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Title: Bibliography of MCNP Verification and Validation: 1990 - 2003

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Submitted to:



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Bibliography of MCNP™ Verification and Validation: 1990 - 2003

A list of publications has been compiled on the subject of verification and validation of the MCNP Monte Carlo code, from 1990 to the present. The list includes journal articles, papers presented at scientific and technical conferences, Los Alamos National Laboratory reports, and evaluations from the International Handbook of Evaluated Criticality Safety Benchmark Experiments.

1 OVERVIEW

The MCNP Monte Carlo code has a wide range of applications, including radiation protection and dosimetry, radiation shielding, criticality, medical physics, and oil well logging, to mention only a few. In order to better document the verification and validation of the code for these and other purposes, lists of publications on that topic are presented herein. The lists cover the time span from 1990 through 2003. The lists include journal articles, papers presented at scientific and technical conferences, Los Alamos National Laboratory (LANL) reports, and evaluations from the *International Handbook of Evaluated Criticality Safety Benchmark Experiments*.

Three general criteria were applied to determine whether a paper or report should be cited herein. First, it must contain a comparison between MCNP results and results from another source, such as measurements, calculations with other codes, or analytic solutions. Second, a LANL staff member had to have made a substantive contribution to the study. Third, the paper or report must contain a reasonably detailed description of the comparisons being made and the basis for those comparisons. Accordingly, abstracts and short summaries, such as those contained in the *Transactions of the American Nuclear Society*, are not cited herein.

2 ARTICLES IN SCIENTIFIC AND TECHNICAL JOURNALS

Table 1 presents a list of articles published in scientific and technical journals, in descending chronological order.

3. PAPERS PRESENTED AT CONFERENCES AND TOPICAL MEETINGS

Table 2 presents a list of papers presented at conferences and topical meetings, most of them sponsored by the American Nuclear Society. The list is presented in descending chronological order.

Table 1. Articles in Scientific and Technical Journals

1. David J. Loaiza and Rene Sanchez, "Examination of the 2x2 SiO₂, Al, and Fe Experiments Mixed with Highly Enriched Uranium on the Thermal Energy Range," *Nucl. Sci. Eng.*, **145**, pp. 256-266 (October 2003).
2. Russell D. Mosteller, Roger W. Brewer, and Peter J. Jaegers, "Analysis of the First Three Zeus Critical Experiments," *Nucl. Sci. Eng.*, **145**, pp. 105-119 (September 2003).
3. David J. Loaiza, Rene Sanchez, and Roger Brewer, "Sensitivity Analyses for Polyethylene-Moderated and Polyethylene-Reflected Highly Enriched Uranium Experiments Mixed with Waste Matrix Materials," *Nucl. Sci. Eng.*, **143**, pp. 132-140 (February 2003).
4. Avneet Sood, R. Arthur Forster, and D. Kent Parsons, "Analytical Benchmark Test Set for Criticality Code Verification," *Prog. Nucl. Energy*, **42**, pp. 55-106 (2003).
5. Russell D. Mosteller, Stephanie C. Frankle, and Phillip G. Young, Jr., "ENDF/B-VI Data Testing with MCNP: Critical Experiments, Thermal-Reactor Lattices, and Neutron Shielding," *Adv. Nucl. Sci. Tech.*, **24**, pp. 131-195 (1997).
6. Todd J. Urbatsch, R. Arthur Forster, Richard E. Prael, and Richard J. Beckman, "Estimation and Interpretation of k_{eff} Confidence Intervals in MCNP," *Nucl. Technol.*, **111**, pp. 169-182 (August 1995).
7. Thomas E. Booth and Shane P. Pederson, "Unbiased Combinations of Nonanalog Monte Carlo Techniques and Fair Games," *Nucl. Sci. Eng.*, **110**, pp. 254-261 (March 1992)
8. John S. Hendricks, "Effects of Changing the Random Number Stride in Monte Carlo Calculations," *Nucl. Sci. Eng.*, **109**, pp. 86-91 (September 1991).
9. R. D. Mosteller, L. D. Eisenhart, R. C. Little, W. J. Eich, and J. Chao, "Benchmark Calculations for the Doppler Coefficient of Reactivity," *Nucl. Sci. Eng.*, **107**, pp. 265-271 (March 1991).

Table 2. Papers Presented at Conferences and Topical Meetings

1. Russell D. Mosteller, Robert E. MacFarlane, Robert C. Little, and Morgan C. White, "Analysis of Hot and Cold Kritz Benchmarks with MCNP5 and Temperature-Specific Nuclear-Data Libraries," *Proceedings of Advances in Nuclear Fuel Management III*, Hilton Head Island, South Carolina (October 2003).
2. David Loaiza and Rene Sanchez, "Analysis on the ^{237}Np Sphere Surrounded by ^{235}U Shells Experiment," *Proceedings of the 7th International Conference on Nuclear Criticality Safety (ICNC 2003)*, Tokai-mura, Japan (October 2003).
3. Forrest B. Brown, Russell D. Mosteller, and Avneet Sood, "Verification of MCNP5," *Proceedings of M&C 2003: A Century in Review, A Century Anew*, Gatlinburg, Tennessee (April 2003).
4. Yasunobu Nagaya and Forrest B. Brown, "Estimation of Change in k_{eff} due to Perturbed Fission Source Distribution in MCNP," *Proceedings of M&C 2003: A Century in Review, A Century Anew*, Gatlinburg, Tennessee (April 2003).
5. Taro Ueki and Forrest B. Brown, "Stationarity and Source Convergence Diagnostics in Monte Carlo Criticality Calculation," *Proceedings of M&C 2003: A Century in Review, A Century Anew*, Gatlinburg, Tennessee (April 2003).
6. Russell D. Mosteller, Roger W. Brewer, and Peter J. Jaegers, "Analysis of the Third Zeus Critical Experiment with MCNPTM," *Proceedings of M&C 2003: A Century in Review, A Century Anew*, Gatlinburg, Tennessee (April 2003).
7. Russell D. Mosteller, "Validation Suites for MCNPTM," *Proceedings of the American Nuclear Society Radiation Protection and Shielding Division 12th Biennial Topical Meeting*, Santa Fe, New Mexico (April 2002).
8. Russell D. Mosteller and Peter J. Jaegers, "Detailed Analysis of the Second Zeus Critical Experiment with MCNPTM," *Proceedings of the ANS International Topical Meeting on Mathematical Methods for Nuclear Applications*, Salt Lake City, Utah (September 2001).
9. Jeffrey A. Favorite and D. Kent Parsons, "Second-Order Cross Terms in Monte Carlo Differential Operator Perturbation Estimates," *Proceedings of the ANS International Topical Meeting on Mathematical Methods for Nuclear Applications*, Salt Lake City, Utah (September 2001).
10. T. Goorley, F. Wheeler, J. Capala, W.S. Kiger III, M. Palmer, and R. Zamenhof. "A Comparison of Two Treatment Planning Programs: MacNCTPLAN and BNCT_RTPE," in **Frontiers in Neutron Capture Therapy**, M.F. Hawthorne, K. Shelly, and R.J. Wiersema, Eds., Plenum Publishers, New York, 2001, pp. 207-212. (Compilation of

Table 2. Papers Presented at Conferences and Topical Meetings (Continued)

papers presented at the 8th *International Symposium on Neutron Capture Therapy for Cancer.*)

11. Russell D. Mosteller and Peter J. Jaegers, "Detailed Analysis of the Initial Zeus Critical Condition with MCNP™ and ENDF/B-VI," *Proceedings of the International Topical Meeting on Advances in Reactor Physics and Mathematics and Computation into the Next Millennium*, Pittsburgh, Pennsylvania (May 2000).
12. John S. Hendricks and Christopher N. Culbertson, "An Assessment of MCNP Weight Windows," *Proceedings of the International Topical Meeting on Advances in Reactor Physics and Mathematics and Computation into the Next Millennium*, Pittsburgh, Pennsylvania (May 2000).
13. Roger W. Brewer, James S. Baker, and Russell D. Mosteller, "UH₃ Critical Assemblies," *Proceedings of the International Topical Meeting on Advances in Reactor Physics and Mathematics and Computation into the Next Millennium*, Pittsburgh, Pennsylvania (May 2000).
14. R. W. Brewer, "²⁴²Pu Critical Mass," *Proceedings of the Sixth International Conference on Nuclear Criticality Safety (ICNC '99)*, Vol. II, pp. 456-460 (September 1999).
15. Russell D. Mosteller and Robert C. Little, "Impact of MCNP Unresolved Resonance Probability-Table Treatment on Uranium and Plutonium Benchmarks," *Proceedings of the Sixth International Conference on Nuclear Criticality Safety (ICNC '99)*, Vol. II, pp. 522-531 (September 1999).
16. D. K. Parsons, Avneet Sood, R. A. Forster, and R. C. Little, "Verification of MCNP and DANT/SYS with the Analytic Benchmark Test Set," *Proceedings of the Sixth International Conference on Nuclear Criticality Safety (ICNC '99)*, Vol. III, pp. 1188-1195 (September 1999).
17. Mark E. Abhold and Michael C. Baker, "MCNP-REN — A Monte Carlo Tool for Neutron Detector Design without Using the Point Model," *Proceedings of the 40th Annual IMM Meeting* (July 1999).
18. Russell D. Mosteller, "ENDF/B-V and ENDF/B-VI Results for UO₂ Lattice Benchmark Problems Using MCNP," *Proceedings of the International Conference on the Physics of Nuclear Science and Technology*, Vol. 2, pp. 1282-1289 (October 1998).
19. Lee L. Carter, Robert C. Little, John S. Hendricks, and Robert E. MacFarlane, "New Probability Table Treatment in MCNP for Unresolved Resonances," *Proceedings of the 1998 ANS Radiation Protection and Shielding Division Topical Conference*, Vol. 2, pp. 341-347 (1998).

Table 2. Papers Presented at Conferences and Topical Meetings (Continued)

20. Brent M. Capell, Russell D. Mosteller, and Denise B. Pelowitz, "MCNP Calculations for Russian Criticality-Safety Benchmarks," *Proceedings of the 1997 Topical Meeting on Criticality Safety Challenges in the Next Decade*, pp. 384-392 (September 1997).
21. Stephanie C. Frankle and John G. Conoway, "MCNP™ Simulation for Identifying Environmental Contaminants Using Prompt Gamma Rays from Thermal Neutron Capture Reactions," *3rd Topical Meeting on Industrial Radiation and Radioisotope Measurements and Applications* (1996).
22. Gregg W. McKinney and Jess L. Iverson, "Verification of the MCNP™ Perturbation Technique," *Proceedings of the Conference on Advances in Radiation Protection and Shielding* (April 1996).
23. Kenneth J. Adams, "MCNP™ Monte Carlo: A Precip of MCNP," *Proceedings of the 1996 Meeting of the International Society for Optical Engineering* (1996).
24. J. L. Iverson and R. D. Mosteller, "MCNP Calculations for Criticality Safety Benchmarks with ENDF/B-V and ENDF/B-VI Libraries," *Proceedings of the Fifth International Conference on Nuclear Criticality Safety*, Vol. I, pp. 6.123-6.130 (September 1995).
25. G. W. McKinney and J. L. Iverson, "MCNP Perturbation Technique for Criticality Analysis," *Proceedings of the Fifth International Conference on Nuclear Criticality Safety*, Vol. I, pp. 6.131-6.137 (September 1995).
26. R. A. Forster, T. E. Booth, T. J. Urbatsch, K. A. Van Riper, and L. S. Waters, "Analyses and Visualization of MCNP Criticality Results," *Proceedings of the Fifth International Conference on Nuclear Criticality Safety*, Vol. I, pp. 6.160-6.168 (September 1995).
27. Todd J. Urbatsch, R. Arthur Forster, Richard E. Prael, and Richard J. Beckman, "Understanding the Three-Combined k_{eff} Confidence Intervals in MCNP," *Proceedings of the Fifth International Conference on Nuclear Criticality Safety*, Vol. I, pp. 6.169-6.174 (September 1995).
28. Kenneth A. Van Riper, Gregg W. McKinney, and Todd J. Urbatsch, "Criticality Analysis Using Monte Carlo Particle Tracks," *Proceedings of the Fifth International Conference on Nuclear Criticality Safety*, Vol. I, pp. 6.175-6.181 (September 1995).
29. Russell D. Mosteller and Jess L. Iverson, "Comparison of ENDF/B-V and ENDF/B-VI Results for a Variety of Thermal Reactor Lattices," *Proceedings of the International Conference on Mathematics and Computations, Reactor Physics, and Environmental Analyses*, Vol. 2, pp. 1024-1033 (April 1995).
30. R. D. Mosteller, R. J. LaBauve, B. J. Krohn, J. L. Sapis, and J. L. Iverson, "Benchmark Calculations for Some Los Alamos Oralloy Critical Experiments," *Proceedings of the*

Table 2. Papers Presented at Conferences and Topical Meetings (Continued)

1994 Topical Meeting on Advances in Reactor Physics, Vol. III, pp. 291-298 (April 1994).

31. R. A. Forster, S. P. Pederson, and T. E. Booth, "Ten New Checks to Assess the Statistical Quality of Monte Carlo Solutions in MCNP," *Proceedings of the 8th International Conference on Radiation Shielding* (April 1994).
32. Ronald C. Brockhoff and John S. Hendricks, "MCNP Analysis of the Livermore Pulsed Spheres with ENDF/B-VI," *Proceedings of the 8th International Conference on Radiation Shielding* (April 1994).
33. J. R. Bland, P. R. Shire, and L. S. Waters, "Analysis of LAMPF Air Activation by High-Energy Particles with LAHET-MCNP," *Proceedings of the 8th International Conference on Radiation Shielding* (April 1994).
34. Gregg W. McKinney, John C. Wagner, and James E. Sisolak, "MCNP/KENO Criticality Benchmarks," *Proceedings of the Topical Meeting on Physics and Methods in Criticality Safety* (September 1993).
35. R. D. Mosteller, J. T. Holly, and L. A. Mott, "Benchmark Calculations for the Doppler Coefficient of Reactivity in Mixed-Oxide Fuel," *Proceedings of the International Topical Meeting on Advances in Mathematics, Computations, and Reactor Physics*, pp. 9.2 1-1-9.2 1-12 (April 1991).

4 LOS ALAMOS NATIONAL LABORATORY REPORTS

LANL publishes reports in a variety of formats, including formal research reports and less formal reports with more limited scope.

4.1 Research Reports

LANL research reports describing the verification or validation of MCNP for various purposes are listed in Table 3, in reverse chronological order.

4.2 Informal Reports

Informal LANL reports involving verification or validation of MCNP are listed in Table 4, in descending chronological order. These reports typically fall within one of three categories: (1) papers that have been submitted for publication but not yet published, (2) papers presented at meetings for which no formal proceedings were published, and (3) papers with such a narrow scope that they are not appropriate for research reports.

5. EVALUATIONS IN THE INTERNATIONAL HANDBOOK OF EVALUATED CRITICALITY SAFETY BENCHMARK EXPERIMENTS

International Handbook of Evaluated Criticality Safety Benchmark Experiments, OECD Nuclear Energy Agency report NEA/NSC/DOC(95)03, September 2003 Edition.

The *Handbook* contains benchmark specifications for 3,070 different critical experiments. Those specifications were prepared by participants from 13 different countries and appear in 350 separate evaluations.

The evaluations in the *Handbook* have undergone three separate levels of review. First, the evaluation is reviewed for completeness and consistency by an “internal reviewer,” who belongs to the same organization as the evaluator(s). Second, it is reviewed in detail by an “external reviewer,” who belongs to a different organization than the evaluator(s). Finally, it is reviewed by the members of the International Criticality Safety Benchmark Evaluation Project and discussed at one or more of their annual meetings. After each level of the review, a list of comments, suggestions, and/or corrections is given to the evaluator(s), who must then respond to them. After a consensus is reached, the revised evaluation moves along to the next review level. Consequently, the evaluation has received extensive scrutiny before it is incorporated into the *Handbook*.

Each evaluation includes sample results from two or more combinations of codes and nuclear data libraries. With very few exceptions, one of those codes is MCNP.

5.1 LANL Evaluations

A list of evaluations written and reviewed by LANL staff members is given in Table 5, in the order in which they appear in the *Handbook*. Each evaluation includes results from an MCNP

Table 3. Los Alamos National Laboratory Research Reports

1. Stephanie C. Frankle and Judith F. Briesmeister, *Spectral Measurements in Critical Assemblies: MCNP Specifications and Calculated Results*, LA-13675 (December 1999).
2. Stephanie C. Frankle, *Criticality Benchmark Results Using Various MCNP Data Libraries*, LA-13627 (July 1999).
3. A. K. Hess, J. S. Hendricks, G. W. McKinney, and L. L. Carter, *Verification of the MCNPTM Perturbation Correction Feature for Cross-Section Dependent Tallies*, LA-13520 (October 1998).
4. Avneet Sood, R. A. Forster, and D. K. Parson, *Analytical Benchmark Test Set for Criticality Code Verification*, LA-13511 (July 1999).
5. D. P. Gierga and K. J. Adams, *Electron/Photon Verification Calculations using MCNP4B*, LA-13440 (April 1999).
6. J. D. Densmore, G. W. McKinney, and J. S. Hendricks, *Correction to the MCNPTM Perturbation Feature for Cross-Section Dependent Tallies*, LA-13374 (October 1997).
7. John S. Hendricks and John D. Court, *MCNP4BTM Verification and Validation*, LA-13181 (August 1996).
8. Gregg W. McKinney and Jess L. Iverson, *Verification of the Monte Carlo Differential Operator Technique for MCNPTM*, LA-13098 (February 1996).
9. Stephanie C. Frankle, *Photon Production Assessment for the MCNPTM Data Libraries*, LA-13092-MS (March 1996).
10. John S. Hendricks, Stephanie C. Frankle, and John D. Court, *ENDF/B-VI Data for MCNP*, LA-12891 (December 1994).
11. John D. Court, John S. Hendricks, and Stephanie C. Frankle, *MCNP ENDF/B-VI Validation: Infinite Media Comparisons of ENDF/B-VI and ENDF/B-V*, LA-12887 (December 1994).
12. John D. Court, Ronald C. Brockhoff, and John S. Hendricks, *Lawrence Livermore Pulsed Sphere Benchmark Analysis of MCNPTM ENDF/B-VI*, LA-12885 (December 1994).
13. John D. Court and John S. Hendricks, *Benchmark Analysis of MCNP ENDF/B-VI Iron*, LA-12884 (December 1994).
14. R. C. Byrd, G. P. Estes, and G. R. Mannon, *Far-Field Fast-Neutron Energy Spectra from an Unshielded Fission Reactor*, LA-12870-MS (January 1995).

Table 3. Los Alamos National Laboratory Research Reports (Continued)

15. Ronald C. Brockhoff and John S. Hendricks, *A New MCNPTM Test Set*, LA-12839 (September 1994).
16. John C. Wagner, Everett L. Redmond II, Scott P. Palmtag, and John S. Hendricks, *MCNP Multigroup/Adjoint Capabilities*, LA-12704 (April 1994).
17. Todd J. Urbatsch, R. Arthur Forster, Richard E. Prael, and Richard J. Beckman, *Estimation and Interpretation of k_{eff} Confidence Intervals in MCNP*, LA-12658 (November 1995).
18. John C. Wagner, James E. Sisolak, and Gregg W. McKinney, *MCNP Criticality Safety Benchmark Problems*, LA-12415 (October 1992).
19. Guy P. Estes, John T. Kriese, and Robert G. Schrandt, *Comparison of First-Principles of MCNP Calculations of NaI and BGO Detector Response Functions to Measurements*, LA-12391 (September 1992).
20. Daniel J. Whalen, David A. Cardon, Jennifer L. Uhle, and John S. Hendricks, *MCNP: Neutron Benchmark Problems*, LA-12212 (November 1991).
21. Daniel J. Whalen, David E. Hollowell, and John S. Hendricks, *MCNP: Photon Benchmark Problems*, LA-12196 (September 1991).
22. John S. Hendricks and Richard E. Prael, *MCNP $S(\alpha, \beta)$ Detector Scheme*, LA-11952 (1990).
23. Robert Springer Brown, Jr., *Collision Biasing Schemes for Monte Carlo Transport Codes*, LA-11913-T (October 1990).
24. Michael J. George, Karl H. Mueller, Rosemary H. O'Connor, and Robert G. Schrandt, *The Use of the Monte Carlo Method to Simulate High-Energy Radiography of Dense Objects*, LA-11727-MS (January 1990).

Table 4. Los Alamos National Laboratory Informal Reports

1. Russell D. Mosteller, David J. Loaiza, and Rene G. Sanchez, "Creation of a Simplified Benchmark Model for the Neptunium Sphere Experiment," LA-UR-03-7348 (2003).
2. Russell D. Mosteller, "ENDF/B-V and ENDF/B-VI Calculations for the LWBR SB Core Benchmarks with MCNP5," LA-UR-03-7231 (2003).
3. Russell D. Mosteller, "An Assessment of ENDF/B-VI Releases Using the MCNP Criticality Validation Suite," LA-UR-03-7072 (2003).
4. Taro Ueki, Forrest B. Brown, D. Kent Parsons, and James S. Warsa, "Time Series Analysis of Monte Carlo Fission Sources: I. Dominance Ratio Computation," LA-UR-03-5823 (2003)
5. M. T. Swinhoe and H. O. Menlove, "Results from LINC Detector MCNP Modeling," LA-UR-03-3688 (2003).
6. Y. Nagaya and F. B. Brown, "Implementation of a Method to Estimate Change in Eigenvalue Due to Perturbed Fission Source Distribution Into MCNP," LA-UR-03-1387 (2003).
7. Russell D. Mosteller, "Testing MCNP5 β Version 4.18 with Criticality and Radiation-Shielding Validation Suites," LA-UR-02-6532 (2002).
8. Forrest B. Brown and Yasunobu Nagaya, "The MCNP5 Random Number Generator," LA-UR-02-3782 (2002).
9. Avneet Sood, R. Arthur Forster, Bryce J. Adams, and Morgan C. White, "Verification of the Pulse Height Tally in MCNP5," LA-UR-02-3502 (2002).
10. F. B. Brown, R. C. Little, A. Sood, D. K. Parsons, and T. A. Wareing, "MCNP Calculations for the OECD/NEA Source Convergence Benchmarks for Criticality Safety Analysis", LA-UR-01-5181 (2001).
11. Arthur B. Crawford, "Dose Assessment Calculations for a Hot Cell Using MCNP," LA-UR-01-2408 (2001). (Presented at the EFCOG Safety Analysis Working Group Workshop, June 2001, Milwaukee, WI).
12. Christopher J. Werner, "Simulation of Delayed Neutrons Using MCNP," LA-UR-00-3696 (2000).
13. Mark Abhold, Michael Baker, Ren Jie, George Eccleston, and Howard Menlove, "Comparisons of UWCC MOX Fuel to MCNP-REN Calculations," LA-UR-98-3893 (1998).

Table 4. Los Alamos National Laboratory Informal Reports (Continued)

14. D. P. Gierga and K. J. Adams, "Electron Photon Verification Calculations Using MCNP4B," LA-UR-97-3582 (1997).
15. S. C. Frankle and R. E. MacFarlane, "Testing of the ENDF/B-VI Neutron Data Library ENDF60 for Use with MCNP™," LA-UR-95-1886 (1995). (Presented at the 1995 meeting of the Nuclear Criticality Technology Safety Project.)
16. R. A. Forster and T. E. Booth, "MCNP Analyses of Criticality Calculation Results," LA-UR-95-1159 (1995). (Presented at the DOE Criticality Safety Workshop, May 17, 1995, San Diego, CA).
17. Stephanie C. Frankle, "Benchmarking the Monte Carlo Simulation Code MCNP," LA-UR-94-1282 (1994).
18. Laurie Waters, "Radiation Calculations Using LAHET/MCNP/CINDER90," LA-UR-92-3223 (1992).

Table 5. Evaluations in the International Handbook of Evaluated Criticality Safety Benchmark Experiments: LANL Evaluations

1. R. Douglas O'Dell, "Bare Sphere of Plutonium-239 Metal (4.5 at.% ^{240}Pu , 1.02 wt.% Ga)," PU-MET-FAST-001 (Roger W. Brewer, internal reviewer).
2. R. Douglas O'Dell, " ^{240}Pu Jezebel: Bare Sphere of Plutonium-239 Metal (20.1 at.% ^{240}Pu , 1.01 wt.% Ga)," PU-MET-FAST-002 (Roger W. Brewer, internal reviewer).
3. Roger W. Brewer, "Benchmark Critical Experiment of a Plutonium Sphere Reflected by Tungsten," PU-MET-FAST-005 (John A. Schlessler, internal reviewer).
4. Roger W. Brewer, "Plutonium Sphere Reflected by Normal Uranium Using Flattop," PU-MET-FAST-006 (T. P. McLaughlin, internal reviewer).
5. Roger W. Brewer, "Benchmark Critical Experiment of a Thorium Reflected Plutonium Sphere," PU-MET-FAST-008 (Thomas P. McLaughlin, internal reviewer).
6. Roger W. Brewer, "Benchmark Critical Experiments of a Plutonium Sphere Reflected by Aluminum," PU-MET-FAST-009 (D. Kent Parsons, internal reviewer).
7. Roger W. Brewer, "Benchmark Critical Experiment of a Delta-Phase Plutonium Sphere Reflected by Normal Uranium," PU-MET-FAST-010 (D. Kent Parsons, internal reviewer).
8. Roger W. Brewer, "Benchmark Critical Experiment of a Water Reflected Alpha-Phase Plutonium Sphere," PU-MET-FAST-011 (R. Douglas O'Dell, internal reviewer).
9. Roger W. Brewer, "Benchmark Critical Experiment of a Delta-Phase Plutonium Sphere Reflected by Beryllium," PU-MET-FAST-018 (D. Kent Parsons, internal reviewer).
10. Roger W. Brewer, "Critical Experiments Performed for LAMPRE, the Los Alamos Molten Plutonium Reactor," PU-MET-FAST-045 (David Loaiza, internal reviewer).
11. Roger W. Brewer, "Reflected Uranium-Hydride Cylindrical Assemblies," HEU-COMP-INTER-003 (Russell Mosteller, internal reviewer).
12. Raphael J. LaBauve, "Bare, Highly Enriched Uranium Sphere (Godiva)," HEU-MET-FAST-001 (Joseph L. Sapir, internal reviewer).
13. Raphael J. LaBauve, "Topsy, 8-Inch Tuballoy-Reflected Oralloy Assemblies," HEU-MET-FAST-002 (Joseph L. Sapir, internal reviewer).
14. Raphael J. LaBauve, "Reflected Oralloy Spherical Assemblies," HEU-MET-FAST-003 (Joseph L. Sapir, internal reviewer).

Table 5. Evaluations in the International Handbook of Evaluated Criticality Safety Benchmark Experiments: LANL Evaluations (Continued)

15. Russell D. Mosteller, "Lattices of Oralloid Cubes in Water," HEU-MET-FAST-006 (Joseph L. Sapir, internal reviewer).
16. Roger W. Brewer, "Uranium-235 Sphere Reflected by Normal Uranium Using Flattop," HEU-MET-FAST-028 (T. P. McLaughlin, internal reviewer).
17. Joseph Sapir and Russell Kidman, "²³⁵U(94%) Spheres Surrounded by Natural-Uranium Reflectors," HEU-MET-FAST-032 (R. W. Brewer, internal reviewer).
18. Joseph Sapir, "²³⁵U(94%) Spheres Surrounded by Beryllium or Graphite Reflectors," HEU-MET-FAST-041 (R. W. Brewer, internal reviewer).
19. Russell D. Mosteller, Joseph Sapir, and Roger W. Brewer, "Zeus: Intermediate-Spectrum Critical Assemblies with a Graphite-HEU Core Surrounded by a Copper Reflector," HEU-MET-INTER-006 (Roger W. Brewer and David Loaiza, internal reviewers).
20. Russell D. Mosteller, "Lattices of Oralloid Cubes in Water," HEU-MET-MIXED-010 (Joseph L. Sapir, internal reviewer).
21. Roger W. Brewer, "Polyethylene Reflected and Moderated Highly Enriched Uranium System with Silicon," HEU-MET-THERM-001 (Rene Sanchez and David Loaiza, internal reviewers).
22. Russell D. Mosteller, "Lattices of Oralloid Cubes in Water," HEU-MET-THERM-003 (Joseph L. Sapir, internal reviewer).
23. David Loaiza, "Polyethylene Reflected and Moderated Highly Enriched Uranium System with Aluminum," HEU-MET-THERM-008 (Roger Brewer and Rene Sanchez, internal reviewers).
24. David Loaiza, "Polyethylene Reflected and Moderated Highly Enriched Uranium System with Magnesium Oxide," HEU-MET-THERM-009 (Roger Brewer, internal reviewer).
25. David Loaiza, "Polyethylene Reflected and Moderated Highly Enriched Uranium Systems with Gadolinium," HEU-MET-THERM-010 (Roger Brewer, internal reviewer).
26. David Loaiza, "Polyethylene Reflected and Moderated Highly Enriched Uranium Systems with Iron," HEU-MET-THERM-013 (Roger Brewer, internal reviewer).
27. David Loaiza, "2 x 2 x 23 Array of Highly Enriched Uranium with Silicon Dioxide, Moderated and Reflected by Polyethylene," HEU-MET-THERM-014 (Roger Brewer, internal reviewer).

Table 5. Evaluations in the International Handbook of Evaluated Criticality Safety Benchmark Experiments: LANL Evaluations (Continued)

28. David Loaiza, "2 x 2 x 11 Array of Highly Enriched Uranium with Ni-Cr-Mo-Gd Alloy, Moderated and Reflected by Polyethylene," HEU-MET-THERM-016 (Roger Brewer, internal reviewer).
29. Joseph L. Sapir, "Reflected Uranyl-Fluoride Solutions in Heavy Water," HEU-SOL-INTER-001 (Russell B. Kidman, internal reviewer).
30. Joseph L. Sapir, "Reflected Uranyl-Fluoride Solutions in Heavy Water," HEU-SOL-THERM-004 (Russell B. Kidman, internal reviewer).
31. Joseph L. Sapir, "Unreflected Cylinders of Uranyl-Fluoride Solutions in Heavy Water," HEU-SOL-THERM-020 (Russell B. Kidman, internal reviewer).
32. Joseph L. Sapir, "A 48-Inch Diameter Unreflected Sphere of Uranyl Nitrate (93.2 wt.% ²³⁵U) Solution," HEU-SOL-THERM-032 (Russell D. Mosteller, internal reviewer).
33. Burton J. Krohn, "The Early Jemima Experiments: Bare Cylindrical Configurations of Enriched and Natural Uranium," IEU-MET-FAST-001 (Joseph L. Sapir, internal reviewer).
34. Russell B. Kidman, "Natural Uranium Reflected Assembly of Enriched and Natural Uranium Plates," IEU-MET-FAST-002 (Joseph L. Sapir, internal reviewer).
35. Joseph L. Sapir and Burton J. Krohn, "BIG TEN: A Large, Mixed-Uranium-Metal Cylindrical Core with 10% Average ²³⁵U Enrichment, Surrounded by a Thick ²³⁸U Reflector," IEU-MET-FAST-007 (Denise B. Pelowitz, internal reviewer).
36. Russell D. Mosteller, "Critical Lattices of UO₂ Fuel Rods and Perturbing Rods in Borated Water," LEU-COMP-THERM-008 (Denise B. Pelowitz, internal reviewer).
37. Raphael J. LaBauve, "Unreflected UO₂F₂+H₂O Cylindrical Assembly: SHEBA-II," LEU-SOL-THERM-001 (Joseph L. Sapir, internal reviewer).
38. R. Douglas O'Dell, "²³³U Jezebel: A Bare Sphere of Uranium-233," U233-MET-FAST-001 (Roger W. Brewer, internal reviewer).
39. Roger W. Brewer, "Benchmark Critical Experiments of Uranium-233 Spheres Surrounded by Uranium-235," U233-MET-FAST-002 (Stuart G. Vessard, internal reviewer).
40. Roger W. Brewer, "Benchmark Critical Experiments of Highly Enriched Uranium-233 Spheres Surrounded by Normal Uranium," U233-MET-FAST-003 (R. Douglas O'Dell, internal reviewer).

Table 5. Evaluations in the International Handbook of Evaluated Criticality Safety Benchmark Experiments: LANL Evaluations (Continued)

41. Roger W. Brewer, "Benchmark Critical Experiments of Highly Enriched Uranium-233 Spheres Reflected by Tungsten," U233-MET-FAST-004 (John A. Schlessler, internal reviewer).
42. Roger W. Brewer, "Benchmark Critical Experiments of Highly Enriched Uranium-233 Spheres Reflected by Beryllium," U233-MET-FAST-005 (D. Kent Parsons, internal reviewer).
43. Roger W. Brewer, "Benchmark Critical Experiment of a Uranium-233 Sphere Reflected by Normal Uranium with Flattop," U233-MET-FAST-006 (D. Kent Parsons, internal reviewer).
44. Joseph L. Sapir, "Unreflected Spheres of ^{233}U Nitrate Solutions," U233-SOL-THERM-001 (Russell D. Mosteller, internal reviewer).
45. Joseph L. Sapir, "A 48-Inch Diameter Unreflected Sphere of ^{233}U Nitrate Solution," U233-SOL-THERM-008 (Russell D. Mosteller, internal reviewer).
46. Roger W. Brewer, "Benchmark Critical Experiment of a Plutonium Sphere Surrounded by Highly Enriched Uranium," MIX-MET-FAST-001 (R. Douglas O'Dell, internal reviewer).
47. Roger W. Brewer, "Spherical Composite Cores Composed of Plutonium and Highly Enriched Uranium Reflected by Normal Uranium," MIX-MET-FAST-002 (Shean P. Monahan, R. Douglas O'Dell, and D. Kent Parsons, internal reviewers).
48. Roger W. Brewer, "Critical Experiments Performed Using Spherical Composite Cores Reflected by Beryllium," MIX-MET-FAST-007 (Thomas P. MacLaughlin, internal reviewer).
49. Roger W. Brewer, "Replacement Measurements Performed with Curium-244, Plutonium-239, and HEU Using Jezebel," SPEC-MET-FAST-001 (R. Douglas O'Dell and D. Kent Parsons, internal reviewers).
50. Roger W. Brewer, "Plutonium-238 and Plutonium-239 Replacement Measurements Performed Using Jezebel," SPEC-MET-FAST-002 (D. Kent Parsons, internal reviewer).
51. Roger W. Brewer, "Neptunium-237 and Highly Enriched Uranium Replacement Measurements Performed Using Flattop," SPEC-MET-FAST-003 (R. G. Sanchez, internal reviewer).
52. Roger W. Brewer, "Critical Experiments Performed Using Plates of Plutonium-242, HEU, and Plutonium-239," SPEC-MET-FAST-004 (Thomas P. MacLaughlin, internal reviewer).

Table 5. Evaluations in the International Handbook of Evaluated Criticality Safety Benchmark Experiments: LANL Evaluations (Continued)

53. David Loaiza, "Neptunium-237 Sphere Reflected by Hemispherical Shells of Highly Enriched Uranium," SPEC-MET-FAST-008 (Roger Brewer and Rene Sanchez, internal reviewers).

calculation for each benchmark within it, based on input that was prepared by a LANL staff member. Comparisons between the benchmark values for k_{eff} and the corresponding value calculated with MCNP appear in a table in Section 4 of each evaluation.

5.2 LANL External Reviews

Evaluations for which the external review was performed by a LANL staff member are listed in Table 6, in the order in which they appear in the *Handbook*. External reviewers confirm that the benchmark specifications are consistent with information provided elsewhere in the evaluation and that they provide a complete description of the benchmark model.

Each of these evaluations includes results from an MCNP calculation for each benchmark in it. Input for that calculation may have been prepared by the evaluator(s) or by the LANL staff member who performed the external review. Comparisons between the benchmark values for k_{eff} and the corresponding value calculated with MCNP appear in a table in Section 4 of each evaluation.

6 EXTERNAL ARTICLES AND REPORTS

A few articles and reports published by other organizations are listed in Table 7. The particular significance of these articles and reports is that they are quite detailed and they describe the manner in which other organizations perform validation for MCNP.

Table 6. Evaluations in the International Handbook of Evaluated Criticality Safety Benchmark Experiments: LANL External Reviews

1. M. V. Gorbatenko, V. P. Gorelov, V. P. Yegorov, V. G. Zagrafov, A. N. Zacharov, V. I. Ilyin, M. I. Kuvshinov, A. A. Malinkin, and V. I. Yuferev, “Bare Spherical Assembly of $^{239}\text{Pu}(\delta,98\%)$,” PU-MET-FAST-022 (Denise B. Pelowitz, external reviewer).
2. M. V. Gorbatenko, V. P. Gorelov, V. P. Yegorov, V. G. Zagrafov, A. N. Zacharov, V. I. Ilyin, M. I. Kuvshinov, A. A. Malinkin, and V. I. Yuferev, “Graphite-Reflected Spherical Assembly of $^{239}\text{Pu}(\delta,98\%)$,” PU-MET-FAST-023 (Denise B. Pelowitz, external reviewer).
3. M. V. Gorbatenko, V. P. Gorelov, V. P. Yegorov, V. G. Zagrafov, A. N. Zacharov, V. I. Ilyin, M. I. Kuvshinov, A. A. Malinkin, and V. I. Yuferev, “Polyethylene-Reflected Spherical Assembly of $^{239}\text{Pu}(\delta,98\%)$,” PU-MET-FAST-024 (Denise B. Pelowitz, external reviewer).
4. M. V. Gorbatenko, V. P. Gorelov, V. P. Yegorov, V. G. Zagrafov, A. N. Zacharov, V. I. Ilyin, M. I. Kuvshinov, A. A. Malinkin, and V. I. Yuferev, “Spherical Assembly of $^{239}\text{Pu}(\delta,98\%)$ with 1.55-cm Steel Reflector,” PU-MET-FAST-025 (Denise B. Pelowitz, external reviewer).
5. M. V. Gorbatenko, V. P. Gorelov, V. P. Yegorov, V. G. Zagrafov, A. N. Zacharov, V. I. Ilyin, M. I. Kuvshinov, A. A. Malinkin, and V. I. Yuferev, “Spherical Assembly of $^{239}\text{Pu}(\delta,98\%)$ with 11.9-cm Steel Reflector,” PU-MET-FAST-026 (Denise B. Pelowitz, external reviewer).
6. M. V. Gorbatenko, V. P. Gorelov, V. P. Yegorov, V. G. Zagrafov, A. N. Zacharov, V. I. Ilyin, M. I. Kuvshinov, A. A. Malinkin, and V. I. Yuferev, “Polyethylene-Reflected Spherical Assembly of $^{239}\text{Pu}(\delta,89\%)$,” PU-MET-FAST-027 (Denise B. Pelowitz, external reviewer).
7. M. V. Gorbatenko, V. P. Gorelov, V. P. Yegorov, V. G. Zagrafov, A. N. Zacharov, V. I. Ilyin, M. I. Kuvshinov, A. A. Malinkin, and V. I. Yuferev, “Steel-Reflected Spherical Assembly of $^{239}\text{Pu}(\delta,89\%)$,” PU-MET-FAST-028 (Denise B. Pelowitz, external reviewer).
8. M. V. Gorbatenko, V. P. Gorelov, V. P. Yegorov, V. G. Zagrafov, A. N. Zacharov, V. I. Ilyin, M. I. Kuvshinov, A. A. Malinkin, and V. I. Yuferev, “Bare Spherical Assembly of $^{239}\text{Pu}(\delta,88\%)$,” PU-MET-FAST-029 (Denise B. Pelowitz, external reviewer).
9. M. V. Gorbatenko, V. P. Gorelov, V. P. Yegorov, V. G. Zagrafov, A. N. Zacharov, V. I. Ilyin, M. I. Kuvshinov, A. A. Malinkin, and V. I. Yuferev, “Graphite-Reflected Spherical Assembly of $^{239}\text{Pu}(\delta,88\%)$,” PU-MET-FAST-030 (Denise B. Pelowitz, external reviewer).
10. M. V. Gorbatenko, V. P. Gorelov, V. P. Yegorov, V. G. Zagrafov, A. N. Zacharov, V. I. Ilyin, M. I. Kuvshinov, A. A. Malinkin, and V. I. Yuferev, “Polyethylene-Reflected

Table 6. Evaluations in the International Handbook of Evaluated Criticality Safety Benchmark Experiments: LANL External Reviews (Continued)

- Spherical Assembly of $^{239}\text{Pu}(\delta,88\%)$,” PU-MET-FAST-031 (Denise B. Pelowitz, external reviewer).
11. M. V. Gorbatenko, V. P. Gorelov, V. P. Yegorov, V. G. Zagrafov, A. N. Zacharov, V. I. Ilyin, M. I. Kuvshinov, A. A. Malinkin, and V. I. Yuferev, “Steel-Reflected Spherical Assembly of $^{239}\text{Pu}(\delta,88\%)$,” PU-MET-FAST-032 (Denise B. Pelowitz, external reviewer).
 12. M. V. Gorbatenko, V. P. Gorelov, V. P. Yegorov, V. G. Zagrafov, V. I. Ilyin, M. I. Kuvshinov, A. A. Malinkin, and V. I. Yuferev, “Spherical Assembly of $^{239}\text{Pu}(\delta,98\%)$ with a 4.25-cm Duralumin Reflector,” PU-MET-FAST-039 (Denise B. Pelowitz, external reviewer).
 13. M. V. Gorbatenko, V. P. Gorelov, V. P. Yegorov, V. G. Zagrafov, V. I. Ilyin, M. I. Kuvshinov, A. A. Malinkin, and V. I. Yuferev, “Spherical Assembly of $^{239}\text{Pu}(\delta,98\%)$ with a 1.6-cm Copper Reflector,” PU-MET-FAST-040 (Denise B. Pelowitz, external reviewer).
 14. M. V. Gorbatenko, V. P. Gorelov, V. P. Yegorov, V. G. Zagrafov, V. I. Ilyin, M. I. Kuvshinov, A. A. Malinkin, and V. I. Yuferev, “Spherical Assembly of $^{239}\text{Pu}(\delta,88\%)$ with a 20.98-cm Depleted Uranium Reflector,” PU-MET-FAST-041 (Denise B. Pelowitz, external reviewer).
 15. David Hanlon, “ k_{∞} Experiments in Intermediate Neutron Spectra for ^{239}Pu ,” PU-COMP-INTER-001 (Russell D. Mosteller, external reviewer).
 16. V. D. Lyutov, A. P. Vasilyev, and V. D. Perezhogin, “Bare Sphere of Highly Enriched Uranium,” HEU-MET-FAST-008 (Denise B. Pelowitz, external reviewer).
 17. M. V. Gorbatenko, V. P. Gorelov, V. P. Yegorov, V. G. Zagrafov, A. N. Zacharov, V. I. Ilyin, M. I. Kuvshinov, A. A. Malinkin, and V. I. Yuferev, “Bare Spherical Assembly of $^{235}\text{U}(90\%)$,” HEU-MET-FAST-018 (Denise B. Pelowitz, external reviewer).
 18. M. V. Gorbatenko, V. P. Gorelov, V. P. Yegorov, V. G. Zagrafov, A. N. Zacharov, V. I. Ilyin, M. I. Kuvshinov, A. A. Malinkin, and V. I. Yuferev, “Graphite-Reflected Spherical Assembly of $^{235}\text{U}(90\%)$,” HEU-MET-FAST-019 (Denise B. Pelowitz, external reviewer).
 19. M. V. Gorbatenko, V. P. Gorelov, V. P. Yegorov, V. G. Zagrafov, A. N. Zacharov, V. I. Ilyin, M. I. Kuvshinov, A. A. Malinkin, and V. I. Yuferev, “Polyethylene-Reflected Spherical Assembly of $^{235}\text{U}(90\%)$,” HEU-MET-FAST-020 (Denise B. Pelowitz, external reviewer).
 20. M. V. Gorbatenko, V. P. Gorelov, V. P. Yegorov, V. G. Zagrafov, A. N. Zacharov, V. I. Ilyin, M. I. Kuvshinov, A. A. Malinkin, and V. I. Yuferev, “Steel-Reflected Spherical Assembly of $^{235}\text{U}(90\%)$,” HEU-MET-FAST-021 (Denise B. Pelowitz, external reviewer).

Table 6. Evaluations in the International Handbook of Evaluated Criticality Safety Benchmark Experiments: LANL External Reviews (Continued)

21. M. V. Gorbatenko, V. P. Gorelov, V. P. Yegorov, V. G. Zagrafov, A. N. Zacharov, V. I. Ilyin, M. I. Kuvshinov, A. A. Malinkin, and V. I. Yuferev, "Duralumin-Reflected Spherical Assembly of ^{235}U (90%)," HEU-MET-FAST-022 (Denise B. Pelowitz, external reviewer).
22. John Justice, Doug Strege, Fitz Trumble, and Bruce Haywood, "Tinkertoy: Unmoderated Uranium Metal (93.2) Arrays with Cylinders of 10.5 kg Mass," HEU-MET-FAST-023 (Roger Brewer, external reviewer).
23. M. V. Gorbatenko, V. P. Gorelov, V. P. Yegorov, V. G. Zagrafov, V. I. Ilyin, M. I. Kuvshinov, and V. I. Yuferev, "Spherical Assembly of ^{235}U (90%) with a 3.25-cm Lead Reflector," HEU-MET-FAST-027 (Denise B. Pelowitz, external reviewer).
24. A. P. Vasilyev, E. N. Lipilina, V. D. Lyutov, S. V. Samarina, Yu. A. Sokolov, V. A. Teryokhin, and E. Ya. Filippova, "Two Heterogeneous Cylinders of Highly Enriched Uranium with Polyethylene and Depleted Uranium," HEU-MET-FAST-036 (Denise B. Pelowitz, external reviewer).
25. A. P. Vasilyev, E. N. Lipilina, V. D. Lyutov, S. V. Samarina, Yu. A. Sokolov, V. A. Teryokhin, and E. Ya. Filippova, "Two Heterogeneous Cylinders of Highly Enriched Uranium, Polyethylene, and Depleted Uranium with Polyethylene or Polyethylene and Cadmium Reflector," HEU-MET-FAST-037 (Denise B. Pelowitz, external reviewer).
26. A. P. Vasilyev, E. N. Lipilina, V. D. Lyutov, S. V. Samarina, Yu. A. Sokolov, V. A. Teryokhin, and E. Ya. Filippova, "Heterogeneous Cylinder of Highly Enriched Uranium with Beryllium and Beryllium Oxide Moderators and Depleted-Uranium Reflector," HEU-MET-FAST-038 (Denise B. Pelowitz, external reviewer).
27. Robert W. Schaefer, Kermit A. Bunde, and Peter J. Collins, "The Uranium/Iron Benchmark Assembly: A ^{235}U (93%) Iron Cylinder Reflected by Stainless Steel," HEU-MET-INTER-001 (Russell D. Mosteller, external reviewer).
28. David Hanlon, " k_{∞} Experiments in Intermediate Neutron Spectra for ^{235}U ," HEU-COMP-INTER-004 (Russell D. Mosteller, external reviewer).
29. M. V. Gorbatenko, V. P. Gorelov, V. P. Yegorov, V. G. Zagrafov, A. N. Zacharov, V. I. Ilyin, M. I. Kuvshinov, A. A. Malinkin, and V. I. Yuferev, "Bare Spherical Assembly of ^{235}U (36%)," IEU-MET-FAST-003 (Denise B. Pelowitz, external reviewer).
30. M. V. Gorbatenko, V. P. Gorelov, V. P. Yegorov, V. G. Zagrafov, A. N. Zacharov, V. I. Ilyin, M. I. Kuvshinov, A. A. Malinkin, and V. I. Yuferev, "Graphite-Reflected Spherical Assembly of ^{235}U (36%)," IEU-MET-FAST-004 (Denise B. Pelowitz, external reviewer).

Table 6. Evaluations in the International Handbook of Evaluated Criticality Safety Benchmark Experiments: LANL External Reviews (Continued)

31. M. V. Gorbatenko, V. P. Gorelov, V. P. Yegorov, V. G. Zagrafov, A. N. Zacharov, V. I. Ilyin, M. I. Kuvshinov, A. A. Malinkin, and V. I. Yuferev, "Steel-Reflected Spherical Assembly of ^{235}U (36%)," IEU-MET-FAST-005 (Denise B. Pelowitz, external reviewer).
32. M. V. Gorbatenko, V. P. Gorelov, V. P. Yegorov, V. G. Zagrafov, A. N. Zacharov, V. I. Ilyin, M. I. Kuvshinov, A. A. Malinkin, and V. I. Yuferev, "Duralumin-Reflected Spherical Assembly of ^{235}U (36%)," IEU-MET-FAST-006 (Denise B. Pelowitz, external reviewer).
33. Alain Santamarina, "Storage Arrays of 3%-Enriched LWR Assemblies: The CRISTO II Experiment in the EOLE Reactor, LEU-COMP-THERM-041 (Russell D. Mosteller, external reviewer).
34. Valerie L. Putman, "LWBR SB Core Experiments," U233-COMP-THERM-001 (Russell D. Mosteller, external reviewer).
35. W. Curtis Jordan, "Paraffin-Reflected 8-, 8.5-, 9-, 10-, and 12-Inch-Diameter Cylinders of ^{233}U Uranyl Nitrate Solutions," U233-SOL-THERM-002 (Russell D. Mosteller, external reviewer).
36. W. Curtis Jordan and Joel T. Shor, "Paraffin-Reflected 5-, 6-, and 7.5-Inch-Diameter Cylinders of ^{233}U Uranyl Nitrate Solutions," U233-SOL-THERM-004 (Russell D. Mosteller, external reviewer).
37. M. V. Gorbatenko, V. P. Gorelov, V. P. Yegorov, V. G. Zagrafov, V. I. Ilyin, M. I. Kuvshinov, and V. I. Yuferev, "Spherical Assembly of ^{239}Pu (δ ,98%) with a 0.75-cm External Shell of ^{235}U (90%)," MIX-MET-FAST-009 (Denise B. Pelowitz, external reviewer).
38. M. V. Gorbatenko, V. P. Gorelov, V. P. Yegorov, V. G. Zagrafov, V. I. Ilyin, M. I. Kuvshinov, and V. I. Yuferev, "Spherical Assembly of ^{239}Pu (δ ,98%) with a 2.89-cm External Shell of ^{235}U (90%)," MIX-MET-FAST-010 (Denise B. Pelowitz, external reviewer).
39. A. P. Vasilyev, E. N. Lipilina, V. D. Lyutov, S. V. Samarina, Yu. A. Sokolov, V. A. Teryokhin, and E. Ya. Filippova, "Heterogeneous Cylinder of Plutonium, Highly Enriched Uranium and Polyethylene," MIX-MET-INTER-002 (Denise B. Pelowitz, external reviewer).
40. Hyung-Kook Joo and Virginia F. Dean, "Rectangular Arrays of Water-Moderated UO_2 -2Wt.% PuO_2 (8% ^{240}Pu) Fuel Rods," MIX-COMP-THERM-002 (Russell D. Mosteller, external reviewer).

Table 7. External Articles and Reports

1. Dennis R. Schaart, Jan Th. M. Jansen, Johannes Zoetelief, and Piet F. A. de Leege, "A Comparison of MCNP4C Electron Transport with ITS 3.0 and Experiment at Incident Energies between 100 keV and 20 MeV: Influence of Voxel Size, Substeps and Energy Indexing Algorithm," *Phys. Med. Biol.*, **47**, pp. 1459-1484 (April 2002).
2. A. Blanchard and O. Rivera, *MCNP-4B Validation for the DFS System at SRS*, Westinghouse Savannah River Company report WSRC-TR-99-00197 (1999).
3. Catherine Crawford and Brian Palmer, *Validation of MCNP, A Comparison with SCALE, Part 1: Highly Enriched Uranium Solutions*, Westinghouse Idaho Nuclear Company report WINCO-1109 (October 1992).
4. Catherine Crawford and Brian Palmer, *Validation of MCNP, A Comparison with SCALE, Part 2: Highly Enriched Uranium Metal Systems*, Westinghouse Idaho Nuclear Company report WINCO-1110 (October 1992).
5. Catherine Crawford and Brian Palmer, *Validation of MCNP, A Comparison with SCALE, Part 3: Highly Enriched Uranium Oxide Systems*, Westinghouse Idaho Nuclear Company report WINCO-1111 (October 1992).
6. Catherine Crawford and Brian Palmer, *Validation of MCNP: SPERT D and BORAX V Fuel*, Westinghouse Idaho Nuclear Company report WINCO-1112 (November 1992).
7. S. Sitaraman, *MCNP: Light Water Reactor Critical Benchmarks*, GE Nuclear Energy report NEDO-32028 (March 1992).