

# **Newly Available Reactor Physics Benchmark Data in the March 2011 Edition of the IRPhEP Handbook**

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**Newly Available Reactor Physics Benchmark Data in the March 2011 Edition of the IRPhEP Handbook**

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**SUMMARY**

The International Reactor Physics Experiment Evaluation Project (IRPhEP) was established to preserve integral reactor physics experimental data, including separate or special effects data for nuclear energy and technology applications. [1] Numerous experiments that have been performed worldwide, represent a large investment of infrastructure, expertise, and cost, and are valuable resources of data for present and future research. These valuable assets provide the basis for recording, development, and validation of methods. If the experimental data are lost, the high cost to repeat many of these measurements may be prohibitive.

The purpose of the IRPhEP is to provide an extensively peer-reviewed set of reactor physics-related integral data that can be used by reactor designers and safety analysts to validate the analytical tools used to design next-generation reactors and establish the safety basis for operation of these reactors. Contributors from around the world collaborate in the evaluation and review of selected benchmark experiments for inclusion in the *International Handbook of Evaluated Reactor Physics Benchmark Experiments* (IRPhEP Handbook). [1] Several new evaluations have been prepared for inclusion in the March 2011 edition of the IRPhEP Handbook.

**NEW AND REVISED BENCHMARKS**

A total of 14 benchmark evaluations were revised or newly prepared for inclusion in the IRPhEP Handbook (Table I). The IRPhEP Handbook now includes data from 53 experimental series (representing 31 reactor facilities) and represents contributions from 16 countries. Of the 53 benchmarks, five are draft contributions to the handbook.

Nine of the benchmark evaluations contain new information to be included in the handbook. The RBMK (Reaktor Bolshoy Moschnosti Kanalniy) benchmark is new to the IRPhEP Handbook, but was taken directly from the 2010 edition of the *International Handbook of Evaluated Criticality Safety Benchmark Experiments* (ICSBEP Handbook). [2] Draft evaluations represent new information that has not been completely evaluated in time for handbook publication; however, there is a desire to preserve the experimental data and current evaluation information, making it available for public use.

Benchmark revisions typically include reactor physics measurements in addition to those previously evaluated, or further clarification of prior evaluation efforts.

**CURRENT EVALUATION ACTIVITIES**

Ongoing benchmark evaluation activities for inclusion in future editions of the IRPhEP Handbook consist of additional configurations of the B&W Spectral Shift Reactor, VENUS, and ZPPR (Zero Power Physics Reactor); reactivity effects measurements for the IPEN/MB01 Research Reactor; reactivity measurements and core modifications for the NRAD reactor; VVER (Vodo-Vodyanoi Energetichesky Reactor) gamma scattering measurements; and new benchmark evaluations of the AGN-201M reactor, Advanced Test Reactor Critical Facility (ATR-C), HTR-PROTEUS, and small space power reactor mock-up assemblies performed at the Oak Ridge Critical Experiments Facility. These and other reactor physics benchmarks should become available as early as March 2012. Those interested in contributing to the IRPhEP Handbook are encouraged to contact the authors.

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Table I. March 2011 Additions to the IRPhEP Handbook.

Evaluation Identification (Measurement Types) <sup>1</sup>	Evaluation Title	Report Type
<b>HTTR-GCR-RESR-003 (CRIT-COEF)</b>	Evaluation of Zero Power Elevated Temperature Measurements at Japan's High Temperature Engineering Test Reactor [3,4]	New
<b>IPEN/MB01-LWR-RESR-001 (CRIT-SPEC-COEF-KIN-RRATE-POWDIS)</b>	Reactor Physics Experiments in the IPEN/MB-01 Research Reactor Facility [5]	Revision
<b>LR(0)-VVER-RESR-001 (CRIT)</b>	VVER Physics Experiments: Hexagonal Lattices (1.22-cm Pitch) of Low-Enriched U(2.0, 3.0, 3.3 wt.% <sup>235</sup> U)O <sub>2</sub> Fuel Assemblies in Light Water with Control Rod Model [6]	New
<b>NRAD-FUND-RESR-001 (CRIT)</b>	Fresh Core Reload of the INL Neutron Radiography (NRAD) Reactor with Uranium(20)-Erbium-Zirconium-Hydride Fuel [7]	New
<b>RBMK(CF)-RBMK-EXP-001 (CRIT)</b>	RBMK Graphite Reactor: Uniform Configurations of U(1.8, 2.0, or 2.4% <sup>235</sup> U)O <sub>2</sub> Fuel Assemblies, and Configurations of U(2.0% <sup>235</sup> U)O <sub>2</sub> Assemblies with Empty Channels, Water Columns, and Boron or Thorium Absorbers, with or without Water in Channels [8]	New
<b>SNEAK-LMFR-EXP-001 (CRIT-<i>BUCK</i>-SPEC-COEF-KIN-RRATE-<i>MISC</i>)</b>	SNEAK 7A and 7B Pu-Fueled Fast Critical Assemblies in the Karlsruhe Fast Critical Facility [9]	Revision
<b>SSCR-PWR-EXP-001 (CRIT-SPEC-POWDIS)</b>	B&W Spectral Shift Reactor Lattice Experiment: a 484-Uranium Rods Critical Experiment with an Infinite Reflector [10,11]	New
<b>VENUS-PWR-EXP-005 (CRIT-SPEC-POWDIS)</b>	Experimental Study of the VENUS Configuration No. 9 [12]	Draft
<b>VHTRC-GCR-EXP-001 (CRIT-COEF)</b>	Temperature Effect on Reactivity of VHTRC-1 Core [13]	Draft
<b>ZEBRA-FUND-RESR-001 (MISC)</b>	K-Infinity Experiments in Fast/Intermediate Neutron Spectra for Various Fissile Materials – ZEBRA Core 8 [14,15]	New
<b>ZED2-HWR-EXP-001 (CRIT)</b>	ZED-2 Reactor: Natural-Uranium Metal Fuel Assemblies in Heavy-Water [16]	New
<b>ZPPR-LMFR-EXP-002 (CRIT-SPEC-REAC-RRATE)</b>	ZPPR-9 Experiment: A 650 MWe-Class Sodium-Cooled MOX-Fueled FBR Core Mock-Up Critical Experiment with Clean Two-Homogenous Zones [17]	Revision
<b>ZPPR-LMFR-EXP-007 (CRIT-SPEC-REAC-RRATE)</b>	ZPPR-13A Experiment: A 650 MWe-Class Sodium-Cooled FBR with a Radially-Heterogeneous Core [18]	New
<b>ZPPR-LMFR-EXP-008 (CRIT-SPEC-REAC-RRATE)</b>	ZPPR-18C Experiment: A 1000 MWe-Class Sodium-Cooled Two-Region Homogenous FBR Core with One Control Rod Fully-Withdrawn [19]	New

<sup>1</sup> Reactor Type: PWR = Pressurized Water Reactor, VVER = VVER Reactor, LMFR = Liquid Metal Fast Reactor  
GCR = Gas Cooled (Thermal) Reactor, LWR = Light Water Moderated Reactor,  
HWR = Heavy Water Moderated Reactor, RBMK = RBMK Reactor, FUND = Fundamental Physics Reactor  
Facility Type: EXP = Experimental Facility, RESR = Research Reactor  
Measurement Type: CRIT = Critical Configuration, BUCK = Buckling & Extrapolation Length,  
SPEC = Spectral Characteristics, REAC = Reactivity Effects, COEF = Reactivity Coefficients,  
KIN = Kinetics Measurements, RRATE = Reaction-Rate Measurements,  
POWDIS = Power Distributions, MISC = Other Miscellaneous Types of Measurements  
*(Italics denote that the measurement data has been preserved but not evaluated.)*