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SCALE 6.2.4 Validation: Nuclear Criticality Safety

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November 2022

OAK RIDGE National Laboratory

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Nuclear Energy and Fuel Cycle Division

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ABBREVIATIONS

ANS	American Nuclear Society
ANSI	American National Standards Institute
C/E	calculated-to-expected
CE	continuous energy
COMP[1]	Compound system (e.g., lattice in water)
CSAS	Criticality Safety Analysis Sequences
EALF	energy of the average lethargy causing fission
ENDF	Evaluated Nuclear Data File
eV	electron volt
FAST[1]	Fast system (≥50% of fissions above 100 keV)
HEU[1]	high enriched uranium ($^{235}U \geq 60$ wt %)
HMF[2]	HEU-MET-FAST
HST[2]	HEU-SOL-THERM
ICSBEP	International Criticality Safety Benchmark Evaluation Project
IEU[1]	Intermediate or mixed enrichment uranium (60 wt % > ^{235}U > 10 wt %)
IMF[2]	IEU-MET-FAST
INTER[1]	Intermediate system (≥50% of fissions from 0.625 eV to 100 keV)
keV	kiloelectron volt
LCT[2]	LEU-COMP-THERM
LEU[1]	Low enriched, natural, or depleted uranium ($^{235}U \leq 10$ wt %)
LST	LEU-SOL-THERM
LWR	light-water reactor
MCF[2]	MIX-COMP-FAST
MCT[2]	MIX-COMP-THERM
MET[1]	metal
MeV	megaelectron volt
MG	multigroup
MIX[1]	mixed uranium and plutonium
MIXED[1]	Mixed energy system (>50% of fissions do not occur in any single energy range)
MoC	method of characteristics
MST[2]	MIX-SOL-THERM
ORNL	Oak Ridge National Laboratory
PMF[2]	PU-MET-FAST
PST[2]	PU-SOL-THERM
PU[1]	plutonium
RNSD	Reactor and Nuclear Systems Division
SOL[1]	solution
THERM[1]	Thermal system (≥50% of fissions below 0.625 eV)
TSUNAMI	[SCALE] Tools for Sensitivity and Uncertainty Analysis Methodology Implementation
U233[1]	^{233}U
UCT[2]	U233-COMP-THERM
UMF[2]	U233-MET-FAST
USI[2]	U233-SOL-INTER
USM[2]	U233-SOL-MIXED
UST[2]	U233-SOL-THERM
VALID	Verified, Archived Library of Inputs and Data

[1] ICSBEP abbreviations used
[2] Experiment categories used in this validation

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ABSTRACT

The computational bias of criticality safety computer codes must be established through the validation of the codes to critical experiments. A large collection of suitable experiments has been vetted by the International Criticality Safety Benchmark Evaluation Project (ICSBEP) and made available in the *International Handbook of Evaluated Criticality Safety Benchmark Experiments* (ICSBEP Handbook). More than 600 cases from this handbook have been prepared and reviewed within the Verified, Archived Library of Inputs and Data (VALID), which is maintained by the Reactor and Nuclear Systems Division at Oak Ridge National Laboratory. The performance of the KENO V.a and KENO-VI Monte Carlo codes within the SCALE 6.2.4 code system is assessed using the VALID models of benchmark experiments. A range of nuclear cross section libraries based on Evaluated Nuclear Data File (ENDF)/B-VII.1 in both multigroup (MG) and continuous energy (CE) formats is considered.

The critical experiments available to validate the KENO V.a code cover 15 broad categories of systems. These systems use a range of fissile materials, including a range of uranium enrichments, various plutonium isotopic vectors, and some mixed uranium/plutonium oxides. The physical forms of the fissile material also vary and are represented as metal, solutions, or arrays of rods or plates in a water moderator. The neutron energy spectra of the systems also vary and cover fast, intermediate, mixed, and thermal spectra. Over 550 of the total cases use the KENO V.a code for the four nuclear data libraries considered in this report.

The validation of the KENO-VI code considers 57 cases drawn from three broad categories of systems. The fissile materials in the added systems vary and include high and intermediate enrichment uranium and mixed uranium/plutonium. The physical form of the fissile material is either metal or oxide rod arrays in water. Both fast and thermal neutron energy spectra are represented in the systems considered.

The results indicate generally good performance of both the KENO V.a and KENO-VI codes across the range of systems analyzed except for intermediate and mixed spectrum solution systems fueled with ^{233}U. The bias of calculated k_{eff} from expected values is less than 1% Δk in all other cases, and it is less than 0.5% Δk for most systems. The CE library generally manifests smaller magnitude biases than the MG data. The systems that are only considered in KENO-VI show slightly larger biases than the same experiment categories modeled in KENO V.a. This is likely due primarily to modeling systems having more geometric complexity, making them more difficult to describe accurately.

Two additional conclusions can be drawn from the results of this validation effort: (1) that some evaluations in the ICSBEP Handbook should be updated to provide more rigorous expected k_{eff} values and uncertainties, and (2) that potential cross section errors can be identified by detailed review of the results of this validation. Biases are generally lower in SCALE 6.2.4 than in SCALE 6.1. Overall, the KENO V.a and KENO-VI codes are shown to provide consistent, low-bias results for a wide range of physical systems of potential interest in criticality safety applications.

1. INTRODUCTION

This report documents performance of the SCALE 6.2.4 code system [1] using ENDF/B-VII.1 [2] cross section data with benchmark-quality criticality experiments and high-quality input models. This analysis included a wide variety of fuel types with differing energy spectra of interest to criticality safety practitioners. The validation is performed using the KENO V.a and KENO-VI Monte Carlo neutron transport codes in both multigroup (MG) and continuous energy (CE) modes.

To predict or bound the computational bias for a design system of interest, the *American National Standards for Nuclear Criticality Safety in Operations with Fissionable Material Outside Reactors,* American National Standards Institute (ANSI)/American Nuclear Society(ANS)-8.1-2014 [3]; the *Criticality Safety Criteria for the Handling, Storage, and Transportation of LWR Fuel Outside Reactors,* ANSI/ANS-8.17-2004 (R2014) [4]; and the *American National Standard for Validation of Neutron Transport Methods for Nuclear Criticality Safety Calculations,* ANSI/ANS-8.24-2017 [5], allow the use of calculations to determine subcritical limits for the design of fissionable material systems. The standards require validation of the analytical methods and data used in nuclear criticality safety calculations to quantify any computational bias and the uncertainty in the bias [5]. The validation procedure must be conducted by comparing the computed results with experimental data, and the design system for which the subcritical limit is established must fall within the area of applicability of the experiments chosen for validation. The ANSI/ANS-8.1 standard defines the area (or areas) of applicability as "the limiting ranges of material compositions, geometric arrangements, neutron-energy spectra, and other relevant parameters (e.g., heterogeneity, leakage, interaction, absorption, etc.) within which the bias of a computational method is established." Any analytical method used to demonstrate the subcriticality of a system must be reliable to the point that it provides confidence that adequate safety margins exist. It is also desirable that the validation methods and codes used are not unnecessarily conservative so that operations are not unduly restricted.

The benchmark critical experiment models used in this validation were generated according to the procedure for the Verified, Archived Library of Inputs and Data (VALID) maintained within the Reactor and Nuclear Systems Division (RNSD) at Oak Ridge National Laboratory (ORNL) [6]. More information about VALID and the process used to generate models for inclusion in the library is provided in Section 4.3 of this document. All cases that were entered in the library using SCALE 6.1, 6.1.1, and 6.1.2 are used included in this validation effort, which contains a total of over 400 individual critical configurations. An additional 190 cases fueled with ^{233}U have also been included; this work was added to VALID using SCALE 6.2.0. The systems analyzed as part of the validation include a range of uranium enrichments, plutonium, and mixed uranium and plutonium as primary fissile components. A range of physical forms, including metal, solution, and rod array systems, is also covered.

The validation data presented here include a wide range of systems and are intended to demonstrate the general applicability of the KENO V.a and KENO-VI Monte Carlo transport codes used in the SCALE Criticality Safety Analysis Sequences (CSAS). Over 600 configurations from 15 categories of systems drawn from the *International Criticality Safety Benchmark Evaluation Project Handbook* (ICSBEP Handbook) [21] are considered. The results documented here cannot be used directly in any safety basis work.

2. REVIEW OF KENO VALIDATION REPORTS GENERATED AT ORNL

The KENO codes have been used extensively around the world since their first development in the 1960s. As such, a large number and wide range of validation reports have been generated for KENO by a variety of different organizations. This section provides a synopsis of recent validation reports generated at ORNL, along with a brief list of some older validation reports generated in Oak Ridge, Tennessee. The responsible organization for some of the oldest reports does not correspond directly to ORNL as the Y-12 Plant (currently the Y-12 National Security Complex), the K-25 Gaseous Diffusion Plant (now the East Tennessee Technology Park), and the X-10 Site (ORNL) were operated as a single entity.

The most recent prior KENO validation report issued by ORNL is the SCALE 6.2.2 validation report [6] in 2018. The report used the available experiments included in or approved for inclusion in VALID, which comprised 561 experiments modeled in KENO V.a and 57 modeled in KENO-VI. The validation report used six libraries: two based on ENDF/B-VII.0 [8] and four based on ENDF/B-VII.1 [2]. CE libraries based on both data releases were used, as well as MG libraries. The MG library based on ENDF/B-VII.0 contained 238 groups, whereas the analogous ENDF/B-VII.1 library contained 252 groups. A broad group structure containing only 56 groups was also considered for ENDF/B-VII.1, as was a 200-group structure primarily intended for shielding calculations. The primary enhancement of this report relative to Volume 1 is a comparison of KENO V.a and KENO-VI using the same benchmarks. All 561 KENO V.a models were converted to KENO-VI using the c5toc6 utility, allowing for confirmation that KENO V.a and KENO-VI yield statistically equivalent answers for the same models. Additionally, the number of system types has been increased to 15 different categories with the addition of mixed uranium/plutonium fast metal systems, mixed uranium/plutonium solutions, and 5 categories of ^{233}U-fueled experiments.

The previous KENO validation report was the SCALE 6.1 validation report [9], which was revised by ORNL in 2013. This report was the first that explicitly used VALID and the first to deliberately cover a wide range of system types. Prior validation reports had been targeted for specific systems or small ranges of systems. The report included 313 KENO V.a systems and 45 KENO-VI systems. The experiments covered eight different categories and played a crucial role in identifying a bias in CE calculations that is particularly pronounced for mixed oxide fuel rod array systems. The report only examined a CE library and 238-group library, both of which are based on ENDF/B-VII.0 [8].

An earlier ANS summary [10] made use of an early version of VALID to compare MG and CE KENO results in the first release of CE-KENO in SCALE 6 [11]. The results presented in the summary are based on approximately 220 benchmark models. This work considered CE and MG performance with libraries based on ENDF/B-VII.0 [8] and expanded on prior work discussing the introduction of CE KENO in works by Goluoglu et al. [12, 13]. The earlier works had included a broader range of benchmarks, but the models had not been subjected to review, so errors in the models could not be differentiated from errors in the code or data.

A number of earlier validation reports are listed in Appendix C of the KENO V.a section (F11.C) of the SCALE 6.1 manual [14]. The first document listed is an ORNL report—ORNL/TM-2001/110 [15]—comparing KENO V.a and KENO-VI. The work started in this document was largely ignored until the SCALE 6.2.2 validation report [7]. These references include two widely used NUREG/CR documents related to validation: NUREG/CR-6361 [16] and NUREG/CR-6483 [17], both of which are focused on performing validation. Two other NUREG documents provide details on specific experience and guidance using specific libraries within SCALE [18, 19], while several other publications are focused on specific facilities, systems, or small ranges of systems. The references provided in the list stretch back to 1972 and include reports generated by Oak Ridge facilities, as well as some external reports.

A final report by Hollenbach and Fox that should be mentioned here is “CENTRM Validation” (ORNL/TM-2004/66) [20], which addresses the validation of CENTRM with ENDF/B-V cross sections. The wide-ranging report covers six different categories of systems; its primary purpose was not to validate KENO-VI for criticality safety calculations, but to demonstrate the accuracy of the CENTRM/PMC cross section process over such a wide range of systems. This was an important step forward in achieving the accurate MG results that have been generated with SCALE over the last 15 years, and this methodology is still the basic underpinning of the MG resonance self-shielding treatments used in SCALE 6.2.4. As such, it has an important place in the history of SCALE validation reports.

3. BENCHMARK EXPERIMENTS

The benchmark experiments used for this validation effort are taken from the International Criticality Safety Benchmark Experiment Program (ICSBEP) Handbook [21]. All cases available in VALID are included in this effort; more information about VALID is available in Section 4.3. A list of International Criticality Safety Evaluation Project (ICSBEP) abbreviations is provided in Table 1, and a list of the different experiment classes in VALID and their abbreviations is provided in Table 2.

Table 1. ICSBEP abbreviations used.

Abbreviation	Meaning
Fissile material	
HEU	High enriched uranium ($^{235}U \geq 60$ wt %)
IEU	Intermediate or mixed enrichment uranium (60 wt % > ^{235}U > 10 wt %)
LEU	Low enriched, natural, or depleted uranium ($^{235}U \leq 10$ wt %)
MIX	Mixed uranium and plutonium
PU	Plutonium
U233	^{233}U
Physical form of fissile material	
MET	Metal
SOL	Solution
COMP	Compound system (e.g., lattice in water)
Spectrum	
FAST	Fast system (≥50% of fissions above 100 keV)
INTER	Intermediate system (≥50% of fissions from 0.625 eV to 100 keV)
THERM	Thermal system (≥50% of fissions below 0.625 eV)
MIXED	Mixed energy system (>50% of fissions do not occur in any single energy range)

Table 2. Experiment categories used in this validation.

HMF	HEU-MET-FAST
HST	HEU-SOL-THERM
IMF	IEU-MET-FAST
LCT	LEU-COMP-THERM
LST	LEU-SOL-THERM
MCF	MIX-COMP-FAST
MCT	MIX-COMP-THERM
MST	MIX-SOL-THERM
PMF	PU-MET-FAST
PST	PU-SOL-THERM
UCT	U233-COMP-THERM
UMF	U233-MET-FAST
USI	U233-SOL-INTER
USM	U233-SOL-MIXED
UST	U233-SOL-THERM

A wide range of physical systems is included in the suite of benchmark experiments presented. The physical forms of the fissile material are varied and include solutions, metal, and oxides of uranium, plutonium, or mixed uranium and plutonium. A range of effective enrichments from 2 wt % to over 90 wt % ^{235}U is included for uranium systems, and the plutonium systems include a wide range of plutonium isotopic vectors. The effective enrichment is the average enrichment of the uranium included in the experiment, which includes combinations of natural and/or depleted uranium with highly enriched uranium to get an effective enrichment. For example, IEU-MET-FAST-007-001 contains depleted and natural uranium along with 10 and 93 wt % 235U for an effective (or average) enrichment of 10 wt % 235U. Light water is the primary moderator used, and reflectors include light water as well as graphite, beryllium, molybdenum, and other materials. The titles, which also serve as brief descriptions, of the experiments used for this validation effort, are provided in Table 3.

The first column of Table 3 includes the report designation from the ICSBEP Handbook [21]. These designations include a terse categorization of the benchmark experiment using a specific format, as shown below. The first group of 2–4 characters indicates the primary fissile material in the system. The second group of three or four characters describes the physical form of the fissile material. The third set of four or five characters provides a rough categorization of the system's energy spectrum. The thermal range is up to 0.625 eV, the intermediate range extends to 100 keV, and the fast range is above 100 keV [21]. The systems are categorized with the energy bin of neutrons that is causing the majority of fissions. If no bin causes the majority of fissions, then the experiment is categorized as a mixed spectrum. The final group of three characters is an integer counter for each experiment in the category.

AAAA	**BBBB**	**CCCCC**	**NNN**
Primary fissile material in the system	Physical form of the fissile material	Categorization of the system's energy spectrum:	Integer counter for each experiment in the category
HEU			000
IEU	COMP	FAST	
LEU	MET	INTER	
MIX	SOL	THERM	
PU			
U233			

Table 3. Critical benchmark experiments available in VALID.

Evaluation	Cases	Fissile material	Moderator	Experiment description
HEU-MET-FAST-005	6	90% enriched U metal	None	Beryllium- and Molybdenum-Reflected Cylinders of Highly Enriched Uranium
HEU-MET-FAST-008	1	90% enriched U metal	None	Bare Sphere of Highly Enriched Uranium
HEU-MET-FAST-009	2	90% enriched U metal	None	Spheres of Highly Enriched Uranium Reflected by Beryllium or Beryllium Oxide
HEU-MET-FAST-010	2	90% enriched U metal	None	Spheres of Highly Enriched Uranium Reflected by Boron+Beryllium or Boron+Beryllium Oxide
HEU-MET-FAST-011	1	90% enriched U metal	None	Sphere of Highly Enriched Uranium Reflected by Polyethylene
HEU-MET-FAST-013	1	90% enriched U metal	None	Sphere of Highly Enriched Uranium Reflected by Steel
HEU-MET-FAST-015	1	96% enriched U metal	None	Unreflected Cylinder of Highly Enriched Uranium
HEU-MET-FAST-016	2	96% enriched U metal	None	Beryllium-Reflected and Beryllium Oxide-Reflected Cylinders of Highly Enriched Uranium
HEU-MET-FAST-017	1	96% enriched U metal	Beryllium	Beryllium-Moderated and -Reflected Cylinder of Highly Enriched Uranium
HEU-MET-FAST-018[a]	1	90% enriched U metal	None	Bare Spherical Assembly of ^{235}U (90%)
HEU-MET-FAST-019[a]	1	90% enriched U metal	None	Graphite-Reflected Spherical Assembly of ^{235}U (90%)
HEU-MET-FAST-020[a]	1	90% enriched U metal	None	Polyethylene-Reflected Spherical Assembly of ^{235}U (90%)
HEU-MET-FAST-021[a]	1	90% enriched U metal	None	Steel-Reflected Spherical Assembly of ^{235}U (90%)
HEU-MET-FAST-024	1	90% enriched U metal	None	Sphere of Highly Enriched Uranium Reflected by Steel and Polyethylene
HEU-MET-FAST-025	5	96% enriched U metal	None	Five Vanadium-Reflected Highly Enriched Uranium Cylinders
HEU-MET-FAST-030	1	96% enriched U metal	Beryllium	Heterogeneous Cylinder of Highly Enriched Uranium with Beryllium Moderator and Depleted-Uranium Reflector
HEU-MET-FAST-038	2	96% enriched U metal	Beryllium, Beryllium oxide	Two Heterogeneous Cylinders of Highly Enriched Uranium with Beryllium and Beryllium Oxide Moderators and Depleted-Uranium Reflector
HEU-MET-FAST-040	1	96% enriched U metal	None	Heterogeneous Vanadium-Diluted Highly Enriched Uranium Cylinder
HEU-MET-FAST-052	1	96% enriched U metal	Beryllium, Beryllium oxide	Heterogeneous, Tungsten-Diluted, Beryllium- and Beryllium Oxide-Moderated, HEU Cylinder Reflected by Depleted Uranium

Table 3. Critical benchmark experiments available in VALID (continued).

Evaluation	Cases	Fissile material	Moderator	Experiment description
HEU-MET-FAST-065	1	96% enriched U metal	None	Unreflected Cylinder of Highly Enriched Uranium—Second Configuration
HEU-MET-FAST-080	1	93% enriched U metal	None	Bare, Highly Enriched Uranium Fast Burst Reactor CALIBAN
HEU-MET-FAST-086	5	93% enriched U metal	None	Godiva-IV Delayed-Critical Experiments and an Associated Prompt-Burst Experiment
HEU-MET-FAST-092	4	96% enriched U metal	None	Four Molybdenum-Reflected HEU Cylinders
HEU-MET-FAST-093	1	96% enriched U metal	None	Heterogeneous Molybdenum-Diluted HEU Cylinder
HEU-MET-FAST-094	2	96% enriched U metal	Beryllium, Beryllium oxide	Two Heterogeneous Cylinders of Highly Enriched Uranium, Beryllium, Beryllium Oxide, and Molybdenum Reflected by Depleted Uranium
HEU-SOL-THERM-001	10	93% enriched uranyl nitrate	Light water	Minimally Reflected Cylinders of Highly Enriched Solutions of Uranyl Nitrate
HEU-SOL-THERM-013	4	93% enriched uranyl nitrate	Light water	Unreflected 174-Liter Spheres of Enriched Uranium Nitrate Solutions
HEU-SOL-THERM-014	3	89% enriched uranyl nitrate	Light water	Uranium Nitrate Solution (70 g U/L) with Gadolinium
HEU-SOL-THERM-016	3	89% enriched uranyl nitrate	Light water	Uranium Nitrate Solution (150 g U/L) with Gadolinium
HEU-SOL-THERM-028	18	89% enriched uranyl nitrate	Light water	Uranium (89% ^{235}U) Nitrate Solutions with Central Boron Carbide Absorber Rod
HEU-SOL-THERM-029	7	89% enriched uranyl nitrate	Light water	Uranium (89% ^{235}U) Nitrate Solutions with Cluster of Seven Boron Carbide Absorber Rods
HEU-SOL-THERM-030	7	89% enriched uranyl nitrate	Light Water	Uranium (89% ^{235}U) Nitrate Solutions with Cluster of Several Boron Carbide Absorber Rods
IEU-MET-FAST-002	1	16% enriched U metal	None	Natural Uranium-Reflected Assembly of Enriched and Natural Uranium Plates
IEU-MET-FAST-003[a]	1	37% enriched U metal	None	Bare Spherical Assembly of ^{235}U (36%)
IEU-MET-FAST-004[a]	1	37% enriched U metal	None	Graphite-Reflected Spherical Assembly of ^{235}U (36%)
IEU-MET-FAST-005[a]	1	37% enriched U metal	None	Steel-Reflected Spherical Assembly of ^{235}U (36%)
IEU-MET-FAST-006	1	37% enriched U metal	None	Duralumin-Reflected Spherical Assembly of ^{235}U (36%)

Table 3. Critical benchmark experiments available in VALID (continued).

Evaluation	Cases	Fissile material	Moderator	Experiment description
IEU-MET-FAST-007	1	10% enriched U metal	None	BIG TEN: A Large, Mixed-Uranium-Metal Cylindrical Core with 10% Average ^{235}U Enrichment, Surrounded by a Thick ^{238}U Reflector
IEU-MET-FAST-008	1	36% enriched U metal	None	Depleted Uranium-Reflected Spherical Assembly of ^{235}U (36%)
IEU-MET-FAST-009	1	36% enriched U metal	None	Spherical Assembly of ^{235}U (36%) with a 5.75 cm Polyethylene Reflector
IEU-MET-FAST-019	2	45% enriched U metal	None	45.5% ^{235}U Pseudo-cylindrical Metal Slabs: Bare Assemblies
LEU-COMP-THERM-001	8	2% enriched UO_2	Light water	Water-Moderated U(2.35)O_2 Fuel Rods in 2.032 cm Square-Pitched Arrays
LEU-COMP-THERM-002	5	4% enriched UO_2	Light water	Water-Moderated U(4.31)O_2 Fuel Rods in 2.54 cm Square-Pitched Arrays
LEU-COMP-THERM-008	17	2.5% enriched UO_2	Light water	Critical Lattices of UO_2 Fuel Rods and Perturbing Rods in Borated Water
LEU-COMP-THERM-010	30	4% enriched UO_2	Light water	Water-Moderated U(4.31)O_2 Fuel Rods Reflected by Two Lead, Uranium, or Steel Walls
LEU-COMP-THERM-017	29	2% enriched UO_2	Light water	Water-Moderated U(2.35)O_2 Fuel Rods Reflected by Two Lead, Uranium, or Steel Walls
LEU-COMP-THERM-042	7	2% enriched UO_2	Light water	Water-Moderated Rectangular Clusters of U(2.35)O_2 Fuel Rods (1.684 cm Pitch) Separated by Steel, Boral, Boraflex, Cadmium, or Copper Plates with Steel Reflecting Walls
LEU-COMP-THERM-050	18	5% enriched UO_2	Light water	^{149}Sm Solution Tank in the Middle of Water-Moderated 4.738 wt % Enriched Uranium Dioxide Rod Arrays
LEU-COMP-THERM-078	15	7% enriched UO_2	Light water	Water-Moderated Square-Pitched U(6.90)O_2 Fuel Rod Lattices with 0.52 Fuel-to-Water Volume Ratio (0.855 cm Pitch)
LEU-COMP-THERM-080	11	7% enriched UO_2	Light water	Water-Moderated Square-Pitched U(6.90)O_2 Fuel Rod Lattices with 0.67 Fuel-to-Water Volume Ratio (0.855 cm Pitch)
LEU-SOL-THERM-002	3	5% enriched uranyl fluoride	Light water	174 Liter Spheres of Low Enriched (4.9%) Uranium Oxyfluoride Solutions
LEU-SOL-THERM-003	9	10% enriched uranyl nitrate	Light water	Full and Truncated Bare Spheres of 10% Enriched Uranyl Nitrate Water Solutions
LEU-SOL-THERM-004	7	10% enriched uranyl nitrate	Light water	STACY: Water-Reflected 10% Enriched Uranyl Nitrate Solution in a 60 cm Diameter Cylindrical Tank

Table 3. Critical benchmark experiments available in VALID (continued).

Evaluation	Cases	Fissile material	Moderator	Experiment description
MIX-COMP-FAST-005	1	Pu and depleted U carbide	None	ZPR-9 Assembly 31: A Cylindrical Assembly with Mixed (Pu, U)-Carbide Fuel and Depleted Uranium Blanket; 87 wt% ^{239}Pu
MIX-COMP-FAST-006	1	Pu and depleted U oxide	None	ZPPR-2: A Cylindrical Assembly with Mixed (Pu, U)-Oxide Fuel with Sodium Reflected by DU, Sodium, and Steel; 87.2 wt% ^{239}Pu
MIX-COMP-THERM-001	4	Pu and natural U oxides	Light water	Water-Reflected Mixed Plutonium-Uranium Oxide (20 wt % Plutonium) Pins
MIX-COMP-THERM-002[b]	6	Pu and natural U oxides	Light water	Rectangular Arrays of Water-Moderated UO_2–2 wt % PuO_2 (8% ^{240}Pu) Fuel Rods
MIX-COMP-THERM-004	11	Pu and natural U oxides	Light water	Critical Arrays of Mixed Plutonium-Uranium Fuel Rods with Water-to-Fuel Volume Ratios Ranging from 2.4 to 5.6
MIX-COMP-THERM-008	28	Pu and natural U oxides	Light water	Hexagonal Lattices of Mixed Oxide Fuel Pins UO_2–2 wt % PuO_2, 24% ^{240}Pu Natural Uranium
MIX-SOL-THERM-002	3	Pu and natural/depleted U nitrates	Light water	Criticality Experiments with Mixed Plutonium and Uranium Nitrate Solution at a Plutonium Fraction of 0.2 and 0.5 in Large Cylindrical Geometry
MIX-SOL-THERM-007	7	Pu and depleted U nitrates	Light water	Water-reflected Plutonium-Uranyl Nitrate Solution Containing Gadolinium
PU-MET-FAST-001	1	95% ^{239}Pu metal	None	Bare Sphere of Plutonium-239 Metal (4.5 at % ^{240}Pu, 1.02 wt % Ga)
PU-MET-FAST-002	1	76% ^{239}Pu metal	None	^{240}Pu JEZEBEL: Bare Sphere of Plutonium-239 Metal (20.1 at % ^{240}Pu, 1.01 wt % Ga)
PU-MET-FAST-005	1	95% ^{239}Pu metal	None	Benchmark Critical Experiment of a Plutonium Sphere Reflected by Tungsten
PU-MET-FAST-006	1	95% ^{239}Pu metal	None	Plutonium Sphere Reflected by Normal Uranium Using FLATTOP
PU-MET-FAST-008	1	95% ^{239}Pu metal	None	Benchmark Critical Experiment of a Thorium Reflected Plutonium Sphere
PU-MET-FAST-010	1	95% ^{239}Pu metal	None	Benchmark Critical Experiment of a Delta-Phase Plutonium Sphere Reflected by Normal Uranium
PU-MET-FAST-018	1	95% ^{239}Pu metal	None	Benchmark Critical Experiment of a Delta-Phase Plutonium Sphere Reflected by Beryllium

Table 3. Critical benchmark experiments available in VALID (continued).

Evaluation	Cases	Fissile material	Moderator	Experiment description
PU-MET-FAST-022	1	98% ^{239}Pu metal	None	Bare Spherical Assembly of ^{239}Pu (δ, 98%)
PU-MET-FAST-023	1	98% ^{239}Pu metal	None	Graphite Reflected Spherical Assembly of ^{239}Pu (δ, 98%)
PU-MET-FAST-024	1	98% ^{239}Pu metal	None	Polyethylene Reflected Spherical Assembly of ^{239}Pu (δ, 98%)
PU-MET-FAST-025	1	98% ^{239}Pu metal	None	Spherical Assembly of ^{239}Pu(δ, 98%) with 1.55-cm Steel Reflector
PU-MET-FAST-026	1	98% ^{239}Pu metal	None	Spherical Assembly of ^{239}Pu(δ, 98%) with 11.9-cm Steel Reflector
PU-SOL-THERM-001	6	95% ^{239}Pu plutonium nitrate	Light water	Water-Reflected 11.5-in.-Diameter Spheres of Plutonium Nitrate Solutions
PU-SOL-THERM-002	7	97% ^{239}Pu plutonium nitrate	Light water	Water-Reflected 12-in.-Diameter Spheres of Plutonium Nitrate Solutions
PU-SOL-THERM-003	8	98% ^{239}Pu plutonium nitrate	Light water	Water-Reflected 13-in.-Diameter Spheres of Plutonium Nitrate Solutions
PU-SOL-THERM-004	13	Various Pu vectors plutonium nitrate	Light water	Water-Reflected 14-in.-Diameter Spheres of Plutonium Nitrate Solutions, 0.54% to 3.43% ^{240}Pu
PU-SOL-THERM-005	9	Various Pu vectors plutonium nitrate	Light water	Water-Reflected 14-in.-Diameter Spheres of Plutonium Nitrate Solutions, 4.05% to 4.40% ^{240}Pu
PU-SOL-THERM-006	3	97% ^{239}Pu plutonium nitrate	Light water	Water-Reflected 15-in.-Diameter Spheres of Plutonium Nitrate Solutions
PU-SOL-THERM-007	8	95% ^{239}Pu plutonium nitrate	Light water	Water-Reflected 11.5-in.-Diameter Spheres Partly Filled with Plutonium Nitrate Solutions
PU-SOL-THERM-011	12	96% ^{239}Pu plutonium nitrate	Light water	Bare 16- and 18-in.-Diameter Spheres of Plutonium Nitrate Solutions
PU-SOL-THERM-020	15[c]	95% ^{239}Pu plutonium nitrate	Light water	Water-Reflected and Water-Cadmium-Reflected 14-in.-Diameter Spheres of Plutonium Nitrate Solutions
U233-COMP-THERM-001	3[d]	97% $^{233}UO_2$	Light water	Light Water Breeder Reactor Seed-and-blanket Core Experiments
U233-MET-FAST-001	1	98% ^{233}U metal	None	^{233}U Jezebel: A Bare Sphere of Uranium-233 Metal
U233-MET-FAST-002	2	98% ^{233}U metal	None	Benchmark Critical Experiments of Uranium-233 Spheres Surrounded by U-235
U233-MET-FAST-003	2	98% ^{233}U metal	None	Benchmark Critical Experiments of Highly Enriched Uranium-233 Spheres Reflected by Normal Uranium

Table 3. Critical benchmark experiments available in VALID (continued).

Evaluation	Cases	Fissile material	Moderator	Experiment description
U233-MET-FAST-004	2	98% ^{233}U metal	None	Benchmark Critical Experiments of Highly Enriched Uranium-233 Spheres Reflected by Tungsten
U233-MET-FAST-005	2	98% ^{233}U metal	None	Benchmark Critical Experiments of Highly Enriched Uranium-233 Spheres Reflected by Beryllium
U233-MET-FAST-006	1	98% ^{233}U metal	None	Benchmark Critical Experiment of a Uranium-233 Sphere Reflected by Normal Uranium with Flattop
U233-SOL-INTER-001	29[e]	98.5% $^{233}UO_2F_2$	Light water	Uranyl-Fluoride (^{233}U) Solutions in Spherical Stainless Steel Vessels with Reflectors of Be, CH_2, and Be-CH_2 Composites – Part I
U233-SOL-MIXED-001	3[e]	98.5% $^{233}UO_2F_2$	Light water	Uranyl-Fluoride (^{233}U) Solutions in Spherical Stainless Steel Vessels with Reflectors of Be, CH_2, and Be-CH_2 Composites – Part I
U233-SOL-MIXED-002	5[f]	99% ^{233}U nitrate solution	Light water	Uranyl-Fluoride (^{233}U) Solutions in Spherical Stainless Steel Vessels with Reflectors of Be, CH_2, and Be-CH_2 Composites – Part II
U233-SOL-THERM-001	5	98% ^{233}U nitrate solution	Light water	Unreflected Spheres of ^{233}U Nitrate Solutions
U233-SOL-THERM-002	16[g]	99% ^{233}U nitrate solution	Light water	Paraffin-Reflected 8-, 8.5-, 9-, 10-, and 12-inch Diameter Cylinders of ^{233}U Uranyl Nitrate Solutions
U233-SOL-THERM-003	10	99% ^{233}U nitrate solution	Light water	Paraffin-Reflected 5-, 5.4-, 6-, 6.6-, 7.5-, 8-, 8.5-, 9-, and 12-inch Diameter Cylinders of ^{233}U Uranyl Fluoride Solutions
U233-SOL-THERM-004	8	99% ^{233}U nitrate solution	Light water	Paraffin-Reflected 5-, 6-, and 7.5-inch Diameter Cylinders of ^{233}U Uranyl Nitrate Solutions
U233-SOL-THERM-005	2	99% ^{233}U nitrate solution	Light water	Water-Reflected ^{233}U Uranyl Nitrate Solutions in Simple Geometry
U233-SOL-THERM-008	1	98% ^{233}U nitrate solution	Light water	A 28-inch Diameter Unreflected Sphere of ^{233}U Nitrate Solution
U233-SOL-THERM-009	4	97% ^{233}U nitrate solution	Light water	Unreflected Large-Diameter Cylinders of ^{233}U Uranyl Nitrate Solutions
U233-SOL-THERM-011	1[e]	98.5% $^{233}UO_2F_2$	Light water	Uranyl-Fluoride (^{233}U) Solutions in Spherical Stainless Steel Vessels with Reflectors of Be, CH_2, and Be-CH_2 Composites – Part I
U233-SOL-THERM-012	8	98% ^{233}U nitrate solution	Light water	Water-Reflected Spherical Vessels Partially Filled or Filled With $^{233}UO_2(NO_3)_2$ Solution

Table 3. Critical benchmark experiments available in VALID (continued).

Evaluation	Cases	Fissile material	Moderator	Experiment description
U233-SOL-THERM-013	21	98% ^{233}U nitrate solution	Light water	Unreflected Spherical Vessels Partially Filled or Filled With $^{233}UO_2(NO_3)_2$ Solution
U233-SOL-THERM-015	26[f]	99% ^{233}U nitrate solution	Light water	Uranyl-Fluoride (^{233}U) Solutions in Spherical Stainless Steel Vessels with Reflectors of Be, CH_2, and Be-CH_2 Composites – Part II
U233-SOL-THERM-016	31[h]	98% ^{233}U nitrate solution	Light water	Unreflected Solutions of $^{233}UO_2(NO_3)_2$ in Cylinders
U233-SOL-THERM-017	7	98% ^{233}U nitrate solution	Light water	Water-Reflected Solutions of $^{233}UO_2(NO_3)_2$ in Cylinders

[a]Both detailed and simplified configuration considered.
[b]Only simplified models considered.
[c]PU-SOL-THERM-020 contains two sets of eight highly correlated experiments. The evaluation states that only one set should be used in validation for a safety application. One of the cases was rejected from the evaluation because of poor calculated results and inconsistency with other similar experiments, leaving 15 cases. All of these cases are included in this validation.
[d]Eight total cases are included in the U233-COMP-THERM-001 evaluation. Only three of the five rectangular cores and none of the three hexagonal cores are included here.
[e]USI-SOL-INTER-001 contains a total of 33 cases; 29 cases are categorized as intermediate, 3 cases (case 14, 16, and 30) are categorized as mixed (U233-SOL-MIXED-001) and 1 case (case 27) is categorized as thermal (U233-SOL-THERM-011).
[f]USI-SOL-THERM-015 contains a total of 31 cases; 26 cases are categorized as thermal, 5 cases (case 3, 5, 6, 8, and 9) are categorized as mixed (U233-SOL-MIXED-002).
[g]Case 16 is excluded because of a discrepancy between the reported tank and solution heights.
[h]Cases 5 and 20 are not included since they are repeat cases of 1 and 19, respectively.

4. CODES, DATA, AND METHODS

A general overview of the SCALE codes and data used in the calculations is provided here, along with descriptions of methods used in validation. A more complete description of the codes and data is available in the SCALE manual [1], and a more complete description of methods for validation of criticality safety codes and methods for safety basis calculations can be found in ANSI/ANS-8.24-2017 [5], Dean and Tayloe [22], or J. J. Lichtenwalter et al. [23].

4.1 CODES

4.1.1 Multigroup Cross Section Processing

The CSAS sequences use the XSProc module to process MG cross sections and provide the appropriate resonance corrections to the group-average cross section values. The corrections are necessary to account for the impact of resonances on group-average cross sections. The impact of an individual resonance on the group-average cross section is determined by the size of the resonance, the isotopic number density of the resonance material, and the flux level at the energy of the resonance. Simplified one-dimensional (1D) models are used to solve representative unit cell problems to approximate the energy-dependent flux in the full transport problem. A two-dimensional (2D) unit cell model is used in the method of characteristics (MoC) solver for the square-pitch lattice experiments. The flux from the 1D or 2D unit cell calculation is used to collapse the cross section data to a set of group-average values that can be used in an MG transport calculation. When appropriate, lattice effect corrections are also applied to the cross sections.

XSProc performs resonance self-shielding calculations for energies outside of the CENTRM pointwise range of 0.001 eV to 20 keV based on the Bondarenko method, which is based on the narrow resonance approximation, with the methods previously in the BONAMI module. The Bondarenko approach is simple and fast, and it is most accurate and useful at high energies. It is therefore well suited and appropriate for use in the unresolved energy range.

In the resolved resonance range, XSProc generates a neutron spectrum based on a transport theory solution in 1D or 2D using a combination of MG and pointwise data. This function was previously performed by the CENTRM module. As mentioned previously, most of these calculations are performed with a 1D discrete ordinates method. The square-pitch lattice cases in the LEU-COMP-THERM (LCT) and MIX-COMP-THERM (MCT) categories use a 2D MoC solver. The MoC solver is a new feature as of SCALE 6.2 that eliminates a portion of the bias that was evident in these systems in earlier versions of SCALE. In CSAS, the detailed flux solutions are used to generate resonance self-shielded MG cross sections. The energy mesh is typically very fine, on the order of 10,000 to 70,000 points, and it provides precise treatment in the resolved resonance range. This detailed treatment also allows for the incorporation of effects of overlapping resonances from different nuclides in the same mixture. With these techniques, the energy fidelity of CE treatment is preserved, even when performing MG calculations.

4.1.2 KENO V.a

KENO V.a solves the k-effective (k_{eff}) eigenvalue problem in three dimensions using the Monte Carlo method. KENO V.a has been used for this purpose in the SCALE system for many years and has been employed in criticality safety applications at sites around the world. KENO V.a allows a fairly simple description of complicated systems and is capable of using repeating Cartesian array structures and holes to facilitate system description. However, each geometry object must be oriented along a coordinate axis, and objects are not allowed to intersect.

KENO V.a operates in MG mode using appropriately self-shielded cross sections per the methods described in Sect. 4.1.1. Additionally, KENO V.a can operate in CE mode without the need for additional resonance self-shielding calculations.

This validation effort focuses on KENO V.a's ability to solve the k_{eff} eigenvalue problem across a wide range of potential systems. These systems use different fissile materials in a range of forms and with differing energy spectra to test the code over many problems. Validation over this wide range is necessary, as KENO V.a is intended as a general purpose Monte Carlo code for use in criticality safety analyses.

4.1.3 KENO-VI

KENO-VI has capabilities similar to those in KENO V.a, but it can represent systems of significantly increased geometric complexity. A predefined set of geometry objects can be specified to define regions. In addition, generalized quadratic surfaces can be supplied to define regions of space that are not well described by any of the predefined shapes. KENO-VI also supports rotation and therefore allows bodies to be oriented in directions that are not parallel to the major coordinate axes. KENO-VI continues to support arrays and holes. The range of arrays that can be used has been expanded significantly to include triangular or hexagonal arrays, as well as dodecahedral arrays. Intersecting geometry definitions can be supplied for the exact modeling of features such as pipe junctions. As with KENO V.a, the focus of this effort is on validation of the k_{eff} eigenvalue problem.

4.2 NUCLEAR DATA

The SCALE system is distributed with several cross section libraries, as documented in the SCALE Code System [1]. The present work is based on validating the performance of four ENDF/B-VII.1 [2] cross section libraries. Six libraries based on ENDF/B-VII.1 are distributed with SCALE 6.2: (1) a CE neutron library, (2) an MG neutron library for criticality and reactor physics containing 252 energy groups, (3) an MG broad group library primarily intended for light-water reactor (LWR) depletion analysis containing 56 groups, (4) a few-group testing library which should not be used for analysis, (5) an MG coupled neutron-gamma library for shielding analysis containing 200 neutron and 47 gamma groups, and (6) another MG coupled neutron-gamma library for shielding analysis containing 28 neutron and 19 gamma groups. Four of these ENDF/B-VII.1 libraries are used here, including the 252- and 56-group MG neutron libraries, the 200-neutron/47-gamma group coupled library, and the CE library. The 200-neutron/47-gamma group MG library is included because it has more fidelity in the fast energy range and is therefore expected to yield more accurate results for fast spectrum systems. The CE results are generally regarded as indicative of the quality of the underlying nuclear data, and the MG results should be in close agreement with the CE results. Large differences between the two are indications of poor MG processing or an inadequate or inappropriate group structure. The MG data are included in this report because they are still widely used for safety analysis work.

The uncertainty in the computed k_{eff} values resulting from uncertainties in the cross section data are included in this validation, but the underlying sensitivity data are taken directly from the SCALE 6.2.2 validation report. The sensitivity data are unlikely to be substantially impacted by the minor code-to-code variations, as was observed and reported in the SCALE 6.2.2 validation report [7]. The use of these data is acceptable because the covariance data have not changed between SCALE 6.2.2 and SCALE 6.2.4. The cross section uncertainties are obtained from the SCALE 56-group covariance data library, and the uncertainty in k_{eff} due to these data uncertainties are calculated using TSUNAMI-IP in SCALE 6.2.4. The SCALE covariance library is a comprehensive library with a total of 401 materials in the SCALE 56-group energy structure. A 252-group covariance library is also available based on the same data. The SCALE covariance library data correspond to relative uncertainties assembled from a variety of sources,

including evaluations from ENDF/B-VII.1, ENDF/B-VI, JENDL-4.0, and many approximated uncertainties from a collaborative project performed by Brookhaven National Laboratory, Los Alamos National Laboratory, and ORNL [24].

There is no "true" uncertainty that can be defined unambiguously for nuclear data. While differences in nuclear data evaluations directly impact calculations that can be affirmed by comparisons with benchmark experiments, it is more difficult to quantify the reliability of uncertainty estimates. In general, the SCALE covariance library should provide a conservative assessment of data uncertainties' impact on k_{eff}, because the ENDF/B-VII.1 covariance data are not adjusted in the same way as the best-estimate data. In other words, critical experiment benchmarks are used to tune the best-estimate evaluation of the cross sections, but this additional information is ignored in the assessment of uncertainties [25]. Nevertheless, the SCALE covariance library is deemed a reasonable representation of the nuclear data uncertainties.

4.3 VALID AND PROCEDURE

As mentioned previously, the models of the benchmark experiments used in this work were generated and are maintained in accordance with the SCALE VALID procedure at ORNL. This section discusses VALID and the procedure [6] that governs its development and maintenance.

VALID contains input, output, and other associated files that have been generated and reviewed according to the procedure documented in Marshall and Reed's "SCALE Procedure for VALID" [6]. The sensitivity data file (SDF) generated by TSUNAMI-3D is the most common type of other associated file. The process codified in the VALID procedure is similar to the quality assurance requirements for safety analysis work in that it requires qualified analysts to complete both the origination and the review before the models and data are entered into the archive. After a TSUNAMI-3D benchmark and its associated CSAS criticality calculation have been completed, reviewed, and added to the library, the SDFs for that evaluation are publicly distributed as part of the ICSBEP Handbook. These SDFs are subsequently available to the entire criticality safety community, and the thorough review required by the procedure allows criticality safety practitioners to use the data with confidence for scoping calculations, even though an internal quality assurance assessment would be required before these are used in a safety analysis [26]. It should be noted that all ^{233}U-fueled experiments were added to VALID without TSUNAMI-3D calculations because of the limited duration of the project that generated the models.

A detailed list of the critical experiments available in the library and used in this validation is provided in Table 3. An abbreviated table is provided below to summarize the number of cases considered in each category of critical experiment. Table 4 also details which cases were performed in KENO V.a and which use KENO-VI.

Table 4. Summary of cases in VALID,

Sequence	Experiment class	ICSBEP evaluation numbers	Number of configurations
CSAS5/KENO V.a	HEU-MET-FAST	15, 16, 17, 18, 19, 20, 21, 25, 30, 38, 40, 52, 65	19/23[a]
	HEU-SOL-THERM	1, 13, 14, 16, 28, 29, 30	52
	IEU-MET-FAST	2, 3, 4, 5, 6, 7, 8, 9	8/11[a]
	LEU-COMP-THERM	1, 2, 8, 10, 17, 42, 50, 78, 80	140
	LEU-SOL-THERM	2, 3, 4	19
	MIX-COMP-FAST	5, 6	2
	MIX-COMP-THERM	1, 2[b], 4	21
	MIX-SOL-THERM	2, 7	10
	PU-MET-FAST	1, 2, 5, 6, 8, 10, 18, 22, 23, 24, 25, 26	12
	PU-SOL-THERM	1, 2, 3, 4, 5, 6, 7, 11, 20	81
	U233-COMP-THERM	1	3[c]
	U233-MET-FAST	1, 2, 3, 4, 5, 6	10
	U233-SOL-INTER	1	29[c]
	U233-SOL-MIXED	1, 2	8[c]
	U233-SOL-THERM	1, 2, 3, 4, 5, 8, 9, 11, 12, 13, 15, 16, 17	140[c]
CSAS6/KENO-VI	HEU-MET-FAST	5, 8, 9, 10, 11, 13, 24, 80, 86, 92, 93, 94	27
	IEU-MET-FAST	19	2
	MIX-COMP-THERM	8	28

[a]The larger number includes simplified cases that are duplicate cases for which detailed models are also available in the library.
[b]Only simplified cases were used for models.
[c]See Table 3 for a list of specific experiments used from each evaluation.

4.4 VALIDATION METHODS

The methods used to calculate the bias values reported in this validation are described in this section. These methods should not be used as an example of a rigorous or complete validation. The purpose of this report is to demonstrate the general performance of the KENO V.a and KENO-VI codes with ENDF/B-VII.1 data across a wide range of problems. The purpose is *not* to determine the bias and bias uncertainty required as part of a criticality safety assessment for a particular safety application. Detailed guidance for performing a criticality safety validation is contained in Dean and Tayloe [22], as well as Lichtenwalter et al. [23].

The performance of the codes and data is reported in terms of the calculated-to-expected (evaluated) (C/E) ratio. The expected k_{eff} value for each benchmark model configuration is provided in the ICSBEP evaluation for each experiment. An estimated uncertainty is also supplied for this expected value for k_{eff}. The C/E ratio and its uncertainty can be calculated from these two values in the evaluation and the calculated k_{eff} and uncertainty from KENO. The C/E is calculated as shown in Eq. (1), and the uncertainty in the C/E is determined as shown in Eq. (2).

$$\frac{C}{E} = \frac{k_{eff}^{calc}}{k_{eff}^{eval}}, \tag{1}$$

where:

$\boldsymbol{k_{eff}^{calc}}$ is the k_{eff} value calculated by KENO V.a or KENO-VI, and
$\boldsymbol{k_{eff}^{eval}}$ is the expected k_{eff} value from the ICSBEP evaluation.

$$\boldsymbol{\sigma_{C/E} = \frac{C}{E}\left(\sqrt{\left(\frac{\sigma_{calc}}{k_{eff}^{calc}}\right)^2 + \left(\frac{\sigma_{eval}}{k_{eff}^{eval}}\right)^2}\right)}, \tag{2}$$

where:

$\boldsymbol{\sigma_{C/E}}$ is the uncertainty in the C/E,

$\boldsymbol{\sigma_{calc}}$ is the calculated (stochastic) uncertainty in the k_{eff} value from KENO V.a or KENO-VI, and

$\boldsymbol{\sigma_{eval}}$ is the uncertainty value reported in the ICSBEP evaluation of the configuration.

An average C/E value was determined for each category of experiment for each code, as shown in Section 5. A *category of experiments* is defined as a unique combination of fissile species, fissile form, and spectrum. An example of a category of experiments is HEU-MET-FAST (see Table 1). In some cases, this is further restricted for models using KENO V.a or KENO-VI. The average value reported is an unweighted arithmetic average of the individual C/E values. The majority of the Monte Carlo calculations were run to achieve a small stochastic uncertainty of approximately 0.00010 Δk_{eff}. The uncertainty in the evaluated k_{eff} value is larger by at least a factor of two and is usually on the order of 10 to 50 times this magnitude, so the primary driver in the C/E uncertainty is the uncertainty from the evaluation. These values vary significantly among the different evaluations both in magnitude and rigor, so weighting with these uncertainties is viewed as unnecessary. Furthermore, the average value and its uncertainty are only intended to represent the range of values that could be expected to result from a rigorous, safety-grade validation effort. The uncertainty in the average C/E value was determined as shown in Eq. (3).

$$\sigma_{C/E}^{Avg} = \frac{\sqrt{\sum_{i=1}^{N}\left(\sigma_{C/E}^{i}\right)^2}}{N}, \tag{3}$$

where:

$\sigma_{C/E}^{Avg}$ is the uncertainty in the average C/E value,

$\sigma_{C/E}^{i}$ is the uncertainty in a single C/E value, and

N is the total number of configurations included for the category of experiments.

As mentioned previously, all calculations were performed for both MG and CE libraries based on ENDF/B-VII.1. The results for each case and category of experiments were generated and are reported for

each library, allowing comparison among the various MG results and between MG and CE results based on the same benchmark models.

Little rigorous trending analysis is presented in this report. As discussed in ANS-8.24-2017 [5], Dean and Tayloe [22], and J. J. Lichtenwalter et al. [23], a complete validation to support a criticality safety analysis should include an examination of the data for trends as a function of physically relevant independent variables. The primary variable used in trending here is the energy of the average lethargy causing fission (EALF).

The deviations of each case from a C/E of unity are characterized in two different ways in various portions of this report. The most straightforward comparison is simply the difference between the C/E and 1.0, also called the *absolute bias*. This difference is sometimes reported in % Δk_{eff}, which is determined by multiplying the absolute difference by 100. Differences from expected k_{eff} values are also reported in standard deviations, in which the absolute difference is divided by the uncertainty in the C/E value to determine the deviation from unity in standard deviations, also called the *relative bias*. The largest individual outlier in each category of experiments is identified considering both the absolute magnitude of the difference and the largest difference relative to the uncertainty in the C/E value. Both outliers are reported for each category in Section 5.

5. RESULTS

This section presents the results of the validation of KENO V.a and KENO-VI in SCALE 6.2.4. The first subsection presents the results for KENO V.a, and the second subsection presents the results for KENO-VI. Each of these subsections presents the average results for each category, followed by more detailed discussions of the results in each category.

A complete list of the calculated k_{eff} and its uncertainty, the benchmark model k_{eff} and its uncertainty, C/E values, and cross section uncertainties are presented in Appendix A for KENO V.a cases and in Appendix B for KENO-VI cases.

5.1 KENO V.A

More than 75% of the KENO V.a calculations performed for this validation were run until the Monte Carlo uncertainty was reduced to 0.00010 Δk. A few cases had uncertainties as high as to 0.00049 Δk, and some cases had final uncertainty values between the two. The maximum reported uncertainty for all the calculations is 0.00049 Δk. As mentioned previously in Section 4.4, this stochastic uncertainty in the calculation is at least a factor of two smaller than the benchmark evaluation uncertainty reported in the ICSBEP Handbook [21]. The uncertainty ratio for most cases is in the range of 20 to 50. The most significant factor affecting the uncertainty of the calculated C/E values is the uncertainty reported in the evaluation.

The average C/E value and its uncertainty for each category of experiments is provided in Table 5 for the libraries based on ENDF/B-VII.1. The results show that the average C/E values are near 1.0 for all categories except the USI and USM experiments. All the experiments in the USI category are from a single evaluation. However, the USI and USM experiments provide clear evidence of a performance problem with these experiments, as is be discussed in Sections 5.1.13 and 5.1.14.

Table 5. Results by category for KENO V.a calculations with ENDF/B-VII.1 libraries.

Category	56-group		252-group		200-group		Continuous energy	
	Avg. C/E	Avg. C/E unc.	Avg. C/E	Avg. C/E unc.	Avg. C/E	Avg. C/E unc.	Avg. C/E	Avg. C/E unc.
HMF	1.00646	0.00039	1.00314	0.00039	1.00272	0.00039	1.00196	0.00039
HST	0.99633	0.00072	0.99694	0.00072	0.99769	0.00074	0.99773	0.00072
IMF	1.00909	0.00083	1.00567	0.00083	1.00484	0.00083	1.00279	0.00083
LCT	0.99944	0.00018	0.99908	0.00018	0.99842	0.00018	0.99959	0.00018
LST	0.99694	0.00083	0.99776	0.00083	0.99816	0.00083	0.99832	0.00083
MCF	1.00113	0.00158	1.00705	0.00158	1.00554	0.00158	1.00257	0.00158
MCT	0.99902	0.00087	0.99852	0.00087	0.99822	0.00087	0.99922	0.00087
MST	0.99799	0.00158	0.99799	0.00158	0.99856	0.00158	0.99822	0.00158
PMF	1.00085	0.00063	1.00019	0.00062	1.00013	0.00062	0.99970	0.00062
PST	1.00163	0.00056	1.00224	0.00056	1.00283	0.00056	1.00297	0.00056
UCT	1.00595	0.00141	1.00092	0.00141	1.00180	0.00141	1.00065	0.00141
UMF	1.00070	0.00051	0.99876	0.00051	0.99856	0.00051	0.99849	0.00051
USI	0.98708	0.00124	0.98273	0.00124	0.98320	0.00124	0.98269	0.00124
USM	0.98257	0.00215	0.97893	0.00215	0.97941	0.00215	0.97898	0.00215
UST	1.00058	0.00052	0.99946	0.00052	0.99991	0.00052	1.00018	0.00052

The average C/E bias (absolute bias or difference from unity) is shown in Figure 1 for each of the categories for all four libraries. The results are also presented in relative bias (standard deviations from unity) in Figure 2. The CE calculations generally exhibit a smaller magnitude bias than the MG calculations. The results indicate only slight differences compared to SCALE 6.2.2. Figure 3 and Figure 4 show the results arranged by library.

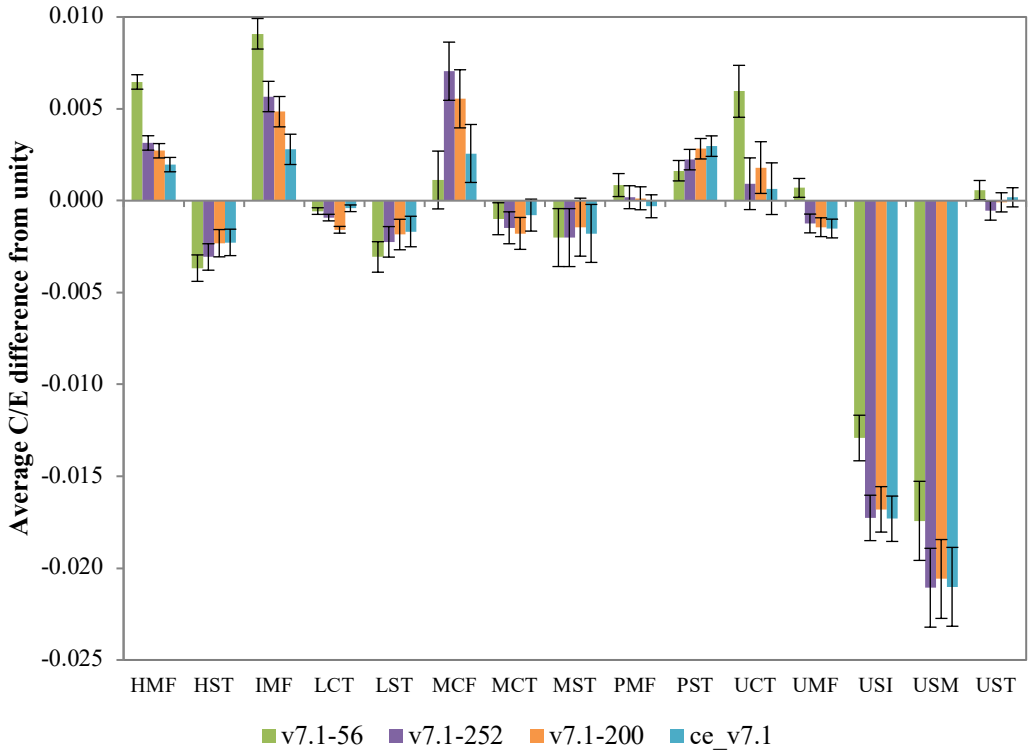

Figure 1. Absolute bias for all 4 libraries for each of the 15 categories of experiments.

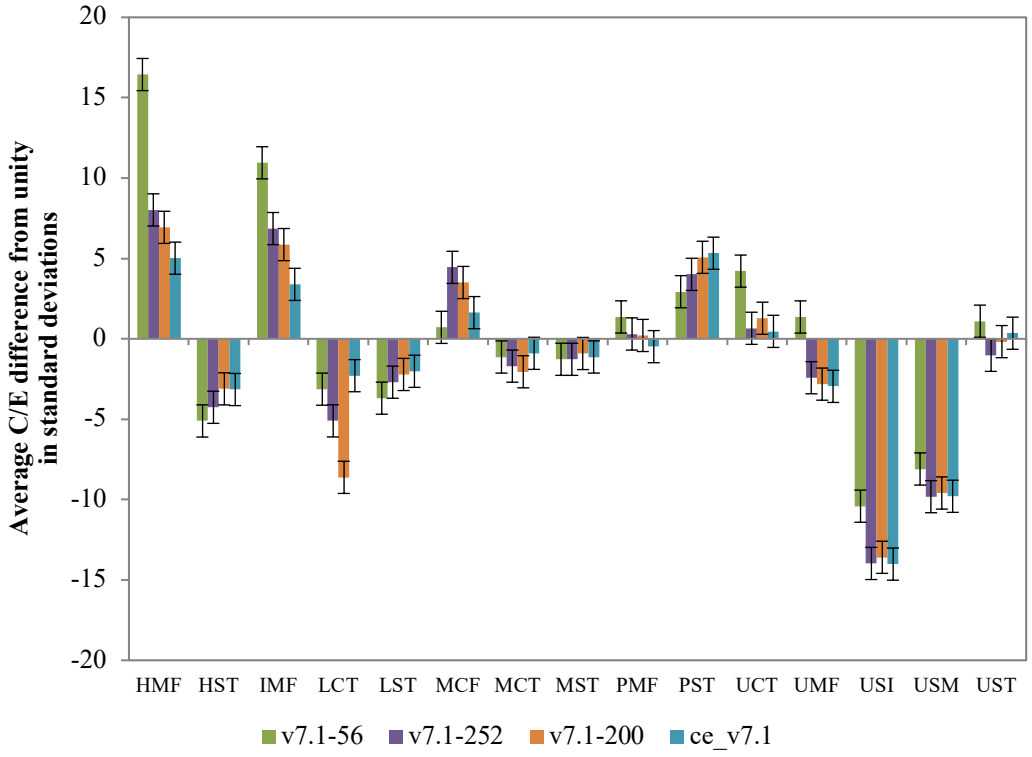

Figure 2. Relative bias for all 4 libraries for each of the 15 categories of experiments.

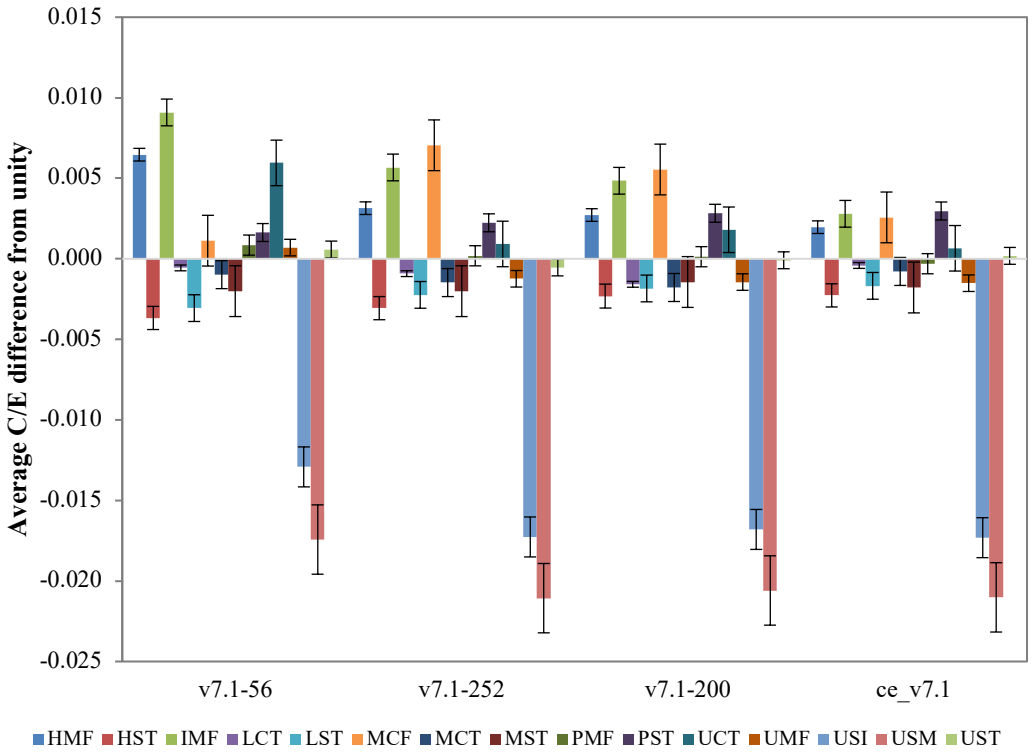

Figure 3. Absolute bias for all 4 libraries for each of the 15 categories of experiments by library.

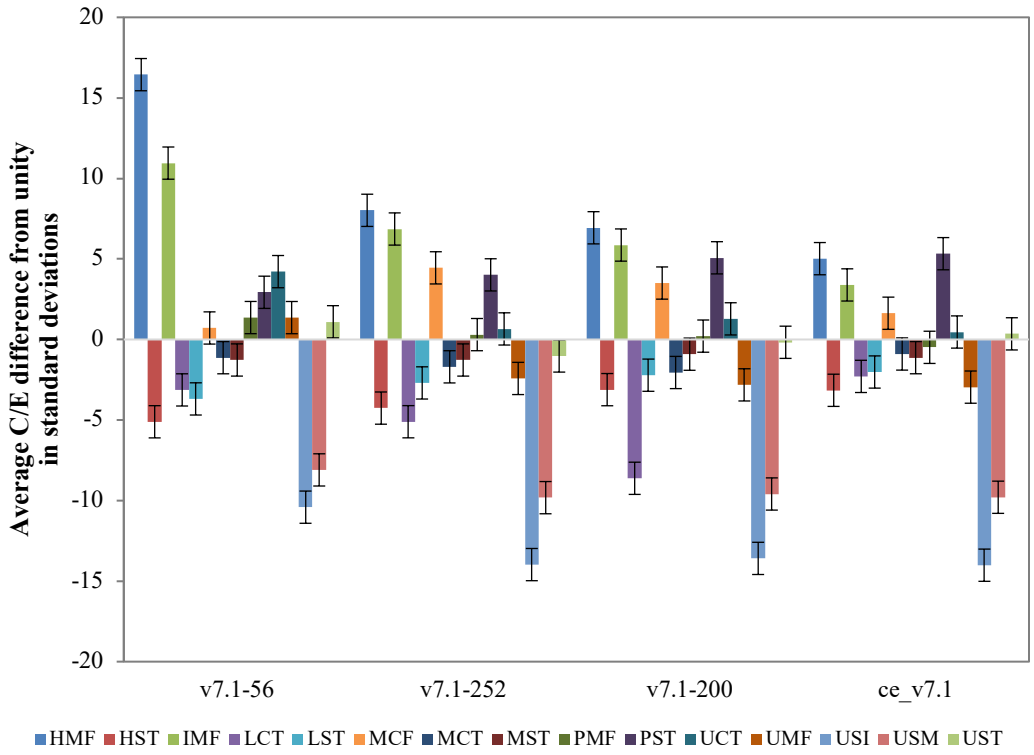

Figure 4. Relative bias for all 4 libraries for each of the 15 categories of experiments by library.

The largest absolute bias for the 56-group ENDF/B-VII.1 library occurs for the USM systems, with a bias of -1.74% Δk. The second largest bias is for the USI systems, with a bias of -1.29% Δk. The third largest bias is for the IMF systems, with a bias of 0.91% Δk. As discussed in Section 4.2, this library is optimized for LWR depletion calculations. As shown in Figure 2, the relative bias is more than 10 standard deviations for the HMF, IMF, and USI systems, and it is 8 standard deviations for the USM systems. Additionally, the HST, LCT, LST, and UCT categories show a bias of more than 3 standard deviations. The absolute bias for the LCT system is only -0.06% Δk, and for the MCT system, it is -0.10% Δk. The results confirm that this is not a general-purpose library, and its use should be limited to the LCT and MCT systems for which it is intended.

For the 252-group ENDF/B-VII.1 library, the largest absolute bias of -2.11% Δk occurs for the USM systems. The second largest bias of -1.73% Δk occurs for the USI systems. The next largest bias of 0.71% Δk occurs for the MCF systems; however, only two experiments are modeled. As mentioned previously, the small sample size for the MCF systems indicates that the results may not be generically applicable. Five categories—MCT, MST, PMF, UCT, and UST—have biases of less than two standard deviations from unity. The additional groups in the multipurpose library were intended to reduce biases for LWR fuel systems [1] and to result in the intended lower biases for LCT systems.

As discussed in Section 4.2, the 200-group ENDF/B-VII.1 library is intended for use in shielding applications and is considered here because of the larger number of fast groups in comparison to the 252-group structure. As with the other libraries, the largest outliers are the USM and USI categories, with biases of -2.06 and -1.68% Δk, respectively. The next largest bias is 0.55% Δk for the MCF systems. The bias for the 200-group library is smaller than the 252-group bias for all the fast systems except for the UMF set. The bias is also lower for the HST, IMF, LST, MCF, MST, PMF, USI, USM, and UST systems. The only bias difference between the 200-group library and the 252-group library that is greater than two

standard deviations is a lower bias for the 252-group library for the LCT systems. The 200-group library can also be used as a multipurpose criticality safety library but has not been documented as such prior to this validation report.

Finally, the largest bias for the CE ENDF/B-VII.1 library is also the USM category. The bias for this set of systems with this library is -2.10% Δk. The second largest bias is 1.73% Δk and applies to the USI systems. The next largest bias is only 0.30% Δk and applies to the PST systems. Six of the 15 categories have a bias of less than two standard deviations, and four of those are less than one standard deviation. The ENDF/B-VII.1 CE library has no category other than the USI and USM categories with a bias as large as six standard deviations.

The subsections below detail the C/E values, the benchmark k_{eff} uncertainty as reported in the ICSBEP Handbook, and the uncertainty in k_{eff} due to uncertainties in the nuclear data for each case in each category of benchmarks. In the C/E figures, the reported benchmark uncertainty for each case is shown as dotted lines, and the nuclear data induced uncertainty values are shown as dashed lines. The sensitivities used to calculate the cross section uncertainties are generated using ENDF/B-VII.1 libraries; MG TSUNAMI-3D is used for thermal systems and CE TSUNAMI-3D for fast systems. The 252-group library is used for MG calculations, and the sensitivities are tallied on the same 252-group structure in the CE calculations. Sensitivity data have not been generated for the U233 systems. Covariance data are propagated with the sensitivities to determine the uncertainty in k_{eff} due to data uncertainties. The 56-group covariance data based on ENDF/B-VII.1 and other sources is used for nuclear data induced uncertainty calculations. If the calculated C/E values are normally distributed, it is expected that 68.3% of the cases would lie within one standard deviation, which should then apply to the experimental and nuclear data uncertainty bands.

5.1.1 HMF Systems

The C/E data for HMF systems is presented in Figure 5 for ENDF/B-VII.1 libraries. The SCALE 6.2.2 covariance band is shown in the figure based on sensitivities calculated in CE TSUNAMI-3D. All three MG libraries based on ENDF/B-VII.1 are included in Figure 5 because the 200-group library is most useful for fast spectrum systems. The 252-group library is generally in good agreement with the CE library, with the clear exceptions of HEU-MET-FAST-021 and -021S. This case is a steel-reflected HEU sphere, so ^{56}Fe is a possible reason for the poor agreement. It should be noted that the 200-group library also has a large bias, but it is 0.26% Δk closer to the CE result than the 252-group library. Agreement between the 56-group and CE libraries is generally poor, further supporting the conclusion that the 56-group library is not a multipurpose library and should not be used for fast systems. The C/E values are shown as a function of EALF for the CE and 252-group libraries based on ENDF/B-VII.1 in Figure 6. No trends are evident, although coverage is somewhat thin below 300 keV.

The C/E data are also compared against the experimental and nuclear data uncertainty bands. The majority of the results are outside the reported experimental uncertainty band. Only 26.1% of the ENDF/B-VII.1 CE library results are within the band. The results are similar for the MG libraries; approximately 9, 35, and 30% of the points are in the band for the 56-, 252-, and 200-group libraries, respectively. All points from the CE library are within the nuclear data uncertainty band. All results for the 252- and 200-group libraries are also within the nuclear data uncertainty band. One point (HEU-MET-FAST-040-001) is slightly above the 1σ band for the 56-group library.

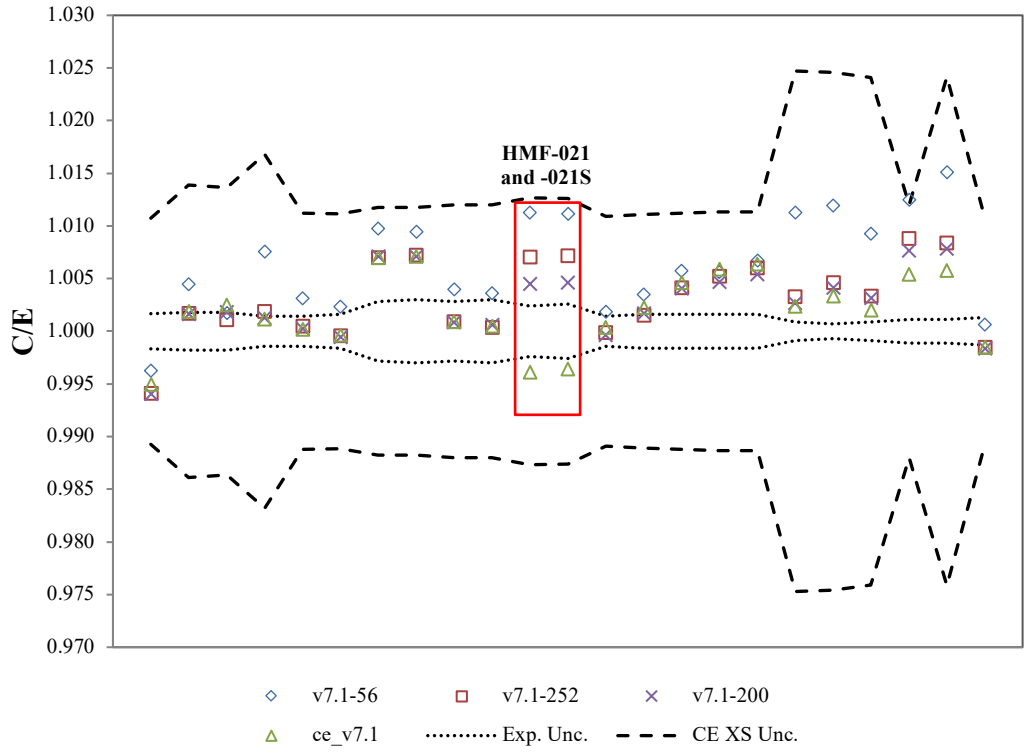

Figure 5. C/E results for libraries based on ENDF/B-VII.1 for the HMF systems.

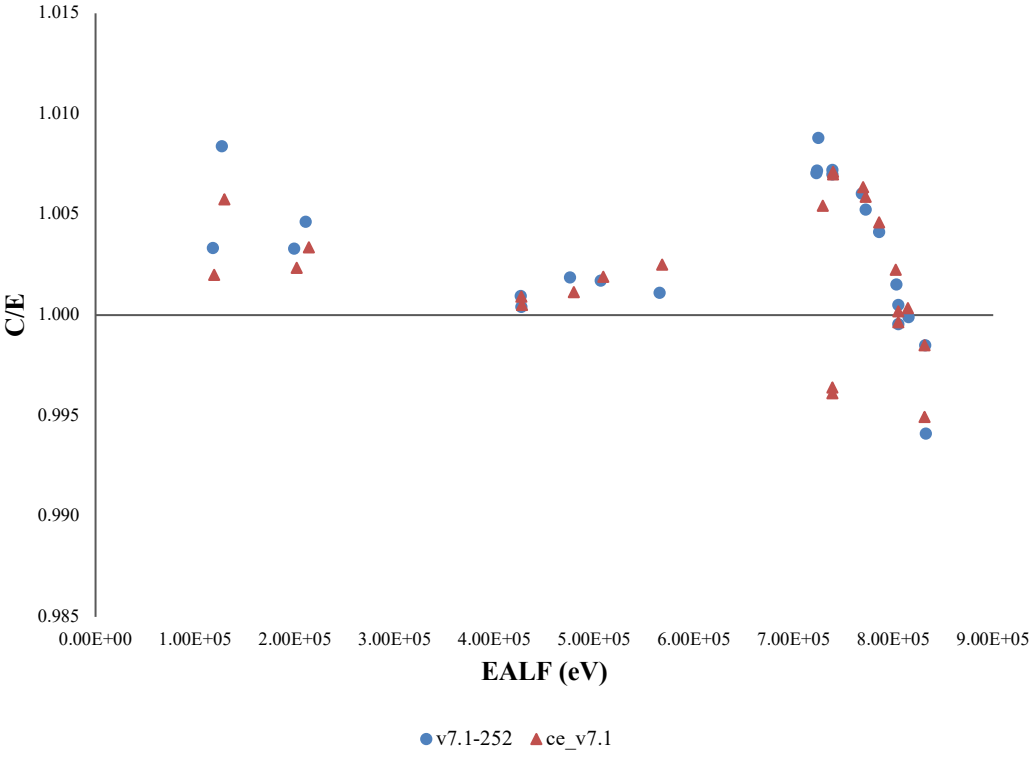

Figure 6. C/E as a function of EALF for 2 ENDF/B-VII.1 libraries for the HMF systems.

5.1.2 HST Systems

The C/E data for the HST systems are shown in Figure 7 for the ENDF/B-VII.1 libraries. Agreement between the MG and CE libraries is generally good, as shown in Figure 7. The 252-group library is consistently 0.075% Δk to 0.1% Δk lower than the CE library, and the 56-group library is somewhat lower than the 252-group library. Both are consistent with the behavior of the average C/E values shown in Figure 1, and both indicate a general difference in calculated k_{eff}. No individual case is driving the differences in the averages. While two cases failed to execute because of an issue with XSProc and the 6.2.4 200-group library (HST-030-002 and HST-030-003), the 200-group library is in remarkable agreement with the CE results (the XSProc issue will be fixed for the release of SCALE 6.3). This outcome was not expected for thermal systems. No clear trends are present in the data. The HEU-SOL-THERM-014 and -016 cases continue to be radical outliers, as identified and discussed in the SCALE 6.1 validation report [9]. These cases both contain soluble gadolinium poison and will be discussed in more detail below. Figure 8 shows the C/E values as a function of EALF for the 252-group and CE libraries. No trends are evident in the figure.

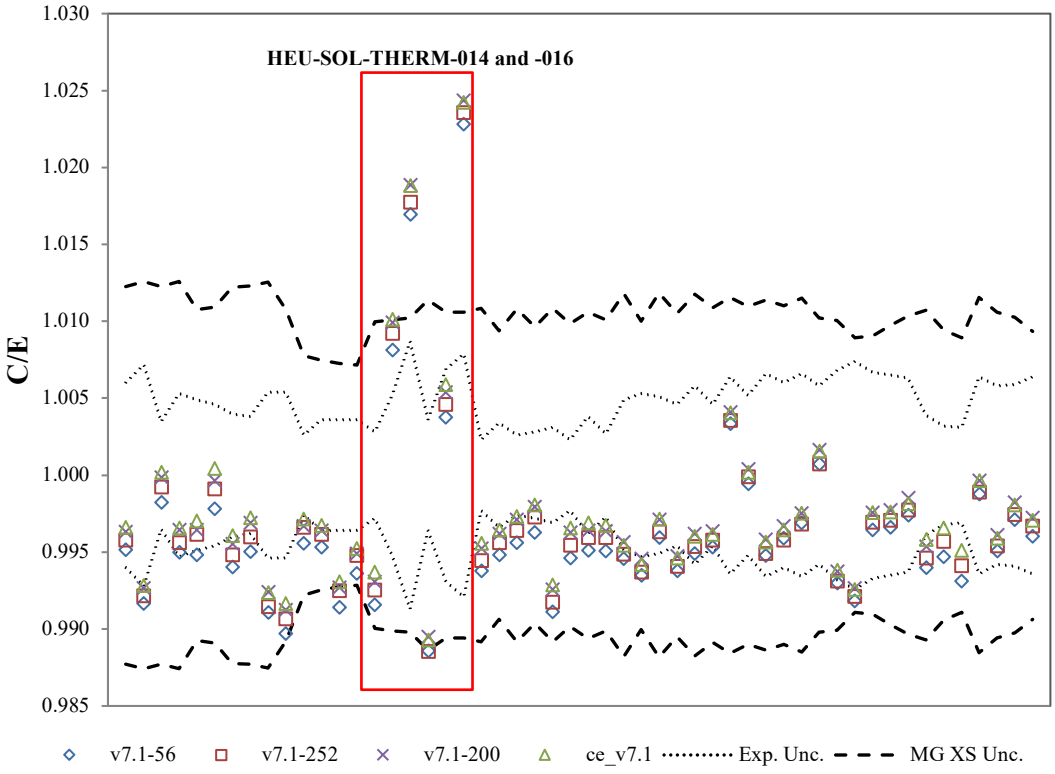

Figure 7. C/E results for libraries based on ENDF/B-VII.1 for the HST systems.

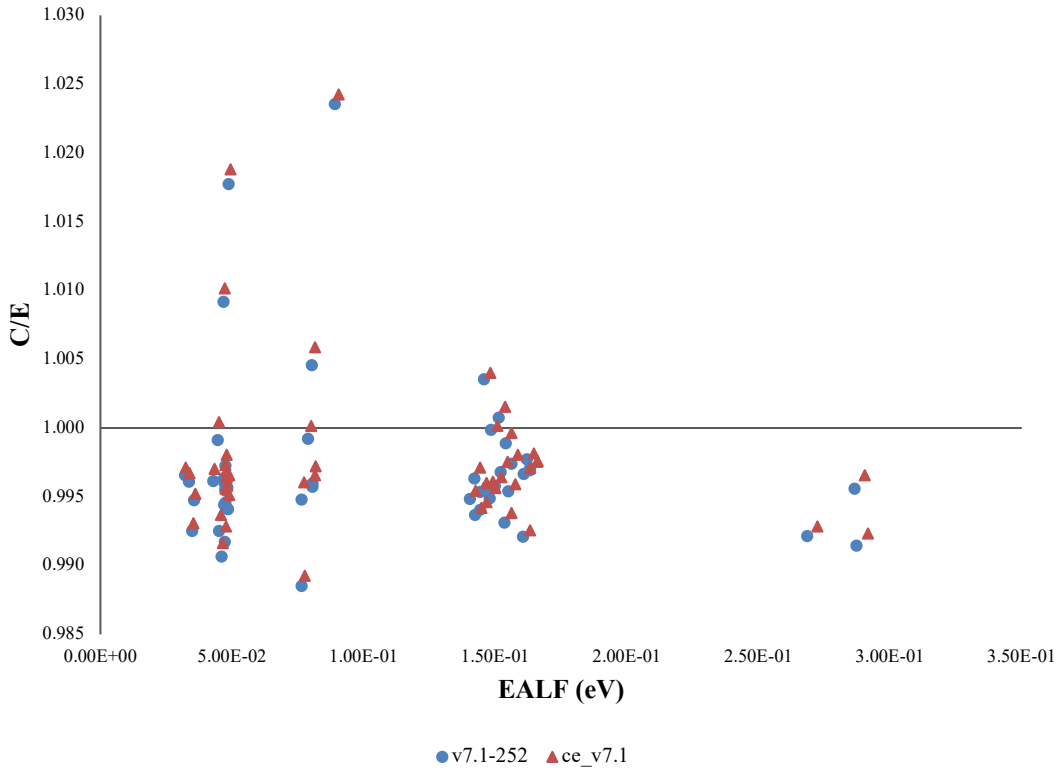

Figure 8. C/E as a function of EALF for 2 ENDF/B-VII.1 libraries for the HST systems.

HEU-SOL-THERM-014 and -016 contain differing levels of soluble gadolinium as a poison. In both evaluations, case 1 has no gadolinium, case 2 has an intermediate amount of the poison, and case 3 has the largest concentration of gadolinium. This has caused considerable consternation over the years, as this could indicate a significant bias with the neutron absorption cross section in ^{157}Gd. Such an error could have safety implications since gadolinium is used in a wide range of nuclear applications, including use as a burnable absorber in commercial nuclear fuel. These power reactor applications may not reveal errors in the gadolinium cross sections because of the self-shielding inherent to their use in fuel rods. The sample results provided in the ICSBEP Handbook evaluation for both HEU-SOL-THERM-014 and -016 indicate similar large biases with increasing case numbers for both the Russian results and sample results using Monte Carlo N-Particle transport code (MCNP) with ENDF/B-V cross sections [21]. ENDF/B-VII.1 contains a new ^{157}Gd evaluation [2], which is of interest in this discussion because it is the primary neutron-absorbing nuclide in natural gadolinium. A comparison of the HEU-SOL-THERM-014 and -016 results provided in Figure 7 shows that the new evaluation has little impact on the bias. Results for the MIX-SOL-THERM-007 evaluation, which was not included in the SCALE 6.1 validation report, are also relevant since that experiment also contains soluble gadolinium. A detailed discussion of the MST results is presented in Section 5.1.8. MIX-SOL-THERM-007 shows no bias as a function of gadolinium concentration. Figure 9 provides the C/E results for all three experiments containing soluble gadolinium as a function of gadolinium concentration. The vertical error bars show the uncertainty in the C/E value, and the horizontal error bars indicate the reported uncertainty in the gadolinium concentration. No discussion is provided in the HEU-SOL-THERM evaluations regarding how the gadolinium concentrations were measured or how their uncertainties were determined. The MIX-SOL-THERM-007 evaluation provides measured gadolinium concentrations from two laboratories for each case considered in the evaluation. Three experiments are excluded from the MIX-SOL-THERM-007 benchmark because of large uncertainties in the gadolinium concentration.

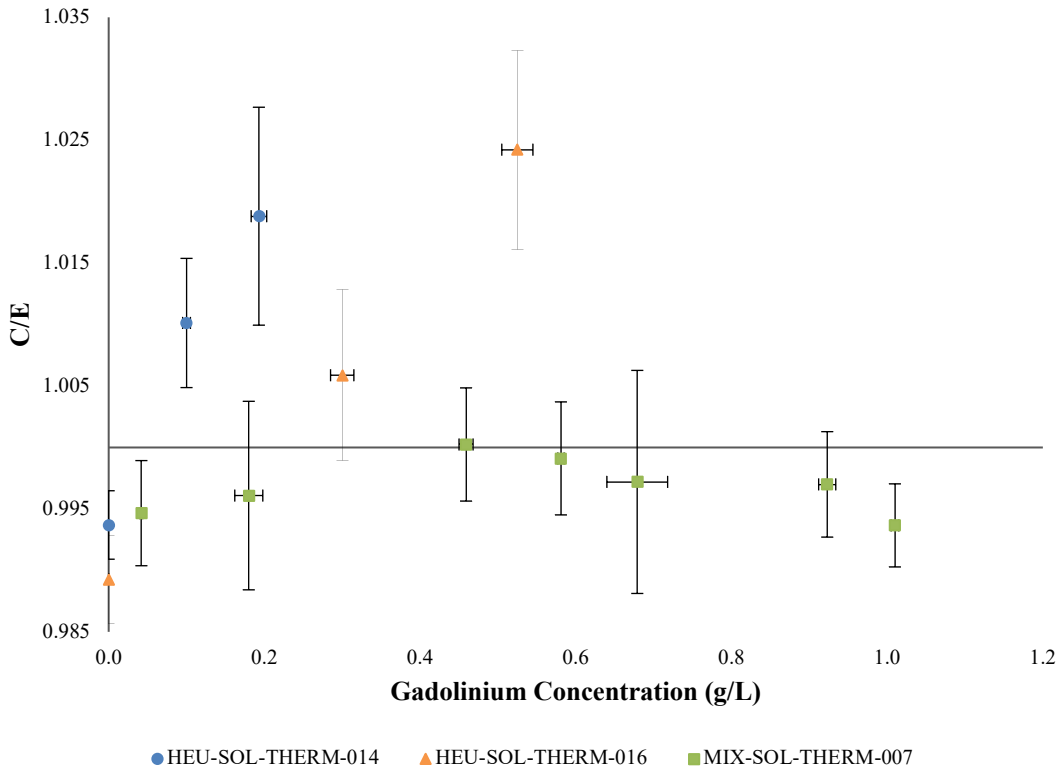

Figure 9. C/E values for solution experiments containing soluble gadolinium, ce_v7.1 library.

Sensitivity/uncertainty tools such as TSUNAMI-3D can also be used to investigate these types of discrepancies. While modeled with natural gadolinium, the total sensitivity profile of ^{157}Gd in the highest gadolinium case for each evaluation is provided in Figure 10. The sensitivities were generated for each case using the MG TSUNAMI implementation, and the results were confirmed by comparison with the prior sensitivity data files (SDFs) included in VALID. These accepted SDFs were confirmed by comparisons with direct perturbation calculations, so there is very high confidence that the calculated sensitivities are correct. The total sensitivity of k_{eff} to changes in the ^{157}Gd cross section for HEU-SOL-THERM-016-003 is -0.156, and for MIX-SOL-THERM-007-007, it is -0.154. These cases contain the highest gadolinium concentration in each of the evaluations. The uncertainty in the ^{157}Gd capture (n,γ) cross section is shown in Figure 11 from the 56-group covariance data. The relevant uncertainty range is around 0.01–0.1 eV, where the sensitivity has the largest magnitude. The uncertainty in this range is approximately 4.4% and would therefore account for a reactivity change of 0.26% Δk on a 1σ basis. The uncertainty in the gadolinium concentrations range up to approximately 5%; this uncertainty can also be propagated with the sensitivity to determine its impact on the calculated k_{eff} value. The impact is about 0.78% Δk for HEU-SOL-THERM-016-003. This is a significant reactivity impact, but it is not enough to explain the apparent discrepancy in the results.

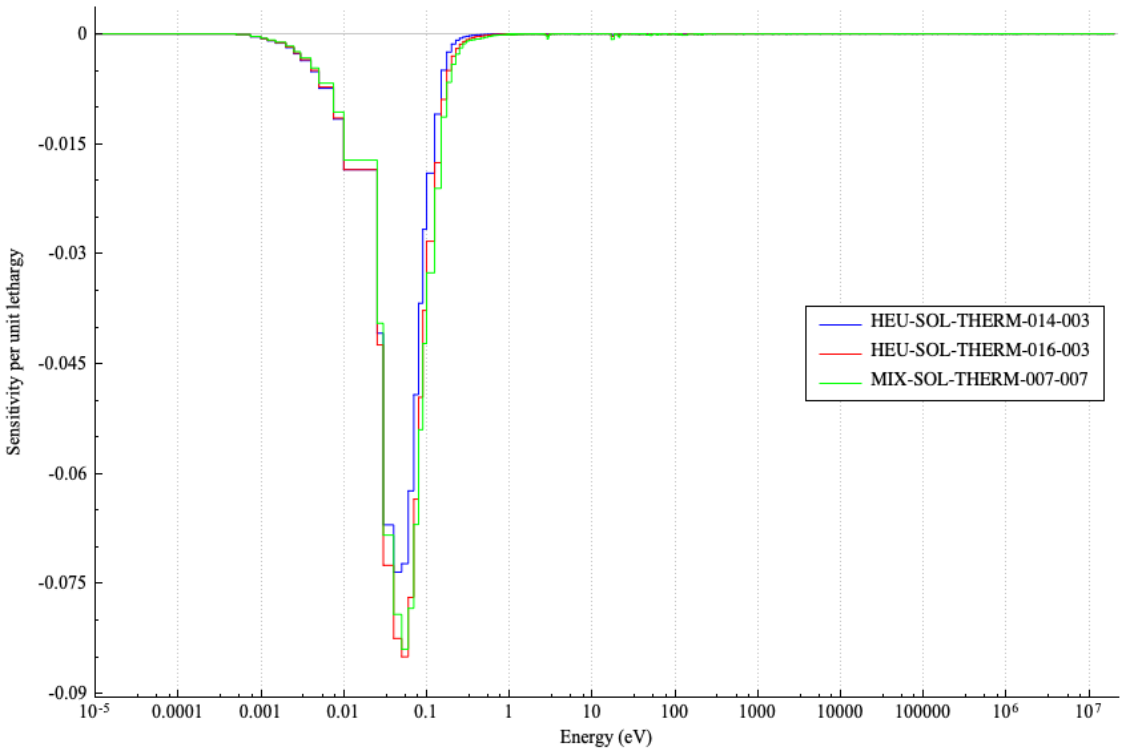

Figure 10. Sensitivity profiles for ^{157}Gd in the cases with the highest gadolinium concentration.

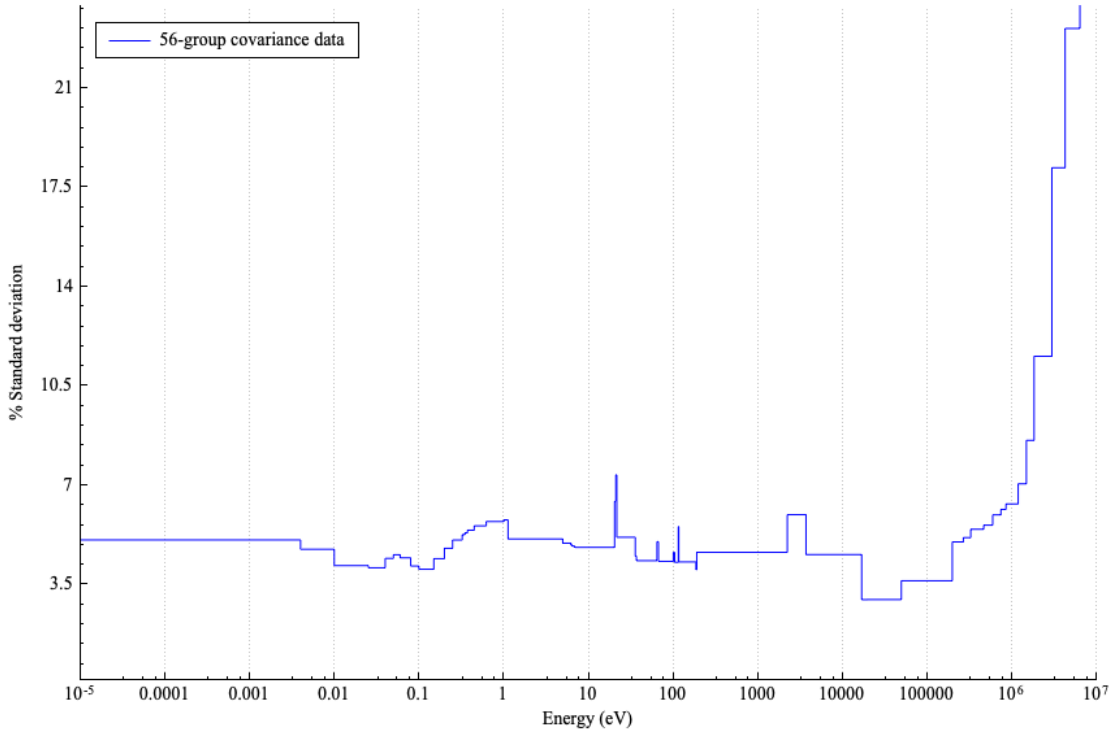

Figure 11. Uncertainty in ^{157}Gd (n,γ) cross section.

The C/E data for all the HST cases are also compared against the experimental and nuclear data uncertainty bands. In comparison with the experimental uncertainty, 57.7% of the ENDF/B-VII.1 CE library results are within the band. For the MG libraries, approximately 39, 44, and 56% of the points are in the band for the 56-, 252-, and 200-group libraries, respectively. A majority of the points from all of the libraries is within the nuclear data uncertainty band. For the ENDF/B-VII.1 CE, library 94.2% of the results are within the band, with all outlier CE library points coming from the HEU-SOL-THERM-014 and -016 cases. For the MG libraries, approximately 92% of the points are in the band for the 56-, 252-, and 200-group libraries, with most of those outlier points coming from the HEU-SOL-THERM-013, -014, and -016 cases.

5.1.3 IMF Systems

The C/E data for the IMF systems are shown in Figure 12 for the ENDF/B-VII.1 libraries. Outside of IMF-005 and -005S, the continuous energy C/E values are consistently lower than the MG C/E values, with the largest differences being for IMF-005-001 and -001S, as reported in the SCALE 6.1 validation report [9]. IMF-005 has a thick steel reflector. A similar difference is evident in HMF-021, which also has a thick steel reflector. As discussed in Marshall and Rearden [9], this difference emphasizes the need to use the same code and data library in a validation that is used in a particular safety evaluation to preserve the respective code/data library bias. Figure 13 shows the C/E values as a function of EALF for the 252-group and CE libraries. No trends are evident in the figure.

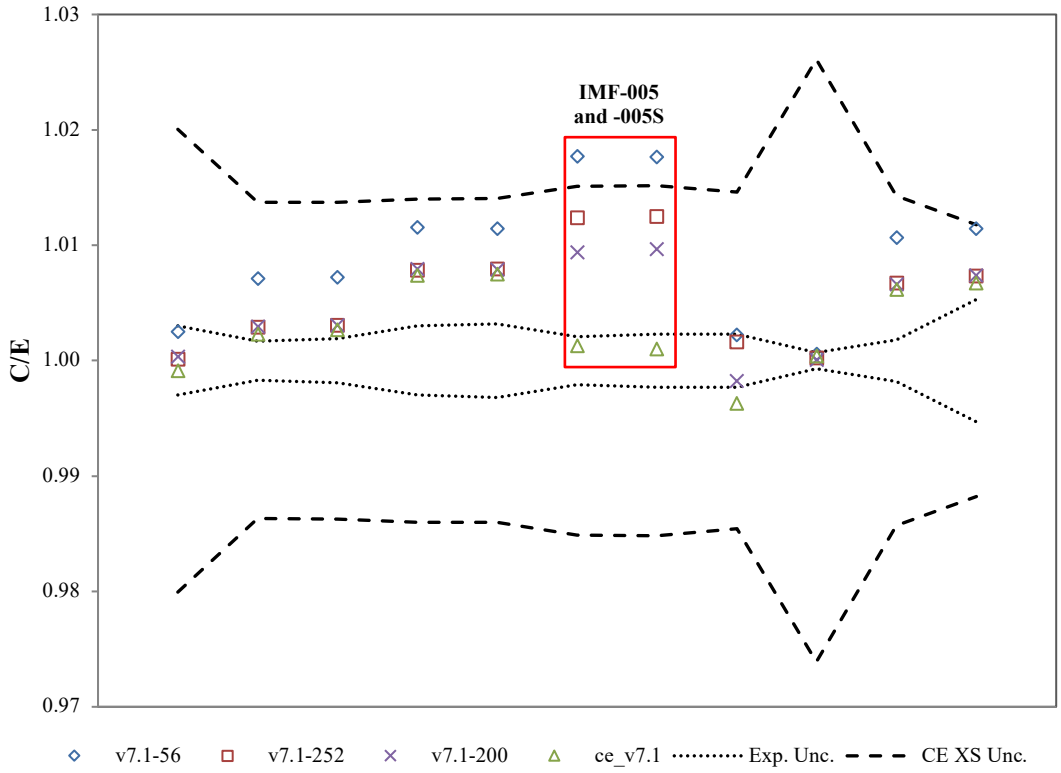

Figure 12. C/E results for libraries based on ENDF/B-VII.1 for the IMF systems.

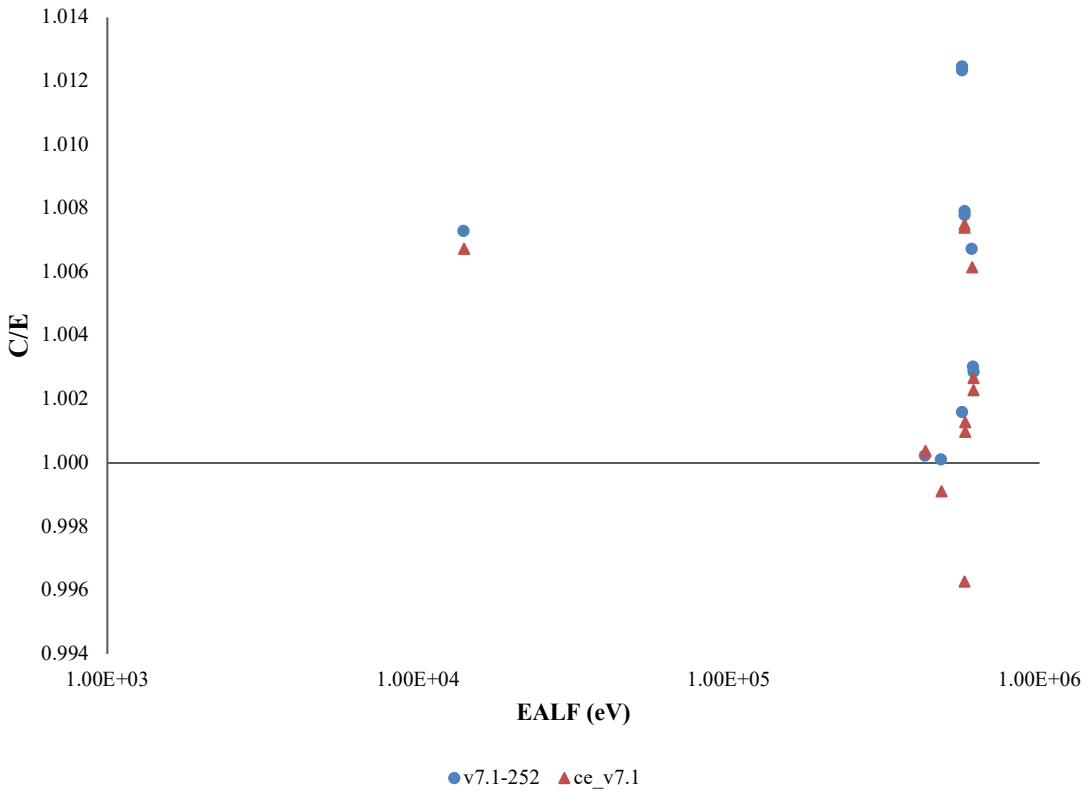

Figure 13. C/E as a function of EALF for 2 ENDF/B-VII.1 libraries for the IMF systems.

The C/E data are also compared against the experimental and nuclear data uncertainty bands. In comparison with the experimental uncertainty, 36.4% of the ENDF/B-VII.1 CE library results are within the band. For the MG libraries, 27.3% of the points are in the band for the 56-, 252-, and 200-group libraries. Almost all points from all libraries are within the nuclear data uncertainty band, the exceptions being the 56-group library points coming from the IMF-005-001 and -001S cases, which are both only slightly above the respective bands.

5.1.4 LCT Systems

The C/E data for the LCT systems are shown in Figure 14 for the ENDF/B-VII.1 libraries. The data generally demonstrate consistent performance between MG and continuous energy C/E calculations. The 56-group and CE libraries' C/E values tend to be the largest. Like the HST cases, three of 200-group cases (LCT-050-008, -009, and -010) failed to execute because of an issue with XSProc and the 6.2.4 200-group library. The cases from LCT-078 and -080 are the most consistent. All of the experiments for LCT-078 and -080 were performed using the same equipment at the same location. Figure 15 shows the C/E values as a function of EALF for the 252-group and CE libraries. No trends are evident in the figure.

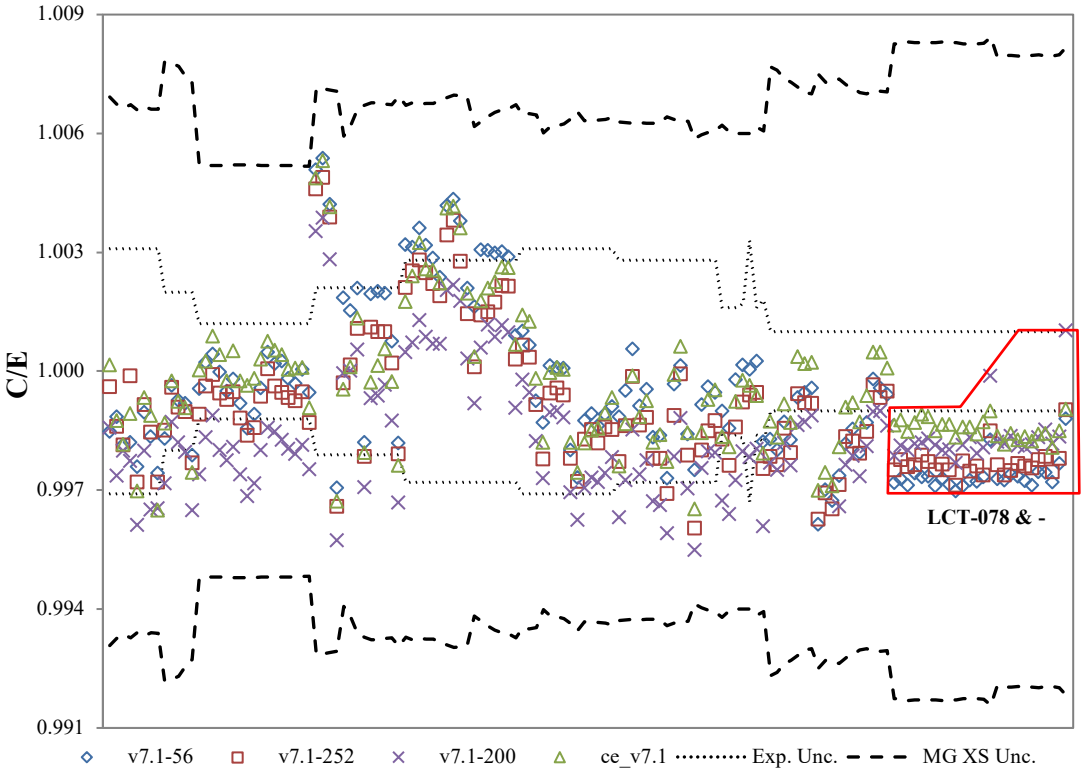

Figure 14. C/E results for libraries based on ENDF/B-VII.1 for the LCT systems.

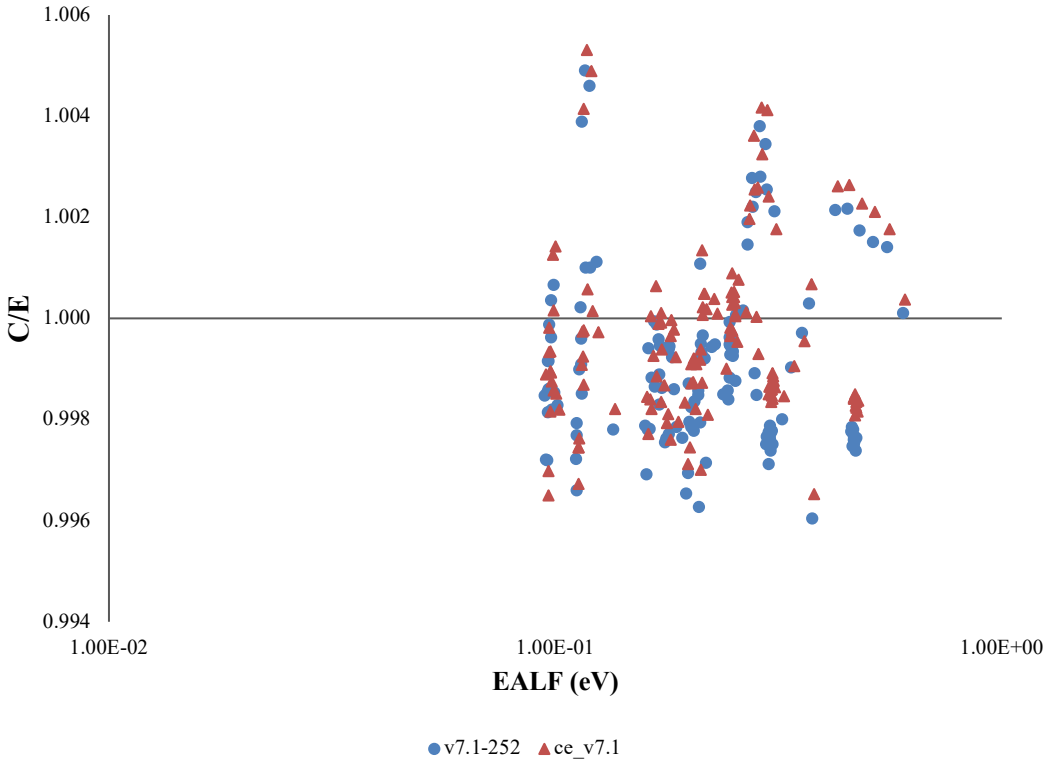

Figure 15. C/E as a function of EALF for 2 ENDF/B-VII.1 libraries for the LCT systems.

The C/E data are also compared against the experimental and nuclear data uncertainty bands. In comparison with the experimental uncertainty, 65.7% of the ENDF/B-VII.1 CE library results are within the band. For the MG libraries, approximately 59, 61, and 41% of the points are in the band for the 56-, 252-, and 200-group libraries, respectively. All of the points from all of the libraries are within the nuclear data uncertainty band.

5.1.5 LST Systems

The C/E data for the LST systems are shown in Figure 16 for the ENDF/B-VII.1 libraries. The data show consistent performance between the MG and CE libraries. The 56-group C/E values tend to be the smallest, and the CE library C/E values tend to be the largest. Figure 17 shows the C/E values as a function of EALF for the 252-group and CE libraries. No trends are evident in the figure, though only a small EALF range is represented in the LST cases in VALID.

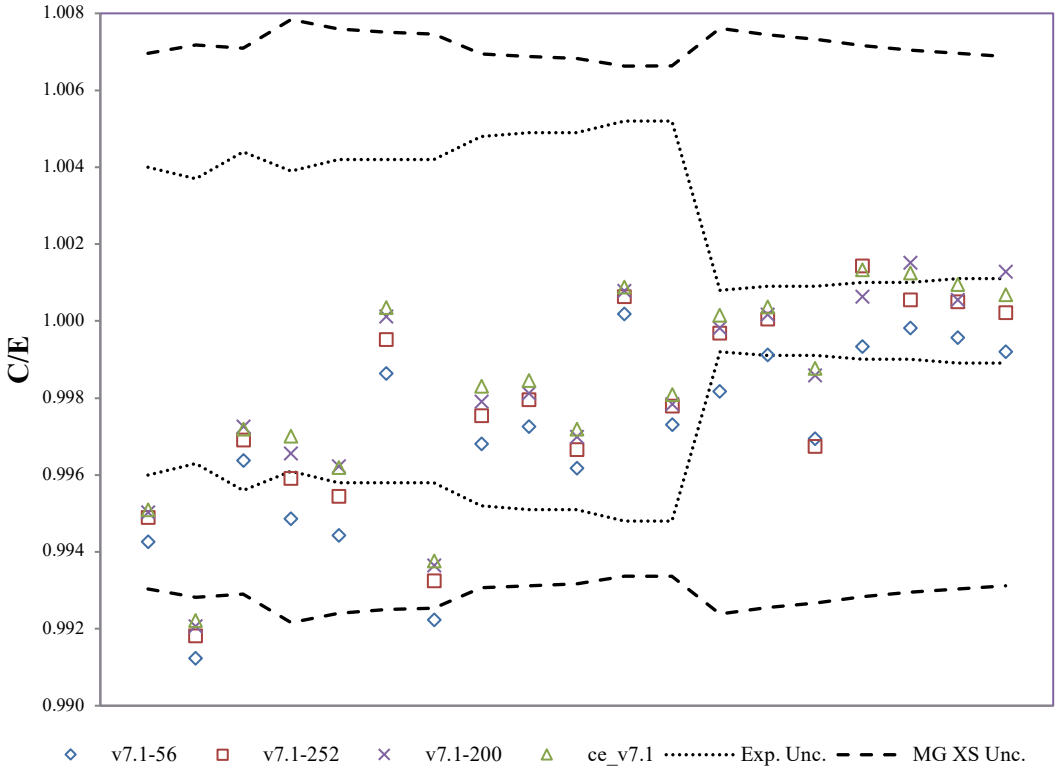

Figure 16. C/E results for libraries based on ENDF/B-VII.1 for the LST systems.

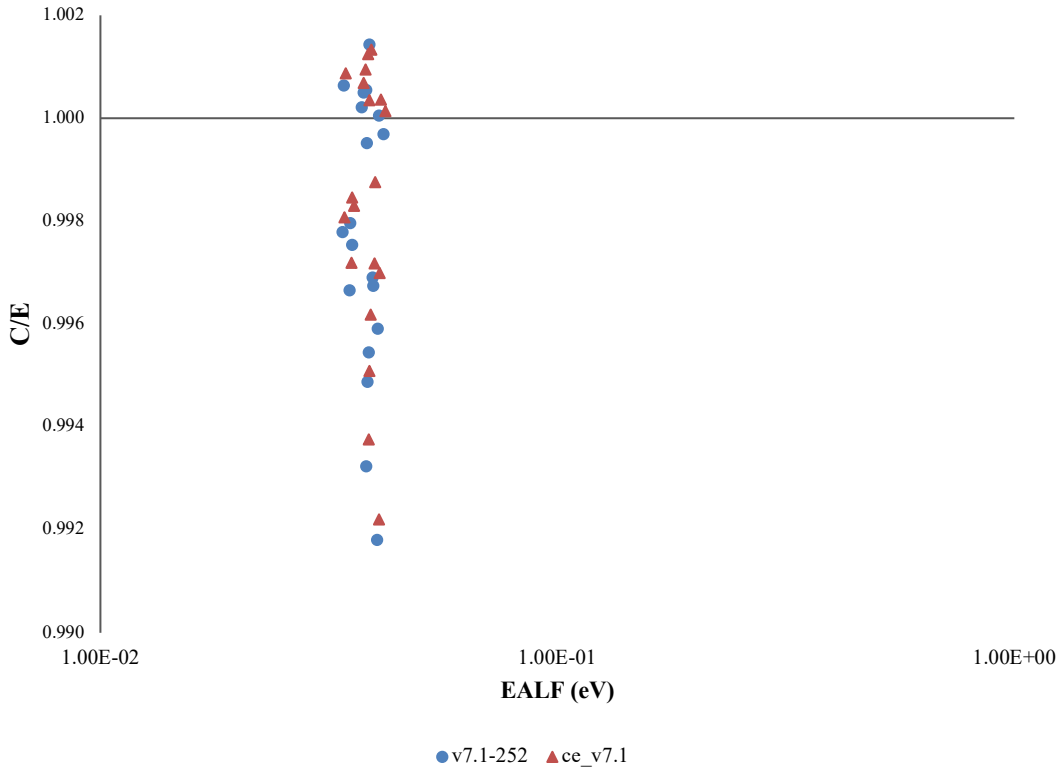

Figure 17. C/E as a function of EALF for 2 ENDF/B-VII.1 libraries for the LST systems.

The C/E data are also compared against the experimental and nuclear data uncertainty bands. In comparison with the experimental uncertainty, 68.4% of the ENDF/B-VII.1 CE library results are within the band. For the MG libraries, approximately 63, 63, and 68% of the points are in the band for the 56-, 252-, and 200-group libraries, respectively. A majority of the points from all of the libraries is within the nuclear data uncertainty band. For the CE library, 94.7% of the results are within the band. For the MG libraries, approximately 90, 95, and 95% of the points are in the band for the 56-, 252-, and 200-group libraries, respectively.

5.1.6 MCF Systems

The C/E data for the MCF systems are shown in Figure 18 for the ENDF/B-VII.1 libraries. With only two cases, generalizations on the tendencies between the different libraries and comparisons with the experimental and uncertainty data are not attempted in this report. Furthermore, the homogenization of the heterogeneous cores for both MCF-005 and -006 both incurred a Monte Carlo Transformation adjustment which resulted in fairly large biases and low benchmark k_{eff} values.

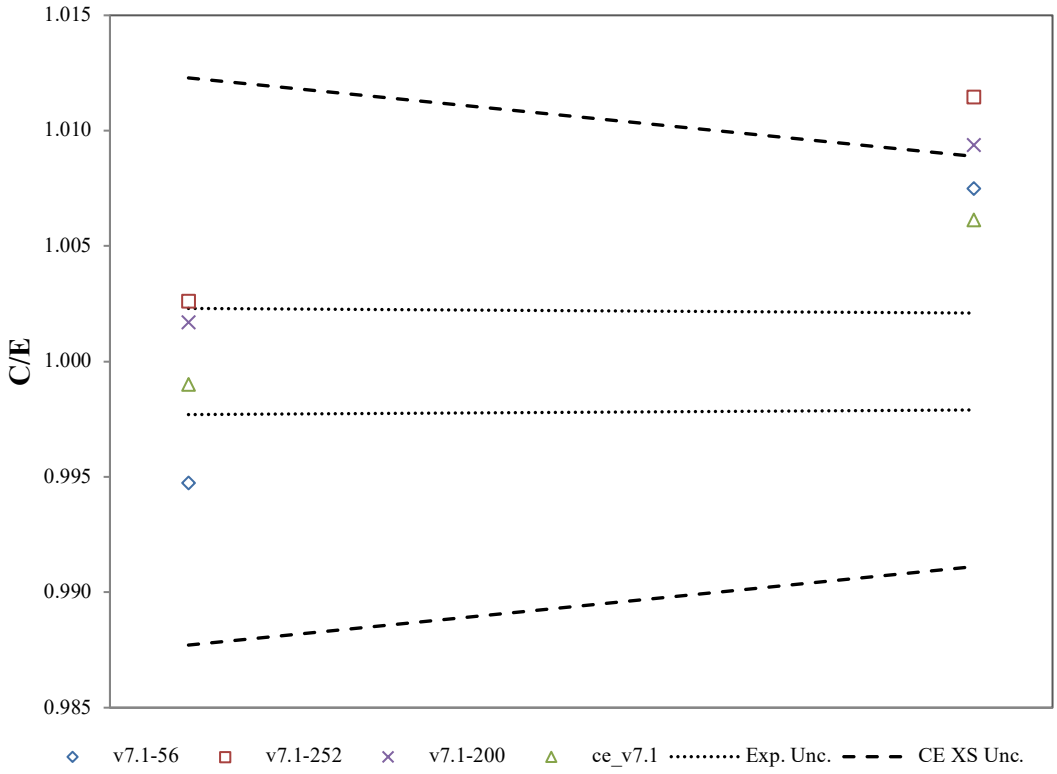

Figure 18. C/E results for libraries based on ENDF/B-VII.1 for the MCF systems.

5.1.7 MCT Systems

The C/E data for the MCT systems are shown in Figure 19 for the ENDF/B-VII.1 libraries. In general, there is good agreement between all of the libraries. The right half of Figure 19 shows an apparent trend with the MCT-004 data, with the C/E values approaching unity for all libraries. The MCT-004 series of experiments examined a series of fuel-rod pitches over a period of several years. Four fuel rod pitches were used, measured at roughly one-year intervals. Each lattice was measured three times, except the largest pitch, which was only measured twice. The fuel-rod pitch increases from Case 1 to Case 11, as does the decay period for ^{241}Pu to transition to ^{241}Am. For the smallest pitch, there is a noticeable increase in C/E for all libraries between the first two measurements, but not between the second and third measurement. This pattern repeats for the second pitch, but the third pitch shows increased C/E values for all three measurements. The largest pitch has essentially the same C/E in both measurements. Figure 20 shows the C/E values as a function of EALF for the 252-group and CE libraries. No trends are evident in the entire data set. A closer examination of just the MCT-004 results, presented in Figure 21, reveals the trends discussed above with respect to both fuel rod pitch and decay time. The larger pitch experiments have a smaller negative bias, as do the longer cooling time cases. This combination of effects indicates a potential deficiency in either the ^{241}Pu or ^{241}Am cross sections and provides some indication of the relevant energy range.

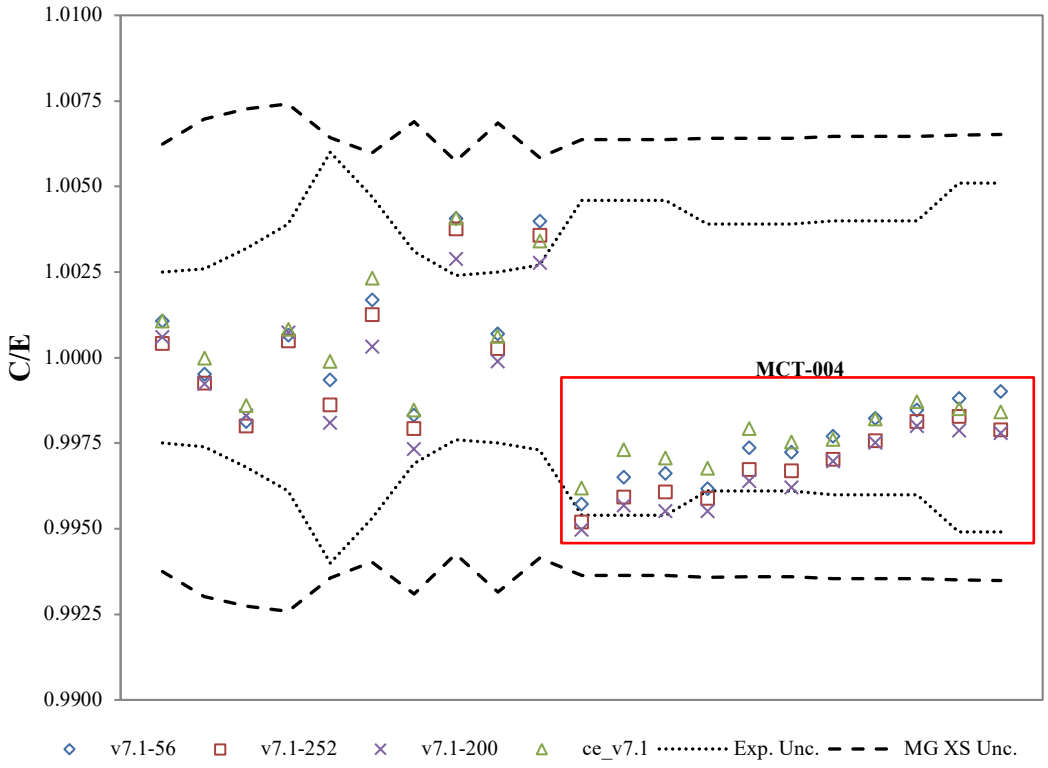

Figure 19. C/E results for libraries based on ENDF/B-VII.1 for the MCT systems.

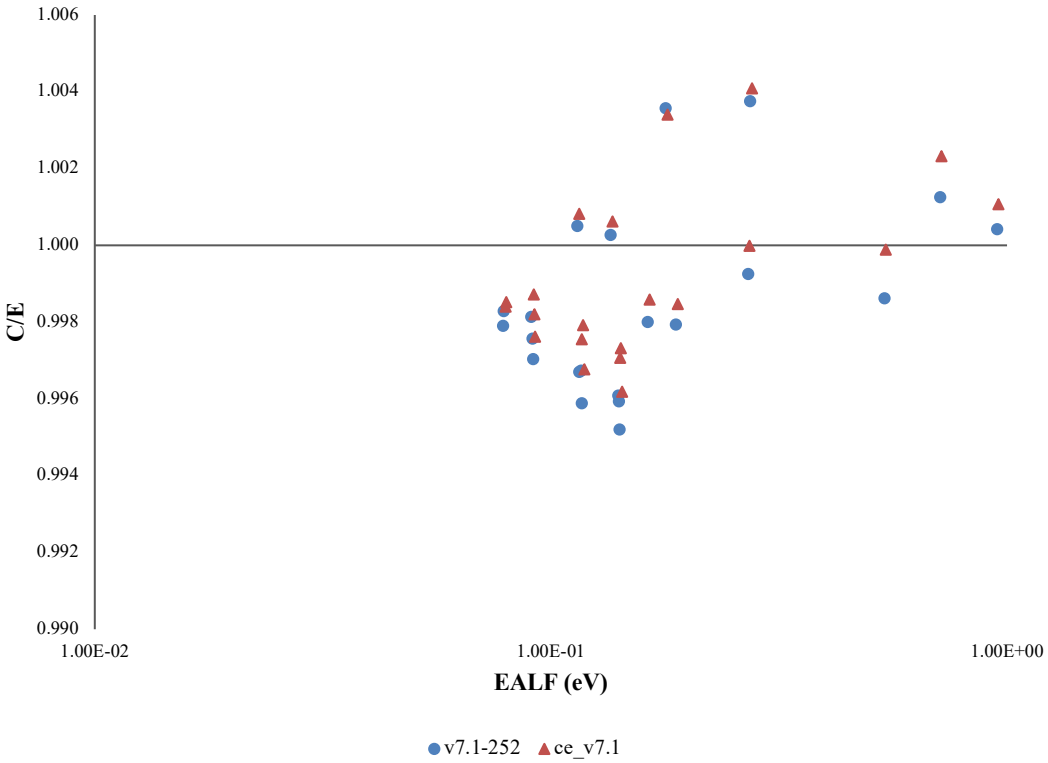

Figure 20. C/E as a function of EALF for 2 ENDF/B-VII.1 libraries for the MCT systems.

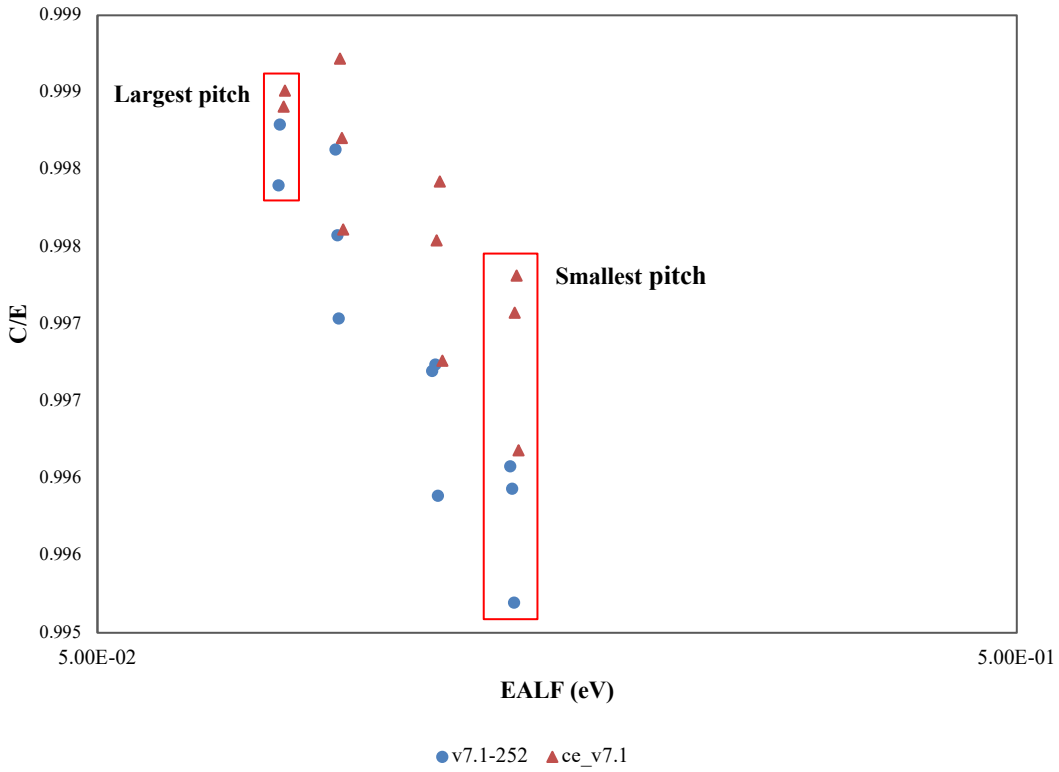

Figure 21. C/E as a function of EALF for MCT-004 for 2 ENDF/B-VII.1 libraries.

The C/E data are also compared against the experimental and nuclear data uncertainty bands. In comparison with the experimental uncertainty, 90.5% of the ENDF/B-VII.1 CE library results are within the band. For the MG libraries, approximately 91, 81, and 81% of the points are in the band for the 56-, 252-, and 200-group libraries, respectively. All points from all libraries are within the nuclear data uncertainty band.

5.1.8 MST Systems

The C/E data for the MST systems are shown in Figure 22 for the ENDF/B-VII.1 libraries, and in general, there is good agreement between all of the libraries. The 200-group library tends to have the largest C/E values. The first three groupings of C/E values on the left sides of Figure 22 are cases from MIX-SOL-THERM-002; the remaining points are cases from MIX-SOL-THERM-007. The MIX-SOL-THERM-007 cases contain different concentrations of gadolinium, and as discussed in Section 5.1.2, no bias is evident as a function of gadolinium concentration. Figure 23 shows the C/E values as a function of EALF for the 252-group and CE libraries, with a noticeable separation between the MIX-SOL-THERM-002 EALFs and the MIX-SOL-THERM-007 EALFs. No trends are evident in the figure.

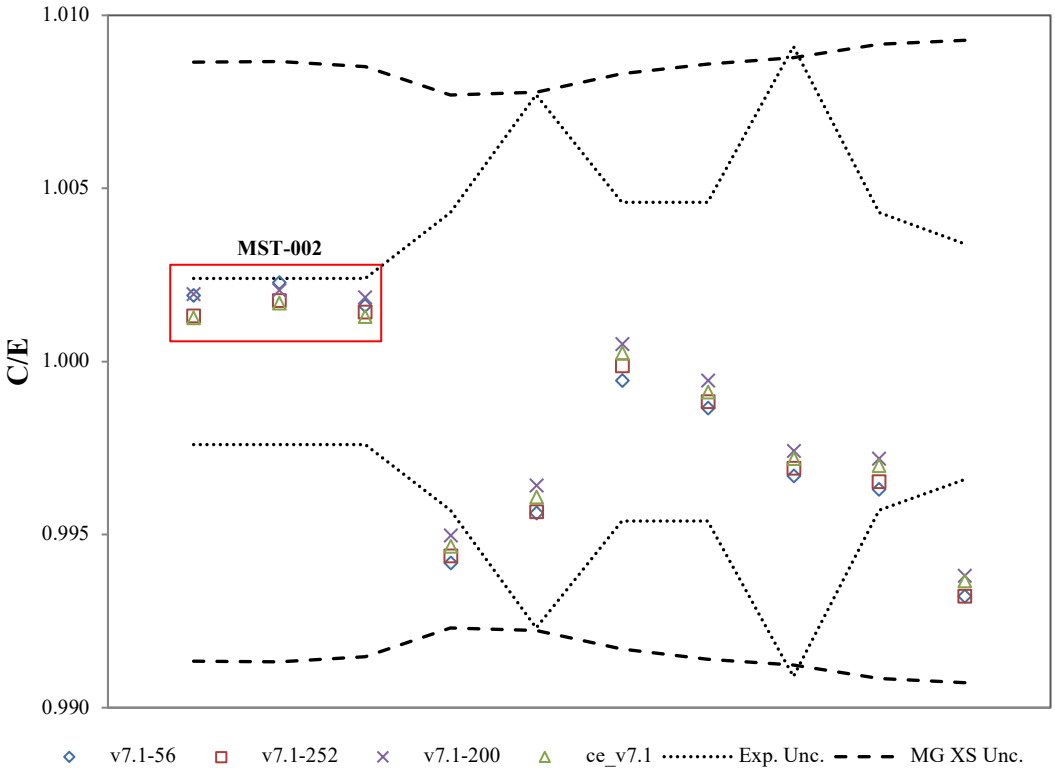

Figure 22. C/E results for libraries based on ENDF/B-VII.1 for the MST systems.

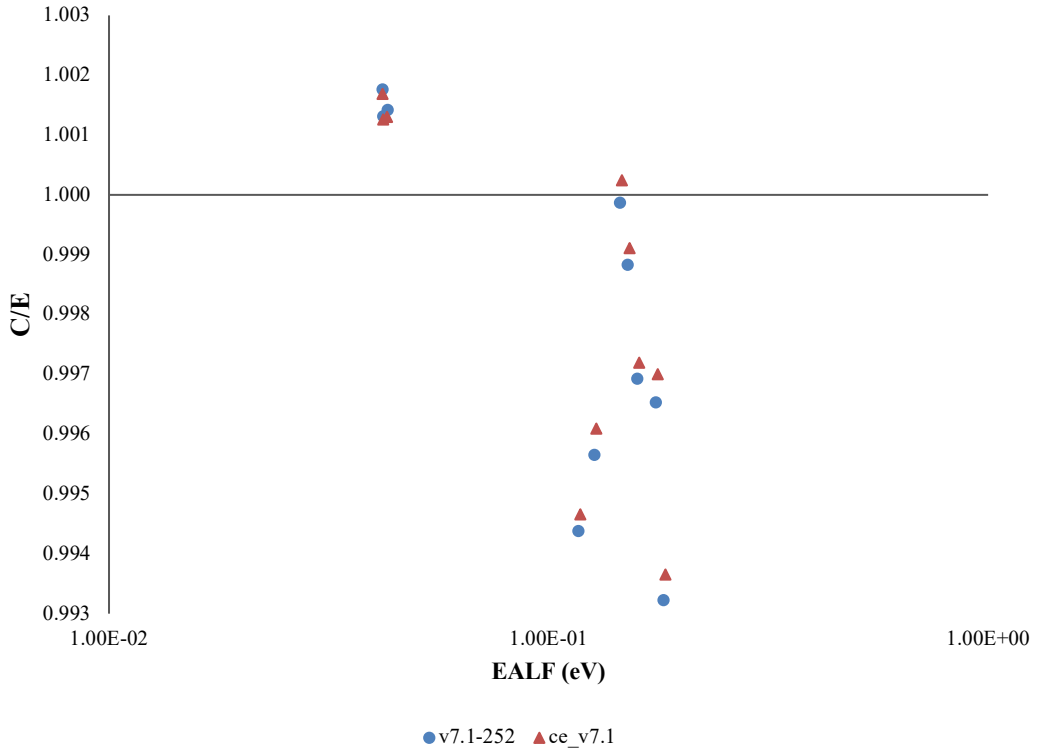

Figure 23. C/E as a function of EALF for 2 ENDF/B-VII.1 libraries for the MST systems.

The C/E data are also compared against the experimental and nuclear data uncertainty bands. In comparison with the experimental uncertainty, 80% of the ENDF/B-VII.1 CE library results are within the band, with the outlier points for both libraries being from MIX-SOL-THERM-007-001 and -007. For the MG libraries, 80% of the points are in the band for each of the 56-, 252-, and 200-group libraries, with most of the outlier points being from MIX-SOL-THERM-007-001 and -007. All points from all libraries are within the nuclear data uncertainty band.

5.1.9 PMF Systems

The C/E data for the PMF systems are shown in Figure 24 for the ENDF/B-VII.1 libraries. The data generally demonstrate consistent performance between MG and continuous energy C/E calculations and generally good agreement between the libraries, with the last case—PU-MET-FAST-026-001—being a notable exception; this case has a thick steel reflector. The C/E values for PU-MET-FAST-026-001 have a larger spread between them, with the MG libraries having the largest values. Generally, the 56-group C/E values tend to be the largest. Figure 25 shows the C/E values as a function of EALF for the 252-group and CE libraries. No trends are evident in the figure.

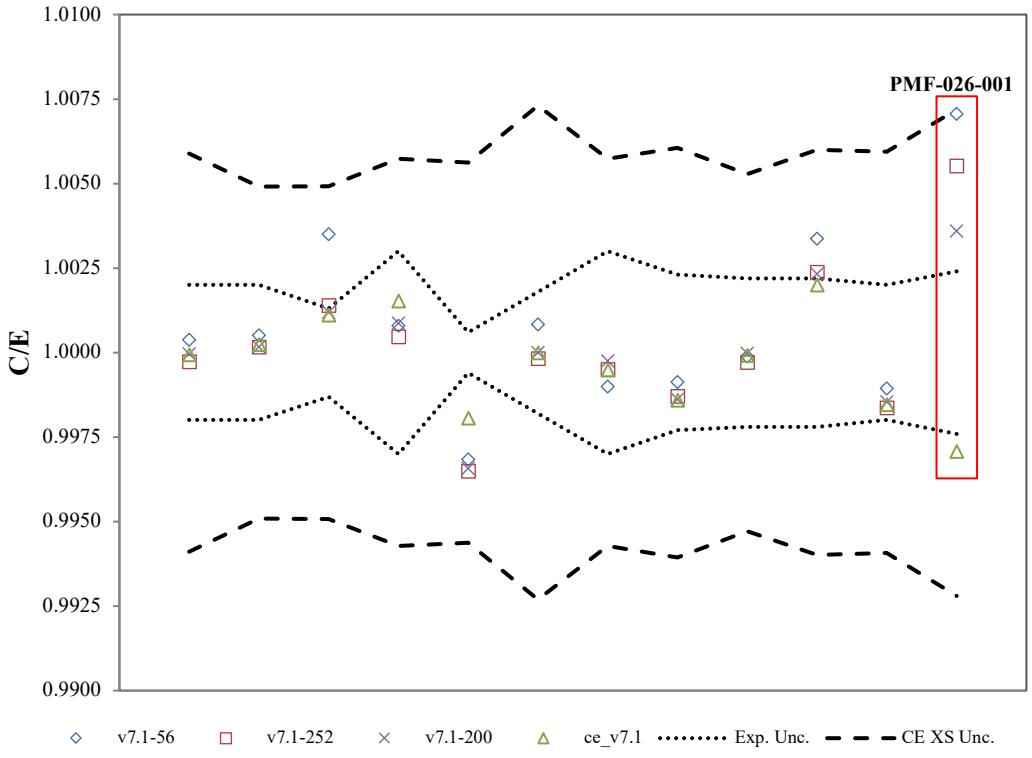

Figure 24. C/E results for libraries based on ENDF/B-VII.1 for the PMF systems.

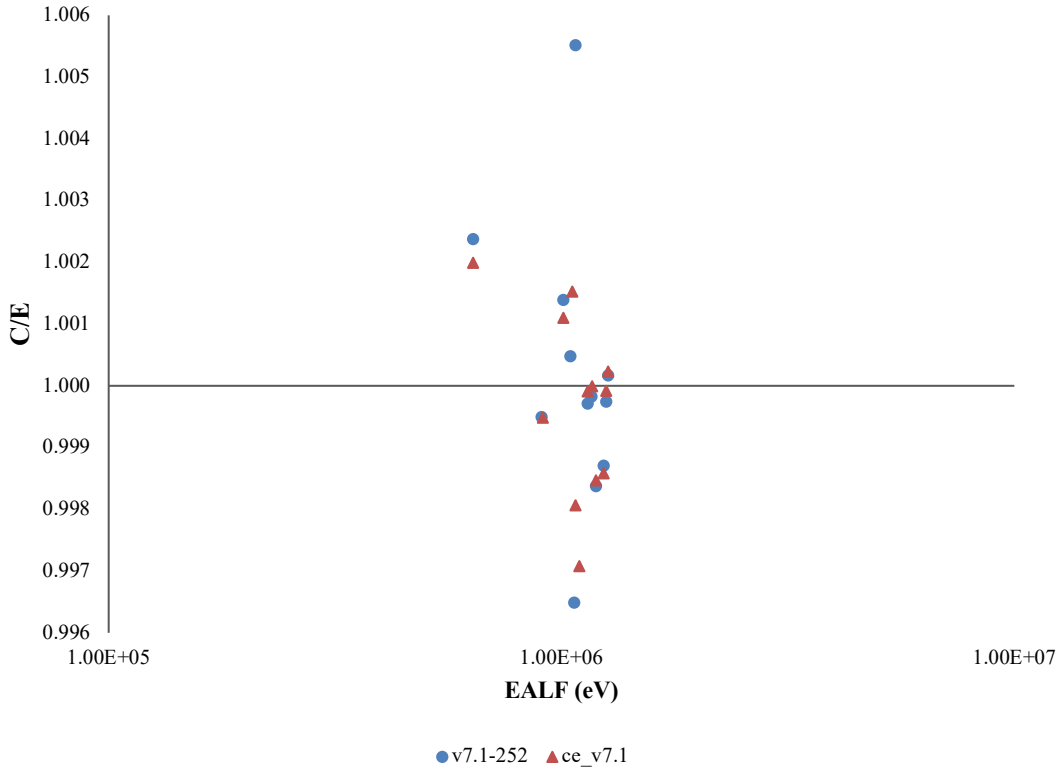

Figure 25. C/E as a function of EALF for 2 ENDF/B-VII.1 libraries for the PMF systems.

The C/E data are also compared against the experimental and nuclear data uncertainty bands. In comparison with the experimental uncertainty, 83.3% of the ENDF/B-VII.1 CE library results are within the band. For the MG libraries, approximately 67, 67, and 75% of the points are in the band for the 56-, 252-, and 200-group libraries, respectively. All points from all libraries are within the nuclear data uncertainty band.

5.1.10 PST Systems

The C/E data for the PST systems are shown in Figure 26 for the ENDF/B-VII.1 libraries. The data generally demonstrate consistent performance between MG and continuous energy C/E calculations and generally good agreement between the libraries. Generally, the 56-group C/E values tend to be the smallest and the continuous energy or 200-group tend to be the largest. As was reported in the SCALE 6.1 validation report [9], the cases with noticeably higher C/E values for both the MG and CE libraries come from PU-SOL-THERM-011. The first 5 cases within PU-SOL-THERM-011 use a sphere that is 16 inches in diameter, and the remaining 7 cases use a sphere that is 18 inches in diameter. The cases with the exceptionally high C/E values are the first five cases with the sphere that is 16 inches in diameter. The PU-SOL-THERM-011 report [21] also notes a similar discrepancy, and as stated in Marshall and Rearden,

> *. . . the five 16-in diameter sphere cases show poor agreement with expected results based on the evaluators' sample calculations also overpredicting k_{eff}, indicating that there may be a discrepancy within the experiment description. However, in the absence of additional information regarding the (ICSBEP) evaluation, the data are included in this validation [9].*

Figure 27 shows the C/E values as a function of EALF for the 252-group and CE libraries. No trends are evident in the figure.

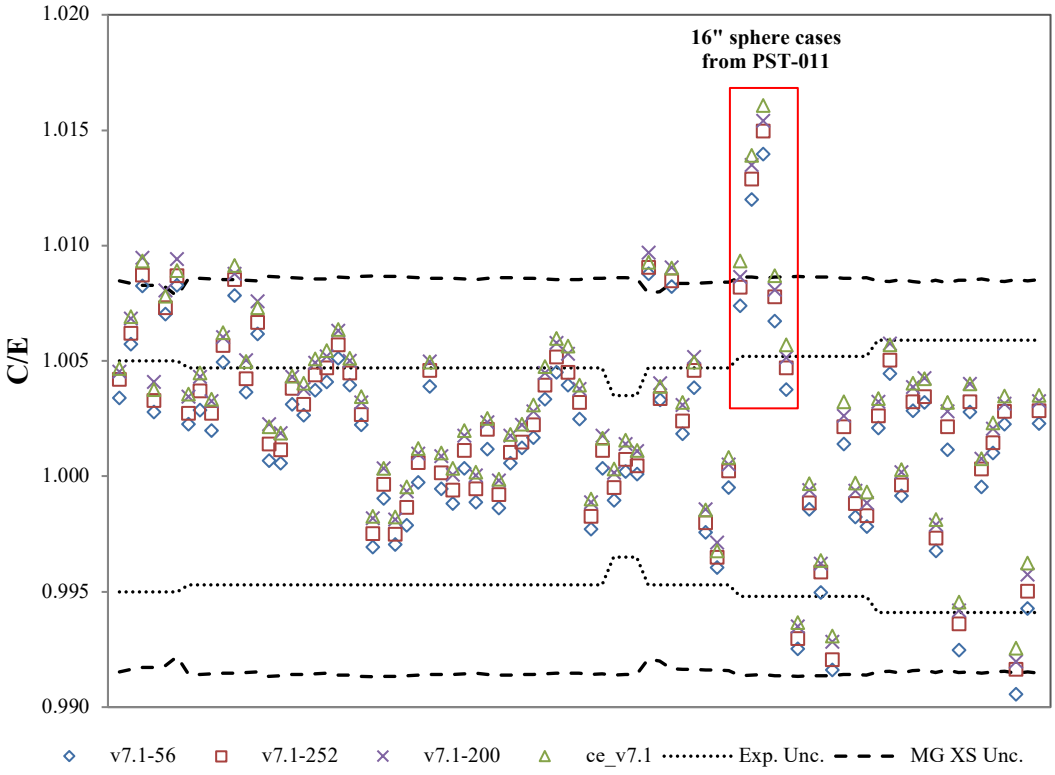

Figure 26. C/E results for libraries based on ENDF/B-VII.1 for the PST systems.

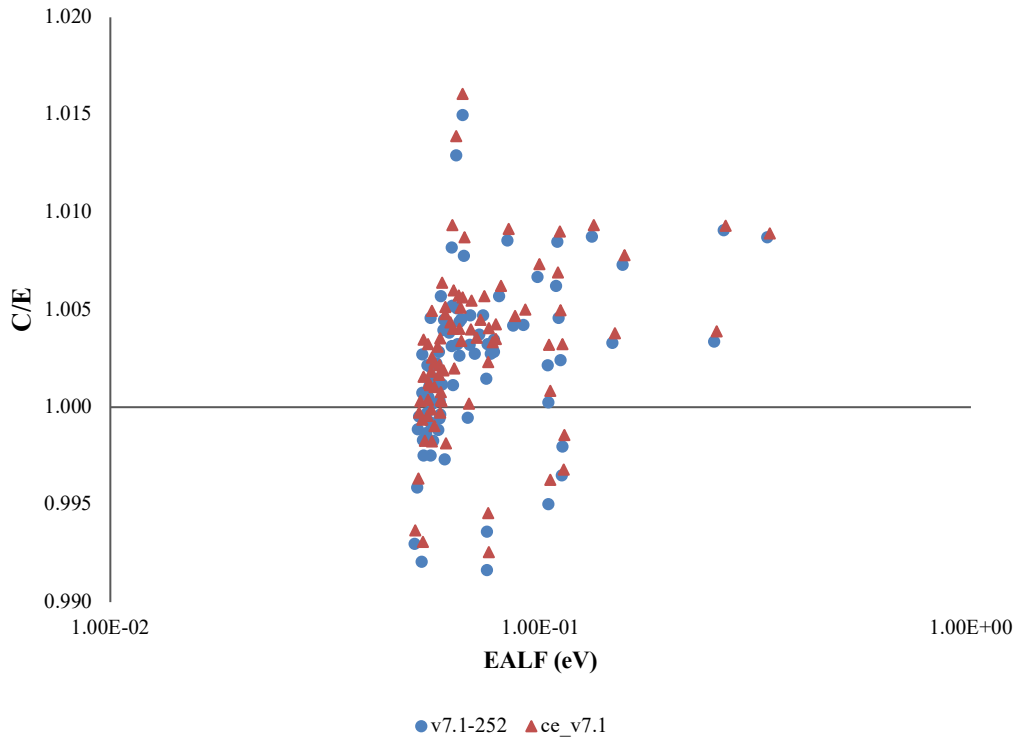

Figure 27. C/E as a function of EALF for 2 ENDF/B-VII.1 libraries for the PST systems.

The C/E data are also compared against the experimental and nuclear data uncertainty bands. In comparison with the experimental uncertainty, 66.7% of the ENDF/B-VII.1 CE library results are within the band. For the MG libraries, approximately 78, 75, and 69% of the points are in the band for the 56-, 252-, and 200-group libraries, respectively. A majority of the points from all of the libraries are within the nuclear data uncertainty band. For the CE library, 88.9% of the results are within the band. For the MG libraries, approximately 94, 91, and 90% of the points are in the band for the 56-, 252-, and 200-group libraries, respectively.

5.1.11 UCT Systems

The C/E data for the UCT systems are shown in Figure 28 for the ENDF/B-VII.1 libraries. With only three benchmark evaluations to compare, generalizations on the tendencies between the different libraries and comparisons with the experimental uncertainty data are difficult to determine. Based on the data presented below, the 56-group C/E values tended to be the largest, and the CE values tended to be the smallest. Comparing the C/E data with the experimental uncertainty bands shows that slightly more than half of the points are within the band, with all of the 56-group points outside the band. No nuclear data uncertainty bands are included in this report for comparison to the C/E data for the U233 systems (UCT, UMF, USI, USM, and UST).

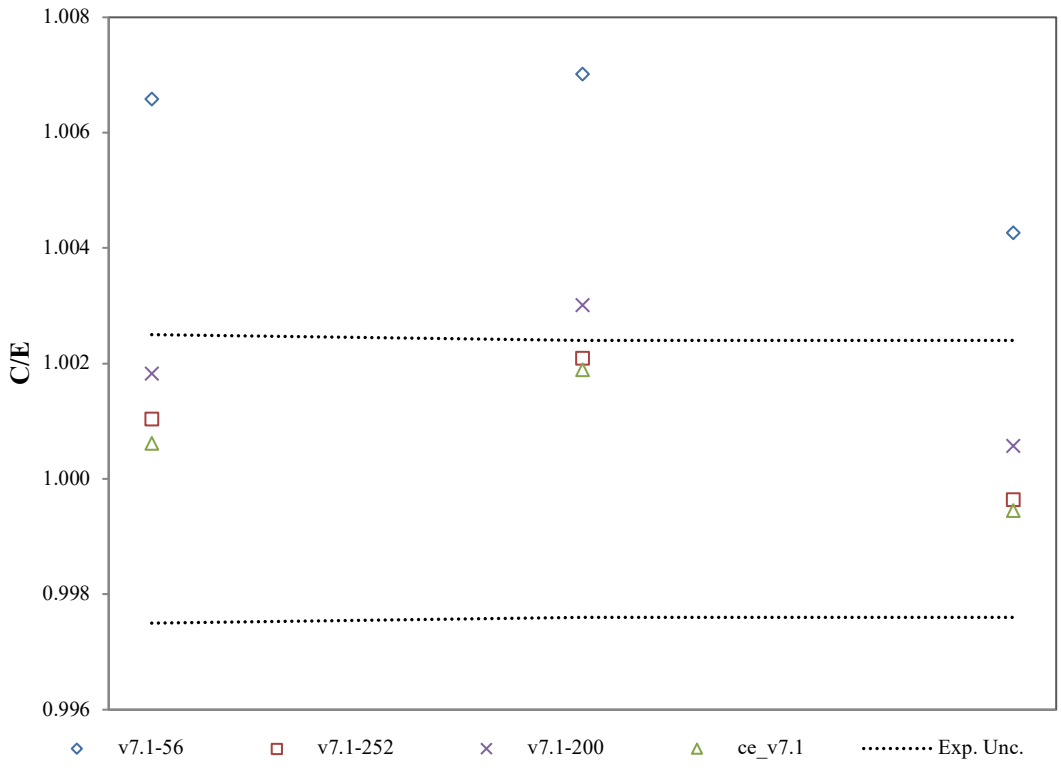

Figure 28. C/E results for libraries based on ENDF/B-VII.1 for the UCT systems.

5.1.12 UMF Systems

The C/E data for the UMF systems are shown in Figure 29 for the ENDF/B-VII.1 libraries. The data demonstrate consistent behavior among all but the 56-group library, which has noticeably higher C/E values. Agreement between MG and CE results is generally good for most cases. Both U233-MET-FAST-004 cases are reflected with tungsten, and both U233-MET-FAST-005 cases are reflected with beryllium. Figure 30 shows the C/E values as a function of EALF for the 252-group and CE libraries. No trends are evident in the figure, though the 10 cases in VALID cover a very narrow energy range.

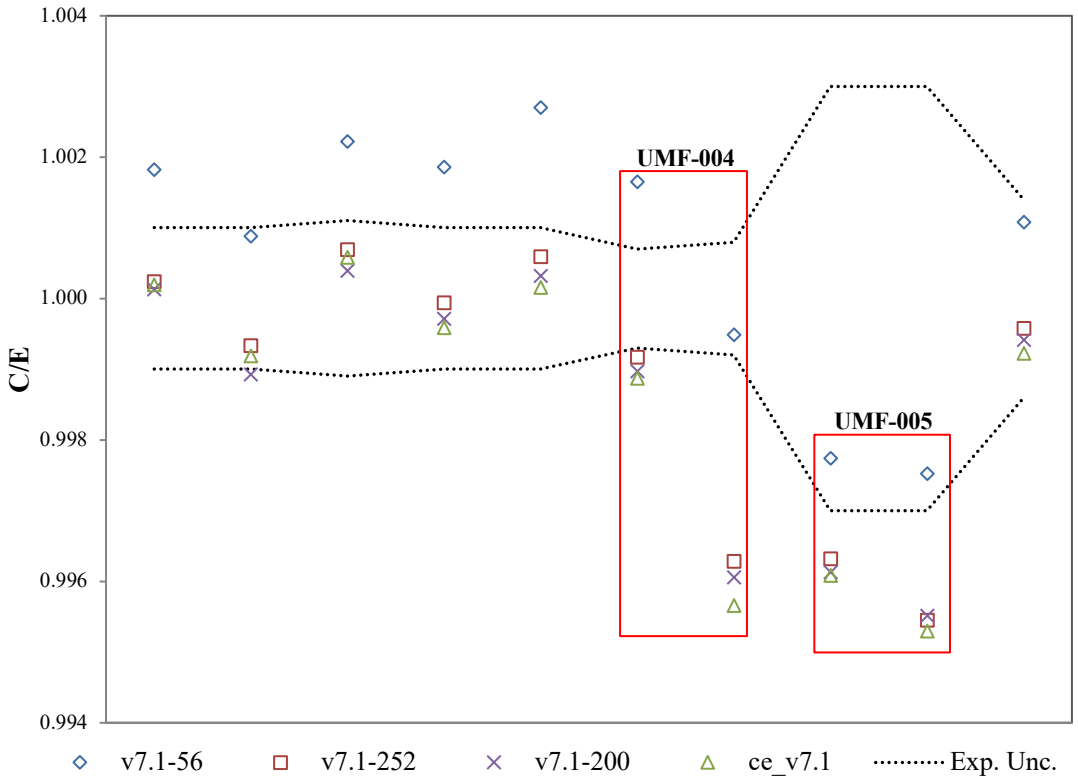

Figure 29. C/E results for libraries based on ENDF/B-VII.1 for the UMF systems.

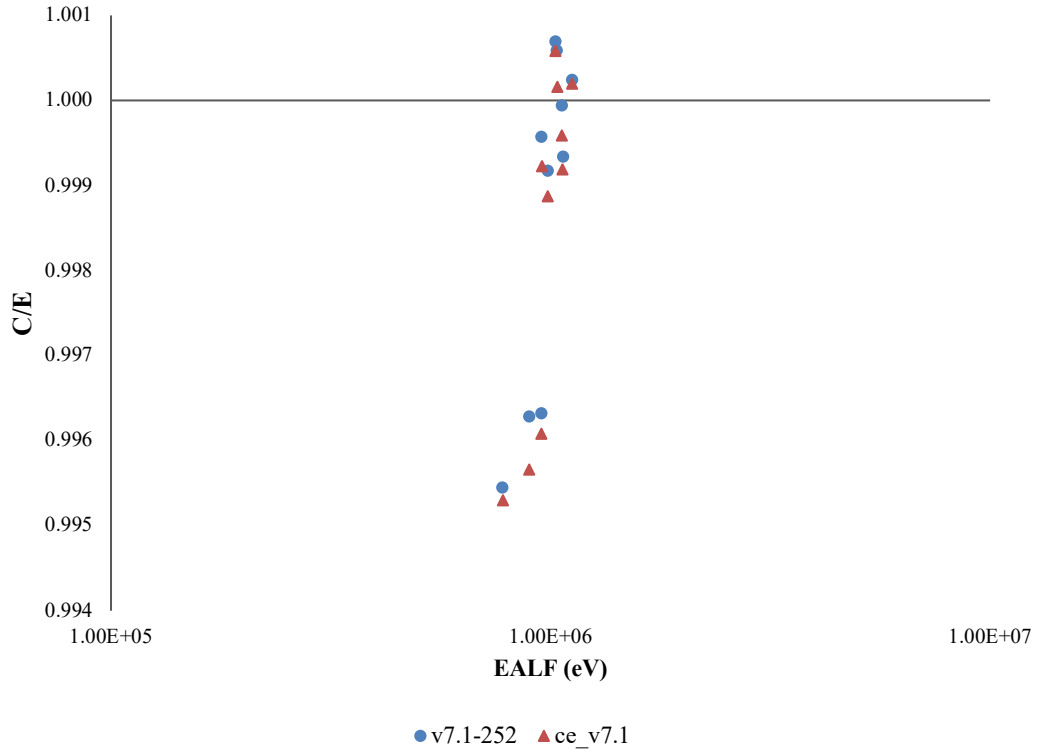

Figure 30. C/E as a function of EALF for 2 ENDF/B-VII.1 libraries for the UMF systems.

The C/E data are also compared against the experimental uncertainty band. In comparison with the experimental uncertainty, 60% of the ENDF/B-VII.1 CE library results are within the band. For the MG libraries, 50, 60, and 50% of the points are in the band for the 56-, 252-, and 200-group libraries, respectively. No nuclear data uncertainty bands are included in this report for comparison to the C/E data for the U233 systems (UCT, UMF, USI, USM, and UST).

5.1.13 USI Systems

The C/E data for the USI systems are shown in Figure 31 for the ENDF/B-VII.1 libraries. The data demonstrate consistent behavior between the libraries. The 56-group C/E values tend to be noticeably larger than the other ENDF/B-VII.1 libraries' C/E values. All the C/E values are less than 1.0 (all of the libraries are underpredicting k_{eff}), and the differences from unity are significantly larger than most of the other systems, which may indicate inadequacies in the nuclear data and/or the experiment descriptions for the USI systems. Figure 32 shows the C/E values as a function of EALF for the 252-group and CE libraries. No trends are evident in the figure, but a clear trend of decreasing C/E with increasing EALF becomes apparent when the results are pooled with the other categories of ^{233}U solution experiments. The pooled results are discussed in Section 5.1.16.

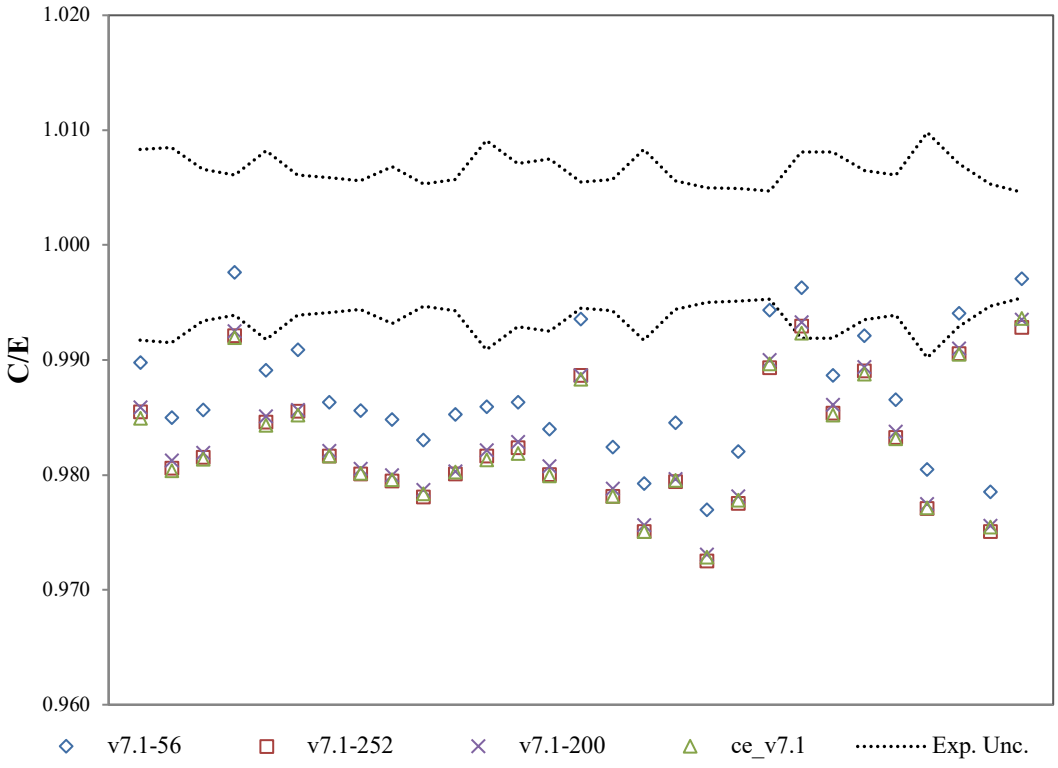

Figure 31. C/E results for libraries based on ENDF/B-VII.1 for the USI systems.

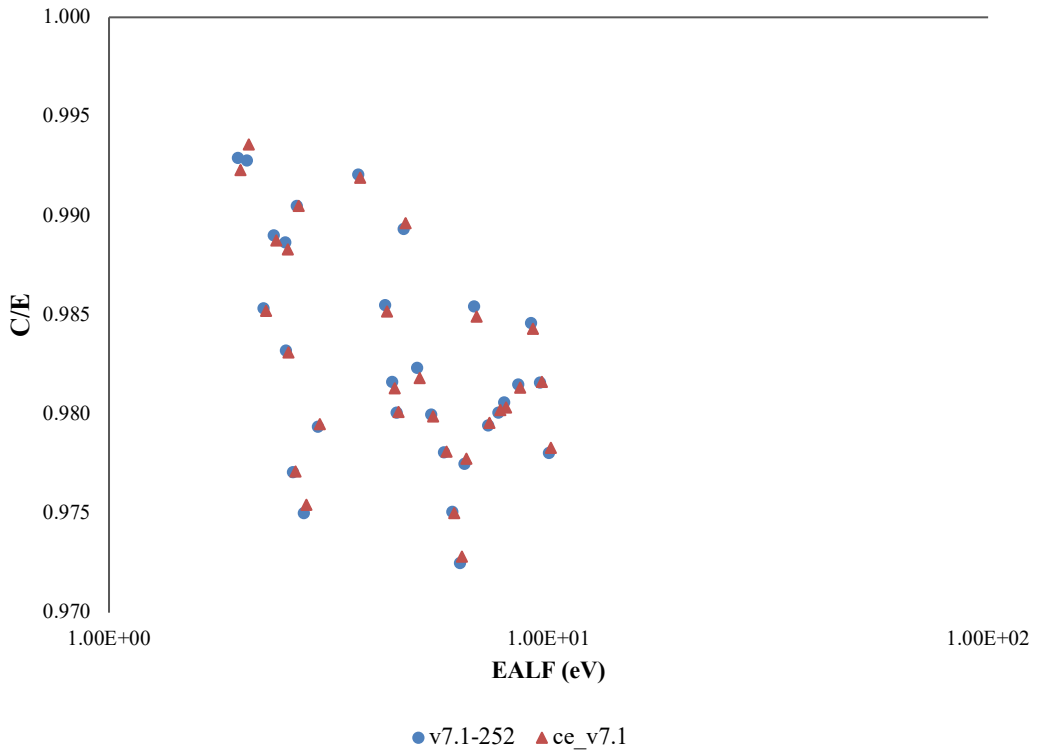

Figure 32. C/E as a function of EALF for 2 ENDF/B-VII.1 libraries for the USI systems.

The C/E data are also compared against the experimental uncertainty band, with most of the points being outside the band. In comparison with the experimental uncertainty, 3.4% of the ENDF/B-VII.1 CE library results are within the band. For the MG libraries, 13.8, 3.4, and 3.4% of the points are in the band for the 56-, 252-, and 200-group libraries, respectively. No nuclear data uncertainty bands are included in this report for comparison to the C/E data for the U233 systems (UCT, UMF, USI, USM, and UST).

5.1.14 USM Systems

The C/E data for the USM systems are shown in Figure 33 for the ENDF/B-VII.1 libraries. The data demonstrate consistent behavior between the libraries. The 56-group C/E values tend to be noticeably larger than the other ENDF/B-VII.1 libraries' C/E values. All the C/E values are less than 1.0 (all libraries are underpredicting k_{eff}), and the differences from unity are significantly larger than most of the other systems, which may indicate inadequacies in the nuclear data and/or the experiment descriptions for the USM systems. Figure 34 shows the C/E values as a function of EALF for the 252-group and CE libraries. No trends are evident in the figure, but as mentioned in the previous section, pooling the ^{233}U solution results reveals a clear trend of decreasing C/E with increasing EALF. See Section 5.1.16 for more information.

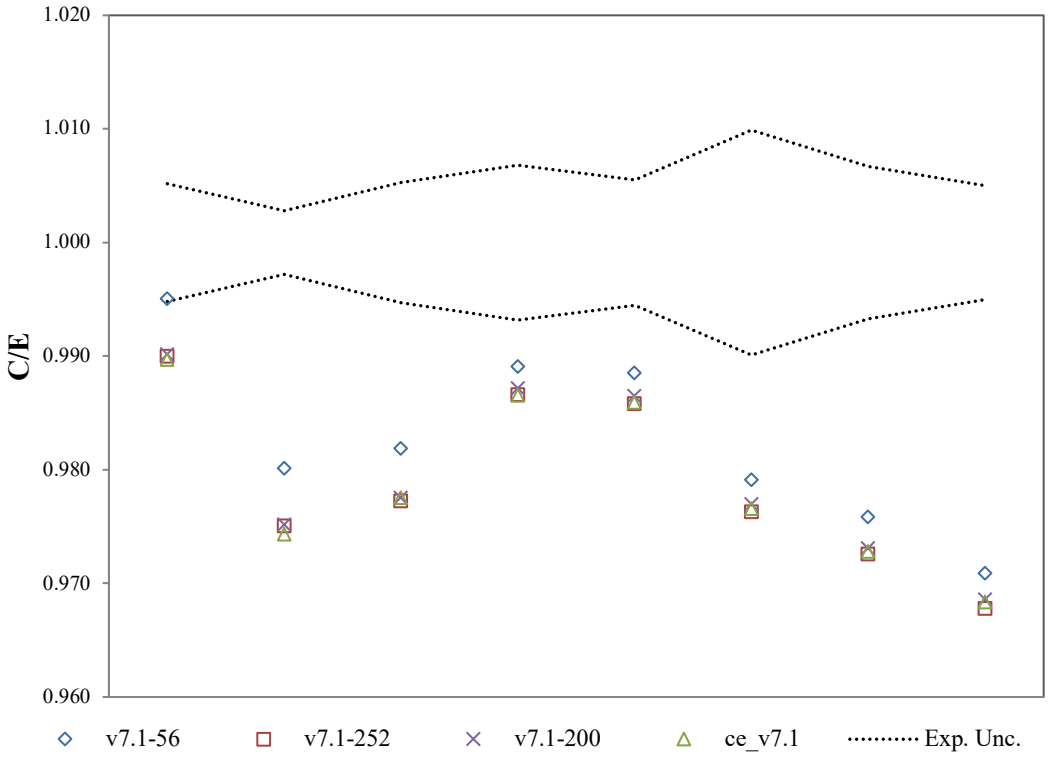

Figure 33. C/E results for libraries based on ENDF/B-VII.1 for the USM systems.

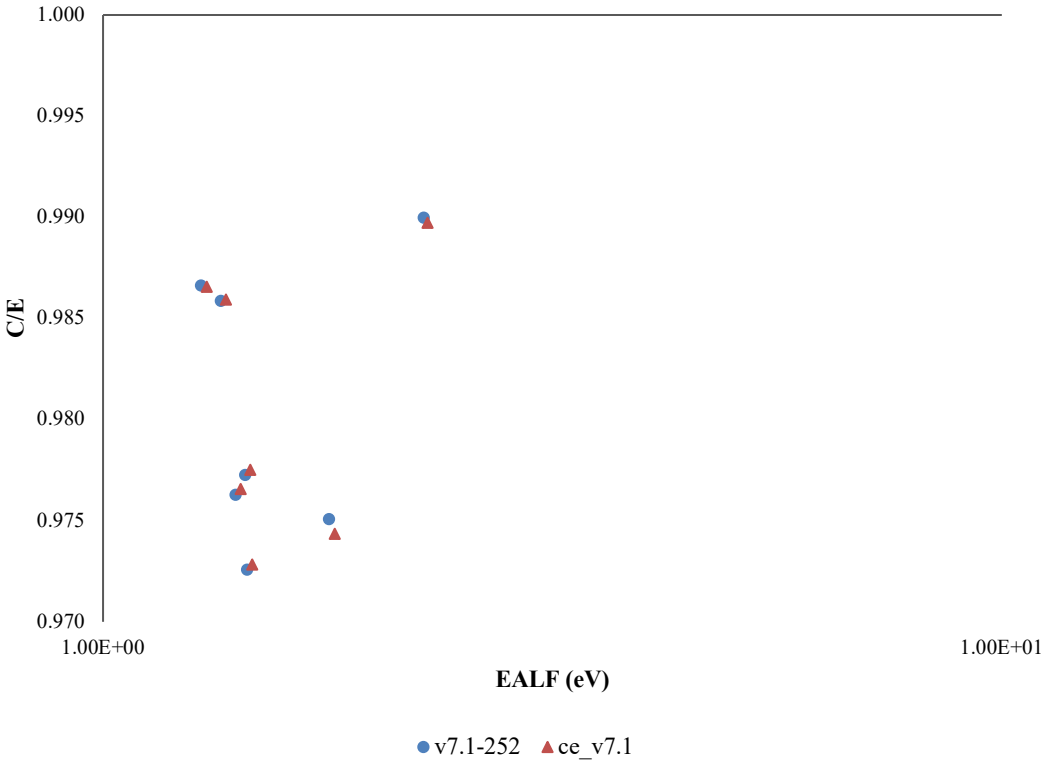

Figure 34. C/E as a function of EALF for 2 ENDF/B-VII.1 libraries for the USM systems.

The C/E data are also compared against the experimental uncertainty band. In comparison with the experimental uncertainty, only one 56-group point is in the band. No nuclear data uncertainty bands are included in this report for comparison to the C/E data for the U233 systems (UCT, UMF, USI, USM, and UST).

5.1.15 UST Systems

The C/E data for the UST systems are shown in Figure 35 for the ENDF/B-VII.1 libraries. The data generally demonstrate consistent performance between MG and continuous energy C/E calculations, and there is generally good agreement between the libraries, with the 252-group C/E values tending to be the smallest. Figure 36 shows the C/E values as a function of EALF for the 252-group and CE libraries. A trend of decreasing C/E with increasing EALF may be present in the data. As mentioned in the previous two sections, it becomes quite clear when the UST C/E values are pooled with the USI and USM data. These pooled results are discussed in Section 5.1.16.

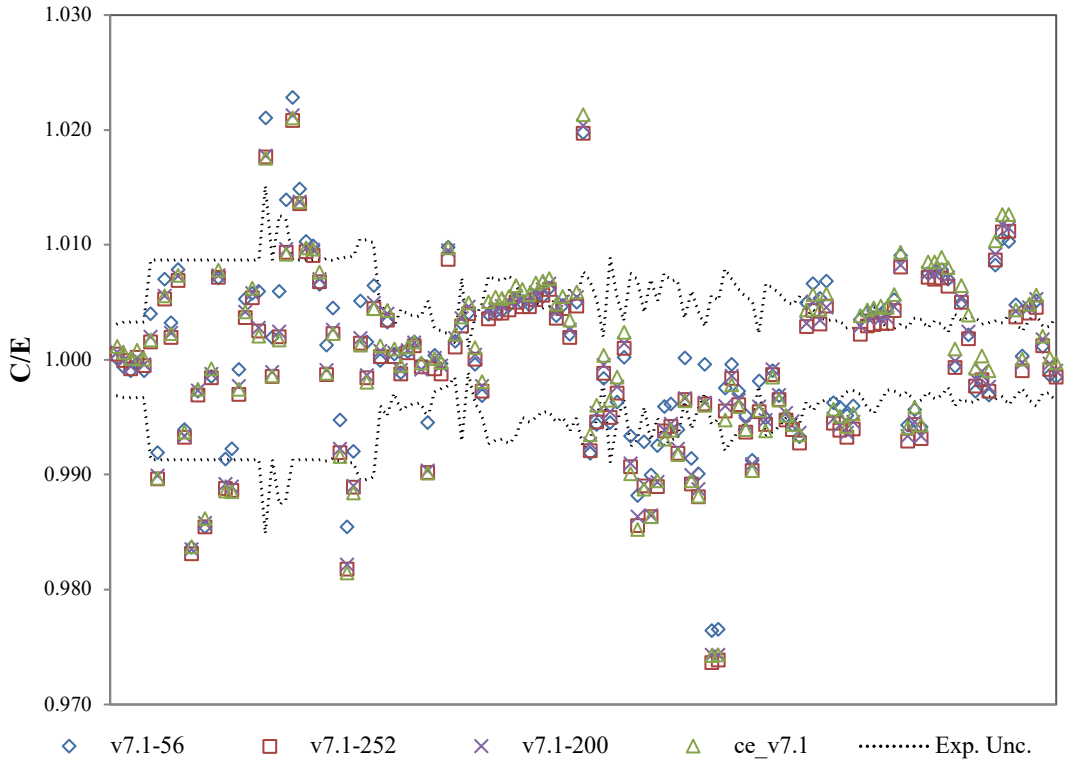

Figure 35. C/E results for libraries based on ENDF/B-VII.1 for the UST systems.

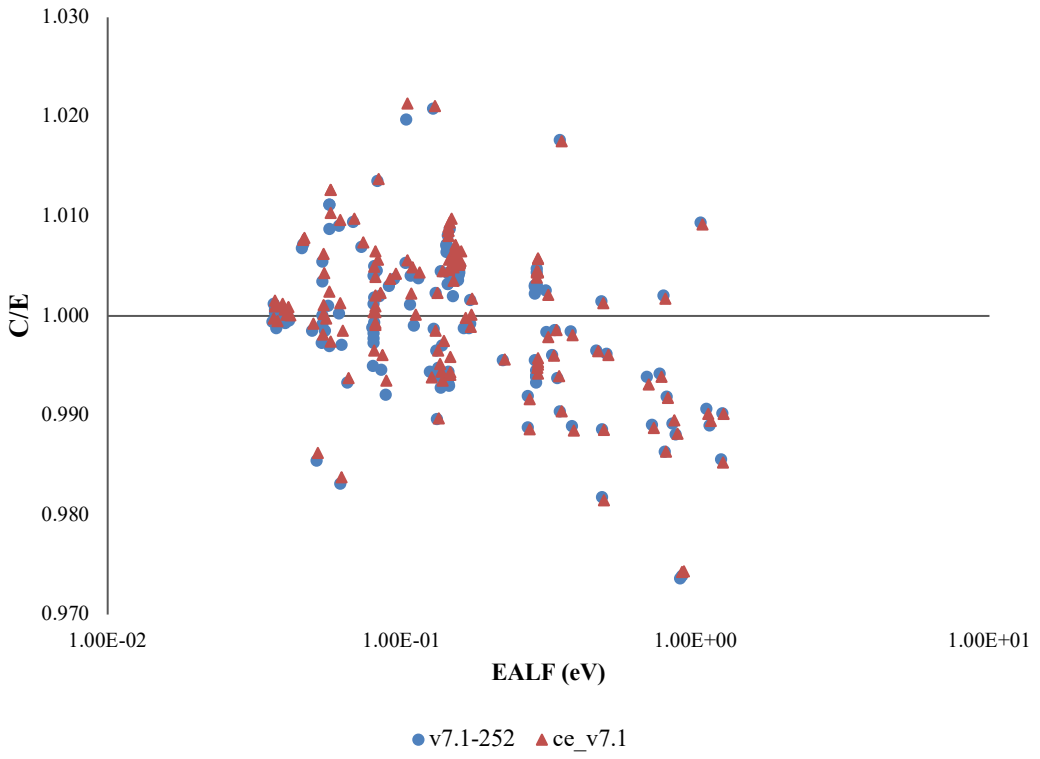

Figure 36. C/E as a function of EALF for 2 ENDF/B-VII.1 libraries for the UST systems.

The C/E data are also compared against the experimental uncertainty band. In comparison with the experimental uncertainty, 51% of the ENDF/B-VII.1 CE library results are within the band. For the MG libraries, approximately 59, 57, and 54% of the points are in the band for the 56-, 252-, and 200-group libraries, respectively. No nuclear data uncertainty bands are included in this report for comparison to the C/E data for the U233 systems (UCT, UMF, USI, USM, and UST).

5.1.16 Pooled Results

The results for the different categories are pooled into similar larger bins to examine performance over broader ranges of systems. For these comparisons, the data for each table are generated separately by combining the appropriate individual case results. The results for pooled categories of fissile material (HEU, IEU, LEU, mixed U/Pu, Pu, and U233 systems) are presented in Table 6 and in Figure 37. Note that the IMF category is not pooled with other experiment categories because no other IEU systems are included in this report. The USI and USM results have been removed from the U233* category. The results for pooled categories of fissile form (metal, solution, and compound systems) are presented in Table 7 and in Figure 38. The USI and USM results have been removed from the solution* category. The results for pooled categories of energy spectrum (fast, thermal, intermediate, and mixed spectrum systems) are presented in Table 8 and in Figure 39. Note that the USI (intermediate energy spectrum) and USM (mixed energy spectrum) categories are only pooled with other ^{233}U-fueled solution experiments because no other intermediate or mixed energy systems are included in this report.

Table 6. Results by fissile material category for ENDF/B-VII.1 libraries.

Fissile material	56-group		252-group		200-group		Continuous energy	
	Avg. C/E	Avg. C/E unc.	Avg. C/E	Avg. C/E unc.	Avg. C/E	Avg. C/E unc.	Avg. C/E	Avg. C/E unc.
HEU	0.99944	0.00051	0.99884	0.00051	0.99927	0.00052	0.99903	0.00051
IEU	1.00909	0.00083	1.00567	0.00083	1.00484	0.00083	1.00279	0.00083
LEU	0.99914	0.00019	0.99892	0.00019	0.99839	0.00019	0.99944	0.00019
MIXED	0.99883	0.00074	0.99888	0.00074	0.99877	0.00074	0.99912	0.00074
Pu	1.00153	0.00049	1.00197	0.00049	1.00248	0.00049	1.00255	0.00049
U233	0.99785	0.00044	0.99603	0.00044	0.99645	0.00044	0.99654	0.00044
U233*	0.99944	0.00051	0.99884	0.00051	0.99927	0.00052	0.99903	0.00051

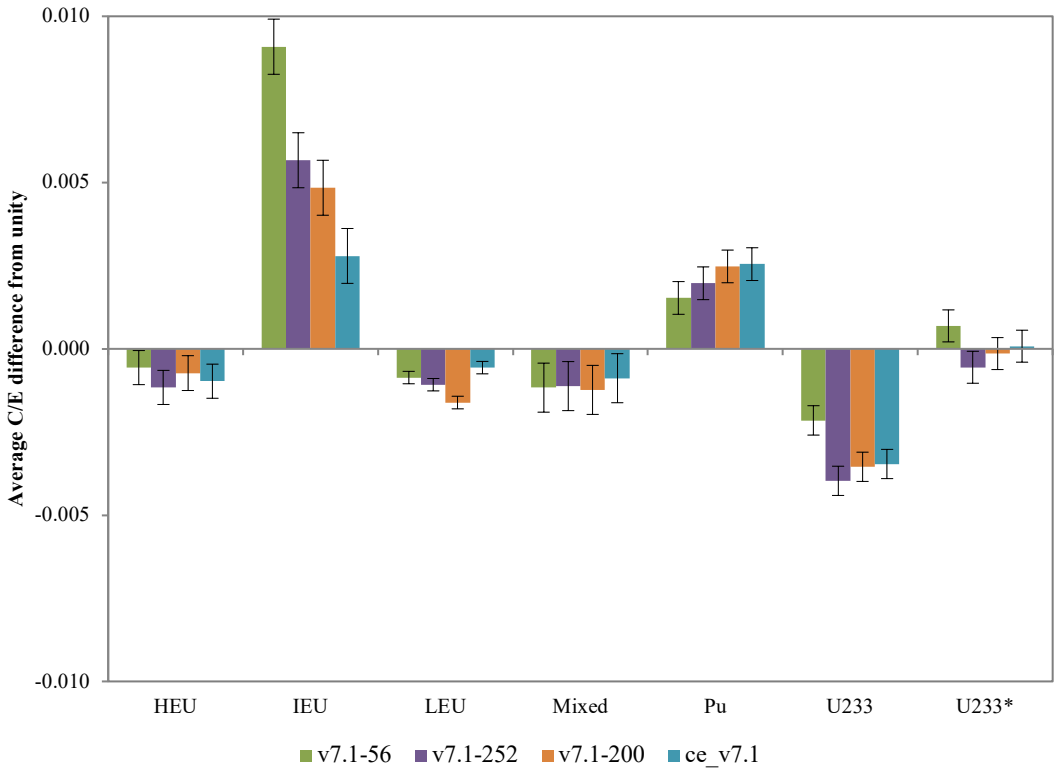

Figure 37. Absolute bias by fissile material category.

Table 7. Results by fissile form category for ENDF/B-VII.1 libraries.

Fissile form	56-group		252-group		200-group		Continuous energy	
	Avg. C/E	Avg. C/E unc.	Avg. C/E	Avg. C/E unc.	Avg. C/E	Avg. C/E unc.	Avg. C/E	Avg. C/E unc.
Metal	1.00475	0.00028	1.00222	0.00028	1.00184	0.00028	1.00102	0.00028
Compound	0.99952	0.00019	0.99914	0.00019	0.99854	0.00019	0.99959	0.00019
Solution	0.99832	0.00031	0.99768	0.00031	0.99822	0.00031	0.99831	0.00031
Solution*	0.99981	0.00032	0.99962	0.00032	1.00017	0.00032	1.00033	0.00032

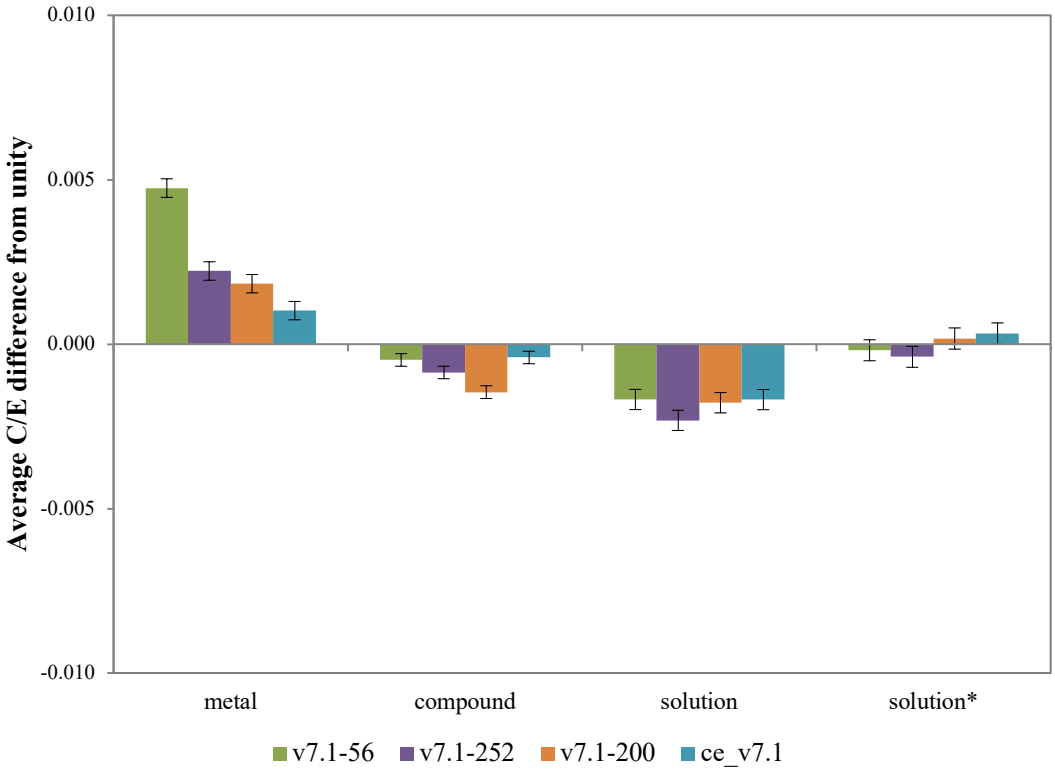

Figure 38. Absolute bias by fissile form category.

Table 8. Results by neutron energy spectrum category for ENDF/B-VII.1 libraries.

Spectrum category	56-group		252-group		200-group		Continuous energy	
	Avg. C/E	Avg. C/E unc.	Avg. C/E	Avg. C/E unc.	Avg. C/E	Avg. C/E unc.	Avg. C/E	Avg. C/E unc.
Fast	1.00462	0.00028	1.00239	0.00028	1.00197	0.00028	1.00107	0.00028
Intermediate	0.98708	0.00124	0.98273	0.00124	0.98320	0.00124	0.98269	0.00124
Mixed	0.98257	0.00215	0.97893	0.00215	0.97941	0.00215	0.97898	0.00215
Thermal	0.99970	0.00022	0.99941	0.00022	0.99957	0.00022	1.00006	0.00022

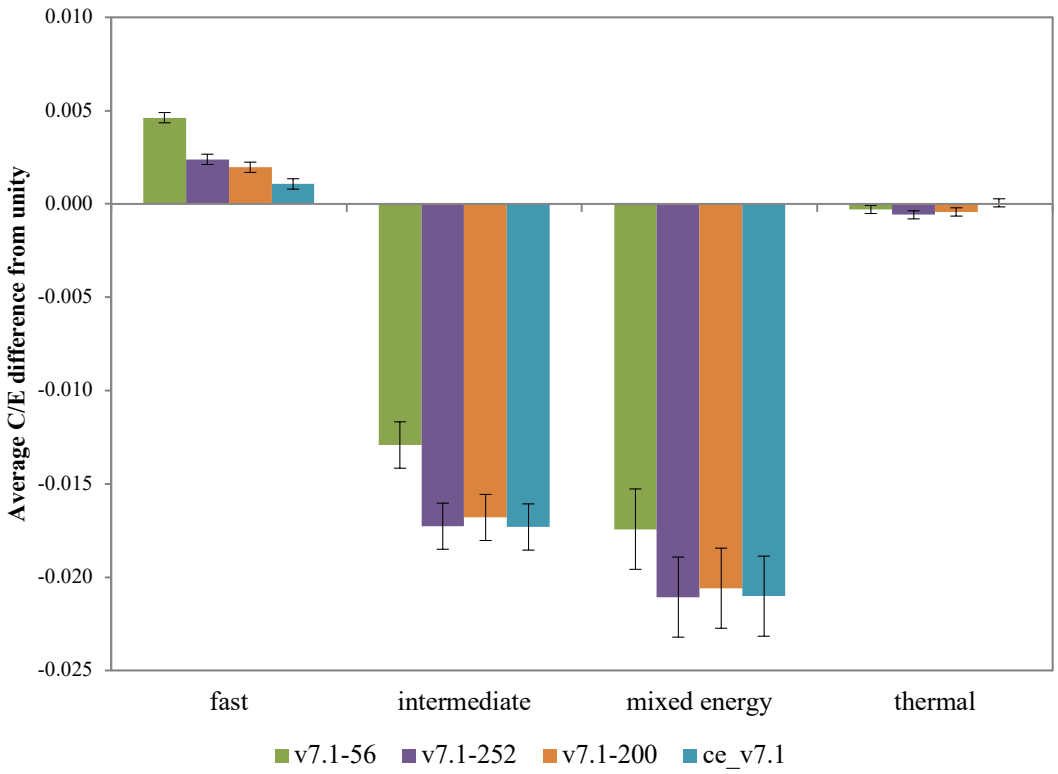

Figure 39. Absolute bias by energy spectrum category.

The results from Table 6 and Figure 37 demonstrate that most fissile materials appear to be treated fairly accurately in KENO V.a. The potential exceptions based on these results are the intermediate enriched uranium and the ^{233}U intermediate and mixed energy solutions. The plutonium systems may also have a positive bias, and the pooled results are dominated by the large number of solution experiments.

The results from Table 7 and Figure 38 demonstrate generally good results for compound systems and solution systems, especially with the USI and USM systems removed from consideration. The metal systems may have a positive bias, but this may be driven by issues with the intermediate enriched systems. The CE results from the ENDF/B-VII.1 library show better results for the metal and compound systems compared to the MG results. The 56- and 252-group libraries are all designed for thermal systems, so it is not surprising that their performance is worse for metal systems. The 56-group library does particularly well for the compound systems for which it was optimized.

The results from Table 8 and from Figure 39 demonstrate that the thermal systems are treated the most accurately in KENO V.a. The CE results from the ENDF/B-VII.1 library include better results for both the fast and thermal systems compared to the MG results. The intermediate and mixed energy systems consist solely of the USI and USM categories, and as discussed in Sections 5.1.13 and 5.1.14, they have the largest C/E differences, all of which are negative, from unity of all the categories.

The EALF values are also pooled to examine for trends and coverage over broader ranges of systems. Figure 40 demonstrates that when pooling the enriched uranium categories (using the ENDF/B-VII.1 CE library), data exist for low and high energies, but data are lacking for intermediate energies. Figure 41 demonstrates the same for the plutonium categories (using the ENDF/B-VII.1 CE library). As mentioned in the U233 categories' discussions, no trends are evident when looking at each individual U233 category

with the exception of UST, but Figure 42 shows a trend of decreasing C/E with increasing EALF when the USI, UST and USM categories are pooled together (using ENDF/B-VII.1 CE and 252-group libraries).

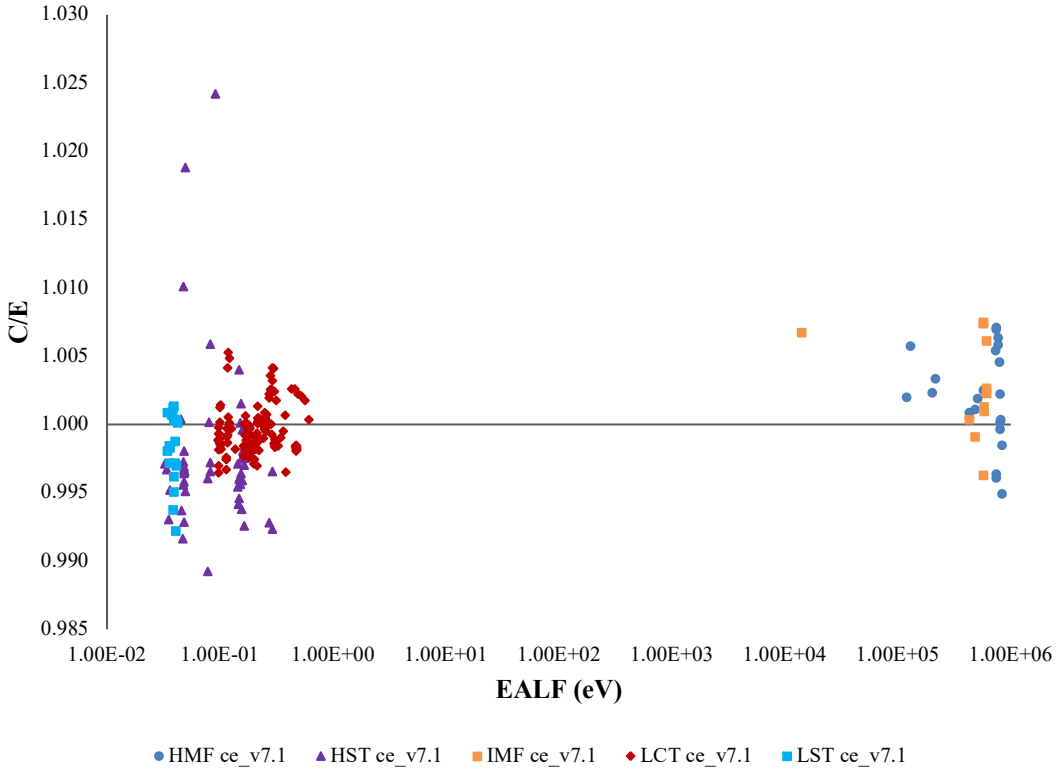

Figure 40. C/E as a function of EALF for the enriched uranium categories.

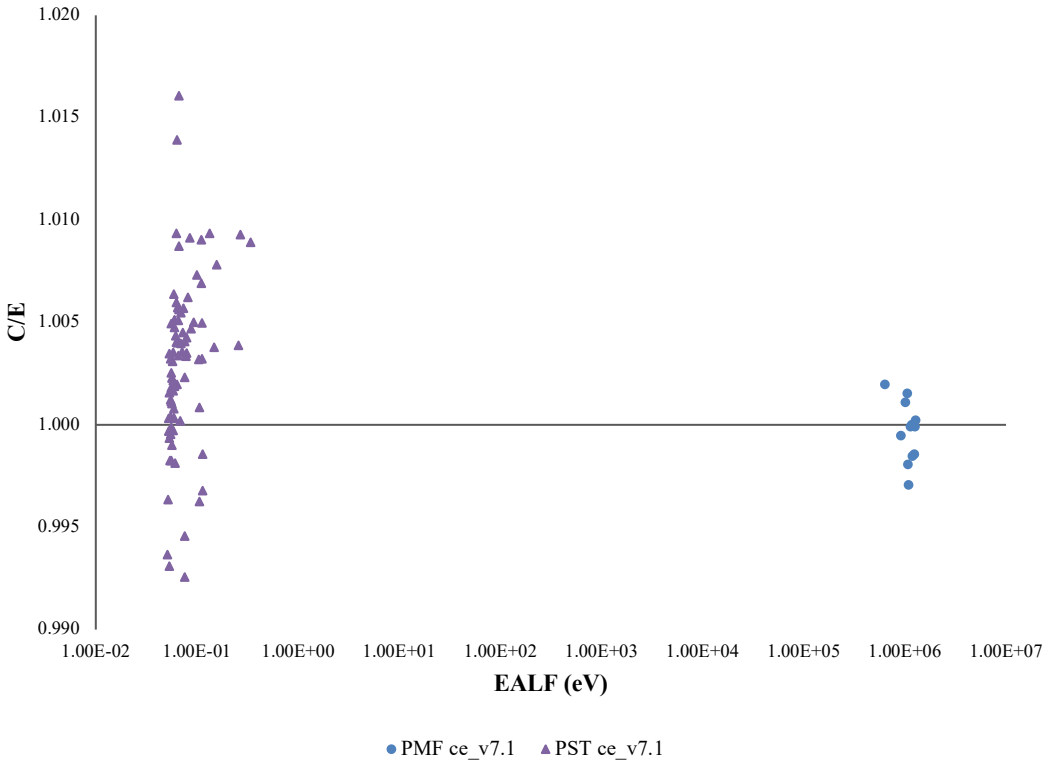

Figure 41. C/E as a function of EALF for the plutonium categories.

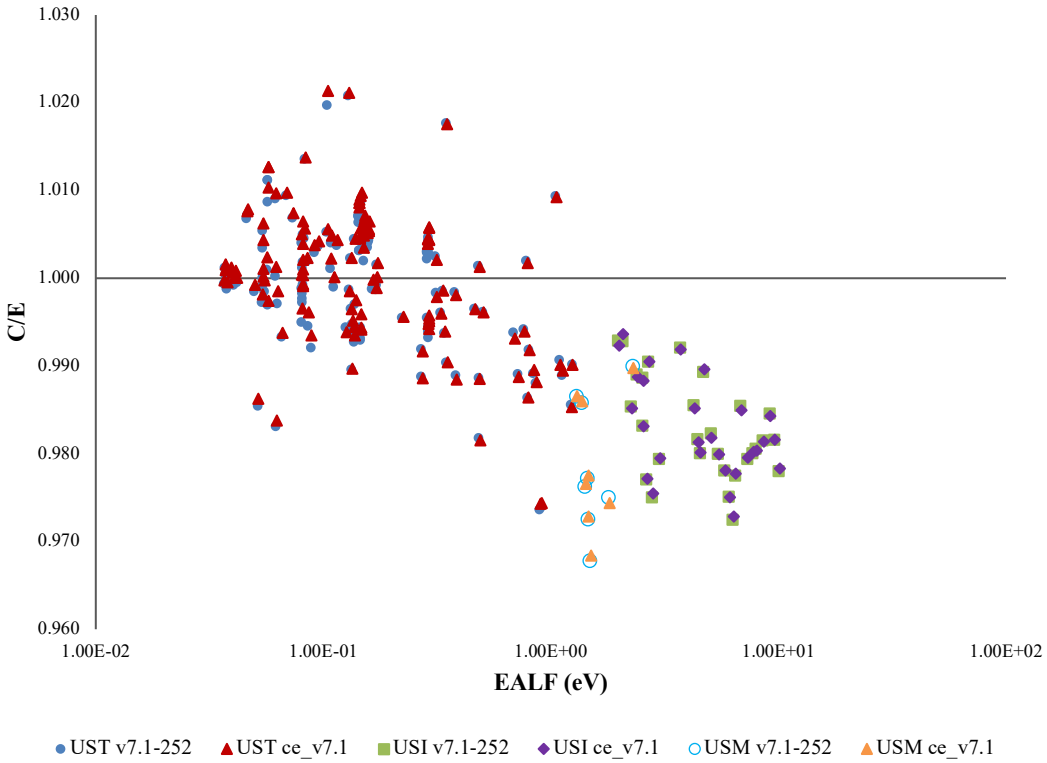

Figure 42. C/E as a function of EALF for the U233 categories.

5.1.17 Outlier Cases

The results of all cases are analyzed to determine the greatest difference from a C/E of unity for each category. These outlier cases can occur for any number of reasons, including errors in the nuclear data, experiment description, code, model, or any combination of these. The case with the largest absolute bias for each category is reported in Table 9, and the case with the largest relative bias for each category is reported in Table 10. The absolute and relative biases are determined as discussed in Section 4.4. The bolded cases in the relative difference tables indicate that the case is different from the case identified in the absolute difference tables.

Table 9. Maximum individual case absolute differences for KENO V.a for ENDF/B-VII.1 libraries.

Category	56-group		252-group		200-group		Continuous energy	
	Maximum difference (C/E from unity)	Case	Maximum difference (C/E from unity)	Case	Maximum difference (C/E from unity)	Case	Maximum difference (C/E from unity)	Case
HMF	0.01508	052-001	0.00881	040-001	0.00782	052-001	0.00712	019-001S
HST	0.02279	016-003	0.02354	016-003	0.02433	016-003	0.02423	016-003
IMF	0.01770	005-001	0.01246	005-001S	0.00965	005-001S	0.00750	004-001S
LCT	0.00537	010-002	0.00490	010-002	-0.00450	017-026	0.00531	010-002
LST	-0.00878	002-002	-0.00819	002-002	-0.00794	002-002	-0.00780	002-002
MCF	0.00750	006-001	0.01147	006-001	0.00938	006-001	0.00612	006-001
MCT	-0.00427	004-001	-0.00480	004-001	-0.00502	004-001	0.00408	002-004S
MST	-0.00677	007-007	-0.00677	007-007	-0.00619	007-007	-0.00634	007-007
PMF	0.00706	026-001	0.00552	026-001	0.00360	026-001	-0.00292	026-001
PST	0.01397	011-003	0.01498	011-003	0.01543	011-003	0.01608	011-003
UCT	0.00702	001-003	0.00209	001-003	0.00301	001-003	0.00189	001-003
UMF	0.00271	003-002	-0.00455	005-002	-0.00449	005-002	-0.00470	005-002
USI	-0.02306	001-021	-0.02749	001-021	-0.02698	001-021	-0.02717	001-021
USM	-0.02909	002-009	-0.03218	002-009	-0.03143	002-009	-0.03161	002-009
UST	-0.02356	015-018	-0.02635	015-018	-0.02566	015-018	-0.02572	015-018

Table 10. Maximum individual case relative differences for KENO V.a for ENDF/B-VII.1 libraries.

Category	56-group		252-group		200-group		Continuous energy	
	Maximum difference (standard deviations)	Case	Maximum difference (standard deviations)	Case	Maximum difference (standard deviations)	Case	Maximum difference (standard deviations)	Case
HMF	16.70	**038-001**	7.90	040-001	7.02	052-001	5.17	**052-001**
HST	3.20	**016-001**	3.22	**016-001**	3.01	016-003	3.01	**016-001**
IMF	8.27	005-001	5.80	**005-001**	4.42	**005-001**	3.39	**008-001**
LCT	3.86	**050-008**	3.72	**050-008**	3.40	**050-011**	2.99	**050-008**
LST	3.02	**004-003**	3.26	**004-003**	2.17	002-002	2.13	002-002
MCF	3.50	006-001	5.33	006-001	4.37	006-001	2.86	006-001
MCT	1.69	**002-004S**	1.56	**002-004S**	1.20	**002-004S**	1.70	002-004S
MST	2.00	007-007	2.01	007-007	1.83	007-007	1.88	007-007
PMF	5.22	**008-001**	5.79	**008-001**	5.66	**008-001**	3.19	**008-001**
PST	2.65	011-003	2.84	011-003	2.92	011-003	3.04	011-003
UCT	2.90	001-003	0.87	001-003	1.25	001-003	0.79	001-003
UMF	2.69	003-002	4.63	**004-002**	4.92	**004-002**	5.41	**004-002**
USI	4.72	001-021	5.65	001-021	5.54	001-021	5.58	001-021
USM	7.23	**001-016**	9.13	**001-016**	9.08	**001-016**	9.40	**001-016**
UST	4.61	**015-019**	5.16	**015-019**	5.06	**015-019**	5.06	**015-019**

5.2 KENO-VI

All of the KENO-VI cases executed for this validation were run until the Monte Carlo uncertainty was reduced to 0.00010 Δk or smaller. As mentioned in Section 4.4, this stochastic uncertainty in the calculation is smaller than the benchmark evaluation uncertainty reported in the ICSBEP Handbook [21] by at least a factor of two. The uncertainty ratio for most cases is in the range of 20 to 50. The most significant factor affecting the uncertainty of the calculated C/E values is the uncertainty reported in the evaluation.

The average C/E value and its uncertainty for each category of experiments is provided in Table 11 for all four cross section libraries considered in this report. The results show that the average C/E values are near 1.0.

Table 11. Results by category for KENO-VI calculations with ENDF/B-VII.1 libraries.

Category	56-group		252-group		200-group		Continuous energy	
	Avg. C/E	Avg. C/E unc.	Avg. C/E	Avg. C/E unc.	Avg. C/E	Avg. C/E unc.	Avg. C/E	Avg. C/E unc.
HMF	1.00064	0.00044	0.99844	0.00044	0.99845	0.00044	0.99852	0.00044
IMF	1.00884	0.00276	1.00536	0.00275	1.00587	0.00275	1.00579	0.00275
MCT	0.99459	0.00078	0.99405	0.00078	0.99317	0.00078	0.99420	0.00078

The average C/E bias (difference from unity) is shown in Figure 43 for each of the categories for all four libraries. The results are also presented in standard deviations from unity in Figure 44. The CE calculations generally exhibit a slightly smaller magnitude bias than the MG calculations. As noted with the KENO V.a results in Section 5.1, the CE results are significantly improved compared to results from SCALE 6.1 [9]. On average, the HMF systems have the smallest magnitude absolute bias, and the MCT systems have the largest magnitude relative bias. With average C/E values larger than unity, the IMF systems are overpredicted. With the exception of the HMF system with the 56-group library, the HMF and MCT systems are underpredicted. Note that with only three categories of experiments and a relatively small number of cases in each category, the generic conclusions presented here may not hold true when more categories and experiments are considered. Figure 45 and Figure 46 show the results arranged by library.

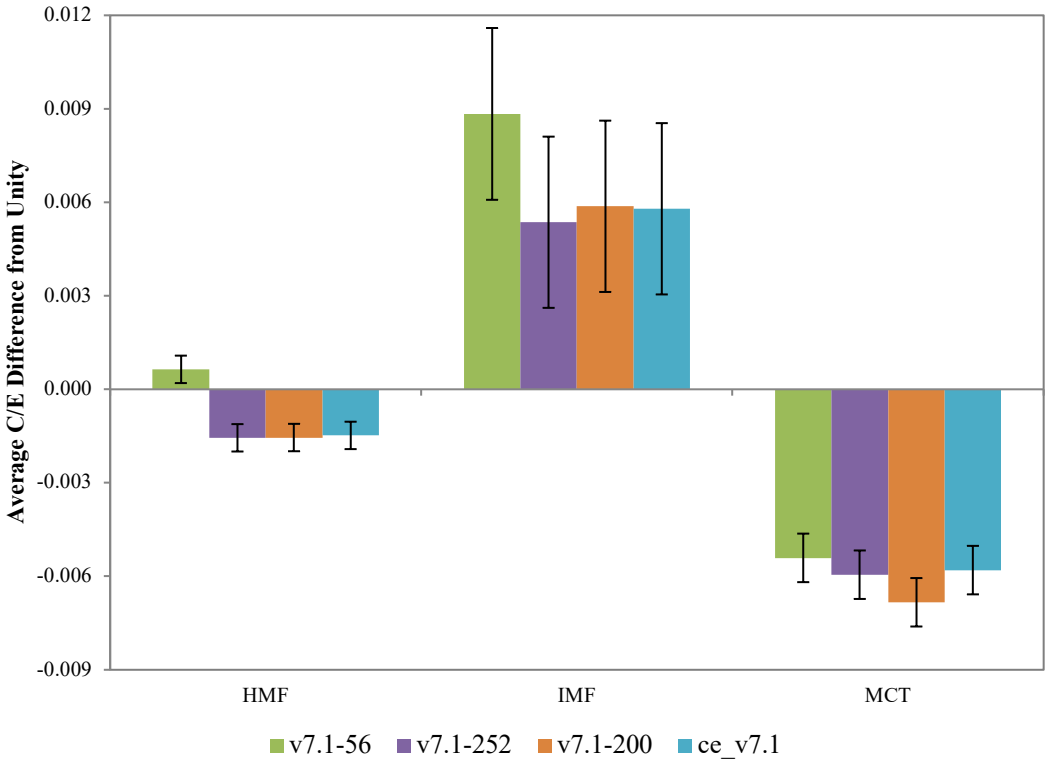

Figure 43. Absolute bias for all 4 libraries for each of the 3 categories of experiments, KENO-VI.

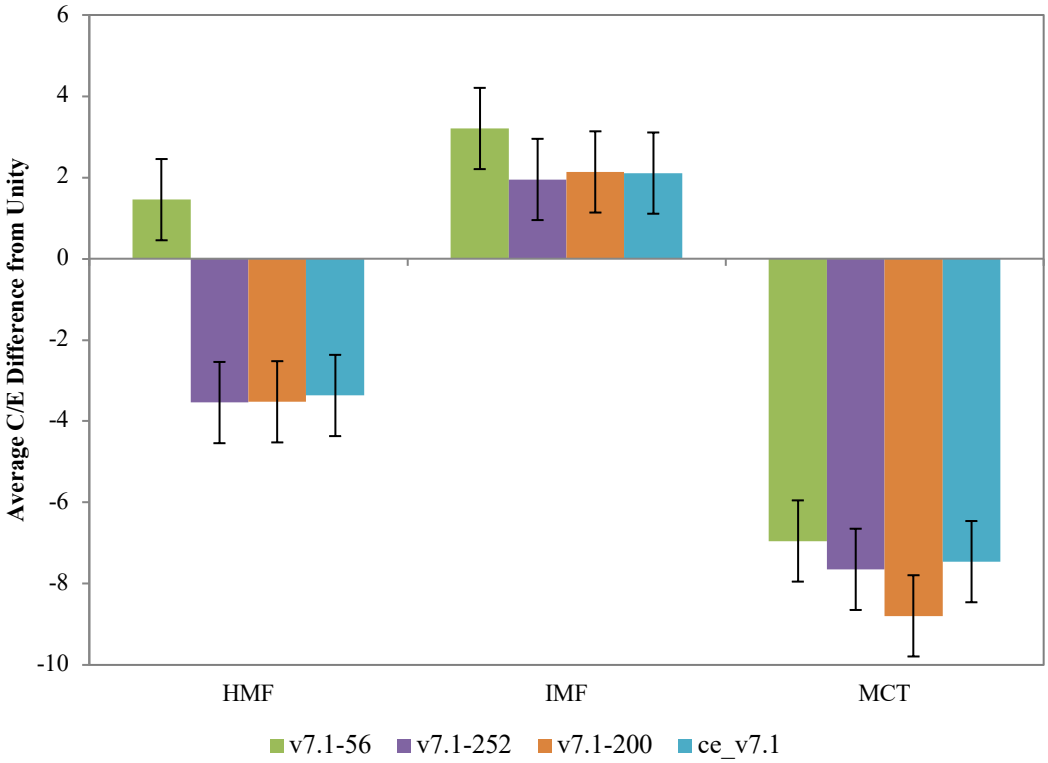

Figure 44. Relative bias for all 4 libraries for each of the 3 categories of experiments.

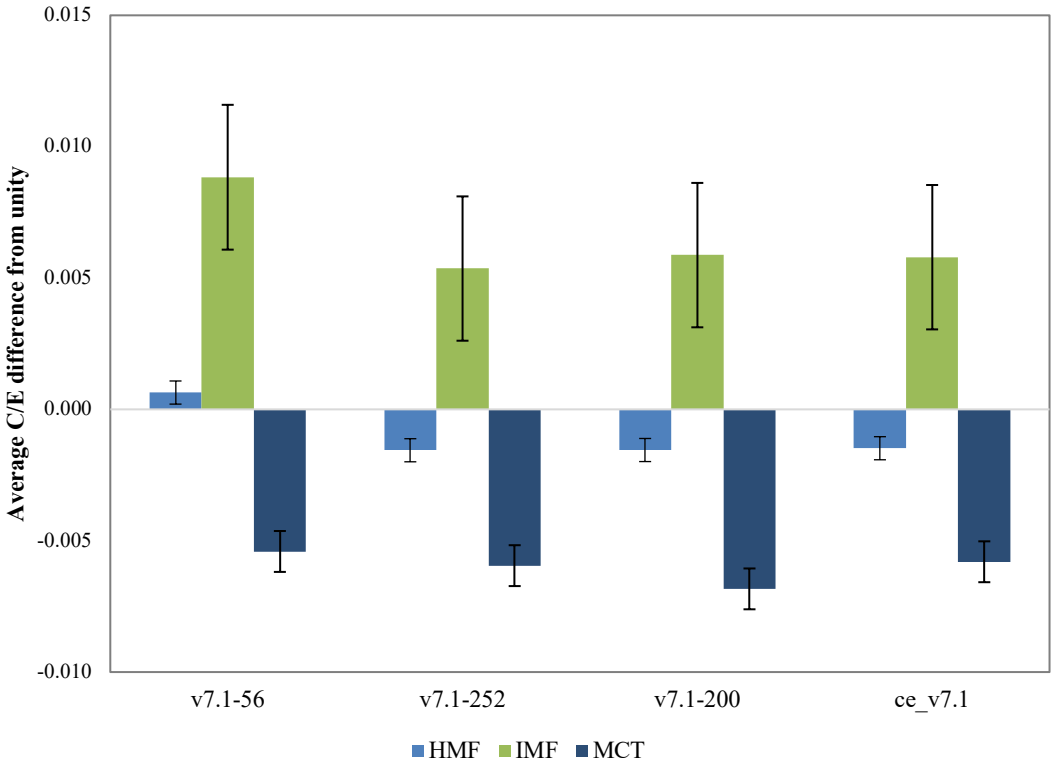

Figure 45. Absolute bias for all 4 libraries for each of the 3 categories of experiments by library.

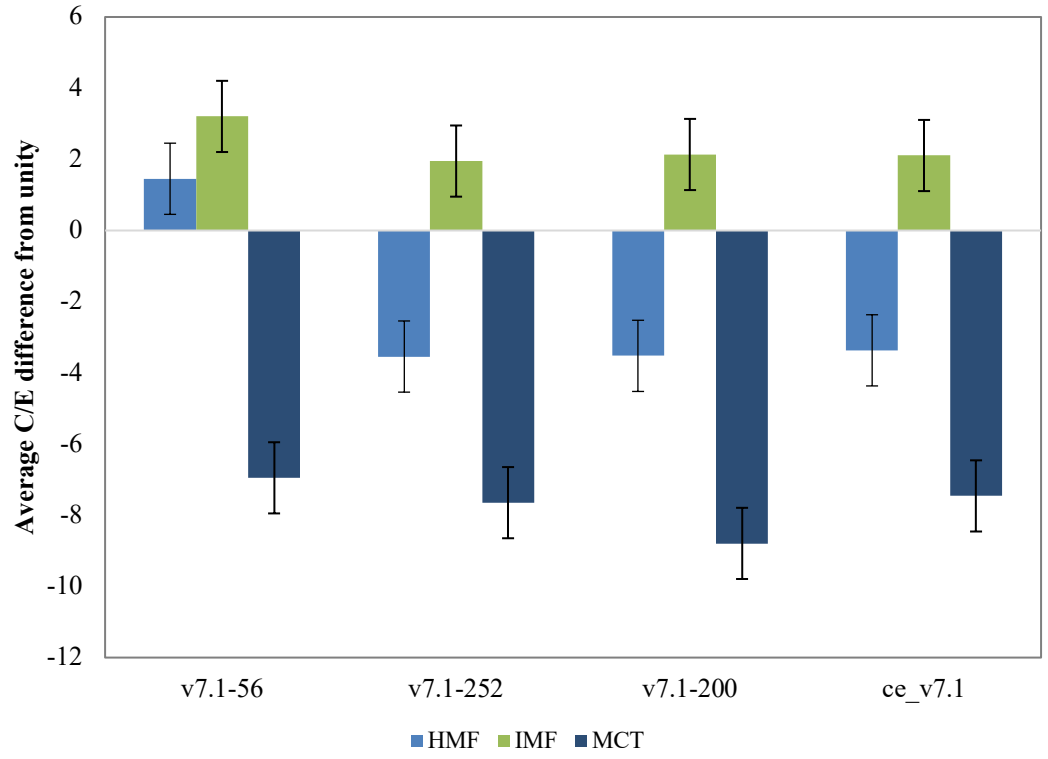

Figure 46. Relative bias for all 4 libraries for each of the 3 categories of experiments by library.

The largest absolute bias for the 56-group ENDF/B-VII.1 library occurs for the IMF systems and is approximately 0.88% Δk. The largest deviation on a relative error basis occurs for the MCT systems and is approximately seven standard deviations from unity.

For the 252-group ENDF/B-VII.1 library, the largest absolute bias occurs for the MCT systems and is approximately -0.60% Δk. The largest deviation on a relative error basis occurs for the MCT systems and is more than seven standard deviations from unity.

The largest absolute bias for the 200-group ENDF/B-VII.1 library occurs for the MCT systems and is approximately -0.68% Δk. The largest deviation on a relative error basis occurs for the MCT systems and is more than eight standard deviations from unity.

For the CE ENDF/B-VII.1 library, the largest absolute bias occurs for the MCT systems and is approximately -0.580% Δk. The magnitude of the absolute bias for the IMF systems is very similar and is approximately 0.579% Δk. The largest deviation on a relative error basis occurs for the MCT systems and is more than seven standard deviations from unity.

The subsections below detail the C/E values, the benchmark k_{eff} uncertainty as reported in the ICSBEP Handbook, and the uncertainty in k_{eff} due to uncertainties in the nuclear data for each case in each category of benchmarks. In the C/E figures, the reported benchmark uncertainty for each case is also shown as dotted lines, and the MG data uncertainty values are shown as dashed lines. The sensitivities used to calculate the cross section uncertainties are generated using ENDF/B-VII.1 libraries; MG TSUNAMI-3D is used for thermal systems, and CE TSUNAMI-3D is used for fast systems. Covariance data are propagated with the sensitivities to determine the uncertainty in k_{eff} due to data uncertainties. The 56-group covariance data based on ENDF/B-VII.1 and other sources are used for all libraries that are also based on ENDF/B-VII.1.

5.2.1 HMF Systems

The C/E data for the HMF systems are shown in Figure 47 for the ENDF/B-VII.1 libraries. The data demonstrate generally consistent performance between MG and continuous energy C/E values. The 56-group C/E values tend to be the largest. Noticeable outliers from the expected k_{eff} values are cases from HEU-MET-FAST-080, -086, -092, -093, and -094. The HEU-MET-FAST-086 cases are below the expected results, while HEU-MET-FAST-080, -092, -093, and -094 cases are all above the expected results. Figure 48 shows the C/E values as a function of EALF for the 252-group and CE libraries. No trends are evident in the figure.

The HEU-MET-FAST-086 cases use the Godiva IV critical assembly. The sample cases provided in the ICSBEP Handbook [21] also calculate k_{eff} values lower than the expected values with differing data libraries. Additional structural details became apparent during the refueling in 2012, and a revised ICSBEP evaluation is pending. Incorporating the revised evaluation details may raise the calculated k_{eff} values closer to the expected k_{eff} values.

The sample cases provided in the ICSBEP Handbook [21] for the HEU-MET-FAST-080, -092, -093, and -094 cases also calculate k_{eff} values higher than the expected values with differing data libraries, which is consistent with the results presented here. These experiments were performed with different materials at different locations.

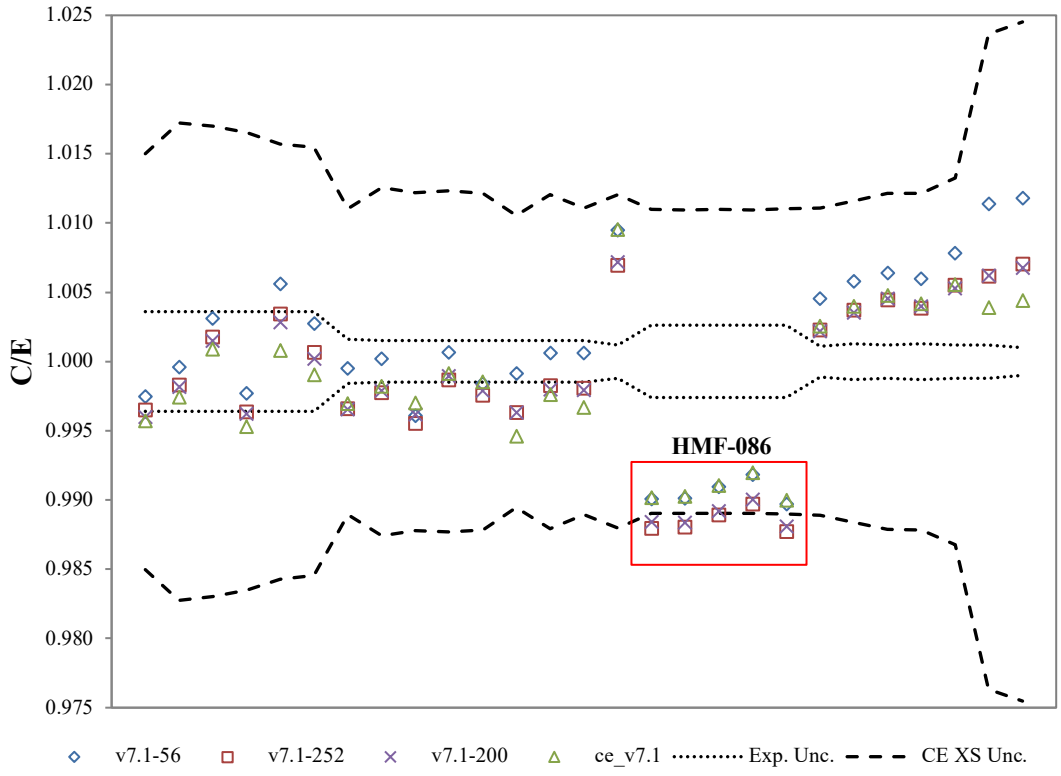

Figure 47. C/E results for libraries based on ENDF/B-VII.1 for the HMF systems, KENO-VI.

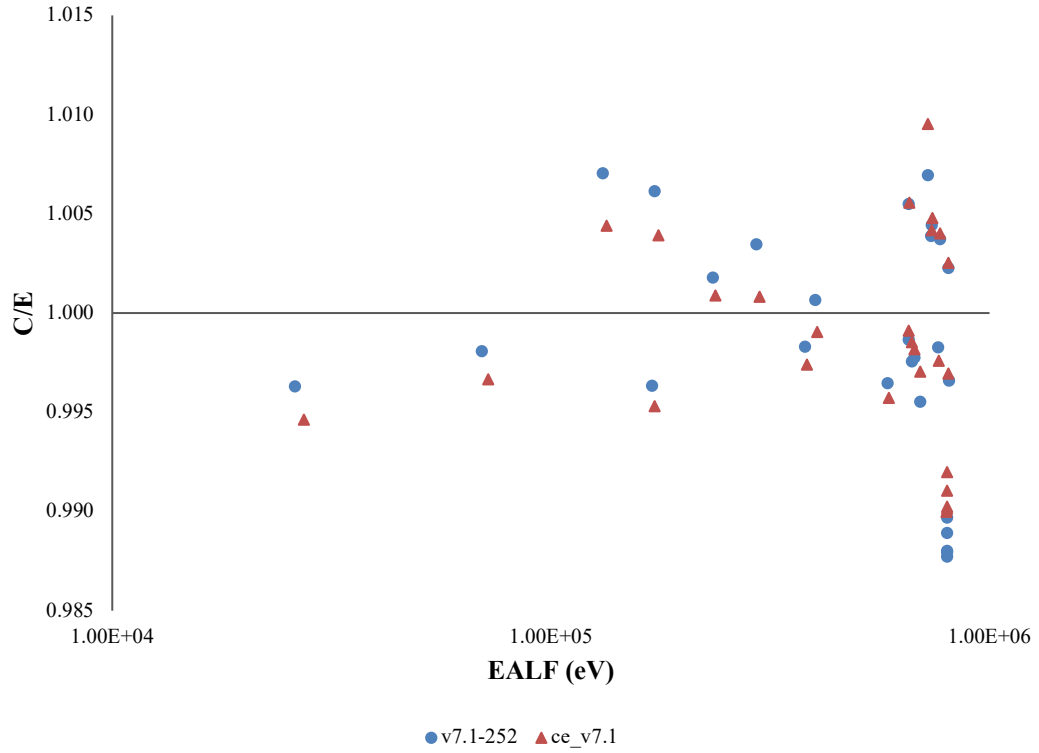

Figure 48. C/E as a function of EALF for 2 ENDF/B-VII.1 libraries for the HMF systems, KENO-VI.

The C/E data are also compared against the experimental and nuclear data uncertainty bands. In comparison with the experimental uncertainty, 22.2% of the ENDF/B-VII.1 CE library results are within the band. For the MG libraries, approximately 41, 22, and 19% of the points are in the band for the 56-, 252-, and 200-group libraries, respectively. A majority of the points from all libraries are within the nuclear data uncertainty band. For the CE library, 100% of the results are within the band. For the MG libraries, approximately 100, 85, and 89% of the points are in the band for the 56-, 252-, and 200-group libraries, respectively.

5.2.2 IMF Systems

The C/E data for the IMF systems are shown in Figure 49 for the ENDF/B-VII.1 libraries. The data set presented here contains only two data points, which causes difficulties in making generalizations about the tendencies of the different libraries and comparisons with the experimental and uncertainty data. However, it is noted that the C/E values are all significantly above unity outside the experimental uncertainty band while being within the nuclear data uncertainty band.

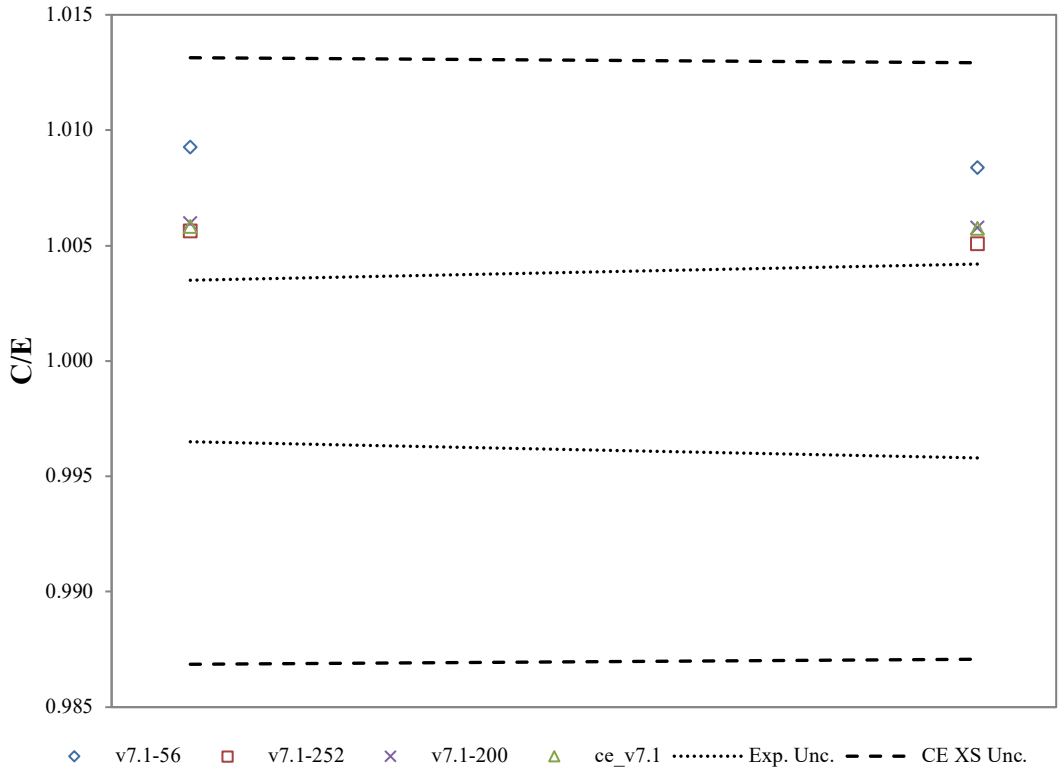

Figure 49. C/E results for libraries based on ENDF/B-VII.1 for the IMF systems, KENO-VI.

5.2.3 MCT Systems

The C/E data for the MCT systems are shown in Figure 50 for the ENDF/B-VII.1 libraries. The data demonstrate a fairly consistent behavior between MG and continuous energy C/E values, with the 56-group values tending to be the largest, and the 200-group C/E values tending to be the smallest. Figure 51 shows the C/E values as a function of EALF for the 252-group and CE libraries. No trends are evident in the figure.

The data set for MCT systems modeled with KENO-VI contains only the 28 cases contained in the MIX-COMP-THERM-008 series of experiments. Two distinct subsets of cases are contained in this experiment series. The first six cases constitute a series of fuel-rod pitches, with pitch increasing along with experiment number. The next 20 cases use the pitch from case 3 and replace the center fuel rod in the array with various poison rods containing aluminum, hafnium, or boron, with and without a cadmium sleeve. Case 7 uses an aluminum rod, cases 8–12 use hafnium rods with increasing hafnium loadings, and cases 13–16 use boron rods with increasing boron loadings. Cases 17–26 repeat cases 7–16 with a cadmium sleeve around the absorber rod. The last two cases use the cadmium sleeve with no absorber rod, filled first with air (case 27) and then filled with water (case 28). The C/E for all the libraries seems to trend lower with increasing poison loadings for both hafnium and boron. The presence of the cadmium sleeve appears to eliminate the trend related to poison loading.

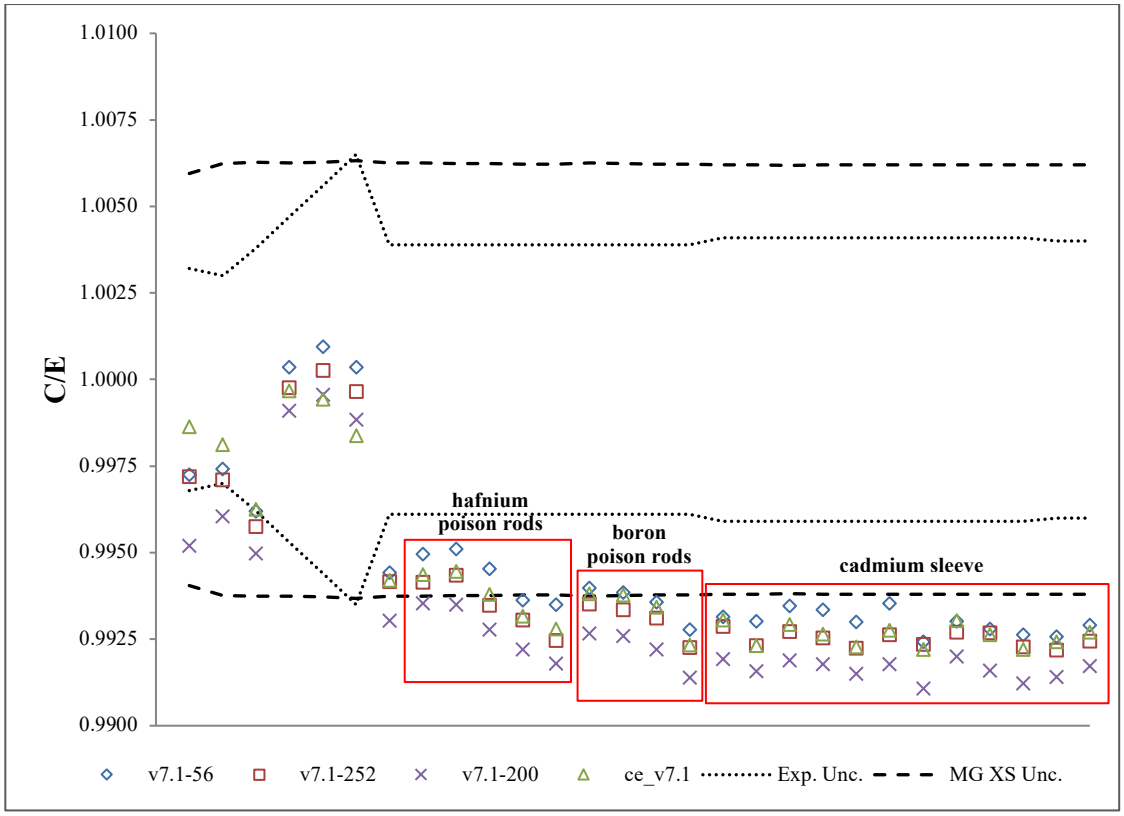

Figure 50. C/E results for libraries based on ENDF/B-VII.1 for the MCT systems, KENO-VI.

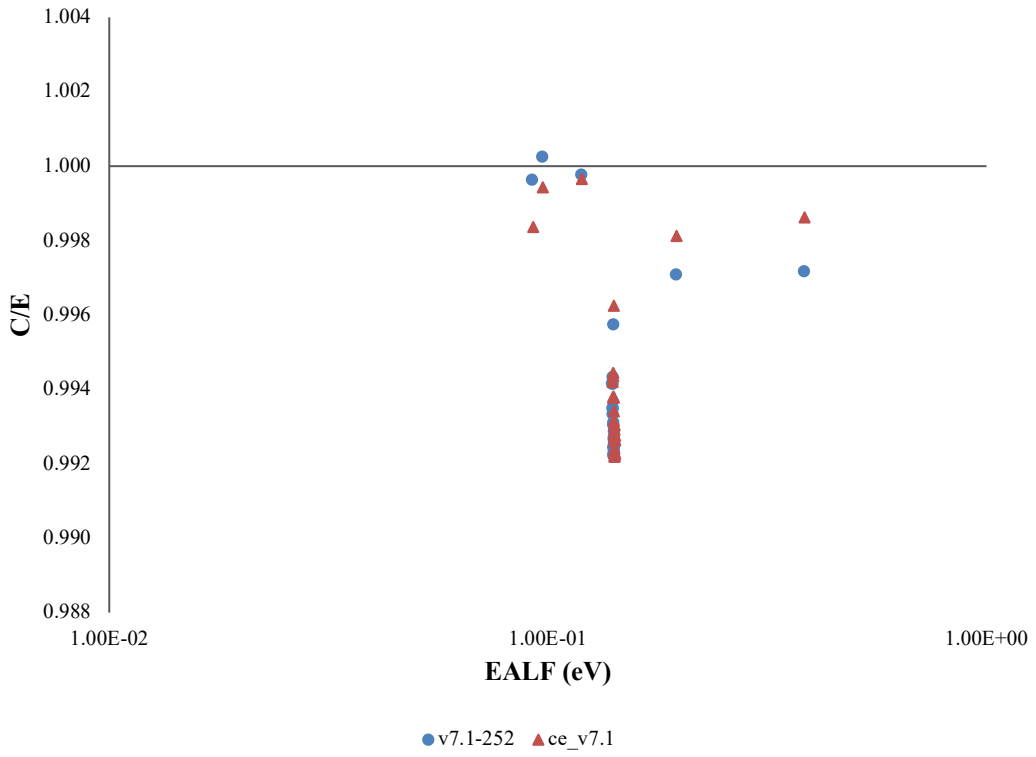

Figure 51. C/E as a function of EALF for 2 ENDF/B-VII.1 libraries for the MCT systems, KENO-VI.

The C/E data are also compared against the experimental and nuclear data uncertainty bands. In comparison with the experimental uncertainty, 21.4% of the ENDF/B-VII.1 CE library results are within the band. For the MG libraries, approximately 18, 18, and 11% of the points are in the band for the 56-, 252-, and 200-group libraries, respectively. For the CE library, 42.9% of the results are within the nuclear data uncertainty band. For the MG libraries, approximately 43, 32, and 21% of the points are in the nuclear data uncertainty band for the 56-, 252-, and 200-group libraries, respectively. The C/E values for the cases with poison rods all lie very near the lower bound of the 1 sigma nuclear data uncertainty. Small changes in the nuclear data induced uncertainty will have significant impacts on the fraction of these cases which fall within the band.

5.2.4 Outlier Cases

The results of all cases are analyzed to determine the greatest difference from a C/E of unity for each category. These outlier cases can occur for any number of reasons, including errors in the nuclear data, experiment description, code, model, or any combination of these. The case with the largest absolute bias for each category is reported in Table 12, and the case with the largest relative bias for each category is reported in Table 13. The absolute and relative biases are determined as discussed in Section 4.4. The cases in boldface font in the relative difference tables indicate that the case is different from those identified in the absolute difference tables.

Table 12. Maximum individual case absolute differences for KENO-VI for ENDF/B-VII.1 libraries.

Category	56-group		252-group		200-group		Continuous energy	
	Maximum difference (C/E from unity)	Case	Maximum difference (C/E from unity)	Case	Maximum difference (C/E from unity)	Case	Maximum difference (C/E from unity)	Case
HMF	0.01180	094-002	-0.01227	086-005	-0.01193	086-005	-0.01003	086-005
IMF	0.00929	019-001	0.00563	019-001	0.00597	019-001	0.00583	019-001
MCT	-0.00758	008-023	-0.00782	008-027	-0.00894	008-023	-0.00781	008-023

Table 13. Maximum individual case relative differences for KENO-VI for ENDF/B-VII.1 libraries.

Category	56-group		252-group		200-group		Continuous energy	
	Maximum difference (standard deviations)	Case	Maximum difference (standard deviations)	Case	Maximum difference (standard deviations)	Case	Maximum difference (standard deviations)	Case
HMF	11.60	094-002	6.97	**094-002**	6.66	**094-002**	7.84	**080-001**
IMF	2.63	019-001	1.60	019-001	1.70	019-001	1.66	019-001
MCT	1.88	**008-027**	2.01	**008-016**	2.24	**008-016**	1.99	**008-016**

Cases in **boldface** are different from those in the absolute difference table above.

6. SUMMARY AND CONCLUSIONS

A review of past KENO validation reports was generated and is reported in Section 2. It is clear from this review that the rigorous validation reports developed since 2011 include high-quality models and cover a broad range of different systems. It is worth noting that the apparent biases of the KENO V.a and KENO-VI codes have been reduced in recent years as nuclear data and processing have improved.

The results presented above provide the basis for several conclusions regarding the validation of the KENO V.a and KENO-VI codes within the SCALE 6.2.4 code suite. The average C/E values shown in Table 5 and Table 11 indicate that the code bias for a wide range of systems is fairly small. When considering all categories of systems examined, the bias is less than 2.2% Δk. Removing the USI and USM systems due to evidence of performance problems (Section 5.1), the bias for KENO V.a is less than 0.91% Δk, and it is less than 0.5% Δk for almost all categories in KENO V.a. The biases in KENO-VI appear to be larger, but they are less than 0.9% Δk. The apparently higher KENO-VI biases may be the result of the increased geometric complexity of the benchmark experiments, which require the use of the generalized geometry capabilities.

The data generated and reported here can also be used to identify potential cases within the ICSBEP Handbook [21], which should be examined for poor experiment descriptions, improved benchmark k_{eff} values, and possibly enhanced experimental uncertainty quantification. A review of the outlier cases and discrepancies identified in Section 5 can provide the initial list of candidate evaluations for such examinations.

An examination of potential cross section errors in both the MG and CE libraries is also possible based on the data that were generated for this validation. Comparable to what was found in work by Saylor et al. [7], trends in several experiment series have been identified that may provide insights into the nuclide and even the energy range that merit further investigation. The USI and USM systems are of special note here. The thick iron reflected cases that exhibit unusual disagreement between MG and CE results can also be used to search for these cross section issues or to identify and quantify methodology limitations on resonance self-shielding calculations.

There are indications that the overall cross section uncertainty as quantified through the SCALE covariance library is overestimated; this is similar to that reported by Saylor, et al. [7]. All categories of experiments in KENO V.a and KENO-VI show significantly more than the expected 68% of cases within one standard deviation of unity based on the calculated cross section uncertainty values. The cause of this overestimation is believed to be inconsistent treatment of cross sections and their uncertainties during the evaluation process [25]. The cross section uncertainties can be used to provide a bounding estimate of the bias that could occur for a particular nuclide that lacks sufficient coverage in the validation suite, so an overestimate of the uncertainty could lead to penalties that are unnecessarily large. Work is ongoing at ORNL to develop nuclear covariances that are consistent with the associated data.

Overall, the KENO V.a and KENO-VI codes have been shown to provide consistent, low bias results across a range of systems commonly encountered in criticality safety applications. The data presented here are of value because the results are based on the models included in VALID and have undergone the quality checks described by Marshall and Reed [6].

7. RECOMMENDATIONS FOR FUTURE WORK

Recommendations for future work, some of which are mentioned throughout this report, are summarized here, in no particular order.

- Existing nuclear data evaluations can be examined in light of the outlier cases, unique occurrences, unexpected trends, and discrepancies described herein, and needed improvements can be identified and made.

- Several of the reports included in the ICSBEP Handbook should be revised to include more rigorous calculations of the expected k_{eff} value, which may resolve many of the apparent discrepancies identified herein and elsewhere. In addition, more rigor and consistency in the reporting of experimental uncertainties may be useful.

- The number of KENO V.a cases in VALID should be increased. Only 4 of the 15 categories of experiments contain more than 50 cases. Currently, light water is the only moderating material represented in the library. Additional materials should be added, especially given the potential importance of graphite in many advanced reactor concepts.

- The number of KENO-VI cases in VALID should be increased. Only 57 cases are included in VALID, and only three categories of experiments are represented. Two of those three categories are represented with a single experiment series.

- The cross section covariance data should be generated in a manner that is consistent with associated nuclear data evaluation.

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APPENDIX A. DETAILED RESULTS FOR KENO V.a

APPENDIX A. DETAILED RESULTS FOR KENO V.A

All uncertainties reported in this appendix are at the 1 sigma level. The Monte Carlo experimental uncertainty values are absolute uncertainties and are reported in Δk_{eff} units. The cross section uncertainty values are relative uncertainties and are reported in $\Delta k_{eff}/k_{eff}$ units.

Table A-1. Detailed ENDF/B-VII.1 56-group results for KENO V.a HMF systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
015-001	0.9996	0.0017	0.99589	0.00010	0.99629	0.00170	0.01074
016-001	0.9996	0.0018	1.00404	0.00010	1.00444	0.00181	0.01391
016-002	0.9996	0.0018	1.00133	0.00010	1.00173	0.00181	0.01365
017-001	0.9993	0.0014	1.00684	0.00010	1.00755	0.00142	0.01682
018-001	1.0000	0.0014	1.00311	0.00010	1.00311	0.00141	0.01118
018-001S	1.0000	0.0016	1.00231	0.00010	1.00231	0.00161	0.01118
019-001	1.0000	0.0028	1.00973	0.00010	1.00973	0.00283	0.01176
019-001S	1.0000	0.0030	1.00942	0.00010	1.00942	0.00303	0.01176
020-001	1.0000	0.0028	1.00398	0.00010	1.00398	0.00281	0.01199
020-001S	1.0000	0.0030	1.00364	0.00010	1.00364	0.00301	0.01198
021-001	1.0000	0.0024	1.01129	0.00010	1.01129	0.00243	0.01265
021-001S	1.0000	0.0026	1.01113	0.00010	1.01113	0.00263	0.01262
025-001	0.9987	0.0014	1.00056	0.00010	1.00186	0.00141	0.01093
025-002	0.9990	0.0016	1.00246	0.00010	1.00347	0.00161	0.01107
025-003	0.9991	0.0016	1.00482	0.00010	1.00572	0.00161	0.01124
025-004	0.9995	0.0016	1.00509	0.00010	1.00559	0.00161	0.01133
025-005	0.9991	0.0016	1.00583	0.00010	1.00673	0.00162	0.01133
030-001	1.0000	0.0009	1.01128	0.00008	1.01128	0.00091	0.02328
038-001	0.9999	0.0007	1.01182	0.00009	1.01192	0.00071	0.02312
038-002	0.9999	0.0009	1.00920	0.00009	1.00930	0.00091	0.02244
040-001	0.9991	0.0011	1.01155	0.00010	1.01246	0.00112	0.01198
052-001	0.9993	0.0011	1.01437	0.00010	1.01508	0.00112	0.02427
065-001	0.9995	0.0013	1.00015	0.00010	1.00065	0.00131	0.01080

Table A-2. Detailed ENDF/B-VII.1 252-group results for KENO V.a HMF systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
015-001	0.9996	0.0017	0.99370	0.00010	0.99409	0.00169	0.01074
016-001	0.9996	0.0018	1.00129	0.00010	1.00169	0.00181	0.01391
016-002	0.9996	0.0018	1.00071	0.00010	1.00111	0.00181	0.01365
017-001	0.9993	0.0014	1.00117	0.00010	1.00187	0.00141	0.01682
018-001	1.0000	0.0014	1.00051	0.00010	1.00051	0.00140	0.01118
018-001S	1.0000	0.0016	0.99956	0.00010	0.99956	0.00160	0.01118
019-001	1.0000	0.0028	1.00698	0.00010	1.00698	0.00282	0.01176
019-001S	1.0000	0.0030	1.00721	0.00010	1.00721	0.00302	0.01176
020-001	1.0000	0.0028	1.00093	0.00010	1.00093	0.00280	0.01199
020-001S	1.0000	0.0030	1.00039	0.00010	1.00039	0.00300	0.01198
021-001	1.0000	0.0024	1.00704	0.00010	1.00704	0.00242	0.01265
021-001S	1.0000	0.0026	1.00719	0.00010	1.00719	0.00262	0.01262
025-001	0.9987	0.0014	0.99858	0.00010	0.99988	0.00141	0.01093
025-002	0.9990	0.0016	1.00051	0.00010	1.00151	0.00161	0.01107
025-003	0.9991	0.0016	1.00322	0.00010	1.00413	0.00161	0.01124
025-004	0.9995	0.0016	1.00474	0.00010	1.00524	0.00161	0.01133
025-005	0.9991	0.0016	1.00512	0.00010	1.00603	0.00161	0.01133
030-001	1.0000	0.0009	1.00329	0.00009	1.00329	0.00091	0.02328
038-001	0.9999	0.0007	1.00453	0.00009	1.00463	0.00071	0.02312
038-002	0.9999	0.0009	1.00323	0.00009	1.00333	0.00091	0.02244
040-001	0.9991	0.0011	1.00790	0.00010	1.00881	0.00112	0.01198
052-001	0.9993	0.0011	1.00769	0.00009	1.00840	0.00111	0.02427
065-001	0.9995	0.0013	0.99798	0.00010	0.99848	0.00130	0.01080

Table A-3. Detailed ENDF/B-VII.1 200-group results for KENO V.a HMF systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
015-001	0.9996	0.0017	0.99366	0.00010	0.99405	0.00169	0.01074
016-001	0.9996	0.0018	1.00123	0.00010	1.00163	0.00181	0.01391
016-002	0.9996	0.0018	1.00143	0.00010	1.00183	0.00181	0.01365
017-001	0.9993	0.0014	1.00055	0.00010	1.00125	0.00141	0.01682
018-001	1.0000	0.0014	1.00023	0.00010	1.00023	0.00140	0.01118
018-001S	1.0000	0.0016	0.99945	0.00010	0.99945	0.00160	0.01118
019-001	1.0000	0.0028	1.00710	0.00010	1.00710	0.00282	0.01176
019-001S	1.0000	0.0030	1.00710	0.00010	1.00710	0.00302	0.01176
020-001	1.0000	0.0028	1.00086	0.00010	1.00086	0.00280	0.01199
020-001S	1.0000	0.0030	1.00063	0.00010	1.00063	0.00300	0.01198
021-001	1.0000	0.0024	1.00447	0.00010	1.00447	0.00241	0.01265
021-001S	1.0000	0.0026	1.00463	0.00010	1.00463	0.00261	0.01262
025-001	0.9987	0.0014	0.99835	0.00010	0.99965	0.00140	0.01093
025-002	0.9990	0.0016	1.00070	0.00010	1.00170	0.00161	0.01107
025-003	0.9991	0.0016	1.00316	0.00010	1.00406	0.00161	0.01124
025-004	0.9995	0.0016	1.00417	0.00010	1.00467	0.00161	0.01133
025-005	0.9991	0.0016	1.00451	0.00010	1.00541	0.00161	0.01133
030-001	1.0000	0.0009	1.00266	0.00008	1.00266	0.00091	0.02328
038-001	0.9999	0.0007	1.00406	0.00009	1.00416	0.00071	0.02312
038-002	0.9999	0.0009	1.00304	0.00009	1.00314	0.00091	0.02244
040-001	0.9991	0.0011	1.00675	0.00010	1.00766	0.00111	0.01198
052-001	0.9993	0.0011	1.00711	0.00010	1.00782	0.00111	0.02427
065-001	0.9995	0.0013	0.99783	0.00010	0.99833	0.00130	0.01080

Table A-4. Detailed ENDF/B-VII.1 CE results for KENO V.a HMF systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
015-001	0.9996	0.0017	0.99455	0.00010	0.99494	0.00169	0.01074
016-001	0.9996	0.0018	1.00151	0.00010	1.00191	0.00181	0.01391
016-002	0.9996	0.0018	1.00210	0.00010	1.00250	0.00181	0.01365
017-001	0.9993	0.0014	1.00043	0.00010	1.00113	0.00141	0.01682
018-001	1.0000	0.0014	1.00019	0.00010	1.00019	0.00140	0.01118
018-001S	1.0000	0.0016	0.99965	0.00010	0.99965	0.00160	0.01118
019-001	1.0000	0.0028	1.00700	0.00010	1.00700	0.00282	0.01176
019-001S	1.0000	0.0030	1.00712	0.00010	1.00712	0.00302	0.01176
020-001	1.0000	0.0028	1.00090	0.00010	1.00090	0.00280	0.01199
020-001S	1.0000	0.0030	1.00051	0.00010	1.00051	0.00300	0.01198
021-001	1.0000	0.0024	0.99612	0.00010	0.99612	0.00239	0.01265
021-001S	1.0000	0.0026	0.99641	0.00010	0.99641	0.00259	0.01262
025-001	0.9987	0.0014	0.99905	0.00010	1.00035	0.00141	0.01093
025-002	0.9990	0.0016	1.00126	0.00010	1.00226	0.00161	0.01107
025-003	0.9991	0.0016	1.00370	0.00010	1.00461	0.00161	0.01124
025-004	0.9995	0.0016	1.00536	0.00010	1.00587	0.00161	0.01133
025-005	0.9991	0.0016	1.00545	0.00010	1.00635	0.00161	0.01133
030-001	1.0000	0.0009	1.00235	0.00009	1.00235	0.00091	0.02328
038-001	0.9999	0.0007	1.00325	0.00009	1.00335	0.00071	0.02312
038-002	0.9999	0.0009	1.00190	0.00009	1.00200	0.00091	0.02244
040-001	0.9991	0.0011	1.00451	0.00010	1.00542	0.00111	0.01198
052-001	0.9993	0.0011	1.00505	0.00010	1.00575	0.00111	0.02427
065-001	0.9995	0.0013	0.99800	0.00010	0.99850	0.00130	0.01080

Table A-5. Detailed ENDF/B-VII.1 56-group results for KENO V.a HST systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
001-001	1.0004	0.0060	0.99555	0.00010	0.99516	0.00597	0.01235
001-002	1.0021	0.0072	0.99374	0.00010	0.99166	0.00713	0.01255
001-003	1.0003	0.0035	0.99852	0.00010	0.99822	0.00349	0.01229
001-004	1.0008	0.0053	0.99576	0.00010	0.99496	0.00527	0.01259
001-005	1.0001	0.0049	0.99489	0.00010	0.99479	0.00487	0.01077
001-006	1.0002	0.0046	0.99799	0.00010	0.99779	0.00459	0.01092
001-007	1.0008	0.0040	0.99481	0.00010	0.99402	0.00397	0.01225
001-008	0.9998	0.0038	0.99483	0.00010	0.99503	0.00378	0.01230
001-009	1.0008	0.0054	0.99185	0.00010	0.99106	0.00535	0.01257
001-010	0.9993	0.0054	0.98899	0.00010	0.98968	0.00535	0.01078
013-001	1.0012	0.0026	0.99675	0.00010	0.99555	0.00259	0.00780
013-002	1.0007	0.0036	0.99599	0.00010	0.99529	0.00358	0.00748
013-003	1.0009	0.0036	0.99229	0.00010	0.99140	0.00357	0.00725
013-004	1.0003	0.0036	0.99390	0.00010	0.99360	0.00358	0.00717
014-001	1.0000	0.0028	0.99158	0.00010	0.99158	0.00278	0.01054
014-002	1.0000	0.0052	1.00811	0.00019	1.00811	0.00525	0.00977
014-003	1.0000	0.0087	1.01693	0.00019	1.01693	0.00885	0.00978
016-001	1.0000	0.0036	0.98858	0.00019	0.98858	0.00356	0.01139
016-002	1.0000	0.0069	1.00374	0.00019	1.00374	0.00693	0.01059
016-003	1.0000	0.0079	1.02279	0.00019	1.02279	0.00808	0.01060
028-001	1.0000	0.0023	0.99375	0.00010	0.99375	0.00229	0.01086
028-002	1.0000	0.0034	0.99481	0.00010	0.99481	0.00338	0.00940
028-003	1.0000	0.0026	0.99558	0.00010	0.99558	0.00259	0.01083
028-004	1.0000	0.0028	0.99628	0.00010	0.99628	0.00279	0.00965
028-005	1.0000	0.0031	0.99112	0.00010	0.99112	0.00307	0.01082
028-006	1.0000	0.0023	0.99461	0.00009	0.99461	0.00229	0.00985
028-007	1.0000	0.0038	0.99511	0.00010	0.99511	0.00378	0.01060
028-008	1.0000	0.0027	0.99507	0.00010	0.99507	0.00269	0.01011
028-009	1.0000	0.0049	0.99457	0.00010	0.99457	0.00487	0.01183
028-010	1.0000	0.0053	0.99349	0.00010	0.99349	0.00527	0.01001
028-011	1.0000	0.0051	0.99592	0.00010	0.99592	0.00508	0.01184
028-012	1.0000	0.0046	0.99376	0.00010	0.99376	0.00457	0.01048
028-013	1.0000	0.0058	0.99489	0.00010	0.99489	0.00577	0.01175
028-014	1.0000	0.0046	0.99529	0.00010	0.99529	0.00458	0.01089
028-015	1.0000	0.0064	1.00332	0.00010	1.00332	0.00642	0.01159
028-016	1.0000	0.0052	0.99943	0.00010	0.99943	0.00520	0.01100
028-017	1.0000	0.0066	0.99477	0.00010	0.99477	0.00657	0.01135
028-018	1.0000	0.0060	0.99590	0.00010	0.99590	0.00598	0.01102
029-001	1.0000	0.0066	0.99689	0.00010	0.99689	0.00658	0.01155
029-002	1.0000	0.0058	1.00071	0.00010	1.00071	0.00580	0.01025
029-003	1.0000	0.0068	0.99299	0.00010	0.99299	0.00675	0.01009
029-004	1.0000	0.0074	0.99183	0.00010	0.99183	0.00734	0.00895
029-005	1.0000	0.0067	0.99642	0.00010	0.99642	0.00668	0.00906
029-006	1.0000	0.0065	0.99661	0.00011	0.99661	0.00648	0.00971
029-007	1.0000	0.0063	0.99740	0.00010	0.99740	0.00628	0.01036
030-001	1.0000	0.0039	0.99396	0.00010	0.99396	0.00388	0.01071
030-002	1.0000	0.0032	0.99467	0.00009	0.99467	0.00318	0.00944
030-003	1.0000	0.0031	0.99308	0.00009	0.99308	0.00308	0.00891
030-004	1.0000	0.0064	0.99876	0.00010	0.99876	0.00639	0.01151
030-005	1.0000	0.0058	0.99506	0.00010	0.99506	0.00577	0.01060
030-006	1.0000	0.0059	0.99708	0.00010	0.99708	0.00588	0.01026
030-007	1.0000	0.0064	0.99601	0.00010	0.99601	0.00638	0.00932

Table A-6. Detailed ENDF/B-VII.1 252-group results for KENO V.a HST systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
001-001	1.0004	0.0060	0.99615	0.00010	0.99575	0.00597	0.01235
001-002	1.0021	0.0072	0.99421	0.00010	0.99213	0.00713	0.01255
001-003	1.0003	0.0035	0.99952	0.00010	0.99922	0.00350	0.01229
001-004	1.0008	0.0053	0.99640	0.00010	0.99560	0.00527	0.01259
001-005	1.0001	0.0049	0.99624	0.00010	0.99614	0.00488	0.01077
001-006	1.0002	0.0046	0.99930	0.00010	0.99910	0.00460	0.01092
001-007	1.0008	0.0040	0.99559	0.00010	0.99479	0.00398	0.01225
001-008	0.9998	0.0038	0.99576	0.00010	0.99595	0.00379	0.01230
001-009	1.0008	0.0054	0.99225	0.00010	0.99146	0.00535	0.01257
001-010	0.9993	0.0054	0.98996	0.00010	0.99065	0.00535	0.01078
013-001	1.0012	0.0026	0.99777	0.00010	0.99658	0.00259	0.00780
013-002	1.0007	0.0036	0.99682	0.00010	0.99612	0.00358	0.00748
013-003	1.0009	0.0036	0.99339	0.00010	0.99250	0.00357	0.00725
013-004	1.0003	0.0036	0.99506	0.00010	0.99477	0.00358	0.00717
014-001	1.0000	0.0028	0.99250	0.00010	0.99250	0.00278	0.01054
014-002	1.0000	0.0052	1.00919	0.00019	1.00919	0.00525	0.00977
014-003	1.0000	0.0087	1.01771	0.00019	1.01771	0.00886	0.00978
016-001	1.0000	0.0036	0.98852	0.00019	0.98852	0.00356	0.01139
016-002	1.0000	0.0069	1.00458	0.00019	1.00458	0.00693	0.01059
016-003	1.0000	0.0079	1.02354	0.00019	1.02354	0.00809	0.01060
028-001	1.0000	0.0023	0.99442	0.00010	0.99442	0.00229	0.01086
028-002	1.0000	0.0034	0.99558	0.00009	0.99558	0.00339	0.00940
028-003	1.0000	0.0026	0.99639	0.00010	0.99639	0.00259	0.01083
028-004	1.0000	0.0028	0.99726	0.00009	0.99726	0.00279	0.00965
028-005	1.0000	0.0031	0.99172	0.00010	0.99172	0.00308	0.01082
028-006	1.0000	0.0023	0.99545	0.00010	0.99545	0.00229	0.00985
028-007	1.0000	0.0038	0.99595	0.00010	0.99595	0.00379	0.01060
028-008	1.0000	0.0027	0.99592	0.00009	0.99592	0.00269	0.01011
028-009	1.0000	0.0049	0.99485	0.00010	0.99485	0.00488	0.01183
028-010	1.0000	0.0053	0.99367	0.00010	0.99367	0.00527	0.01001
028-011	1.0000	0.0051	0.99632	0.00010	0.99632	0.00508	0.01184
028-012	1.0000	0.0046	0.99404	0.00010	0.99404	0.00457	0.01048
028-013	1.0000	0.0058	0.99536	0.00010	0.99536	0.00577	0.01175
028-014	1.0000	0.0046	0.99575	0.00010	0.99575	0.00458	0.01089
028-015	1.0000	0.0064	1.00353	0.00010	1.00353	0.00642	0.01159
028-016	1.0000	0.0052	0.99989	0.00010	0.99989	0.00520	0.01100
028-017	1.0000	0.0066	0.99488	0.00011	0.99488	0.00657	0.01135
028-018	1.0000	0.0060	0.99578	0.00010	0.99578	0.00598	0.01102
029-001	1.0000	0.0066	0.99681	0.00010	0.99681	0.00658	0.01155
029-002	1.0000	0.0058	1.00073	0.00010	1.00073	0.00581	0.01025
029-003	1.0000	0.0068	0.99312	0.00010	0.99312	0.00675	0.01009
029-004	1.0000	0.0074	0.99210	0.00010	0.99210	0.00734	0.00895
029-005	1.0000	0.0067	0.99693	0.00010	0.99693	0.00668	0.00906
029-006	1.0000	0.0065	0.99706	0.00010	0.99706	0.00648	0.00971
029-007	1.0000	0.0063	0.99771	0.00010	0.99771	0.00629	0.01036
030-001	1.0000	0.0039	0.99458	0.00010	0.99458	0.00388	0.01071
030-002	1.0000	0.0032	0.99568	0.00010	0.99568	0.00319	0.00944
030-003	1.0000	0.0031	0.99409	0.00009	0.99409	0.00308	0.00891
030-004	1.0000	0.0064	0.99888	0.00010	0.99888	0.00639	0.01151
030-005	1.0000	0.0058	0.99541	0.00010	0.99541	0.00577	0.01060
030-006	1.0000	0.0059	0.99741	0.00010	0.99741	0.00589	0.01026
030-007	1.0000	0.0064	0.99668	0.00010	0.99668	0.00638	0.00932

Table A-7. Detailed ENDF/B-VII.1 200-group results for KENO V.a HST systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
001-001	1.0004	0.0060	0.99668	0.00010	0.99628	0.00598	0.01235
001-002	1.0021	0.0072	0.99475	0.00010	0.99266	0.00713	0.01255
001-003	1.0003	0.0035	1.00013	0.00010	0.99983	0.00350	0.01229
001-004	1.0008	0.0053	0.99724	0.00010	0.99644	0.00528	0.01259
001-005	1.0001	0.0049	0.99655	0.00010	0.99645	0.00488	0.01077
001-006	1.0002	0.0046	0.99985	0.00010	0.99965	0.00460	0.01092
001-007	1.0008	0.0040	0.99630	0.00010	0.99550	0.00398	0.01225
001-008	0.9998	0.0038	0.99667	0.00010	0.99687	0.00379	0.01230
001-009	1.0008	0.0054	0.99320	0.00010	0.99241	0.00536	0.01257
001-010	0.9993	0.0054	0.99054	0.00010	0.99124	0.00536	0.01078
013-001	1.0012	0.0026	0.99788	0.00010	0.99668	0.00259	0.00780
013-002	1.0007	0.0036	0.99707	0.00010	0.99638	0.00359	0.00748
013-003	1.0009	0.0036	0.99356	0.00010	0.99267	0.00357	0.00725
013-004	1.0003	0.0036	0.99519	0.00010	0.99489	0.00358	0.00717
014-001	1.0000	0.0028	0.99305	0.00010	0.99305	0.00278	0.01054
014-002	1.0000	0.0052	1.00991	0.00019	1.00991	0.00525	0.00977
014-003	1.0000	0.0087	1.01886	0.00019	1.01886	0.00887	0.00978
016-001	1.0000	0.0036	0.98949	0.00019	0.98949	0.00357	0.01139
016-002	1.0000	0.0069	1.00539	0.00019	1.00539	0.00694	0.01059
016-003	1.0000	0.0079	1.02433	0.00019	1.02433	0.00809	0.01060
028-001	1.0000	0.0023	0.99524	0.00010	0.99524	0.00229	0.01086
028-002	1.0000	0.0034	0.99618	0.00009	0.99618	0.00339	0.00940
028-003	1.0000	0.0026	0.99710	0.00010	0.99710	0.00259	0.01083
028-004	1.0000	0.0028	0.99793	0.00009	0.99793	0.00280	0.00965
028-005	1.0000	0.0031	0.99255	0.00010	0.99255	0.00308	0.01082
028-006	1.0000	0.0023	0.99626	0.00010	0.99626	0.00229	0.00985
028-007	1.0000	0.0038	0.99640	0.00010	0.99640	0.00379	0.01060
028-008	1.0000	0.0027	0.99634	0.00010	0.99634	0.00269	0.01011
028-009	1.0000	0.0049	0.99566	0.00010	0.99566	0.00488	0.01183
028-010	1.0000	0.0053	0.99456	0.00010	0.99456	0.00527	0.01001
028-011	1.0000	0.0051	0.99709	0.00010	0.99709	0.00509	0.01184
028-012	1.0000	0.0046	0.99471	0.00010	0.99471	0.00458	0.01048
028-013	1.0000	0.0058	0.99619	0.00010	0.99619	0.00578	0.01175
028-014	1.0000	0.0046	0.99636	0.00010	0.99636	0.00458	0.01089
028-015	1.0000	0.0064	1.00408	0.00010	1.00408	0.00643	0.01159
028-016	1.0000	0.0052	1.00038	0.00010	1.00038	0.00520	0.01100
028-017	1.0000	0.0066	0.99581	0.00010	0.99581	0.00657	0.01135
028-018	1.0000	0.0060	0.99669	0.00010	0.99669	0.00598	0.01102
029-001	1.0000	0.0066	0.99751	0.00011	0.99751	0.00658	0.01155
029-002	1.0000	0.0058	1.00164	0.00010	1.00164	0.00581	0.01025
029-003	1.0000	0.0068	0.99371	0.00010	0.99371	0.00676	0.01009
029-004	1.0000	0.0074	0.99266	0.00010	0.99266	0.00735	0.00895
029-005	1.0000	0.0067	0.99757	0.00010	0.99757	0.00668	0.00906
029-006	1.0000	0.0065	0.99770	0.00010	0.99770	0.00649	0.00971
029-007	1.0000	0.0063	0.99850	0.00010	0.99850	0.00629	0.01036
030-001	1.0000	0.0039	0.99534	0.00010	0.99534	0.00388	0.01071
030-002	1.0000	0.0032	*Did not run, as explained in Section 4.1.2*				0.00944
030-003	1.0000	0.0031					0.00891
030-004	1.0000	0.0064	0.99965	0.00010	0.99965	0.00640	0.01151
030-005	1.0000	0.0058	0.99609	0.00010	0.99609	0.00578	0.01060
030-006	1.0000	0.0059	0.99820	0.00010	0.99820	0.00589	0.01026
030-007	1.0000	0.0064	0.99724	0.00010	0.99724	0.00638	0.00932

Table A-8. Detailed ENDF/B-VII.1 CE results for KENO V.a HST systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
001-001	1.0004	0.0060	0.99698	0.00010	0.99658	0.00598	0.01235
001-002	1.0021	0.0072	0.99491	0.00010	0.99282	0.00713	0.01255
001-003	1.0003	0.0035	1.00047	0.00010	1.00017	0.00350	0.01229
001-004	1.0008	0.0053	0.99736	0.00010	0.99656	0.00528	0.01259
001-005	1.0001	0.0049	0.99713	0.00010	0.99703	0.00489	0.01077
001-006	1.0002	0.0046	1.00062	0.00010	1.00042	0.00460	0.01092
001-007	1.0008	0.0040	0.99687	0.00010	0.99608	0.00398	0.01225
001-008	0.9998	0.0038	0.99701	0.00010	0.99721	0.00379	0.01230
001-009	1.0008	0.0054	0.99314	0.00010	0.99235	0.00536	0.01257
001-010	0.9993	0.0054	0.99094	0.00010	0.99164	0.00536	0.01078
013-001	1.0012	0.0026	0.99833	0.00010	0.99713	0.00259	0.00780
013-002	1.0007	0.0036	0.99741	0.00010	0.99672	0.00359	0.00748
013-003	1.0009	0.0036	0.99397	0.00010	0.99308	0.00357	0.00725
013-004	1.0003	0.0036	0.99551	0.00009	0.99521	0.00358	0.00717
014-001	1.0000	0.0028	0.99370	0.00010	0.99370	0.00278	0.01054
014-002	1.0000	0.0052	1.01013	0.00019	1.01013	0.00526	0.00977
014-003	1.0000	0.0087	1.01882	0.00019	1.01882	0.00887	0.00978
016-001	1.0000	0.0036	0.98927	0.00019	0.98927	0.00357	0.01139
016-002	1.0000	0.0069	1.00588	0.00019	1.00588	0.00694	0.01059
016-003	1.0000	0.0079	1.02423	0.00019	1.02423	0.00809	0.01060
028-001	1.0000	0.0023	0.99557	0.00009	0.99557	0.00229	0.01086
028-002	1.0000	0.0034	0.99645	0.00009	0.99645	0.00339	0.00940
028-003	1.0000	0.0026	0.99729	0.00009	0.99729	0.00259	0.01083
028-004	1.0000	0.0028	0.99807	0.00009	0.99807	0.00280	0.00965
028-005	1.0000	0.0031	0.99285	0.00010	0.99285	0.00308	0.01082
028-006	1.0000	0.0023	0.99657	0.00009	0.99657	0.00229	0.00985
028-007	1.0000	0.0038	0.99690	0.00009	0.99690	0.00379	0.01060
028-008	1.0000	0.0027	0.99671	0.00009	0.99671	0.00269	0.01011
028-009	1.0000	0.0049	0.99544	0.00010	0.99544	0.00488	0.01183
028-010	1.0000	0.0053	0.99418	0.00009	0.99418	0.00527	0.01001
028-011	1.0000	0.0051	0.99713	0.00010	0.99713	0.00509	0.01184
028-012	1.0000	0.0046	0.99459	0.00010	0.99459	0.00458	0.01048
028-013	1.0000	0.0058	0.99600	0.00010	0.99600	0.00578	0.01175
028-014	1.0000	0.0046	0.99612	0.00010	0.99612	0.00458	0.01089
028-015	1.0000	0.0064	1.00403	0.00010	1.00403	0.00643	0.01159
028-016	1.0000	0.0052	1.00016	0.00010	1.00016	0.00520	0.01100
028-017	1.0000	0.0066	0.99564	0.00010	0.99564	0.00657	0.01135
028-018	1.0000	0.0060	0.99641	0.00010	0.99641	0.00598	0.01102
029-001	1.0000	0.0066	0.99752	0.00010	0.99752	0.00658	0.01155
029-002	1.0000	0.0058	1.00154	0.00010	1.00154	0.00581	0.01025
029-003	1.0000	0.0068	0.99382	0.00010	0.99382	0.00676	0.01009
029-004	1.0000	0.0074	0.99258	0.00010	0.99258	0.00735	0.00895
029-005	1.0000	0.0067	0.99756	0.00010	0.99756	0.00668	0.00906
029-006	1.0000	0.0065	0.99761	0.00010	0.99761	0.00649	0.00971
029-007	1.0000	0.0063	0.99814	0.00010	0.99814	0.00629	0.01036
030-001	1.0000	0.0039	0.99580	0.00010	0.99580	0.00388	0.01071
030-002	1.0000	0.0032	0.99656	0.00009	0.99656	0.00319	0.00944
030-003	1.0000	0.0031	0.99510	0.00009	0.99510	0.00309	0.00891
030-004	1.0000	0.0064	0.99962	0.00010	0.99962	0.00640	0.01151
030-005	1.0000	0.0058	0.99589	0.00010	0.99589	0.00578	0.01060
030-006	1.0000	0.0059	0.99805	0.00010	0.99805	0.00589	0.01026
030-007	1.0000	0.0064	0.99706	0.00010	0.99706	0.00638	0.00932

Table A-9. Detailed ENDF/B-VII.1 56-group results for KENO V.a IMF systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
002-001	1.0000	0.0030	1.00247	0.00010	1.00247	0.00301	0.01968
003-001	1.0000	0.0017	1.00711	0.00010	1.00711	0.00172	0.01349
003-001S	1.0000	0.0019	1.00721	0.00010	1.00721	0.00192	0.01351
004-001	1.0000	0.0030	1.01151	0.00010	1.01151	0.00304	0.01382
004-001S	1.0000	0.0032	1.01143	0.00010	1.01143	0.00324	0.01382
005-001	1.0000	0.0021	1.01770	0.00010	1.01770	0.00214	0.01466
005-001S	1.0000	0.0023	1.01764	0.00010	1.01764	0.00234	0.01468
006-001	1.0000	0.0023	1.00223	0.00010	1.00223	0.00231	0.01413
007-001	1.0045	0.0007	1.00504	0.00010	1.00054	0.00070	0.02635
008-001	1.0000	0.0018	1.01067	0.00010	1.01067	0.00182	0.01393
009-001	1.0000	0.0053	1.01144	0.00010	1.01144	0.00536	0.01163

Table A-10. Detailed ENDF/B-VII.1 252-group results for KENO V.a IMF systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
002-001	1.0000	0.0030	1.00011	0.00010	1.00011	0.00300	0.01968
003-001	1.0000	0.0017	1.00287	0.00010	1.00287	0.00171	0.01349
003-001S	1.0000	0.0019	1.00304	0.00010	1.00304	0.00191	0.01351
004-001	1.0000	0.0030	1.00780	0.00010	1.00780	0.00303	0.01382
004-001S	1.0000	0.0032	1.00791	0.00010	1.00791	0.00323	0.01382
005-001	1.0000	0.0021	1.01235	0.00010	1.01235	0.00213	0.01466
005-001S	1.0000	0.0023	1.01246	0.00010	1.01246	0.00233	0.01468
006-001	1.0000	0.0023	1.00160	0.00010	1.00160	0.00231	0.01413
007-001	1.0045	0.0007	1.00473	0.00010	1.00023	0.00070	0.02635
008-001	1.0000	0.0018	1.00673	0.00010	1.00673	0.00181	0.01393
009-001	1.0000	0.0053	1.00729	0.00010	1.00729	0.00534	0.01163

Table A-11. Detailed ENDF/B-VII.1 200-group results for KENO V.a IMF systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
002-001	1.0000	0.0030	1.00031	0.00010	1.00031	0.00300	0.01968
003-001	1.0000	0.0017	1.00292	0.00010	1.00292	0.00171	0.01349
003-001S	1.0000	0.0019	1.00302	0.00010	1.00302	0.00191	0.01351
004-001	1.0000	0.0030	1.00792	0.00010	1.00792	0.00303	0.01382
004-001S	1.0000	0.0032	1.00785	0.00010	1.00785	0.00323	0.01382
005-001	1.0000	0.0021	1.00938	0.00010	1.00938	0.00212	0.01466
005-001S	1.0000	0.0023	1.00965	0.00010	1.00965	0.00232	0.01468
006-001	1.0000	0.0023	0.99825	0.00010	0.99825	0.00230	0.01413
007-001	1.0045	0.0007	1.00455	0.00010	1.00005	0.00070	0.02635
008-001	1.0000	0.0018	1.00659	0.00010	1.00659	0.00181	0.01393
009-001	1.0000	0.0053	1.00735	0.00010	1.00735	0.00534	0.01163

Table A-12. Detailed ENDF/B-VII.1 CE results for KENO V.a IMF systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
002-001	1.0000	0.0030	0.99911	0.00010	0.99911	0.00300	0.01968
003-001	1.0000	0.0017	1.00228	0.00010	1.00228	0.00171	0.01349
003-001S	1.0000	0.0019	1.00267	0.00010	1.00267	0.00191	0.01351
004-001	1.0000	0.0030	1.00740	0.00010	1.00740	0.00302	0.01382
004-001S	1.0000	0.0032	1.00750	0.00010	1.00750	0.00323	0.01382
005-001	1.0000	0.0021	1.00129	0.00010	1.00129	0.00211	0.01466
005-001S	1.0000	0.0023	1.00099	0.00010	1.00099	0.00230	0.01468
006-001	1.0000	0.0023	0.99627	0.00010	0.99627	0.00229	0.01413
007-001	1.0045	0.0007	1.00488	0.00010	1.00038	0.00070	0.02635
008-001	1.0000	0.0018	1.00614	0.00010	1.00614	0.00181	0.01393
009-001	1.0000	0.0053	1.00673	0.00010	1.00673	0.00534	0.01163

Table A-13. Detailed ENDF/B-VII.1 56-group results for KENO V.a LCT systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
001-001	0.9998	0.0031	0.99828	0.00040	0.99848	0.00312	0.00692
001-002	0.9998	0.0031	0.99866	0.00048	0.99886	0.00313	0.00674
001-003	0.9998	0.0031	0.99794	0.00047	0.99814	0.00313	0.00665
001-004	0.9998	0.0031	0.99801	0.00041	0.99821	0.00312	0.00672
001-005	0.9998	0.0031	0.99740	0.00048	0.99760	0.00313	0.00660
001-006	0.9998	0.0031	0.99877	0.00048	0.99897	0.00313	0.00668
001-007	0.9998	0.0031	0.99816	0.00039	0.99836	0.00312	0.00660
001-008	0.9998	0.0031	0.99724	0.00048	0.99744	0.00313	0.00662
002-001	0.9997	0.0020	0.99800	0.00011	0.99830	0.00200	0.00780
002-002	0.9997	0.0020	0.99935	0.00010	0.99965	0.00200	0.00777
002-003	0.9997	0.0020	0.99898	0.00012	0.99928	0.00200	0.00769
002-004	0.9997	0.0020	0.99889	0.00010	0.99919	0.00200	0.00744
002-005	0.9997	0.0020	0.99759	0.00011	0.99789	0.00200	0.00727
008-001	1.0007	0.0012	1.00027	0.00010	0.99957	0.00120	0.00524
008-002	1.0007	0.0012	1.00092	0.00010	1.00022	0.00120	0.00519
008-003	1.0007	0.0012	1.00113	0.00010	1.00043	0.00120	0.00519
008-004	1.0007	0.0012	1.00068	0.00009	0.99998	0.00120	0.00520
008-005	1.0007	0.0012	1.00020	0.00010	0.99950	0.00120	0.00520
008-006	1.0007	0.0012	1.00050	0.00010	0.99980	0.00120	0.00520
008-007	1.0007	0.0012	0.99989	0.00010	0.99919	0.00120	0.00521
008-008	1.0007	0.0012	0.99927	0.00010	0.99857	0.00120	0.00521
008-009	1.0007	0.0012	0.99961	0.00010	0.99891	0.00120	0.00521
008-010	1.0007	0.0012	1.00029	0.00010	0.99959	0.00120	0.00520
008-011	1.0007	0.0012	1.00118	0.00010	1.00048	0.00120	0.00520
008-012	1.0007	0.0012	1.00090	0.00010	1.00019	0.00120	0.00519
008-013	1.0007	0.0012	1.00096	0.00010	1.00026	0.00120	0.00519
008-014	1.0007	0.0012	1.00052	0.00010	0.99982	0.00120	0.00520
008-015	1.0007	0.0012	1.00039	0.00010	0.99969	0.00120	0.00520
008-016	1.0007	0.0012	1.00075	0.00010	1.00005	0.00120	0.00518
008-017	1.0007	0.0012	1.00017	0.00010	0.99947	0.00120	0.00517
010-001	1.0000	0.0021	1.00509	0.00009	1.00509	0.00211	0.00713
010-002	1.0000	0.0021	1.00537	0.00010	1.00537	0.00211	0.00713
010-003	1.0000	0.0021	1.00422	0.00010	1.00422	0.00211	0.00709
010-004	1.0000	0.0021	0.99706	0.00009	0.99706	0.00210	0.00707
010-005	1.0000	0.0021	1.00186	0.00010	1.00186	0.00211	0.00594
010-006	1.0000	0.0021	1.00154	0.00010	1.00154	0.00211	0.00621
010-007	1.0000	0.0021	1.00210	0.00010	1.00210	0.00211	0.00659
010-008	1.0000	0.0021	0.99820	0.00010	0.99820	0.00210	0.00671
010-009	1.0000	0.0021	1.00196	0.00010	1.00196	0.00211	0.00678
010-010	1.0000	0.0021	1.00202	0.00010	1.00202	0.00211	0.00677
010-011	1.0000	0.0021	1.00197	0.00009	1.00197	0.00211	0.00675
010-012	1.0000	0.0021	1.00075	0.00010	1.00075	0.00210	0.00673
010-013	1.0000	0.0021	0.99819	0.00009	0.99819	0.00210	0.00694
010-014	1.0000	0.0028	1.00320	0.00009	1.00320	0.00281	0.00671
010-015	1.0000	0.0028	1.00314	0.00010	1.00314	0.00281	0.00678
010-016	1.0000	0.0028	1.00362	0.00010	1.00362	0.00281	0.00675
010-017	1.0000	0.0028	1.00318	0.00010	1.00318	0.00281	0.00676
010-018	1.0000	0.0028	1.00287	0.00010	1.00287	0.00281	0.00676
010-019	1.0000	0.0028	1.00237	0.00010	1.00237	0.00281	0.00684
010-020	1.0000	0.0028	1.00419	0.00010	1.00419	0.00281	0.00691
010-021	1.0000	0.0028	1.00434	0.00009	1.00434	0.00281	0.00696
010-022	1.0000	0.0028	1.00379	0.00009	1.00379	0.00281	0.00694
010-023	1.0000	0.0028	1.00210	0.00007	1.00210	0.00281	0.00690
010-024	1.0000	0.0028	1.00163	0.00010	1.00163	0.00281	0.00618
010-025	1.0000	0.0028	1.00308	0.00010	1.00308	0.00281	0.00631
010-026	1.0000	0.0028	1.00305	0.00009	1.00305	0.00281	0.00644
010-027	1.0000	0.0028	1.00299	0.00010	1.00299	0.00281	0.00654

Table A-13. Detailed ENDF/B-VII.1 56-group results for KENO V.a LCT systems (continued).

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
010-028	1.0000	0.0028	1.00302	0.00009	1.00302	0.00281	0.00660
010-029	1.0000	0.0028	1.00289	0.00007	1.00289	0.00281	0.00662
010-030	1.0000	0.0028	1.00091	0.00009	1.00091	0.00280	0.00673
017-001	1.0000	0.0031	1.00102	0.00010	1.00102	0.00310	0.00648
017-002	1.0000	0.0031	1.00067	0.00010	1.00067	0.00310	0.00651
017-003	1.0000	0.0031	0.99926	0.00010	0.99926	0.00310	0.00647
017-004	1.0000	0.0031	0.99870	0.00010	0.99870	0.00310	0.00602
017-005	1.0000	0.0031	1.00015	0.00010	1.00015	0.00310	0.00616
017-006	1.0000	0.0031	1.00010	0.00009	1.00010	0.00310	0.00619
017-007	1.0000	0.0031	1.00008	0.00010	1.00008	0.00310	0.00624
017-008	1.0000	0.0031	0.99801	0.00007	0.99801	0.00309	0.00637
017-009	1.0000	0.0031	0.99731	0.00010	0.99731	0.00309	0.00655
017-010	1.0000	0.0031	0.99876	0.00007	0.99876	0.00310	0.00631
017-011	1.0000	0.0031	0.99894	0.00010	0.99894	0.00310	0.00633
017-012	1.0000	0.0031	0.99863	0.00010	0.99863	0.00310	0.00634
017-013	1.0000	0.0031	0.99892	0.00010	0.99892	0.00310	0.00635
017-014	1.0000	0.0031	0.99912	0.00009	0.99912	0.00310	0.00640
017-015	1.0000	0.0028	0.99885	0.00008	0.99885	0.00280	0.00630
017-016	1.0000	0.0028	0.99951	0.00007	0.99951	0.00280	0.00628
017-017	1.0000	0.0028	1.00057	0.00007	1.00057	0.00280	0.00626
017-018	1.0000	0.0028	0.99913	0.00007	0.99913	0.00280	0.00627
017-019	1.0000	0.0028	0.99955	0.00006	0.99955	0.00280	0.00625
017-020	1.0000	0.0028	0.99833	0.00007	0.99833	0.00280	0.00626
017-021	1.0000	0.0028	0.99838	0.00006	0.99838	0.00280	0.00630
017-022	1.0000	0.0028	0.99731	0.00009	0.99731	0.00279	0.00643
017-023	1.0000	0.0028	0.99968	0.00009	0.99968	0.00280	0.00635
017-024	1.0000	0.0028	1.00014	0.00009	1.00014	0.00280	0.00635
017-025	1.0000	0.0028	0.99842	0.00008	0.99842	0.00280	0.00630
017-026	1.0000	0.0028	0.99751	0.00008	0.99751	0.00279	0.00587
017-027	1.0000	0.0028	0.99916	0.00008	0.99916	0.00280	0.00597
017-028	1.0000	0.0028	0.99962	0.00007	0.99962	0.00280	0.00604
017-029	1.0000	0.0028	0.99946	0.00008	0.99946	0.00280	0.00608
042-001	1.0000	0.0016	0.99900	0.00009	0.99900	0.00160	0.00621
042-002	1.0000	0.0016	0.99856	0.00009	0.99856	0.00160	0.00605
042-003	1.0000	0.0016	0.99980	0.00008	0.99980	0.00160	0.00600
042-004	1.0000	0.0017	1.00016	0.00010	1.00016	0.00170	0.00600
042-005	1.0000	0.0033	1.00005	0.00010	1.00005	0.00330	0.00601
042-006	1.0000	0.0016	1.00026	0.00009	1.00026	0.00160	0.00616
042-007	1.0000	0.0018	0.99823	0.00010	0.99823	0.00180	0.00607
050-001	1.0004	0.0010	0.99869	0.00010	0.99829	0.00100	0.00768
050-002	1.0004	0.0010	0.99841	0.00010	0.99801	0.00100	0.00760
050-003	1.0004	0.0010	0.99913	0.00010	0.99873	0.00100	0.00739
050-004	1.0004	0.0010	0.99868	0.00010	0.99828	0.00100	0.00730
050-005	1.0004	0.0010	0.99974	0.00010	0.99934	0.00100	0.00716
050-006	1.0004	0.0010	0.99986	0.00010	0.99946	0.00100	0.00703
050-007	1.0004	0.0010	0.99998	0.00010	0.99958	0.00100	0.00700
050-008	1.0004	0.0010	0.99654	0.00010	0.99614	0.00100	0.00748
050-009	1.0004	0.0010	0.99742	0.00010	0.99702	0.00100	0.00729
050-010	1.0004	0.0010	0.99714	0.00010	0.99674	0.00100	0.00734
050-011	1.0004	0.0010	0.99776	0.00010	0.99736	0.00100	0.00737
050-012	1.0004	0.0010	0.99858	0.00010	0.99818	0.00100	0.00723
050-013	1.0004	0.0010	0.99895	0.00010	0.99855	0.00100	0.00715
050-014	1.0004	0.0010	0.99834	0.00010	0.99794	0.00100	0.00704
050-015	1.0004	0.0010	0.99910	0.00010	0.99870	0.00100	0.00700
050-016	1.0004	0.0010	1.00021	0.00010	0.99981	0.00100	0.00707
050-017	1.0004	0.0010	0.99998	0.00010	0.99958	0.00100	0.00706
050-018	1.0004	0.0010	0.99982	0.00010	0.99942	0.00100	0.00706
078-001	0.9995	0.0010	0.99670	0.00010	0.99720	0.00100	0.00825

Table A-13. Detailed ENDF/B-VII.1 56-group results for KENO V.a LCT systems (continued).

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
078-002	0.9999	0.0010	0.99718	0.00010	0.99728	0.00100	0.00827
078-003	0.9990	0.0010	0.99612	0.00010	0.99712	0.00100	0.00831
078-004	0.9986	0.0010	0.99604	0.00010	0.99743	0.00100	0.00829
078-005	0.9980	0.0010	0.99534	0.00010	0.99734	0.00100	0.00830
078-006	0.9974	0.0010	0.99476	0.00010	0.99736	0.00100	0.00829
078-007	0.9994	0.0010	0.99651	0.00010	0.99711	0.00100	0.00830
078-008	0.9987	0.0010	0.99600	0.00010	0.99730	0.00100	0.00830
078-009	0.9978	0.0010	0.99496	0.00010	0.99715	0.00100	0.00830
078-010	0.9969	0.0010	0.99390	0.00010	0.99699	0.00101	0.00830
078-011	0.9994	0.0010	0.99652	0.00010	0.99711	0.00100	0.00825
078-012	0.9993	0.0010	0.99656	0.00010	0.99726	0.00100	0.00826
078-013	0.9993	0.0010	0.99653	0.00010	0.99723	0.00100	0.00827
078-014	0.9991	0.0010	0.99644	0.00010	0.99734	0.00100	0.00828
078-015	0.9996	0.0010	0.99787	0.00010	0.99827	0.00100	0.00843
080-001	0.9976	0.0010	0.99489	0.00010	0.99728	0.00100	0.00794
080-002	0.9982	0.0010	0.99545	0.00010	0.99725	0.00100	0.00797
080-003	0.9984	0.0010	0.99580	0.00010	0.99739	0.00100	0.00797
080-004	0.9981	0.0010	0.99546	0.00010	0.99735	0.00100	0.00796
080-005	0.9979	0.0010	0.99514	0.00010	0.99723	0.00100	0.00798
080-006	0.9975	0.0010	0.99463	0.00010	0.99713	0.00100	0.00797
080-007	0.9993	0.0010	0.99676	0.00010	0.99746	0.00100	0.00798
080-008	0.9987	0.0010	0.99615	0.00010	0.99745	0.00100	0.00795
080-009	0.9982	0.0010	0.99542	0.00010	0.99721	0.00100	0.00796
080-010	0.9972	0.0010	0.99488	0.00010	0.99767	0.00101	0.00798
080-011	0.9984	0.0010	0.99721	0.00010	0.99881	0.00101	0.00819

Table A-14. Detailed ENDF/B-VII.1 252-group results for KENO V.a LCT systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
001-001	0.9998	0.0031	0.99942	0.00043	0.99962	0.00313	0.00692
001-002	0.9998	0.0031	0.99841	0.00041	0.99861	0.00312	0.00674
001-003	0.9998	0.0031	0.99794	0.00047	0.99814	0.00313	0.00665
001-004	0.9998	0.0031	0.99968	0.00048	0.99988	0.00314	0.00672
001-005	0.9998	0.0031	0.99701	0.00035	0.99721	0.00311	0.00660
001-006	0.9998	0.0031	0.99896	0.00042	0.99916	0.00313	0.00668
001-007	0.9998	0.0031	0.99827	0.00036	0.99847	0.00312	0.00660
001-008	0.9998	0.0031	0.99700	0.00043	0.99720	0.00312	0.00662
002-001	0.9997	0.0020	0.99821	0.00012	0.99851	0.00200	0.00780
002-002	0.9997	0.0020	0.99930	0.00010	0.99960	0.00200	0.00777
002-003	0.9997	0.0020	0.99879	0.00012	0.99909	0.00200	0.00769
002-004	0.9997	0.0020	0.99869	0.00011	0.99899	0.00200	0.00744
002-005	0.9997	0.0020	0.99739	0.00011	0.99769	0.00200	0.00727
008-001	1.0007	0.0012	0.99961	0.00010	0.99891	0.00120	0.00524
008-002	1.0007	0.0012	1.00033	0.00010	0.99963	0.00120	0.00519
008-003	1.0007	0.0012	1.00063	0.00010	0.99993	0.00120	0.00519
008-004	1.0007	0.0012	1.00016	0.00010	0.99946	0.00120	0.00520
008-005	1.0007	0.0012	0.99998	0.00010	0.99928	0.00120	0.00520
008-006	1.0007	0.0012	1.00019	0.00010	0.99949	0.00120	0.00520
008-007	1.0007	0.0012	0.99953	0.00010	0.99883	0.00120	0.00521
008-008	1.0007	0.0012	0.99909	0.00010	0.99839	0.00120	0.00521
008-009	1.0007	0.0012	0.99928	0.00010	0.99858	0.00120	0.00521
008-010	1.0007	0.0012	1.00006	0.00010	0.99936	0.00120	0.00520
008-011	1.0007	0.0012	1.00077	0.00010	1.00007	0.00120	0.00520
008-012	1.0007	0.0012	1.00032	0.00010	0.99962	0.00120	0.00519
008-013	1.0007	0.0012	1.00016	0.00010	0.99946	0.00120	0.00519
008-014	1.0007	0.0012	1.00005	0.00010	0.99935	0.00120	0.00520
008-015	1.0007	0.0012	0.99995	0.00010	0.99925	0.00120	0.00520
008-016	1.0007	0.0012	1.00018	0.00010	0.99948	0.00120	0.00518
008-017	1.0007	0.0012	0.99941	0.00010	0.99871	0.00120	0.00517
010-001	1.0000	0.0021	1.00460	0.00009	1.00460	0.00211	0.00713
010-002	1.0000	0.0021	1.00490	0.00010	1.00490	0.00211	0.00713
010-003	1.0000	0.0021	1.00390	0.00010	1.00390	0.00211	0.00709
010-004	1.0000	0.0021	0.99660	0.00009	0.99660	0.00209	0.00707
010-005	1.0000	0.0021	0.99972	0.00009	0.99972	0.00210	0.00594
010-006	1.0000	0.0021	1.00016	0.00010	1.00016	0.00210	0.00621
010-007	1.0000	0.0021	1.00108	0.00009	1.00108	0.00210	0.00659
010-008	1.0000	0.0021	0.99786	0.00009	0.99786	0.00210	0.00671
010-009	1.0000	0.0021	1.00112	0.00010	1.00112	0.00210	0.00678
010-010	1.0000	0.0021	1.00100	0.00010	1.00100	0.00210	0.00677
010-011	1.0000	0.0021	1.00100	0.00010	1.00100	0.00210	0.00675
010-012	1.0000	0.0021	1.00022	0.00010	1.00022	0.00210	0.00673
010-013	1.0000	0.0021	0.99792	0.00009	0.99792	0.00210	0.00694
010-014	1.0000	0.0028	1.00212	0.00010	1.00212	0.00281	0.00671
010-015	1.0000	0.0028	1.00254	0.00010	1.00254	0.00281	0.00678
010-016	1.0000	0.0028	1.00280	0.00010	1.00280	0.00281	0.00675
010-017	1.0000	0.0028	1.00249	0.00010	1.00249	0.00281	0.00676
010-018	1.0000	0.0028	1.00221	0.00009	1.00221	0.00281	0.00676
010-019	1.0000	0.0028	1.00191	0.00010	1.00191	0.00281	0.00684
010-020	1.0000	0.0028	1.00344	0.00010	1.00344	0.00281	0.00691
010-021	1.0000	0.0028	1.00381	0.00010	1.00381	0.00281	0.00696
010-022	1.0000	0.0028	1.00278	0.00009	1.00278	0.00281	0.00694
010-023	1.0000	0.0028	1.00146	0.00007	1.00146	0.00280	0.00690
010-024	1.0000	0.0028	1.00011	0.00010	1.00011	0.00280	0.00618
010-025	1.0000	0.0028	1.00141	0.00010	1.00141	0.00281	0.00631
010-026	1.0000	0.0028	1.00151	0.00010	1.00151	0.00281	0.00644
010-027	1.0000	0.0028	1.00174	0.00010	1.00174	0.00281	0.00654

Table A-14. Detailed ENDF/B-VII.1 252-group results for KENO V.a LCT systems (continued).

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
010-028	1.0000	0.0028	1.00217	0.00010	1.00217	0.00281	0.00660
010-029	1.0000	0.0028	1.00214	0.00007	1.00214	0.00281	0.00662
010-030	1.0000	0.0028	1.00030	0.00010	1.00030	0.00280	0.00673
017-001	1.0000	0.0031	1.00066	0.00010	1.00066	0.00310	0.00648
017-002	1.0000	0.0031	1.00036	0.00010	1.00036	0.00310	0.00651
017-003	1.0000	0.0031	0.99916	0.00010	0.99916	0.00310	0.00647
017-004	1.0000	0.0031	0.99778	0.00010	0.99778	0.00309	0.00602
017-005	1.0000	0.0031	0.99945	0.00010	0.99945	0.00310	0.00616
017-006	1.0000	0.0031	0.99958	0.00010	0.99958	0.00310	0.00619
017-007	1.0000	0.0031	0.99941	0.00010	0.99941	0.00310	0.00624
017-008	1.0000	0.0031	0.99780	0.00007	0.99780	0.00309	0.00637
017-009	1.0000	0.0031	0.99722	0.00008	0.99722	0.00309	0.00655
017-010	1.0000	0.0031	0.99828	0.00007	0.99828	0.00310	0.00631
017-011	1.0000	0.0031	0.99854	0.00010	0.99854	0.00310	0.00633
017-012	1.0000	0.0031	0.99820	0.00010	0.99820	0.00310	0.00634
017-013	1.0000	0.0031	0.99860	0.00010	0.99860	0.00310	0.00635
017-014	1.0000	0.0031	0.99853	0.00010	0.99853	0.00310	0.00640
017-015	1.0000	0.0028	0.99772	0.00007	0.99772	0.00279	0.00630
017-016	1.0000	0.0028	0.99863	0.00007	0.99863	0.00280	0.00628
017-017	1.0000	0.0028	0.99988	0.00007	0.99988	0.00280	0.00626
017-018	1.0000	0.0028	0.99865	0.00006	0.99865	0.00280	0.00627
017-019	1.0000	0.0028	0.99883	0.00006	0.99883	0.00280	0.00625
017-020	1.0000	0.0028	0.99781	0.00007	0.99781	0.00279	0.00626
017-021	1.0000	0.0028	0.99780	0.00005	0.99780	0.00279	0.00630
017-022	1.0000	0.0028	0.99692	0.00008	0.99692	0.00279	0.00643
017-023	1.0000	0.0028	0.99889	0.00009	0.99889	0.00280	0.00635
017-024	1.0000	0.0028	0.99994	0.00009	0.99994	0.00280	0.00635
017-025	1.0000	0.0028	0.99788	0.00009	0.99788	0.00280	0.00630
017-026	1.0000	0.0028	0.99604	0.00008	0.99604	0.00279	0.00587
017-027	1.0000	0.0028	0.99801	0.00008	0.99801	0.00280	0.00597
017-028	1.0000	0.0028	0.99849	0.00008	0.99849	0.00280	0.00604
017-029	1.0000	0.0028	0.99876	0.00008	0.99876	0.00280	0.00608
042-001	1.0000	0.0016	0.99829	0.00008	0.99829	0.00160	0.00621
042-002	1.0000	0.0016	0.99763	0.00010	0.99763	0.00160	0.00605
042-003	1.0000	0.0016	0.99859	0.00010	0.99859	0.00160	0.00600
042-004	1.0000	0.0017	0.99923	0.00010	0.99923	0.00170	0.00600
042-005	1.0000	0.0033	0.99940	0.00010	0.99940	0.00330	0.00601
042-006	1.0000	0.0016	0.99946	0.00008	0.99946	0.00160	0.00616
042-007	1.0000	0.0018	0.99754	0.00009	0.99754	0.00180	0.00607
050-001	1.0004	0.0010	0.99825	0.00010	0.99785	0.00100	0.00768
050-002	1.0004	0.0010	0.99804	0.00010	0.99764	0.00100	0.00760
050-003	1.0004	0.0010	0.99897	0.00010	0.99857	0.00100	0.00739
050-004	1.0004	0.0010	0.99835	0.00010	0.99795	0.00100	0.00730
050-005	1.0004	0.0010	0.99983	0.00010	0.99943	0.00100	0.00716
050-006	1.0004	0.0010	0.99961	0.00010	0.99921	0.00100	0.00703
050-007	1.0004	0.0010	0.99960	0.00010	0.99920	0.00100	0.00700
050-008	1.0004	0.0010	0.99667	0.00010	0.99627	0.00100	0.00748
050-009	1.0004	0.0010	0.99734	0.00010	0.99694	0.00100	0.00729
050-010	1.0004	0.0010	0.99693	0.00010	0.99653	0.00100	0.00734
050-011	1.0004	0.0010	0.99754	0.00010	0.99714	0.00100	0.00737
050-012	1.0004	0.0010	0.99875	0.00010	0.99835	0.00100	0.00723
050-013	1.0004	0.0010	0.99865	0.00010	0.99825	0.00100	0.00715
050-014	1.0004	0.0010	0.99833	0.00010	0.99793	0.00100	0.00704
050-015	1.0004	0.0010	0.99888	0.00010	0.99848	0.00100	0.00700
050-016	1.0004	0.0010	1.00006	0.00010	0.99966	0.00100	0.00707
050-017	1.0004	0.0010	0.99974	0.00010	0.99934	0.00100	0.00706
050-018	1.0004	0.0010	0.99990	0.00010	0.99950	0.00100	0.00706
078-001	0.9995	0.0010	0.99702	0.00010	0.99752	0.00100	0.00825

Table A-14. Detailed ENDF/B-VII.1 252-group results for KENO V.a LCT systems (continued).

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
078-002	0.9999	0.0010	0.99768	0.00010	0.99778	0.00100	0.00827
078-003	0.9990	0.0010	0.99660	0.00010	0.99760	0.00100	0.00831
078-004	0.9986	0.0010	0.99625	0.00010	0.99764	0.00100	0.00829
078-005	0.9980	0.0010	0.99589	0.00010	0.99788	0.00100	0.00830
078-006	0.9974	0.0010	0.99513	0.00010	0.99772	0.00101	0.00829
078-007	0.9994	0.0010	0.99691	0.00010	0.99751	0.00100	0.00830
078-008	0.9987	0.0010	0.99637	0.00010	0.99766	0.00100	0.00830
078-009	0.9978	0.0010	0.99533	0.00010	0.99752	0.00100	0.00830
078-010	0.9969	0.0010	0.99403	0.00010	0.99712	0.00101	0.00830
078-011	0.9994	0.0010	0.99715	0.00010	0.99775	0.00100	0.00825
078-012	0.9993	0.0010	0.99679	0.00010	0.99749	0.00100	0.00826
078-013	0.9993	0.0010	0.99691	0.00010	0.99761	0.00100	0.00827
078-014	0.9991	0.0010	0.99649	0.00010	0.99739	0.00100	0.00828
078-015	0.9996	0.0010	0.99810	0.00010	0.99850	0.00100	0.00843
080-001	0.9976	0.0010	0.99525	0.00010	0.99764	0.00100	0.00794
080-002	0.9982	0.0010	0.99559	0.00010	0.99739	0.00100	0.00797
080-003	0.9984	0.0010	0.99591	0.00010	0.99750	0.00100	0.00797
080-004	0.9981	0.0010	0.99578	0.00010	0.99768	0.00100	0.00796
080-005	0.9979	0.0010	0.99551	0.00010	0.99760	0.00100	0.00798
080-006	0.9975	0.0010	0.99506	0.00010	0.99755	0.00100	0.00797
080-007	0.9993	0.0010	0.99707	0.00010	0.99777	0.00100	0.00798
080-008	0.9987	0.0010	0.99655	0.00010	0.99785	0.00100	0.00795
080-009	0.9982	0.0010	0.99567	0.00010	0.99747	0.00100	0.00796
080-010	0.9972	0.0010	0.99501	0.00010	0.99781	0.00101	0.00798
080-011	0.9984	0.0010	0.99743	0.00010	0.99902	0.00101	0.00819

Table A-15. Detailed ENDF/B-VII.1 200-group results for KENO V.a LCT systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
001-001	0.9998	0.0031	0.99838	0.00047	0.99858	0.00313	0.00692
001-002	0.9998	0.0031	0.99717	0.00044	0.99737	0.00312	0.00674
001-003	0.9998	0.0031	0.99779	0.00048	0.99799	0.00313	0.00665
001-004	0.9998	0.0031	0.99754	0.00047	0.99774	0.00313	0.00672
001-005	0.9998	0.0031	0.99592	0.00040	0.99612	0.00311	0.00660
001-006	0.9998	0.0031	0.99779	0.00047	0.99799	0.00313	0.00668
001-007	0.9998	0.0031	0.99631	0.00043	0.99651	0.00312	0.00660
001-008	0.9998	0.0031	0.99635	0.00040	0.99655	0.00312	0.00662
002-001	0.9997	0.0020	0.99688	0.00011	0.99718	0.00200	0.00780
002-002	0.9997	0.0020	0.99842	0.00010	0.99872	0.00200	0.00777
002-003	0.9997	0.0020	0.99791	0.00012	0.99821	0.00200	0.00769
002-004	0.9997	0.0020	0.99766	0.00010	0.99796	0.00200	0.00744
002-005	0.9997	0.0020	0.99619	0.00011	0.99649	0.00200	0.00727
008-001	1.0007	0.0012	0.99811	0.00010	0.99741	0.00120	0.00524
008-002	1.0007	0.0012	0.99903	0.00010	0.99833	0.00120	0.00519
008-003	1.0007	0.0012	0.99959	0.00010	0.99889	0.00120	0.00519
008-004	1.0007	0.0012	0.99872	0.00010	0.99802	0.00120	0.00520
008-005	1.0007	0.0012	0.99846	0.00010	0.99776	0.00120	0.00520
008-006	1.0007	0.0012	0.99880	0.00010	0.99810	0.00120	0.00520
008-007	1.0007	0.0012	0.99810	0.00010	0.99740	0.00120	0.00521
008-008	1.0007	0.0012	0.99754	0.00010	0.99685	0.00120	0.00521
008-009	1.0007	0.0012	0.99787	0.00010	0.99717	0.00120	0.00521
008-010	1.0007	0.0012	0.99871	0.00010	0.99802	0.00120	0.00520
008-011	1.0007	0.0012	0.99928	0.00010	0.99858	0.00120	0.00520
008-012	1.0007	0.0012	0.99919	0.00010	0.99849	0.00120	0.00519
008-013	1.0007	0.0012	0.99898	0.00010	0.99828	0.00120	0.00519
008-014	1.0007	0.0012	0.99875	0.00010	0.99805	0.00120	0.00520
008-015	1.0007	0.0012	0.99861	0.00010	0.99791	0.00120	0.00520
008-016	1.0007	0.0012	0.99884	0.00010	0.99814	0.00120	0.00518
008-017	1.0007	0.0012	0.99823	0.00010	0.99753	0.00120	0.00517
010-001	1.0000	0.0021	1.00353	0.00009	1.00353	0.00211	0.00713
010-002	1.0000	0.0021	1.00388	0.00010	1.00388	0.00211	0.00713
010-003	1.0000	0.0021	1.00282	0.00010	1.00282	0.00211	0.00709
010-004	1.0000	0.0021	0.99573	0.00009	0.99573	0.00209	0.00707
010-005	1.0000	0.0021	0.99995	0.00010	0.99995	0.00210	0.00594
010-006	1.0000	0.0021	1.00002	0.00009	1.00002	0.00210	0.00621
010-007	1.0000	0.0021	1.00055	0.00010	1.00055	0.00210	0.00659
010-008	1.0000	0.0021	0.99707	0.00010	0.99707	0.00210	0.00671
010-009	1.0000	0.0021	0.99933	0.00010	0.99933	0.00210	0.00678
010-010	1.0000	0.0021	0.99938	0.00010	0.99938	0.00210	0.00677
010-011	1.0000	0.0021	0.99966	0.00010	0.99966	0.00210	0.00675
010-012	1.0000	0.0021	0.99876	0.00010	0.99876	0.00210	0.00673
010-013	1.0000	0.0021	0.99668	0.00009	0.99668	0.00210	0.00694
010-014	1.0000	0.0028	1.00049	0.00010	1.00049	0.00280	0.00671
010-015	1.0000	0.0028	1.00072	0.00009	1.00072	0.00280	0.00678
010-016	1.0000	0.0028	1.00129	0.00010	1.00129	0.00281	0.00675
010-017	1.0000	0.0028	1.00088	0.00010	1.00088	0.00280	0.00676
010-018	1.0000	0.0028	1.00069	0.00010	1.00069	0.00280	0.00676
010-019	1.0000	0.0028	1.00069	0.00009	1.00069	0.00280	0.00684
010-020	1.0000	0.0028	1.00205	0.00010	1.00205	0.00281	0.00691
010-021	1.0000	0.0028	1.00218	0.00009	1.00218	0.00281	0.00696
010-022	1.0000	0.0028	1.00178	0.00009	1.00178	0.00281	0.00694
010-023	1.0000	0.0028	1.00033	0.00007	1.00033	0.00280	0.00690
010-024	1.0000	0.0028	0.99919	0.00010	0.99919	0.00280	0.00618
010-025	1.0000	0.0028	1.00059	0.00010	1.00059	0.00280	0.00631
010-026	1.0000	0.0028	1.00118	0.00010	1.00118	0.00280	0.00644
010-027	1.0000	0.0028	1.00087	0.00010	1.00087	0.00280	0.00654

Table A-15. Detailed ENDF/B-VII.1 200-group results for KENO V.a LCT systems (continued).

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
010-028	1.0000	0.0028	1.00116	0.00010	1.00116	0.00280	0.00660
010-029	1.0000	0.0028	1.00099	0.00007	1.00099	0.00280	0.00662
010-030	1.0000	0.0028	0.99908	0.00010	0.99908	0.00280	0.00673
017-001	1.0000	0.0031	0.99978	0.00010	0.99978	0.00310	0.00648
017-002	1.0000	0.0031	0.99947	0.00009	0.99947	0.00310	0.00651
017-003	1.0000	0.0031	0.99823	0.00009	0.99823	0.00310	0.00647
017-004	1.0000	0.0031	0.99731	0.00009	0.99731	0.00309	0.00602
017-005	1.0000	0.0031	0.99896	0.00010	0.99896	0.00310	0.00616
017-006	1.0000	0.0031	0.99902	0.00010	0.99902	0.00310	0.00619
017-007	1.0000	0.0031	0.99883	0.00010	0.99883	0.00310	0.00624
017-008	1.0000	0.0031	0.99695	0.00006	0.99695	0.00309	0.00637
017-009	1.0000	0.0031	0.99625	0.00010	0.99625	0.00309	0.00655
017-010	1.0000	0.0031	0.99707	0.00007	0.99707	0.00309	0.00631
017-011	1.0000	0.0031	0.99732	0.00010	0.99732	0.00309	0.00633
017-012	1.0000	0.0031	0.99720	0.00010	0.99720	0.00309	0.00634
017-013	1.0000	0.0031	0.99744	0.00010	0.99744	0.00309	0.00635
017-014	1.0000	0.0031	0.99783	0.00010	0.99783	0.00309	0.00640
017-015	1.0000	0.0028	0.99631	0.00008	0.99631	0.00279	0.00630
017-016	1.0000	0.0028	0.99726	0.00007	0.99726	0.00279	0.00628
017-017	1.0000	0.0028	0.99853	0.00007	0.99853	0.00280	0.00626
017-018	1.0000	0.0028	0.99740	0.00006	0.99740	0.00279	0.00627
017-019	1.0000	0.0028	0.99776	0.00007	0.99776	0.00279	0.00625
017-020	1.0000	0.0028	0.99673	0.00008	0.99673	0.00279	0.00626
017-021	1.0000	0.0028	0.99663	0.00007	0.99663	0.00279	0.00630
017-022	1.0000	0.0028	0.99592	0.00008	0.99592	0.00279	0.00643
017-023	1.0000	0.0028	0.99786	0.00009	0.99786	0.00280	0.00635
017-024	1.0000	0.0028	0.99882	0.00009	0.99882	0.00280	0.00635
017-025	1.0000	0.0028	0.99704	0.00009	0.99704	0.00279	0.00630
017-026	1.0000	0.0028	0.99550	0.00009	0.99550	0.00279	0.00587
017-027	1.0000	0.0028	0.99756	0.00007	0.99756	0.00279	0.00597
017-028	1.0000	0.0028	0.99798	0.00007	0.99798	0.00280	0.00604
017-029	1.0000	0.0028	0.99795	0.00008	0.99795	0.00280	0.00608
042-001	1.0000	0.0016	0.99674	0.00008	0.99674	0.00160	0.00621
042-002	1.0000	0.0016	0.99640	0.00009	0.99640	0.00160	0.00605
042-003	1.0000	0.0016	0.99726	0.00010	0.99726	0.00160	0.00600
042-004	1.0000	0.0017	0.99798	0.00009	0.99798	0.00170	0.00600
042-005	1.0000	0.0033	0.99784	0.00010	0.99784	0.00329	0.00601
042-006	1.0000	0.0016	0.99804	0.00009	0.99804	0.00160	0.00616
042-007	1.0000	0.0018	0.99609	0.00010	0.99609	0.00180	0.00607
050-001	1.0004	0.0010	0.99809	0.00010	0.99769	0.00100	0.00768
050-002	1.0004	0.0010	0.99792	0.00010	0.99752	0.00100	0.00760
050-003	1.0004	0.0010	0.99860	0.00010	0.99820	0.00100	0.00739
050-004	1.0004	0.0010	0.99802	0.00010	0.99762	0.00100	0.00730
050-005	1.0004	0.0010	0.99905	0.00010	0.99865	0.00100	0.00716
050-006	1.0004	0.0010	0.99912	0.00010	0.99872	0.00100	0.00703
050-007	1.0004	0.0010	0.99928	0.00010	0.99888	0.00100	0.00700
050-008	1.0004	0.0010					0.00748
050-009	1.0004	0.0010	*Did not run, as explained in Section 5.1.4*				0.00729
050-010	1.0004	0.0010					0.00734
050-011	1.0004	0.0010	0.99700	0.00010	0.99660	0.00100	0.00737
050-012	1.0004	0.0010	0.99805	0.00010	0.99765	0.00100	0.00723
050-013	1.0004	0.0010	0.99827	0.00010	0.99787	0.00100	0.00715
050-014	1.0004	0.0010	0.99775	0.00010	0.99735	0.00100	0.00704
050-015	1.0004	0.0010	0.99851	0.00010	0.99811	0.00100	0.00700
050-016	1.0004	0.0010	0.99939	0.00010	0.99899	0.00100	0.00707
050-017	1.0004	0.0010	0.99939	0.00010	0.99899	0.00100	0.00706
050-018	1.0004	0.0010	0.99903	0.00010	0.99863	0.00100	0.00706
078-001	0.9995	0.0010	0.99736	0.00010	0.99786	0.00100	0.00825

Table A-15. Detailed ENDF/B-VII.1 200-group results for KENO V.a LCT systems (continued).

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
078-002	0.9999	0.0010	0.99803	0.00010	0.99813	0.00100	0.00827
078-003	0.9990	0.0010	0.99702	0.00010	0.99802	0.00100	0.00831
078-004	0.9986	0.0010	0.99678	0.00010	0.99818	0.00100	0.00829
078-005	0.9980	0.0010	0.99620	0.00010	0.99820	0.00101	0.00830
078-006	0.9974	0.0010	0.99570	0.00010	0.99830	0.00101	0.00829
078-007	0.9994	0.0010	0.99754	0.00010	0.99814	0.00100	0.00830
078-008	0.9987	0.0010	0.99671	0.00010	0.99801	0.00100	0.00830
078-009	0.9978	0.0010	0.99584	0.00010	0.99803	0.00101	0.00830
078-010	0.9969	0.0010	0.99461	0.00010	0.99770	0.00101	0.00830
078-011	0.9994	0.0010	0.99754	0.00010	0.99814	0.00100	0.00825
078-012	0.9993	0.0010	0.99764	0.00010	0.99834	0.00100	0.00826
078-013	0.9993	0.0010	0.99724	0.00010	0.99793	0.00100	0.00827
078-014	0.9991	0.0010	0.99718	0.00010	0.99807	0.00100	0.00828
078-015	0.9996	0.0010	0.99949	0.00010	0.99989	0.00101	0.00843
080-001	0.9976	0.0010	0.99583	0.00010	0.99823	0.00101	0.00794
080-002	0.9982	0.0010	0.99638	0.00010	0.99818	0.00100	0.00797
080-003	0.9984	0.0010	0.99677	0.00010	0.99837	0.00100	0.00797
080-004	0.9981	0.0010	0.99624	0.00010	0.99813	0.00100	0.00796
080-005	0.9979	0.0010	0.99600	0.00010	0.99810	0.00101	0.00798
080-006	0.9975	0.0010	0.99567	0.00010	0.99817	0.00101	0.00797
080-007	0.9993	0.0010	0.99764	0.00010	0.99833	0.00100	0.00798
080-008	0.9987	0.0010	0.99723	0.00010	0.99853	0.00100	0.00795
080-009	0.9982	0.0010	0.99638	0.00010	0.99817	0.00100	0.00796
080-010	0.9972	0.0010	0.99556	0.00010	0.99836	0.00101	0.00798
080-011	0.9984	0.0010	0.99943	0.00010	1.00104	0.00101	0.00819

Table A-16. Detailed ENDF/B-VII.1 CE results for KENO V.a LCT systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
001-001	0.9998	0.0031	0.99996	0.00047	1.00016	0.00314	0.00692
001-002	0.9998	0.0031	0.99855	0.00048	0.99875	0.00313	0.00674
001-003	0.9998	0.0031	0.99796	0.00049	0.99816	0.00313	0.00665
001-004	0.9998	0.0031	0.99873	0.00047	0.99893	0.00313	0.00672
001-005	0.9998	0.0031	0.99678	0.00048	0.99698	0.00313	0.00660
001-006	0.9998	0.0031	0.99914	0.00045	0.99934	0.00313	0.00668
001-007	0.9998	0.0031	0.99869	0.00047	0.99889	0.00313	0.00660
001-008	0.9998	0.0031	0.99630	0.00047	0.99650	0.00313	0.00662
002-001	0.9997	0.0020	0.99839	0.00012	0.99869	0.00200	0.00780
002-002	0.9997	0.0020	0.99946	0.00010	0.99976	0.00200	0.00777
002-003	0.9997	0.0020	0.99894	0.00012	0.99924	0.00200	0.00769
002-004	0.9997	0.0020	0.99878	0.00010	0.99908	0.00200	0.00744
002-005	0.9997	0.0020	0.99715	0.00011	0.99745	0.00200	0.00727
008-001	1.0007	0.0012	1.00073	0.00010	1.00003	0.00120	0.00524
008-002	1.0007	0.0012	1.00097	0.00010	1.00027	0.00120	0.00519
008-003	1.0007	0.0012	1.00159	0.00010	1.00089	0.00120	0.00519
008-004	1.0007	0.0012	1.00113	0.00010	1.00042	0.00120	0.00520
008-005	1.0007	0.0012	1.00047	0.00010	0.99977	0.00120	0.00520
008-006	1.0007	0.0012	1.00122	0.00010	1.00051	0.00120	0.00520
008-007	1.0007	0.0012	1.00046	0.00010	0.99976	0.00120	0.00521
008-008	1.0007	0.0012	1.00034	0.00010	0.99964	0.00120	0.00521
008-009	1.0007	0.0012	1.00052	0.00010	0.99982	0.00120	0.00521
008-010	1.0007	0.0012	1.00100	0.00010	1.00030	0.00120	0.00520
008-011	1.0007	0.0012	1.00147	0.00010	1.00077	0.00120	0.00520
008-012	1.0007	0.0012	1.00123	0.00010	1.00053	0.00120	0.00519
008-013	1.0007	0.0012	1.00112	0.00010	1.00042	0.00120	0.00519
008-014	1.0007	0.0012	1.00074	0.00010	1.00004	0.00120	0.00520
008-015	1.0007	0.0012	1.00078	0.00010	1.00008	0.00120	0.00520
008-016	1.0007	0.0012	1.00079	0.00010	1.00009	0.00120	0.00518
008-017	1.0007	0.0012	0.99979	0.00010	0.99909	0.00120	0.00517
010-001	1.0000	0.0021	1.00488	0.00009	1.00488	0.00211	0.00713
010-002	1.0000	0.0021	1.00531	0.00010	1.00531	0.00211	0.00713
010-003	1.0000	0.0021	1.00415	0.00010	1.00415	0.00211	0.00709
010-004	1.0000	0.0021	0.99672	0.00009	0.99672	0.00209	0.00707
010-005	1.0000	0.0021	0.99955	0.00010	0.99955	0.00210	0.00594
010-006	1.0000	0.0021	1.00012	0.00010	1.00012	0.00210	0.00621
010-007	1.0000	0.0021	1.00134	0.00010	1.00134	0.00211	0.00659
010-008	1.0000	0.0021	0.99796	0.00010	0.99796	0.00210	0.00671
010-009	1.0000	0.0021	0.99973	0.00010	0.99973	0.00210	0.00678
010-010	1.0000	0.0021	1.00015	0.00010	1.00015	0.00210	0.00677
010-011	1.0000	0.0021	1.00057	0.00010	1.00057	0.00210	0.00675
010-012	1.0000	0.0021	0.99974	0.00010	0.99974	0.00210	0.00673
010-013	1.0000	0.0021	0.99762	0.00009	0.99762	0.00210	0.00694
010-014	1.0000	0.0028	1.00177	0.00010	1.00177	0.00281	0.00671
010-015	1.0000	0.0028	1.00241	0.00010	1.00241	0.00281	0.00678
010-016	1.0000	0.0028	1.00325	0.00010	1.00325	0.00281	0.00675
010-017	1.0000	0.0028	1.00258	0.00010	1.00258	0.00281	0.00676
010-018	1.0000	0.0028	1.00255	0.00010	1.00255	0.00281	0.00676
010-019	1.0000	0.0028	1.00223	0.00010	1.00223	0.00281	0.00684
010-020	1.0000	0.0028	1.00412	0.00010	1.00412	0.00281	0.00691
010-021	1.0000	0.0028	1.00417	0.00010	1.00417	0.00281	0.00696
010-022	1.0000	0.0028	1.00361	0.00009	1.00361	0.00281	0.00694
010-023	1.0000	0.0028	1.00197	0.00007	1.00197	0.00281	0.00690
010-024	1.0000	0.0028	1.00038	0.00010	1.00038	0.00280	0.00618
010-025	1.0000	0.0028	1.00177	0.00010	1.00177	0.00281	0.00631
010-026	1.0000	0.0028	1.00210	0.00010	1.00210	0.00281	0.00644
010-027	1.0000	0.0028	1.00226	0.00010	1.00226	0.00281	0.00654

Table A-16. Detailed ENDF/B-VII.1 CE results for KENO V.a LCT systems (continued).

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
010-028	1.0000	0.0028	1.00263	0.00009	1.00263	0.00281	0.00660
010-029	1.0000	0.0028	1.00261	0.00007	1.00261	0.00281	0.00662
010-030	1.0000	0.0028	1.00068	0.00010	1.00068	0.00280	0.00673
017-001	1.0000	0.0031	1.00142	0.00010	1.00142	0.00311	0.00648
017-002	1.0000	0.0031	1.00125	0.00010	1.00125	0.00311	0.00651
017-003	1.0000	0.0031	0.99982	0.00009	0.99982	0.00310	0.00647
017-004	1.0000	0.0031	0.99820	0.00010	0.99820	0.00310	0.00602
017-005	1.0000	0.0031	0.99996	0.00010	0.99996	0.00310	0.00616
017-006	1.0000	0.0031	1.00010	0.00010	1.00010	0.00310	0.00619
017-007	1.0000	0.0031	1.00004	0.00009	1.00004	0.00310	0.00624
017-008	1.0000	0.0031	0.99820	0.00007	0.99820	0.00310	0.00637
017-009	1.0000	0.0031	0.99744	0.00010	0.99744	0.00309	0.00655
017-010	1.0000	0.0031	0.99820	0.00007	0.99820	0.00310	0.00631
017-011	1.0000	0.0031	0.99852	0.00010	0.99852	0.00310	0.00633
017-012	1.0000	0.0031	0.99857	0.00010	0.99857	0.00310	0.00634
017-013	1.0000	0.0031	0.99895	0.00010	0.99895	0.00310	0.00635
017-014	1.0000	0.0031	0.99933	0.00010	0.99933	0.00310	0.00640
017-015	1.0000	0.0028	0.99761	0.00008	0.99761	0.00279	0.00630
017-016	1.0000	0.0028	0.99867	0.00008	0.99867	0.00280	0.00628
017-017	1.0000	0.0028	0.99989	0.00007	0.99989	0.00280	0.00626
017-018	1.0000	0.0028	0.99885	0.00007	0.99885	0.00280	0.00627
017-019	1.0000	0.0028	0.99926	0.00008	0.99926	0.00280	0.00625
017-020	1.0000	0.0028	0.99820	0.00008	0.99820	0.00280	0.00626
017-021	1.0000	0.0028	0.99840	0.00006	0.99840	0.00280	0.00630
017-022	1.0000	0.0028	0.99772	0.00008	0.99772	0.00279	0.00643
017-023	1.0000	0.0028	0.99992	0.00009	0.99992	0.00280	0.00635
017-024	1.0000	0.0028	1.00064	0.00008	1.00064	0.00280	0.00635
017-025	1.0000	0.0028	0.99845	0.00009	0.99845	0.00280	0.00630
017-026	1.0000	0.0028	0.99652	0.00009	0.99652	0.00279	0.00587
017-027	1.0000	0.0028	0.99845	0.00008	0.99845	0.00280	0.00597
017-028	1.0000	0.0028	0.99929	0.00007	0.99929	0.00280	0.00604
017-029	1.0000	0.0028	0.99953	0.00007	0.99953	0.00280	0.00608
042-001	1.0000	0.0016	0.99835	0.00008	0.99835	0.00160	0.00621
042-002	1.0000	0.0016	0.99810	0.00009	0.99810	0.00160	0.00605
042-003	1.0000	0.0016	0.99923	0.00009	0.99923	0.00160	0.00600
042-004	1.0000	0.0017	0.99978	0.00010	0.99978	0.00170	0.00600
042-005	1.0000	0.0033	0.99965	0.00009	0.99965	0.00330	0.00601
042-006	1.0000	0.0016	0.99939	0.00010	0.99939	0.00160	0.00616
042-007	1.0000	0.0018	0.99793	0.00009	0.99793	0.00180	0.00607
050-001	1.0004	0.0010	0.99914	0.00010	0.99874	0.00100	0.00768
050-002	1.0004	0.0010	0.99874	0.00010	0.99834	0.00100	0.00760
050-003	1.0004	0.0010	0.99958	0.00010	0.99918	0.00100	0.00739
050-004	1.0004	0.0010	0.99911	0.00010	0.99871	0.00100	0.00730
050-005	1.0004	0.0010	1.00078	0.00010	1.00038	0.00100	0.00716
050-006	1.0004	0.0010	1.00059	0.00010	1.00019	0.00100	0.00703
050-007	1.0004	0.0010	1.00062	0.00010	1.00022	0.00100	0.00700
050-008	1.0004	0.0010	0.99740	0.00010	0.99700	0.00100	0.00748
050-009	1.0004	0.0010	0.99784	0.00010	0.99745	0.00100	0.00729
050-010	1.0004	0.0010	0.99751	0.00010	0.99712	0.00100	0.00734
050-011	1.0004	0.0010	0.99850	0.00010	0.99810	0.00100	0.00737
050-012	1.0004	0.0010	0.99950	0.00010	0.99910	0.00100	0.00723
050-013	1.0004	0.0010	0.99961	0.00010	0.99921	0.00100	0.00715
050-014	1.0004	0.0010	0.99913	0.00010	0.99873	0.00100	0.00704
050-015	1.0004	0.0010	0.99978	0.00010	0.99938	0.00100	0.00700
050-016	1.0004	0.0010	1.00089	0.00010	1.00049	0.00100	0.00707
050-017	1.0004	0.0010	1.00088	0.00010	1.00048	0.00100	0.00706
050-018	1.0004	0.0010	1.00047	0.00010	1.00007	0.00100	0.00706
078-001	0.9995	0.0010	0.99814	0.00010	0.99864	0.00100	0.00825

Table A-16. Detailed ENDF/B-VII.1 CE results for KENO V.a LCT systems (continued).

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
078-002	0.9999	0.0010	0.99867	0.00010	0.99877	0.00100	0.00827
078-003	0.9990	0.0010	0.99748	0.00010	0.99847	0.00100	0.00831
078-004	0.9986	0.0010	0.99731	0.00010	0.99870	0.00101	0.00829
078-005	0.9980	0.0010	0.99692	0.00010	0.99891	0.00101	0.00830
078-006	0.9974	0.0010	0.99626	0.00010	0.99886	0.00101	0.00829
078-007	0.9994	0.0010	0.99790	0.00010	0.99849	0.00100	0.00830
078-008	0.9987	0.0010	0.99736	0.00010	0.99866	0.00100	0.00830
078-009	0.9978	0.0010	0.99646	0.00009	0.99865	0.00101	0.00830
078-010	0.9969	0.0010	0.99525	0.00010	0.99834	0.00101	0.00830
078-011	0.9994	0.0010	0.99799	0.00010	0.99859	0.00100	0.00825
078-012	0.9993	0.0010	0.99790	0.00010	0.99860	0.00100	0.00826
078-013	0.9993	0.0010	0.99772	0.00010	0.99841	0.00100	0.00827
078-014	0.9991	0.0010	0.99782	0.00010	0.99872	0.00100	0.00828
078-015	0.9996	0.0010	0.99860	0.00010	0.99900	0.00100	0.00843
080-001	0.9976	0.0010	0.99598	0.00010	0.99837	0.00101	0.00794
080-002	0.9982	0.0010	0.99636	0.00010	0.99816	0.00100	0.00797
080-003	0.9984	0.0010	0.99683	0.00010	0.99843	0.00100	0.00797
080-004	0.9981	0.0010	0.99637	0.00010	0.99827	0.00101	0.00796
080-005	0.9979	0.0010	0.99625	0.00010	0.99835	0.00101	0.00798
080-006	0.9975	0.0010	0.99574	0.00010	0.99823	0.00101	0.00797
080-007	0.9993	0.0010	0.99772	0.00010	0.99841	0.00100	0.00798
080-008	0.9987	0.0010	0.99714	0.00010	0.99843	0.00100	0.00795
080-009	0.9982	0.0010	0.99629	0.00010	0.99808	0.00100	0.00796
080-010	0.9972	0.0010	0.99570	0.00010	0.99849	0.00101	0.00798
080-011	0.9984	0.0010	0.99745	0.00010	0.99905	0.00101	0.00819

Table A-17. Detailed ENDF/B-VII.1 56-group results for KENO V.a LST systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
002-001	1.0038	0.0040	0.99804	0.00010	0.99426	0.00396	0.00697
002-002	1.0024	0.0037	0.99360	0.00010	0.99122	0.00366	0.00718
002-003	1.0024	0.0044	0.99876	0.00010	0.99637	0.00437	0.00710
003-001	0.9997	0.0039	0.99456	0.00010	0.99485	0.00388	0.00784
003-002	0.9993	0.0042	0.99372	0.00010	0.99442	0.00418	0.00760
003-003	0.9995	0.0042	0.99814	0.00010	0.99864	0.00420	0.00750
003-004	0.9995	0.0042	0.99173	0.00010	0.99223	0.00417	0.00747
003-005	0.9997	0.0048	0.99651	0.00010	0.99681	0.00479	0.00694
003-006	0.9999	0.0049	0.99715	0.00010	0.99725	0.00489	0.00688
003-007	0.9994	0.0049	0.99558	0.00010	0.99618	0.00489	0.00683
003-008	0.9993	0.0052	0.99947	0.00009	1.00017	0.00521	0.00664
003-009	0.9996	0.0052	0.99690	0.00010	0.99729	0.00519	0.00664
004-001	0.9994	0.0008	0.99757	0.00049	0.99817	0.00094	0.00761
004-002	0.9999	0.0009	0.99902	0.00049	0.99912	0.00102	0.00745
004-003	0.9999	0.0009	0.99684	0.00047	0.99694	0.00101	0.00733
004-004	0.9999	0.0010	0.99923	0.00043	0.99933	0.00109	0.00716
004-005	0.9999	0.0010	0.99971	0.00046	0.99981	0.00110	0.00705
004-006	0.9994	0.0011	0.99897	0.00038	0.99957	0.00116	0.00697
004-007	0.9996	0.0011	0.99880	0.00038	0.99920	0.00116	0.00688

Table A-18. Detailed ENDF/B-VII.1 252-group results for KENO V.a LST systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
002-001	1.0038	0.0040	0.99866	0.00010	0.99488	0.00397	0.00697
002-002	1.0024	0.0037	0.99419	0.00009	0.99181	0.00366	0.00718
002-003	1.0024	0.0044	0.99930	0.00010	0.99691	0.00438	0.00710
003-001	0.9997	0.0039	0.99561	0.00010	0.99591	0.00389	0.00784
003-002	0.9993	0.0042	0.99475	0.00010	0.99544	0.00418	0.00760
003-003	0.9995	0.0042	0.99902	0.00010	0.99952	0.00420	0.00750
003-004	0.9995	0.0042	0.99274	0.00010	0.99324	0.00417	0.00747
003-005	0.9997	0.0048	0.99724	0.00010	0.99754	0.00479	0.00694
003-006	0.9999	0.0049	0.99786	0.00010	0.99796	0.00489	0.00688
003-007	0.9994	0.0049	0.99606	0.00009	0.99666	0.00489	0.00683
003-008	0.9993	0.0052	0.99993	0.00010	1.00063	0.00521	0.00664
003-009	0.9996	0.0052	0.99739	0.00009	0.99778	0.00519	0.00664
004-001	0.9994	0.0008	0.99909	0.00048	0.99969	0.00093	0.00761
004-002	0.9999	0.0009	0.99995	0.00048	1.00005	0.00102	0.00745
004-003	0.9999	0.0009	0.99664	0.00044	0.99674	0.00100	0.00733
004-004	0.9999	0.0010	1.00133	0.00043	1.00143	0.00109	0.00716
004-005	0.9999	0.0010	1.00045	0.00046	1.00055	0.00110	0.00705
004-006	0.9994	0.0011	0.99990	0.00040	1.00050	0.00117	0.00697
004-007	0.9996	0.0011	0.99981	0.00043	1.00021	0.00118	0.00688

Table A-19. Detailed ENDF/B-VII.1 200-group results for KENO V.a LST systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
002-001	1.0038	0.0040	0.99881	0.00010	0.99502	0.00397	0.00697
002-002	1.0024	0.0037	0.99444	0.00010	0.99206	0.00366	0.00718
002-003	1.0024	0.0044	0.99965	0.00010	0.99726	0.00438	0.00710
003-001	0.9997	0.0039	0.99625	0.00010	0.99655	0.00389	0.00784
003-002	0.9993	0.0042	0.99553	0.00010	0.99623	0.00419	0.00760
003-003	0.9995	0.0042	0.99962	0.00010	1.00012	0.00420	0.00750
003-004	0.9995	0.0042	0.99314	0.00010	0.99364	0.00418	0.00747
003-005	0.9997	0.0048	0.99760	0.00010	0.99790	0.00479	0.00694
003-006	0.9999	0.0049	0.99801	0.00010	0.99811	0.00489	0.00688
003-007	0.9994	0.0049	0.99638	0.00010	0.99698	0.00489	0.00683
003-008	0.9993	0.0052	1.00009	0.00010	1.00079	0.00521	0.00664
003-009	0.9996	0.0052	0.99743	0.00010	0.99783	0.00519	0.00664
004-001	0.9994	0.0008	0.99921	0.00048	0.99981	0.00093	0.00761
004-002	0.9999	0.0009	1.00007	0.00048	1.00017	0.00102	0.00745
004-003	0.9999	0.0009	0.99848	0.00046	0.99858	0.00101	0.00733
004-004	0.9999	0.0010	1.00053	0.00040	1.00063	0.00108	0.00716
004-005	0.9999	0.0010	1.00141	0.00044	1.00151	0.00109	0.00705
004-006	0.9994	0.0011	0.99995	0.00045	1.00055	0.00119	0.00697
004-007	0.9996	0.0011	1.00088	0.00030	1.00128	0.00114	0.00688

Table A-20. Detailed ENDF/B-VII.1 CE results for KENO V.a LST systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
002-001	1.0038	0.0040	0.99887	0.00010	0.99508	0.00397	0.00697
002-002	1.0024	0.0037	0.99459	0.00010	0.99220	0.00366	0.00718
002-003	1.0024	0.0044	0.99957	0.00010	0.99718	0.00438	0.00710
003-001	0.9997	0.0039	0.99670	0.00010	0.99700	0.00389	0.00784
003-002	0.9993	0.0042	0.99549	0.00010	0.99618	0.00419	0.00760
003-003	0.9995	0.0042	0.99985	0.00010	1.00035	0.00420	0.00750
003-004	0.9995	0.0042	0.99327	0.00010	0.99376	0.00418	0.00747
003-005	0.9997	0.0048	0.99800	0.00009	0.99830	0.00479	0.00694
003-006	0.9999	0.0049	0.99836	0.00010	0.99846	0.00489	0.00688
003-007	0.9994	0.0049	0.99659	0.00010	0.99719	0.00489	0.00683
003-008	0.9993	0.0052	1.00017	0.00010	1.00087	0.00521	0.00664
003-009	0.9996	0.0052	0.99768	0.00010	0.99808	0.00519	0.00664
004-001	0.9994	0.0008	0.99954	0.00049	1.00014	0.00094	0.00761
004-002	0.9999	0.0009	1.00026	0.00048	1.00036	0.00102	0.00745
004-003	0.9999	0.0009	0.99866	0.00049	0.99876	0.00102	0.00733
004-004	0.9999	0.0010	1.00123	0.00048	1.00133	0.00111	0.00716
004-005	0.9999	0.0010	1.00114	0.00045	1.00124	0.00110	0.00705
004-006	0.9994	0.0011	1.00035	0.00044	1.00095	0.00119	0.00697
004-007	0.9996	0.0011	1.00028	0.00039	1.00068	0.00117	0.00688

Table A-21. Detailed ENDF/B-VII.1 56-group results for KENO V.a MCF systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
005-001	0.9913	0.0023	0.98609	0.00010	0.99475	0.00231	0.01363
006-001	0.9889	0.0021	0.99632	0.00010	1.00750	0.00214	0.01066

Table A-22. Detailed ENDF/B-VII.1 252-group results for KENO V.a MCF systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
005-001	0.9913	0.0023	0.99390	0.00010	1.00263	0.00233	0.01363
006-001	0.9889	0.0021	1.00024	0.00010	1.01147	0.00215	0.01066

Table A-23. Detailed ENDF/B-VII.1 200-group results for KENO V.a MCF systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
005-001	0.9913	0.0023	0.99299	0.00010	1.00171	0.00233	0.01363
006-001	0.9889	0.0021	0.99818	0.00010	1.00938	0.00215	0.01066

Table A-24. Detailed ENDF/B-VII.1 CE results for KENO V.a MCF systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
005-001	0.9913	0.0023	0.99033	0.00010	0.99902	0.00232	0.01363
006-001	0.9889	0.0021	0.99495	0.00010	1.00612	0.00214	0.01066

Table A-25. Detailed ENDF/B-VII.1 56-group results for KENO V.a MCT systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
001-001	1.0000	0.0025	1.00107	0.00010	1.00107	0.00250	0.00624
001-002	1.0000	0.0026	0.99952	0.00010	0.99952	0.00260	0.00697
001-003	1.0000	0.0032	0.99814	0.00010	0.99814	0.00320	0.00726
001-004	1.0000	0.0039	1.00066	0.00010	1.00066	0.00390	0.00741
002-001S	1.0024	0.0060	1.00175	0.00010	0.99935	0.00598	0.00644
002-002S	1.0009	0.0047	1.00258	0.00010	1.00168	0.00470	0.00597
002-003S	1.0042	0.0031	1.00252	0.00010	0.99833	0.00308	0.00690
002-004S	1.0024	0.0024	1.00648	0.00010	1.00407	0.00241	0.00574
002-005S	1.0038	0.0025	1.00450	0.00010	1.00070	0.00249	0.00685
002-006S	1.0029	0.0027	1.00690	0.00010	1.00399	0.00270	0.00585
004-001	1.0000	0.0046	0.99573	0.00010	0.99573	0.00458	0.00637
004-002	1.0000	0.0046	0.99652	0.00010	0.99652	0.00459	0.00636
004-003	1.0000	0.0046	0.99661	0.00010	0.99661	0.00459	0.00636
004-004	1.0000	0.0039	0.99617	0.00010	0.99617	0.00389	0.00641
004-005	1.0000	0.0039	0.99737	0.00010	0.99737	0.00389	0.00640
004-006	1.0000	0.0039	0.99724	0.00010	0.99724	0.00389	0.00641
004-007	1.0000	0.0040	0.99771	0.00010	0.99771	0.00399	0.00646
004-008	1.0000	0.0040	0.99823	0.00010	0.99823	0.00399	0.00645
004-009	1.0000	0.0040	0.99847	0.00010	0.99847	0.00400	0.00646
004-010	1.0000	0.0051	0.99882	0.00010	0.99882	0.00509	0.00650
004-011	1.0000	0.0051	0.99901	0.00009	0.99901	0.00510	0.00651

Table A-26. Detailed ENDF/B-VII.1 252-group results for KENO V.a MCT systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
001-001	1.0000	0.0025	1.00042	0.00010	1.00042	0.00250	0.00624
001-002	1.0000	0.0026	0.99925	0.00010	0.99925	0.00260	0.00697
001-003	1.0000	0.0032	0.99800	0.00010	0.99800	0.00320	0.00726
001-004	1.0000	0.0039	1.00050	0.00010	1.00050	0.00390	0.00741
002-001S	1.0024	0.0060	1.00102	0.00010	0.99862	0.00598	0.00644
002-002S	1.0009	0.0047	1.00215	0.00010	1.00125	0.00470	0.00597
002-003S	1.0042	0.0031	1.00212	0.00010	0.99793	0.00308	0.00690
002-004S	1.0024	0.0024	1.00617	0.00010	1.00376	0.00241	0.00574
002-005S	1.0038	0.0025	1.00406	0.00010	1.00026	0.00249	0.00685
002-006S	1.0029	0.0027	1.00648	0.00010	1.00357	0.00270	0.00585
004-001	1.0000	0.0046	0.99520	0.00010	0.99520	0.00458	0.00637
004-002	1.0000	0.0046	0.99594	0.00010	0.99594	0.00458	0.00636
004-003	1.0000	0.0046	0.99608	0.00010	0.99608	0.00458	0.00636
004-004	1.0000	0.0039	0.99589	0.00010	0.99589	0.00389	0.00641
004-005	1.0000	0.0039	0.99674	0.00010	0.99674	0.00389	0.00640
004-006	1.0000	0.0039	0.99670	0.00010	0.99670	0.00389	0.00641
004-007	1.0000	0.0040	0.99704	0.00010	0.99704	0.00399	0.00646
004-008	1.0000	0.0040	0.99758	0.00010	0.99758	0.00399	0.00645
004-009	1.0000	0.0040	0.99813	0.00010	0.99813	0.00399	0.00646
004-010	1.0000	0.0051	0.99829	0.00010	0.99829	0.00509	0.00650
004-011	1.0000	0.0051	0.99790	0.00010	0.99790	0.00509	0.00651

Table A-27. Detailed ENDF/B-VII.1 200-group results for KENO V.a MCT systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
001-001	1.0000	0.0025	1.00061	0.00010	1.00061	0.00250	0.00624
001-002	1.0000	0.0026	0.99924	0.00010	0.99924	0.00260	0.00697
001-003	1.0000	0.0032	0.99830	0.00010	0.99830	0.00320	0.00726
001-004	1.0000	0.0039	1.00073	0.00010	1.00073	0.00390	0.00741
002-001S	1.0024	0.0060	1.00049	0.00010	0.99810	0.00598	0.00644
002-002S	1.0009	0.0047	1.00122	0.00010	1.00032	0.00470	0.00597
002-003S	1.0042	0.0031	1.00151	0.00010	0.99732	0.00308	0.00690
002-004S	1.0024	0.0024	1.00529	0.00010	1.00289	0.00240	0.00574
002-005S	1.0038	0.0025	1.00368	0.00010	0.99988	0.00249	0.00685
002-006S	1.0029	0.0027	1.00567	0.00010	1.00276	0.00270	0.00585
004-001	1.0000	0.0046	0.99498	0.00010	0.99498	0.00458	0.00637
004-002	1.0000	0.0046	0.99569	0.00010	0.99569	0.00458	0.00636
004-003	1.0000	0.0046	0.99552	0.00010	0.99552	0.00458	0.00636
004-004	1.0000	0.0039	0.99552	0.00010	0.99552	0.00388	0.00641
004-005	1.0000	0.0039	0.99640	0.00010	0.99640	0.00389	0.00640
004-006	1.0000	0.0039	0.99621	0.00010	0.99621	0.00389	0.00641
004-007	1.0000	0.0040	0.99697	0.00010	0.99697	0.00399	0.00646
004-008	1.0000	0.0040	0.99751	0.00010	0.99751	0.00399	0.00645
004-009	1.0000	0.0040	0.99800	0.00010	0.99800	0.00399	0.00646
004-010	1.0000	0.0051	0.99788	0.00010	0.99788	0.00509	0.00650
004-011	1.0000	0.0051	0.99780	0.00010	0.99780	0.00509	0.00651

Table A-28. Detailed ENDF/B-VII.1 CE results for KENO V.a MCT systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
001-001	1.0000	0.0025	1.00107	0.00010	1.00107	0.00250	0.00624
001-002	1.0000	0.0026	0.99999	0.00010	0.99999	0.00260	0.00697
001-003	1.0000	0.0032	0.99859	0.00010	0.99859	0.00320	0.00726
001-004	1.0000	0.0039	1.00083	0.00010	1.00083	0.00390	0.00741
002-001S	1.0024	0.0060	1.00229	0.00010	0.99989	0.00599	0.00644
002-002S	1.0009	0.0047	1.00323	0.00010	1.00232	0.00471	0.00597
002-003S	1.0042	0.0031	1.00267	0.00010	0.99847	0.00308	0.00690
002-004S	1.0024	0.0024	1.00649	0.00010	1.00408	0.00241	0.00574
002-005S	1.0038	0.0025	1.00442	0.00010	1.00061	0.00249	0.00685
002-006S	1.0029	0.0027	1.00632	0.00010	1.00341	0.00270	0.00585
004-001	1.0000	0.0046	0.99618	0.00010	0.99618	0.00458	0.00637
004-002	1.0000	0.0046	0.99732	0.00010	0.99732	0.00459	0.00636
004-003	1.0000	0.0046	0.99707	0.00010	0.99707	0.00459	0.00636
004-004	1.0000	0.0039	0.99676	0.00010	0.99676	0.00389	0.00641
004-005	1.0000	0.0039	0.99792	0.00010	0.99792	0.00389	0.00640
004-006	1.0000	0.0039	0.99754	0.00010	0.99754	0.00389	0.00641
004-007	1.0000	0.0040	0.99761	0.00010	0.99761	0.00399	0.00646
004-008	1.0000	0.0040	0.99821	0.00010	0.99821	0.00399	0.00645
004-009	1.0000	0.0040	0.99872	0.00010	0.99872	0.00400	0.00646
004-010	1.0000	0.0051	0.99851	0.00010	0.99851	0.00509	0.00650
004-011	1.0000	0.0051	0.99841	0.00009	0.99841	0.00509	0.00651

Table A-29. Detailed ENDF/B-VII.1 56-group results for KENO V.a MST systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
002-001	1.0000	0.0024	1.00191	0.00010	1.00191	0.00241	0.00865
002-002	1.0000	0.0024	1.00227	0.00010	1.00227	0.00241	0.00867
002-003	1.0000	0.0024	1.00161	0.00010	1.00161	0.00241	0.00852
007-001	1.0000	0.0043	0.99419	0.00010	0.99419	0.00428	0.00770
007-002	1.0000	0.0077	0.99563	0.00010	0.99563	0.00767	0.00778
007-003	1.0000	0.0046	0.99946	0.00010	0.99946	0.00460	0.00831
007-004	1.0000	0.0046	0.99865	0.00010	0.99865	0.00459	0.00859
007-005	1.0000	0.0091	0.99669	0.00010	0.99669	0.00907	0.00877
007-006	1.0000	0.0043	0.99630	0.00010	0.99630	0.00429	0.00916
007-007	1.0000	0.0034	0.99323	0.00010	0.99323	0.00338	0.00928

Table A-30. Detailed ENDF/B-VII.1 252-group results for KENO V.a MST systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
002-001	1.0000	0.0024	1.00132	0.00010	1.00132	0.00241	0.00865
002-002	1.0000	0.0024	1.00176	0.00010	1.00176	0.00241	0.00867
002-003	1.0000	0.0024	1.00142	0.00010	1.00142	0.00241	0.00852
007-001	1.0000	0.0043	0.99438	0.00010	0.99438	0.00428	0.00770
007-002	1.0000	0.0077	0.99565	0.00010	0.99565	0.00767	0.00778
007-003	1.0000	0.0046	0.99987	0.00010	0.99987	0.00460	0.00831
007-004	1.0000	0.0046	0.99883	0.00010	0.99883	0.00460	0.00859
007-005	1.0000	0.0091	0.99693	0.00010	0.99693	0.00907	0.00877
007-006	1.0000	0.0043	0.99653	0.00010	0.99653	0.00429	0.00916
007-007	1.0000	0.0034	0.99323	0.00010	0.99323	0.00338	0.00928

Table A-31. Detailed ENDF/B-VII.1 200-group results for KENO V.a MST systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
002-001	1.0000	0.0024	1.00194	0.00010	1.00194	0.00241	0.00865
002-002	1.0000	0.0024	1.00205	0.00010	1.00205	0.00241	0.00867
002-003	1.0000	0.0024	1.00186	0.00010	1.00186	0.00241	0.00852
007-001	1.0000	0.0043	0.99498	0.00010	0.99498	0.00428	0.00770
007-002	1.0000	0.0077	0.99641	0.00010	0.99641	0.00767	0.00778
007-003	1.0000	0.0046	1.00050	0.00010	1.00050	0.00460	0.00831
007-004	1.0000	0.0046	0.99945	0.00010	0.99945	0.00460	0.00859
007-005	1.0000	0.0091	0.99741	0.00010	0.99741	0.00908	0.00877
007-006	1.0000	0.0043	0.99720	0.00010	0.99720	0.00429	0.00916
007-007	1.0000	0.0034	0.99381	0.00010	0.99381	0.00338	0.00928

Table A-32. Detailed ENDF/B-VII.1 CE results for KENO V.a MST systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
002-001	1.0000	0.0024	1.00125	0.00010	1.00125	0.00241	0.00865
002-002	1.0000	0.0024	1.00168	0.00010	1.00168	0.00241	0.00867
002-003	1.0000	0.0024	1.00130	0.00010	1.00130	0.00241	0.00852
007-001	1.0000	0.0043	0.99466	0.00010	0.99466	0.00428	0.00770
007-002	1.0000	0.0077	0.99609	0.00010	0.99609	0.00767	0.00778
007-003	1.0000	0.0046	1.00024	0.00010	1.00024	0.00460	0.00831
007-004	1.0000	0.0046	0.99911	0.00010	0.99911	0.00460	0.00859
007-005	1.0000	0.0091	0.99720	0.00010	0.99720	0.00908	0.00877
007-006	1.0000	0.0043	0.99700	0.00010	0.99700	0.00429	0.00916
007-007	1.0000	0.0034	0.99366	0.00010	0.99366	0.00338	0.00928

Table A-33. Detailed ENDF/B-VII.1 56-group results for KENO V.a PMF systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
001-001	1.0000	0.0020	1.00038	0.00010	1.00038	0.00200	0.00588
002-001	1.0000	0.0020	1.00051	0.00010	1.00051	0.00200	0.00491
005-001	1.0000	0.0013	1.00351	0.00010	1.00351	0.00131	0.00493
006-001	1.0000	0.0030	1.00080	0.00010	1.00080	0.00300	0.00573
008-001	1.0000	0.0006	0.99684	0.00010	0.99684	0.00061	0.00563
010-001	1.0000	0.0018	1.00082	0.00010	1.00082	0.00180	0.00730
018-001	1.0000	0.0030	0.99899	0.00010	0.99899	0.00300	0.00573
022-001	1.0000	0.0023	0.99913	0.00010	0.99913	0.00230	0.00606
023-001	1.0000	0.0022	0.99988	0.00010	0.99988	0.00220	0.00528
024-001	1.0000	0.0022	1.00336	0.00010	1.00336	0.00221	0.00599
025-001	1.0000	0.0020	0.99893	0.00010	0.99893	0.00200	0.00594
026-001	1.0000	0.0024	1.00706	0.00010	1.00706	0.00242	0.00719

Table A-34. Detailed ENDF/B-VII.1 252-group results for KENO V.a PMF systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
001-001	1.0000	0.0020	0.99974	0.00010	0.99974	0.00200	0.00588
002-001	1.0000	0.0020	1.00017	0.00010	1.00017	0.00200	0.00491
005-001	1.0000	0.0013	1.00139	0.00010	1.00139	0.00131	0.00493
006-001	1.0000	0.0030	1.00048	0.00010	1.00048	0.00300	0.00573
008-001	1.0000	0.0006	0.99649	0.00010	0.99649	0.00061	0.00563
010-001	1.0000	0.0018	0.99983	0.00010	0.99983	0.00180	0.00730
018-001	1.0000	0.0030	0.99950	0.00010	0.99950	0.00300	0.00573
022-001	1.0000	0.0023	0.99870	0.00010	0.99870	0.00230	0.00606
023-001	1.0000	0.0022	0.99971	0.00010	0.99971	0.00220	0.00528
024-001	1.0000	0.0022	1.00237	0.00010	1.00237	0.00221	0.00599
025-001	1.0000	0.0020	0.99837	0.00010	0.99837	0.00200	0.00594
026-001	1.0000	0.0024	1.00552	0.00010	1.00552	0.00242	0.00719

Table A-35. Detailed ENDF/B-VII.1 200-group results for KENO V.a PMF systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
001-001	1.0000	0.0020	0.99997	0.00010	0.99997	0.00200	0.00588
002-001	1.0000	0.0020	1.00017	0.00010	1.00017	0.00200	0.00491
005-001	1.0000	0.0013	1.00119	0.00010	1.00119	0.00131	0.00493
006-001	1.0000	0.0030	1.00087	0.00010	1.00087	0.00300	0.00573
008-001	1.0000	0.0006	0.99657	0.00010	0.99657	0.00061	0.00563
010-001	1.0000	0.0018	0.99999	0.00010	0.99999	0.00180	0.00730
018-001	1.0000	0.0030	0.99975	0.00010	0.99975	0.00300	0.00573
022-001	1.0000	0.0023	0.99861	0.00010	0.99861	0.00230	0.00606
023-001	1.0000	0.0022	0.99997	0.00010	0.99997	0.00220	0.00528
024-001	1.0000	0.0022	1.00233	0.00010	1.00233	0.00221	0.00599
025-001	1.0000	0.0020	0.99855	0.00010	0.99855	0.00200	0.00594
026-001	1.0000	0.0024	1.00360	0.00010	1.00360	0.00241	0.00719

Table A-36. Detailed ENDF/B-VII.1 CE results for KENO V.a PMF systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
001-001	1.0000	0.0020	0.99992	0.00010	0.99992	0.00200	0.00588
002-001	1.0000	0.0020	1.00023	0.00010	1.00023	0.00200	0.00491
005-001	1.0000	0.0013	1.00110	0.00010	1.00110	0.00131	0.00493
006-001	1.0000	0.0030	1.00153	0.00010	1.00153	0.00301	0.00573
008-001	1.0000	0.0006	0.99806	0.00010	0.99806	0.00061	0.00563
010-001	1.0000	0.0018	1.00000	0.00010	1.00000	0.00180	0.00730
018-001	1.0000	0.0030	0.99949	0.00010	0.99949	0.00300	0.00573
022-001	1.0000	0.0023	0.99858	0.00010	0.99858	0.00230	0.00606
023-001	1.0000	0.0022	0.99991	0.00010	0.99991	0.00220	0.00528
024-001	1.0000	0.0022	1.00199	0.00010	1.00199	0.00221	0.00599
025-001	1.0000	0.0020	0.99846	0.00010	0.99846	0.00200	0.00594
026-001	1.0000	0.0024	0.99708	0.00010	0.99708	0.00240	0.00719

Table A-37. Detailed ENDF/B-VII.1 56-group results for KENO V.a PST systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
001-001	1.0000	0.0050	1.00342	0.00010	1.00342	0.00502	0.00846
001-002	1.0000	0.0050	1.00575	0.00010	1.00575	0.00503	0.00836
001-003	1.0000	0.0050	1.00826	0.00010	1.00826	0.00504	0.00827
001-004	1.0000	0.0050	1.00280	0.00010	1.00280	0.00501	0.00827
001-005	1.0000	0.0050	1.00703	0.00010	1.00703	0.00504	0.00820
001-006	1.0000	0.0050	1.00828	0.00010	1.00828	0.00504	0.00781
002-001	1.0000	0.0047	1.00227	0.00010	1.00227	0.00471	0.00859
002-002	1.0000	0.0047	1.00287	0.00010	1.00287	0.00471	0.00858
002-003	1.0000	0.0047	1.00200	0.00010	1.00200	0.00471	0.00856
002-004	1.0000	0.0047	1.00495	0.00010	1.00495	0.00472	0.00854
002-005	1.0000	0.0047	1.00785	0.00010	1.00785	0.00474	0.00852
002-006	1.0000	0.0047	1.00365	0.00009	1.00365	0.00472	0.00850
002-007	1.0000	0.0047	1.00618	0.00010	1.00618	0.00473	0.00848
003-001	1.0000	0.0047	1.00070	0.00010	1.00070	0.00470	0.00866
003-002	1.0000	0.0047	1.00057	0.00010	1.00057	0.00470	0.00865
003-003	1.0000	0.0047	1.00314	0.00010	1.00314	0.00472	0.00860
003-004	1.0000	0.0047	1.00266	0.00010	1.00266	0.00471	0.00858
003-005	1.0000	0.0047	1.00373	0.00010	1.00373	0.00472	0.00856
003-006	1.0000	0.0047	1.00411	0.00010	1.00411	0.00472	0.00854
003-007	1.0000	0.0047	1.00512	0.00010	1.00512	0.00473	0.00862
003-008	1.0000	0.0047	1.00396	0.00010	1.00396	0.00472	0.00862
004-001	1.0000	0.0047	1.00224	0.00010	1.00224	0.00471	0.00867
004-002	1.0000	0.0047	0.99696	0.00010	0.99696	0.00469	0.00868
004-003	1.0000	0.0047	0.99905	0.00010	0.99905	0.00470	0.00867
004-004	1.0000	0.0047	0.99707	0.00010	0.99707	0.00469	0.00867
004-005	1.0000	0.0047	0.99789	0.00010	0.99789	0.00469	0.00865
004-006	1.0000	0.0047	0.99974	0.00010	0.99974	0.00470	0.00861
004-007	1.0000	0.0047	1.00390	0.00010	1.00390	0.00472	0.00859

Table A-37. Detailed ENDF/B-VII.1 56-group results for KENO V.a PST systems (continued).

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
004-008	1.0000	0.0047	0.99948	0.00010	0.99948	0.00470	0.00859
004-009	1.0000	0.0047	0.99885	0.00010	0.99885	0.00470	0.00857
004-010	1.0000	0.0047	1.00037	0.00010	1.00037	0.00470	0.00856
004-011	1.0000	0.0047	0.99888	0.00010	0.99888	0.00470	0.00854
004-012	1.0000	0.0047	1.00120	0.00010	1.00120	0.00471	0.00859
004-013	1.0000	0.0047	0.99864	0.00010	0.99864	0.00469	0.00861
005-001	1.0000	0.0047	1.00057	0.00010	1.00057	0.00470	0.00861
005-002	1.0000	0.0047	1.00125	0.00010	1.00125	0.00471	0.00859
005-003	1.0000	0.0047	1.00169	0.00010	1.00169	0.00471	0.00858
005-004	1.0000	0.0047	1.00337	0.00010	1.00337	0.00472	0.00855
005-005	1.0000	0.0047	1.00452	0.00010	1.00452	0.00472	0.00853
005-006	1.0000	0.0047	1.00396	0.00010	1.00396	0.00472	0.00852
005-007	1.0000	0.0047	1.00250	0.00010	1.00250	0.00471	0.00852
005-008	1.0000	0.0047	0.99772	0.00010	0.99772	0.00469	0.00859
005-009	1.0000	0.0047	1.00035	0.00010	1.00035	0.00470	0.00857
006-001	1.0000	0.0035	0.99898	0.00010	0.99898	0.00350	0.00862
006-002	1.0000	0.0035	1.00021	0.00010	1.00021	0.00350	0.00860
006-003	1.0000	0.0035	1.00011	0.00010	1.00011	0.00350	0.00857
007-001	1.0000	0.0047	1.00880	0.00010	1.00880	0.00474	0.00793
007-002	1.0000	0.0047	1.00332	0.00010	1.00332	0.00472	0.00799
007-003	1.0000	0.0047	1.00825	0.00010	1.00825	0.00474	0.00835
007-004	1.0000	0.0047	1.00187	0.00010	1.00187	0.00471	0.00837
007-005	1.0000	0.0047	1.00386	0.00010	1.00386	0.00472	0.00837
007-006	1.0000	0.0047	0.99758	0.00010	0.99758	0.00469	0.00839
007-007	1.0000	0.0047	0.99605	0.00010	0.99605	0.00468	0.00840
007-008	1.0000	0.0047	0.99954	0.00010	0.99954	0.00470	0.00841
011-001	1.0000	0.0052	1.00739	0.00010	1.00739	0.00524	0.00864
011-002	1.0000	0.0052	1.01201	0.00010	1.01201	0.00526	0.00862
011-003	1.0000	0.0052	1.01397	0.00010	1.01397	0.00527	0.00859
011-004	1.0000	0.0052	1.00674	0.00010	1.00674	0.00524	0.00864
011-005	1.0000	0.0052	1.00376	0.00010	1.00376	0.00522	0.00864
011-006	1.0000	0.0052	0.99254	0.00010	0.99254	0.00516	0.00867
011-007	1.0000	0.0052	0.99857	0.00010	0.99857	0.00519	0.00864
011-008	1.0000	0.0052	0.99497	0.00010	0.99497	0.00517	0.00865
011-009	1.0000	0.0052	0.99163	0.00010	0.99163	0.00516	0.00865
011-010	1.0000	0.0052	1.00140	0.00010	1.00140	0.00521	0.00858
011-011	1.0000	0.0052	0.99826	0.00010	0.99826	0.00519	0.00858
011-012	1.0000	0.0052	0.99785	0.00010	0.99785	0.00519	0.00862
020-001	1.0000	0.0059	1.00212	0.00010	1.00212	0.00591	0.00846
020-002	1.0000	0.0059	1.00447	0.00010	1.00447	0.00593	0.00846
020-003	1.0000	0.0059	0.99915	0.00010	0.99915	0.00590	0.00852
020-004	1.0000	0.0059	1.00286	0.00010	1.00286	0.00592	0.00843
020-005	1.0000	0.0059	1.00321	0.00010	1.00321	0.00592	0.00839
020-006	1.0000	0.0059	0.99678	0.00010	0.99678	0.00588	0.00851
020-007	1.0000	0.0059	1.00116	0.00010	1.00116	0.00591	0.00840
020-008	1.0000	0.0059	0.99248	0.00010	0.99248	0.00586	0.00850
020-009	1.0000	0.0059	1.00279	0.00010	1.00279	0.00592	0.00849
020-010	1.0000	0.0059	0.99956	0.00010	0.99956	0.00590	0.00854
020-011	1.0000	0.0059	1.00103	0.00010	1.00103	0.00591	0.00846
020-012	1.0000	0.0059	1.00227	0.00010	1.00227	0.00591	0.00844
020-013	1.0000	0.0059	0.99058	0.00010	0.99058	0.00585	0.00853
020-014	1.0000	0.0059	0.99428	0.00010	0.99428	0.00587	0.00847
020-015	1.0000	0.0059	1.00230	0.00010	1.00230	0.00591	0.00853

Table A-38. Detailed ENDF/B-VII.1 252-group results for KENO V.a PST systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
001-001	1.0000	0.0050	1.00420	0.00010	1.00420	0.00502	0.00846
001-002	1.0000	0.0050	1.00621	0.00010	1.00621	0.00503	0.00836
001-003	1.0000	0.0050	1.00874	0.00010	1.00874	0.00504	0.00827
001-004	1.0000	0.0050	1.00330	0.00010	1.00330	0.00502	0.00827
001-005	1.0000	0.0050	1.00731	0.00010	1.00731	0.00504	0.00820
001-006	1.0000	0.0050	1.00872	0.00010	1.00872	0.00504	0.00781
002-001	1.0000	0.0047	1.00275	0.00010	1.00275	0.00471	0.00859
002-002	1.0000	0.0047	1.00373	0.00010	1.00373	0.00472	0.00858
002-003	1.0000	0.0047	1.00274	0.00010	1.00274	0.00471	0.00856
002-004	1.0000	0.0047	1.00568	0.00010	1.00568	0.00473	0.00854
002-005	1.0000	0.0047	1.00854	0.00010	1.00854	0.00474	0.00852
002-006	1.0000	0.0047	1.00423	0.00010	1.00423	0.00472	0.00850
002-007	1.0000	0.0047	1.00667	0.00010	1.00667	0.00473	0.00848
003-001	1.0000	0.0047	1.00141	0.00010	1.00141	0.00471	0.00866
003-002	1.0000	0.0047	1.00116	0.00010	1.00116	0.00471	0.00865
003-003	1.0000	0.0047	1.00384	0.00010	1.00384	0.00472	0.00860
003-004	1.0000	0.0047	1.00314	0.00010	1.00314	0.00472	0.00858
003-005	1.0000	0.0047	1.00440	0.00010	1.00440	0.00472	0.00856
003-006	1.0000	0.0047	1.00472	0.00010	1.00472	0.00472	0.00854
003-007	1.0000	0.0047	1.00571	0.00010	1.00571	0.00473	0.00862
003-008	1.0000	0.0047	1.00449	0.00010	1.00449	0.00472	0.00862
004-001	1.0000	0.0047	1.00269	0.00010	1.00269	0.00471	0.00867
004-002	1.0000	0.0047	0.99752	0.00010	0.99752	0.00469	0.00868
004-003	1.0000	0.0047	0.99968	0.00010	0.99968	0.00470	0.00867
004-004	1.0000	0.0047	0.99751	0.00010	0.99751	0.00469	0.00867
004-005	1.0000	0.0047	0.99866	0.00010	0.99866	0.00469	0.00865
004-006	1.0000	0.0047	1.00062	0.00010	1.00062	0.00470	0.00861
004-007	1.0000	0.0047	1.00460	0.00010	1.00460	0.00472	0.00859
004-008	1.0000	0.0047	1.00017	0.00010	1.00017	0.00470	0.00859
004-009	1.0000	0.0047	0.99943	0.00010	0.99943	0.00470	0.00857
004-010	1.0000	0.0047	1.00112	0.00010	1.00112	0.00471	0.00856
004-011	1.0000	0.0047	0.99947	0.00010	0.99947	0.00470	0.00854
004-012	1.0000	0.0047	1.00204	0.00010	1.00204	0.00471	0.00859
004-013	1.0000	0.0047	0.99924	0.00010	0.99924	0.00470	0.00861
005-001	1.0000	0.0047	1.00106	0.00010	1.00106	0.00471	0.00861
005-002	1.0000	0.0047	1.00150	0.00010	1.00150	0.00471	0.00859
005-003	1.0000	0.0047	1.00224	0.00010	1.00224	0.00471	0.00858
005-004	1.0000	0.0047	1.00396	0.00010	1.00396	0.00472	0.00855
005-005	1.0000	0.0047	1.00519	0.00010	1.00519	0.00473	0.00853
005-006	1.0000	0.0047	1.00452	0.00010	1.00452	0.00472	0.00852
005-007	1.0000	0.0047	1.00322	0.00010	1.00322	0.00472	0.00852
005-008	1.0000	0.0047	0.99827	0.00010	0.99827	0.00469	0.00859
005-009	1.0000	0.0047	1.00112	0.00010	1.00112	0.00471	0.00857
006-001	1.0000	0.0035	0.99953	0.00010	0.99953	0.00350	0.00862
006-002	1.0000	0.0035	1.00075	0.00010	1.00075	0.00350	0.00860
006-003	1.0000	0.0035	1.00046	0.00010	1.00046	0.00350	0.00857
007-001	1.0000	0.0047	1.00907	0.00010	1.00907	0.00474	0.00793
007-002	1.0000	0.0047	1.00337	0.00010	1.00337	0.00472	0.00799
007-003	1.0000	0.0047	1.00850	0.00010	1.00850	0.00474	0.00835
007-004	1.0000	0.0047	1.00241	0.00010	1.00241	0.00471	0.00837
007-005	1.0000	0.0047	1.00459	0.00010	1.00459	0.00472	0.00837
007-006	1.0000	0.0047	0.99799	0.00010	0.99799	0.00469	0.00839
007-007	1.0000	0.0047	0.99649	0.00010	0.99649	0.00468	0.00840
007-008	1.0000	0.0047	1.00025	0.00010	1.00025	0.00470	0.00841
011-001	1.0000	0.0052	1.00819	0.00010	1.00819	0.00524	0.00864
011-002	1.0000	0.0052	1.01291	0.00010	1.01291	0.00527	0.00862
011-003	1.0000	0.0052	1.01498	0.00010	1.01498	0.00528	0.00859

Table A-38. Detailed ENDF/B-VII.1 252-group results for KENO V.a PST systems (continued).

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
011-004	1.0000	0.0052	1.00778	0.00010	1.00778	0.00524	0.00864
011-005	1.0000	0.0052	1.00472	0.00010	1.00472	0.00523	0.00864
011-006	1.0000	0.0052	0.99298	0.00010	0.99298	0.00516	0.00867
011-007	1.0000	0.0052	0.99885	0.00010	0.99885	0.00519	0.00864
011-008	1.0000	0.0052	0.99586	0.00010	0.99586	0.00518	0.00865
011-009	1.0000	0.0052	0.99208	0.00010	0.99208	0.00516	0.00865
011-010	1.0000	0.0052	1.00216	0.00010	1.00216	0.00521	0.00858
011-011	1.0000	0.0052	0.99884	0.00010	0.99884	0.00519	0.00858
011-012	1.0000	0.0052	0.99830	0.00010	0.99830	0.00519	0.00862
020-001	1.0000	0.0059	1.00263	0.00010	1.00263	0.00592	0.00846
020-002	1.0000	0.0059	1.00506	0.00010	1.00506	0.00593	0.00846
020-003	1.0000	0.0059	0.99963	0.00010	0.99963	0.00590	0.00852
020-004	1.0000	0.0059	1.00325	0.00010	1.00325	0.00592	0.00843
020-005	1.0000	0.0059	1.00347	0.00010	1.00347	0.00592	0.00839
020-006	1.0000	0.0059	0.99733	0.00010	0.99733	0.00589	0.00851
020-007	1.0000	0.0059	1.00216	0.00010	1.00216	0.00591	0.00840
020-008	1.0000	0.0059	0.99361	0.00010	0.99361	0.00586	0.00850
020-009	1.0000	0.0059	1.00324	0.00010	1.00324	0.00592	0.00849
020-010	1.0000	0.0059	1.00032	0.00010	1.00032	0.00590	0.00854
020-011	1.0000	0.0059	1.00148	0.00010	1.00148	0.00591	0.00846
020-012	1.0000	0.0059	1.00283	0.00010	1.00283	0.00592	0.00844
020-013	1.0000	0.0059	0.99165	0.00010	0.99165	0.00585	0.00853
020-014	1.0000	0.0059	0.99504	0.00010	0.99504	0.00587	0.00847
020-015	1.0000	0.0059	1.00285	0.00010	1.00285	0.00592	0.00853

Table A-39. Detailed ENDF/B-VII.1 200-group results for KENO V.a PST systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
001-001	1.0000	0.0050	1.00454	0.00010	1.00454	0.00502	0.00846
001-002	1.0000	0.0050	1.00685	0.00010	1.00685	0.00504	0.00836
001-003	1.0000	0.0050	1.00947	0.00010	1.00947	0.00505	0.00827
001-004	1.0000	0.0050	1.00411	0.00010	1.00411	0.00502	0.00827
001-005	1.0000	0.0050	1.00807	0.00010	1.00807	0.00504	0.00820
001-006	1.0000	0.0050	1.00943	0.00010	1.00943	0.00505	0.00781
002-001	1.0000	0.0047	1.00348	0.00010	1.00348	0.00472	0.00859
002-002	1.0000	0.0047	1.00433	0.00010	1.00433	0.00472	0.00858
002-003	1.0000	0.0047	1.00327	0.00010	1.00327	0.00472	0.00856
002-004	1.0000	0.0047	1.00604	0.00010	1.00604	0.00473	0.00854
002-005	1.0000	0.0047	1.00880	0.00010	1.00880	0.00474	0.00852
002-006	1.0000	0.0047	1.00505	0.00010	1.00505	0.00472	0.00850
002-007	1.0000	0.0047	1.00761	0.00010	1.00761	0.00474	0.00848
003-001	1.0000	0.0047	1.00228	0.00010	1.00228	0.00471	0.00866
003-002	1.0000	0.0047	1.00188	0.00010	1.00188	0.00471	0.00865
003-003	1.0000	0.0047	1.00432	0.00010	1.00432	0.00472	0.00860
003-004	1.0000	0.0047	1.00381	0.00010	1.00381	0.00472	0.00858
003-005	1.0000	0.0047	1.00492	0.00010	1.00492	0.00472	0.00856
003-006	1.0000	0.0047	1.00522	0.00010	1.00522	0.00473	0.00854
003-007	1.0000	0.0047	1.00633	0.00010	1.00633	0.00473	0.00862
003-008	1.0000	0.0047	1.00501	0.00010	1.00501	0.00472	0.00862
004-001	1.0000	0.0047	1.00322	0.00009	1.00322	0.00472	0.00867
004-002	1.0000	0.0047	0.99819	0.00010	0.99819	0.00469	0.00868
004-003	1.0000	0.0047	1.00035	0.00010	1.00035	0.00470	0.00867
004-004	1.0000	0.0047	0.99815	0.00010	0.99815	0.00469	0.00867
004-005	1.0000	0.0047	0.99935	0.00010	0.99935	0.00470	0.00865
004-006	1.0000	0.0047	1.00098	0.00010	1.00098	0.00471	0.00861

Table A-39. Detailed ENDF/B-VII.1 200-group results for KENO V.a PST systems (continued).

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
004-007	1.0000	0.0047	1.00500	0.00010	1.00500	0.00472	0.00859
004-008	1.0000	0.0047	1.00089	0.00010	1.00089	0.00471	0.00859
004-009	1.0000	0.0047	1.00009	0.00010	1.00009	0.00470	0.00857
004-010	1.0000	0.0047	1.00177	0.00010	1.00177	0.00471	0.00856
004-011	1.0000	0.0047	1.00007	0.00010	1.00007	0.00470	0.00854
004-012	1.0000	0.0047	1.00237	0.00010	1.00237	0.00471	0.00859
004-013	1.0000	0.0047	0.99983	0.00010	0.99983	0.00470	0.00861
005-001	1.0000	0.0047	1.00179	0.00010	1.00179	0.00471	0.00861
005-002	1.0000	0.0047	1.00224	0.00010	1.00224	0.00471	0.00859
005-003	1.0000	0.0047	1.00282	0.00010	1.00282	0.00471	0.00858
005-004	1.0000	0.0047	1.00448	0.00010	1.00448	0.00472	0.00855
005-005	1.0000	0.0047	1.00578	0.00010	1.00578	0.00473	0.00853
005-006	1.0000	0.0047	1.00531	0.00010	1.00531	0.00473	0.00852
005-007	1.0000	0.0047	1.00380	0.00010	1.00380	0.00472	0.00852
005-008	1.0000	0.0047	0.99889	0.00010	0.99889	0.00470	0.00859
005-009	1.0000	0.0047	1.00176	0.00010	1.00176	0.00471	0.00857
006-001	1.0000	0.0035	1.00017	0.00010	1.00017	0.00350	0.00862
006-002	1.0000	0.0035	1.00143	0.00010	1.00143	0.00351	0.00860
006-003	1.0000	0.0035	1.00110	0.00010	1.00110	0.00351	0.00857
007-001	1.0000	0.0047	1.00971	0.00010	1.00971	0.00475	0.00793
007-002	1.0000	0.0047	1.00404	0.00010	1.00404	0.00472	0.00799
007-003	1.0000	0.0047	1.00905	0.00010	1.00905	0.00474	0.00835
007-004	1.0000	0.0047	1.00311	0.00010	1.00311	0.00472	0.00837
007-005	1.0000	0.0047	1.00518	0.00010	1.00518	0.00473	0.00837
007-006	1.0000	0.0047	0.99859	0.00010	0.99859	0.00469	0.00839
007-007	1.0000	0.0047	0.99713	0.00010	0.99713	0.00469	0.00840
007-008	1.0000	0.0047	1.00053	0.00010	1.00053	0.00470	0.00841
011-001	1.0000	0.0052	1.00866	0.00010	1.00866	0.00525	0.00864
011-002	1.0000	0.0052	1.01350	0.00010	1.01350	0.00527	0.00862
011-003	1.0000	0.0052	1.01543	0.00010	1.01543	0.00528	0.00859
011-004	1.0000	0.0052	1.00810	0.00010	1.00810	0.00524	0.00864
011-005	1.0000	0.0052	1.00516	0.00010	1.00516	0.00523	0.00864
011-006	1.0000	0.0052	0.99351	0.00010	0.99351	0.00517	0.00867
011-007	1.0000	0.0052	0.99942	0.00010	0.99942	0.00520	0.00864
011-008	1.0000	0.0052	0.99622	0.00010	0.99622	0.00518	0.00865
011-009	1.0000	0.0052	0.99285	0.00010	0.99285	0.00516	0.00865
011-010	1.0000	0.0052	1.00264	0.00010	1.00264	0.00521	0.00858
011-011	1.0000	0.0052	0.99939	0.00010	0.99939	0.00520	0.00858
011-012	1.0000	0.0052	0.99887	0.00010	0.99887	0.00520	0.00862
020-001	1.0000	0.0059	1.00324	0.00010	1.00324	0.00592	0.00846
020-002	1.0000	0.0059	1.00577	0.00010	1.00577	0.00593	0.00846
020-003	1.0000	0.0059	1.00019	0.00010	1.00019	0.00590	0.00852
020-004	1.0000	0.0059	1.00388	0.00010	1.00388	0.00592	0.00843
020-005	1.0000	0.0059	1.00428	0.00010	1.00428	0.00593	0.00839
020-006	1.0000	0.0059	0.99793	0.00010	0.99793	0.00589	0.00851
020-007	1.0000	0.0059	1.00282	0.00010	1.00282	0.00592	0.00840
020-008	1.0000	0.0059	0.99421	0.00010	0.99421	0.00587	0.00850
020-009	1.0000	0.0059	1.00401	0.00010	1.00401	0.00592	0.00849
020-010	1.0000	0.0059	1.00079	0.00010	1.00079	0.00591	0.00854
020-011	1.0000	0.0059	1.00208	0.00010	1.00208	0.00591	0.00846
020-012	1.0000	0.0059	1.00315	0.00010	1.00315	0.00592	0.00844
020-013	1.0000	0.0059	0.99198	0.00010	0.99198	0.00585	0.00853
020-014	1.0000	0.0059	0.99576	0.00010	0.99576	0.00588	0.00847
020-015	1.0000	0.0059	1.00326	0.00010	1.00326	0.00592	0.00853

Table A-40. Detailed ENDF/B-VII.1 CE results for KENO V.a PST systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
001-001	1.0000	0.0050	1.00469	0.00009	1.00469	0.00502	0.00846
001-002	1.0000	0.0050	1.00693	0.00010	1.00693	0.00504	0.00836
001-003	1.0000	0.0050	1.00934	0.00010	1.00934	0.00505	0.00827
001-004	1.0000	0.0050	1.00378	0.00010	1.00378	0.00502	0.00827
001-005	1.0000	0.0050	1.00781	0.00010	1.00781	0.00504	0.00820
001-006	1.0000	0.0050	1.00892	0.00010	1.00892	0.00505	0.00781
002-001	1.0000	0.0047	1.00358	0.00010	1.00358	0.00472	0.00859
002-002	1.0000	0.0047	1.00449	0.00010	1.00449	0.00472	0.00858
002-003	1.0000	0.0047	1.00334	0.00010	1.00334	0.00472	0.00856
002-004	1.0000	0.0047	1.00623	0.00010	1.00623	0.00473	0.00854
002-005	1.0000	0.0047	1.00914	0.00010	1.00914	0.00474	0.00852
002-006	1.0000	0.0047	1.00500	0.00010	1.00500	0.00472	0.00850
002-007	1.0000	0.0047	1.00732	0.00010	1.00732	0.00474	0.00848
003-001	1.0000	0.0047	1.00216	0.00010	1.00216	0.00471	0.00866
003-002	1.0000	0.0047	1.00189	0.00010	1.00189	0.00471	0.00865
003-003	1.0000	0.0047	1.00435	0.00010	1.00435	0.00472	0.00860
003-004	1.0000	0.0047	1.00404	0.00010	1.00404	0.00472	0.00858
003-005	1.0000	0.0047	1.00511	0.00010	1.00511	0.00473	0.00856
003-006	1.0000	0.0047	1.00547	0.00010	1.00547	0.00473	0.00854
003-007	1.0000	0.0047	1.00639	0.00010	1.00639	0.00473	0.00862
003-008	1.0000	0.0047	1.00513	0.00010	1.00513	0.00473	0.00862
004-001	1.0000	0.0047	1.00347	0.00010	1.00347	0.00472	0.00867
004-002	1.0000	0.0047	0.99827	0.00010	0.99827	0.00469	0.00868
004-003	1.0000	0.0047	1.00037	0.00010	1.00037	0.00470	0.00867
004-004	1.0000	0.0047	0.99826	0.00010	0.99826	0.00469	0.00867
004-005	1.0000	0.0047	0.99955	0.00010	0.99955	0.00470	0.00865
004-006	1.0000	0.0047	1.00122	0.00010	1.00122	0.00471	0.00861
004-007	1.0000	0.0047	1.00496	0.00010	1.00496	0.00472	0.00859
004-008	1.0000	0.0047	1.00103	0.00010	1.00103	0.00471	0.00859
004-009	1.0000	0.0047	1.00036	0.00010	1.00036	0.00470	0.00857
004-010	1.0000	0.0047	1.00198	0.00010	1.00198	0.00471	0.00856
004-011	1.0000	0.0047	1.00019	0.00010	1.00019	0.00470	0.00854
004-012	1.0000	0.0047	1.00253	0.00010	1.00253	0.00471	0.00859
004-013	1.0000	0.0047	0.99988	0.00010	0.99988	0.00470	0.00861
005-001	1.0000	0.0047	1.00183	0.00010	1.00183	0.00471	0.00861
005-002	1.0000	0.0047	1.00228	0.00010	1.00228	0.00471	0.00859
005-003	1.0000	0.0047	1.00310	0.00010	1.00310	0.00472	0.00858
005-004	1.0000	0.0047	1.00477	0.00010	1.00477	0.00472	0.00855
005-005	1.0000	0.0047	1.00599	0.00010	1.00599	0.00473	0.00853
005-006	1.0000	0.0047	1.00565	0.00010	1.00565	0.00473	0.00852
005-007	1.0000	0.0047	1.00398	0.00010	1.00398	0.00472	0.00852
005-008	1.0000	0.0047	0.99902	0.00010	0.99902	0.00470	0.00859
005-009	1.0000	0.0047	1.00167	0.00010	1.00167	0.00471	0.00857
006-001	1.0000	0.0035	1.00032	0.00010	1.00032	0.00350	0.00862
006-002	1.0000	0.0035	1.00157	0.00010	1.00157	0.00351	0.00860
006-003	1.0000	0.0035	1.00113	0.00010	1.00113	0.00351	0.00857
007-001	1.0000	0.0047	1.00930	0.00010	1.00930	0.00474	0.00793
007-002	1.0000	0.0047	1.00390	0.00010	1.00390	0.00472	0.00799
007-003	1.0000	0.0047	1.00903	0.00010	1.00903	0.00474	0.00835
007-004	1.0000	0.0047	1.00322	0.00010	1.00322	0.00472	0.00837
007-005	1.0000	0.0047	1.00497	0.00010	1.00497	0.00472	0.00837
007-006	1.0000	0.0047	0.99857	0.00010	0.99857	0.00469	0.00839
007-007	1.0000	0.0047	0.99679	0.00010	0.99679	0.00469	0.00840
007-008	1.0000	0.0047	1.00084	0.00010	1.00084	0.00470	0.00841
011-001	1.0000	0.0052	1.00935	0.00010	1.00935	0.00525	0.00864
011-002	1.0000	0.0052	1.01391	0.00010	1.01391	0.00527	0.00862
011-003	1.0000	0.0052	1.01608	0.00010	1.01608	0.00528	0.00859

Table A-40. Detailed ENDF/B-VII.1 CE results for KENO V.a PST systems (continued).

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
011-004	1.0000	0.0052	1.00872	0.00010	1.00872	0.00525	0.00864
011-005	1.0000	0.0052	1.00570	0.00010	1.00570	0.00523	0.00864
011-006	1.0000	0.0052	0.99367	0.00010	0.99367	0.00517	0.00867
011-007	1.0000	0.0052	0.99971	0.00010	0.99971	0.00520	0.00864
011-008	1.0000	0.0052	0.99636	0.00010	0.99636	0.00518	0.00865
011-009	1.0000	0.0052	0.99309	0.00010	0.99309	0.00517	0.00865
011-010	1.0000	0.0052	1.00324	0.00010	1.00324	0.00522	0.00858
011-011	1.0000	0.0052	0.99973	0.00010	0.99973	0.00520	0.00858
011-012	1.0000	0.0052	0.99935	0.00010	0.99935	0.00520	0.00862
020-001	1.0000	0.0059	1.00340	0.00010	1.00340	0.00592	0.00846
020-002	1.0000	0.0059	1.00572	0.00010	1.00572	0.00593	0.00846
020-003	1.0000	0.0059	1.00031	0.00010	1.00031	0.00590	0.00852
020-004	1.0000	0.0059	1.00406	0.00010	1.00406	0.00592	0.00843
020-005	1.0000	0.0059	1.00424	0.00010	1.00424	0.00593	0.00839
020-006	1.0000	0.0059	0.99814	0.00010	0.99814	0.00589	0.00851
020-007	1.0000	0.0059	1.00321	0.00010	1.00321	0.00592	0.00840
020-008	1.0000	0.0059	0.99456	0.00010	0.99456	0.00587	0.00850
020-009	1.0000	0.0059	1.00402	0.00010	1.00402	0.00592	0.00849
020-010	1.0000	0.0059	1.00077	0.00010	1.00077	0.00591	0.00854
020-011	1.0000	0.0059	1.00232	0.00010	1.00232	0.00591	0.00846
020-012	1.0000	0.0059	1.00350	0.00010	1.00350	0.00592	0.00844
020-013	1.0000	0.0059	0.99257	0.00010	0.99257	0.00586	0.00853
020-014	1.0000	0.0059	0.99626	0.00010	0.99626	0.00588	0.00847
020-015	1.0000	0.0059	1.00352	0.00010	1.00352	0.00592	0.00853

Table A-41. Detailed ENDF/B-VII.1 56-group results for KENO V.a UCT systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty
001-002	1.0015	0.0025	1.00809	0.00010	1.00658	0.00251
001-003	1.0000	0.0024	1.00702	0.00010	1.00702	0.00242
001-004	1.0015	0.0024	1.00577	0.00010	1.00426	0.00241

Table A-42. Detailed ENDF/B-VII.1 252-group results for KENO V.a UCT systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty
001-002	1.0015	0.0025	1.00254	0.00010	1.00104	0.00250
001-003	1.0000	0.0024	1.00209	0.00010	1.00209	0.00241
001-004	1.0015	0.0024	1.00114	0.00010	0.99964	0.00240

Table A-43. Detailed ENDF/B-VII.1 200-group results for KENO V.a UCT systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty
001-002	1.0015	0.0025	1.00333	0.00010	1.00183	0.00250
001-003	1.0000	0.0024	1.00301	0.00010	1.00301	0.00241
001-004	1.0015	0.0024	1.00207	0.00010	1.00057	0.00240

Table A-44. Detailed ENDF/B-VII.1 CE results for KENO V.a UCT systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty
001-002	1.0015	0.0025	1.00211	0.00010	1.00061	0.00250
001-003	1.0000	0.0024	1.00189	0.00010	1.00189	0.00241
001-004	1.0015	0.0024	1.00095	0.00010	0.99945	0.00240

Table A-45. Detailed ENDF/B-VII.1 56-group results for KENO V.a UMF systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty
001-001	1.0000	0.0010	1.00183	0.00010	1.00183	0.00101
002-001	1.0000	0.0010	1.00088	0.00010	1.00088	0.00101
002-002	1.0000	0.0011	1.00222	0.00010	1.00222	0.00111
003-001	1.0000	0.0010	1.00186	0.00010	1.00186	0.00101
003-002	1.0000	0.0010	1.00271	0.00010	1.00271	0.00101
004-001	1.0000	0.0007	1.00165	0.00010	1.00165	0.00071
004-002	1.0000	0.0008	0.99949	0.00010	0.99949	0.00081
005-001	1.0000	0.0030	0.99774	0.00010	0.99774	0.00299
005-002	1.0000	0.0030	0.99753	0.00010	0.99753	0.00299
006-001	1.0000	0.0014	1.00108	0.00010	1.00108	0.00141

Table A-46. Detailed ENDF/B-VII.1 252-group results for KENO V.a UMF systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty
001-001	1.0000	0.0010	1.00024	0.00010	1.00024	0.00101
002-001	1.0000	0.0010	0.99934	0.00010	0.99934	0.00100
002-002	1.0000	0.0011	1.00070	0.00010	1.00070	0.00111
003-001	1.0000	0.0010	0.99994	0.00010	0.99994	0.00100
003-002	1.0000	0.0010	1.00059	0.00010	1.00059	0.00101
004-001	1.0000	0.0007	0.99917	0.00010	0.99917	0.00071
004-002	1.0000	0.0008	0.99628	0.00010	0.99628	0.00080
005-001	1.0000	0.0030	0.99632	0.00010	0.99632	0.00299
005-002	1.0000	0.0030	0.99545	0.00010	0.99545	0.00299
006-001	1.0000	0.0014	0.99958	0.00010	0.99958	0.00140

Table A-47. Detailed ENDF/B-VII.1 200-group results for KENO V.a UMF systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty
001-001	1.0000	0.0010	1.00013	0.00010	1.00013	0.00101
002-001	1.0000	0.0010	0.99893	0.00010	0.99893	0.00100
002-002	1.0000	0.0011	1.00039	0.00010	1.00039	0.00110
003-001	1.0000	0.0010	0.99971	0.00010	0.99971	0.00100
003-002	1.0000	0.0010	1.00032	0.00010	1.00032	0.00101
004-001	1.0000	0.0007	0.99898	0.00010	0.99898	0.00071
004-002	1.0000	0.0008	0.99605	0.00010	0.99605	0.00080
005-001	1.0000	0.0030	0.99613	0.00010	0.99613	0.00299
005-002	1.0000	0.0030	0.99551	0.00010	0.99551	0.00299
006-001	1.0000	0.0014	0.99942	0.00010	0.99942	0.00140

Table A-48. Detailed ENDF/B-VII.1 CE results for KENO V.a UMF systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty
001-001	1.0000	0.0010	1.00020	0.00010	1.00020	0.00101
002-001	1.0000	0.0010	0.99919	0.00010	0.99919	0.00100
002-002	1.0000	0.0011	1.00058	0.00010	1.00058	0.00111
003-001	1.0000	0.0010	0.99959	0.00010	0.99959	0.00100
003-002	1.0000	0.0010	1.00016	0.00010	1.00016	0.00101
004-001	1.0000	0.0007	0.99888	0.00010	0.99888	0.00071
004-002	1.0000	0.0008	0.99566	0.00010	0.99566	0.00080
005-001	1.0000	0.0030	0.99608	0.00010	0.99608	0.00299
005-002	1.0000	0.0030	0.99530	0.00010	0.99530	0.00299
006-001	1.0000	0.0014	0.99923	0.00010	0.99923	0.00140

Table A-49. Detailed ENDF/B-VII.1 56-group results for KENO V.a USI systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty
001-001	1.0000	0.0083	0.98973	0.00010	0.98973	0.00822
001-002	1.0000	0.0085	0.98498	0.00010	0.98498	0.00837
001-003	1.0000	0.0066	0.98563	0.00011	0.98563	0.00651
001-004	1.0000	0.0061	0.99760	0.00010	0.99760	0.00609
001-005	1.0000	0.0082	0.98906	0.00011	0.98906	0.00811
001-006	1.0000	0.0061	0.99088	0.00011	0.99088	0.00605
001-007	1.0000	0.0059	0.98631	0.00010	0.98631	0.00582
001-008	1.0000	0.0056	0.98559	0.00011	0.98559	0.00552
001-009	1.0000	0.0068	0.98478	0.00011	0.98478	0.00670
001-010	1.0000	0.0053	0.98300	0.00011	0.98300	0.00521
001-011	1.0000	0.0057	0.98526	0.00011	0.98526	0.00562
001-012	1.0000	0.0091	0.98588	0.00011	0.98588	0.00897
001-013	1.0000	0.0071	0.98629	0.00011	0.98629	0.00700
001-015	1.0000	0.0075	0.98397	0.00011	0.98397	0.00738
001-017	1.0000	0.0055	0.99354	0.00011	0.99354	0.00547
001-018	1.0000	0.0057	0.98241	0.00011	0.98241	0.00560
001-019	1.0000	0.0083	0.97924	0.00011	0.97924	0.00813
001-020	1.0000	0.0056	0.98450	0.00011	0.98450	0.00551
001-021	1.0000	0.0050	0.97694	0.00011	0.97694	0.00489
001-022	1.0000	0.0049	0.98199	0.00011	0.98199	0.00481
001-023	1.0000	0.0047	0.99433	0.00011	0.99433	0.00467
001-024	1.0000	0.0081	0.99625	0.00010	0.99625	0.00807
001-025	1.0000	0.0081	0.98862	0.00011	0.98862	0.00801
001-026	1.0000	0.0065	0.99210	0.00011	0.99210	0.00645
001-028	1.0000	0.0061	0.98650	0.00011	0.98650	0.00602
001-029	1.0000	0.0098	0.98044	0.00012	0.98044	0.00961
001-031	1.0000	0.0071	0.99402	0.00011	0.99402	0.00706
001-032	1.0000	0.0053	0.97850	0.00011	0.97850	0.00519
001-033	1.0000	0.0046	0.99703	0.00012	0.99703	0.00459

Table A-50. Detailed ENDF/B-VII.1 252-group results for KENO V.a USI systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty
001-001	1.0000	0.0083	0.98544	0.00010	0.98544	0.00818
001-002	1.0000	0.0085	0.98058	0.00010	0.98058	0.00834
001-003	1.0000	0.0066	0.98151	0.00011	0.98151	0.00648
001-004	1.0000	0.0061	0.99207	0.00010	0.99207	0.00605
001-005	1.0000	0.0082	0.98459	0.00011	0.98459	0.00807
001-006	1.0000	0.0061	0.98550	0.00011	0.98550	0.00601
001-007	1.0000	0.0059	0.98161	0.00010	0.98161	0.00579
001-008	1.0000	0.0056	0.98008	0.00011	0.98008	0.00549
001-009	1.0000	0.0068	0.97942	0.00011	0.97942	0.00666
001-010	1.0000	0.0053	0.97804	0.00012	0.97804	0.00519
001-011	1.0000	0.0057	0.98007	0.00011	0.98007	0.00559
001-012	1.0000	0.0091	0.98163	0.00010	0.98163	0.00893
001-013	1.0000	0.0071	0.98234	0.00011	0.98234	0.00698
001-015	1.0000	0.0075	0.97999	0.00010	0.97999	0.00735
001-017	1.0000	0.0055	0.98865	0.00011	0.98865	0.00544
001-018	1.0000	0.0057	0.97809	0.00011	0.97809	0.00558
001-019	1.0000	0.0083	0.97507	0.00011	0.97507	0.00809
001-020	1.0000	0.0056	0.97937	0.00011	0.97937	0.00549
001-021	1.0000	0.0050	0.97251	0.00011	0.97251	0.00486
001-022	1.0000	0.0049	0.97749	0.00011	0.97749	0.00479
001-023	1.0000	0.0047	0.98932	0.00012	0.98932	0.00465
001-024	1.0000	0.0081	0.99291	0.00011	0.99291	0.00804

Table A-50. Detailed ENDF/B-VII.1 252-group results for KENO V.a USI systems (continued).

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty
001-025	1.0000	0.0081	0.98535	0.00011	0.98535	0.00798
001-026	1.0000	0.0065	0.98900	0.00011	0.98900	0.00643
001-028	1.0000	0.0061	0.98322	0.00011	0.98322	0.00600
001-029	1.0000	0.0098	0.97707	0.00011	0.97707	0.00958
001-031	1.0000	0.0071	0.99051	0.00011	0.99051	0.00703
001-032	1.0000	0.0053	0.97502	0.00012	0.97502	0.00517
001-033	1.0000	0.0046	0.99280	0.00012	0.99280	0.00457

Table A-51. Detailed ENDF/B-VII.1 200-group results for KENO V.a USI systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty
001-001	1.0000	0.0083	0.98583	0.00010	0.98583	0.00818
001-002	1.0000	0.0085	0.98123	0.00010	0.98123	0.00834
001-003	1.0000	0.0066	0.98188	0.00011	0.98188	0.00648
001-004	1.0000	0.0061	0.99250	0.00010	0.99250	0.00606
001-005	1.0000	0.0082	0.98508	0.00011	0.98508	0.00808
001-006	1.0000	0.0061	0.98561	0.00011	0.98561	0.00601
001-007	1.0000	0.0059	0.98208	0.00010	0.98208	0.00580
001-008	1.0000	0.0056	0.98048	0.00011	0.98048	0.00549
001-009	1.0000	0.0068	0.97992	0.00011	0.97992	0.00666
001-010	1.0000	0.0053	0.97869	0.00011	0.97869	0.00519
001-011	1.0000	0.0057	0.98028	0.00011	0.98028	0.00559
001-012	1.0000	0.0091	0.98212	0.00011	0.98212	0.00894
001-013	1.0000	0.0071	0.98287	0.00011	0.98287	0.00698
001-015	1.0000	0.0075	0.98073	0.00011	0.98073	0.00736
001-017	1.0000	0.0055	0.98862	0.00011	0.98862	0.00544
001-018	1.0000	0.0057	0.97875	0.00011	0.97875	0.00558
001-019	1.0000	0.0083	0.97558	0.00011	0.97558	0.00810
001-020	1.0000	0.0056	0.97960	0.00011	0.97960	0.00549
001-021	1.0000	0.0050	0.97302	0.00012	0.97302	0.00487
001-022	1.0000	0.0049	0.97812	0.00011	0.97812	0.00479
001-023	1.0000	0.0047	0.98998	0.00012	0.98998	0.00465
001-024	1.0000	0.0081	0.99325	0.00010	0.99325	0.00805
001-025	1.0000	0.0081	0.98606	0.00011	0.98606	0.00799
001-026	1.0000	0.0065	0.98935	0.00011	0.98935	0.00643
001-028	1.0000	0.0061	0.98373	0.00011	0.98373	0.00600
001-029	1.0000	0.0098	0.97742	0.00011	0.97742	0.00958
001-031	1.0000	0.0071	0.99096	0.00011	0.99096	0.00704
001-032	1.0000	0.0053	0.97557	0.00012	0.97557	0.00517
001-033	1.0000	0.0046	0.99348	0.00012	0.99348	0.00457

Table A-52. Detailed ENDF/B-VII.1 CE results for KENO V.a USI systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty
001-001	1.0000	0.0083	0.98491	0.00010	0.98491	0.00818
001-002	1.0000	0.0085	0.98033	0.00010	0.98033	0.00833
001-003	1.0000	0.0066	0.98134	0.00011	0.98134	0.00648
001-004	1.0000	0.0061	0.99191	0.00010	0.99191	0.00605
001-005	1.0000	0.0082	0.98430	0.00011	0.98430	0.00807
001-006	1.0000	0.0061	0.98518	0.00011	0.98518	0.00601
001-007	1.0000	0.0059	0.98162	0.00010	0.98162	0.00579
001-008	1.0000	0.0056	0.98010	0.00011	0.98010	0.00549
001-009	1.0000	0.0068	0.97956	0.00011	0.97956	0.00666
001-010	1.0000	0.0053	0.97832	0.00011	0.97832	0.00519
001-011	1.0000	0.0057	0.98022	0.00011	0.98022	0.00559
001-012	1.0000	0.0091	0.98129	0.00011	0.98129	0.00893
001-013	1.0000	0.0071	0.98183	0.00011	0.98183	0.00697
001-015	1.0000	0.0075	0.97990	0.00011	0.97990	0.00735
001-017	1.0000	0.0055	0.98829	0.00010	0.98829	0.00544
001-018	1.0000	0.0057	0.97810	0.00011	0.97810	0.00558
001-019	1.0000	0.0083	0.97503	0.00011	0.97503	0.00809
001-020	1.0000	0.0056	0.97951	0.00010	0.97951	0.00549
001-021	1.0000	0.0050	0.97283	0.00010	0.97283	0.00487
001-022	1.0000	0.0049	0.97775	0.00011	0.97775	0.00479
001-023	1.0000	0.0047	0.98962	0.00011	0.98962	0.00465
001-024	1.0000	0.0081	0.99229	0.00011	0.99229	0.00804
001-025	1.0000	0.0081	0.98520	0.00011	0.98520	0.00798
001-026	1.0000	0.0065	0.98877	0.00011	0.98877	0.00643
001-028	1.0000	0.0061	0.98311	0.00011	0.98311	0.00600
001-029	1.0000	0.0098	0.97711	0.00011	0.97711	0.00958
001-031	1.0000	0.0071	0.99050	0.00011	0.99050	0.00703
001-032	1.0000	0.0053	0.97544	0.00011	0.97544	0.00517
001-033	1.0000	0.0046	0.99359	0.00011	0.99359	0.00457

Table A-53. Detailed ENDF/B-VII.1 56-group results for KENO V.a USM systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty
001-014	1.0000	0.0052	0.99505	0.00011	0.99505	0.00518
001-016	1.0000	0.0028	0.98015	0.00010	0.98015	0.00275
001-030	1.0000	0.0053	0.98189	0.00011	0.98189	0.00521
002-003	1.0000	0.0068	0.98908	0.00011	0.98908	0.00673
002-005	1.0000	0.0055	0.98854	0.00011	0.98854	0.00544
002-006	1.0000	0.0099	0.97913	0.00011	0.97913	0.00969
002-008	1.0000	0.0067	0.97583	0.00011	0.97583	0.00654
002-009	1.0000	0.0050	0.97091	0.00010	0.97091	0.00486

Table A-54. Detailed ENDF/B-VII.1 252-group results for KENO V.a USM systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty
001-014	1.0000	0.0052	0.98999	0.00011	0.98999	0.00515
001-016	1.0000	0.0028	0.97507	0.00010	0.97507	0.00273
001-030	1.0000	0.0053	0.97726	0.00011	0.97726	0.00518
002-003	1.0000	0.0068	0.98662	0.00011	0.98662	0.00671
002-005	1.0000	0.0055	0.98585	0.00012	0.98585	0.00542
002-006	1.0000	0.0099	0.97628	0.00011	0.97628	0.00967
002-008	1.0000	0.0067	0.97257	0.00012	0.97257	0.00652
002-009	1.0000	0.0050	0.96782	0.00010	0.96782	0.00484

Table A-55. Detailed ENDF/B-VII.1 200-group results for KENO V.a USM systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty
001-014	1.0000	0.0052	0.99017	0.00011	0.99017	0.00515
001-016	1.0000	0.0028	0.97520	0.00011	0.97520	0.00273
001-030	1.0000	0.0053	0.97757	0.00011	0.97757	0.00518
002-003	1.0000	0.0068	0.98717	0.00012	0.98717	0.00671
002-005	1.0000	0.0055	0.98653	0.00011	0.98653	0.00543
002-006	1.0000	0.0099	0.97696	0.00011	0.97696	0.00967
002-008	1.0000	0.0067	0.97310	0.00011	0.97310	0.00652
002-009	1.0000	0.0050	0.96858	0.00010	0.96858	0.00484

Table A-56. Detailed ENDF/B-VII.1 CE results for KENO V.a USM systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty
001-014	1.0000	0.0052	0.98973	0.00010	0.98973	0.00515
001-016	1.0000	0.0028	0.97435	0.00010	0.97435	0.00273
001-030	1.0000	0.0053	0.97752	0.00011	0.97752	0.00518
002-003	1.0000	0.0068	0.98655	0.00011	0.98655	0.00671
002-005	1.0000	0.0055	0.98594	0.00011	0.98594	0.00542
002-006	1.0000	0.0099	0.97656	0.00011	0.97656	0.00967
002-008	1.0000	0.0067	0.97282	0.00011	0.97282	0.00652
002-009	1.0000	0.0050	0.96839	0.00010	0.96839	0.00484

Table A-57. Detailed ENDF/B-VII.1 56-group results for KENO V.a UST systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty
001-001	1.0000	0.0031	1.00012	0.00010	1.00012	0.00310
001-002	1.0005	0.0033	0.99991	0.00010	0.99941	0.00330
001-003	1.0006	0.0033	0.99970	0.00010	0.99910	0.00330
001-004	0.9998	0.0033	0.99953	0.00010	0.99972	0.00330
001-005	0.9999	0.0033	0.99900	0.00010	0.99910	0.00330
002-001	1.0040	0.0087	1.00806	0.00011	1.00404	0.00870
002-002	1.0040	0.0087	0.99592	0.00011	0.99195	0.00860
002-003	1.0040	0.0087	1.01108	0.00010	1.00705	0.00873
002-004	1.0040	0.0087	1.00725	0.00011	1.00324	0.00869
002-005	1.0040	0.0087	1.01191	0.00010	1.00788	0.00873
002-006	1.0040	0.0087	0.99790	0.00010	0.99392	0.00861
002-007	1.0040	0.0087	0.98763	0.00010	0.98370	0.00852
002-008	1.0040	0.0087	1.00130	0.00010	0.99731	0.00864
002-009	1.0040	0.0087	0.98942	0.00010	0.98548	0.00854
002-010	1.0040	0.0087	1.00255	0.00010	0.99856	0.00865
002-011	1.0040	0.0087	1.01116	0.00010	1.00713	0.00873
002-012	1.0040	0.0087	0.99538	0.00011	0.99141	0.00859
002-013	1.0040	0.0087	0.99623	0.00011	0.99226	0.00860
002-014	1.0040	0.0087	1.00319	0.00011	0.99919	0.00866
002-015	1.0040	0.0087	1.00932	0.00010	1.00530	0.00871
002-017	1.0040	0.00870	1.00982	0.00010	1.00579	0.00872
003-001	0.9995	0.00871	1.00550	0.00011	1.00600	0.00877
003-002	0.9991	0.01513	1.02014	0.00011	1.02106	0.01546
003-003	1.0007	0.00871	1.00266	0.00011	1.00196	0.00872
003-004	1.0015	0.01258	1.00748	0.00011	1.00597	0.01264
003-005	1.0006	0.01222	1.01454	0.00011	1.01393	0.01238
003-006	1.0012	0.00871	1.02409	0.00011	1.02286	0.00890

Table A-57. Detailed ENDF/B-VII.1 56-group results for KENO V.a UST systems (continued).

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty
003-007	1.0016	0.00871	1.01654	0.00010	1.01492	0.00883
003-008	1.0016	0.00871	1.01196	0.00010	1.01035	0.00879
003-009	1.0018	0.00871	1.01177	0.00010	1.00995	0.00878
003-010	1.0008	0.00871	1.00738	0.00010	1.00658	0.00876
004-001	1.0039	0.0088	1.00522	0.00010	1.00131	0.00878
004-002	1.0034	0.0086	1.00795	0.00011	1.00453	0.00861
004-003	1.0041	0.0089	0.99888	0.00011	0.99480	0.00882
004-004	1.0051	0.0089	0.99050	0.00011	0.98547	0.00873
004-005	1.0037	0.0090	0.99571	0.00010	0.99204	0.00890
004-006	1.0020	0.0105	1.00718	0.00011	1.00517	0.01053
004-007	1.0020	0.0104	1.00359	0.00011	1.00159	0.01040
004-008	1.0020	0.0102	1.00851	0.00011	1.00650	0.01025
005-001	1.0000	0.0040	0.99995	0.00010	0.99995	0.00400
005-002	1.0000	0.0049	1.00329	0.00010	1.00329	0.00492
008-001	1.0006	0.0029	1.00111	0.00010	1.00051	0.00290
009-001	0.9966	0.0044	0.99553	0.00010	0.99893	0.00441
009-002	0.9981	0.0040	0.99883	0.00010	1.00073	0.00401
009-003	0.9989	0.0038	1.00045	0.00010	1.00155	0.00381
009-004	0.9998	0.0038	0.99948	0.00010	0.99968	0.00380
011-027	1.0000	0.0051	0.99454	0.00011	0.99454	0.00507
012-001	0.9990	0.0028	0.99941	0.00010	1.00041	0.00281
012-002	0.9993	0.0025	0.99897	0.00010	0.99967	0.00250
012-003	0.9994	0.0023	1.00921	0.00010	1.00981	0.00233
012-004	1.0000	0.0015	1.00161	0.00010	1.00161	0.00151
012-005	1.0000	0.0071	1.00322	0.00010	1.00322	0.00712
012-006	0.9987	0.0011	1.00280	0.00010	1.00410	0.00111
012-007	1.0000	0.0038	0.99963	0.00010	0.99963	0.00380
012-008	1.0000	0.0048	0.99690	0.00010	0.99690	0.00479
013-001	0.9992	0.0073	1.00319	0.00012	1.00399	0.00734
013-002	0.9992	0.0070	1.00338	0.00012	1.00418	0.00704
013-003	0.9992	0.0069	1.00350	0.00012	1.00430	0.00694
013-004	0.9992	0.0073	1.00394	0.00012	1.00474	0.00734
013-005	0.9992	0.0067	1.00448	0.00012	1.00528	0.00674
013-006	0.9992	0.0050	1.00418	0.00012	1.00498	0.00503
013-007	0.9992	0.0054	1.00400	0.00012	1.00480	0.00543
013-008	0.9992	0.0050	1.00477	0.00012	1.00557	0.00503
013-009	0.9992	0.0045	1.00473	0.00012	1.00553	0.00453
013-010	0.9992	0.0046	1.00543	0.00010	1.00624	0.00463
013-011	0.9992	0.0054	1.00304	0.00010	1.00385	0.00543
013-012	0.9992	0.0050	1.00396	0.00012	1.00476	0.00503
013-013	0.9992	0.0062	1.00145	0.00010	1.00225	0.00622
013-014	0.9992	0.0051	1.00425	0.00012	1.00505	0.00513
013-015	0.9992	0.0077	1.01897	0.00012	1.01979	0.00786
013-016	0.9992	0.0069	0.99109	0.00011	0.99188	0.00685
013-017	0.9992	0.0052	0.99358	0.00010	0.99438	0.00518
013-018	0.9992	0.0020	0.99758	0.00010	0.99838	0.00200
013-019	0.9992	0.0089	0.99378	0.00012	0.99458	0.00886
013-020	0.9992	0.0056	0.99555	0.00011	0.99635	0.00559
013-021	0.9992	0.0034	0.99943	0.00010	1.00023	0.00340
015-001	1.0000	0.0075	0.99339	0.00011	0.99339	0.00745
015-002	1.0000	0.0070	0.98819	0.00011	0.98819	0.00692
015-004	1.0000	0.0041	0.99287	0.00010	0.99287	0.00407
015-007	1.0000	0.0070	0.98998	0.00010	0.98998	0.00693
015-010	1.0000	0.0051	0.99258	0.00010	0.99258	0.00506
015-011	1.0000	0.0075	0.99593	0.00011	0.99593	0.00747
015-012	1.0000	0.0069	0.99619	0.00011	0.99619	0.00687
015-013	1.0000	0.0069	0.99393	0.00012	0.99393	0.00686
015-014	1.0000	0.0036	1.00017	0.00010	1.00017	0.00360

Table A-57. Detailed ENDF/B-VII.1 56-group results for KENO V.a UST systems (continued).

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty
015-015	1.0000	0.0060	0.99144	0.00011	0.99144	0.00595
015-016	1.0000	0.0043	0.99010	0.00011	0.99010	0.00426
015-017	1.0000	0.0029	0.99963	0.00010	0.99963	0.00290
015-018	1.0000	0.0056	0.97644	0.00011	0.97644	0.00547
015-019	1.0000	0.0052	0.97659	0.00012	0.97659	0.00508
015-020	1.0000	0.0079	0.99755	0.00010	0.99755	0.00788
015-021	1.0000	0.0070	0.99961	0.00011	0.99961	0.00700
015-022	1.0000	0.0062	0.99727	0.00011	0.99727	0.00618
015-023	1.0000	0.0055	0.99518	0.00011	0.99518	0.00547
015-024	1.0000	0.0051	0.99128	0.00011	0.99128	0.00506
015-025	1.0000	0.0023	0.99821	0.00010	0.99821	0.00230
015-026	1.0000	0.0066	0.99496	0.00011	0.99496	0.00657
015-027	1.0000	0.0063	0.99907	0.00011	0.99907	0.00630
015-028	1.0000	0.0058	0.99690	0.00010	0.99690	0.00578
015-029	1.0000	0.0051	0.99514	0.00010	0.99514	0.00508
015-030	1.0000	0.0048	0.99436	0.00010	0.99436	0.00477
015-031	1.0000	0.0055	0.99333	0.00011	0.99333	0.00546
016-001	0.9987	0.0037	1.00370	0.00012	1.00501	0.00373
016-002	0.9983	0.0044	1.00492	0.00010	1.00663	0.00444
016-003	0.9992	0.0036	1.00458	0.00012	1.00538	0.00362
016-004	0.9992	0.0035	1.00604	0.00012	1.00685	0.00353
016-006	0.9993	0.0034	0.99561	0.00013	0.99631	0.00339
016-007	1.0008	0.0034	0.99669	0.00012	0.99589	0.00339
016-008	1.0011	0.0028	0.99626	0.00010	0.99517	0.00279
016-009	1.0000	0.0027	0.99603	0.00012	0.99603	0.00269
016-010	1.0000	0.0030	1.00352	0.00010	1.00352	0.00301
016-011	0.9992	0.0041	1.00330	0.00012	1.00410	0.00412
016-012	0.9992	0.0047	1.00345	0.00012	1.00425	0.00473
016-013	0.9993	0.0036	1.00330	0.00011	1.00400	0.00362
016-014	1.0000	0.0026	1.00454	0.00012	1.00454	0.00261
016-015	1.0000	0.0027	1.00527	0.00011	1.00527	0.00272
016-016	0.9994	0.0031	1.00847	0.00011	1.00908	0.00313
016-017	1.0000	0.0028	0.99433	0.00011	0.99433	0.00279
016-018	0.9988	0.0036	0.99450	0.00012	0.99569	0.00359
016-019	1.0000	0.0035	0.99420	0.00012	0.99420	0.00348
016-021	1.0000	0.0028	1.00755	0.00011	1.00755	0.00282
016-022	1.0000	0.0034	1.00772	0.00011	1.00772	0.00343
016-023	1.0000	0.0031	1.00785	0.00012	1.00785	0.00313
016-024	1.0012	0.0024	1.00824	0.00012	1.00703	0.00242
016-025	0.9981	0.0040	0.99758	0.00010	0.99948	0.00401
016-026	0.9980	0.0034	1.00299	0.00011	1.00500	0.00343
016-027	0.9988	0.0037	1.00098	0.00011	1.00218	0.00371
016-028	0.9986	0.0037	0.99592	0.00011	0.99732	0.00370
016-029	0.9985	0.0031	0.99663	0.00011	0.99813	0.00310
016-030	0.9993	0.0032	0.99628	0.00011	0.99698	0.00319
016-031	0.9990	0.0034	1.00723	0.00010	1.00824	0.00343
016-032	0.9985	0.0032	1.00904	0.00010	1.01056	0.00324
016-033	0.9986	0.0039	1.00893	0.00010	1.01034	0.00395
017-001	0.9997	0.0032	1.00451	0.00011	1.00481	0.00322
017-002	1.0000	0.0025	1.00038	0.00011	1.00038	0.00250
017-003	1.0001	0.0035	1.00478	0.00011	1.00468	0.00352
017-004	0.9994	0.0040	1.00454	0.00010	1.00514	0.00402
017-005	1.0000	0.0029	1.00118	0.00010	1.00118	0.00291
017-006	1.0000	0.0029	0.99867	0.00010	0.99867	0.00290
017-007	1.0000	0.0037	0.99851	0.00010	0.99851	0.00370

Table A-58. Detailed ENDF/B-VII.1 252-group results for KENO V.a UST systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty
001-001	1.0000	0.0031	1.00052	0.00010	1.00052	0.00310
001-002	1.0005	0.0033	1.00044	0.00010	0.99994	0.00330
001-003	1.0006	0.0033	0.99987	0.00010	0.99927	0.00330
001-004	0.9998	0.0033	1.00005	0.00010	1.00025	0.00330
001-005	0.9999	0.0033	0.99944	0.00010	0.99953	0.00330
002-001	1.0040	0.0087	1.00560	0.00011	1.00159	0.00868
002-002	1.0040	0.0087	0.99360	0.00010	0.98964	0.00858
002-003	1.0040	0.0087	1.00935	0.00011	1.00533	0.00871
002-004	1.0040	0.0087	1.00598	0.00010	1.00197	0.00868
002-005	1.0040	0.0087	1.01095	0.00010	1.00692	0.00873
002-006	1.0040	0.0087	0.99727	0.00010	0.99330	0.00861
002-007	1.0040	0.0087	0.98708	0.00010	0.98315	0.00852
002-008	1.0040	0.0087	1.00096	0.00010	0.99697	0.00864
002-009	1.0040	0.0087	0.98942	0.00010	0.98547	0.00854
002-010	1.0040	0.0087	1.00248	0.00010	0.99849	0.00865
002-011	1.0040	0.0087	1.01125	0.00010	1.00722	0.00873
002-012	1.0040	0.0087	0.99279	0.00011	0.98883	0.00857
002-013	1.0040	0.0087	0.99260	0.00011	0.98865	0.00857
002-014	1.0040	0.0087	1.00102	0.00011	0.99703	0.00864
002-015	1.0040	0.0087	1.00773	0.00010	1.00372	0.00870
002-017	1.0040	0.00870	1.00947	0.00010	1.00545	0.00871
003-001	0.9995	0.00871	1.00205	0.00011	1.00255	0.00874
003-002	0.9991	0.01513	1.01679	0.00011	1.01771	0.01541
003-003	1.0007	0.00871	0.99928	0.00011	0.99858	0.00869
003-004	1.0015	0.01258	1.00355	0.00011	1.00205	0.01259
003-005	1.0006	0.01222	1.00998	0.00011	1.00937	0.01233
003-006	1.0012	0.00871	1.02206	0.00011	1.02083	0.00888
003-007	1.0016	0.00871	1.01521	0.00010	1.01359	0.00881
003-008	1.0016	0.00871	1.01103	0.00010	1.00942	0.00878
003-009	1.0018	0.00871	1.01090	0.00010	1.00908	0.00877
003-010	1.0008	0.00871	1.00761	0.00010	1.00681	0.00876
004-001	1.0039	0.0088	1.00265	0.00010	0.99876	0.00876
004-002	1.0034	0.0086	1.00570	0.00011	1.00229	0.00859
004-003	1.0041	0.0089	0.99602	0.00011	0.99195	0.00879
004-004	1.0051	0.0089	0.98680	0.00011	0.98179	0.00869
004-005	1.0037	0.0090	0.99258	0.00011	0.98892	0.00887
004-006	1.0020	0.0105	1.00346	0.00011	1.00146	0.01049
004-007	1.0020	0.0104	1.00046	0.00011	0.99846	0.01036
004-008	1.0020	0.0102	1.00651	0.00011	1.00450	0.01023
005-001	1.0000	0.0040	1.00027	0.00010	1.00027	0.00400
005-002	1.0000	0.0049	1.00345	0.00010	1.00345	0.00492
008-001	1.0006	0.0029	1.00090	0.00010	1.00030	0.00290
009-001	0.9966	0.0044	0.99538	0.00010	0.99877	0.00441
009-002	0.9981	0.0040	0.99872	0.00010	1.00062	0.00401
009-003	0.9989	0.0038	1.00014	0.00010	1.00124	0.00381
009-004	0.9998	0.0038	0.99920	0.00010	0.99940	0.00380
011-027	1.0000	0.0051	0.99021	0.00011	0.99021	0.00505
012-001	0.9990	0.0028	0.99822	0.00010	0.99922	0.00280
012-002	0.9993	0.0025	0.99808	0.00010	0.99878	0.00250
012-003	0.9994	0.0023	1.00816	0.00010	1.00876	0.00232
012-004	1.0000	0.0015	1.00112	0.00010	1.00112	0.00150
012-005	1.0000	0.0071	1.00299	0.00010	1.00299	0.00712
012-006	0.9987	0.0011	1.00275	0.00010	1.00406	0.00111
012-007	1.0000	0.0038	1.00008	0.00010	1.00008	0.00380
012-008	1.0000	0.0048	0.99728	0.00010	0.99728	0.00479
013-001	0.9992	0.0073	1.00276	0.00012	1.00356	0.00733
013-002	0.9992	0.0070	1.00329	0.00012	1.00409	0.00704

Table A-58. Detailed ENDF/B-VII.1 252-group results for KENO V.a UST systems (continued).

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty
013-003	0.9992	0.0069	1.00330	0.00012	1.00410	0.00693
013-004	0.9992	0.0073	1.00355	0.00012	1.00435	0.00734
013-005	0.9992	0.0067	1.00423	0.00012	1.00503	0.00674
013-006	0.9992	0.0050	1.00386	0.00012	1.00466	0.00503
013-007	0.9992	0.0054	1.00382	0.00011	1.00462	0.00543
013-008	0.9992	0.0050	1.00448	0.00012	1.00528	0.00503
013-009	0.9992	0.0045	1.00485	0.00012	1.00565	0.00453
013-010	0.9992	0.0046	1.00533	0.00010	1.00613	0.00463
013-011	0.9992	0.0054	1.00285	0.00010	1.00365	0.00542
013-012	0.9992	0.0050	1.00366	0.00012	1.00446	0.00503
013-013	0.9992	0.0062	1.00119	0.00010	1.00199	0.00622
013-014	0.9992	0.0051	1.00391	0.00012	1.00471	0.00513
013-015	0.9992	0.0077	1.01893	0.00012	1.01975	0.00786
013-016	0.9992	0.0069	0.99131	0.00012	0.99210	0.00685
013-017	0.9992	0.0052	0.99381	0.00010	0.99461	0.00518
013-018	0.9992	0.0020	0.99805	0.00010	0.99885	0.00200
013-019	0.9992	0.0089	0.99419	0.00011	0.99499	0.00886
013-020	0.9992	0.0056	0.99631	0.00010	0.99711	0.00559
013-021	0.9992	0.0034	1.00021	0.00010	1.00101	0.00341
015-001	1.0000	0.0075	0.99070	0.00011	0.99070	0.00743
015-002	1.0000	0.0070	0.98560	0.00011	0.98560	0.00690
015-004	1.0000	0.0041	0.98908	0.00010	0.98908	0.00406
015-007	1.0000	0.0070	0.98637	0.00010	0.98637	0.00691
015-010	1.0000	0.0051	0.98898	0.00010	0.98898	0.00504
015-011	1.0000	0.0075	0.99386	0.00011	0.99386	0.00745
015-012	1.0000	0.0069	0.99422	0.00011	0.99422	0.00686
015-013	1.0000	0.0069	0.99191	0.00011	0.99191	0.00685
015-014	1.0000	0.0036	0.99654	0.00010	0.99654	0.00359
015-015	1.0000	0.0060	0.98920	0.00011	0.98920	0.00594
015-016	1.0000	0.0043	0.98808	0.00011	0.98808	0.00425
015-017	1.0000	0.0029	0.99619	0.00010	0.99619	0.00289
015-018	1.0000	0.0056	0.97365	0.00011	0.97365	0.00545
015-019	1.0000	0.0052	0.97388	0.00011	0.97388	0.00507
015-020	1.0000	0.0079	0.99555	0.00010	0.99555	0.00787
015-021	1.0000	0.0070	0.99839	0.00011	0.99839	0.00699
015-022	1.0000	0.0062	0.99610	0.00011	0.99610	0.00618
015-023	1.0000	0.0055	0.99374	0.00011	0.99374	0.00547
015-024	1.0000	0.0051	0.99040	0.00011	0.99040	0.00505
015-025	1.0000	0.0023	0.99554	0.00010	0.99554	0.00229
015-026	1.0000	0.0066	0.99442	0.00010	0.99442	0.00656
015-027	1.0000	0.0063	0.99872	0.00010	0.99872	0.00629
015-028	1.0000	0.0058	0.99655	0.00010	0.99655	0.00578
015-029	1.0000	0.0051	0.99476	0.00010	0.99476	0.00507
015-030	1.0000	0.0048	0.99396	0.00010	0.99396	0.00477
015-031	1.0000	0.0055	0.99278	0.00011	0.99278	0.00546
016-001	0.9987	0.0037	1.00164	0.00012	1.00294	0.00372
016-002	0.9983	0.0044	1.00263	0.00010	1.00434	0.00443
016-003	0.9992	0.0036	1.00232	0.00012	1.00312	0.00362
016-004	0.9992	0.0035	1.00392	0.00012	1.00472	0.00352
016-006	0.9993	0.0034	0.99382	0.00012	0.99452	0.00339
016-007	1.0008	0.0034	0.99468	0.00012	0.99388	0.00338
016-008	1.0011	0.0028	0.99437	0.00010	0.99328	0.00278
016-009	1.0000	0.0027	0.99402	0.00012	0.99402	0.00269
016-010	1.0000	0.0030	1.00223	0.00010	1.00223	0.00301
016-011	0.9992	0.0041	1.00215	0.00013	1.00295	0.00412
016-012	0.9992	0.0047	1.00227	0.00012	1.00307	0.00472
016-013	0.9993	0.0036	1.00250	0.00011	1.00320	0.00362
016-014	1.0000	0.0026	1.00320	0.00012	1.00320	0.00261

Table A-58. Detailed ENDF/B-VII.1 252-group results for KENO V.a UST systems (continued).

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty
016-015	1.0000	0.0027	1.00429	0.00012	1.00429	0.00271
016-016	0.9994	0.0031	1.00752	0.00011	1.00812	0.00313
016-017	1.0000	0.0028	0.99297	0.00011	0.99297	0.00278
016-018	0.9988	0.0036	0.99321	0.00012	0.99440	0.00359
016-019	1.0000	0.0035	0.99317	0.00011	0.99317	0.00348
016-021	1.0000	0.0028	1.00719	0.00012	1.00719	0.00282
016-022	1.0000	0.0034	1.00702	0.00011	1.00702	0.00343
016-023	1.0000	0.0031	1.00714	0.00012	1.00714	0.00312
016-024	1.0012	0.0024	1.00762	0.00012	1.00641	0.00242
016-025	0.9981	0.0040	0.99743	0.00010	0.99933	0.00401
016-026	0.9980	0.0034	1.00301	0.00011	1.00502	0.00343
016-027	0.9988	0.0037	1.00063	0.00011	1.00183	0.00371
016-028	0.9986	0.0037	0.99634	0.00011	0.99774	0.00370
016-029	0.9985	0.0031	0.99678	0.00011	0.99828	0.00310
016-030	0.9993	0.0032	0.99660	0.00011	0.99730	0.00320
016-031	0.9990	0.0034	1.00771	0.00010	1.00872	0.00343
016-032	0.9985	0.0032	1.00967	0.00010	1.01119	0.00324
016-033	0.9986	0.0039	1.00979	0.00010	1.01121	0.00395
017-001	0.9997	0.0032	1.00348	0.00011	1.00378	0.00321
017-002	1.0000	0.0025	0.99905	0.00011	0.99905	0.00250
017-003	1.0001	0.0035	1.00417	0.00011	1.00407	0.00352
017-004	0.9994	0.0040	1.00396	0.00011	1.00456	0.00402
017-005	1.0000	0.0029	1.00124	0.00010	1.00124	0.00291
017-006	1.0000	0.0029	0.99917	0.00010	0.99917	0.00290
017-007	1.0000	0.0037	0.99850	0.00010	0.99850	0.00370

Table A-59. Detailed ENDF/B-VII.1 200-group results for KENO V.a UST systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty
001-001	1.0000	0.0031	1.00068	0.00010	1.00068	0.00310
001-002	1.0005	0.0033	1.00050	0.00010	1.00000	0.00330
001-003	1.0006	0.0033	1.00008	0.00010	0.99948	0.00330
001-004	0.9998	0.0033	0.99999	0.00010	1.00019	0.00330
001-005	0.9999	0.0033	0.99956	0.00010	0.99966	0.00330
002-001	1.0040	0.0087	1.00604	0.00011	1.00203	0.00868
002-002	1.0040	0.0087	0.99391	0.00011	0.98995	0.00858
002-003	1.0040	0.0087	1.00964	0.00011	1.00562	0.00871
002-004	1.0040	0.0087	1.00636	0.00010	1.00235	0.00869
002-005	1.0040	0.0087	1.01136	0.00010	1.00733	0.00873
002-006	1.0040	0.0087	0.99739	0.00010	0.99342	0.00861
002-007	1.0040	0.0087	0.98747	0.00010	0.98354	0.00852
002-008	1.0040	0.0087	1.00133	0.00010	0.99734	0.00864
002-009	1.0040	0.0087	0.98979	0.00010	0.98584	0.00854
002-010	1.0040	0.0087	1.00282	0.00010	0.99882	0.00866
002-011	1.0040	0.0087	1.01142	0.00010	1.00739	0.00873
002-012	1.0040	0.0087	0.99315	0.00011	0.98919	0.00857
002-013	1.0040	0.0087	0.99295	0.00011	0.98899	0.00857
002-014	1.0040	0.0087	1.00174	0.00011	0.99775	0.00865
002-015	1.0040	0.0087	1.00824	0.00011	1.00422	0.00870
002-017	1.0040	0.00870	1.00984	0.00010	1.00582	0.00872
003-001	0.9995	0.00871	1.00230	0.00011	1.00280	0.00874
003-002	0.9991	0.01513	1.01688	0.00011	1.01780	0.01541
003-003	1.0007	0.00871	0.99964	0.00011	0.99894	0.00870
003-004	1.0015	0.01258	1.00395	0.00011	1.00245	0.01259
003-005	1.0006	0.01222	1.01028	0.00011	1.00967	0.01233
003-006	1.0012	0.00871	1.02250	0.00012	1.02127	0.00889

Table A-59. Detailed ENDF/B-VII.1 200-group results for KENO V.a UST systems (continued).

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty
003-007	1.0016	0.00871	1.01540	0.00010	1.01378	0.00882
003-008	1.0016	0.00871	1.01134	0.00010	1.00972	0.00878
003-009	1.0018	0.00871	1.01144	0.00010	1.00962	0.00878
003-010	1.0008	0.00871	1.00786	0.00010	1.00705	0.00876
004-001	1.0039	0.0088	1.00303	0.00010	0.99914	0.00876
004-002	1.0034	0.0086	1.00604	0.00011	1.00263	0.00859
004-003	1.0041	0.0089	0.99634	0.00011	0.99227	0.00880
004-004	1.0051	0.0089	0.98718	0.00011	0.98217	0.00870
004-005	1.0037	0.0090	0.99270	0.00011	0.98904	0.00887
004-006	1.0020	0.0105	1.00392	0.00010	1.00192	0.01050
004-007	1.0020	0.0104	1.00067	0.00011	0.99867	0.01037
004-008	1.0020	0.0102	1.00701	0.00011	1.00500	0.01023
005-001	1.0000	0.0040	1.00082	0.00010	1.00082	0.00400
005-002	1.0000	0.0049	1.00404	0.00010	1.00404	0.00492
008-001	1.0006	0.0029	1.00122	0.00010	1.00062	0.00290
009-001	0.9966	0.0044	0.99572	0.00010	0.99912	0.00441
009-002	0.9981	0.0040	0.99897	0.00010	1.00087	0.00401
009-003	0.9989	0.0038	1.00045	0.00010	1.00155	0.00381
009-004	0.9998	0.0038	0.99899	0.00010	0.99919	0.00380
011-027	1.0000	0.0051	0.99040	0.00011	0.99040	0.00505
012-001	0.9990	0.0028	0.99918	0.00010	1.00018	0.00281
012-002	0.9993	0.0025	0.99880	0.00010	0.99950	0.00250
012-003	0.9994	0.0023	1.00893	0.00010	1.00953	0.00233
012-004	1.0000	0.0015	1.00194	0.00010	1.00194	0.00151
012-005	1.0000	0.0071	1.00364	0.00010	1.00364	0.00713
012-006	0.9987	0.0011	1.00335	0.00010	1.00465	0.00111
012-007	1.0000	0.0038	1.00045	0.00010	1.00045	0.00380
012-008	1.0000	0.0048	0.99774	0.00010	0.99774	0.00479
013-001	0.9992	0.0073	1.00344	0.00011	1.00424	0.00734
013-002	0.9992	0.0070	1.00358	0.00012	1.00438	0.00704
013-003	0.9992	0.0069	1.00388	0.00012	1.00468	0.00694
013-004	0.9992	0.0073	1.00426	0.00012	1.00506	0.00734
013-005	0.9992	0.0067	1.00474	0.00012	1.00554	0.00674
013-006	0.9992	0.0050	1.00449	0.00011	1.00529	0.00503
013-007	0.9992	0.0054	1.00436	0.00011	1.00516	0.00543
013-008	0.9992	0.0050	1.00504	0.00011	1.00584	0.00503
013-009	0.9992	0.0045	1.00532	0.00012	1.00612	0.00453
013-010	0.9992	0.0046	1.00582	0.00010	1.00663	0.00464
013-011	0.9992	0.0054	1.00340	0.00010	1.00420	0.00543
013-012	0.9992	0.0050	1.00426	0.00012	1.00506	0.00503
013-013	0.9992	0.0062	1.00181	0.00010	1.00261	0.00622
013-014	0.9992	0.0051	1.00466	0.00011	1.00546	0.00513
013-015	0.9992	0.0077	1.01958	0.00011	1.02040	0.00786
013-016	0.9992	0.0069	0.99194	0.00011	0.99273	0.00686
013-017	0.9992	0.0052	0.99462	0.00010	0.99542	0.00518
013-018	0.9992	0.0020	0.99877	0.00010	0.99957	0.00200
013-019	0.9992	0.0089	0.99473	0.00011	0.99553	0.00887
013-020	0.9992	0.0056	0.99691	0.00010	0.99771	0.00559
013-021	0.9992	0.0034	1.00066	0.00010	1.00146	0.00341
015-001	1.0000	0.0075	0.99098	0.00011	0.99098	0.00743
015-002	1.0000	0.0070	0.98638	0.00011	0.98638	0.00691
015-004	1.0000	0.0041	0.98916	0.00010	0.98916	0.00406
015-007	1.0000	0.0070	0.98648	0.00010	0.98648	0.00691
015-010	1.0000	0.0051	0.98941	0.00010	0.98941	0.00505
015-011	1.0000	0.0075	0.99388	0.00011	0.99388	0.00745
015-012	1.0000	0.0069	0.99443	0.00011	0.99443	0.00686
015-013	1.0000	0.0069	0.99226	0.00011	0.99226	0.00685
015-014	1.0000	0.0036	0.99669	0.00010	0.99669	0.00359

Table A-59. Detailed ENDF/B-VII.1 200-group results for KENO V.a UST systems (continued).

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty
015-015	1.0000	0.0060	0.98999	0.00011	0.98999	0.00594
015-016	1.0000	0.0043	0.98877	0.00011	0.98877	0.00425
015-017	1.0000	0.0029	0.99627	0.00010	0.99627	0.00289
015-018	1.0000	0.0056	0.97434	0.00011	0.97434	0.00546
015-019	1.0000	0.0052	0.97437	0.00012	0.97437	0.00507
015-020	1.0000	0.0079	0.99603	0.00010	0.99603	0.00787
015-021	1.0000	0.0070	0.99863	0.00011	0.99863	0.00699
015-022	1.0000	0.0062	0.99652	0.00011	0.99652	0.00618
015-023	1.0000	0.0055	0.99445	0.00011	0.99445	0.00547
015-024	1.0000	0.0051	0.99093	0.00011	0.99093	0.00505
015-025	1.0000	0.0023	0.99593	0.00010	0.99593	0.00229
015-026	1.0000	0.0066	0.99476	0.00010	0.99476	0.00657
015-027	1.0000	0.0063	0.99921	0.00011	0.99921	0.00630
015-028	1.0000	0.0058	0.99696	0.00010	0.99696	0.00578
015-029	1.0000	0.0051	0.99538	0.00010	0.99538	0.00508
015-030	1.0000	0.0048	0.99469	0.00010	0.99469	0.00478
015-031	1.0000	0.0055	0.99365	0.00011	0.99365	0.00547
016-001	0.9987	0.0037	1.00187	0.00011	1.00317	0.00372
016-002	0.9983	0.0044	1.00337	0.00010	1.00508	0.00443
016-003	0.9992	0.0036	1.00267	0.00012	1.00347	0.00362
016-004	0.9992	0.0035	1.00380	0.00012	1.00460	0.00352
016-006	0.9993	0.0034	0.99420	0.00012	0.99490	0.00339
016-007	1.0008	0.0034	0.99516	0.00012	0.99436	0.00338
016-008	1.0011	0.0028	0.99477	0.00010	0.99368	0.00278
016-009	1.0000	0.0027	0.99462	0.00012	0.99462	0.00269
016-010	1.0000	0.0030	1.00297	0.00010	1.00297	0.00301
016-011	0.9992	0.0041	1.00291	0.00012	1.00371	0.00412
016-012	0.9992	0.0047	1.00300	0.00012	1.00380	0.00472
016-013	0.9993	0.0036	1.00296	0.00012	1.00366	0.00362
016-014	1.0000	0.0026	1.00370	0.00012	1.00370	0.00261
016-015	1.0000	0.0027	1.00464	0.00012	1.00464	0.00272
016-016	0.9994	0.0031	1.00767	0.00012	1.00827	0.00313
016-017	1.0000	0.0028	0.99339	0.00012	0.99339	0.00278
016-018	0.9988	0.0036	0.99340	0.00012	0.99459	0.00359
016-019	1.0000	0.0035	0.99340	0.00012	0.99340	0.00348
016-021	1.0000	0.0028	1.00758	0.00012	1.00758	0.00282
016-022	1.0000	0.0034	1.00749	0.00012	1.00749	0.00343
016-023	1.0000	0.0031	1.00783	0.00011	1.00783	0.00313
016-024	1.0012	0.0024	1.00843	0.00012	1.00722	0.00242
016-025	0.9981	0.0040	0.99799	0.00010	0.99989	0.00401
016-026	0.9980	0.0034	1.00331	0.00011	1.00532	0.00343
016-027	0.9988	0.0037	1.00128	0.00011	1.00248	0.00372
016-028	0.9986	0.0037	0.99693	0.00011	0.99833	0.00370
016-029	0.9985	0.0031	0.99750	0.00011	0.99900	0.00310
016-030	0.9993	0.0032	0.99698	0.00011	0.99768	0.00320
016-031	0.9990	0.0034	1.00820	0.00010	1.00921	0.00344
016-032	0.9985	0.0032	1.01024	0.00010	1.01176	0.00324
016-033	0.9986	0.0039	1.01008	0.00010	1.01150	0.00395
017-001	0.9997	0.0032	1.00393	0.00011	1.00423	0.00322
017-002	1.0000	0.0025	0.99977	0.00011	0.99977	0.00250
017-003	1.0001	0.0035	1.00470	0.00010	1.00460	0.00352
017-004	0.9994	0.0040	1.00471	0.00010	1.00531	0.00402
017-005	1.0000	0.0029	1.00182	0.00010	1.00182	0.00291
017-006	1.0000	0.0029	0.99968	0.00010	0.99968	0.00290
017-007	1.0000	0.0037	0.99906	0.00010	0.99906	0.00370

Table A-60. Detailed ENDF/B-VII.1 CE results for KENO V.a UST systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty
001-001	1.0000	0.0031	1.00120	0.00010	1.00120	0.00311
001-002	1.0005	0.0033	1.00115	0.00010	1.00065	0.00330
001-003	1.0006	0.0033	1.00074	0.00010	1.00014	0.00330
001-004	0.9998	0.0033	1.00067	0.00010	1.00087	0.00331
001-005	0.9999	0.0033	0.99996	0.00010	1.00006	0.00330
002-001	1.0040	0.0087	1.00576	0.00011	1.00175	0.00868
002-002	1.0040	0.0087	0.99365	0.00011	0.98969	0.00858
002-003	1.0040	0.0087	1.00963	0.00010	1.00561	0.00871
002-004	1.0040	0.0087	1.00630	0.00010	1.00229	0.00869
002-005	1.0040	0.0087	1.01141	0.00010	1.00738	0.00873
002-006	1.0040	0.0087	0.99773	0.00010	0.99375	0.00861
002-007	1.0040	0.0087	0.98772	0.00010	0.98378	0.00853
002-008	1.0040	0.0087	1.00144	0.00010	0.99745	0.00864
002-009	1.0040	0.0087	0.99018	0.00010	0.98623	0.00855
002-010	1.0040	0.0087	1.00323	0.00010	0.99923	0.00866
002-011	1.0040	0.0087	1.01188	0.00010	1.00784	0.00873
002-012	1.0040	0.0087	0.99254	0.00010	0.98859	0.00857
002-013	1.0040	0.0087	0.99249	0.00010	0.98854	0.00857
002-014	1.0040	0.0087	1.00145	0.00011	0.99746	0.00864
002-015	1.0040	0.0087	1.00823	0.00010	1.00421	0.00870
002-017	1.0040	0.00870	1.01027	0.00010	1.00625	0.00872
003-001	0.9995	0.00871	1.00160	0.00010	1.00210	0.00873
003-002	0.9991	0.01513	1.01663	0.00010	1.01755	0.01541
003-003	1.0007	0.00871	0.99931	0.00010	0.99861	0.00869
003-004	1.0015	0.01258	1.00325	0.00011	1.00175	0.01258
003-005	1.0006	0.01222	1.00982	0.00011	1.00921	0.01233
003-006	1.0012	0.00871	1.02231	0.00010	1.02108	0.00888
003-007	1.0016	0.00871	1.01540	0.00010	1.01378	0.00882
003-008	1.0016	0.00871	1.01137	0.00010	1.00975	0.00878
003-009	1.0018	0.00871	1.01148	0.00010	1.00966	0.00878
003-010	1.0008	0.00871	1.00843	0.00010	1.00763	0.00877
004-001	1.0039	0.0088	1.00277	0.00010	0.99887	0.00876
004-002	1.0034	0.0086	1.00571	0.00010	1.00230	0.00859
004-003	1.0041	0.0089	0.99569	0.00010	0.99162	0.00879
004-004	1.0051	0.0089	0.98649	0.00010	0.98148	0.00869
004-005	1.0037	0.0090	0.99212	0.00011	0.98846	0.00886
004-006	1.0020	0.0105	1.00330	0.00011	1.00130	0.01049
004-007	1.0020	0.0104	1.00009	0.00010	0.99809	0.01036
004-008	1.0020	0.0102	1.00648	0.00010	1.00447	0.01023
005-001	1.0000	0.0040	1.00126	0.00010	1.00126	0.00401
005-002	1.0000	0.0049	1.00433	0.00010	1.00433	0.00492
008-001	1.0006	0.0029	1.00155	0.00010	1.00095	0.00290
009-001	0.9966	0.0044	0.99611	0.00010	0.99951	0.00441
009-002	0.9981	0.0040	0.99923	0.00010	1.00113	0.00401
009-003	0.9989	0.0038	1.00046	0.00010	1.00156	0.00381
009-004	0.9998	0.0038	0.99955	0.00010	0.99975	0.00380
011-027	1.0000	0.0051	0.99016	0.00010	0.99016	0.00505
012-001	0.9990	0.0028	0.99914	0.00010	1.00014	0.00280
012-002	0.9993	0.0025	0.99910	0.00010	0.99980	0.00250
012-003	0.9994	0.0023	1.00914	0.00010	1.00975	0.00233
012-004	1.0000	0.0015	1.00226	0.00010	1.00226	0.00151
012-005	1.0000	0.0071	1.00375	0.00010	1.00375	0.00713
012-006	0.9987	0.0011	1.00367	0.00010	1.00497	0.00111
012-007	1.0000	0.0038	1.00109	0.00010	1.00109	0.00381
012-008	1.0000	0.0048	0.99814	0.00010	0.99814	0.00479
013-001	0.9992	0.0073	1.00431	0.00012	1.00511	0.00734
013-002	0.9992	0.0070	1.00466	0.00011	1.00546	0.00704

Table A-60. Detailed ENDF/B-VII.1 CE results for KENO V.a UST systems (continued).

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty
013-003	0.9992	0.0069	1.00454	0.00011	1.00534	0.00694
013-004	0.9992	0.0073	1.00475	0.00011	1.00555	0.00735
013-005	0.9992	0.0067	1.00566	0.00011	1.00647	0.00675
013-006	0.9992	0.0050	1.00536	0.00011	1.00616	0.00504
013-007	0.9992	0.0054	1.00492	0.00011	1.00572	0.00544
013-008	0.9992	0.0050	1.00591	0.00011	1.00672	0.00504
013-009	0.9992	0.0045	1.00608	0.00011	1.00689	0.00454
013-010	0.9992	0.0046	1.00630	0.00010	1.00711	0.00464
013-011	0.9992	0.0054	1.00407	0.00010	1.00488	0.00543
013-012	0.9992	0.0050	1.00473	0.00011	1.00553	0.00503
013-013	0.9992	0.0062	1.00270	0.00010	1.00350	0.00623
013-014	0.9992	0.0051	1.00514	0.00011	1.00594	0.00514
013-015	0.9992	0.0077	1.02053	0.00011	1.02135	0.00787
013-016	0.9992	0.0069	0.99272	0.00011	0.99351	0.00686
013-017	0.9992	0.0052	0.99529	0.00010	0.99608	0.00518
013-018	0.9992	0.0020	0.99961	0.00010	1.00041	0.00200
013-019	0.9992	0.0089	0.99571	0.00010	0.99651	0.00888
013-020	0.9992	0.0056	0.99771	0.00010	0.99851	0.00560
013-021	0.9992	0.0034	1.00161	0.00010	1.00241	0.00341
015-001	1.0000	0.0075	0.99013	0.00010	0.99013	0.00743
015-002	1.0000	0.0070	0.98528	0.00010	0.98528	0.00690
015-004	1.0000	0.0041	0.98877	0.00010	0.98877	0.00406
015-007	1.0000	0.0070	0.98637	0.00010	0.98637	0.00691
015-010	1.0000	0.0051	0.98948	0.00010	0.98948	0.00505
015-011	1.0000	0.0075	0.99309	0.00011	0.99309	0.00745
015-012	1.0000	0.0069	0.99390	0.00011	0.99390	0.00686
015-013	1.0000	0.0069	0.99177	0.00011	0.99177	0.00684
015-014	1.0000	0.0036	0.99647	0.00010	0.99647	0.00359
015-015	1.0000	0.0060	0.98951	0.00011	0.98951	0.00594
015-016	1.0000	0.0043	0.98816	0.00011	0.98816	0.00425
015-017	1.0000	0.0029	0.99608	0.00010	0.99608	0.00289
015-018	1.0000	0.0056	0.97428	0.00011	0.97428	0.00546
015-019	1.0000	0.0052	0.97437	0.00011	0.97437	0.00507
015-020	1.0000	0.0079	0.99480	0.00010	0.99480	0.00786
015-021	1.0000	0.0070	0.99787	0.00010	0.99787	0.00699
015-022	1.0000	0.0062	0.99598	0.00011	0.99598	0.00618
015-023	1.0000	0.0055	0.99394	0.00011	0.99394	0.00547
015-024	1.0000	0.0051	0.99040	0.00011	0.99040	0.00505
015-025	1.0000	0.0023	0.99560	0.00010	0.99560	0.00229
015-026	1.0000	0.0066	0.99384	0.00010	0.99384	0.00656
015-027	1.0000	0.0063	0.99850	0.00010	0.99850	0.00629
015-028	1.0000	0.0058	0.99650	0.00010	0.99650	0.00578
015-029	1.0000	0.0051	0.99517	0.00010	0.99517	0.00508
015-030	1.0000	0.0048	0.99442	0.00010	0.99442	0.00477
015-031	1.0000	0.0055	0.99351	0.00011	0.99351	0.00547
016-001	0.9987	0.0037	1.00306	0.00011	1.00437	0.00372
016-002	0.9983	0.0044	1.00400	0.00010	1.00571	0.00443
016-003	0.9992	0.0036	1.00361	0.00011	1.00441	0.00362
016-004	0.9992	0.0035	1.00497	0.00011	1.00577	0.00352
016-006	0.9993	0.0034	0.99505	0.00011	0.99575	0.00339
016-007	1.0008	0.0034	0.99589	0.00011	0.99509	0.00338
016-008	1.0011	0.0028	0.99533	0.00010	0.99424	0.00278
016-009	1.0000	0.0027	0.99534	0.00012	0.99534	0.00269
016-010	1.0000	0.0030	1.00387	0.00010	1.00387	0.00301
016-011	0.9992	0.0041	1.00358	0.00011	1.00438	0.00412
016-012	0.9992	0.0047	1.00371	0.00011	1.00451	0.00473
016-013	0.9993	0.0036	1.00401	0.00011	1.00471	0.00362
016-014	1.0000	0.0026	1.00460	0.00011	1.00460	0.00261

Table A-60. Detailed ENDF/B-VII.1 CE results for KENO V.a UST systems (continued).

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty
016-015	1.0000	0.0027	1.00568	0.00011	1.00568	0.00272
016-016	0.9994	0.0031	1.00876	0.00011	1.00937	0.00313
016-017	1.0000	0.0028	0.99410	0.00011	0.99410	0.00279
016-018	0.9988	0.0036	0.99471	0.00011	0.99591	0.00359
016-019	1.0000	0.0035	0.99435	0.00011	0.99435	0.00348
016-021	1.0000	0.0028	1.00856	0.00011	1.00856	0.00283
016-022	1.0000	0.0034	1.00857	0.00011	1.00857	0.00343
016-023	1.0000	0.0031	1.00891	0.00011	1.00891	0.00313
016-024	1.0012	0.0024	1.00927	0.00011	1.00806	0.00242
016-025	0.9981	0.0040	0.99908	0.00010	1.00098	0.00401
016-026	0.9980	0.0034	1.00448	0.00010	1.00649	0.00343
016-027	0.9988	0.0037	1.00270	0.00010	1.00390	0.00372
016-028	0.9986	0.0037	0.99791	0.00010	0.99931	0.00370
016-029	0.9985	0.0031	0.99885	0.00011	1.00035	0.00311
016-030	0.9993	0.0032	0.99837	0.00010	0.99907	0.00320
016-031	0.9990	0.0034	1.00935	0.00010	1.01036	0.00344
016-032	0.9985	0.0032	1.01116	0.00010	1.01268	0.00325
016-033	0.9986	0.0039	1.01124	0.00010	1.01266	0.00396
017-001	0.9997	0.0032	1.00406	0.00010	1.00436	0.00322
017-002	1.0000	0.0025	1.00010	0.00010	1.00010	0.00250
017-003	1.0001	0.0035	1.00499	0.00010	1.00489	0.00352
017-004	0.9994	0.0040	1.00505	0.00010	1.00565	0.00403
017-005	1.0000	0.0029	1.00206	0.00010	1.00206	0.00291
017-006	1.0000	0.0029	1.00018	0.00010	1.00018	0.00290
017-007	1.0000	0.0037	0.99972	0.00010	0.99972	0.00370

APPENDIX B. DETAILED RESULTS FOR KENO-VI

APPENDIX B. DETAILED RESULTS FOR KENO-VI

All uncertainties reported in this appendix are at the 1 sigma level. The Monte Carlo experimental uncertainty values are absolute uncertainties and are reported in Δk_{eff} units. The cross section uncertainty values are relative uncertainties and are reported in $\Delta k_{eff}/k_{eff}$ units.

Table B-1. Detailed ENDF/B-VII.1 56-group results for KENO-VI HMF systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
005-001	1.0000	0.0036	0.99748	0.00010	0.99748	0.00359	0.01492
005-002	1.0007	0.0036	1.00030	0.00010	0.99960	0.00360	0.01721
005-003	0.9996	0.0036	1.00271	0.00010	1.00311	0.00361	0.01718
005-004	0.9989	0.0036	0.99662	0.00010	0.99772	0.00360	0.01699
005-005	0.9980	0.0036	1.00357	0.00010	1.00559	0.00363	0.01580
005-006	0.9987	0.0036	1.00145	0.00010	1.00276	0.00362	0.01544
008-001	0.9989	0.0016	0.99843	0.00010	0.99952	0.00160	0.01101
009-001	0.9992	0.0015	0.99941	0.00010	1.00021	0.00150	0.01268
009-002	0.9992	0.0015	0.99527	0.00010	0.99607	0.00150	0.01228
010-001	0.9992	0.0015	0.99984	0.00010	1.00064	0.00151	0.01235
010-002	0.9992	0.0015	0.99761	0.00010	0.99840	0.00150	0.01215
011-001	0.9989	0.0015	0.99802	0.00010	0.99912	0.00150	0.01060
013-001	0.9990	0.0015	0.99960	0.00010	1.00060	0.00151	0.01192
024-001	0.9990	0.0015	0.99963	0.00010	1.00063	0.00151	0.01100
080-001	1.0000	0.0012	1.00949	0.00010	1.00949	0.00122	0.01198
086-001	0.9986	0.0026	0.98868	0.00005	0.99006	0.00258	0.01098
086-002	0.9986	0.0026	0.98872	0.00005	0.99011	0.00258	0.01098
086-003	0.9986	0.0026	0.98958	0.00005	0.99097	0.00258	0.01099
086-004	0.9986	0.0026	0.99046	0.00005	0.99185	0.00258	0.01100
086-005	1.0056	0.0026	0.99527	0.00005	0.98972	0.00256	0.01105
092-001	0.9986	0.0011	1.00314	0.00010	1.00455	0.00111	0.01108
092-002	0.9989	0.0013	1.00468	0.00010	1.00578	0.00131	0.01158
092-003	0.9993	0.0012	1.00566	0.00010	1.00637	0.00121	0.01211
092-004	0.9993	0.0013	1.00526	0.00010	1.00596	0.00131	0.01213
093-001	0.9978	0.0012	1.00559	0.00010	1.00780	0.00122	0.01317
094-001	0.9994	0.0012	1.01077	0.00010	1.01138	0.00122	0.02356
094-002	0.9993	0.0010	1.01109	0.00010	1.01180	0.00102	0.02428

Table B-2. Detailed ENDF/B-VII.1 252-group results for KENO-VI HMF systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
005-001	1.0000	0.0036	0.99648	0.00010	0.99648	0.00359	0.01492
005-002	1.0007	0.0036	0.99899	0.00010	0.99829	0.00359	0.01721
005-003	0.9996	0.0036	1.00137	0.00010	1.00177	0.00361	0.01718
005-004	0.9989	0.0036	0.99524	0.00010	0.99634	0.00359	0.01699
005-005	0.9980	0.0036	1.00144	0.00010	1.00345	0.00362	0.01580
005-006	0.9987	0.0036	0.99936	0.00010	1.00066	0.00361	0.01544
008-001	0.9989	0.0016	0.99550	0.00010	0.99660	0.00160	0.01101
009-001	0.9992	0.0015	0.99695	0.00010	0.99775	0.00150	0.01268
009-002	0.9992	0.0015	0.99473	0.00010	0.99553	0.00150	0.01228
010-001	0.9992	0.0015	0.99787	0.00010	0.99867	0.00150	0.01235
010-002	0.9992	0.0015	0.99675	0.00010	0.99755	0.00150	0.01215
011-001	0.9989	0.0015	0.99522	0.00010	0.99632	0.00150	0.01060
013-001	0.9990	0.0015	0.99727	0.00010	0.99827	0.00150	0.01192
024-001	0.9990	0.0015	0.99709	0.00010	0.99809	0.00150	0.01100
080-001	1.0000	0.0012	1.00696	0.00010	1.00696	0.00121	0.01198
086-001	0.9986	0.0026	0.98655	0.00005	0.98794	0.00257	0.01098
086-002	0.9986	0.0026	0.98664	0.00005	0.98802	0.00257	0.01098
086-003	0.9986	0.0026	0.98753	0.00005	0.98892	0.00258	0.01099
086-004	0.9986	0.0026	0.98830	0.00005	0.98968	0.00258	0.01100
086-005	1.0056	0.0026	0.99326	0.00005	0.98773	0.00255	0.01105
092-001	0.9986	0.0011	1.00087	0.00010	1.00228	0.00111	0.01108
092-002	0.9989	0.0013	1.00261	0.00010	1.00372	0.00131	0.01158
092-003	0.9993	0.0012	1.00373	0.00010	1.00443	0.00121	0.01211
092-004	0.9993	0.0013	1.00317	0.00010	1.00387	0.00131	0.01213
093-001	0.9978	0.0012	1.00328	0.00010	1.00549	0.00121	0.01317
094-001	0.9994	0.0012	1.00554	0.00010	1.00615	0.00121	0.02356
094-002	0.9993	0.0010	1.00635	0.00010	1.00706	0.00101	0.02428

Table B-3. Detailed ENDF/B-VII.1 200-group results for KENO-VI HMF systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
005-001	1.0000	0.0036	0.99598	0.00010	0.99598	0.00359	0.01492
005-002	1.0007	0.0036	0.99886	0.00010	0.99816	0.00359	0.01721
005-003	0.9996	0.0036	1.00108	0.00010	1.00148	0.00361	0.01718
005-004	0.9989	0.0036	0.99511	0.00010	0.99621	0.00359	0.01699
005-005	0.9980	0.0036	1.00084	0.00010	1.00285	0.00362	0.01580
005-006	0.9987	0.0036	0.99888	0.00010	1.00018	0.00361	0.01544
008-001	0.9989	0.0016	0.99544	0.00010	0.99653	0.00160	0.01101
009-001	0.9992	0.0015	0.99710	0.00010	0.99790	0.00150	0.01268
009-002	0.9992	0.0015	0.99537	0.00010	0.99616	0.00150	0.01228
010-001	0.9992	0.0015	0.99815	0.00010	0.99895	0.00150	0.01235
010-002	0.9992	0.0015	0.99710	0.00010	0.99790	0.00150	0.01215
011-001	0.9989	0.0015	0.99524	0.00010	0.99633	0.00150	0.01060
013-001	0.9990	0.0015	0.99699	0.00010	0.99799	0.00150	0.01192
024-001	0.9990	0.0015	0.99694	0.00010	0.99793	0.00150	0.01100
080-001	1.0000	0.0012	1.00717	0.00010	1.00717	0.00121	0.01198
086-001	0.9986	0.0026	0.98701	0.00005	0.98839	0.00257	0.01098
086-002	0.9986	0.0026	0.98700	0.00005	0.98838	0.00257	0.01098
086-003	0.9986	0.0026	0.98780	0.00005	0.98919	0.00258	0.01099
086-004	0.9986	0.0026	0.98863	0.00005	0.99002	0.00258	0.01100
086-005	1.0056	0.0026	0.99361	0.00005	0.98807	0.00256	0.01105
092-001	0.9986	0.0011	1.00076	0.00010	1.00216	0.00111	0.01108
092-002	0.9989	0.0013	1.00242	0.00010	1.00352	0.00131	0.01158
092-003	0.9993	0.0012	1.00386	0.00010	1.00456	0.00121	0.01211
092-004	0.9993	0.0013	1.00326	0.00010	1.00397	0.00131	0.01213
093-001	0.9978	0.0012	1.00305	0.00010	1.00526	0.00121	0.01317
094-001	0.9994	0.0012	1.00560	0.00010	1.00620	0.00121	0.02356
094-002	0.9993	0.0010	1.00604	0.00010	1.00674	0.00101	0.02428

Table B-4. Detailed ENDF/B-VII.1 CE results for KENO-VI HMF systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
005-001	1.0000	0.0036	0.99571	0.00010	0.99571	0.00359	0.01492
005-002	1.0007	0.0036	0.99811	0.00010	0.99741	0.00359	0.01721
005-003	0.9996	0.0036	1.00049	0.00010	1.00089	0.00361	0.01718
005-004	0.9989	0.0036	0.99421	0.00010	0.99530	0.00359	0.01699
005-005	0.9980	0.0036	0.99880	0.00010	1.00080	0.00361	0.01580
005-006	0.9987	0.0036	0.99773	0.00010	0.99903	0.00360	0.01544
008-001	0.9989	0.0016	0.99585	0.00010	0.99694	0.00160	0.01101
009-001	0.9992	0.0015	0.99739	0.00010	0.99819	0.00150	0.01268
009-002	0.9992	0.0015	0.99623	0.00010	0.99703	0.00150	0.01228
010-001	0.9992	0.0015	0.99831	0.00010	0.99911	0.00150	0.01235
010-002	0.9992	0.0015	0.99773	0.00010	0.99852	0.00150	0.01215
011-001	0.9989	0.0015	0.99352	0.00010	0.99462	0.00150	0.01060
013-001	0.9990	0.0015	0.99660	0.00010	0.99760	0.00150	0.01192
024-001	0.9990	0.0015	0.99567	0.00010	0.99667	0.00150	0.01100
080-001	1.0000	0.0012	1.00953	0.00010	1.00953	0.00122	0.01198
086-001	0.9986	0.0026	0.98876	0.00005	0.99015	0.00258	0.01098
086-002	0.9986	0.0026	0.98885	0.00005	0.99024	0.00258	0.01098
086-003	0.9986	0.0026	0.98965	0.00005	0.99103	0.00258	0.01099
086-004	0.9986	0.0026	0.99058	0.00005	0.99197	0.00258	0.01100
086-005	1.0056	0.0026	0.99552	0.00005	0.98997	0.00256	0.01105
092-001	0.9986	0.0011	1.00113	0.00010	1.00253	0.00111	0.01108
092-002	0.9989	0.0013	1.00289	0.00010	1.00399	0.00131	0.01158
092-003	0.9993	0.0012	1.00407	0.00010	1.00477	0.00121	0.01211
092-004	0.9993	0.0013	1.00348	0.00010	1.00418	0.00131	0.01213
093-001	0.9978	0.0012	1.00335	0.00010	1.00556	0.00121	0.01317
094-001	0.9994	0.0012	1.00330	0.00010	1.00390	0.00121	0.02356
094-002	0.9993	0.0010	1.00369	0.00010	1.00439	0.00101	0.02428

Table B-5. Detailed ENDF/B-VII.1 56-group results for KENO-VI IMF systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
019-001	1.0008	0.0035	1.01009	0.00010	1.00929	0.00353	0.01297
019-002	1.0007	0.0042	1.00909	0.00010	1.00839	0.00423	0.01281

Table B-6. Detailed ENDF/B-VII.1 252-group results for KENO-VI IMF systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
019-001	1.0008	0.0035	1.00644	0.00010	1.00563	0.00352	0.01297
019-002	1.0007	0.0042	1.00579	0.00010	1.00509	0.00422	0.01281

Table B-7. Detailed ENDF/B-VII.1 200-group results for KENO-VI IMF systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
019-001	1.0008	0.0035	1.00678	0.00010	1.00597	0.00352	0.01297
019-002	1.0007	0.0042	1.00648	0.00010	1.00577	0.00422	0.01281

Table B-8. Detailed ENDF/B-VII.1 CE results for KENO-VI IMF systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
019-001	1.0008	0.0035	1.00664	0.00010	1.00583	0.00352	0.01297
019-002	1.0007	0.0042	1.00646	0.00010	1.00575	0.00422	0.01281

Table B-9. Detailed ENDF/B-VII.1 56-group results for KENO-VI MCT systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
008-001	0.9997	0.0032	0.99695	0.00007	0.99725	0.00319	0.00595
008-002	1.0008	0.0030	0.99820	0.00010	0.99740	0.00299	0.00624
008-003	1.0023	0.0038	0.99849	0.00010	0.99619	0.00378	0.00627
008-004	1.0015	0.0047	1.00185	0.00010	1.00035	0.00470	0.00625
008-005	1.0022	0.0056	1.00314	0.00010	1.00094	0.00559	0.00628
008-006	1.0028	0.0065	1.00316	0.00010	1.00036	0.00648	0.00632
008-007	1.0023	0.0039	0.99670	0.00010	0.99441	0.00387	0.00627
008-008	1.0023	0.0039	0.99724	0.00009	0.99495	0.00387	0.00625
008-009	1.0023	0.0039	0.99740	0.00010	0.99511	0.00387	0.00624
008-010	1.0023	0.0039	0.99682	0.00010	0.99453	0.00387	0.00623
008-011	1.0023	0.0039	0.99590	0.00010	0.99362	0.00387	0.00622
008-012	1.0023	0.0039	0.99577	0.00010	0.99349	0.00387	0.00621
008-013	1.0023	0.0039	0.99626	0.00010	0.99397	0.00387	0.00625
008-014	1.0023	0.0039	0.99613	0.00010	0.99385	0.00387	0.00623
008-015	1.0023	0.0039	0.99586	0.00010	0.99357	0.00387	0.00623
008-016	1.0023	0.0039	0.99506	0.00010	0.99277	0.00386	0.00622
008-017	1.0023	0.0041	0.99542	0.00010	0.99314	0.00406	0.00620
008-018	1.0023	0.0041	0.99529	0.00010	0.99301	0.00406	0.00620
008-019	1.0023	0.0041	0.99575	0.00010	0.99346	0.00407	0.00619
008-020	1.0023	0.0041	0.99562	0.00010	0.99334	0.00406	0.00620
008-021	1.0023	0.0041	0.99527	0.00010	0.99299	0.00406	0.00620
008-022	1.0023	0.0041	0.99581	0.00010	0.99352	0.00407	0.00620
008-023	1.0023	0.0041	0.99471	0.00010	0.99242	0.00406	0.00620
008-024	1.0023	0.0041	0.99530	0.00010	0.99301	0.00406	0.00620
008-025	1.0023	0.0041	0.99507	0.00010	0.99279	0.00406	0.00620
008-026	1.0023	0.0041	0.99491	0.00010	0.99262	0.00406	0.00620
008-027	1.0023	0.0040	0.99485	0.00009	0.99257	0.00396	0.00621
008-028	1.0023	0.0040	0.99519	0.00010	0.99291	0.00396	0.00620

Table B-10. Detailed ENDF/B-VII.1 252-group results for KENO-VI MCT systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
008-001	0.9997	0.0032	0.99689	0.00007	0.99718	0.00319	0.00595
008-002	1.0008	0.0030	0.99789	0.00010	0.99709	0.00299	0.00624
008-003	1.0023	0.0038	0.99804	0.00010	0.99575	0.00378	0.00627
008-004	1.0015	0.0047	1.00127	0.00010	0.99977	0.00469	0.00625
008-005	1.0022	0.0056	1.00246	0.00010	1.00026	0.00559	0.00628
008-006	1.0028	0.0065	1.00244	0.00009	0.99964	0.00648	0.00632
008-007	1.0023	0.0039	0.99645	0.00010	0.99416	0.00387	0.00627
008-008	1.0023	0.0039	0.99643	0.00010	0.99415	0.00387	0.00625
008-009	1.0023	0.0039	0.99662	0.00010	0.99434	0.00387	0.00624
008-010	1.0023	0.0039	0.99576	0.00009	0.99347	0.00387	0.00623
008-011	1.0023	0.0039	0.99533	0.00010	0.99305	0.00387	0.00622
008-012	1.0023	0.0039	0.99473	0.00010	0.99245	0.00386	0.00621
008-013	1.0023	0.0039	0.99579	0.00010	0.99350	0.00387	0.00625
008-014	1.0023	0.0039	0.99563	0.00010	0.99334	0.00387	0.00623
008-015	1.0023	0.0039	0.99540	0.00010	0.99311	0.00387	0.00623
008-016	1.0023	0.0039	0.99453	0.00010	0.99224	0.00386	0.00622
008-017	1.0023	0.0041	0.99515	0.00009	0.99287	0.00406	0.00620
008-018	1.0023	0.0041	0.99460	0.00009	0.99231	0.00406	0.00620
008-019	1.0023	0.0041	0.99500	0.00010	0.99272	0.00406	0.00619
008-020	1.0023	0.0041	0.99482	0.00010	0.99254	0.00406	0.00620
008-021	1.0023	0.0041	0.99452	0.00010	0.99224	0.00406	0.00620
008-022	1.0023	0.0041	0.99491	0.00010	0.99263	0.00406	0.00620
008-023	1.0023	0.0041	0.99463	0.00010	0.99234	0.00406	0.00620

Table B-10. Detailed ENDF/B-VII.1 252-group results for KENO-VI MCT systems (continued).

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
008-024	1.0023	0.0041	0.99499	0.00010	0.99270	0.00406	0.00620
008-025	1.0023	0.0041	0.99495	0.00010	0.99267	0.00406	0.00620
008-026	1.0023	0.0041	0.99456	0.00010	0.99228	0.00406	0.00620
008-027	1.0023	0.0040	0.99447	0.00010	0.99218	0.00396	0.00621
008-028	1.0023	0.0040	0.99472	0.00010	0.99244	0.00396	0.00620

Table B-11. Detailed ENDF/B-VII.1 200-group results for KENO-VI MCT systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
008-001	0.9997	0.0032	0.99490	0.00007	0.99520	0.00319	0.00595
008-002	1.0008	0.0030	0.99684	0.00010	0.99604	0.00299	0.00624
008-003	1.0023	0.0038	0.99725	0.00010	0.99496	0.00377	0.00627
008-004	1.0015	0.0047	1.00059	0.00009	0.99909	0.00469	0.00625
008-005	1.0022	0.0056	1.00176	0.00010	0.99956	0.00559	0.00628
008-006	1.0028	0.0065	1.00163	0.00010	0.99883	0.00647	0.00632
008-007	1.0023	0.0039	0.99531	0.00010	0.99303	0.00387	0.00627
008-008	1.0023	0.0039	0.99581	0.00010	0.99353	0.00387	0.00625
008-009	1.0023	0.0039	0.99578	0.00010	0.99349	0.00387	0.00624
008-010	1.0023	0.0039	0.99506	0.00010	0.99278	0.00386	0.00623
008-011	1.0023	0.0039	0.99449	0.00010	0.99221	0.00386	0.00622
008-012	1.0023	0.0039	0.99407	0.00010	0.99178	0.00386	0.00621
008-013	1.0023	0.0039	0.99495	0.00009	0.99267	0.00386	0.00625
008-014	1.0023	0.0039	0.99486	0.00010	0.99258	0.00386	0.00623
008-015	1.0023	0.0039	0.99448	0.00010	0.99220	0.00386	0.00623
008-016	1.0023	0.0039	0.99366	0.00010	0.99137	0.00386	0.00622
008-017	1.0023	0.0041	0.99420	0.00010	0.99192	0.00406	0.00620
008-018	1.0023	0.0041	0.99384	0.00009	0.99156	0.00406	0.00620
008-019	1.0023	0.0041	0.99416	0.00010	0.99187	0.00406	0.00619
008-020	1.0023	0.0041	0.99405	0.00010	0.99176	0.00406	0.00620
008-021	1.0023	0.0041	0.99377	0.00009	0.99149	0.00406	0.00620
008-022	1.0023	0.0041	0.99405	0.00010	0.99176	0.00406	0.00620
008-023	1.0023	0.0041	0.99334	0.00010	0.99106	0.00406	0.00620
008-024	1.0023	0.0041	0.99427	0.00010	0.99199	0.00406	0.00620
008-025	1.0023	0.0041	0.99387	0.00010	0.99159	0.00406	0.00620
008-026	1.0023	0.0041	0.99349	0.00010	0.99121	0.00406	0.00620
008-027	1.0023	0.0040	0.99368	0.00010	0.99140	0.00396	0.00621
008-028	1.0023	0.0040	0.99400	0.00010	0.99172	0.00396	0.00620

Table B-12. Detailed ENDF/B-VII.1 CE results for KENO-VI MCT systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
008-001	0.9997	0.0032	0.99833	0.00007	0.99862	0.00320	0.00595
008-002	1.0008	0.0030	0.99892	0.00009	0.99812	0.00299	0.00624
008-003	1.0023	0.0038	0.99855	0.00010	0.99625	0.00378	0.00627
008-004	1.0015	0.0047	1.00116	0.00010	0.99966	0.00469	0.00625
008-005	1.0022	0.0056	1.00163	0.00010	0.99943	0.00559	0.00628
008-006	1.0028	0.0065	1.00116	0.00009	0.99837	0.00647	0.00632
008-007	1.0023	0.0039	0.99649	0.00010	0.99420	0.00387	0.00627
008-008	1.0023	0.0039	0.99664	0.00010	0.99435	0.00387	0.00625
008-009	1.0023	0.0039	0.99674	0.00010	0.99445	0.00387	0.00624
008-010	1.0023	0.0039	0.99607	0.00010	0.99378	0.00387	0.00623
008-011	1.0023	0.0039	0.99544	0.00010	0.99315	0.00387	0.00622
008-012	1.0023	0.0039	0.99507	0.00010	0.99279	0.00386	0.00621
008-013	1.0023	0.0039	0.99608	0.00010	0.99380	0.00387	0.00625

Table B-12. Detailed ENDF/B-VII.1 CE results for KENO-VI MCT systems.

Case	Expected k_{eff}	Experimental uncertainty	k_{eff}	Uncertainty	C/E	C/E uncertainty	Cross section uncertainty
008-014	1.0023	0.0039	0.99606	0.00010	0.99377	0.00387	0.00623
008-015	1.0023	0.0039	0.99570	0.00010	0.99341	0.00387	0.00623
008-016	1.0023	0.0039	0.99460	0.00009	0.99232	0.00386	0.00622
008-017	1.0023	0.0041	0.99533	0.00009	0.99305	0.00406	0.00620
008-018	1.0023	0.0041	0.99459	0.00010	0.99231	0.00406	0.00620
008-019	1.0023	0.0041	0.99520	0.00010	0.99291	0.00406	0.00619
008-020	1.0023	0.0041	0.99493	0.00010	0.99264	0.00406	0.00620
008-021	1.0023	0.0041	0.99455	0.00010	0.99227	0.00406	0.00620
008-022	1.0023	0.0041	0.99503	0.00010	0.99275	0.00406	0.00620
008-023	1.0023	0.0041	0.99448	0.00010	0.99219	0.00406	0.00620
008-024	1.0023	0.0041	0.99532	0.00010	0.99304	0.00406	0.00620
008-025	1.0023	0.0041	0.99490	0.00010	0.99262	0.00406	0.00620
008-026	1.0023	0.0041	0.99449	0.00010	0.99221	0.00406	0.00620
008-027	1.0023	0.0040	0.99470	0.00010	0.99241	0.00396	0.00621
008-028	1.0023	0.0040	0.99498	0.00010	0.99269	0.00396	0.00620