20th Symposium of AER on

VVER Reactor Physics and Reactor Safety

Hanasaari, Espoo, Finland
September 20–24, 2010

Conference organizer:

Fortum Nuclear & Thermal, Finland

VUJE, Inc., Okruzna 5, SK 918 64 Trnava, Slovakia

KFKI Atomic Energy Research Institute, Reactor Analysis Department, Budapest, Hungary

Corporate organizations:

Lappeenranta University of Technology, Finland

Aalto University School of Science and Technology, Finland

Nuclear Regulatory Authority of the Slovak Republic, Slovakia

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Studsvik Scandpower GmbH, Germany.

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VTT, Espoo, Finland

Nuclear Research Institute Řež, plc Czech Republic

JSC OKB, ‘GIDRORESS’, Russian Federation

JSC 'TVEL', Russian Federation

ŠKODA JS, a.s., Czech Republic

ČEZ, a.s., Czech Republic

University of Defence in Brno, Czech Republic

The University of West Bohemia Faculty of Applied Sciences, Czech Republic

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Department of Nuclear Physics and Technology, Slovak University of Technology , Slovakia

Paks NPP, Hungary

Hungarian Atomic Energy Authority, Hungary

Nuclear and Radiation Safety Centre, Armenia

Jiangsu Nuclear Power Corporation, Tianwan Nuclear Power Station, China

Program

Monday, September 20

09:00 Opening of the Symposium (chair: T. Vanttola, Finland)

0.1 Opening of the symposium, *K. Larjava, VTT, Finland*

0.2 Welcome address, *P. Lundström, Fortum, Finland*, presentation

0.3 Finnish Research Programmes on Nuclear Safety, *E. K. Puska, VTT, Finland*, presentation

0.4 STUK Preliminary Safety Assessment of New Nuclear Power Plants. *R. Sairanen, STUK Radiation and Nuclear Safety Authority, Finland*, presentation

10.15 Coffee break

10:45 Session 1 (chair: J. Bajgl, Czech Republic)

Topic 1 Spectral and Core Calculations

1.1 Information of AER WG A on improvement, extension and validation of parametrized few-group libraries for VVER-440 and VVER-1000, *P. Mikoláš, Škoda JS a.s., Czech republic*, presentation

1.2 SERPENT Monte Carlo reactor physics code, *J. Leppänen, VTT, Finland*, presentation

1.3 HELIOS2: simple procedutre for generating few group homogenized parameters for non-multiplying domain in hexagonal geometry, *T. Simeonov, Studsvik Scandpower GmbH., Germany*, presentation

1.4 Quadriga and Kirke - front end applications for HELIOS, F. Havlůj, *R. Vočka, Nuclear Research Institute Rez, Czech Republic*, presentation

1.5 A nodal SP3 approach for reactors with hexagonal fuel assemblies, *S. Duerigen, U. Grundmann, S.Mittag, B. Merk, S. Kliem, FZD, Germany*, presentation

12:30 Lunch

Monday, cont.

13:30 Session 2 (chair: Y. Kukushkin, Russia)

Topic 2 Reactor physics experiment and code validation

2.1 Calculation of Novovoronezh re-criticality experiment with CASMO/HEXBU code system. *M. Antila & S. Saarinen, Fortum Nuclear & Thermal, Finland,* presentation

2.2 Validation of the KARATE-440 code system by Analysis of recriticality measurement of Novovoronesh NPP. *A. Keresztúri, Gy. Hegyi,A. Molnár, KFKI AEKI, Hungary,* presentation

2.3 Accuracy estimation for the calculation of the core state at VVER-1000 reactor with incomplete fuel overlapping by the absorber. *A.V.Tikhomirov, G.L.Ponomarenko, OKB "Gidropress", Russia,* presentation

2.4 Selected examples on multiphysics researches at KFKI AEKI. *I. Panka, A. Keresztúri, C. Maráczy, KFKI AEKI, Hungary,* presentation

15.15 Coffee break

15.45 Session 3 (chair: P. Mikoláš, Czech Republic)

Topic 1 Spectral and Core Calculations (cont.)

1.6 Application of Discontinuity factors in C-PORCA 7 code, *I. Pós, T. Parkó, S. Patai Szabó, Paks NPP Ltd, Hungary (presented by I. Nemes***),** presentation

1.7 MCU calculation of spacing grid influence on FA's axial power distribution. *S.S. Gorodkov, L.K. Shishkov, E.A. Suhino-Homenko, RRC Kurchatov Institute, Russia,* presentation

1.8 Calculation of CPNB44 ex-core detector weighting functions for VVER using MCNP5 , *G. Farkas, V. Slugeň, J. Haščík, Slovak University of Technology, Slovakia,* presentation

18.00 -19.30 Welcome Reception of City of Espoo
at Karhusaari Art Centre, Karhusaarenpiha 5 A.
(about 900 m from the conference site and hotel)

Tuesday, September 21

09:00 Session 4 (chair: P. Darilek, Slovakia)

Topic 2 Reactor physics experiment and code validation

2.5 'MIDICORE' VVER-1000 core periphery power tilt benchmark proposal, *V. Krýsl, P. Mikoláš, D. Sprinzl, J. Švarný, ŠKODA JS a.s., Czech Republic*, presentation

2.6 MCU participation in MIDICORE benchmark, *S.S.Gorodkov, E.A.Suhino-Homenko, RRC Kurchatov Institute, Russia*, presentation

2.7 Core periphery power tilt benchmark for VVER-440, definition. *P. Darilek, V. Chrapciak, J. Majercik, VUJE, Inc., Slovakia*, presentation

10.15 Coffee break

10.45 Session 5 (chair: L. Shishkov, Russia)

2.8 Corrections and additions to the proposal of a benchmark for core burnup calculations for a VVER-1000 reactor. *T. Lötsch, V. Khalimonchuk, A. Kuchin, TÜV SÜD, Germany*, presentation

2.9 Influence of operational parameters on DPA in reactor pressure vessel of VVER-440 reactor. *M. Stacho, G. Farkas, V. Slugeň, S. Sojak, Slovak University of Technology, Slovakia*, presentation

2.10 Justification of the radiation load calculation procedure for VVER reactor vessels. *A.D. Dzhalandinov, V.I. Tsofin, OKB "Gidropress", Russia*, presentation

2.11 The VVER Core Physics, Reactor Dosimetry, and Shielding Researches in the LR-0 Reactor. *S. Zaritskiy, A. Egorov, RRC Kurchatov Institute, Russia; B. Ošmera, M. Mařik, V.Rypar, M. Košťál, NRI, Řež, Czech Republic; F. Cvachovec, University of Defense, Czech Republic*, presentation

12:30 Lunch

Tuesday, cont.
13:30 Session 6 (chair: M. Antila, Finland)

Topic 3 Core Design and Operation

3.1 AER Working Group B activities in 2010, *P. Dařílek, VÚJE Trnava Inc., Slovakia,* presentation

3.2 Review of core design and operating experience in Loviisa. *T. Lahtinen, M. Antila & S. Saarinen. Fortum Nuclear & Thermal, Finland,* presentation

3.3 Introduction of Gd-2 fuel to Paks NPP Units. *I. Nemes, Zs. Szécsényi, T. Parkó, I. Pós., Paks NPP Ltd., Hungary,* presentation

3.4 Introduction of In-Core fuel management for TNPS. *Li Youyi, Jiangsu Nuclear Power Corporation, China,* presentation

3.5 Fuel cycles of VVER, *V.V. Morozov, V.V. Saprykin, RRC Kurchatov Institute, Russia,* presentation

15.15 Coffee break
15.45 Session 7 (chair: I. Vidovszky, Hungary)

3.6 Challenging cycles of Dukovany NPP with highly enriched fuel optimized by the Athena code. *K. Katovsky, SKODA JS, a.s.; F. Fej & J. Prehradny, Czech Technical University; R. Čada, University of West Bohemia, Czech Republic,* presentation

3.7 VVER-440 Fuel Cycles Possibilities Using Modified FA Design. *P. Mikoláš, ŠKODA JS a.s., Czech Republic,* presentation

3.8 Progress at the 5-year fuel cycle strategy implementation at Dukovany NPP. *J. Bajgl, CEZ Inc., Dukovany NPP, Czech Republic,* presentation

Wednesday, September 22

09:00 Session 8 (chair: V. Lelek, Czech Republic)

Topic 8 Criticality, spent fuel, decommissioning

8.1 Information about AER working group E on physical problems of spent fuel, radwaste, decommissioning. *V. Chrapciak, VUJE, Inc., Slovakia; L.Marková, NRI Rez, Czech Republic*, presentation

8.2 Impact of burnable absorber Gd on nuclide composition for VVER-440 fuel (Gd-2). *R. Zajac & V. Chrapciak, VUJE, Inc., Slovakia*, presentation

Topic 10 Engineering factors

10.1 Summary of the special AER group meeting "Elaboration of the methodology for calculating the core design engineering factors". *S.V. Tsyganov, RRC Kurchatov Institute, Russia*, presentation

10.2 Components of VVER engineering factors for peaking factors: status and trends. *S.V. Tsyganov, RRC Kurchatov Institute, Russia*, presentation

10.15 Coffee break
10.45 Session 9 (chair: P. Siltanen, Finland)

10.3 Determination of engineering safety factor -routine in Hungary (a methodology for the normal operation local power engineering safety factors), *Z. Szécsényi, L. Korpás, G. Bóna, Paks NPP Ltd, Hungary & A. Keresztúri KFKI AEKI, Hungary*, presentation

10.4 Some remarks about engineering factor determination, *J. Švarný, ŠKODA JS a.s., Czech Republic*, presentation

10.5 A possible way for conservatism reduction at the modelling of VVER operational modes, *L.K. Shishkov, RRC Kurchatov Institute, Russia*, presentation (also in russian)

10.6 Assessment of the influence of design limits to the economics of VVER fuel cycle, V.G. Dementiev, *L.K. Shishkov, RRC Kurchatov Institute, Russia*, presentation

12:30 Lunch

Wednesday, cont.

13:30 Session 10 (chair: S. Kliem, Germany)

Topic 6 Nuclear applications of three-dimensional thermal hydraulics

6.1 Summary on the activity of working group G. *A. Aszódi, Budapest University of Technology and Economics, Hungary*, presentation

6.2 3D PORFLO simulations of Loviisa steam generator. *V. Hovi & M. Ilvonen, VTT, Finland*, presentation

6.3 Study of thermal stratification and mixing using PIV. *B. Yamaji, R. Szijártó, A. Aszódi, Budapest University of Technology and Economics, Hungary*, presentation

6.4 Experimental Investigation of Coolant Mixing in VVER and PWR Reactor Fuel Bundles by Laser Optical Techniques for CFD Validation. *D. Tar, G. Baranyai, Gy. Ézsöl, I. Tóth, KFKI AEKI, Hungary*, presentation

6.5 Study on Natural Convection around a vertical heated rod using PIV/LIF technique, *R. Szijártó, B. Yamaji, A. Aszódi,Budapest University of Technology and Economics, Hungary*, presentation

6.6 Fuel assembly head CFD study with comparison against in-core thermocouple readings at the Loviisa NPP. *K. Myllymäki, S. Saarinen, Fortum Nuclear & Thermal, Finland*, presentation

15.15 Coffee break

15.45 Session 11 (chair: A. Aszódi, Hungary)

6.7 Introduction of VVER-440 Fuel Assembly Head CFD benchmark. *A. Aszódi, S. Tóth, Budapest University of Technology and Economics, Hungary*, presentation

6.8 Results of VVER-440 fuel assembly head benchmark. *M. Bykov, A. Shishov, O. Kudryavtsev, D. Posysaev, OKB "GIDROPRESS", Russia*, presentation

6.9 A simplified approach to VVER-440 fuel assembly head benchmark. *P. Mühlbauer, NRI Rez plc, Czech Republic*, presentation

6.10 Results of VVER-440 Fuel assembly head CFD benchmark. *K. Myllymäki, Fortum Nuclear & Thermal, Finland*, presentation

6.11 Summary of results of VVER-440 Fuel Assembly Head CFD Benchmark. *A. Aszódi, S. Tóth, Budapest University of Technology and*

Economics; I. Farkas, KFKI AEKI; K. Myllymäki, Fortum Power & Heat; P. Kodl, Skoda JS a.s., P. Mühlbauer, NRI Rez plc; D. Posysaev, OKG "GIDROPRESS"; J. Remis, VUJE a.s., presentation

Panel discussion on the benchmark, moderator: A. Aszodi

19.00-22.00 Sauna at the Hanasaari Hotel reserved for the AER2010 participants

Thursday, September 23

09:00 Session 12 (chair: P. Kotiluoto, Finland)

Topic 9 Transmutations of spent fuel and future nuclear energy

9.1 Summary of 12th session of the AER Working Group F – "Spent Fuel Transmutations" and 3rd meeting of INPRO Project RMI – "Meeting energy needs in the period of raw materials insufficiency during the 21st century". *V. Lelek, Nuclear Research Institute Rez, Czech Republic*, presentation

9.2 VVER-440 IMF core calculations. *P. Darilek, R. Zajac, C. Stremensky, J. Majercik, VUJE, Inc., Slovakia*, presentation

9.3 Considerations about energy. *V. Lelek, Nuclear Research Institute Rez, Czech Republic*, presentation

9.4 About energy vision in the 21st century and the role of ecological resources. *V. Lelek, Nuclear Research Institute Rez, Czech Republic*, presentation

10.15 Coffee break

10.45 Session 13 (chair: A. Keresztúri, Hungary)

0.5 Renewal or AER. I. Vidovszky, KFKI AEKI, Hungary (Oral presentation), presentation

Topic 5 Reactor dynamics and safety analysis

5.1 Working group on VVER safety analysis - report of the 2010 meeting. *S. Kliem, FZD, Germany*, presentation

5.2 Study of transient connected with WWER-1000 cluster drop with subsequent working of automatic power controller. *A.Kuchin, I.Ovdiienko, V.Khalimonchuk, SSTC N&RS, Ukraine*, presentation

5.3 Effect of burnup dependence of fuel cladding gap properties on WWER core characteristics. *M.Ieremenko & I.Ovdiienko SSTC N&RS, Ukraine*, presentation

12:30 Lunch

Thursday, cont.

13:30 Session 14 (chair: K. Velkov, Germany)

~~5.4 Sensitivity Analysis of CRE accident. *S. Bznuni, NRSC, Armenia*~~

5.5 Coupling of the CFD code ANSYS CFX with the 3D neutron kinetic core model DYN3D . *S. Kliem, A. Grahn, U. Rohde. FZD; J. Schuetze, Th. Frank, ANSYS Germany GmbH, Germany*, presentation

5.6 LUT infrastructure for VVER safety studies. *R. Kyrki-Rajamäki, J. Laine, T. Merisaari, V. Riikonen, A. Räsänen, H. Purhonen, Lappeenranta University of Technology, Finland*, presentation

5.7 Validation of new 3-D neutronics model in APROS for hexagonal geometry. *J. Rintala, VTT, Finland*, presentation

15.15 Coffee break

15.45 Session 15 (chair: R. Kyrki-Rajamäki, Finland)

5.8 Definition of the 7th dynamic AER benchmark - VVER-440 pressure vessel coolant mixing by re-connection of an isolated loop. *A. Kotsarev, M. Lizorkin, R. Petrin, RRC Kurchatov Institute, Russia*, presentation

5.9 Benchmark calculation with improved VVER-440/213 RPV CFD model. *B. Kiss, A. Aszodi, Budapest University of Technology and Economics, Hungary*, presentation

5.10 Comparison of In-Core Thermocouple and SPND Measured Data with the ATHLET-BIPR-VVER Predictions. *S.P. Nikonov, RRC Kurchatov Institute, Russia; K. Velkov, A. Pautz, GRS mbH, Germany*, presentation

5.11 Peculiarity by Modeling of the Control Rod Movement by the Kalinin-3 Benchmark. *S.P. Nikonov, RRC Kurchatov Institute, Russia; K. Velkov, A. Pautz, GRS mbH, Germany*, presentation

19.00 Dinner on a charter cruise ship, starting from and returning to Hanasaari

Friday, September 24

09:00 Session 16 (chair: J. Molnar, Czech Republik)

Topic 4 Core Monitoring

4.1 Summary on the activity of AER's Working Group on core monitoring (flux reconstruction, in-core measurements). *I. Nemes, Paks NPP Ltd*, presentation

4.2 Reload Startup Physics Tests for TNPS. *X. Yang, Jiangsu Nuclear Power Corporation, Tianwan NPS*, presentation

4.3 Preparation of physics commissioning of Mochovce units 3 & 4. *M. Sedlacek, V. Chrapčiak, VUJE, Inc., Slovakia*, presentation

4.4 Operational experience with neutron power on-line calibration system AKE-02R at Bohunice NPP. *M. Závodský, K. Kľučárová, VUJE Inc., Slovakia*, presentation

10.15 Coffee break

10.45 Session 17 (chair: I. Nemes, Hungary)

4.5 SCORPIO-VVER Core Monitoring and Surveillance System for VVER-440 Reactors. *J. Molnar, R. Vocka, Nuclear Research Institute Rez plc, Czech Republic*, presentation

4.6 Reconstruction of core inlet temperature distribution by cold leg temperature measurements. *S. Saarinen, M. Antila, Fortum Nuclear & Thermal, Finland*, presentation

4.7 Primary circuit and reactor core T-H characteristics determination of WWER 440 reactors. *J. Hermanský, V. Petényi, M. Závodský, VUJE Inc., Slovakia*, presentation

General discussion and closure of the Symposium

12:00 Lunch

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