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Benchmark Data Through The International Reactor Physics Experiment Evaluation Project (IRPHEP)

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BENCHMARK DATA THROUGH THE INTERNATIONAL REACTOR PHYSICS EXPERIMENT EVALUATION PROJECT (IRPHEP)

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ABSTRACT

The International Reactor Physics Experiments Evaluation Project (IRPhEP) was initiated by the Organization for Economic Cooperation and Development (OECD) Nuclear Energy Agency's (NEA) Nuclear Science Committee (NSC) in June of 2002. The IRPhEP focus is on the derivation of internationally peer reviewed benchmark models for several types of integral measurements, in addition to the critical configuration. While the benchmarks produced by the IRPhEP are of primary interest to the Reactor Physics Community, many of the benchmarks can be of significant value to the Criticality Safety and Nuclear Data Communities. Benchmarks that support the Next Generation Nuclear Plant (NGNP), for example, also support fuel manufacture, handling, transportation, and storage activities and could challenge current analytical methods. The IRPhEP is patterned after the International Criticality Safety Benchmark Evaluation Project (ICSBEP) and is closely coordinated with the ICSBEP. This paper highlights the benchmarks that are currently being prepared by the IRPhEP that are also of interest to the Criticality Safety Community. The different types of measurements and associated benchmarks that can be expected in the first publication and beyond are described. The protocol for inclusion of IRPhEP benchmarks as ICSBEP benchmarks and for inclusion of ICSBEP benchmarks as IRPhEP benchmarks is detailed. The format for IRPhEP benchmark evaluations is described as an extension of the ICSBEP format. Benchmarks produced by the IRPhEP add new dimension to criticality safety benchmarking efforts and expand the collection of available integral benchmarks for nuclear data testing. The first publication of the "International Handbook of Evaluated Reactor Physics Benchmark Experiments" is scheduled for January of 2006.

Key Words: Integral-Benchmarks, Reactor Physics

1 INTRODUCTION

The International Reactor Physics Experiments Evaluation Project (IRPhEP) was initiated by the Organization for Economic Cooperation and Development (OECD) Nuclear Energy Agency's (NEA) Nuclear Science Committee (NSC) in June of 2002, after three years of pilot activities. The IRPhEP focus is on the derivation of internationally peer reviewed benchmark models for several types of integral measurements, in addition to the critical configuration. While the benchmarks produced by the IRPhEP are of primary interest to the Reactor Physics

Community, many of the benchmarks can be of significant value to the Criticality Safety and Nuclear Data Communities. Benchmarks that support the Next Generation Nuclear Plant (NGNP), for example, also support fuel manufacture, handling, transportation, and storage activities and could challenge current analytical methods. The IRPhEP is patterned after the International Criticality Safety Benchmark Evaluation Project (ICSBEP) and is closely coordinated with the ICSBEP in order to avoid duplication of effort and to effectively utilize available resources.

This paper highlights the benchmarks that are currently being prepared by the IRPhEP that are also of interest to the Criticality Safety Community. The different types of measurements and associated benchmarks that can be expected in the first publication and beyond are described. The protocol for inclusion of IRPhEP benchmarks as ICSBEP benchmarks and for inclusion of ICSBEP benchmarks as IRPhEP benchmarks is detailed. The format for IRPhEP benchmark evaluations is described as an extension of the ICSBEP format.

2 IDENTIFICATION AND TYPES OF MEASUREMENTS

Each experiment has a unique identifier that consists of two parts. Part 1 consists of the Reactor Name, Reactor Type, Facility Type and a Three Digit Numerical Identifier. Part 2 of the identifier begins on a separate line and includes the Measurement Type(s). Identifiers take the following form:

(Reactor Name)-(Reactor Type)-(Facility Type)-(Three-Digit Numerical Identifier)
(Measurement Type(s))

Identifier elements and their meanings are given below.

REACTOR TYPE		FACILITY TYPE		MEASUREMENT TYPE	
Pressurized Water Reactor	PWR	Experimental Facility	EXP	Critical Configuration	CRIT
VVER Reactors	VVER	Power Reactor	POWER	Subcritical Configuration	SUB
Boiling Water Reactor	BWR	Research Reactor	RESR	Buckling & Extrapolation Length	BUCK
Liquid Metal Fast Reactor	LMFR			Spectral Characteristics	SPEC
Gas Cooled (Thermal) Reactor	GCR			Reactivity Effects	REAC
Gas Cooled (Fast) Reactor	GCFR			Reactivity Coefficients	COEF
Light Water Moderated Reactor	LWR			Kinetics Measurements	KIN
Heavy Water Moderated Reactor	HWR			Reaction-Rate Distributions	RRATE
Molten Salt Reactor	MSR			Power Distributions	POWDIS
RBMK Reactor	RBMK			Nuclide Composition	ISO
Fundamental	FUND			Other Miscellaneous Types of Measurements	MISC

Examples of identifiers are:

ZPR-LMFR-EXP-001
CRIT-SPEC-REAC-COEF-KIN-RRATE

This identifier corresponds to the first evaluation of measurements made on the ZPR liquid metal fast reactor experimental facility. The critical configuration, spectral measurements, reactivity measurements and coefficients, kinetics parameters, and reaction rates were measured and the data are provided.

VENUS-PWR-EXP-001
CRIT-BUCK-RRATE

This identifier corresponds to the first evaluation of measurements made on the VENUS pressurized water reactor experimental facility. The critical configuration, buckling and extrapolation length, and reaction rate measurements were measured and the data are provided.

ZR6-VVER-EXP-001
CRIT-BUCK-SPEC-REAC-COEF-RRATE

This identifier corresponds to the first evaluation of measurements made on the ZR-6 VVER experimental facility. The critical configuration, buckling and extrapolation length, reaction rate, spectral measurements, reactivity measurements and coefficients, and reaction rates were measured and the data are provided.

3 FORMAT

The format for IRPhEP evaluations is patterned after the format used by the ICSBEP. The general format is: (1) describe the experiments, (2) evaluate the experiments, (3) derive benchmark specifications, and (4) provide results from sample calculations. Code and cross section information, including typical input lists, are provided in Appendix A. Additional information may be provided in subsequent appendices. The format is the same for all evaluations. Seldom, if ever, are all types of measurements made in a particular series of experiments. However, sections for all measurement types are retained in the format and it is simply stated, when applicable, that no such measurements were made. A detailed IRPhEP Evaluation Guide [1] can be obtained on the following two Internet Sites: http://nuclear.inl.gov/programs.shtml and http://www.nea.fr/lists/irphe/ . A brief description of the format is provided in this section.

Most criticality safety experts are familiar with the ICSBEP format [2]. Except for the expansion to include other types of measurements, there is only one minor difference between the two formats, a specific section for temperature has been added to Section 1.

The types of information and format presentation are the essentially the same for each measurement type. Therefore, the details of each subsection will only be stated once.

***SECTION 1.0 DETAILED DESCRIPTION*:** This section should start with a brief description of the scope and objectives of the experiment carried out.

A detailed description of the experiments and all relevant data are provided in the appropriate subsections within this section. The detailed description includes the measurement methods used and the results obtained. Enough information should be given in this section so that the derivation of benchmark-model specifications in Section 3.0 is evident. In general, modeling (idealization, simplification) of the experiment is not discussed here. However, if the exact experimental configuration is unknown (was not reported) or was too complicated to describe in detail and an idealization was provided by the experimenters, then the idealized experiment may also be discussed here, as well as in Section 3.1. Any discussion of an idealized experiment includes an explanation of the assumptions used in going from the real experimental configuration to the idealization.

Sources of the data should be indicated. Sources of data include published reports, logbooks, photographs, memos or other records provided by experimenters, and discussions with experimenters. Any inconsistencies in the data are mentioned in this section. A justification as to why the data can still be used is provided in the Evaluation of Experimental Data section (Section 2.0). Uncertainties in the measurements that were assigned by the experimenters, either in published or unpublished (e.g., logbooks) sources, should be included. Details of the main features of an experiment given in Section 1.1 for the critical and / or subcritical configurations are often the same for all other types of measurements. It is not necessary to repeat this information in each subsequent section. However, additions and modifications to the geometry and additional materials that are introduced for each particular measurement type must be described in detail in the appropriate subsections.

Descriptive information is provided for each measurement type in the appropriate section, Sections 1.1 through 1.10. In general, the descriptive information includes an overview of the experiment (Section 1.X.1), description of the experimental configuration (Section 1.X.2), description of material data (Section 1.X.3), temperature information (Section 1.X.4), and additional information that is relevant to the type of measurement. Drawings and sketches should be used liberally.

SECTION 1.1 ***Description of the Critical and / or Subcritical Configuration*****:** This section contains a detailed description of any critical and / or subcritical measurements that were performed. Uncertainties in the measurements assigned by the experimentalists, either in published or unpublished (e.g., logbooks) sources, should be included. Subsections 1.1.1 through 1.1.5 should contain an overview of the measurements, a description of the geometry of the experimental configurations, a description of the material data, temperature data, and additional information relevant to the critical and / or subcritical measurements, respectively. Detailed descriptions of the methods used to obtain the data should be included in the appropriate subsections.

SECTION 1.2 ***Description of Buckling and Extrapolation Length Measurements*****:** This section contains a detailed description of any buckling and/or extrapolation length measurements.

SECTION 1.3 ***Description of Spectral Characteristics Measurements*****:** This section contains a detailed description of any measurements made to determine spectral characteristics such as neutron spectra or $^{238}U_c/^{235}U_f$ ratios.

SECTION 1.4 ***Description of Reactivity Effects Measurements*****:** This section contains a detailed description of measurements such as control-rod worth, void effects, small sample worth, fuel substitution, and xenon effects. Values of parameters that were actually measured should be given in this section as well as specific data that were used to transform measured values into other parameters, such as group parameters of delayed neutrons. A clear distinction should be made between measured values, calculated values, and data that were used to process measured results.

SECTION 1.5 ***Description of Reactivity Coefficient Measurements*****:** This section contains a detailed description of measurements such as the temperature coefficient of reactivity, $\partial\rho/\partial T$; the moderator-height coefficient of reactivity, $\partial\rho/\partial H$; and soluble boron worth, $\partial\rho/\partial C_B$.

SECTION 1.6 ***Description of Kinetics Measurements*****:** This section contains a detailed description of measurements such as decay constants, β_{eff}, or prompt neutron lifetime.

SECTION 1.7 ***Description of Reaction-Rate Distribution Measurements*****:** This section contains a detailed description of reaction rate measurements such as flux maps, fission chamber scans, and wire activation fine-structure and macro-structure measurements.

SECTION 1.8 ***Description of Power Distribution Measurements*****:** This section contains a detailed description of power distribution measurements.

SECTION 1.9 ***Description of Isotopic Measurements*****:** This section contains a detailed description of isotopic measurements of discharged fuel.

SECTION 1.10 ***Description of Other Miscellaneous Types of Measurements*****:** This section contains a detailed description of other miscellaneous types of measurements that do not fit directly into one of the other categories such as conversion or breeding ratio measurements.

SECTION 2.0 ***EVALUATION OF EXPERIMENTAL DATA*****:** Missing data or weaknesses and inconsistencies in published data are discussed for each measurement type in Sections 2.1 through 2.10. The effects of uncertainties in data on the measured parameters are discussed and, if practical, quantified. All codes and data used for calculations of the effects of uncertainties should be specified. Use of data with large uncertainties or data that require assumptions on the part of the evaluator is justified in this section. If all or part of the data is found to be unacceptable for use as benchmark data, this fact is noted, and the reasons summarized. Unacceptable data are not included in Sections 3.0, 4.0, and Appendix A.

If data are provided in Section 1 for a certain measurement type, but have not yet been evaluated, it is so stated in the appropriate evaluation subsection.

SECTION 3.0 ***BENCHMARK SPECIFICATIONS*****:** Benchmark specifications provide the data necessary to construct a calculational model that represents the important aspects of the experiment. Data that are determined to be acceptable as benchmark-model data are provided in Sections 3.1 through 3.10. In general, the benchmark-model specifications include a description of the calculational methodology (Section 3.X.1); dimensions (Section 3.X.2); material data (Section 3.X.3); temperature data (Section 3.X.4); and the experimental value of each parameter and the benchmark-model value of each parameter with the associated uncertainty (Section 3.X.5). Schematics of the benchmark models should always be included.

The benchmark specifications should retain as much detail as necessary to model all important aspects of the actual experiment. When it is necessary or desirable to simplify the representation of the experiment for the benchmark specifications, the benchmark specifications must include the transformations from the measured to the benchmark-model values and the uncertainties associated with these transformations. The transformation and associated bias are addressed in Section 3.X.1.

***SECTION 4.0 RESULTS OF SAMPLE CALCULATIONS*:** Calculated results obtained with the benchmark-model specification data given in Section 3.0 are tabulated for each measurement type in the appropriate subsection, Sections 4.1 through 4.10. Details about the calculations, including code versions, cross sections, and typical input listings, are given in Appendix A (A.1 through A.10). Results should be reported both as obtained directly from calculations and in the form 100(C-E)/E, where C is the calculated result and E is the expected result from a calculation with the benchmark model as given in Section 3.X.5. Benchmark uncertainties should be repeated as percentages for comparison purposes.

***SECTION 5.0 REFERENCES*:** All published documents referenced in the evaluation that contain relevant information about the experiments are listed. Internal documents such as logbooks, memos and internal reports should be included in footnotes. Handbooks and computer code documentation should also be included in footnotes. When a primary reference, internal or published, is available in electronic form, it may be included on the CD or DVD with a hyperlink from the point of reference.

***APPENDICES*:** Supplemental information that is useful, but not essential, to the derivation of the benchmark specification or the sample calculations is provided in appendices. Appendices are labeled using letters (e.g., Appendix A). Appendix A is reserved for a description of the codes, cross section data, and typical input listings used in the sample calculations whose results are given in Section 4. Other appendices may be added, as needed, after Appendix A.

***APPENDIX A: COMPUTER CODES, CROSS SECTIONS, AND TYPICAL INPUT LISTINGS*:** Appendix A provides a description of the codes, options, and cross section data used in the calculations of the results given in Section 4. The following information should be included in Appendix A for each measurement type, X. The format should be followed, but where certain information or data are determined to be “Not applicable”, “Not available”, or “Not Significant” it should be so stated.

A.X.1 ***Name(s) of code system(s) used.***

A.X.2 ***Bibliographic references for the codes used.***

A.X.3 ***Origin of cross-section data* –** Nuclear data libraries that were used in the evaluation such as ENDF/B-VI, JEF-2.2, JENDL-3.2 should be specified. Deviations from standard libraries, (e.g., mix of different libraries, details) should be described.

A.X.4 ***Spectral calculations and data reduction methods used* –** Describe calculational scheme, through a figure and explanatory words that provide essential details about assumptions made such as:

- Resonance shielding: specify method(s), energy range(s), the nuclides affected (actinides, clad, fission products, oxygen), and which unresolved resonance treatment is used;
- Describe how mutual shielding (overlapping of resonances) is handled, or not;
- Fission spectra: specify whether only a single spectrum was used or a weighted mix from all fissile nuclides, explaining the procedure for obtaining the weighted mix;
- Describe how the (n,2n) reaction was treated (Optional);
- Weighting spectrum for scattering matrices, e.g., corrections of the out-scatter and self-scatter terms considering the differences between the original weighting spectrum and the actual spectrum (Optional).

A.X.5 ***Number of energy groups or if continuous-energy cross sections are used in the different phases of the calculation.***

A.X.6 ***Component calculations –*** The following information should be provided for each component calculation (pin cell, assembly, etc.) as well as full core calculations**:**

- Type of cell calculation (pin cell, assembly, etc.)
- Geometry
- Theory used (diffusion, transport)
- Method used (finite difference, finite element, nodal, S_n (order), collision probability, Monte Carlo, J+/-, etc.)
- Calculation characteristics (meshes, elements/assembly, meshes/pin, number of histories, multi-group, continuous energy, etc.).

A.X.7 ***Other assumptions and characteristics.***

A.X.8 ***Typical Input Listings for each code system type –*** Typical input listings used to obtain the results reported in Section 4.0 should be provided. Unique and/or important features of the input may also be discussed just prior to the input listings. Listing titles refer to the case number and number of the table in Section 4.0 that gives the calculated result.

4 TECHNICAL REVIEW AND THE TECHNICAL REVIEW GROUP

IRPhEP evaluations will under go a similar level of peer review as ICSBEP evaluations. Included are internal, independent and working group level reviews.

A Technical Review Group was organized during 2004 and the first IRPhEP Technical Review Meeting was held on October 27 and 28, 2004. Representatives from France, Germany, Hungary, Japan, Russian Federation, United Kingdom, United States and the OECD NEA participated.

Eleven evaluations were reviewed in detail at the October meeting. None of the eleven were judged to be ready for final approval and publication, but actions were assigned for each that should, if completed, ensure approval at the 2005 Technical Review Meeting. The learning curve for the IRPhEP should be greatly accelerated by drawing on the experience of the ICSBEP. To put things into prospective, the first ICSBEP Meeting was held in November of 1992, the first formal publication was March of 1995.

5 COORDINATION BETWEEN THE ICSBEP AND THE IRPHEP

A protocol for coordination between the ICSBEP and the IRPhEP was established to maximize the benefits from the efforts of both and to avoid duplication of effort. When data for other measurement types are added to an existing ICSBEP evaluation by the IRPhEP, the original ICSBEP evaluation is incorporated into IRPhEP documents by reference only with a hyperlink to the actual evaluation report that will be duplicated on IRPhEP electronic publications. Similarly, data that are reviewed and approved by the IRPhEP that are of common interest to the ICSBEP will be referenced (an ICSBEP identifier will be assigned and a short summary of the data will be provided) and duplicated on ICSBEP electronic publications (a link to the IRPhEP evaluation will be included in the summary).

Major errors, omissions, or duplications that are identified by either group will be formally transmitted to the evaluator for consideration.

6 THE FIRST (2006) EDITION OF THE INTERNATIONAL HANDBOOK OF EVALUATED REACTOR PHYSICS BENCHMARK EXPERIMENTS

The first IRPhEP publication is scheduled for the January of 2006. It will be published on electronic media (CD-ROM or DVD), as an OECD NEA Handbook entitled, "The International Handbook of Evaluated Reactor Physics Benchmark Experiments" and will include evaluated experiments that are approved by the IRPhEP Technical Review Group.

A summary of the experiments that are expected to be reviewed and considered for publication in the 2006 Edition of the IRPhEP Handbook are given in Table I. Experiments that are of particular interest to Criticality Safety include additional measurements for several experiments for which the criticality data are already included in the ICSBEP Handbook. Among those are LEU-COMP-THERM-048 and 055, two series of DIMPLE measurements for which buckling, spectral characteristics, and reaction-rate distributions have been added; LEU-COMP-THERM-061, a series of VVER experiments performed on the PFacility at the Russian Research Center "Kurchatov Institute" for which reaction-rate distributions have been added; and LEU-COMP-THERM-015 and 036, two large series of VVER experiments that were performed on the ZR-6 critical assembly at the KFKI Atomic Energy Research Institute for which buckling, reaction-rate distributions, and power distributions have been added.

Experiments that may be of particular interest to the criticality safety community that are being prepared for the 2006 Edition of the IRPhEP Handbook, but do not appear in the ICSBEP Handbook include the initial HTR-10 pebble bed reactor experiment, VENUS, KRITZ, and BFS-2 MOX experiments, and JNC heavy water experiments.

Table I. IRPhEP Evaluations in Progress for 2006

Identifier	Summary
ZEBRA-LMFR-RESR-001 CRIT-SPEC-REAC-RRATE	Fast Critical Experiments in Plate and Pin Geometry Form. The ZEBRA CADENZA Cores, Assemblies 22, 23, 24 and 25.
DIMPLE-RESR-EXP-001 CRIT-BUCK-SPEC-RRATE (LEU-COMP-THERM-048)	Light Water Moderated and Reflected Low Enriched Uranium (3 wt.% ^{235U}) Dioxide Rod Lattices DIMPLE S01
DIMPLE-RESR-START-002 CRIT-BUCK-SPEC-RRATE (LEU-COMP-THERM-055)	Light Water Moderated and Reflected Low Enriched Uranium (3 wt.% ^{235}U) Dioxide Rod Lattices DIMPLE S06
CROCUS-LWR-RESR-001 CRIT-KIN	Kinetic Parameters and Reactivity Effect Experiments in CROCUS
PFACILITY-VVER-EXP-001 CRIT-RRATE (LEU-COMP-THERM-061)	VVER Physics Experiments: Hexagonal (1.27-vm Pitch) Lattices of U(4.4 wt.% $^{235}U)O_2$ Fuel Rods In Light Water, Perturbed by Boron, Hafnium, or Dysprosium Absorber Rods, or by Water Gap With/Without Aluminium Tubes
VENUS-PWR-RESR-001 CRIT-BUCK-RRATE-POWDIS	VENUS-2 PWR MOX Core Measurements
VENUS-PWR-RESR-002 CRIT-BUCK-RRATE-POWDIS	VENUS-1 PWR UO_2 Core 2-Dimensional Benchmark Experiment
VENUS-PWR-RESR-003 CRIT-BUCK-RRATE-POWDIS	VENUS-3 PWR UO_2 Core 3-Dimensional Benchmark Experiment
ZR6-VVER-EXP-001 CRIT-BUCK-SPEC-REAC-COEF-RRATE (LEU-COMP-THERM-015 and 036)	The VVER Experiments: Regular and Perturbed Hexagonal Lattic Low-Enriched UO_2 Fuel Rods in Light Water
VHTRC-GCR-RESR-001 CRIT-COEF	VHTRC Temperature Coefficient Benchmark
KRITZ-RESR-EXP-001 CRIT-BUCK-REAC-RRATE	KRITZ-2:19 Experiment on Regular H2O/Fuel Pin Lattices with Mixed Oxide Fuel at Temperatures up to 245^{O}C
HTR10-GCR-RESR-001 CRIT	Evaluation of the Initial Critical Configuration for the HTR-10 Pebble Bed Reactor
HTTR-GCR-RESR-001 CRIT-REAC-COEF-POWDIS	Evaluation of the High Temperature Engineering Test Reactor
ZPPR-LMFR-RESR-001 CRIT-REAC-RRATE	JNC Large fast reactor experiment ZPPR-10A in JUPITER
JOYO-LMFR-RESR-001 CRIT-REAC-COEF	JNC Experimental Fast Reactor JOYO Mk-I core physics tests
DCA-HWR-RESR-001 CRIT-BUCKLING	JNC Heavy water core critical experiment, DCA
BFS2-LMFR-RESR-001 CRIT-SPEC-REAC-RRATE	Critical Assembly of a Full Scale Model of a BN-600 Reactor Hybrid (UO2 + MOX) Core (BFS-62-3A)
BFS1-LMFR-RESR-001 CRIT-SPEC-COEF-RRATE	Model of a Sodium-Cooled Fast Reactor Fueled by Uranium (18.5% U-235) Metal

7 FUTURE EDITIONS OF THE INTERNATIONAL HANDBOOK OF EVALUATED REACTOR PHYSICS BENCHMARK EXPERIMENTS

Several experiments have already been identified for future evaluation. Those experiments are given in Table II. Experiments that may be of particular interest to the criticality safety community that have been identified for future IRPhEP evaluation include more pebble bed reactor data from the ASTRA facility at Kurchatov Institute in Russia, HTR-PROTEUS at the Paul Scherrer Institut (PSI) in Switzerland, and AVR Test Reactor at Forschungszentrum Jülich (FZJ) in Germany. An evaluation that should be of particular interest to both criticality safety and nuclear data communities is an extension of the ZPR-9 Uranium / Iron Benchmark for which the critical configurations has already been published by the ICSBEP (HEU-MET-INTER-001). This evaluation is being extended to include measurements of spectral characteristics, reactivity effects, kinetics parameters, reaction-rate distributions, and other miscellaneous measurements.

Table II. IRPhEP Evaluations in Progress for 2007 and Beyond

Identifier	Summary
IPEN/MB01-RESR-EXP-001 COEF	The Isothermal Experiment of the IPEN/MB-01 Reactor
VENUS-PWR-EXP-004 CRIT-BUCK-RRATE-POWDIS	Experimental Study of the VENUS Configuration No. 7
VENUS-PWR-EXP-005 CRIT-BUCK-RRATE-POWDIS	Experimental Study of the VENUS Configuration No. 9
VENUS-PWR-EXP-006 CRIT-BUCK-RRATE-POWDIS	Experimental Study of the VENUS Configuration No. 17
ASTRA-HTGR-EXP-001 CRIT-REAC-RRATE	ASTRA Critical Facility Experiments
TER2-LWR-EXP-001	TER-2 in LWR UO_2 with Soluble Poisons
STEK-LMFR-EXP-001 CRIT-SPEC-REAC-RRATE	Reactivity Worth Measurements and Other Experiments in the Critical Facility STEK
PROTEUS-GCR-RESR-001 CRIT-SPEC-REAC-COEF-KIN-RRATE	Evaluation of HTR- PROTEUS
AVR-GCR-RESR-001 CRIT-COEF-KIN	Evaluation of the AVR High Temperature Reactor
ZPR9-LMFR-RESR-001 CRIT-SPEC-REAC-KIN-RRATE-MISC (HEU-MET-INTER-001)	Evaluation of the Uranium Iron Benchmark

8 ARCHIVAL OF PRIMARY DOCUMENTATION

Since the inception of the IRPhEP, the NEA has been collecting primary documentation and has been transforming those documents into electronic form to facilitate data retrieval and dissemination. An archive of those documents has been established at the NEA and contains the following:

- IRPHE/B&W-SS-LATTICE, Spectral Shift Reactor Lattice Experiments
- IRPHE/ZEBRA, AEEW Fast Reactor Experiments
- IRPHE/JOYO MK-II, core management and characteristics database
- IRPHE/JAPAN, Reactor Physics Experiments carried out in Japan
- IRPhE/HTR-ARCH-01, Archive of HTR Primary Documents
- IRPHE-SNEAK, KFK SNEAK Fast Reactor Experiments
- IRPhE/STEK, Experiments from Fast-Thermal Coupled Facility
- IRPhE-DRAGON-DPR, OECD High Temperature Reactor Dragon Project
- IRPhE/RRR-SEG, Experiments from Fast-Thermal Coupled Facility
- Experiments in VENUS- Project on the Physics of Plutonium Recycling

9 CONCLUSIONS

The ICSBEP has eliminated a large portion of the tedious and redundant research and processing of experimental data and has greatly streamlined the validation process for the criticality safety community. The project has also significantly increased the number of benchmarks available for nuclear data testing. Benchmarks produced by the IRPhEP add new dimension to criticality safety benchmarking efforts and expand the collection of available integral benchmarks for nuclear data testing. The first publication of the “International Handbook of Evaluated Reactor Physics Benchmark Experiments” is scheduled for January of 2006.

10 ACKNOWLEDGMENTS

The authors would like to acknowledge the efforts of all past and present contributors to the IRPhEP Executive Committee and Technical Review Group.

11 REFERENCES

1. "International Reactor Physics Experiments Evaluation Project Evaluation Guide", NEA/NSC/DOC(2005)2.
2. "International Handbook Of Evaluated Criticality Safety Benchmark Experiments", NEA/NSC/DOC(95)03/I-VIII, OECD-NEA, September, 2004.