

William Jay (B.J.) Marshall, PhD

Business Address:

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EDUCATION

University of Tennessee-Knoxville

Doctor of Philosophy in Nuclear Engineering, December 2017

Dissertation: "Determination of Critical Experiment Correlations Via the Monte Carlo Sampling Technique"

Cumulative Graduate GPA: 3.82/4.0

University of Tennessee-Knoxville

Master of Science in Nuclear Engineering, August 2001

Thesis: "Power Distribution Calculations in the High Flux Isotope Reactor for Various Control Blade Tantalum Loadings"

Graduate GPA: 3.72/4.0

University of Missouri-Rolla (Now Missouri University of Science & Technology)

Bachelor of Science in Nuclear Engineering, December 1999 (Cum Laude)

Undergraduate GPA: 3.41/4.0

WORK EXPERIENCE

June 2010–Present

Senior R&D Staff (January 2017 – Present) / R&D Staff (June 2010 – December 2016)

Nuclear Data and Criticality Safety Group; Reactor and Nuclear Systems Division, Oak Ridge National Laboratory, Oak Ridge, TN

- Perform research supporting burnup credit basis for PWR and BWR SNF
- Lead SCALE criticality safety validation efforts for cross sections and covariance data
- Assist with delivery of SCALE training; Lead for SCALE Training, Spring 2015 – Fall 2016
- Test SCALE criticality safety and nuclear data developments
- Instructor for NCSP Hands-on criticality safety practitioner course, February 2017 - present
- Mentor graduate and summer students

February 2018–Present

Lecturer

University of Tennessee-Knoxville, Nuclear Engineering Department, Knoxville, TN

- Prepare and present material related to computer code use, Monte Carlo method, computer code testing, validation, and nuclear data use in nuclear criticality safety in graduate level course

November 2008–May 2010

Product Manager/Lead Engineer

Westinghouse Electric Company

- Provided technical leadership to spent fuel pool criticality safety product line, including proposals
- Participated in industry-wide NEI forum with NRC
- Supervised work on new analyses and licensing support for past analyses
- Developed and delivered SFP NCS training with other qualified personnel

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July 2006–October 2008

Senior Core Design Engineer

Westinghouse Electric Company

- Performed and verified PWR core reload analyses, assisted improvement of core modeling
- Executed spent fuel pool criticality safety analyses
- Mentored new employees in core design and criticality safety

November 2001–July 2006

Design Engineer

Knolls Atomic Power Laboratory

- Assisted in new reactor designs
- Performed 2D and 3D Monte Carlo calculations
- Carried out nodal synthesis calculations
- Helped develop and provide RACER Monte Carlo code training

January 2000–August 2001

Graduate Research Assistant

University of Tennessee

- Performed research on High Flux Isotope Reactor
- Used SCALE and DORT for core modeling
- Lectured on MCNP4 at Tennessee Industries Week

June 1999–August 1999

Summer Intern

Oak Ridge National Laboratory

- Used MCNP4 for shielding benchmark
- Upgraded NRC code HABIT

September 1998–December 1999

Student Health Physics Technician

University of Missouri-Rolla (Now Missouri University of Science & Technology)

- Performed radiation and contamination surveys
- Performed meter and dosimeter calibrations

PUBLICATIONS

W.J. Marshall, J.B. Clarity, and S.M. Bowman, “Validation of k_{eff} Calculations for Extended BWR Burnup Credit,” NUREG/CR-7252 (ORNL/TM-2018/797), prepared for the U.S. Nuclear Regulatory Commission by Oak Ridge National Laboratory, Oak Ridge, TN (2018).

W.J. Marshall and A.M. Holcomb, “A Testing Trifecta: Data, Codes, and Evaluations,” *Trans. Am. Nucl. Soc.* **119**, 724-727 (2018).

W.J. Marshall, J.B. Clarity, and E.M. Saylor, “Sensitivity Calculations for Systems with Fissionable Reflector Materials Using TSUNAMI,” *Trans. Am. Nucl. Soc.* **119**, 787-790 (2018).

PUBLICATIONS (continued)

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E.M. Saylor, W.J. Marshall, J.B. Clarity, J.B. Clarity, Z.J. Clifton, and B.T. Rearden, *Criticality Safety Validation of SCALE 6.2.2*, ORNL/TM-2018/884, Oak Ridge, TN (2018).

W.J. Marshall, "The Case for and Against a Gadolinium Bias in SCALE: Opening Arguments," *Trans. Am. Nucl. Soc.* **118**, 554-557 (2018).

W.J. Marshall and E.M. Saylor, "Enhanced Engineering Analyses with Visualization of Geometry and Mesh-Based Data in Fulcrum," *Trans. Am. Nucl. Soc.* **118**, 987-990 (2018).

Z.J. Clifton, W.J. Marshall, and I. Hill, "Benchmark Model Temperatures Incorporated into DICE," *Trans. Am. Nucl. Soc.* **118**, 543-546 (2018).

E.M. Saylor, W.J. Marshall, Z.J. Clifton, J.B. Clarity, and B.T. Rearden, "Validation of KENO V.a and KENO-VI in SCALE 6.2.2 using ENDF/B-VII.0 and ENDF/B-VII.1 Libraries," *Trans. Am. Nucl. Soc.* **118**, 571-574 (2018).

C.M. Perfetti, B.T. Rearden, and W.J. Marshall, "Estimating Computational Biases for Criticality Safety Applications with Few Neutronically Similar Benchmarks," *Trans. Am. Nucl. Soc.* **118**, 561-564 (2018).

B.J. Ade, W.J. Marshall, G. Ilas, B.R. Betzler, and S.M. Bowman, "Impact of Operating Parameters on Extended BWR Burnup Credit," NUREG/CR-7240 (ORNL/TM-2017/46), prepared for the U.S. Nuclear Regulatory Commission by Oak Ridge National Laboratory, Oak Ridge, TN (2018).

J.B. Clarity, K. Banerjee, H.K. Liljenfeldt, and W.J. Marshall, "As-Loaded Criticality Margin Assessment of Dual-Purpose Canisters Using UNF-ST&DARDS," *Nucl. Tech.*, **199**(3), 245 – 275 (2017).

W.J. Marshall, D.E. Mueller, J.B. Clarity, and S.M. Bowman, "Development of Criticality Safety Validation Guidance for NRC-Regulated Activities," *Proceedings of NCSD 2017: Criticality Safety – pushing boundaries by modernizing and integrating data, methods, and regulations*, Carlsbad, NM (2017).

W.J. Marshall, B.T. Rearden, and R.E. Pevey, "Determination of Critical Experiment Correlations for Experiments Involving Arrays of Low-Enriched Fuel Rods," *Proceedings of NCSD 2017: Criticality Safety – pushing boundaries by modernizing and integrating data, methods, and regulations*, Carlsbad, NM (2017).

W.J. Marshall, B.T. Rearden, and R.E. Pevey, "Determination of Critical Experiment Correlations for Experiments Involving Highly Enriched Uranium Solutions," *Proceedings of NCSD 2017: Criticality Safety – pushing boundaries by modernizing and integrating data, methods, and regulations*, Carlsbad, NM (2017).

B.J. Ade, W.J. Marshall, and S.M. Bowman, "The Effect of Modeling Assembly-Specific Parameters in Extended BWR Burnup Credit Analyses," *Proceedings of NCSD 2017: Criticality Safety – pushing boundaries by modernizing and integrating data, methods, and regulations*, Carlsbad, NM (2017).

PUBLICATIONS (continued)

J.B. Clarity, K. Banerjee, W.J. Marshall, and H.K. Liljenfeldt, “A Burnup Credit Approach for Margin Estimation of Loaded Boiling Water Reactor Canisters in UNF-ST&DARDS,” *Proceedings of NCSD 2017: Criticality Safety – pushing boundaries by modernizing and integrating data, methods, and regulations*, Carlsbad, NM (2017).

A. Holcomb, D. Wiarda, and W.J. Marshall, “ENDF/B-VIII.0 Testing With AMPX and SCALE,” *Proceedings of NCSD 2017: Criticality Safety – pushing boundaries by modernizing and integrating data, methods, and regulations*, Carlsbad, NM (2017).

R.A. Lefebvre and W.J. Marshall, “Template Engine Applied to Rapid Modeling,” *Proceedings of NCSD 2017: Criticality Safety – pushing boundaries by modernizing and integrating data, methods, and regulations*, Carlsbad, NM (2017).

B.T. Rearden, B.R. Betzler, M.A. Jessee, W.J. Marshall, U. Mertyurek, and M.L. Williams, “Accuracy and Runtime Improvements with SCALE 6.2,” *Proceedings of International Conference on Mathematics and Computational Methods Applied to Nuclear Science & Engineering*, Jeju, Korea (2017).

C.M. Perfetti, B.T. Rearden, and W.J. Marshall, “Diagnosing Undersampling Biases in Monte Carlo Eigenvalue and Flux Tally Estimates,” *Nucl. Sci. and Eng.*, **185**(1) 139 – 158 (2017).

E.L. Jones, W.J. Marshall, B.T. Rearden, M.E. Dunn, and G.I. Maldonado, “A Case Study in the Application of TSUNAMI-3D – Part 2, Continuous Energy,” *Trans. Am. Nucl. Soc.* **115**, 677-680 (2016).

W.J. Marshall, E.L. Jones, B.T. Rearden, and M.E. Dunn, “A Case Study in the Application of TSUNAMI-3D – Part 1, Multigroup,” *Trans. Am. Nucl. Soc.* **115**, 673-676 (2016).

J.A. Hanna, R.A.L. Rosenthal, W.J. Marshall, D.E. Mueller, E.L. Jones, S.R. Blair, and B.T. Rearden, “Validation for ²³³U-Fueled Systems in KENO V.a in SCALE 6.2,” *Trans. Am. Nucl. Soc.* **115**, 665-668 (2016).

W.J. Marshall, B.J. Ade, and S.M. Bowman, “Study of Axial Burnup Profile Effects on BWR Burnup Credit,” *Proceedings of the 18th International Symposium on the Packaging and Transportation of Radioactive Materials (PATRAM 2016)*, Kobe, Japan (2016).

W.J. Marshall, B.J. Ade, S.M. Bowman, and J.S. Martinez-Gonzalez, “Axial Moderator Density Distributions, Control Blade Usage, and Axial Burnup Distributions for Extended BWR Burnup Credit,” NUREG/CR-7224 (ORNL/TM-2015/544), prepared for the U.S. Nuclear Regulatory Commission by Oak Ridge National Laboratory, Oak Ridge, TN (2016).

W.J. Marshall, B.J. Ade, and S.M. Bowman, “Apparent Monte Carlo Source Convergence Problem with BWR Fuel Depleted with Partial Control Blade Insertion,” *Trans. Am. Nucl. Soc.* **114**, 475-478 (2016).

T.A. Eckleberry, W.J. Marshall, E.L. Jones, and G.I. Maldonado, “Validation of KENO Thermal Moderator Doppler Broadening Method in SCALE 6.2 Beta5 Using Continuous-Energy B-VII.1 Library,” *Trans. Am. Nucl. Soc.* **114**, 484-487 (2016).

B.J. Ade, W.J. Marshall, J.S. Martinez, and S.M. Bowman, “Effects of Control Blade History, Axial Coolant Density Profiles, and Axial Burnup Profiles on BWR Burnup Credit,” *Proceedings of PHYSOR 2016*, Sun Valley, ID (2016).

PUBLICATIONS (continued)

W.J. Marshall, B.J. Ade, S.M. Bowman, I.C. Gauld, G. Ilas, U. Mertuyurek, G. Radulescu, “Technical Basis for Peak Reactivity Burnup Credit for BWR Spent Nuclear Fuel in Storage and Transportation Systems,” *Proceedings of International Conference on Nuclear Criticality Safety*, Charlotte, NC (2015).

W.J. Marshall and B.T. Rearden, “Determination of Critical Experiment Correlations Using the Sampler Sequence Within SCALE 6.2,” *Proceedings of International Conference on Nuclear Criticality Safety*, Charlotte, NC (2015).

W.J. Marshall, B.T. Rearden, and E.L. Jones, “Validation of SCALE 6.2 Criticality Calculations Using KENO V.A and KENO-VI,” *Proceedings of International Conference on Nuclear Criticality Safety*, Charlotte, NC (2015).

W.J. Marshall, M.L. Williams, D. Wiarda, B.T. Rearden, M.E. Dunn, D.E. Mueller, J.B. Clarity, and E.L. Jones, “Development and Testing of Neutron Cross Section Covariance Data for SCALE 6.2,” *Proceedings of International Conference on Nuclear Criticality Safety*, Charlotte, NC (2015).

D.E. Mueller, D.G. Bowen, and W.J. Marshall, “Addressing Fission Product Validation in MCNP Burnup Credit Criticality Calculations,” *Proceedings of International Conference on Nuclear Criticality Safety*, Charlotte, NC (2015).

V. Sobes, B.T. Rearden, D.E. Mueller, W.J. Marshall, J.M. Scaglione, M.E. Dunn, “Upper Subcritical Calculations Based on Correlated Data,” *Proceedings of International Conference on Nuclear Criticality Safety*, Charlotte, NC (2015).

J.S. Martinez-Gonzalez, B.J. Ade, S.M. Bowman, I.C. Gauld, G. Ilas, W.J. Marshall, “Impact of modeling Choices on Inventory and In-Cask Criticality Calculations for Forsmark3 BWR Spent Fuel,” *Proceedings of International Conference on Nuclear Criticality Safety*, Charlotte, NC (2015).

B.J. Ade, W.J. Marshall, S.M. Bowman, I.C. Gauld, G. Ilas, and J.S. Martinez-Gonzalez, “Coolant Density and Control Blade History Effects in Extended BWR Burnup Credit,” *Proceedings of International Conference on Nuclear Criticality Safety*, Charlotte, NC (2015).

B.T. Rearden, K.B. Bekar, C. Celik, K.T. Clarno, M.E. Dunn, S.W.D. Hart, A.M. Ibrahim, S.R. Johnson, B.R. Langley, J.P. Lefebvre, R.A. Lefebvre, W.J. Marshall, U. Mertuyurek, D.E. Mueller, D.E. Peplow, C.M. Perfetti, L.M. Petrie Jr., A.B. Thompson, D. Wiarda, W.A. Wieselquist, and M.L. Williams, “Criticality Safety Enhancements For Scale 6.2 And Beyond,” *Proceedings of International Conference on Nuclear Criticality Safety*, Charlotte, NC (2015).

E.L. Jones, G.I. Maldonado, W.J. Marshall, C.M. Perfetti, and B.T. Rearden, “Investigation of the Continuous-Energy Sensitivity Methods in SCALE 6.2 Using TSUNAMI-3D,” *Proceedings of International Conference on Nuclear Criticality Safety*, Charlotte, NC (2015).

D.E. Mueller, W.J. Marshall, D.G. Bowen, and J.C. Wagner, “Bias Estimates in Lieu of Validation of Fission Products and Minor Actinides in MCNP k_{eff} Calculations for PWR Burnup Credit Casks,” NUREG/CR-7205 (ORNL/TM-2012/544), prepared for the U.S. Nuclear Regulatory Commission by Oak Ridge National Laboratory, Oak Ridge, TN (2015).

B.T. Rearden, L.M. Petrie, D.E. Peplow, K.B. Bekar, D. Wiarda, C. Celik, C.M. Perfetti, A.M. Ibrahim, S.W.D. Hart, M.E. Dunn, and W.J. Marshall, “Monte Carlo Capabilities of the SCALE Code System,” *Annals of Nucl. Energy* **82**, 130-141 (2015).

PUBLICATIONS (continued)

V. Sobes, B.T. Rearden, D.E. Mueller, W.J. Marshall, J.M. Scaglione, and M.E. Dunn, "Upper Subcritical Limit Calculations with Correlated Integral Experiments," *Trans. Am. Nucl. Soc.* **112**, 467-470 (2015).

J.M. Scaglione, G. Radulescu, W.J. Marshall, and K.R. Robb, "A Quantitative Impact Assessment of Hypothetical Spent Fuel Reconfiguration in Spent Fuel Storage Casks and Transportation Packages," NUREG/CR-7203 (ORNL/TM-2013/92), prepared for the U.S. Nuclear Regulatory Commission by Oak Ridge National Laboratory, Oak Ridge, TN (2015).

W.J. Marshall, B.J. Ade, S.M. Bowman, I.C. Gauld, G. Ilas, U. Mertyurek, and G. Radulescu, "Technical Basis for Peak Reactivity Burnup Credit for BWR Spent Nuclear Fuel in Storage and Transportation Systems," NUREG/CR-7194 (ORNL/TM-2014/240), prepared for the U.S. Nuclear Regulatory Commission by Oak Ridge National Laboratory, Oak Ridge, TN (2015).

M.L. Williams, D. Wiarda, G. Ilas, W.J. Marshall, B.T. Rearden, "Covariance Applications in Criticality Safety, Light Water Reactor Analysis, and Spent Fuel Characterization," *Nucl. Data Sheets*, **123**, 92 – 96 (2015).

W.J. Marshall and B.T. Rearden, "Determination of Experimental Correlations Using the Sampler Sequence Within SCALE 6.2," *Trans. Am. Nucl. Soc.* **111**, 867-870 (2014).

W.J. Marshall and S.M. Bowman, "Validation of k_{eff} Calculations for Boiling-Water Reactor Fuel at Peak Reactivity in Transportation and Storage Casks," *Trans. Am. Nucl. Soc.* **111**, 883-886 (2014).

W.J. Marshall, B.J. Ade, and S.M. Bowman, "Evaluation of Peak Reactivity Analysis of Boiling-Water Reactor Fuel in Storage and Transportation Casks," *Trans. Am. Nucl. Soc.* **111**, 875-878 (2014).

E.L. Jones, G.I. Maldonado and W.J. Marshall, "Mixed Uranium-Plutonium Solution Validation of KENO V.a and KENO-VI in SCALE 6.1.2 and 6.2b3 Using Multigroup and Continuous-Energy ENDF/B-VII.0 Libraries," *Trans. Am. Nucl. Soc.* **111**, 857-860 (2014).

J.M. Scaglione, G. Radulescu, K.R. Robb, and W.J. Marshall, "Consequence Assessment of Fuel Reconfiguration for Dry Storage and Transportation Packages," *Trans. Am. Nucl. Soc.* **111**, 330-333 (2014).

W.J. Marshall, S. Croft, I.C. Gauld, J. Hu, C.E. Romano, and A. Worrall, "Special Nuclear Material Inventory Processes at US Domestic Power Plants," *55th Annual Meeting of the Institute of Nuclear Materials Management*, Atlanta, GA (2014).

M.L. Williams, G. Ilas, W.J. Marshall, and B.T. Rearden, "Applications of Nuclear Data Covariances to Criticality Safety and Spent Fuel Characterization," *Nucl. Data Sheets*, **118**, 341 – 345 (2014).

W.J. Marshall and J.C. Wagner, "Additional Studies of the Criticality Safety of Failed Used Nuclear Fuel," *Packaging, Transport, Storage and Security of Radioactive Materials*, **25**(1), 1 – 7 (2014).

W.J. Marshall, D. Wiarda, C. Celik, B.T. Rearden and D.R. Wentz, "Validation of Criticality Safety Calculations with SCALE 6.2," *Proceedings of NCSD 2013: Criticality Safety in the Modern Era – Raising the Bar*, Wilmington, NC (2013).

W.J. Marshall and B.T. Rearden, "The SCALE Verified Archived Library of Inputs and Data – VALID," *Proceedings of NCSD 2013: Criticality Safety in the Modern Era – Raising the Bar*, Wilmington, NC (2013).

PUBLICATIONS (continued)

W.J. Marshall and J.C. Wagner, "Additional Studies of the Criticality Safety of Failed Used Nuclear Fuel," *Proceedings of the 17th International Symposium on the Packaging and Transportation of Radioactive Materials (PATRAM 2013)*, San Francisco, CA (2013).

J.M. Scaglione, G. Radulescu, K.R. Robb, W.J. Marshall, J.C. Wagner, M. Flanagan, M. Aissa, Z. Li, "Consequence Analysis of Spent Nuclear Fuel Reconfiguration Scenarios," *Proceedings of the 17th International Symposium on the Packaging and Transportation of Radioactive Materials (PATRAM 2013)*, San Francisco, CA (2013).

J.M. Scaglione, K.R. Robb, R.A. Lefebvre, D. Ilas, G. Radulescu, W.J. Marshall, J.C. Wagner, H.E. Adkins, T.E. Michener, D. Vinson, "Integrated Data and Analysis System for Commercial Used Nuclear Fuel Safety Assessments," *Proceedings of the 17th International Symposium on the Packaging and Transportation of Radioactive Materials (PATRAM 2013)*, San Francisco, CA (2013).

W.J. Marshall and J.C. Wagner, "Consequences of Used Nuclear Fuel Failure on Criticality Safety," *Proceedings of International High-Level Radioactive Waste Management*, Albuquerque, NM (2013).

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W.J. Marshall and B.T. Rearden, *Criticality Safety Validation of SCALE 6.1*, ORNL/TM-2011/450 (Revised), Oak Ridge, TN (2013).

W.J. Marshall and J.C. Wagner, *Consequences of Fuel Failure on Criticality Safety of Used Nuclear Fuel*, ORNL/TM-2012/325, Oak Ridge, TN (2013).

D.E. Mueller, S.M. Bowman, W.J. Marshall, and J.M. Scaglione, *Review and Prioritization of Technical Issues Related to Burnup Credit for BWR Fuel*, NUREG/CR-7158 (ORNL/TM-2012/261), prepared for the U.S. Nuclear Regulatory Commission by Oak Ridge National Laboratory, Oak Ridge, TN (2013).

W.J. Marshall and J.C. Wagner, "Impact of Fuel Failure on Criticality Safety of Used Nuclear Fuel," *Proceedings of PSAM11*, Helsinki, Finland (2012).

W.J. Marshall and B.T. Rearden, "Criticality Safety Validation of SCALE 6.1 with ENDF/B-VII.0 Libraries," *Trans. Am. Nucl. Soc.* **106**, 456-460 (2012).

B.T. Rearden and W.J. Marshall, "Examination of Validation Outlier Cases Using the Sensitivity and Uncertainty Analysis Tools of SCALE 6.1," *Trans. Am. Nucl. Soc.* **106**, 461-464 (2012).

J.M. Scaglione, D.E. Mueller, J.C. Wagner, and W.J. Marshall, *An Approach for Validating Actinide and Fission Product Burnup Credit Criticality Safety Analyses-Criticality (k_{eff}) Predictions*, NUREG/CR-7109 (ORNL/TM-2011/514), prepared for the U.S. Nuclear Regulatory Commission by Oak Ridge National Laboratory, Oak Ridge, TN (2012).

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V.N. Kucukboyaci and W.J. Marshall, "ISOCRIT: A Burnup Credit Tool for Spent Fuel Pool Storage Calculations," *Proc. PHYSOR 2010*, Pittsburgh, PA (2010).

V.N. Kucukboyaci, W.J. Marshall, and M.G. Anness, "Criticality Calculations Supporting PWR Spent Fuel Pool Activities," *Trans. Am. Nucl. Soc.* **97**, 161-163 (2007).

R. E. Pevey, L.F. Miller, W.J. Marshall, L.W. Townsend, and B. Alvord, "Coarse-Mesh Adjoint Biasing of a Monte Carlo Dose Calculation," *J. ASTM International* **3**(7) (2006).

R. Pevey, L.F. Miller, B.J. Marshall, L.W. Townsend, and B. Alvord, "Shielding for a Cyclotron Used for Medical Isotope Production in China," *Radiat. Prot. Dosim.* **115**, 415-419 (2005).

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B.J. Marshall and L.F. Miller, "Power Distribution Calculations for Various Tantalum Loadings in the HFIR Control Blades," in *Transactions of the American Nuclear Society 2001 Annual Meeting*, Milwaukee, Wisconsin, (2001).

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H.T. Hunter, J.L. Parsons, W.J. Marshall, E. Sartori, and I. Kodeli, "Shielding Experimental Benchmark Storage, Retrieval, and Display System," *Proceedings of ICRS-9*, Ibaraki, Japan (1999).