Model Development				0.40	0.30	0.00
Nuclear Reaction Data Measurements					0.96	0.00
Astrophysics Nuclear Data Needs	0.50		1.05		0.90	0.00
Reaction Data for RIA Target Design					1.95	0.00
					0.00	0.00
DOE/Science Funded Staff	1.00	0.20	1.75	1.90	20.36	2.30
Staff Supported by Other Funding	0.50	0.80		0.00	26.20	0.20
TOTAL STAFF	1.50	1.00	1.75	1.90	46.56	2.50