AREVA	Form 3.2-1 Calculation Cover Sheet Revision 10	Calculation No.:	TN-BGC1-0600
		Revision No.:	1
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DCR NO (if applicable) : 502800-002	PROJECT NAME: TN-BGC1	
PROJECT NO: 502800	CLIENT: AREVA Inc.	

CALCULATION TITLE: Criticality Code Validation for TN-BGC1 – Contents 11a, 11b, 11c and 11g

SUMMARY DESCRIPTION:

1) **Calculation Summary**

This calculation documents the evaluation performed to validate the criticality code used in the TN-BGC1 package analysis for content uranium-metal along with uranium oxides, uranium tetrafluorides and uranium-alloys. 279 critical experiments are selected and simulated using SCALE 6.0 computer code to perform the benchmark analysis. A trending analysis is performed to check the dependency of the k_{eff} values of critical experiments on the independent parameters. USLSTATS is used to obtain the USL functions for parameters of interest.

Revision 1 is performed to provide the criticality code validation and USL determination with additional critical experiments involving uranium oxides, uranium tetrafluorides and uranium-alloys as fissile medium.

2) **Storage Media Description**

COLDSTOR, location: /areva_tn/502800/TN-BGC1-0600-001.

If original issue, is licensing review per TIP 3.5 required?

Yes ☐ **No** ☒ **(explain below)** **Licensing Review No.:** _____

This calculation is performed to support a transport license revalidation of French competent authority, certificate F/313/B(U) F-96, that will be reviewed and approved by NRC, certificate USA/0492/B(U) F-96. Therefore, a licensing review per TIP 3.5 is not applicable.

Software Utilized (subject to test requirements of TIP 3.3):	**Software Version:**	**Software Log Revision:**
SCALE 6.0 Module: CSAS5 & USLSTATS	C750MNYCP01	32

Calculation is complete: For Nandan NC P. Pham

Originator Name and Signature: Nandan GC (Analysis and Documentation)
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Date: 01/28/16

Calculation has been checked for consistency, completeness and correctness:

Checker Name and Signature: Robert H Smith

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Calculation is approved for use: Olivier Gandou 2016.01.29 11:19:21 -05'00'

Project Engineer Name and Signature: Olivier Gandou

Date: 01/29/2016

REVISION SUMMARY

Rev.	Description	Affected Pages	Affected Disks
0	Initial issue	All	All
1	Critical experiments on uranium oxides, uranium tetrafluorides and uranium-alloys are added for the USL determination	6, 9, 10, 13, 16-17, 22, 26-27, 35-36, 44-45, 48-54 & 62-63	All

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1.0 PURPOSE

The purpose of this evaluation is to validate the criticality code used in the TN-BGC1 package analysis. The evaluation is performed for contents uranium metals, uranium oxides, uranium fluorides and uranium-alloys. TN-BGC1 is the French Atomic Energy Commission (CEA) owned Type B Fissile (BF) packaging used to transport non-irradiated (fissile) materials. TN-BGC1 contents are described in section 4 of Ref. [1].

The criticality benchmark is performed with the use of SCALE 6.0 (Ref. [2]) computer software using 238-group ENDF/B-V nuclear data library. The objective of the validation is the identification of the difference (bias) between calculated and experimental reactivity. This bias and the uncertainty associated with the bias, along with the administrative margin of 0.05 are used to establish an upper subcritical limit (USL). Criticality experiments for the analysis are selected on the basis of having similar material composition and geometrical characteristics as the TN-BGC1 package along with the consideration of parameters of interest. Trending analysis is performed for each parameter of interest. This calculation documents the criticality results of the benchmark experiments that can be used for benchmarking system applications.

The purpose of revision 1 of the calculation is to provide the criticality code validation and USL determination with additional critical experiments involving uranium oxides, uranium tetrafluorides and uranium-alloys as fissile medium.

2.0 CONSERVATISM

None

3.0 ASSUMPTIONS

1. Based on a comparison of experimental data to the system application, the benchmark models and TN-BGC1 model are assumed to exhibit identical neutronic properties.

2. In addition to established cross-section bias, the benchmarking is expected to determine modeling bias. The premise is that a system application may be modeled in different ways. Therefore, it is not crucial that exact modeling of benchmark experiments occurs and minor errors are accounted for in the bias. However, for purposes of this application, major and glaring errors in modeling of experiments in KENO V.a are assumed to not exist.

4.0 DESIGN INPUT/DATA

The computational models of the criticality experiments are obtained from Database for the International Criticality Safety Benchmark Evaluation Project (DICE) (Ref. [3]). The experiments are selected such that the material configuration and geometrical characteristics are similar to the properties of the TN-BGC1 package. The experiments include metallic uranium, uranium oxides, uranium fluorides and uranium alloys as fissile medium; polyethylene and water as moderator; and, water, stainless steel and polyethylene as reflector, which are the properties of TN-BGC1 package. The comparison of system application materials to experimental materials is tabulated in Table 10-1.

The selected critical experiments have metallic uranium, UO_2, UO_2-BeO (even though the TN-BGC1 package contents doesn't have beryllium oxide, the presence of beryllium oxide in the fissile mixture extends the area of applicability and the spectrum is similar based on EALF, MFP and neutron fission yield), UF_4 and U-Al as fissile material. The critical experiments are subdivided into four categories as fast, intermediate, thermal and mixed spectra systems, depending upon the energy range of where the majority of the fission occurs. The fast, intermediate and thermal systems are defined as systems in which over 50% of the fissions occur at energies over 100 keV, from 0.625 eV to 100 keV, and less than 0.625 eV, respectively. Systems for which over 50% of the fissions do not occur in any one of these three energy ranges are classified as mixed spectra systems.

4.1 TN-BGC1 Package Description

The TN-BGC1 is the French Atomic Energy Commission (CEA) owned Type BF packaging used to transport non-irradiated (mostly fissile) materials. The TN-BGC1 package consists of a parallelepiped cage inside which a generally cylindrical body equipped with a closure system and a shock absorbing cover is fixed. The TN-BGC1 package mainly consists of cage, body, closure system and shock absorbing cover.

The cage is a structure made using tubes welded together of dimensions 600 x 600 x 1821 mm^3. Aluminum rolled tubes of square section 30 x 30 mm^2 and thickness 2 mm are used. The cage consists mainly of uprights and horizontal bars forming three 'floors'. Tubes across the diagonals give the structure its transverse rigidity.

The body cavity is a stainless steel-resin-stainless steel cask. The inner stainless steel shell (rolled then welded plate) is of useful inner diameter 178 mm and minimum thickness of 6 mm; an 8 mm thick bottom made of stainless steel is connected by a circular weld. An outer stainless steel shell of inner diameter 292 mm and thickness 1.5 mm co-operates with the first shell to delimit a space full of loaded resin that acts as a neutron absorber and active heat insulation. A 25 mm thick distribution plate made from stainless steel is attached to the bottom of the outer shell to strengthen it in the event of a fall on the packaging base. A compartment made from a poplar disc in the central section and a balsa ring on the outside in the lower part of the body acts as shock absorber in case of a fall. In the upper part, a stainless steel machined flange is welded to the two shells to receive the closure system to provide suitable bearing surface at its seals.

The contents (fissile material) are stored in an internal fitting inside the inner useful cavity. The internal fitting is a stainless steel cylinder with thickness of 2 mm. The diameter of the internal fitting varies for different contents.

The closure of the body cavity consists of a system composed of a plug, a clamping ring and a bayonet ring. The plug is machined from a 92 mm thick stainless steel disc. The plug is held in place by a bronze clamping ring that is screwed into the stainless steel bayonet ring itself resting on the body flange.

A shock-absorber cover is placed over the top of the body and the closure system. It is composed of two steel plate compartments; the one closest to the body is filled with resin and the other is filled with wood.

The TN-BGC1 package layout is presented in Figure 11-1.

4.2 TN-BGC1 Package Contents

TN-BGC1 package is used to transport uranium and plutonium metals/mixtures. The detailed descriptions of the contents are provided in Section 4 of Ref. [1]. Table 9 and Table 10 of Ref. [1] show that TN-BGC1 package configuration with content 11 as most reactive. The analysis focusses on content 11, which has uranium metal as fissile medium with various internal fitting diameter and maximum allowable uranium mass. The details of the contents 11a, 11b and 11c are described in section 4.11.1.1 of Ref. [1] and for 11g in section 4.11.1.2 of Ref. [1]. Along with the uranium metals, other contents such as uranium oxides, uranium fluorides and uranium alloys are also included in the benchmark analysis to extend the area of applicability.

4.3 Critical Experiments Selection

The critical experiments selected for code validation are based on the parameters of interest along with the similarities to TN-BGC1 package in the material configuration and geometrical characteristics. The material configuration and geometrical characteristics affect the neutronics of the system. 279 critical experiments are selected from DICE (Ref. [3]) for the code validation analysis. The selected experiments are listed in Table 10-2. The configurations of the experiments are listed below:

- 1 configuration from HEU-MET-FAST-001: This configuration involves spherical metallic uranium fuel with no moderator and reflector. Metallic uranium with 93.71 wt. % U-235 is used in this experiment.
- 6 configurations (cases 1-6) from HEU-MET-FAST-002: These configurations involve spherical metallic fuel and no moderator. The experiments are performed using natural uranium as reflector. These experiments involve metallic uranium with 93.50 wt. % U-235.
- 11 configurations (cases 1-11) from HEU-MET-FAST-003: These configurations involve spherical metallic fuel and no moderator. The experiments are conducted with different reflector namely, natural uranium (cases 1-7) and tungsten carbide (cases 8-11). These experiments involve metallic uranium with 93.50 wt. % U-235.
- 1 configuration from HEU-MET-FAST-004: This configuration involves light water reflected cylindrical metallic uranium fuel and no moderator. Metallic uranium with 97.68 wt. % U-235 is used in this experiment.
- 43 configurations (cases 1-43) from HEU-MET-FAST-007: These configurations involve metallic uranium cuboids stacked one upon the other. The experiments are conducted with different moderator namely, polyethylene (cases 2-26, 35-43), Lucite/Plexiglas (cases 27-31), Teflon (cases 32-34). Case 1 is without moderator. Cases 1-34 do not use reflector and cases 35-43 use polyethylene as reflector. These experiments involve metallic uranium with 93.15 wt. % U-235.
- 1 configuration from HEU-MET-FAST-015: This configuration involves cylindrical metallic uranium fuel with no moderator and reflector. Metallic uranium with 95.97 wt. % U-235 is used in this experiment.

- 1 configuration from HEU-MET-FAST-018: This configuration involves spherical metallic uranium fuel with no moderator and reflector. Metallic uranium with 89.50 wt. % U-235 is used in this experiment.
- 1 configuration from HEU-MET-FAST-019: This configuration involves spherical metallic uranium fuel with graphite reflector and no moderator. Metallic uranium with 89.50 wt. % U-235 is used in this experiment.
- 1 configuration from HEU-MET-FAST-020: This configuration involves spherical metallic uranium fuel with polyethylene reflector and no moderator. Metallic uranium with 89.49 wt. % U-235 is used in this experiment.
- 1 configuration from HEU-MET-FAST-021: This configuration involves spherical metallic uranium fuel with carbon steel reflector and no moderator. Metallic uranium with 89.49 wt. % U-235 is used in this experiment.
- 1 configuration from HEU-MET-FAST-022: This configuration involves spherical metallic uranium fuel with duralumin (Al, Fe and Cu) reflector and no moderator. Metallic uranium with 89.49 wt. % U-235 is used in this experiment.
- 2 configurations (cases 16 and 20) from HEU-MET-FAST-023: These configurations involve metallic uranium cylindrical rods arranged in arrays with pitch 11.3145 cm (case 16) and 18.3125 cm (case 20). Case 16 does not involve both moderator and reflector. Case 20 involves wax (C and H) reflector and no moderator. Both these cases use metallic uranium cylindrical rods with 93.20 wt. % U-235.
- 5 configurations (cases 1, 8, 17, 19 and 32) from HEU-MET-FAST-026: These configurations involve metallic uranium cylindrical rods arranged in arrays with pitch 10.6875 cm (case 1), 19.9735 cm (case 8), 23.1215 cm (case 17), 19.6985 cm (case 19) and 37.4635 cm (case 32). Case 1 does not involve both moderator and reflector. Cases 8, 17, 19 and 32 experiments involve wax (C and H) reflector and no moderator. All cases use metallic uranium cylindrical rods with 93.20 wt. % U-235.
- 1 configuration from HEU-MET-FAST-027: This configuration involves spherical metallic uranium fuel with lead reflector and no moderator. Metallic uranium with 89.46 wt. % U-235 is used in this experiment.
- 1 configuration from HEU-MET-FAST-028: This configuration involves spherical metallic uranium fuel with natural uranium reflector and no moderator. Metallic uranium with 93.24 wt. % U-235 is used in this experiment.
- 1 configuration from HEU-MET-FAST-029: This configuration involves spherical metallic uranium fuel with depleted uranium reflector and no moderator. Metallic uranium with 89.60 wt. % U-235 is used in this experiment.
- 1 configuration from HEU-MET-FAST-031: This configuration involves spherical metallic uranium fuel with polyethylene reflector and no moderator. Metallic uranium with 89.41 wt. % U-235 is used in this experiment.
- 4 configurations (cases 1-4) from HEU-MET-FAST-032: These configurations involve spherical metallic fuel and no moderator. The experiments are performed using natural uranium as reflector. These experiments involve metallic uranium with 93.90 wt. % U-235 (case 1 and 2), 93.99 wt. % U-235 (case 3) and 93.91 wt. % U-235 (case 4).

- 2 configurations (cases 1-2) from HEU-MET-FAST-033: These configurations involve metallic uranium cylindrical plates stacked one upon the other with polyethylene and steel separators in between. The cylindrical plates are stacked vertically with pitch 2.475 cm (case 1) and 3.455 (case 2). The experiments are performed with polyethylene as moderator and without reflector. All these experiments use metallic uranium with 95.98 wt. % U-235.

- 3 configurations (cases 1-3) from HEU-MET-FAST-034: These configurations involve metallic uranium cylindrical plates stacked one upon the other. These experiments involve different separators in between the cylindrical plates namely, polyethylene & titanium (case1), aluminum & polyethylene (case 2) and carbon steel & polyethylene (case 3). The experiments are performed with polyethylene as moderator and without reflector. The cylindrical plates in all the three cases are stacked vertically with pitch 4.45 cm. All these experiments use metallic uranium with 95.98 wt. % U-235.

- 2 configurations (cases 1-2) from HEU-MET-FAST-036: These configurations involve metallic uranium cylindrical plates stacked one upon the other with polyethylene and depleted uranium separators in between. The cylindrical plates are stacked vertically with pitch 3.955 cm. The experiments are performed with polyethylene as moderator and without reflector. All these experiments use metallic uranium with 95.98 wt. % U-235.

- 1 configuration from HEU-MET-FAST-037: This configuration involves metallic uranium cylindrical plates stacked one upon the other with polyethylene and depleted uranium separators in between. The cylindrical plates are stacked vertically with pitch 3.965 cm. The experiment is performed with polyethylene as moderator and reflector. Metallic uranium with 95.98 wt. % U-235 is used in this experiment.

- 4 configurations (cases 3-6) from HEU-MET-FAST-041: These configurations involve graphite (cases 3-6) reflected spherical metallic fuel and no moderator. These experiments use metallic uranium with 93.90 wt. % U-235.

- 6 configurations (cases 2-7) from HEU-MET-FAST-053: These configurations involve metallic uranium cylindrical rods arranged in square pitch. In cases 2 and 3, fuel rods are arranged in 25.3 cm square-pitched arrays with Celotex (C, H &O) used as moderator and separator. In case 4, fuel rods are arranged in 19.2 cm square-pitched arrays with Foamglas (B, Si, Na & O) used as moderator and separator. In cases 5, 6 and 7, fuel rods are arranged in 18.5 cm square-pitched arrays with borated plastic foam (B, C, H & O) used as moderator and separator. All the cases use polyethylene as moderator. These experiments use metallic uranium with 93.20 wt. % U-235.

- 1 configuration from HEU-MET-FAST-055: This configuration involves metallic uranium cylindrical rods arranged in 5.5461 cm square-pitched arrays with aluminum and steel as separator. This experiment is performed with depleted uranium as reflector and without moderator. This experiment uses metallic uranium with 93.24 wt. % U-235.

- 4 configurations (cases 1-4) from HEU-MET-INTER-006: These configurations involve metallic uranium cylinders stacked one upon the other with pitch 8.3058 cm (case 1), 6.3043 cm (case 2), 4.3028 cm (case 3) and 2.3012 cm (case 4). In all the cases, graphite is used as moderator and separator and copper is used as reflector. These experiments involve metallic uranium with 93.23 wt. % U-235 (case 1 and 2), 93.24 wt. % U-235 (case 3) and 93.30 wt. % U-235 (case 4).

- 1 configuration from HEU-MET-MIXED-001: This configuration involves metallic uranium cylindrical plates stacked one upon the other with polyethylene and titanium separators in between. The cylindrical plates are stacked vertically with pitch 5.95 cm. The experiment is performed with polyethylene as moderator and reflector. Metallic uranium with 95.98 wt. % U-235 is used in this experiment.

- 1 configuration from HEU-MET-MIXED-002: This configuration involves spherical metallic uranium fuel with polyethylene as reflector and moderator. Metallic uranium with 89.57 wt. % U-235 is used in this experiment.

- 1 configuration from HEU-MET-MIXED-003: This configuration involves spherical metallic uranium fuel with polyethylene as reflector and moderator. Metallic uranium with 89.57 wt. % U-235 is used in this experiment.

- 1 configuration from HEU-MET-THERM-001: This configuration involves vertically stacked metallic uranium foils with pitch 1.905 cm. This experiment is performed with polyethylene as moderator and reflector with polyethylene and silicon dioxide being the separator. Metallic uranium with 93.23 wt. % U-235 is used in this experiment.

- 7 configurations (cases 1-7) from HEU-MET-THERM-003: These configurations involve metallic uranium cuboids in square-pitched arrays. Experiment is performed with only one cube in cases 1 and 2. The uranium cuboids are arranged in arrays with pitch 3.81 cm (case 3), 4.445 cm (case 4), 3.302 cm (case 5), 2.54 cm (case 6) and 2.9718 cm (case 7). All the experiments use Lucite/Plexiglas and light water as moderator and light water as reflector. Metallic uranium with 94.01 wt. % U-235 (cases 1-2) and 94.26 wt. % U-235 (cases 3-7) are used in these experiments.

- 20 configurations (cases 1-12,14-16 & 19-23) from HEU-MET-THERM-006: These configurations involve metallic uranium rectangular plates arranged with pitch 0.3164 cm. Light water is used as reflector and polyethylene is used as moderator in case 1. Cases 2-16 use light water as both reflector and moderator. Cases 19-23 uses solution with natural boron as moderator and reflector. All these experiments use metallic uranium with 93.17 wt. % U-235.

- 1 configuration from HEU-MET-THERM-008: This configuration involves metallic uranium foils in parallel arrangement with aluminum as separator with pitch 1.905 cm. This experiment is performed with polyethylene as moderator and reflector. Metallic uranium with 93.23 wt. % U-235 is used in this experiment.

- 1 configuration from HEU-MET-THERM-009: This configuration involves metallic uranium foils in parallel arrangement with magnesium oxide as separator with pitch 1.905 cm. This experiment is performed with polyethylene as moderator and reflector. Metallic uranium with 93.23 wt. % U-235 is used in this experiment.

- 43 configurations (cases 1-43) from HEU-MET-THERM-011: These configurations involve water-moderated and water-reflected highly enriched uranium fuel plates arranged in parallel arrays of pitch varying from 1 cm to 4.8 cm. The rectangular fuel plates are made of an alloy of uranium and aluminum, with uranium content of 26 wt. %. All the cases use Lucite/Plexiglas as separator. All these experiments use metallic uranium with 93.13 wt. % U-235 with uranium plates varying from 61 to 136 in numbers.

- 1 configuration from HEU-MET-THERM-012: This configuration involves metallic uranium foils in parallel arrangement with aluminum as separator with pitch 1.0541 cm. This experiment is performed with polyethylene as moderator and reflector. Metallic uranium with 93.23 wt. % U-235 is used in this experiment.

- 2 configurations (cases 1-2) from HEU-MET-THERM-013: These configurations involve metallic uranium foils in parallel arrangement with iron as separator with pitch 1.905 cm. These experiments are performed with polyethylene as moderator and reflector. Metallic uranium with 93.23 wt. % U-235 is used in both the experiments.

- 1 configuration from HEU-MET-THERM-014: This configuration involves metallic uranium foils in parallel arrangement with silicon dioxide as separator with pitch 1.0541 cm. This experiment is performed with polyethylene as moderator and reflector. Metallic uranium with 93.23 wt. % U-235 is used in this experiment.

- 4 configurations (cases 1-4) from IEU-MET-FAST-001: These configurations involve metallic uranium cylindrical plates in parallel arrangement with depleted uranium separators in between. The cylindrical plates are stacked with pitch 1.408 cm. The experiments are performed without moderator and reflector. Metallic uranium with 55.38 wt. % U-235 (case 1), 53.53 wt. % U-235 (case 2), 36.33 wt. % U-235 (case 3) and 37.76 wt. % U-235 (case 4) is used in these experiments.

- 1 configuration from IEU-MET-FAST-002: This configuration involves metallic uranium cylindrical plates in parallel arrangement with pitch 1.8 cm. Natural uranium is used as separator and reflector and the experiment is performed without moderator. Metallic uranium with 16.19 wt. % U-235 is used in this experiment.

- 1 configuration from IEU-MET-FAST-003: This configuration involves spherical metallic uranium fuel. This experiment is performed without moderator, reflector and separator. Metallic uranium with 36.53 wt. % U-235 is used in this experiment.

- 1 configuration from IEU-MET-FAST-004: This configuration involves spherical metallic uranium fuel with graphite as reflector. This experiment is performed without moderator and separator. Metallic uranium with 36.54 wt. % U-235 is used in this experiment.

- 1 configuration from IEU-MET-FAST-005: This configuration involves spherical metallic uranium fuel with carbon steel as reflector. This experiment is performed without moderator and separator. Metallic uranium with 36.51 wt. % U-235 is used in this experiment.

- 1 configuration from IEU-MET-FAST-006: This configuration involves spherical metallic uranium fuel with duralumin as reflector. This experiment is performed without moderator and separator. Metallic uranium with 36.51 wt. % U-235 is used in this experiment.

- 1 configuration from IEU-MET-FAST-007: This configuration involves metallic uranium cylindrical plates in parallel arrangement with pitch 2.9972 cm. Depleted uranium is used as reflector and the experiment is performed without moderator. Metallic uranium with 10.06 wt. % U-235 is used in this experiment.

- 1 configuration from IEU-MET-FAST-008: This configuration involves spherical metallic uranium fuel with depleted uranium as reflector. This experiment is performed without moderator and separator. Metallic uranium with 36.49 wt. % U-235 is used in this experiment.

- 1 configuration from IEU-MET-FAST-009: This configuration involves spherical metallic uranium fuel with polyethylene as reflector. This experiment is performed without moderator and separator. Metallic uranium with 36.47 wt. % U-235 is used in this experiment.

- 1 configuration from IEU-MET-FAST-010: This configuration involves metallic uranium cylindrical rods arranged in 5.5245 cm square pitched arrays. This experiment is performed with depleted uranium as reflector and separator. Experiment does not involve moderator. Metallic uranium with 8.88 wt. % U-235 is used in this experiment.

- 1 configuration from IEU-MET-FAST-012: This configuration involves metallic uranium cylindrical rods arranged in 5.5461 cm square pitched arrays. This experiment is performed with depleted uranium and aluminum as separator and depleted uranium as reflector. Experiment does not involve moderator. Metallic uranium with 16.79 wt. % U-235 is used in this experiment.

- 1 configuration from IEU-MET-FAST-013: This configuration involves metallic uranium cylindrical rods arranged in 5.5347 cm square pitched arrays. This experiment is performed with depleted uranium and aluminum as separator and aluminum as reflector. Experiment does not involve moderator. Metallic uranium with 11.69 wt. % U-235 is used in this experiment.

- 2 configurations (cases 92-93) from IEU-MET-FAST-014: These configurations involve metallic uranium cylindrical rods arranged in 5.5347 cm square pitched arrays. These experiments are performed with depleted uranium, tungsten and aluminum as separator and aluminum as reflector. These experiments does not involve moderator. Metallic uranium with 15.50 wt. % U-235 (case 92) and 20.54 wt. % U-235 (case 93) is used in these experiments.

- 7 configurations (cases 1-7) from IEU-MET-FAST-020: These configurations involve metallic uranium cylindrical fuel rods with copper as reflector. These experiments are performed without moderator and separator. Metallic uranium with 20.05 wt. % U-235 is used in these experiments.

- 1 configuration from IEU-MET-FAST-021: This configuration involves metallic uranium cylindrical fuel rods with natural uranium as reflector. This experiment is performed without moderator and separator. Metallic uranium with 20.05 wt. % U-235 is used in this experiment.

- 6 configurations (cases 1-5, 7) from IEU-MET-FAST-022: These configurations involve metallic uranium cylindrical fuel rods with copper as reflector. These experiments are performed with different moderator namely, graphite and Teflon (case 1), graphite, polyethylene and Teflon (case 2-5) and polyethylene and Teflon (case 7). Metallic uranium with 20.05 wt. % U-235 is used in all the experiments.

- 30 configurations (cases 1-30) from LEU-MET-THERM-006: These configurations involve metallic uranium annular rods arranged in triangular (cases 1-18) and square (cases 19-30) pitches. All the experiments are performed with light water as moderator and reflector. All these experiments use metallic uranium with 1.6 wt. % U-235 with uranium annular rods varying from 32 to 52 in numbers.

- 2 configurations (cases 1 and 4) from LEU-MET-THERM-007: These configurations involve metallic uranium cylindrical rods arranged in 1.3 cm (case 1) and 2.05 cm (case 4) square-pitched arrays. Both the experiments are performed with light water as moderator and reflector. Both the experiments use metallic uranium with 4.95 wt. % U-235.

- 15 configurations (cases 1-15) from HEU-COMP-THERM-010: These configurations involve fuel pins made of a homogeneous mixture of UO_2 and BeO. The fuel pins are cladded using 0.0508 cm thick Hastelloy X-280 tubes. Hastelloy X-280 has a density of 8.23 g/cm^3 and composed of a mixture of Mo, Co, Fe, Cr, W, C and Ni. The UO_2-BeO fuel pins are arranged in 1.242 cm square-pitched (case 1-2), 1.488 cm square-pitched (case 3), 1.742 cm square-pitched (case 4), 1.999 cm square-pitched (case 5-6), 2.276 cm square-pitched (case 7-8), 2.253 cm square-pitched (case 9), 2.507 cm square-pitched (case 10-11), 2.779 cm square-pitched (case 12), 2.995 cm square-pitched (case 13), 2.537 cm square-pitched (case 14) and 2.588 cm triangular-pitched (case 15) arrays. All the critical experiments are performed with water as moderator and reflector. Plexiglas is used as separator in the experiments. All these experiments use UO_2 and BeO homogeneous mixture fuel with 62 wt. % U-235.

  Note: The beryllium cross-section used is consistent with benchmark sample inputs, but 'Be-bound' may be applicable; however, comparison is not performed, but should be considered in future.

- 3 configurations (cases 1-3) from HEU-COMP-THERM-011: These configurations involve stainless steel cladded, sintered uranium dioxide and aluminum cylindrical rods arranged in 1.4 cm 21x21 square-pitched arrays. The fuel mixture also contains silicon in traces and fuel unit clad is majorly made of zirconium. These experiments are performed using water as both reflector and moderator; aluminum is used as separator. Uranium dioxide with 80 wt. % U-235 is used in these experiments.

- 2 configurations (cases 1-2) from HEU-COMP-THERM-012: These configurations involve stainless steel cladded, sintered uranium dioxide and aluminum cylindrical rods arranged in 1.4 cm 18x18 square-pitched arrays. The fuel mixture also contains silicon in traces and fuel unit clad is majorly made of zirconium. These experiments are performed using water as both reflector and moderator; aluminum is used as separator. Uranium dioxide with 80 wt. % U-235 is used in these experiments.

- 2 configurations (cases 1-2) from HEU-COMP-THERM-013: These configurations involve stainless steel cladded, sintered uranium dioxide and aluminum cylindrical rods arranged in 1.4 cm 14x14 square-pitched arrays. The fuel mixture also contains silicon in traces and fuel unit clad is majorly made of zirconium. These experiments are performed using water as both reflector and moderator; aluminum is used as separator. Uranium dioxide with 80 wt. % U-235 is used in these experiments.

- 2 configurations (cases 1-2) from HEU-COMP-THERM-014: These configurations involve stainless steel cladded, sintered uranium dioxide and aluminum cylindrical rods arranged in 1.4 cm 10x10 square-pitched arrays. The fuel mixture also contains silicon in traces and fuel unit clad is majorly made of zirconium. These experiments are performed using water as both reflector and moderator; aluminum is used as separator. Uranium dioxide with 80 wt. % U-235 is used in these experiments.

- 6 configurations (cases 4-9) from IEU-COMP-MIXED-002: These experiments use an equimolar mixture of uranium tetrafluoride (UF_4) and Teflon (CF_2). The UF_4-CF_2 mixture is compressed into different sizes of blocks to enable stacking of critical configurations of various shapes. Plexiglas is used as separator in the experiments. The UF_4-CF_2 mixture with 19 wt. % U-235 (cases 4-6) and 13 wt. % U-235 (cases 7-9) are used in these experiments.

In addition to 279 critical experiments, 11 critical experiments are initially selected and simulated, but the results are not used in the USL analysis. Table 10-3 tabulates the experiments along with the criticality results that are excluded from the analysis. The critical experiments are rejected based on the criteria of bias being maximum of ±0.025. The k_{eff} value in the listed experiments is either less than 0.9750 or greater than

1.0250, or correspondingly bias results more negative than -0.025 or more positive than +0.025. The high bias results are consistent with the sample calculation results in the OECD handbook.

The high bias is due to the involvement of infinite lattice and particular materials in the experiments. HEU-MET-FAST-003-012 critical experiment involves large amount of nickel, resulting in the high k_{eff} value. HEU-MET-INTER-001-001 critical experiment involves relatively large amounts of iron in the core, and stainless steel as a reflector, which resulted in high bias. HEU-MET-THERM-006-013 experiment calculates high due to sensitivity to small amounts of water and interpolation to critical condition. Five cases from HEU-COMP-INTER-005 critical experiment, results in high bias due to the involvement of relatively large amounts of chromium, nickel, zirconium, or stainless steel, in infinite models. 3 cases from IEU-COMP-MIXED-002 critical experiment, results in higher bias; these experiments have a large fraction of the fissions occurring in the intermediate energy region, the bias may be a result of missing or incorrect resonance data.

4.4 Trending Analysis

Determination of the parameters responsible for variation in k_{eff} is of primary importance in the criticality analysis. Trending analysis is performed to determine each parameter's effectiveness in explaining variations in calculated k_{eff} values. The correlation coefficient (Irl) provides a measure of statistical correlation between each parameter and variations in the calculated k_{eff} values. A correlation value Irl = 0 implies no correlation, and a value of Irl = 1 implies strong correlation.

The parameters considered to perform trending analysis against k_{eff} are; energy of average lethargy of fission (EALF) (eV), U-235 enrichment (wt. %), mean free path (MFP) (cm), fission neutron yield ($\bar{\nu}$) and moderator to fuel ratio. All 279 critical experiments have data on EALF, U-235 enrichment, mean free path, fission neutron yield and moderator to fuel ratio value and are used for trending analysis.

The range of EALF values used in the analysis is between 5.16E-02 eV and 9.60E+05 eV. The range of enrichment in the selected critical experiments used for analysis is from 1.60 wt. % U-235 to 97.68 wt. % U-235. The range of MFP values in the selected experiments is between 0.3780 cm and 3.5712 cm. The range of fission neutron yield values in the selected experiments is from 2.4377 to 2.6119. The range of moderator to fuel ratio values used in the analysis is between 0 and 62.37.

4.5 USL Computation

One of the main elements of the criticality analysis for a given storage/transportation system is the development of the upper subcritical limit (USL). The USL is the k_{eff} value used to specify the maximum value the reactivity of the system can be. The USL is dependent on the set of critical experiments considered for the evaluation, which have similar neutronic properties as the system evaluated. USLSTATS statistical analysis code (Ref. [4]) is used to compute USL function. All 279 critical experiments selected have data on EALF, U-235 enrichment, MFP, neutron fission yield and moderator to fuel ratio value and are used to compute USL.

The criticality evaluation may select any number of critical experiments that meets the statistical significance requirements to compute the USL for the system application. The parameter selection is also dependent on its applicability to the system application.

5.0 METHODOLOGY

5.1 Bias and Bias Uncertainty

Critical experiments with geometrical characteristics and material composition similar to the TN-BGC1 package are selected for criticality code validation. The SCALE 6.0 (Ref. [2]) computer code is used to perform KENO V.a k_{eff} calculation for selected critical experiments. It is necessary to make an adjustment to the calculated k_{eff}, as certain critical experiments are at slightly subcritical or supercritical state (Ref. [5]). This adjustment is done by normalizing the calculated k_{eff} value to the experimental value by using Equation 1 (Ref. [5]). The uncertainty (combined uncertainty) calculation involves determining a weighted mean that incorporates the uncertainty from both the experiment and the calculation method using Equation 2. However, the combined uncertainty is obtained using Equation 3 (Ref. [5]), which is a simplified error propagation equation for critical experiments considering both calculation and experimental uncertainty.

$$k_{norm} = {}^{k_{calc}}\!/_{k_{expt}} \qquad \text{Equation 1}$$

Where, k_{norm} = normalized k_{eff}

k_{calc} = calculated k_{eff}

k_{expt} = experimental k_{eff}

$$\sigma_{norm} = k_{norm} * \sqrt{\left(\frac{\sigma_{calc}}{k_{calc}}\right)^2 + \left(\frac{\sigma_{expt}}{k_{expt}}\right)^2} \qquad \text{Equation 2}$$

Where, σ_{norm} = combined uncertainty

$k_{norm} = k_{calc}/k_{expt}$

σ_{calc} = calculation uncertainty

σ_{expt} = experimental uncertainty

$$\sigma_{norm} = \sqrt{\sigma_{calc}^2 + \sigma_{expt}^2} \qquad \text{Equation 3}$$

5.2 Trending Analysis

The trending analysis is performed using the normalized k_{eff} values. The plots are generated using MS EXCEL for EALF, U-235 enrichment, MFP, neutron fission yield and moderator to fuel ratio. Correlation coefficient is estimated for each parameter using the generated MS EXCEL plots.

5.3 USL Functions

The USLSTATS software (Ref. [4]) is used to evaluate the USL functions with the USL method 1 (Ref. [6]). The critical experiments that have similar properties as TN-BGC1 package are selected for USL computation. The USL is computed using EALF, U-235 enrichment, MFP, neutron fission yield and moderator to fuel ratio parameters data available from the computational models along with the normalized k_{eff} and associated uncertainty. The USL function can be used if the value of the parameters in the analyzing

system is within the applicable range of values from the experimental data. For the parameter values slightly outside the range of applicability, the USL function can be obtained by extrapolation using the methodology outlined in Ref. [6]. There is no precise guidelines specified for the limits of extrapolation, thus engineering judgement should be applied when extrapolating beyond the range of the parameter bounds. The approach presented in Ref. [6] is as follows:

The USL Method 1 is defined as:

$$USL_1(X) = 1 - \Delta k_m - W + \beta(X) \qquad \text{Equation 4}$$

Where, Δk_m is the administrative margin of 0.05, W is the confidence band that accounts for uncertainties in the experiments, the calculation approach, and in the calculation data (e.g., cross sections), and $\beta(X)$ is defined as:

$$\beta(X) = k_c(X) - 1 \qquad \text{Equation 5}$$

Where, $k_c(X)$ is the linear regression fit of the data set. The adjustment has to be made to prevent taking credit for a positive bias ($\beta(X) > 0$) by assuming $k_c(X) = 1$ everywhere that $k_c(X) > 1$ (Ref. [6]). This additional margin provides further assurance of subcriticality.

While performing extrapolation, curvilinear function [w(X)] should be used rather than W because $k_c(X) - W$ is a straight line based on w(X) and is only assured of being conservative within the range of the parameter bounds (Ref. [6]). Curvilinear function, w(X) is defined as:

$$w(X) = t_{1-\gamma_1} S_p \left[1 + \frac{1}{n} + \frac{(X-\bar{X})^2}{\sum_{i=1,n}(X_i-\bar{X})^2}\right]^{\frac{1}{2}} \qquad \text{Equation 6}$$

Where, n = the number of critical calculations used in establishing $k_c(X)$,

$t_{1-\gamma}$ = the Student-t distribution statistic,

$\bar{X}$ = the mean value of parameter X in the set of calculations,

S_p = the pooled standard deviation for the set of criticality calculations.

6.0 REFERENCES

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3. DICE: Database for the International Criticality Safety Benchmark Evaluation Project, NEA Nuclear Science Committee. (https://www.oecd-nea.org/science/wpncs/icsbep/dice.html)
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5. J.C. Dean, R.W. Tayloe, Jr., "Guide for Validation of Nuclear Criticality Safety Calculational Methodology," NUREG/CR-6698, U. S. Nuclear Regulatory Commission, January 2001.
6. J. J. Lichtenwalter, S. M. Bowman, M. D. DeHart and C. M. Hopper, "Criticality Benchmark Guide for Light-Water-Reactor Fuel in Transportation and Storage Packages," NUREG/CR-6361, U. S. Nuclear Regulatory Commission, March 1997.
7. International Handbook of Evaluated Criticality Safety Benchmark Experiments, NEA/NSC/DOC(95)03, NEA Nuclear Science Committee, September 2014. (http://icsbep.inel.gov/)

7.0 NOMENCLATURE

CEA: The French Atomic Energy Commission

cm: centimeter

CSAS: Criticality Safety Analysis Sequence

DICE: Database for the International Criticality Safety Benchmark Evaluation Project

EALF: Energy of Average Lethargy of Fission

ICSBEP: International Criticality Safety Benchmark Evaluation Project

MFP: Mean Free Path

NRC: Nuclear Regulatory Commission

SCALE 6.0: Standardized Computer Analyses for Licensing Evaluation, Version 6.0

USL: Upper Subcritical Limit

wt. %: Weight Percent

8.0 COMPUTATIONS

8.1 SCALE 6.0 KENO V.a Input

All the KENO V.a simulations are performed for 10,100 generations (GEN) with 10,000 particles per generation (NPG) and by skipping 100 generations (NSK). The parameters run time limit (TME), which is the maximum execution time and check sigma (SIG), which terminates the simulation when the specified sigma is reached are used with the modified values. The simulations are performed with TME=60 (mins) and SIG=0.000099. In the KENO V.a simulations, the 238-group ENDF/B-V cross-section library and the NITAWL options are used. The CSAS5 control module of SCALE 6.0 allows simplified data input to the functional modules BONAMI, NITAWL and KENO V.a. These modules process the required cross-sections and calculate the k_{eff} of the system. BONAMI performs resonance self-shielding calculations for nuclides that have Bondarenko data associated with their cross-sections. NITAWL applies a Nordheim resonance self-shielding correction to nuclides having resonance parameters. KENO V.a calculates the k_{eff} of a three-dimensional system.

The KENO V.a inputs for the benchmark analysis are obtained from DICE (Ref. [3]). The geometry and material composition in the inputs are verified by comparing with the critical experiments description provided in the ICSBEP Handbook. The inputs are modified to use 238-group ENDF/B-V nuclear data library, 10,100 generations, 10,000 particles per generation and to skip 100 generations. The value for TME is set to 60 mins and SIG to 0.000099.

The cases which fail X^2 test for normality at the 95% level, but pass at the 99% level are re-run by entering alphanumeric value for random sequence (RND) in parameter section of the KENO V.a input. The random number package utilized by SCALE 6.0 always starts with the same seed and thus always produces the same sequence of random numbers. By using alphanumeric value for random sequence (RND) in parameter section, the problem will be run with a different random sequence. Ten cases, HEU-MET-FAST-002-002, HEU-MET-FAST-003-008, HEU-MET-THERM-006-006, HEU-MET-THERM-006-023, HEU-COMP-THERM-010-001, HEU-COMP-THERM-010-010, HEU-COMP-THERM-010-013, LEU-MET-THERM-006-005, LEU-MET-THERM-006-024 and LEU-MET-THERM-006-028 fail X^2 test for normality at the 95% level, but pass at the 99% level. All the cases are re-run once and HEU-MET-FAST-003-008 and HEU-COMP-THERM-010-001 cases are re-run twice by entering different alphanumeric values for RND parameter to satisfy the X^2 test for normality at the 95% level.

8.2 Trending Analysis

The values of the parameters of interest, EALF, U-235 enrichment, MFP, neutron fission yield and moderator to fuel ratio are collected from the experimental descriptions provided in the International Handbook of Evaluated Criticality Safety Benchmark Experiments (Ref. [7]) or KENO V.a outputs. Using the values of parameters, trending analysis is performed for parameters against normalized k_{eff} obtained for each experiment. The parameter values are described below:

a) U-235 Enrichment (wt. %)

The values of U-235 enrichment for all the critical experiments are collected from the experimental description of each experiment provided in Ref. [7]. The range of U-235 enrichment in the experiments selected for analysis is 1.60 wt. % U-235 to 97.68 wt. % U-235.

b) EALF (eV)

EALF values of all the experiments used for the analysis are collected from KENO V.a simulation output of each experiment. The range of EALF values in the selected experiments is between 5.16E-02 eV and 9.60E+05 eV.

c) Moderator to Fuel Ratio

The moderator to fuel ratio is obtained by taking ratio of moderator to that region of fuel covered by moderator. This is obtained by area covered by moderator as well as the fuel. Following are the examples to demonstrate the calculation of moderator to fuel ratio. The dimensions used to calculate moderator to fuel ratio in the following examples are provided in Figure 11-2 and Figure 11-3.

The area of the moderator is calculated using Equation 7,

$$(\text{Moderator Area}) = A_1 - A_2 \qquad \text{Equation 7}$$

Where,

A_1 = Total Area = $\begin{cases} P^2, \text{for square} - \text{pitched arrays; where } P = 2.540 \text{ cm} \\ \left(\frac{1}{2} * P * \frac{\sqrt{3}}{2} P\right), \text{for triangular} - \text{pitched arrays; where } P = 2.159 \text{ cm} \end{cases}$

A_2 = Area enclosed by the clad = $\begin{cases} \pi * \frac{D_2^2}{4}, \text{for square} - \text{pitched arrays; where } D_2 = 1.415 \text{ cm} \\ \frac{1}{2} * \pi * \frac{D_2^2}{4}, \text{for triangular} - \text{pitched arrays; where } D_2 = 1.434 \text{ cm} \end{cases}$

The moderator area for square-pitched arrays is calculated as,

$= (2.540^2) - [\pi * (1.415^2/4)] = 4.879 \text{ cm}^2$

The moderator area for triangular-pitched arrays is calculated as,

$= [(1/2) * (\sqrt{3}/2) * 2.159^2] - [(1/2) * \pi * (1.434^2/4)] = 1.211 \text{ cm}^2$

The moderator to fuel ratio is calculated using Equation 8,

$$\text{Moderator to Fuel Ratio} = \frac{\text{Moderator Area}}{\text{Fuel Area}} \qquad \text{Equation 8}$$

Where, Fuel Area = $\begin{cases} \pi * \frac{D_1^2}{4}, \text{for square} - \text{pitched arrays; where } D_1 = 1.265 \text{ cm} \\ \frac{1}{2} * \pi * \frac{D_1^2}{4}, \text{for triangular} - \text{pitched arrays; where } D_1 = 1.264 \text{ cm} \end{cases}$

The fuel area for square-pitched arrays is calculated as,

$= \pi * (1.265^2/4) = 1.257 \text{ cm}^2$

The fuel area for triangular-pitched arrays is calculated as,

$= (1/2) * \pi * (1.264^2/4) = 0.627\ cm^2$

Therefore, the moderator to fuel ratio for square-pitched arrays is, 4.879 cm^2/ 1.257 cm^2 = 3.882, and the moderator to fuel ratio for triangular-pitched arrays is, 1.211 cm^2/ 0.627 cm^2 = 1.931

The range of the moderator to fuel volume ratio in the selected critical experiments is from 0 to 62.37.

d) Mean Free Path (cm)

MFP values of all the experiments used for the analysis are collected from KENO V.a simulation output of each experiment. The range of MFP values in the selected experiments is between 0.3780 cm and 3.5712 cm.

e) Fission Neutron Yield ($\bar{\nu}$)

Fission neutron yield values of all the experiments used for the analysis are collected from KENO V.a simulation output of each experiment. The range of fission neutron yield values in the selected experiments is from 2.4377 to 2.6119.

8.3 USLSTATS Input

The inputs for computing USL functions are prepared in accordance to User's Manual for USLSTATS V1.0 (Ref. [4]). The input consists of three sections; first section (line) contains a title, second line contains problem specification parameters and the third section contains the parameter value, k_{eff} and its standard deviation. The problem specification parameter values are described below:

P = 0.995

This input is the proportion of population falling above lower tolerance level, which is a statistical parameter, used only in the USL method 2, single-sided uniform width closed interval approach. The typical value is 0.995. However, this input value does not matter as the analysis is performed using USL method 1.

1-γ = 0.95

This value is used in Student-t calculation of USL methods 1 and 2, is typically assigned a value of 0.95 and represents the desired confidence level to be assigned the linear regression fit of k_{eff} values.

σ = 0.95

This statistical parameter represents the confidence on the proportion P, and is typically assigned a value of 0.95.

X_{min} = 0

The lower limit of the parameter input value. The value of 0 (zero) indicates that no lower limit is imposed on the input values.

X_{max} = 0

The upper limit of the parameter input value. The value of 0 (zero) indicates that no upper limit is imposed on the input values.

$\sigma_{sample} = -1.0$

The parameter is the average standard deviation estimated for the supplied values of k_{eff}. The value assigned is -1.0, which is to instruct USLSTATS to read the standard deviation associated with each value of k_{eff} provided in third section of the input.

$\Delta k_M = 0.05$

This parameter is an administrative margin; generally a value of 0.05 is assigned.

The values of the parameters of interest are collected from the experimental descriptions provided in ICSBEP Handbook (Ref. [7]) or KENO V.a outputs for selected critical experiments. The benchmark experiments, values of the relevant parameters and their k_{eff} along with their associated standard deviation for each experiment are presented in Table 10-4.

9.0 RESULTS, CONCLUSIONS, AND RECOMMENDATIONS

The criticality code validation is performed using 279 critical experiments obtained from DICE (Ref. [3]). The critical experiments are selected such that the geometric characteristics and material compositions are similar to that of TN-BGC1 package. The critical experiments have the fissile medium of uranium-metal/uranium oxides/uranium fluorides/uranium alloys. All the critical experiments are benchmarked with the use of the SCALE 6.0. The normalized k_{eff} results along with the values of parameters of interest are tabulated in Table 10-4. The difference in the results obtained from the re-run of ten cases (for the normality test) with different alphanumeric values for RND parameter are nearly insignificant. The largest difference observed is about 3 sigma.

Trending analysis is performed for each parameter against normalized k_{eff} and associated uncertainty. The obtained results are tabulated in Table 10-5. The strongest relative correlation is obtained for the parameter mean free path and the weakest correlation is for neutron fission yield. The relatively low correlation values obtained for the parameters imply that a strong relationship does not exist between experimental k_{eff} values and corresponding parameter values. Figure 11-4 to Figure 11-8 provides the trending analysis results for each parameter and demonstrates that the mean free path parameter is relatively more correlated.

The USLSTATS runs are performed for EALF, U-235 enrichment, MFP, neutron fission yield and moderator to fuel ratio parameters. All the USLSTATS runs for the parameters satisfy the normality test. The USL functions along with the applicable range for each parameter is tabulated in Table 10-6. The USL function can be used to determine USL values for systems having parameter values within the applicable range. However, the USL function can be obtained by extrapolation using the data provided in Table 10-7, if the parameter value is outside the applicable range.

10.0 TABLES

Table 10-1: Comparison of Material Used in KENO V.a and Benchmark Models

	System Application	Benchmark KENO V.a Models
Fuel	Uranium Metal, Uranium oxides, Uranium tetrafluorides and Uranium-Alloys	Uranium Metal, UO_2, UO_2-BeO, UF_4-CF_2 and uranium-aluminum alloy
Enrichment	20 wt. %U-235[a] 100 wt. % U-235[a]	1.6 wt. % U-235 to 97.6 wt. % U-235
Moderator	Polyethylene Water Mixture of Polyethylene, Water and Graphite	Polyethylene Lucite/Plexiglas Teflon Celotex (C, H, O) Foamglas (B, C, H, O) Borated Plastic Foam Graphite Light Water Solution with Natural Boron
Reflector[b]	Light Water	Natural Uranium Tungsten Carbide Nickel Light Water Polyethylene Graphite Carbon Steel Duralumin (Al, Fe, Cu) Wax (C, H) Depleted Uranium Lead Copper
Absorber	Boron in Resin	Aluminum Nickel Iron Borated Plastic Foam, Solution with Natural Boron Foamglas (B, C, H, O)
Structure Materials	Stainless Steel Aluminum Balsa	Aluminum Polyethylene Stainless Steel Tungsten Iron Titanium Carbon Steel Borated Plastic Foam Plexiglas

[a] 20 wt. % U-235 and 100 wt. % U-235 are the maximum allowable enrichment for the considered contents in the package. Lower values are permissible and covered in the validation.
[b] Structure materials can also be considered as reflectors, as they surround the fissile material.

Table 10-2: Critical Experiments and k_{eff} Results

(Part 1 of 8)

Experiment Name	KENO k_{eff}	σ_{KENO}	Benchmark k_{eff}	σ_{BENCH}	Normalised k_{eff}	Combined σ
HEU-MET-FAST-001-001	0.9973	0.0001	1.0000	0.0010	0.9973	0.0010
HEU-MET-FAST-002-001	1.0027	0.0001	1.0000	0.0030	1.0027	0.0030
HEU-MET-FAST-002-002	1.0035	0.0001	1.0000	0.0030	1.0035	0.0030
HEU-MET-FAST-002-003	1.0018	0.0001	1.0000	0.0030	1.0018	0.0030
HEU-MET-FAST-002-004	0.9970	0.0001	1.0000	0.0030	0.9970	0.0030
HEU-MET-FAST-002-005	1.0019	0.0001	1.0000	0.0030	1.0019	0.0030
HEU-MET-FAST-002-006	0.9983	0.0001	1.0000	0.0030	0.9983	0.0030
HEU-MET-FAST-003-001	0.9932	0.0001	1.0000	0.0050	0.9932	0.0050
HEU-MET-FAST-003-002	0.9937	0.0001	1.0000	0.0050	0.9937	0.0050
HEU-MET-FAST-003-003	0.9991	0.0001	1.0000	0.0050	0.9991	0.0050
HEU-MET-FAST-003-004	0.9976	0.0001	1.0000	0.0030	0.9976	0.0030
HEU-MET-FAST-003-005	1.0022	0.0001	1.0000	0.0030	1.0022	0.0030
HEU-MET-FAST-003-006	1.0028	0.0001	1.0000	0.0030	1.0028	0.0030
HEU-MET-FAST-003-007	1.0034	0.0001	1.0000	0.0030	1.0034	0.0030
HEU-MET-FAST-003-008	1.0042	0.0001	1.0000	0.0050	1.0042	0.0050
HEU-MET-FAST-003-009	1.0055	0.0001	1.0000	0.0050	1.0055	0.0050
HEU-MET-FAST-003-010	1.0090	0.0001	1.0000	0.0050	1.0090	0.0050
HEU-MET-FAST-003-011	1.0128	0.0001	1.0000	0.0050	1.0128	0.0050
HEU-MET-FAST-004-001	0.9977	0.0001	1.0020	0.0012	0.9957	0.0012
HEU-MET-FAST-007-001	0.9920	0.0001	0.9950	0.0024	0.9970	0.0024
HEU-MET-FAST-007-002	0.9934	0.0001	0.9964	0.0014	0.9970	0.0014
HEU-MET-FAST-007-003	0.9945	0.0001	0.9990	0.0013	0.9955	0.0013
HEU-MET-FAST-007-004	0.9921	0.0001	0.9948	0.0013	0.9973	0.0013
HEU-MET-FAST-007-005	0.9933	0.0001	0.9978	0.0018	0.9955	0.0018
HEU-MET-FAST-007-006	1.0000	0.0001	1.0006	0.0013	0.9994	0.0013
HEU-MET-FAST-007-007	0.9948	0.0001	0.9974	0.0014	0.9974	0.0014
HEU-MET-FAST-007-008	0.9924	0.0001	0.9973	0.0013	0.9951	0.0013
HEU-MET-FAST-007-009	0.9963	0.0001	0.9995	0.0056	0.9968	0.0056
HEU-MET-FAST-007-010	0.9935	0.0001	0.9981	0.0012	0.9954	0.0012
HEU-MET-FAST-007-011	0.9931	0.0001	0.9958	0.0013	0.9973	0.0013
HEU-MET-FAST-007-012	0.9887	0.0001	0.9932	0.0012	0.9954	0.0012
HEU-MET-FAST-007-013	0.9965	0.0001	0.9990	0.0012	0.9975	0.0012
HEU-MET-FAST-007-014	0.9925	0.0001	0.9964	0.0012	0.9961	0.0012
HEU-MET-FAST-007-015	0.9922	0.0001	0.9959	0.0012	0.9963	0.0012
HEU-MET-FAST-007-016	0.9931	0.0001	0.9969	0.0012	0.9961	0.0012

Table 10-2: Critical Experiments and k_{eff} Results (Part 2 of 8)

Experiment Name	KENO k_{eff}	σ_{KENO}	Benchmark k_{eff}	σ_{BENCH}	Normalised k_{eff}	Combined σ
HEU-MET-FAST-007-017	0.9928	0.0001	0.9953	0.0012	0.9975	0.0012
HEU-MET-FAST-007-018	0.9952	0.0001	0.9972	0.0012	0.9980	0.0012
HEU-MET-FAST-007-019	0.9946	0.0001	0.9956	0.0015	0.9990	0.0015
HEU-MET-FAST-007-020	0.9917	0.0001	0.9950	0.0017	0.9967	0.0017
HEU-MET-FAST-007-021	0.9926	0.0001	0.9956	0.0018	0.9969	0.0018
HEU-MET-FAST-007-022	0.9931	0.0001	0.9963	0.0019	0.9968	0.0019
HEU-MET-FAST-007-023	0.9937	0.0001	0.9962	0.0017	0.9975	0.0017
HEU-MET-FAST-007-024	0.9940	0.0001	0.9970	0.0018	0.9970	0.0018
HEU-MET-FAST-007-025	0.9928	0.0001	0.9959	0.0018	0.9969	0.0018
HEU-MET-FAST-007-026	0.9931	0.0001	0.9966	0.0017	0.9965	0.0017
HEU-MET-FAST-007-027	0.9916	0.0001	0.9948	0.0014	0.9967	0.0014
HEU-MET-FAST-007-028	0.9918	0.0001	0.9970	0.0023	0.9948	0.0023
HEU-MET-FAST-007-029	0.9922	0.0001	0.9961	0.0014	0.9961	0.0014
HEU-MET-FAST-007-030	0.9923	0.0001	0.9964	0.0021	0.9959	0.0021
HEU-MET-FAST-007-031	0.9979	0.0001	0.9996	0.0022	0.9983	0.0022
HEU-MET-FAST-007-032	0.9981	0.0001	0.9941	0.0012	1.0040	0.0012
HEU-MET-FAST-007-033	1.0049	0.0001	0.9977	0.0019	1.0072	0.0019
HEU-MET-FAST-007-034	1.0072	0.0001	0.9959	0.0017	1.0114	0.0017
HEU-MET-FAST-007-035	0.9923	0.0001	1.0003	0.0018	0.9920	0.0018
HEU-MET-FAST-007-036	1.0010	0.0001	0.9999	0.0007	1.0011	0.0007
HEU-MET-FAST-007-037	0.9995	0.0001	0.9988	0.0008	1.0007	0.0008
HEU-MET-FAST-007-038	0.9998	0.0001	1.0000	0.0008	0.9998	0.0008
HEU-MET-FAST-007-039	1.0022	0.0001	1.0018	0.0014	1.0004	0.0014
HEU-MET-FAST-007-040	1.0040	0.0001	1.0013	0.0008	1.0027	0.0008
HEU-MET-FAST-007-041	1.0009	0.0001	0.9994	0.0009	1.0015	0.0009
HEU-MET-FAST-007-042	1.0025	0.0001	1.0016	0.0009	1.0009	0.0009
HEU-MET-FAST-007-043	1.0030	0.0001	0.9998	0.0008	1.0032	0.0008
HEU-MET-FAST-015-001	0.9923	0.0001	0.9996	0.0017	0.9927	0.0017
HEU-MET-FAST-018-001	0.9978	0.0001	1.0000	0.0014	0.9978	0.0014
HEU-MET-FAST-019-001	1.0033	0.0001	1.0000	0.0028	1.0033	0.0028
HEU-MET-FAST-020-001	0.9958	0.0001	1.0000	0.0028	0.9958	0.0028
HEU-MET-FAST-021-001	1.0188	0.0001	1.0000	0.0024	1.0188	0.0024
HEU-MET-FAST-022-001	0.9923	0.0001	1.0000	0.0019	0.9923	0.0019
HEU-MET-FAST-023-016	0.9970	0.0001	1.0000	0.0052	0.9970	0.0052
HEU-MET-FAST-023-020	0.9992	0.0001	1.0000	0.0052	0.9992	0.0052

Table 10-2: Critical Experiments and k_{eff} Results (Part 3 of 8)

Experiment Name	KENO k_{eff}	σ_{KENO}	Benchmark k_{eff}	σ_{BENCH}	Normalised k_{eff}	Combined σ
HEU-MET-FAST-026-001	0.9990	0.0001	0.9982	0.0042	1.0008	0.0042
HEU-MET-FAST-026-008	1.0013	0.0001	1.0000	0.0038	1.0013	0.0038
HEU-MET-FAST-026-017	0.9993	0.0001	1.0000	0.0038	0.9993	0.0038
HEU-MET-FAST-026-019	0.9883	0.0001	0.9982	0.0042	0.9900	0.0042
HEU-MET-FAST-026-032	0.9995	0.0001	1.0000	0.0038	0.9995	0.0038
HEU-MET-FAST-027-001	1.0087	0.0001	1.0000	0.0025	1.0087	0.0025
HEU-MET-FAST-028-001	1.0038	0.0001	1.0000	0.0030	1.0038	0.0030
HEU-MET-FAST-029-001	1.0036	0.0001	1.0000	0.0020	1.0036	0.0020
HEU-MET-FAST-031-001	1.0014	0.0001	1.0000	0.0059	1.0014	0.0059
HEU-MET-FAST-032-001	1.0040	0.0001	1.0000	0.0016	1.0040	0.0016
HEU-MET-FAST-032-002	1.0041	0.0001	1.0000	0.0027	1.0041	0.0027
HEU-MET-FAST-032-003	0.9981	0.0001	1.0000	0.0017	0.9981	0.0017
HEU-MET-FAST-032-004	0.9982	0.0001	1.0000	0.0017	0.9982	0.0017
HEU-MET-FAST-033-001	0.9905	0.0001	0.9991	0.0014	0.9913	0.0014
HEU-MET-FAST-033-002	0.9961	0.0001	0.9991	0.0014	0.9970	0.0014
HEU-MET-FAST-034-001	0.9939	0.0001	0.9990	0.0012	0.9949	0.0012
HEU-MET-FAST-034-002	0.9932	0.0001	0.9990	0.0012	0.9942	0.0012
HEU-MET-FAST-034-003	0.9984	0.0001	0.9990	0.0012	0.9994	0.0012
HEU-MET-FAST-036-001	0.9919	0.0001	0.9993	0.0015	0.9926	0.0015
HEU-MET-FAST-036-002	0.9957	0.0001	0.9993	0.0013	0.9964	0.0013
HEU-MET-FAST-037-001	1.0017	0.0001	0.9997	0.0011	1.0020	0.0011
HEU-MET-FAST-041-003	0.9976	0.0001	1.0006	0.0029	0.9970	0.0029
HEU-MET-FAST-041-004	1.0018	0.0001	1.0006	0.0025	1.0012	0.0025
HEU-MET-FAST-041-005	0.9976	0.0001	1.0006	0.0031	0.9970	0.0031
HEU-MET-FAST-041-006	0.9994	0.0001	1.0006	0.0045	0.9988	0.0045
HEU-MET-FAST-053-002	1.0032	0.0001	1.0010	0.0014	1.0021	0.0014
HEU-MET-FAST-053-003	1.0046	0.0001	1.0024	0.0013	1.0022	0.0013
HEU-MET-FAST-053-004	0.9874	0.0001	1.0011	0.0010	0.9863	0.0010
HEU-MET-FAST-053-005	0.9955	0.0001	0.9997	0.0014	0.9958	0.0014
HEU-MET-FAST-053-006	0.9968	0.0001	1.0003	0.0013	0.9965	0.0013
HEU-MET-FAST-053-007	0.9952	0.0001	1.0010	0.0014	0.9942	0.0014
HEU-MET-FAST-055-001	1.0079	0.0001	0.9955	0.0028	1.0124	0.0028
HEU-MET-INTER-006-001	1.0017	0.0001	0.9977	0.0008	1.0040	0.0008
HEU-MET-INTER-006-002	1.0041	0.0001	1.0001	0.0008	1.0040	0.0008
HEU-MET-INTER-006-003	1.0073	0.0001	1.0015	0.0009	1.0058	0.0009

Table 10-2: Critical Experiments and k_{eff} Results (Part 4 of 8)

Experiment Name	KENO k_{eff}	σ_{KENO}	Benchmark k_{eff}	σ_{BENCH}	Normalised k_{eff}	Combined σ
HEU-MET-INTER-006-004	1.0081	0.0001	1.0016	0.0008	1.0065	0.0008
HEU-MET-MIXED-001-001	1.0019	0.0001	0.9995	0.0013	1.0024	0.0013
HEU-MET-MIXED-002-001	1.0072	0.0001	1.0000	0.0037	1.0072	0.0037
HEU-MET-MIXED-003-001	1.0081	0.0001	1.0000	0.0038	1.0081	0.0038
HEU-MET-THERM-001-001	1.0064	0.0001	1.0010	0.0060	1.0054	0.0060
HEU-MET-THERM-003-001	0.9976	0.0001	1.0000	0.0010	0.9976	0.0010
HEU-MET-THERM-003-002	0.9779	0.0001	0.9910	0.0030	0.9868	0.0030
HEU-MET-THERM-003-003	0.9680	0.0001	0.9826	0.0060	0.9852	0.0060
HEU-MET-THERM-003-004	0.9777	0.0001	0.9876	0.0040	0.9900	0.0040
HEU-MET-THERM-003-005	0.9903	0.0001	0.9930	0.0030	0.9973	0.0030
HEU-MET-THERM-003-006	0.9714	0.0001	0.9889	0.0030	0.9823	0.0030
HEU-MET-THERM-003-007	0.9801	0.0001	0.9919	0.0030	0.9881	0.0030
HEU-MET-THERM-006-001	0.9990	0.0001	1.0000	0.0044	0.9990	0.0044
HEU-MET-THERM-006-002	1.0016	0.0001	1.0000	0.0040	1.0016	0.0040
HEU-MET-THERM-006-003	1.0070	0.0001	1.0000	0.0040	1.0070	0.0040
HEU-MET-THERM-006-004	0.9959	0.0001	1.0000	0.0040	0.9959	0.0040
HEU-MET-THERM-006-005	1.0026	0.0001	1.0000	0.0040	1.0026	0.0040
HEU-MET-THERM-006-006	1.0025	0.0001	1.0000	0.0040	1.0025	0.0040
HEU-MET-THERM-006-007	1.0005	0.0001	1.0000	0.0040	1.0005	0.0040
HEU-MET-THERM-006-008	0.9973	0.0001	1.0000	0.0040	0.9973	0.0040
HEU-MET-THERM-006-009	0.9955	0.0001	1.0000	0.0040	0.9955	0.0040
HEU-MET-THERM-006-010	1.0078	0.0001	1.0000	0.0040	1.0078	0.0040
HEU-MET-THERM-006-011	1.0070	0.0001	1.0000	0.0040	1.0070	0.0040
HEU-MET-THERM-006-012	1.0080	0.0001	1.0000	0.0040	1.0080	0.0040
HEU-MET-THERM-006-014	0.9986	0.0001	1.0000	0.0040	0.9986	0.0040
HEU-MET-THERM-006-015	0.9952	0.0001	1.0000	0.0040	0.9952	0.0040
HEU-MET-THERM-006-016	1.0065	0.0001	1.0000	0.0040	1.0065	0.0040
HEU-MET-THERM-006-019	0.9953	0.0001	1.0000	0.0040	0.9953	0.0040
HEU-MET-THERM-006-020	0.9982	0.0001	1.0000	0.0040	0.9982	0.0040
HEU-MET-THERM-006-021	1.0003	0.0001	1.0000	0.0040	1.0003	0.0040
HEU-MET-THERM-006-022	1.0028	0.0001	1.0000	0.0040	1.0028	0.0040
HEU-MET-THERM-006-023	1.0066	0.0001	1.0000	0.0040	1.0066	0.0040
HEU-MET-THERM-008-001	1.0143	0.0001	1.0009	0.0052	1.0134	0.0052
HEU-MET-THERM-009-001	1.0109	0.0001	1.0032	0.0063	1.0076	0.0063
HEU-MET-THERM-011-001	1.0039	0.0002	1.0000	0.0010	1.0039	0.0010

Table 10-2: Critical Experiments and k_{eff} Results (Part 5 of 8)

Experiment Name	KENO k_{eff}	σ_{KENO}	Benchmark k_{eff}	σ_{BENCH}	Normalised k_{eff}	Combined σ
HEU-MET-THERM-011-002	1.0026	0.0001	1.0000	0.0010	1.0026	0.0010
HEU-MET-THERM-011-003	1.0036	0.0001	1.0000	0.0005	1.0036	0.0006
HEU-MET-THERM-011-004	1.0027	0.0001	1.0000	0.0005	1.0027	0.0006
HEU-MET-THERM-011-005	1.0036	0.0001	1.0000	0.0005	1.0036	0.0005
HEU-MET-THERM-011-006	1.0014	0.0001	1.0000	0.0006	1.0014	0.0006
HEU-MET-THERM-011-007	1.0016	0.0001	1.0000	0.0006	1.0016	0.0006
HEU-MET-THERM-011-008	1.0018	0.0001	1.0000	0.0006	1.0018	0.0006
HEU-MET-THERM-011-009	1.0020	0.0001	1.0000	0.0006	1.0020	0.0006
HEU-MET-THERM-011-010	1.0026	0.0001	1.0000	0.0005	1.0026	0.0005
HEU-MET-THERM-011-011	1.0032	0.0001	1.0000	0.0005	1.0032	0.0005
HEU-MET-THERM-011-012	1.0082	0.0001	1.0000	0.0005	1.0082	0.0005
HEU-MET-THERM-011-013	1.0033	0.0001	1.0000	0.0005	1.0033	0.0005
HEU-MET-THERM-011-014	1.0036	0.0001	1.0000	0.0005	1.0036	0.0005
HEU-MET-THERM-011-015	1.0032	0.0002	1.0000	0.0005	1.0032	0.0005
HEU-MET-THERM-011-016	1.0024	0.0001	1.0000	0.0005	1.0024	0.0005
HEU-MET-THERM-011-017	1.0027	0.0001	1.0000	0.0005	1.0027	0.0005
HEU-MET-THERM-011-018	1.0027	0.0001	1.0000	0.0005	1.0027	0.0005
HEU-MET-THERM-011-019	1.0023	0.0001	1.0000	0.0005	1.0023	0.0005
HEU-MET-THERM-011-020	1.0030	0.0001	1.0000	0.0005	1.0030	0.0005
HEU-MET-THERM-011-021	1.0031	0.0001	1.0000	0.0005	1.0031	0.0005
HEU-MET-THERM-011-022	1.0032	0.0002	1.0000	0.0005	1.0032	0.0006
HEU-MET-THERM-011-023	1.0028	0.0001	1.0000	0.0006	1.0028	0.0006
HEU-MET-THERM-011-024	1.0032	0.0001	1.0000	0.0006	1.0032	0.0006
HEU-MET-THERM-011-025	1.0023	0.0001	1.0000	0.0007	1.0023	0.0007
HEU-MET-THERM-011-026	1.0012	0.0001	1.0000	0.0007	1.0012	0.0007
HEU-MET-THERM-011-027	0.9998	0.0001	1.0000	0.0008	0.9998	0.0008
HEU-MET-THERM-011-028	1.0003	0.0001	1.0000	0.0008	1.0003	0.0008
HEU-MET-THERM-011-029	1.0010	0.0001	1.0000	0.0008	1.0010	0.0008
HEU-MET-THERM-011-030	1.0012	0.0001	1.0000	0.0008	1.0012	0.0008
HEU-MET-THERM-011-031	1.0033	0.0001	1.0000	0.0005	1.0033	0.0005
HEU-MET-THERM-011-032	1.0034	0.0001	1.0000	0.0005	1.0034	0.0005
HEU-MET-THERM-011-033	1.0037	0.0001	1.0000	0.0005	1.0037	0.0005
HEU-MET-THERM-011-034	1.0002	0.0001	1.0000	0.0005	1.0002	0.0005
HEU-MET-THERM-011-035	1.0021	0.0002	1.0000	0.0017	1.0021	0.0017
HEU-MET-THERM-011-036	1.0018	0.0002	1.0000	0.0017	1.0018	0.0017

Table 10-2: Critical Experiments and k_{eff} Results (Part 6 of 8)

Experiment Name	KENO k_{eff}	σ_{KENO}	Benchmark k_{eff}	σ_{BENCH}	Normalised k_{eff}	Combined σ
HEU-MET-THERM-011-037	1.0035	0.0001	1.0000	0.0005	1.0035	0.0005
HEU-MET-THERM-011-038	1.0039	0.0001	1.0000	0.0006	1.0039	0.0006
HEU-MET-THERM-011-039	1.0016	0.0001	1.0000	0.0006	1.0016	0.0006
HEU-MET-THERM-011-040	1.0023	0.0001	1.0000	0.0008	1.0023	0.0009
HEU-MET-THERM-011-041	1.0020	0.0001	1.0000	0.0010	1.0020	0.0010
HEU-MET-THERM-011-042	1.0032	0.0001	1.0000	0.0006	1.0032	0.0006
HEU-MET-THERM-011-043	1.0004	0.0001	1.0000	0.0006	1.0004	0.0006
HEU-MET-THERM-012-001	1.0063	0.0001	0.9971	0.0025	1.0092	0.0025
HEU-MET-THERM-013-001	1.0114	0.0001	1.0021	0.0022	1.0093	0.0022
HEU-MET-THERM-013-002	1.0032	0.0001	0.9983	0.0020	1.0049	0.0020
HEU-MET-THERM-014-001	1.0063	0.0001	0.9939	0.0015	1.0125	0.0015
IEU-MET-FAST-001-001	1.0008	0.0001	0.9989	0.0009	1.0019	0.0009
IEU-MET-FAST-001-002	1.0010	0.0001	0.9997	0.0009	1.0013	0.0009
IEU-MET-FAST-001-003	1.0032	0.0001	0.9993	0.0003	1.0039	0.0003
IEU-MET-FAST-001-004	1.0036	0.0001	1.0002	0.0003	1.0034	0.0003
IEU-MET-FAST-002-001	1.0076	0.0001	1.0000	0.0030	1.0076	0.0030
IEU-MET-FAST-003-001	1.0039	0.0001	1.0000	0.0017	1.0039	0.0017
IEU-MET-FAST-004-001	1.0085	0.0001	1.0000	0.0030	1.0085	0.0030
IEU-MET-FAST-005-001	1.0099	0.0001	1.0000	0.0021	1.0099	0.0021
IEU-MET-FAST-006-001	0.9963	0.0001	1.0000	0.0023	0.9963	0.0023
IEU-MET-FAST-007-001	1.0173	0.0001	1.0045	0.0007	1.0127	0.0007
IEU-MET-FAST-008-001	1.0077	0.0001	1.0000	0.0018	1.0077	0.0018
IEU-MET-FAST-009-001	1.0108	0.0001	1.0000	0.0053	1.0108	0.0053
IEU-MET-FAST-010-001	1.0064	0.0001	0.9954	0.0024	1.0111	0.0024
IEU-MET-FAST-012-001	1.0090	0.0001	1.0007	0.0027	1.0083	0.0027
IEU-MET-FAST-013-001	1.0131	0.0001	0.9941	0.0023	1.0191	0.0023
IEU-MET-FAST-014-001	1.0130	0.0001	0.9958	0.0022	1.0173	0.0022
IEU-MET-FAST-014-002	1.0107	0.0001	0.9927	0.0022	1.0181	0.0022
IEU-MET-FAST-020-001	1.0092	0.0001	1.0020	0.0013	1.0072	0.0013
IEU-MET-FAST-020-002	1.0147	0.0001	1.0041	0.0013	1.0105	0.0013
IEU-MET-FAST-020-003	1.0155	0.0001	1.0040	0.0013	1.0115	0.0013
IEU-MET-FAST-020-004	1.0171	0.0001	1.0053	0.0013	1.0118	0.0013
IEU-MET-FAST-020-005	1.0182	0.0001	1.0067	0.0013	1.0114	0.0013
IEU-MET-FAST-020-006	1.0171	0.0001	1.0065	0.0013	1.0105	0.0013
IEU-MET-FAST-020-007	1.0201	0.0001	1.0104	0.0014	1.0096	0.0014

Table 10-2: Critical Experiments and k_{eff} Results (Part 7 of 8)

Experiment Name	KENO k_{eff}	σ_{KENO}	Benchmark k_{eff}	σ_{BENCH}	Normalised k_{eff}	Combined σ
IEU-MET-FAST-021-001	1.0199	0.0001	1.0084	0.0015	1.0114	0.0015
IEU-MET-FAST-022-001	1.0089	0.0001	1.0006	0.0013	1.0083	0.0013
IEU-MET-FAST-022-002	1.0105	0.0001	1.0004	0.0011	1.0100	0.0011
IEU-MET-FAST-022-003	1.0104	0.0001	1.0013	0.0011	1.0090	0.0011
IEU-MET-FAST-022-004	1.0131	0.0001	1.0010	0.0011	1.0120	0.0011
IEU-MET-FAST-022-005	1.0075	0.0001	1.0002	0.0012	1.0073	0.0012
IEU-MET-FAST-022-007	1.0154	0.0001	1.0015	0.0013	1.0139	0.0013
LEU-MET-THERM-006-001	0.9897	0.0001	1.0000	0.0018	0.9897	0.0018
LEU-MET-THERM-006-002	0.9898	0.0001	1.0000	0.0018	0.9898	0.0018
LEU-MET-THERM-006-003	0.9905	0.0001	1.0000	0.0018	0.9905	0.0018
LEU-MET-THERM-006-004	0.9942	0.0001	1.0000	0.0017	0.9942	0.0017
LEU-MET-THERM-006-005	0.9941	0.0001	1.0000	0.0017	0.9941	0.0017
LEU-MET-THERM-006-006	0.9944	0.0001	1.0000	0.0016	0.9944	0.0016
LEU-MET-THERM-006-007	0.9946	0.0002	1.0000	0.0016	0.9946	0.0016
LEU-MET-THERM-006-008	0.9943	0.0001	1.0000	0.0016	0.9943	0.0016
LEU-MET-THERM-006-009	0.9944	0.0001	1.0000	0.0016	0.9944	0.0016
LEU-MET-THERM-006-010	0.9948	0.0001	1.0000	0.0016	0.9948	0.0016
LEU-MET-THERM-006-011	0.9941	0.0001	1.0000	0.0016	0.9941	0.0016
LEU-MET-THERM-006-012	0.9957	0.0001	1.0000	0.0017	0.9957	0.0017
LEU-MET-THERM-006-013	0.9957	0.0001	1.0000	0.0017	0.9957	0.0017
LEU-MET-THERM-006-014	0.9973	0.0001	1.0000	0.0019	0.9973	0.0019
LEU-MET-THERM-006-015	0.9969	0.0002	1.0000	0.0019	0.9969	0.0019
LEU-MET-THERM-006-016	0.9972	0.0002	1.0000	0.0019	0.9972	0.0019
LEU-MET-THERM-006-017	0.9972	0.0002	1.0000	0.0019	0.9972	0.0019
LEU-MET-THERM-006-018	0.9971	0.0002	1.0000	0.0019	0.9971	0.0019
LEU-MET-THERM-006-019	0.9917	0.0001	1.0000	0.0016	0.9917	0.0016
LEU-MET-THERM-006-020	0.9930	0.0001	1.0000	0.0016	0.9930	0.0016
LEU-MET-THERM-006-021	0.9931	0.0001	1.0000	0.0016	0.9931	0.0016
LEU-MET-THERM-006-022	0.9933	0.0001	1.0000	0.0016	0.9933	0.0016
LEU-MET-THERM-006-023	0.9937	0.0001	1.0000	0.0016	0.9937	0.0016
LEU-MET-THERM-006-024	0.9936	0.0001	1.0000	0.0016	0.9936	0.0016
LEU-MET-THERM-006-025	0.9952	0.0001	1.0000	0.0016	0.9952	0.0016
LEU-MET-THERM-006-026	0.9957	0.0001	1.0000	0.0016	0.9957	0.0016
LEU-MET-THERM-006-027	0.9953	0.0001	1.0000	0.0016	0.9953	0.0016
LEU-MET-THERM-006-028	0.9957	0.0001	1.0000	0.0016	0.9957	0.0016

Table 10-2: Critical Experiments and k_{eff} Results (Part 8 of 8)

Experiment Name	KENO k_{eff}	σ_{KENO}	Benchmark k_{eff}	σ_{BENCH}	Normalised k_{eff}	Combined σ
LEU-MET-THERM-006-029	0.9953	0.0001	1.0000	0.0018	0.9953	0.0018
LEU-MET-THERM-006-030	0.9953	0.0001	1.0000	0.0018	0.9953	0.0018
LEU-MET-THERM-007-001	0.9895	0.0001	0.9983	0.0114	0.9912	0.0114
LEU-MET-THERM-007-004	0.9958	0.0001	0.9974	0.0006	0.9984	0.0006
HEU-COMP-THERM-010-001	0.9989	0.0001	1.0000	0.0050	0.9989	0.0050
HEU-COMP-THERM-010-002	0.9959	0.0001	1.0000	0.0050	0.9959	0.0050
HEU-COMP-THERM-010-003	0.9990	0.0001	1.0000	0.0050	0.9990	0.0050
HEU-COMP-THERM-010-004	0.9986	0.0001	1.0000	0.0050	0.9986	0.0050
HEU-COMP-THERM-010-005	0.9996	0.0001	1.0000	0.0050	0.9996	0.0050
HEU-COMP-THERM-010-006	0.9974	0.0001	1.0000	0.0050	0.9974	0.0050
HEU-COMP-THERM-010-007	1.0014	0.0001	1.0000	0.0050	1.0014	0.0050
HEU-COMP-THERM-010-008	1.0009	0.0001	1.0000	0.0050	1.0009	0.0050
HEU-COMP-THERM-010-009	0.9993	0.0001	1.0000	0.0050	0.9993	0.0050
HEU-COMP-THERM-010-010	1.0021	0.0001	1.0000	0.0050	1.0021	0.0050
HEU-COMP-THERM-010-011	0.9995	0.0001	1.0000	0.0050	0.9995	0.0050
HEU-COMP-THERM-010-012	0.9986	0.0001	1.0000	0.0050	0.9986	0.0050
HEU-COMP-THERM-010-013	1.0010	0.0001	1.0000	0.0050	1.0010	0.0050
HEU-COMP-THERM-010-014	1.0008	0.0001	1.0000	0.0050	1.0008	0.0050
HEU-COMP-THERM-010-015	1.0005	0.0001	1.0000	0.0050	1.0005	0.0050
HEU-COMP-THERM-011-001	0.9934	0.0001	1.0000	0.0041	0.9934	0.0041
HEU-COMP-THERM-011-002	0.9950	0.0001	1.0000	0.0041	0.9950	0.0041
HEU-COMP-THERM-011-003	0.9955	0.0001	1.0000	0.0041	0.9955	0.0041
HEU-COMP-THERM-012-001	0.9959	0.0001	1.0000	0.0031	0.9959	0.0031
HEU-COMP-THERM-012-002	0.9956	0.0001	1.0000	0.0033	0.9956	0.0033
HEU-COMP-THERM-013-001	0.9954	0.0001	1.0000	0.0041	0.9954	0.0041
HEU-COMP-THERM-013-002	0.9954	0.0001	1.0000	0.0042	0.9954	0.0042
HEU-COMP-THERM-014-001	0.9996	0.0001	1.0000	0.0047	0.9996	0.0047
HEU-COMP-THERM-014-002	0.9992	0.0001	1.0000	0.0048	0.9992	0.0048
IEU-COMP-MIXED-002-004	1.0159	0.0001	0.9974	0.0024	1.0185	0.0024
IEU-COMP-MIXED-002-005	1.0182	0.0001	0.9976	0.0024	1.0206	0.0024
IEU-COMP-MIXED-002-006	1.0130	0.0001	0.9984	0.0025	1.0146	0.0025
IEU-COMP-MIXED-002-007	1.0147	0.0001	0.9982	0.0020	1.0165	0.0020
IEU-COMP-MIXED-002-008	1.0189	0.0001	0.9978	0.0021	1.0212	0.0021
IEU-COMP-MIXED-002-009	1.0027	0.0001	0.9983	0.0022	1.0045	0.0022

Table 10-3: Critical Experiments Removed Based on ±0.025 Bias Criteria

Experiment Name	KENO k_{eff}	σ_{KENO}	Benchmark k_{eff}	σ_{BENCH}	Normalised k_{eff}	Combined σ
HEU-MET-FAST-003-012	1.0255	0.0001	1.0000	0.0030	1.0255	0.0030
HEU-MET-INTER-001-001	1.0837	0.0001	0.9966	0.0026	1.0874	0.0026
HEU-MET-THERM-006-013	1.0297	0.0001	1.0000	0.0061	1.0297	0.0061
HEU-COMP-INTER-005-007	0.9578	0.0001	1.0320	0.0040	0.9281	0.0040
HEU-COMP-INTER-005-009	1.0014	0.0001	1.0500	0.0080	0.9537	0.0080
HEU-COMP-INTER-005-010	0.9962	0.0002	1.0300	0.0060	0.9672	0.0060
HEU-COMP-INTER-005-015	0.9206	0.0001	1.0640	0.0180	0.8653	0.0180
HEU-COMP-INTER-005-016	0.9501	0.0002	0.9970	0.0130	0.9529	0.0130
IEU-COMP-MIXED-002-001	1.0265	0.0001	0.9980	0.0030	1.0285	0.0030
IEU-COMP-MIXED-002-002	1.0268	0.0001	0.9980	0.0028	1.0289	0.0028
IEU-COMP-MIXED-002-003	1.0263	0.0001	0.9980	0.0025	1.0284	0.0025

Table 10-4: Parameters Used for Criticality Code Validation

(Part 1 of 8)

Experiment Name	Enrichment (%)	Mod/fuel ratio	EALF (eV)	σ	MFP (cm)	σ	$\bar{\nu}$	σ	k_{eff}	σ
HEU-MET-FAST-001-001	93.71	0.00	9.48E+5	1.35E+2	1.96E+0	1.18E-4	2.60E+0	2.45E-5	0.9973	0.0010
HEU-MET-FAST-002-001	93.50	0.00	8.51E+5	1.25E+2	2.11E+0	5.14E-5	2.61E+0	2.70E-5	1.0027	0.0030
HEU-MET-FAST-002-002	93.50	0.00	8.38E+5	1.22E+2	2.10E+0	4.69E-5	2.61E+0	2.66E-5	1.0035	0.0030
HEU-MET-FAST-002-003	93.50	0.00	8.32E+5	1.26E+2	2.10E+0	4.59E-5	2.61E+0	2.79E-5	1.0018	0.0030
HEU-MET-FAST-002-004	93.50	0.00	8.21E+5	1.38E+2	2.10E+0	5.00E-5	2.61E+0	3.04E-5	0.9970	0.0030
HEU-MET-FAST-002-005	93.50	0.00	8.17E+5	1.29E+2	2.10E+0	4.85E-5	2.61E+0	2.88E-5	1.0019	0.0030
HEU-MET-FAST-002-006	93.50	0.00	8.24E+5	1.28E+2	2.10E+0	4.76E-5	2.61E+0	2.79E-5	0.9983	0.0030
HEU-MET-FAST-003-001	93.50	0.00	9.09E+5	1.39E+2	2.12E+0	9.74E-5	2.61E+0	2.63E-5	0.9932	0.0050
HEU-MET-FAST-003-002	93.50	0.00	8.98E+5	1.32E+2	2.15E+0	8.51E-5	2.61E+0	2.60E-5	0.9937	0.0050
HEU-MET-FAST-003-003	93.50	0.00	8.87E+5	1.37E+2	2.16E+0	7.94E-5	2.61E+0	2.70E-5	0.9991	0.0050
HEU-MET-FAST-003-004	93.50	0.00	8.78E+5	1.36E+2	2.15E+0	7.21E-5	2.61E+0	2.79E-5	0.9976	0.0030
HEU-MET-FAST-003-005	93.50	0.00	8.59E+5	1.30E+2	2.12E+0	5.74E-5	2.61E+0	2.79E-5	1.0022	0.0030
HEU-MET-FAST-003-006	93.50	0.00	8.50E+5	1.32E+2	2.11E+0	5.39E-5	2.61E+0	2.88E-5	1.0028	0.0030
HEU-MET-FAST-003-007	93.50	0.00	8.29E+5	1.34E+2	2.08E+0	4.47E-5	2.61E+0	2.93E-5	1.0034	0.0030
HEU-MET-FAST-003-008	93.50	0.00	7.13E+5	1.21E+2	1.91E+0	8.77E-5	2.58E+0	2.36E-5	1.0042	0.0050
HEU-MET-FAST-003-009	93.50	0.00	6.41E+5	1.14E+2	1.83E+0	7.69E-5	2.57E+0	2.36E-5	1.0055	0.0050
HEU-MET-FAST-003-010	93.50	0.00	5.84E+5	1.11E+2	1.72E+0	6.06E-5	2.57E+0	2.35E-5	1.0090	0.0050
HEU-MET-FAST-003-011	93.50	0.00	5.65E+5	1.06E+2	1.65E+0	4.59E-5	2.57E+0	2.26E-5	1.0128	0.0050
HEU-MET-FAST-004-001	97.68	0.00	3.18E+4	2.93E+1	4.44E-1	1.50E-5	2.56E+0	2.68E-5	0.9957	0.0012
HEU-MET-FAST-007-001	93.15	0.00	9.59E+5	1.32E+2	2.03E+0	1.23E-4	2.61E+0	2.41E-5	0.9970	0.0024
HEU-MET-FAST-007-002	93.15	0.29	5.30E+5	1.40E+2	1.88E+0	1.15E-4	2.59E+0	2.37E-5	0.9970	0.0014
HEU-MET-FAST-007-003	93.15	0.39	4.00E+5	1.20E+2	1.81E+0	1.09E-4	2.58E+0	2.15E-5	0.9955	0.0013
HEU-MET-FAST-007-004	93.15	0.47	3.55E+5	1.15E+2	1.79E+0	1.14E-4	2.58E+0	2.29E-5	0.9973	0.0013
HEU-MET-FAST-007-005	93.15	0.61	2.70E+5	8.75E+1	1.74E+0	1.03E-4	2.57E+0	2.10E-5	0.9955	0.0018
HEU-MET-FAST-007-006	93.15	0.71	1.72E+5	7.31E+1	1.64E+0	1.07E-4	2.57E+0	2.11E-5	0.9994	0.0013
HEU-MET-FAST-007-007	93.15	0.71	2.11E+5	7.67E+1	1.69E+0	1.04E-4	2.57E+0	2.12E-5	0.9974	0.0014
HEU-MET-FAST-007-008	93.15	0.71	2.19E+5	7.86E+1	1.71E+0	1.05E-4	2.57E+0	2.14E-5	0.9951	0.0013
HEU-MET-FAST-007-009	93.15	0.71	1.93E+5	7.54E+1	1.68E+0	1.05E-4	2.57E+0	2.12E-5	0.9968	0.0056
HEU-MET-FAST-007-010	93.15	1.64	2.84E+4	1.51E+1	1.40E+0	9.37E-5	2.54E+0	1.85E-5	0.9954	0.0012
HEU-MET-FAST-007-011	93.15	2.79	5.88E+3	3.08E+0	1.27E+0	7.77E-5	2.52E+0	1.51E-5	0.9973	0.0013
HEU-MET-FAST-007-012	93.15	3.04	4.32E+3	2.51E+0	1.24E+0	8.22E-5	2.51E+0	1.60E-5	0.9954	0.0012
HEU-MET-FAST-007-013	93.15	3.04	2.68E+3	1.73E+0	1.09E+0	9.30E-5	2.52E+0	1.61E-5	0.9975	0.0012
HEU-MET-FAST-007-014	93.15	3.10	3.97E+3	2.25E+0	1.24E+0	8.11E-5	2.51E+0	1.54E-5	0.9961	0.0012
HEU-MET-FAST-007-015	93.15	2.96	3.00E+3	1.87E+0	1.10E+0	9.01E-5	2.52E+0	1.55E-5	0.9963	0.0012
HEU-MET-FAST-007-016	93.15	2.98	2.93E+3	1.85E+0	1.10E+0	9.29E-5	2.52E+0	1.59E-5	0.9961	0.0012

Table 10-4: Parameters Used for Criticality Code Validation (Part 2 of 8)

Experiment Name	Enrichment (%)	Mod/fuel ratio	EALF (eV)	σ	MFP (cm)	σ	$\bar{\nu}$	σ	k_{eff}	σ
HEU-MET-FAST-007-017	93.15	5.37	3.89E+2	2.45E-1	9.98E-1	7.70E-5	2.49E+0	1.34E-5	0.9975	0.0012
HEU-MET-FAST-007-018	93.15	5.43	3.70E+2	2.29E-1	9.94E-1	7.53E-5	2.49E+0	1.28E-5	0.9980	0.0012
HEU-MET-FAST-007-019	93.15	0.00	9.53E+5	1.34E+2	2.01E+0	1.20E-4	2.61E+0	2.45E-5	0.9990	0.0015
HEU-MET-FAST-007-020	93.15	0.63	2.28E+5	9.06E+1	1.69E+0	1.10E-4	2.57E+0	2.20E-5	0.9967	0.0017
HEU-MET-FAST-007-021	93.15	0.66	2.10E+5	8.29E+1	1.67E+0	1.07E-4	2.57E+0	2.11E-5	0.9969	0.0018
HEU-MET-FAST-007-022	93.15	0.70	1.93E+5	8.33E+1	1.66E+0	1.13E-4	2.57E+0	2.23E-5	0.9968	0.0019
HEU-MET-FAST-007-023	93.15	1.09	6.63E+4	3.66E+1	1.45E+0	1.18E-4	2.56E+0	2.04E-5	0.9975	0.0017
HEU-MET-FAST-007-024	93.15	1.11	6.19E+4	3.40E+1	1.43E+0	1.15E-4	2.56E+0	2.01E-5	0.9970	0.0018
HEU-MET-FAST-007-025	93.15	1.53	2.81E+4	1.69E+1	1.33E+0	1.14E-4	2.55E+0	1.98E-5	0.9969	0.0018
HEU-MET-FAST-007-026	93.15	1.57	2.61E+4	1.61E+1	1.31E+0	1.15E-4	2.54E+0	1.98E-5	0.9965	0.0017
HEU-MET-FAST-007-027	93.15	0.44	4.97E+5	1.36E+2	1.91E+0	1.17E-4	2.59E+0	2.30E-5	0.9967	0.0014
HEU-MET-FAST-007-028	93.15	0.75	2.97E+5	1.04E+2	1.83E+0	1.15E-4	2.57E+0	2.28E-5	0.9948	0.0023
HEU-MET-FAST-007-029	93.15	1.09	1.73E+5	6.83E+1	1.75E+0	1.10E-4	2.56E+0	2.16E-5	0.9961	0.0014
HEU-MET-FAST-007-030	93.15	2.56	1.87E+4	1.01E+1	1.49E+0	9.45E-5	2.53E+0	1.73E-5	0.9959	0.0021
HEU-MET-FAST-007-031	93.15	5.21	1.72E+3	1.01E+0	1.33E+0	8.28E-5	2.50E+0	1.41E-5	0.9983	0.0022
HEU-MET-FAST-007-032	93.15	0.61	8.41E+5	1.24E+2	2.19E+0	1.21E-4	2.60E+0	2.27E-5	1.0040	0.0012
HEU-MET-FAST-007-033	93.15	1.04	7.69E+5	1.26E+2	2.28E+0	1.29E-4	2.59E+0	2.28E-5	1.0072	0.0019
HEU-MET-FAST-007-034	93.15	1.49	7.06E+5	1.14E+2	2.35E+0	1.22E-4	2.58E+0	2.13E-5	1.0114	0.0017
HEU-MET-FAST-007-035	93.15	0.00	7.74E+3	7.10E+0	3.85E-1	1.41E-5	2.54E+0	2.36E-5	0.9920	0.0018
HEU-MET-FAST-007-036	93.15	0.47	3.89E+3	3.42E+0	3.88E-1	1.45E-5	2.53E+0	2.16E-5	1.0011	0.0007
HEU-MET-FAST-007-037	93.15	0.95	1.94E+3	1.62E+0	3.90E-1	1.47E-5	2.52E+0	1.94E-5	1.0007	0.0008
HEU-MET-FAST-007-038	93.15	1.05	1.75E+3	1.49E+0	3.91E-1	1.52E-5	2.51E+0	1.92E-5	0.9998	0.0008
HEU-MET-FAST-007-039	93.15	1.08	1.70E+3	1.42E+0	3.91E-1	1.54E-5	2.51E+0	1.92E-5	1.0004	0.0014
HEU-MET-FAST-007-040	93.15	1.03	1.76E+3	1.50E+0	3.90E-1	1.49E-5	2.52E+0	1.94E-5	1.0027	0.0008
HEU-MET-FAST-007-041	93.15	2.50	3.23E+2	2.48E-1	3.93E-1	1.54E-5	2.49E+0	1.55E-5	1.0015	0.0009
HEU-MET-FAST-007-042	93.15	2.56	3.06E+2	2.38E-1	3.93E-1	1.51E-5	2.49E+0	1.55E-5	1.0009	0.0009
HEU-MET-FAST-007-043	93.15	6.10	3.44E+1	2.38E-2	3.95E-1	1.60E-5	2.47E+0	1.15E-5	1.0032	0.0008
HEU-MET-FAST-015-001	95.97	0.00	9.60E+5	1.44E+2	1.99E+0	1.28E-4	2.61E+0	2.59E-5	0.9927	0.0017
HEU-MET-FAST-018-001	89.50	0.00	9.30E+5	1.30E+2	2.01E+0	1.14E-4	2.60E+0	2.38E-5	0.9978	0.0014
HEU-MET-FAST-019-001	89.50	0.00	8.57E+5	1.35E+2	2.28E+0	1.27E-4	2.59E+0	2.47E-5	1.0033	0.0028
HEU-MET-FAST-020-001	89.49	0.00	5.09E+5	1.79E+2	1.74E+0	1.32E-4	2.59E+0	2.39E-5	0.9958	0.0028
HEU-MET-FAST-021-001	89.49	0.00	8.17E+5	1.32E+2	2.85E+0	1.64E-4	2.59E+0	2.44E-5	1.0188	0.0024
HEU-MET-FAST-022-001	89.49	0.00	8.89E+5	1.33E+2	2.34E+0	1.33E-4	2.60E+0	2.47E-5	0.9923	0.0019
HEU-MET-FAST-023-016	93.20	0.00	9.30E+5	1.57E+2	1.45E+0	3.13E-5	2.61E+0	2.51E-5	0.9970	0.0052
HEU-MET-FAST-023-020	93.20	0.00	5.25E+3	5.42E+0	4.14E-1	3.61E-5	2.55E+0	2.52E-5	0.9992	0.0052

Table 10-4: Parameters Used for Criticality Code Validation (Part 3 of 8)

Experiment Name	Enrichment (%)	Mod/fuel ratio	EALF (eV)	σ	MFP (cm)	σ	$\bar{\nu}$	σ	k_{eff}	σ
HEU-MET-FAST-026-001	93.20	0.00	9.40E+5	1.48E+2	1.45E+0	3.09E-5	2.61E+0	2.52E-5	1.0008	0.0042
HEU-MET-FAST-026-008	93.20	0.00	3.14E+4	2.64E+1	1.14E+0	5.94E-5	2.57E+0	2.36E-5	1.0013	0.0038
HEU-MET-FAST-026-017	93.20	0.00	1.10E+4	1.12E+1	4.12E-1	3.50E-5	2.56E+0	2.65E-5	0.9993	0.0038
HEU-MET-FAST-026-019	93.20	0.00	5.22E+5	2.00E+2	1.40E+0	3.28E-5	2.60E+0	2.49E-5	0.9900	0.0042
HEU-MET-FAST-026-032	93.20	0.00	1.66E+4	1.73E+1	4.33E-1	3.69E-5	2.56E+0	2.74E-5	0.9995	0.0038
HEU-MET-FAST-027-001	89.46	0.00	8.99E+5	1.31E+2	2.28E+0	1.23E-4	2.60E+0	2.39E-5	1.0087	0.0025
HEU-MET-FAST-028-001	93.24	0.00	8.55E+5	1.27E+2	2.12E+0	5.57E-5	2.61E+0	2.74E-5	1.0038	0.0030
HEU-MET-FAST-029-001	89.60	0.00	8.86E+5	1.34E+2	2.16E+0	9.79E-5	2.60E+0	2.54E-5	1.0036	0.0020
HEU-MET-FAST-031-001	89.41	0.00	6.81E+3	6.29E+0	3.96E-1	1.52E-5	2.54E+0	2.30E-5	1.0014	0.0059
HEU-MET-FAST-032-001	93.90	0.00	8.86E+5	1.37E+2	2.15E+0	8.04E-5	2.61E+0	2.75E-5	1.0040	0.0016
HEU-MET-FAST-032-002	93.90	0.00	8.90E+5	1.31E+2	2.15E+0	8.06E-5	2.61E+0	2.57E-5	1.0041	0.0027
HEU-MET-FAST-032-003	93.99	0.00	9.12E+5	1.40E+2	2.12E+0	1.02E-4	2.61E+0	2.67E-5	0.9981	0.0017
HEU-MET-FAST-032-004	93.91	0.00	9.28E+5	1.45E+2	2.03E+0	1.19E-4	2.61E+0	2.69E-5	0.9982	0.0017
HEU-MET-FAST-033-001	95.98	0.99	1.54E+4	8.32E+0	1.46E+0	9.20E-5	2.53E+0	1.62E-5	0.9913	0.0014
HEU-MET-FAST-033-002	95.98	1.80	1.19E+3	8.10E-1	1.06E+0	9.11E-5	2.51E+0	1.54E-5	0.9970	0.0014
HEU-MET-FAST-034-001	95.98	0.99	1.68E+4	1.12E+1	1.32E+0	1.27E-4	2.54E+0	1.95E-5	0.9949	0.0012
HEU-MET-FAST-034-002	95.98	0.99	1.70E+4	1.11E+1	1.41E+0	1.29E-4	2.54E+0	1.90E-5	0.9942	0.0012
HEU-MET-FAST-034-003	95.98	0.99	1.57E+4	1.06E+1	1.25E+0	1.24E-4	2.54E+0	1.91E-5	0.9994	0.0012
HEU-MET-FAST-036-001	95.98	0.86	4.45E+3	3.12E+0	1.18E+0	9.85E-5	2.53E+0	1.82E-5	0.9926	0.0015
HEU-MET-FAST-036-002	95.98	0.48	2.93E+4	1.88E+1	1.35E+0	1.18E-4	2.56E+0	2.02E-5	0.9964	0.0013
HEU-MET-FAST-037-001	95.98	1.63	2.40E+3	1.97E+0	4.49E-1	2.34E-5	2.53E+0	2.03E-5	1.0020	0.0011
HEU-MET-FAST-041-003	93.90	0.00	8.36E+5	1.37E+2	2.40E+0	1.29E-4	2.59E+0	2.46E-5	0.9970	0.0029
HEU-MET-FAST-041-004	93.90	0.00	7.13E+5	1.40E+2	2.76E+0	1.28E-4	2.59E+0	2.37E-5	1.0012	0.0025
HEU-MET-FAST-041-005	93.90	0.00	5.70E+5	1.53E+2	2.87E+0	1.15E-4	2.58E+0	2.34E-5	0.9970	0.0031
HEU-MET-FAST-041-006	93.89	0.00	4.35E+5	1.61E+2	2.85E+0	1.00E-4	2.58E+0	2.33E-5	0.9988	0.0045
HEU-MET-FAST-053-002	93.20	13.39	1.19E+4	1.12E+1	7.06E-1	5.83E-5	2.56E+0	2.45E-5	1.0021	0.0014
HEU-MET-FAST-053-003	93.20	13.39	1.00E+4	9.58E+0	7.08E-1	5.91E-5	2.55E+0	2.48E-5	1.0022	0.0013
HEU-MET-FAST-053-004	93.20	5.29	1.05E+5	7.12E+1	5.80E-1	3.78E-5	2.58E+0	2.46E-5	0.9863	0.0010
HEU-MET-FAST-053-005	93.20	4.62	2.41E+5	1.22E+2	5.72E-1	4.05E-5	2.58E+0	2.51E-5	0.9958	0.0014
HEU-MET-FAST-053-006	93.20	4.62	1.74E+5	9.32E+1	5.60E-1	3.61E-5	2.58E+0	2.38E-5	0.9965	0.0013
HEU-MET-FAST-053-007	93.20	4.62	2.06E+5	1.03E+2	5.88E-1	4.03E-5	2.58E+0	2.36E-5	0.9942	0.0014
HEU-MET-FAST-055-001	93.24	0.00	4.21E+5	7.64E+1	3.14E+0	1.41E-4	2.55E+0	2.07E-5	1.0124	0.0028
HEU-MET-INTER-006-001	93.23	26.71	5.03E+3	1.89E+0	2.48E+0	6.41E-5	2.47E+0	9.66E-6	1.0040	0.0008
HEU-MET-INTER-006-002	93.22	20.03	1.04E+4	3.69E+0	2.46E+0	7.03E-5	2.48E+0	1.05E-5	1.0040	0.0008
HEU-MET-INTER-006-003	93.24	13.36	2.44E+4	7.75E+0	2.44E+0	7.17E-5	2.48E+0	1.15E-5	1.0058	0.0009

Table 10-4: Parameters Used for Criticality Code Validation (Part 4 of 8)

Experiment Name	Enrichment (%)	Mod/fuel ratio	EALF (eV)	σ	MFP (cm)	σ	$\bar{\nu}$	σ	k_{eff}	σ
HEU-MET-INTER-006-004	93.30	6.68	8.47E+4	2.37E+1	2.40E+0	7.35E-5	2.50E+0	1.38E-5	1.0065	0.0008
HEU-MET-MIXED-001-001	95.98	0.99	2.31E+3	1.75E+0	4.76E-1	2.72E-5	2.52E+0	1.81E-5	1.0024	0.0013
HEU-MET-MIXED-002-001	89.57	0.67	1.16E+3	9.79E-1	4.08E-1	1.70E-5	2.52E+0	1.90E-5	1.0072	0.0037
HEU-MET-MIXED-003-001	89.57	0.66	1.16E+3	1.03E+0	3.98E-1	1.55E-5	2.52E+0	2.04E-5	1.0081	0.0038
HEU-MET-THERM-001-001	93.23	6.13	7.42E-2	2.18E-5	4.40E-1	2.63E-5	2.44E+0	2.81E-6	1.0054	0.0060
HEU-MET-THERM-003-001	94.01	0.00	1.92E+4	1.77E+1	4.44E-1	1.41E-5	2.56E+0	2.55E-5	0.9976	0.0010
HEU-MET-THERM-003-002	94.01	0.00	1.81E+4	1.67E+1	4.42E-1	1.40E-5	2.55E+0	2.58E-5	0.9868	0.0030
HEU-MET-THERM-003-003	94.26	2.38	2.34E+2	1.99E-1	4.57E-1	1.54E-5	2.50E+0	1.73E-5	0.9852	0.0060
HEU-MET-THERM-003-004	94.26	4.36	4.86E+1	4.00E-2	4.58E-1	1.54E-5	2.49E+0	1.54E-5	0.9900	0.0040
HEU-MET-THERM-003-005	94.52	16.58	2.83E+0	1.96E-3	4.71E-1	1.70E-5	2.46E+0	1.05E-5	0.9973	0.0030
HEU-MET-THERM-003-006	94.52	7.00	9.15E+0	6.67E-3	4.63E-1	1.63E-5	2.47E+0	1.18E-5	0.9823	0.0030
HEU-MET-THERM-003-007	94.52	11.81	3.03E+0	2.06E-3	4.65E-1	1.64E-5	2.46E+0	1.03E-5	0.9881	0.0030
HEU-MET-THERM-006-001	93.17	5.23	8.54E-2	2.56E-5	6.24E-1	4.35E-5	2.44E+0	8.60E-7	0.9990	0.0044
HEU-MET-THERM-006-002	93.17	5.23	7.06E-2	1.95E-5	6.00E-1	3.74E-5	2.44E+0	7.72E-7	1.0016	0.0040
HEU-MET-THERM-006-003	93.17	5.23	6.32E-2	1.62E-5	5.94E-1	3.45E-5	2.44E+0	7.23E-7	1.0070	0.0040
HEU-MET-THERM-006-004	93.17	5.23	6.18E-2	1.66E-5	5.84E-1	3.49E-5	2.44E+0	7.42E-7	0.9959	0.0040
HEU-MET-THERM-006-005	93.17	5.23	5.84E-2	1.54E-5	5.74E-1	3.09E-5	2.44E+0	7.29E-7	1.0026	0.0040
HEU-MET-THERM-006-006	93.17	5.23	5.58E-2	1.32E-5	5.67E-1	2.79E-5	2.44E+0	6.66E-7	1.0025	0.0040
HEU-MET-THERM-006-007	93.17	5.23	5.41E-2	1.29E-5	5.63E-1	2.76E-5	2.44E+0	6.86E-7	1.0005	0.0040
HEU-MET-THERM-006-008	93.17	5.23	5.21E-2	1.19E-5	5.56E-1	2.58E-5	2.44E+0	6.56E-7	0.9973	0.0040
HEU-MET-THERM-006-009	93.17	5.23	5.16E-2	1.20E-5	5.52E-1	2.62E-5	2.44E+0	6.76E-7	0.9955	0.0040
HEU-MET-THERM-006-010	93.17	5.23	8.30E-2	2.36E-5	6.33E-1	4.25E-5	2.44E+0	8.09E-7	1.0078	0.0040
HEU-MET-THERM-006-011	93.17	5.23	6.22E-2	1.59E-5	5.92E-1	3.35E-5	2.44E+0	7.12E-7	1.0070	0.0040
HEU-MET-THERM-006-012	93.17	5.23	5.39E-2	1.22E-5	5.72E-1	2.75E-5	2.44E+0	6.49E-7	1.0080	0.0040
HEU-MET-THERM-006-014	93.17	5.23	5.70E-2	1.36E-5	5.81E-1	3.03E-5	2.44E+0	6.87E-7	0.9986	0.0040
HEU-MET-THERM-006-015	93.17	5.23	5.64E-2	1.36E-5	5.66E-1	2.94E-5	2.44E+0	6.99E-7	0.9952	0.0040
HEU-MET-THERM-006-016	93.17	5.23	6.34E-2	1.65E-5	5.82E-1	3.27E-5	2.44E+0	7.36E-7	1.0065	0.0040
HEU-MET-THERM-006-019	93.17	5.23	5.27E-2	1.35E-5	5.55E-1	4.48E-5	2.44E+0	6.50E-7	0.9953	0.0040
HEU-MET-THERM-006-020	93.17	5.23	6.48E-2	1.47E-5	7.09E-1	5.29E-5	2.44E+0	6.27E-7	0.9982	0.0040
HEU-MET-THERM-006-021	93.17	5.23	6.99E-2	1.54E-5	7.84E-1	5.44E-5	2.44E+0	6.25E-7	1.0003	0.0040
HEU-MET-THERM-006-022	93.17	5.23	7.44E-2	1.64E-5	8.40E-1	5.84E-5	2.44E+0	6.38E-7	1.0028	0.0040
HEU-MET-THERM-006-023	93.17	5.23	7.60E-2	1.65E-5	8.69E-1	5.68E-5	2.44E+0	6.31E-7	1.0066	0.0040
HEU-MET-THERM-008-001	93.23	6.13	8.97E-2	3.26E-5	4.49E-1	3.05E-5	2.44E+0	3.04E-6	1.0134	0.0052
HEU-MET-THERM-009-001	93.23	6.13	8.58E-2	2.83E-5	4.60E-1	2.52E-5	2.44E+0	2.46E-6	1.0076	0.0063
HEU-MET-THERM-011-001	93.13	2.58	1.21E-1	4.06E-5	5.11E-1	2.87E-5	2.44E+0	1.31E-6	1.0039	0.0010

Table 10-4: Parameters Used for Criticality Code Validation (Part 5 of 8)

Experiment Name	Enrichment (%)	Mod/fuel ratio	EALF (eV)	σ	MFP (cm)	σ	$\bar{\nu}$	σ	k_{eff}	σ
HEU-MET-THERM-011-002	93.13	2.58	1.23E-1	4.02E-5	5.18E-1	2.96E-5	2.44E+0	1.31E-6	1.0026	0.0010
HEU-MET-THERM-011-003	93.13	4.37	7.82E-2	2.27E-5	4.96E-1	2.48E-5	2.44E+0	1.06E-6	1.0036	0.0006
HEU-MET-THERM-011-004	93.13	4.37	7.99E-2	2.27E-5	5.07E-1	2.62E-5	2.44E+0	1.03E-6	1.0027	0.0006
HEU-MET-THERM-011-005	93.13	6.16	6.44E-2	1.69E-5	4.91E-1	2.30E-5	2.44E+0	9.15E-7	1.0036	0.0005
HEU-MET-THERM-011-006	93.13	7.95	5.80E-2	1.35E-5	4.90E-1	2.13E-5	2.44E+0	8.21E-7	1.0014	0.0006
HEU-MET-THERM-011-007	93.13	7.95	5.79E-2	1.38E-5	4.88E-1	2.13E-5	2.44E+0	8.23E-7	1.0016	0.0006
HEU-MET-THERM-011-008	93.13	7.95	5.77E-2	1.39E-5	4.85E-1	2.08E-5	2.44E+0	8.34E-7	1.0018	0.0006
HEU-MET-THERM-011-009	93.13	7.95	5.76E-2	1.39E-5	4.81E-1	2.08E-5	2.44E+0	8.37E-7	1.0020	0.0006
HEU-MET-THERM-011-010	93.13	6.16	7.14E-2	2.00E-5	4.94E-1	2.40E-5	2.44E+0	9.91E-7	1.0026	0.0005
HEU-MET-THERM-011-011	93.13	6.16	6.89E-2	1.87E-5	4.94E-1	2.36E-5	2.44E+0	9.62E-7	1.0032	0.0005
HEU-MET-THERM-011-012	93.13	6.16	6.94E-2	1.86E-5	5.01E-1	2.46E-5	2.44E+0	9.67E-7	1.0082	0.0005
HEU-MET-THERM-011-013	93.13	6.16	6.69E-2	1.79E-5	4.92E-1	2.38E-5	2.44E+0	9.28E-7	1.0033	0.0005
HEU-MET-THERM-011-014	93.13	6.16	6.52E-2	1.77E-5	4.86E-1	2.25E-5	2.44E+0	9.64E-7	1.0036	0.0005
HEU-MET-THERM-011-015	93.13	6.16	6.40E-2	1.71E-5	4.85E-1	2.24E-5	2.44E+0	9.48E-7	1.0032	0.0005
HEU-MET-THERM-011-016	93.13	6.16	6.32E-2	1.60E-5	4.90E-1	2.23E-5	2.44E+0	9.09E-7	1.0024	0.0005
HEU-MET-THERM-011-017	93.13	6.16	6.31E-2	1.61E-5	4.87E-1	2.20E-5	2.44E+0	9.02E-7	1.0027	0.0005
HEU-MET-THERM-011-018	93.13	6.16	7.08E-2	1.97E-5	4.95E-1	2.43E-5	2.44E+0	9.97E-7	1.0027	0.0005
HEU-MET-THERM-011-019	93.13	6.16	7.03E-2	1.96E-5	4.94E-1	2.35E-5	2.44E+0	9.98E-7	1.0023	0.0005
HEU-MET-THERM-011-020	93.13	6.16	6.97E-2	1.93E-5	4.90E-1	2.28E-5	2.44E+0	9.91E-7	1.0030	0.0005
HEU-MET-THERM-011-021	93.13	6.16	6.93E-2	1.97E-5	4.88E-1	2.29E-5	2.44E+0	1.00E-6	1.0031	0.0005
HEU-MET-THERM-011-022	93.13	4.37	8.21E-2	2.46E-5	4.95E-1	2.45E-5	2.44E+0	1.13E-6	1.0032	0.0006
HEU-MET-THERM-011-023	93.13	7.95	6.23E-2	1.58E-5	4.92E-1	2.25E-5	2.44E+0	8.83E-7	1.0028	0.0006
HEU-MET-THERM-011-024	93.13	7.95	6.21E-2	1.64E-5	4.87E-1	2.27E-5	2.44E+0	9.22E-7	1.0032	0.0006
HEU-MET-THERM-011-025	93.13	9.74	5.81E-2	1.40E-5	4.86E-1	2.10E-5	2.44E+0	8.33E-7	1.0023	0.0007
HEU-MET-THERM-011-026	93.13	9.74	5.85E-2	1.39E-5	4.93E-1	2.23E-5	2.44E+0	8.33E-7	1.0012	0.0007
HEU-MET-THERM-011-027	93.13	11.54	5.58E-2	1.26E-5	4.92E-1	2.16E-5	2.44E+0	7.90E-7	0.9998	0.0008
HEU-MET-THERM-011-028	93.13	11.54	5.57E-2	1.28E-5	4.89E-1	2.15E-5	2.44E+0	7.86E-7	1.0003	0.0008
HEU-MET-THERM-011-029	93.13	11.54	5.55E-2	1.32E-5	4.82E-1	2.07E-5	2.44E+0	8.35E-7	1.0010	0.0008
HEU-MET-THERM-011-030	93.13	11.54	5.54E-2	1.31E-5	4.79E-1	2.01E-5	2.44E+0	8.40E-7	1.0012	0.0008
HEU-MET-THERM-011-031	93.13	6.16	6.90E-2	1.76E-5	4.99E-1	2.34E-5	2.44E+0	9.18E-7	1.0033	0.0005
HEU-MET-THERM-011-032	93.13	6.16	6.89E-2	1.78E-5	4.96E-1	2.35E-5	2.44E+0	8.99E-7	1.0034	0.0005
HEU-MET-THERM-011-033	93.13	6.16	6.87E-2	1.87E-5	4.91E-1	2.29E-5	2.44E+0	9.73E-7	1.0037	0.0005
HEU-MET-THERM-011-034	93.13	6.16	6.89E-2	1.97E-5	4.93E-1	2.49E-5	2.44E+0	1.00E-6	1.0002	0.0005
HEU-MET-THERM-011-035	93.13	1.88	1.72E-1	6.19E-5	5.23E-1	3.14E-5	2.44E+0	1.62E-6	1.0021	0.0017
HEU-MET-THERM-011-036	93.13	1.88	1.70E-1	6.35E-5	5.12E-1	2.90E-5	2.44E+0	1.68E-6	1.0018	0.0017

Table 10-4: Parameters Used for Criticality Code Validation (Part 6 of 8)

Experiment Name	Enrichment (%)	Mod/fuel ratio	EALF (eV)	σ	MFP (cm)	σ	$\bar{\nu}$	σ	k_{eff}	σ
HEU-MET-THERM-011-037	93.13	3.31	1.08E-1	3.44E-5	5.02E-1	2.66E-5	2.44E+0	1.34E-6	1.0035	0.0005
HEU-MET-THERM-011-038	93.13	4.75	8.78E-2	2.54E-5	4.98E-1	2.42E-5	2.44E+0	1.17E-6	1.0039	0.0006
HEU-MET-THERM-011-039	93.13	4.75	8.96E-2	2.49E-5	5.10E-1	2.57E-5	2.44E+0	1.14E-6	1.0016	0.0006
HEU-MET-THERM-011-040	93.13	6.19	7.84E-2	2.15E-5	4.92E-1	2.27E-5	2.44E+0	1.10E-6	1.0023	0.0009
HEU-MET-THERM-011-041	93.13	7.63	7.29E-2	1.88E-5	4.88E-1	2.15E-5	2.44E+0	1.06E-6	1.0020	0.0010
HEU-MET-THERM-011-042	93.13	4.75	8.72E-2	2.41E-5	4.94E-1	2.34E-5	2.44E+0	1.13E-6	1.0032	0.0006
HEU-MET-THERM-011-043	93.13	4.75	8.87E-2	2.29E-5	5.13E-1	2.62E-5	2.44E+0	1.08E-6	1.0004	0.0006
HEU-MET-THERM-012-001	93.23	39.14	1.23E-1	4.60E-5	5.23E-1	4.09E-5	2.44E+0	2.77E-6	1.0092	0.0025
HEU-MET-THERM-013-001	93.23	55.45	8.32E-2	2.34E-5	4.01E-1	1.78E-5	2.44E+0	2.41E-6	1.0093	0.0022
HEU-MET-THERM-013-002	93.23	62.37	7.46E-2	2.09E-5	3.78E-1	1.51E-5	2.44E+0	2.40E-6	1.0049	0.0020
HEU-MET-THERM-014-001	93.23	29.80	1.23E-1	4.57E-5	5.23E-1	4.07E-5	2.44E+0	2.76E-6	1.0125	0.0015
IEU-MET-FAST-001-001	55.38	0.00	8.09E+5	1.16E+2	2.17E+0	1.08E-4	2.59E+0	2.34E-5	1.0019	0.0009
IEU-MET-FAST-001-002	53.53	0.00	8.08E+5	1.17E+2	2.17E+0	1.09E-4	2.59E+0	2.40E-5	1.0013	0.0009
IEU-MET-FAST-001-003	36.33	0.00	7.39E+5	1.11E+2	2.18E+0	9.85E-5	2.59E+0	2.42E-5	1.0039	0.0003
IEU-MET-FAST-001-004	37.76	0.00	7.39E+5	1.06E+2	2.18E+0	9.64E-5	2.59E+0	2.33E-5	1.0034	0.0003
IEU-MET-FAST-002-001	16.19	0.00	5.56E+5	9.20E+1	2.15E+0	6.88E-5	2.58E+0	2.67E-5	1.0076	0.0030
IEU-MET-FAST-003-001	36.53	0.00	7.09E+5	1.04E+2	2.19E+0	9.82E-5	2.58E+0	2.31E-5	1.0039	0.0017
IEU-MET-FAST-004-001	36.54	0.00	6.66E+5	1.05E+2	2.28E+0	1.02E-4	2.58E+0	2.39E-5	1.0085	0.0030
IEU-MET-FAST-005-001	36.51	0.00	6.59E+5	1.04E+2	2.64E+0	1.32E-4	2.57E+0	2.34E-5	1.0099	0.0021
IEU-MET-FAST-006-001	36.51	0.00	6.59E+5	1.04E+2	3.00E+0	1.54E-4	2.58E+0	2.45E-5	0.9963	0.0023
IEU-MET-FAST-007-001	10.06	0.00	4.91E+5	1.12E+2	2.09E+0	6.11E-5	2.57E+0	3.46E-5	1.0127	0.0007
IEU-MET-FAST-008-001	36.49	0.00	7.01E+5	1.14E+2	2.20E+0	9.69E-5	2.58E+0	2.64E-5	1.0077	0.0018
IEU-MET-FAST-009-001	36.47	0.00	1.52E+4	1.28E+1	7.23E-1	7.47E-5	2.55E+0	2.23E-5	1.0108	0.0053
IEU-MET-FAST-010-001	8.88	0.00	4.12E+5	6.87E+1	2.34E+0	6.81E-5	2.56E+0	2.48E-5	1.0111	0.0024
IEU-MET-FAST-012-001	16.79	0.00	3.70E+5	6.72E+1	3.05E+0	1.10E-4	2.55E+0	2.25E-5	1.0083	0.0027
IEU-MET-FAST-013-001	11.69	0.00	4.15E+5	7.26E+1	3.57E+0	2.21E-4	2.56E+0	2.57E-5	1.0191	0.0023
IEU-MET-FAST-014-001	15.50	0.00	3.21E+5	5.36E+1	3.35E+0	2.28E-4	2.54E+0	2.11E-5	1.0173	0.0022
IEU-MET-FAST-014-002	20.54	0.00	2.66E+5	4.02E+1	3.18E+0	2.13E-4	2.52E+0	1.68E-5	1.0181	0.0022
IEU-MET-FAST-020-001	20.05	0.00	4.18E+5	8.71E+1	2.17E+0	6.54E-5	2.55E+0	2.54E-5	1.0072	0.0013
IEU-MET-FAST-020-002	20.05	0.00	4.35E+5	7.85E+1	2.28E+0	8.24E-5	2.55E+0	2.33E-5	1.0105	0.0013
IEU-MET-FAST-020-003	20.05	0.00	4.45E+5	8.52E+1	2.31E+0	9.23E-5	2.55E+0	2.49E-5	1.0115	0.0013
IEU-MET-FAST-020-004	20.05	0.00	4.56E+5	8.15E+1	2.33E+0	9.49E-5	2.56E+0	2.39E-5	1.0118	0.0013
IEU-MET-FAST-020-005	20.05	0.00	4.68E+5	8.41E+1	2.35E+0	9.76E-5	2.56E+0	2.32E-5	1.0114	0.0013
IEU-MET-FAST-020-006	20.05	0.00	4.85E+5	8.53E+1	2.37E+0	9.99E-5	2.56E+0	2.38E-5	1.0105	0.0013
IEU-MET-FAST-020-007	20.05	0.00	4.97E+5	8.17E+1	2.37E+0	9.75E-5	2.56E+0	2.28E-5	1.0096	0.0014

Table 10-4: Parameters Used for Criticality Code Validation (Part 7 of 8)

Experiment Name	Enrichment (%)	Mod/fuel ratio	EALF (eV)	σ	MFP (cm)	σ	$\bar{\nu}$	σ	k_{eff}	σ
IEU-MET-FAST-021-001	20.05	0.00	5.52E+5	9.55E+1	2.43E+0	1.04E-4	2.57E+0	2.69E-5	1.0114	0.0015
IEU-MET-FAST-022-001	20.05	0.50	2.61E+5	7.08E+1	2.14E+0	7.62E-5	2.54E+0	2.63E-5	1.0083	0.0013
IEU-MET-FAST-022-002	20.05	0.71	3.10E+4	1.54E+1	2.06E+0	7.48E-5	2.52E+0	2.20E-5	1.0100	0.0011
IEU-MET-FAST-022-003	20.05	1.40	1.16E+4	6.06E+0	2.09E+0	7.47E-5	2.51E+0	1.88E-5	1.0090	0.0011
IEU-MET-FAST-022-004	20.05	0.50	2.18E+4	1.06E+1	1.98E+0	7.49E-5	2.51E+0	1.88E-5	1.0120	0.0011
IEU-MET-FAST-022-005	20.05	0.61	1.28E+5	4.83E+1	2.15E+0	7.80E-5	2.53E+0	2.43E-5	1.0073	0.0012
IEU-MET-FAST-022-007	20.05	0.10	6.36E+4	2.79E+1	2.08E+0	7.28E-5	2.52E+0	2.15E-5	1.0139	0.0013
LEU-MET-THERM-006-001	1.60	0.52	6.86E-1	4.43E-4	6.25E-1	5.67E-5	2.48E+0	1.79E-5	0.9897	0.0018
LEU-MET-THERM-006-002	1.60	0.52	6.90E-1	4.46E-4	6.27E-1	5.88E-5	2.48E+0	1.80E-5	0.9898	0.0018
LEU-MET-THERM-006-003	1.60	0.52	6.99E-1	4.55E-4	6.38E-1	6.13E-5	2.48E+0	1.81E-5	0.9905	0.0018
LEU-MET-THERM-006-004	1.60	0.67	5.27E-1	3.18E-4	6.08E-1	5.14E-5	2.47E+0	1.71E-5	0.9942	0.0017
LEU-MET-THERM-006-005	1.60	0.67	5.58E-1	3.47E-4	6.25E-1	5.82E-5	2.48E+0	1.73E-5	0.9941	0.0017
LEU-MET-THERM-006-006	1.60	0.83	4.41E-1	2.48E-4	5.99E-1	4.87E-5	2.47E+0	1.56E-5	0.9944	0.0016
LEU-MET-THERM-006-007	1.60	0.83	4.39E-1	2.54E-4	5.96E-1	5.02E-5	2.47E+0	1.62E-5	0.9946	0.0016
LEU-MET-THERM-006-008	1.60	0.83	4.41E-1	2.54E-4	5.98E-1	4.98E-5	2.47E+0	1.59E-5	0.9943	0.0016
LEU-MET-THERM-006-009	1.60	0.83	4.52E-1	2.70E-4	6.05E-1	5.18E-5	2.47E+0	1.65E-5	0.9944	0.0016
LEU-MET-THERM-006-010	1.60	0.83	4.53E-1	2.64E-4	6.08E-1	5.34E-5	2.47E+0	1.64E-5	0.9948	0.0016
LEU-MET-THERM-006-011	1.60	0.83	4.76E-1	2.98E-4	6.20E-1	5.63E-5	2.47E+0	1.68E-5	0.9941	0.0016
LEU-MET-THERM-006-012	1.60	0.99	3.80E-1	2.18E-4	5.88E-1	4.86E-5	2.47E+0	1.59E-5	0.9957	0.0017
LEU-MET-THERM-006-013	1.60	0.99	3.90E-1	2.32E-4	5.97E-1	5.05E-5	2.47E+0	1.65E-5	0.9957	0.0017
LEU-MET-THERM-006-014	1.60	1.17	3.41E-1	2.05E-4	5.83E-1	4.99E-5	2.47E+0	1.65E-5	0.9973	0.0019
LEU-MET-THERM-006-015	1.60	1.17	3.42E-1	2.06E-4	5.84E-1	4.99E-5	2.47E+0	1.67E-5	0.9969	0.0019
LEU-MET-THERM-006-016	1.60	1.17	3.49E-1	2.15E-4	5.90E-1	5.10E-5	2.47E+0	1.71E-5	0.9972	0.0019
LEU-MET-THERM-006-017	1.60	1.35	3.08E-1	1.99E-4	5.73E-1	5.23E-5	2.47E+0	1.75E-5	0.9972	0.0019
LEU-MET-THERM-006-018	1.60	1.35	3.08E-1	2.03E-4	5.76E-1	5.44E-5	2.47E+0	1.86E-5	0.9971	0.0019
LEU-MET-THERM-006-019	1.60	2.17	6.35E-1	3.00E-4	6.12E-1	3.88E-5	2.48E+0	1.30E-5	0.9917	0.0016
LEU-MET-THERM-006-020	1.60	2.17	6.52E-1	2.94E-4	6.22E-1	3.90E-5	2.48E+0	1.26E-5	0.9930	0.0016
LEU-MET-THERM-006-021	1.60	2.50	5.02E-1	2.28E-4	6.04E-1	3.83E-5	2.47E+0	1.27E-5	0.9931	0.0016
LEU-MET-THERM-006-022	1.60	2.50	5.07E-1	2.28E-4	6.06E-1	3.95E-5	2.47E+0	1.26E-5	0.9933	0.0016
LEU-MET-THERM-006-023	1.60	2.50	5.10E-1	2.26E-4	6.07E-1	3.71E-5	2.47E+0	1.24E-5	0.9937	0.0016
LEU-MET-THERM-006-024	1.60	2.50	5.16E-1	2.40E-4	6.10E-1	3.97E-5	2.47E+0	1.31E-5	0.9936	0.0016
LEU-MET-THERM-006-025	1.60	2.85	4.22E-1	1.96E-4	5.93E-1	3.78E-5	2.47E+0	1.29E-5	0.9952	0.0016
LEU-MET-THERM-006-026	1.60	2.85	4.24E-1	1.77E-4	5.97E-1	3.41E-5	2.47E+0	1.15E-5	0.9957	0.0016
LEU-MET-THERM-006-027	1.60	2.85	4.25E-1	1.82E-4	5.98E-1	3.53E-5	2.47E+0	1.18E-5	0.9953	0.0016
LEU-MET-THERM-006-028	1.60	2.85	4.28E-1	1.90E-4	5.99E-1	3.86E-5	2.47E+0	1.25E-5	0.9957	0.0016

Table 10-4: Parameters Used for Criticality Code Validation (Part 8 of 8)

Experiment Name	Enrichment (%)	Mod/fuel ratio	EALF (eV)	σ	MFP (cm)	σ	$\bar{\nu}$	σ	k_{eff}	σ
LEU-MET-THERM-006-029	1.60	3.22	3.68E-1	1.62E-4	5.83E-1	3.45E-5	2.47E+0	1.22E-5	0.9953	0.0018
LEU-MET-THERM-006-030	1.60	3.22	3.69E-1	1.60E-4	5.87E-1	3.61E-5	2.47E+0	1.23E-5	0.9953	0.0018
LEU-MET-THERM-007-001	4.95	2.60	5.64E-1	2.11E-4	5.22E-1	2.58E-5	2.46E+0	8.83E-6	0.9912	0.0114
LEU-MET-THERM-007-004	4.95	7.96	1.38E-1	3.96E-5	4.88E-1	1.88E-5	2.45E+0	6.30E-6	0.9984	0.0006
HEU-COMP-THERM-010-001	62.40	1.59	7.79E-1	2.57E-4	5.14E-1	2.28E-5	2.44E+0	2.43E-6	0.9989	0.0050
HEU-COMP-THERM-010-002	62.40	1.59	7.85E-1	2.71E-4	5.15E-1	2.41E-5	2.45E+0	2.57E-6	0.9959	0.0050
HEU-COMP-THERM-010-003	62.40	2.83	3.12E-1	8.76E-5	4.96E-1	2.06E-5	2.44E+0	2.01E-6	0.9990	0.0050
HEU-COMP-THERM-010-004	62.40	4.34	1.87E-1	4.76E-5	4.88E-1	1.93E-5	2.44E+0	1.77E-6	0.9986	0.0050
HEU-COMP-THERM-010-005	62.40	6.12	1.36E-1	3.17E-5	4.82E-1	1.81E-5	2.44E+0	1.58E-6	0.9996	0.0050
HEU-COMP-THERM-010-006	62.40	6.12	1.37E-1	3.20E-5	4.83E-1	1.79E-5	2.44E+0	1.60E-6	0.9974	0.0050
HEU-COMP-THERM-010-007	62.40	8.30	1.09E-1	2.35E-5	4.79E-1	1.72E-5	2.44E+0	1.43E-6	1.0014	0.0050
HEU-COMP-THERM-010-008	62.40	8.30	1.09E-1	2.35E-5	4.80E-1	1.72E-5	2.44E+0	1.44E-6	1.0009	0.0050
HEU-COMP-THERM-010-009	62.40	8.11	1.11E-1	2.39E-5	4.79E-1	1.70E-5	2.44E+0	1.42E-6	0.9993	0.0050
HEU-COMP-THERM-010-010	62.40	10.34	9.58E-2	1.93E-5	4.77E-1	1.62E-5	2.44E+0	1.31E-6	1.0021	0.0050
HEU-COMP-THERM-010-011	62.40	10.34	9.63E-2	2.00E-5	4.78E-1	1.69E-5	2.44E+0	1.38E-6	0.9995	0.0050
HEU-COMP-THERM-010-012	62.40	12.99	8.61E-2	1.69E-5	4.76E-1	1.64E-5	2.44E+0	1.29E-6	0.9986	0.0050
HEU-COMP-THERM-010-013	62.40	15.30	8.05E-2	1.50E-5	4.75E-1	1.61E-5	2.44E+0	1.24E-6	1.0010	0.0050
HEU-COMP-THERM-010-014	62.40	10.25	9.51E-2	1.95E-5	4.78E-1	1.70E-5	2.44E+0	1.35E-6	1.0008	0.0050
HEU-COMP-THERM-010-015	62.40	9.44	1.00E-1	2.42E-5	4.78E-1	1.94E-5	2.44E+0	1.60E-6	1.0005	0.0050
HEU-COMP-THERM-011-001	80.00	1.62	7.22E-1	2.60E-4	8.31E-1	8.24E-5	2.44E+0	1.83E-6	0.9934	0.0041
HEU-COMP-THERM-011-002	80.00	1.62	5.55E-1	1.90E-4	8.31E-1	7.81E-5	2.44E+0	1.73E-6	0.9950	0.0041
HEU-COMP-THERM-011-003	80.00	1.62	4.33E-1	1.44E-4	7.88E-1	6.87E-5	2.44E+0	1.66E-6	0.9955	0.0041
HEU-COMP-THERM-012-001	80.00	1.62	5.40E-1	1.81E-4	7.63E-1	6.62E-5	2.44E+0	1.89E-6	0.9959	0.0031
HEU-COMP-THERM-012-002	80.00	1.62	4.16E-1	1.37E-4	7.28E-1	5.75E-5	2.44E+0	1.86E-6	0.9956	0.0033
HEU-COMP-THERM-013-001	80.00	1.62	4.57E-1	1.51E-4	8.26E-1	7.34E-5	2.44E+0	1.64E-6	0.9954	0.0041
HEU-COMP-THERM-013-002	80.00	1.62	3.18E-1	9.81E-5	7.60E-1	5.80E-5	2.44E+0	1.52E-6	0.9954	0.0042
HEU-COMP-THERM-014-001	80.00	6.72	1.17E-1	2.74E-5	6.91E-1	4.43E-5	2.44E+0	1.12E-6	0.9996	0.0047
HEU-COMP-THERM-014-002	80.00	6.72	9.78E-2	2.31E-5	6.44E-1	3.91E-5	2.44E+0	1.08E-6	0.9992	0.0048
IEU-COMP-MIXED-002-004	18.80	0.37	9.81E+0	4.27E-3	1.83E+0	8.52E-5	2.46E+0	5.99E-6	1.0185	0.0024
IEU-COMP-MIXED-002-005	18.80	0.25	3.48E+1	1.56E-2	2.14E+0	7.85E-5	2.47E+0	6.55E-6	1.0206	0.0024
IEU-COMP-MIXED-002-006	18.80	0.06	1.72E+3	6.97E-1	2.70E+0	7.35E-5	2.48E+0	9.02E-6	1.0146	0.0025
IEU-COMP-MIXED-002-007	12.50	0.25	1.32E+1	5.95E-3	2.08E+0	7.77E-5	2.47E+0	6.74E-6	1.0165	0.0020
IEU-COMP-MIXED-002-008	12.50	0.25	1.31E+1	5.75E-3	2.08E+0	7.60E-5	2.47E+0	6.64E-6	1.0212	0.0021
IEU-COMP-MIXED-002-009	12.50	0.12	1.08E+2	5.18E-2	2.46E+0	7.03E-5	2.47E+0	7.94E-6	1.0045	0.0022

Table 10-5: Trending Analysis Results

Parameter	Correlation Coefficient (Irl)
Enrichment (wt. % U-235)	0.1030
Moderator to Fuel Ratio	0.0906
EALF (eV)	0.1428
MFP (cm)	0.3929
Neutron Fission Yield	0.0095

Table 10-6: USL Functions

Parameter	Applicable Range	USL Function	
Enrichment (wt. % U-235)	[1.60, 97.68]	0.9384	
EALF (eV)	[0.0516, 9.5950E5]	0.9384	
Moderator to Fuel Ratio	[0, 62.37]	0.9370	
MFP (cm)	[0.378, 3.57]	0.9362 + (3.1175E-03)*X	X < 0.9034
		0.9391	X >= 0.9034
Neutron Fission Yield	[2.44, 2.61]	0.9384	

Table 10-7: Parameters for USL Calculation Using Extrapolation Method

Parameter	Linear Regression, $k_c(X)$	Number of Data Points (n)	Mean Value ($\bar{X}$)	Pooled Standard Deviation (S_p)	Student-t Distribution Statistic (t)
Enrichment (wt. % U-235)	1.0022 + (-1.8914E-05)*X	279	7.1450E+01	6.9491E-03	1.6504
EALF (eV)	1.0003 + (2.8748E-09)*X	279	1.9467E+05	6.9201E-03	1.6504
Moderator to Fuel Ratio	1.0005 + (8.7353E-05)*X	279	3.6835E+00	6.9561E-03	1.6504
MFP (cm)	0.9972 + (3.1175E-03)*X	279	1.1737E+00	6.5120E-03	1.6504
Neutron Fission Yield	0.9984 + (9.8552E-04)*X	279	2.5064E+00	6.9799E-03	1.6504

11.0 FIGURES

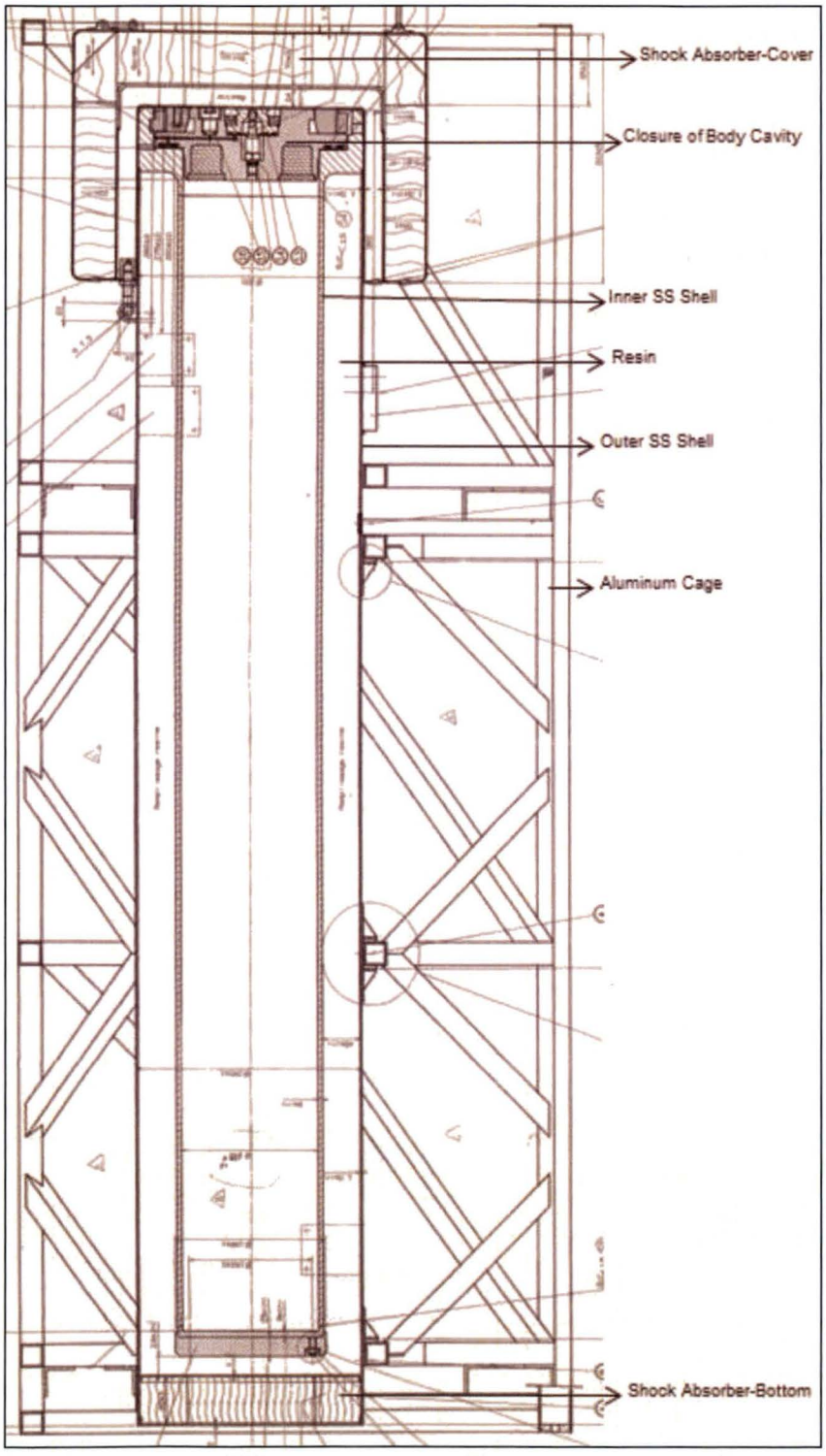

Figure 11-1: TN-BGC1 Package

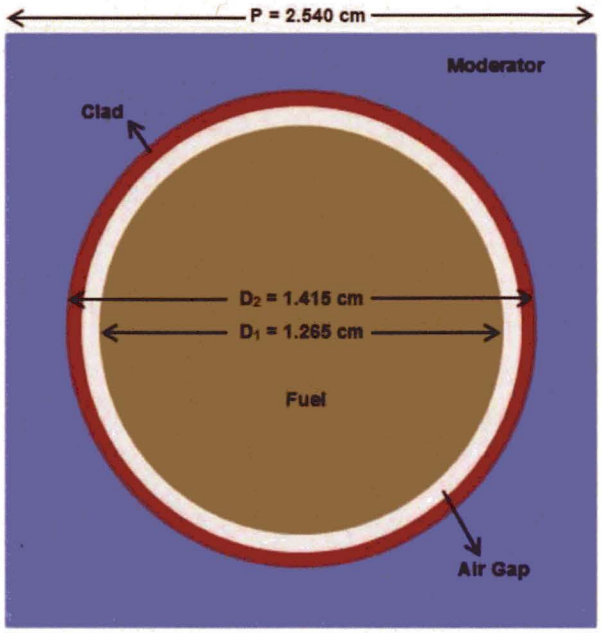

Figure 11-2: Dimensions Used to Calculate Moderator to Fuel Ratio for Square-Pitched Arrays

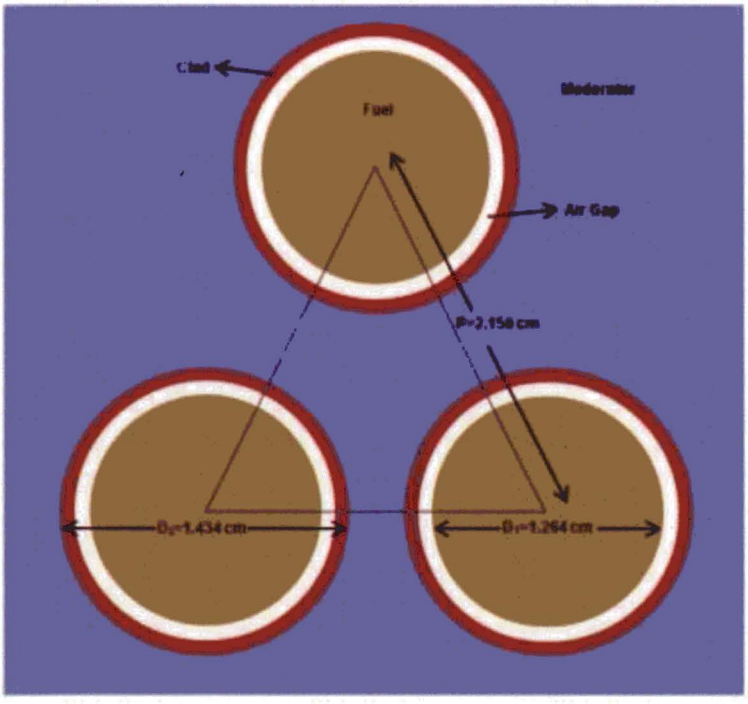

Figure 11-3: Dimensions Used to Calculate Moderator to Fuel Ratio for Triangular-Pitched Arrays

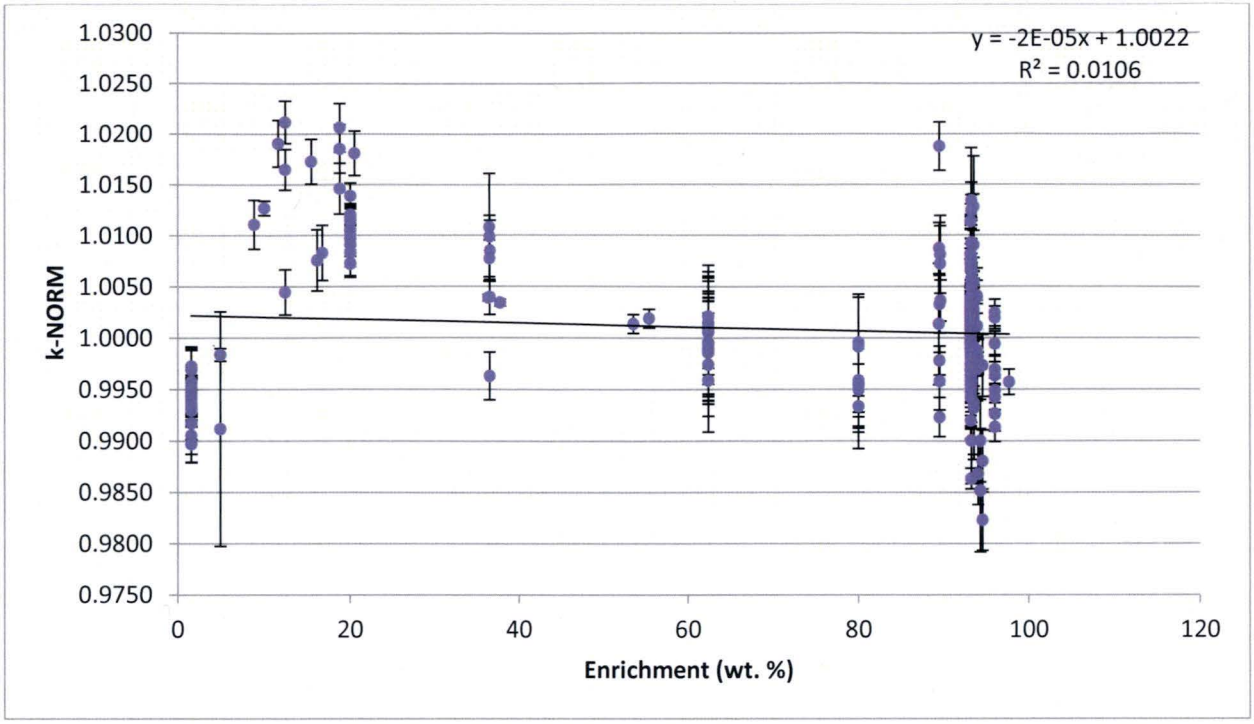

Figure 11-4: k_{NORM} Vs. Enrichment (wt. % U-235)

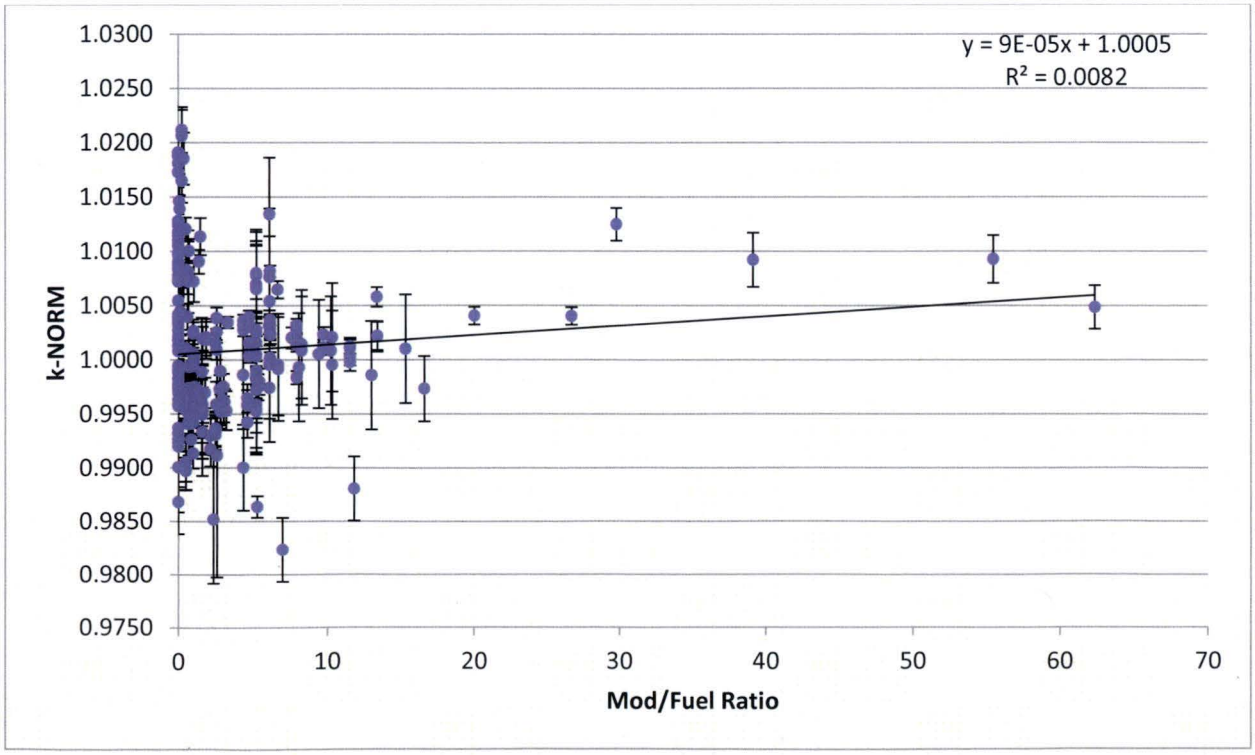

Figure 11-5: k_{NORM} Vs. Moderator to Fuel Ratio

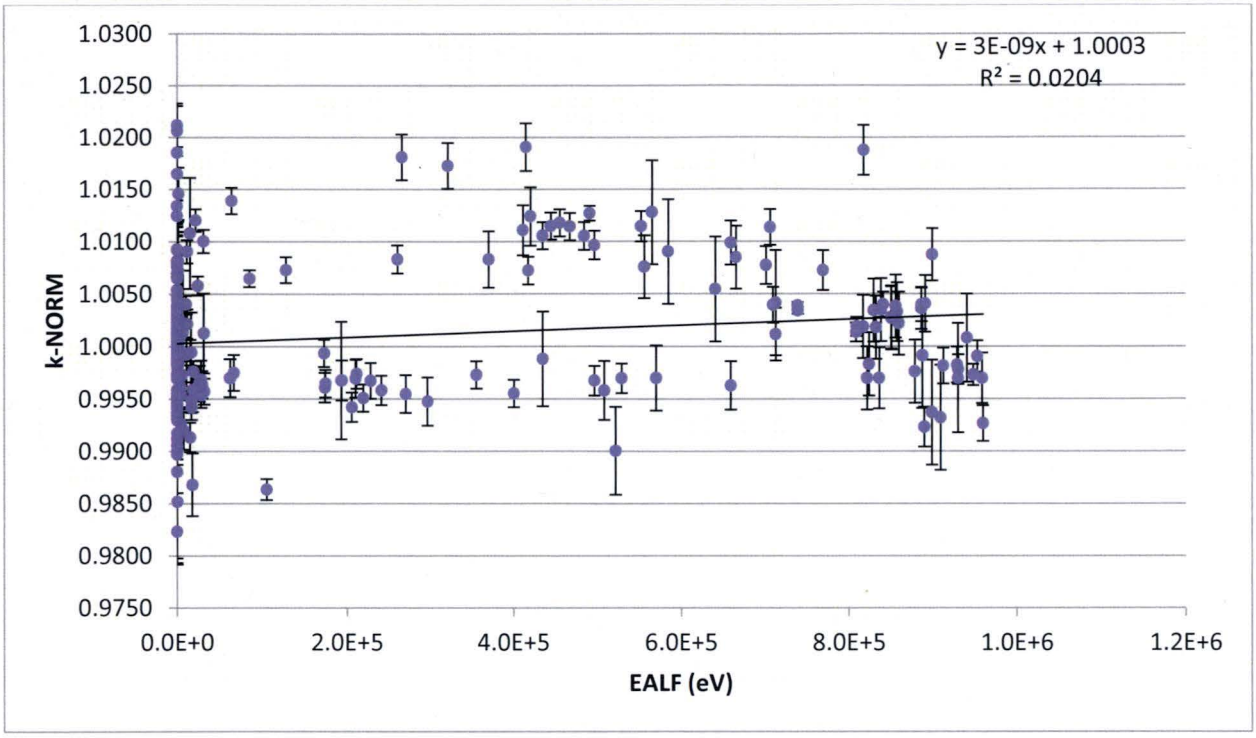

Figure 11-6: k_{NORM} Vs. EALF (eV)

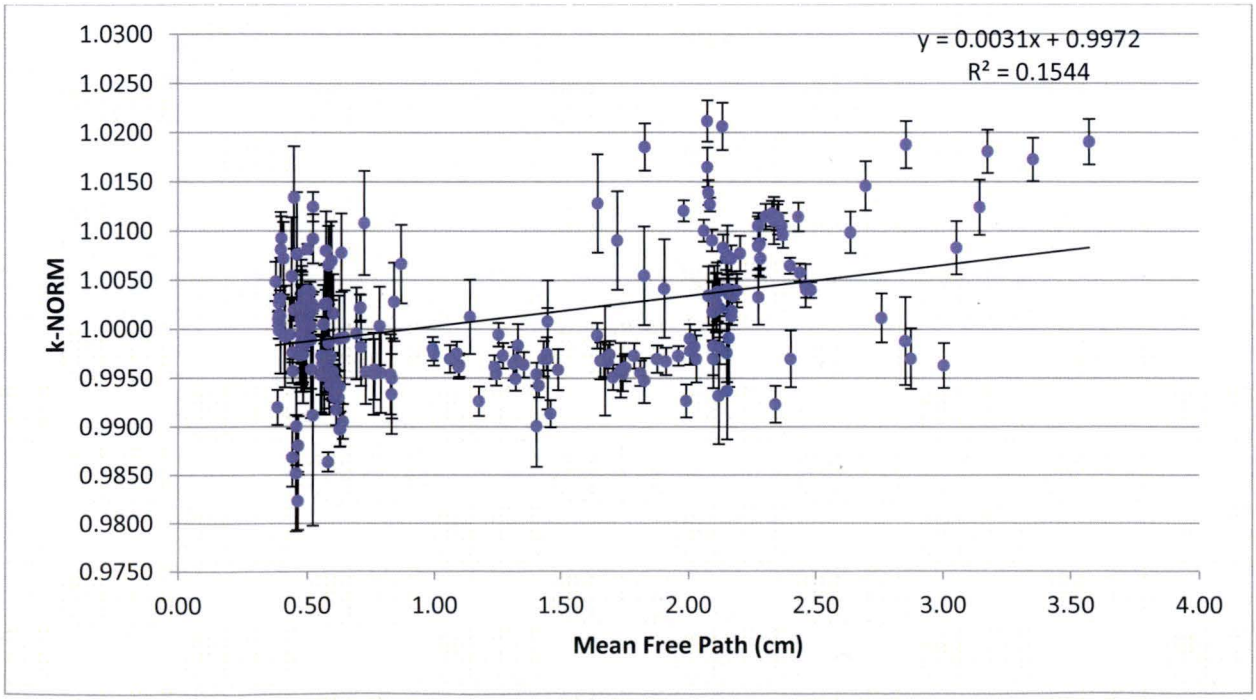

Figure 11-7: k_{NORM} Vs. Mean Free Path (cm)

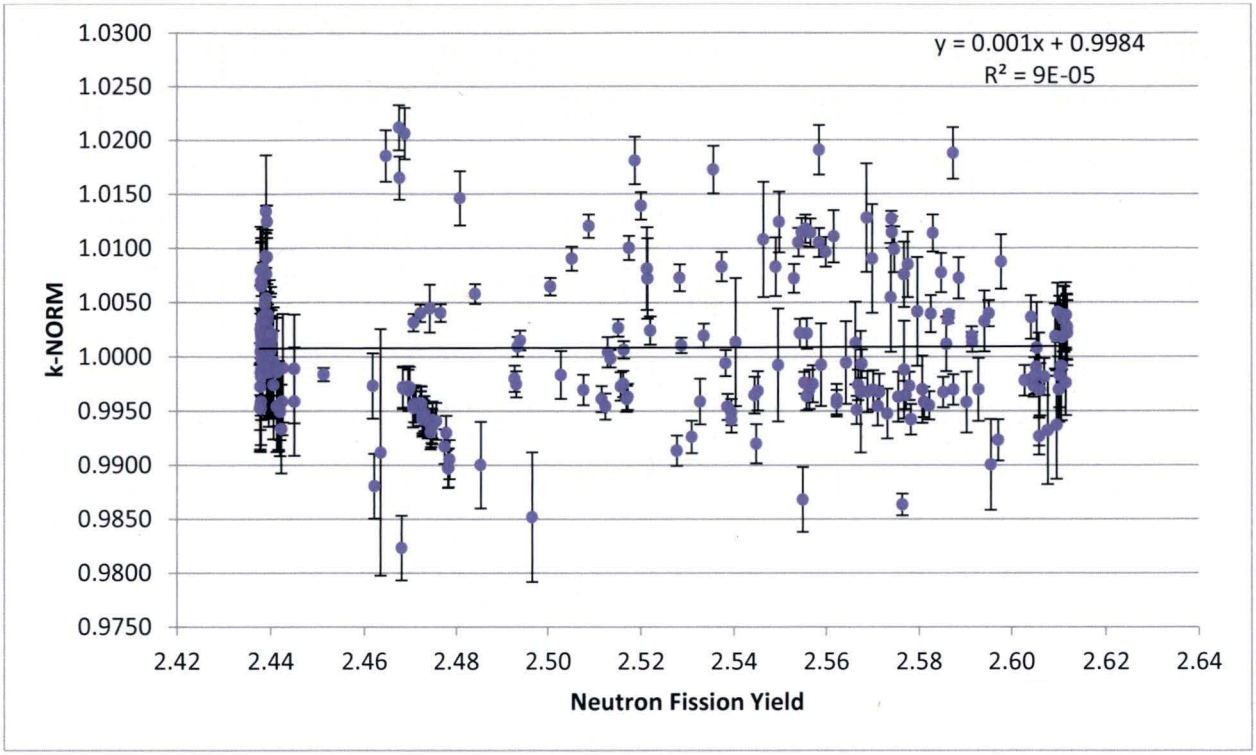

Figure 11-8: k_{NORM} Vs. Neutron Fission Yield

12.0 APPENDICES

12.1 USLSTATS Input

Sample USLSTATS input for USL function determination using fuel enrichment:

```
TN-BGC1: USL-Enrichment
0.995 0.95 0.95 0.0 0.0 -1.0 0.05
93.71  0.99729  0.00100
93.50  1.00269  0.00300
93.50  1.00348  0.00300
93.50  1.00180  0.00300
93.50  0.99698  0.00300
93.50  1.00187  0.00300
93.50  0.99831  0.00300
93.50  0.99321  0.00500
93.50  0.99370  0.00500
93.50  0.99912  0.00500
93.50  0.99760  0.00300
93.50  1.00218  0.00300
93.50  1.00276  0.00300
93.50  1.00342  0.00300
93.50  1.00415  0.00500
93.50  1.00545  0.00500
93.50  1.00903  0.00500
93.50  1.01279  0.00500
97.68  0.99572  0.00123
93.15  0.99697  0.00240
93.15  0.99697  0.00140
93.15  0.99551  0.00130
93.15  0.99729  0.00130
93.15  0.99547  0.00180
93.15  0.99936  0.00130
93.15  0.99740  0.00140
93.15  0.99509  0.00130
93.15  0.99676  0.00560
93.15  0.99539  0.00120
93.15  0.99729  0.00130
93.15  0.99543  0.00120
93.15  0.99751  0.00120
93.15  0.99612  0.00120
93.15  0.99632  0.00120
93.15  0.99614  0.00120
93.15  0.99748  0.00120
93.15  0.99799  0.00120
93.15  0.99904  0.00150
93.15  0.99673  0.00170
93.15  0.99695  0.00180
93.15  0.99678  0.00190
93.15  0.99750  0.00170
93.15  0.99700  0.00180
93.15  0.99686  0.00180
93.15  0.99647  0.00170
93.15  0.99673  0.00140
93.15  0.99476  0.00230
93.15  0.99609  0.00140
93.15  0.99588  0.00210
93.15  0.99834  0.00220
93.15  1.00398  0.00120
93.15  1.00724  0.00190
93.15  1.01136  0.00170
93.15  0.99198  0.00180
93.15  1.00106  0.00071
93.15  1.00065  0.00081
93.15  0.99984  0.00081
93.15  1.00043  0.00140
93.15  1.00268  0.00081
93.15  1.00151  0.00091
93.15  1.00094  0.00091
93.15  1.00315  0.00081
95.97  0.99266  0.00170
89.50  0.99780  0.00140
89.50  1.00327  0.00280
89.49  0.99581  0.00280
89.49  1.01878  0.00240
89.49  0.99232  0.00190
93.20  0.99699  0.00520
```

93.20	0.99924	0.00520
93.20	1.00080	0.00420
93.20	1.00126	0.00380
93.20	0.99926	0.00380
93.20	0.99005	0.00420
93.20	0.99945	0.00380
89.46	1.00874	0.00250
93.24	1.00382	0.00300
89.60	1.00363	0.00200
89.41	1.00136	0.00590
93.90	1.00397	0.00160
93.90	1.00407	0.00270
93.99	0.99814	0.00170
93.91	0.99823	0.00170
95.98	0.99135	0.00140
95.98	0.99695	0.00140
95.98	0.99490	0.00120
95.98	0.99423	0.00120
95.98	0.99943	0.00120
95.98	0.99262	0.00150
95.98	0.99637	0.00130
95.98	1.00196	0.00110
93.90	0.99698	0.00290
93.90	1.00116	0.00250
93.90	0.99699	0.00310
93.89	0.99880	0.00450
93.20	1.00215	0.00140
93.20	1.00219	0.00130
93.20	0.98635	0.00100
93.20	0.99582	0.00140
93.20	0.99647	0.00130
93.20	0.99422	0.00140
93.24	1.01241	0.00280
93.23	1.00401	0.00081
93.22	1.00404	0.00081
93.24	1.00579	0.00091
93.30	1.00647	0.00081
95.98	1.00243	0.00130
89.57	1.00722	0.00370
89.57	1.00813	0.00380
93.23	1.00539	0.00600
94.01	0.99761	0.00101
94.01	0.98681	0.00300
94.26	0.98518	0.00600
94.26	0.99002	0.00400
94.52	0.99732	0.00300
94.52	0.98232	0.00300
94.52	0.98805	0.00300
93.17	0.99901	0.00440
93.17	1.00160	0.00400
93.17	1.00695	0.00400
93.17	0.99587	0.00400
93.17	1.00264	0.00400
93.17	1.00253	0.00400
93.17	1.00049	0.00400
93.17	0.99727	0.00400
93.17	0.99545	0.00400
93.17	1.00779	0.00400
93.17	1.00697	0.00400
93.17	1.00800	0.00400
93.17	0.99859	0.00400
93.17	0.99524	0.00400
93.17	1.00652	0.00400
93.17	0.99526	0.00400
93.17	0.99819	0.00400
93.17	1.00033	0.00400
93.17	1.00278	0.00400
93.17	1.00664	0.00400
93.23	1.01341	0.00520
93.23	1.00765	0.00630
93.13	1.00386	0.00097
93.13	1.00256	0.00097
93.13	1.00362	0.00056
93.13	1.00274	0.00056
93.13	1.00357	0.00053
93.13	1.00137	0.00061
93.13	1.00161	0.00061
93.13	1.00182	0.00061
93.13	1.00200	0.00061
93.13	1.00257	0.00053

93.13	1.00317	0.00053
93.13	1.00816	0.00053
93.13	1.00329	0.00053
93.13	1.00361	0.00053
93.13	1.00315	0.00053
93.13	1.00240	0.00053
93.13	1.00268	0.00053
93.13	1.00269	0.00053
93.13	1.00234	0.00053
93.13	1.00296	0.00053
93.13	1.00310	0.00053
93.13	1.00321	0.00056
93.13	1.00280	0.00061
93.13	1.00318	0.00062
93.13	1.00231	0.00071
93.13	1.00115	0.00071
93.13	0.99976	0.00080
93.13	1.00027	0.00080
93.13	1.00104	0.00080
93.13	1.00123	0.00080
93.13	1.00332	0.00053
93.13	1.00340	0.00052
93.13	1.00369	0.00053
93.13	1.00018	0.00053
93.13	1.00209	0.00170
93.13	1.00183	0.00170
93.13	1.00346	0.00052
93.13	1.00394	0.00062
93.13	1.00157	0.00061
93.13	1.00232	0.00085
93.13	1.00203	0.00098
93.13	1.00322	0.00061
93.13	1.00035	0.00061
93.23	1.00921	0.00250
93.23	1.00927	0.00220
93.23	1.00486	0.00200
93.23	1.01247	0.00150
55.38	1.00188	0.00091
53.53	1.00135	0.00091
36.33	1.00388	0.00032
37.76	1.00340	0.00032
16.19	1.00757	0.00300
36.53	1.00395	0.00170
36.54	1.00848	0.00300
36.51	1.00987	0.00210
36.51	0.99630	0.00230
10.06	1.01269	0.00071
36.49	1.00772	0.00180
36.47	1.01081	0.00530
8.88	1.01108	0.00240
16.79	1.00829	0.00270
11.69	1.01907	0.00230
15.50	1.01727	0.00220
20.54	1.01809	0.00220
20.05	1.00722	0.00132
20.05	1.01055	0.00130
20.05	1.01148	0.00129
20.05	1.01178	0.00130
20.05	1.01142	0.00130
20.05	1.01052	0.00133
20.05	1.00965	0.00136
20.05	1.01144	0.00145
20.05	1.00831	0.00134
20.05	1.01004	0.00111
20.05	1.00905	0.00111
20.05	1.01204	0.00108
20.05	1.00729	0.00123
20.05	1.01390	0.00126
1.60	0.98971	0.00180
1.60	0.98976	0.00180
1.60	0.99053	0.00181
1.60	0.99419	0.00170
1.60	0.99407	0.00170
1.60	0.99435	0.00160
1.60	0.99458	0.00161
1.60	0.99426	0.00160
1.60	0.99440	0.00160
1.60	0.99479	0.00161
1.60	0.99410	0.00161
1.60	0.99569	0.00170

1.60	0.99566	0.00170
1.60	0.99725	0.00190
1.60	0.99692	0.00191
1.60	0.99718	0.00191
1.60	0.99721	0.00191
1.60	0.99711	0.00191
1.60	0.99174	0.00160
1.60	0.99297	0.00160
1.60	0.99307	0.00160
1.60	0.99328	0.00160
1.60	0.99365	0.00160
1.60	0.99355	0.00160
1.60	0.99523	0.00160
1.60	0.99571	0.00160
1.60	0.99526	0.00160
1.60	0.99567	0.00160
1.60	0.99532	0.00180
1.60	0.99533	0.00180
4.95	0.99116	0.01140
4.95	0.99837	0.00061
62.40	0.99889	0.00500
62.40	0.99588	0.00500
62.40	0.99896	0.00500
62.40	0.99861	0.00500
62.40	0.99956	0.00500
62.40	0.99741	0.00500
62.40	1.00144	0.00500
62.40	1.00085	0.00500
62.40	0.99931	0.00500
62.40	1.00208	0.00500
62.40	0.99954	0.00500
62.40	0.99857	0.00500
62.40	1.00101	0.00500
62.40	1.00084	0.00500
62.40	1.00053	0.00500
80.00	0.99335	0.00410
80.00	0.99495	0.00410
80.00	0.99552	0.00410
80.00	0.99588	0.00310
80.00	0.99564	0.00330
80.00	0.99538	0.00410
80.00	0.99543	0.00420
80.00	0.99956	0.00470
80.00	0.99916	0.00480
18.80	1.01853	0.00240
18.80	1.02062	0.00240
18.80	1.01460	0.00250
12.50	1.01649	0.00200
12.50	1.02117	0.00210
12.50	1.00445	0.00220

13.0 LISTING OF COMPUTER FILES

SCALE 6.0 input and output files used for the criticality code validation:

Code: SCALE 6.0
Module: CSAS5
Version: C00750MNYCP01
Computer System: TN Linux Cluster
Files: Secure network initially, then redundant backup

Note: Listed file names are complete OECD Handbook and DICE benchmark designations. Actual file names for input and output files are obtained by shortening each designator to 3-letter combinations, and may include removing a leading hyphen or zero. For example, HEU-MET-FAST-001-001 becomes hmf001-01.

File Name	Input Files			Output Files		
	Date	Time	Size	Date	Time	Size
HEU-MET-FAST-001-001	03-24-2015	11:41 PM	1,033	03-24-2015	11:41 PM	3,059,296
HEU-MET-FAST-002-001	03-24-2015	11:56 PM	512	03-24-2015	11:56 PM	3,004,521
HEU-MET-FAST-002-002	03-25-2015	07:23 AM	575	03-25-2015	07:23 AM	3,262,165
HEU-MET-FAST-002-003	03-25-2015	12:01 AM	590	03-25-2015	12:01 AM	3,150,336
HEU-MET-FAST-002-004	03-24-2015	11:58 PM	577	03-24-2015	11:58 PM	2,785,026
HEU-MET-FAST-002-005	03-24-2015	11:59 PM	602	03-24-2015	11:59 PM	2,901,460
HEU-MET-FAST-002-006	03-25-2015	12:00 AM	580	03-25-2015	12:00 AM	3,002,417
HEU-MET-FAST-003-001	03-24-2015	11:42 PM	531	03-24-2015	11:42 PM	2,503,374
HEU-MET-FAST-003-002	03-24-2015	11:45 PM	555	03-24-2015	11:45 PM	2,686,181
HEU-MET-FAST-003-003	03-24-2015	11:46 PM	531	03-24-2015	11:46 PM	2,571,470
HEU-MET-FAST-003-004	03-24-2015	11:49 PM	531	03-24-2015	11:49 PM	2,585,880
HEU-MET-FAST-003-005	03-24-2015	11:55 PM	532	03-24-2015	11:55 PM	2,870,899
HEU-MET-FAST-003-006	03-24-2015	11:57 PM	531	03-24-2015	11:57 PM	2,797,675
HEU-MET-FAST-003-007	03-25-2015	12:04 AM	531	03-25-2015	12:04 AM	2,931,242
HEU-MET-FAST-003-008	03-25-2015	08:21 AM	626	03-25-2015	08:21 AM	2,298,140
HEU-MET-FAST-003-009	03-24-2015	11:46 PM	611	03-24-2015	11:46 PM	2,215,531
HEU-MET-FAST-003-010	03-24-2015	11:51 PM	611	03-24-2015	11:51 PM	2,145,618
HEU-MET-FAST-003-011	03-24-2015	11:56 PM	611	03-24-2015	11:56 PM	2,235,146
HEU-MET-FAST-004-001	03-25-2015	12:42 AM	909	03-25-2015	12:42 AM	2,072,765
HEU-MET-FAST-007-001	03-24-2015	11:45 PM	881	03-24-2015	11:45 PM	2,868,584
HEU-MET-FAST-007-002	03-24-2015	11:47 PM	1,306	03-24-2015	11:47 PM	2,866,289
HEU-MET-FAST-007-003	03-24-2015	11:48 PM	1,306	03-24-2015	11:48 PM	3,321,434
HEU-MET-FAST-007-004	03-24-2015	11:49 PM	1,303	03-24-2015	11:49 PM	2,928,384
HEU-MET-FAST-007-005	03-24-2015	11:50 PM	1,304	03-24-2015	11:50 PM	3,287,573

File Name	Input Files			Output Files		
	Date	Time	Size	Date	Time	Size
HEU-MET-FAST-007-006	03-24-2015	11:50 PM	1,304	03-24-2015	11:50 PM	3,219,142
HEU-MET-FAST-007-007	03-24-2015	11:51 PM	1,304	03-24-2015	11:51 PM	3,183,286
HEU-MET-FAST-007-008	03-24-2015	11:51 PM	1,304	03-24-2015	11:51 PM	3,133,363
HEU-MET-FAST-007-009	03-24-2015	11:51 PM	1,304	03-24-2015	11:51 PM	3,234,121
HEU-MET-FAST-007-010	03-24-2015	11:53 PM	1,307	03-24-2015	11:53 PM	3,430,189
HEU-MET-FAST-007-011	03-24-2015	11:55 PM	1,307	03-24-2015	11:55 PM	3,713,268
HEU-MET-FAST-007-012	03-24-2015	11:54 PM	1,307	03-24-2015	11:54 PM	3,301,655
HEU-MET-FAST-007-013	03-24-2015	11:55 PM	1,307	03-24-2015	11:55 PM	3,415,408
HEU-MET-FAST-007-014	03-24-2015	11:55 PM	1,307	03-24-2015	11:55 PM	3,427,667
HEU-MET-FAST-007-015	03-24-2015	11:56 PM	1,307	03-24-2015	11:56 PM	3,670,490
HEU-MET-FAST-007-016	03-24-2015	11:56 PM	1,307	03-24-2015	11:56 PM	3,532,537
HEU-MET-FAST-007-017	03-24-2015	11:58 PM	1,307	03-24-2015	11:58 PM	3,381,045
HEU-MET-FAST-007-018	03-24-2015	11:58 PM	1,307	03-24-2015	11:58 PM	3,558,819
HEU-MET-FAST-007-019	03-24-2015	11:52 PM	882	03-24-2015	11:52 PM	2,686,192
HEU-MET-FAST-007-020	03-24-2015	11:55 PM	1,307	03-24-2015	11:55 PM	3,022,144
HEU-MET-FAST-007-021	03-24-2015	11:55 PM	1,307	03-24-2015	11:55 PM	3,214,309
HEU-MET-FAST-007-022	03-24-2015	11:56 PM	1,307	03-24-2015	11:56 PM	2,879,807
HEU-MET-FAST-007-023	03-24-2015	11:57 PM	1,307	03-24-2015	11:57 PM	3,161,234
HEU-MET-FAST-007-024	03-24-2015	11:57 PM	1,307	03-24-2015	11:57 PM	3,314,220
HEU-MET-FAST-007-025	03-24-2015	11:57 PM	1,307	03-24-2015	11:57 PM	3,143,717
HEU-MET-FAST-007-026	03-24-2015	11:58 PM	1,307	03-24-2015	11:58 PM	3,120,879
HEU-MET-FAST-007-027	03-24-2015	11:57 PM	1,332	03-24-2015	11:57 PM	2,969,439
HEU-MET-FAST-007-028	03-24-2015	11:58 PM	1,332	03-24-2015	11:58 PM	2,850,763
HEU-MET-FAST-007-029	03-24-2015	11:59 PM	1,332	03-24-2015	11:59 PM	2,961,766
HEU-MET-FAST-007-030	03-25-2015	12:01 AM	1,332	03-25-2015	12:01 AM	3,550,302
HEU-MET-FAST-007-031	03-25-2015	12:03 AM	1,332	03-25-2015	12:03 AM	3,508,963
HEU-MET-FAST-007-032	03-25-2015	12:00 AM	1,309	03-25-2015	12:00 AM	2,963,605
HEU-MET-FAST-007-033	03-25-2015	12:00 AM	1,309	03-25-2015	12:00 AM	2,731,829
HEU-MET-FAST-007-034	03-25-2015	12:01 AM	1,309	03-25-2015	12:01 AM	2,975,438
HEU-MET-FAST-007-035	03-25-2015	12:56 AM	960	03-25-2015	12:56 AM	2,199,095
HEU-MET-FAST-007-036	03-25-2015	12:56 AM	1,405	03-25-2015	12:56 AM	2,307,536
HEU-MET-FAST-007-037	03-25-2015	12:57 AM	1,405	03-25-2015	12:57 AM	2,383,042
HEU-MET-FAST-007-038	03-25-2015	12:59 AM	1,407	03-25-2015	12:59 AM	2,369,709
HEU-MET-FAST-007-039	03-25-2015	12:57 AM	1,407	03-25-2015	12:57 AM	2,345,047
HEU-MET-FAST-007-040	03-25-2015	12:58 AM	1,402	03-25-2015	12:58 AM	2,328,582
HEU-MET-FAST-007-041	03-25-2015	12:58 AM	1,403	03-25-2015	12:58 AM	2,475,410
HEU-MET-FAST-007-042	03-25-2015	12:58 AM	1,403	03-25-2015	12:58 AM	2,484,346
HEU-MET-FAST-007-043	03-25-2015	12:59 AM	1,402	03-25-2015	12:59 AM	2,498,846

File Name	Input Files			Output Files		
	Date	Time	Size	Date	Time	Size
HEU-MET-FAST-015-001	03-25-2015	12:02 AM	1,615	03-25-2015	12:02 AM	2,814,475
HEU-MET-FAST-018-001	03-25-2015	12:03 AM	3,139	03-25-2015	12:03 AM	3,675,897
HEU-MET-FAST-019-001	03-25-2015	12:03 AM	2,328	03-25-2015	12:03 AM	2,986,955
HEU-MET-FAST-020-001	03-25-2015	12:05 AM	2,844	03-25-2015	12:05 AM	3,420,009
HEU-MET-FAST-021-001	03-25-2015	12:06 AM	2,935	03-25-2015	12:06 AM	3,087,275
HEU-MET-FAST-022-001	03-25-2015	12:05 AM	2,910	03-25-2015	12:05 AM	3,241,851
HEU-MET-FAST-023-016	03-25-2015	01:01 AM	2,708	03-25-2015	01:01 AM	3,244,945
HEU-MET-FAST-023-020	03-25-2015	01:02 AM	2,640	03-25-2015	01:02 AM	2,630,315
HEU-MET-FAST-026-001	03-25-2015	01:01 AM	2,885	03-25-2015	01:01 AM	3,239,300
HEU-MET-FAST-026-008	03-25-2015	01:00 AM	3,040	03-25-2015	01:00 AM	3,102,602
HEU-MET-FAST-026-017	03-25-2015	01:02 AM	3,079	03-25-2015	01:02 AM	2,576,653
HEU-MET-FAST-026-019	03-25-2015	01:03 AM	3,054	03-25-2015	01:03 AM	3,248,391
HEU-MET-FAST-026-032	03-25-2015	01:02 AM	3,089	03-25-2015	01:02 AM	2,514,765
HEU-MET-FAST-027-001	03-25-2015	12:07 AM	2,932	03-25-2015	12:07 AM	3,420,688
HEU-MET-FAST-028-001	03-25-2015	12:19 AM	510	03-25-2015	12:19 AM	2,896,612
HEU-MET-FAST-029-001	03-25-2015	12:09 AM	2,317	03-25-2015	12:09 AM	3,088,914
HEU-MET-FAST-031-001	03-25-2015	01:04 AM	2,149	03-25-2015	01:04 AM	2,566,359
HEU-MET-FAST-032-001	03-25-2015	12:12 AM	516	03-25-2015	12:12 AM	2,513,892
HEU-MET-FAST-032-002	03-25-2015	12:12 AM	516	03-25-2015	12:12 AM	2,724,454
HEU-MET-FAST-032-003	03-25-2015	12:09 AM	517	03-25-2015	12:09 AM	2,433,946
HEU-MET-FAST-032-004	03-25-2015	12:08 AM	523	03-25-2015	12:08 AM	2,321,041
HEU-MET-FAST-033-001	03-25-2015	12:16 AM	2,250	03-25-2015	12:16 AM	4,209,470
HEU-MET-FAST-033-002	03-25-2015	12:16 AM	2,267	03-25-2015	12:16 AM	3,804,763
HEU-MET-FAST-034-001	03-25-2015	12:15 AM	1,894	03-25-2015	12:15 AM	3,443,560
HEU-MET-FAST-034-002	03-25-2015	12:15 AM	2,011	03-25-2015	12:15 AM	3,655,041
HEU-MET-FAST-034-003	03-25-2015	12:16 AM	1,888	03-25-2015	12:16 AM	3,468,309
HEU-MET-FAST-036-001	03-25-2015	12:19 AM	2,149	03-25-2015	12:19 AM	3,936,279
HEU-MET-FAST-036-002	03-25-2015	12:19 AM	2,400	03-25-2015	12:19 AM	3,960,487
HEU-MET-FAST-037-001	03-25-2015	01:11 AM	2,643	03-25-2015	01:11 AM	3,455,243
HEU-MET-FAST-041-003	03-25-2015	12:12 AM	508	03-25-2015	12:12 AM	2,362,654
HEU-MET-FAST-041-004	03-25-2015	12:15 AM	508	03-25-2015	12:15 AM	2,391,407
HEU-MET-FAST-041-005	03-25-2015	12:18 AM	508	03-25-2015	12:18 AM	2,376,323
HEU-MET-FAST-041-006	03-25-2015	12:22 AM	508	03-25-2015	12:22 AM	2,333,171
HEU-MET-FAST-053-002	04-01-2015	09:40 PM	1,464	04-01-2015	09:40 PM	2,258,218
HEU-MET-FAST-053-003	04-01-2015	09:40 PM	1,508	04-01-2015	09:40 PM	2,242,172
HEU-MET-FAST-053-004	04-01-2015	09:40 PM	1,474	04-01-2015	09:40 PM	2,595,568
HEU-MET-FAST-053-005	04-01-2015	09:32 PM	2,263	04-01-2015	09:32 PM	2,607,395
HEU-MET-FAST-053-006	04-01-2015	09:40 PM	2,202	04-01-2015	09:40 PM	2,827,739

File Name	Input Files			Output Files		
	Date	Time	Size	Date	Time	Size
HEU-MET-FAST-053-007	04-01-2015	09:38 PM	2,349	04-01-2015	09:38 PM	2,894,493
HEU-MET-FAST-055-001	03-25-2015	12:34 AM	920	03-25-2015	12:34 AM	2,079,437
HEU-MET-INTER-006-001	03-25-2015	12:59 AM	2,816	03-25-2015	12:59 AM	4,112,205
HEU-MET-INTER-006-002	03-25-2015	12:54 AM	2,994	03-25-2015	12:54 AM	3,898,028
HEU-MET-INTER-006-003	03-25-2015	12:58 AM	2,608	03-25-2015	12:58 AM	4,017,411
HEU-MET-INTER-006-004	03-25-2015	01:00 AM	2,602	03-25-2015	01:00 AM	3,980,514
HEU-MET-MIXED-001-001	03-25-2015	01:14 AM	3,016	03-25-2015	01:14 AM	4,110,638
HEU-MET-MIXED-002-001	03-25-2015	01:18 AM	1,470	03-25-2015	01:18 AM	2,755,953
HEU-MET-MIXED-003-001	03-25-2015	01:20 AM	1,416	03-25-2015	01:20 AM	2,510,282
HEU-MET-THERM-001-001	03-25-2015	01:22 AM	1,606	03-25-2015	01:22 AM	2,445,043
HEU-MET-THERM-003-001	03-25-2015	01:37 AM	1,062	03-25-2015	01:37 AM	2,143,715
HEU-MET-THERM-003-002	03-25-2015	01:36 AM	1,062	03-25-2015	01:36 AM	2,075,623
HEU-MET-THERM-003-003	03-25-2015	01:36 AM	8,458	03-25-2015	01:36 AM	3,956,811
HEU-MET-THERM-003-004	03-25-2015	01:37 AM	10,716	03-25-2015	01:37 AM	4,408,491
HEU-MET-THERM-003-005	03-25-2015	01:42 AM	63,560	03-25-2015	01:42 AM	3,874,389
HEU-MET-THERM-003-006	03-25-2015	01:54 AM	13,366	03-25-2015	01:54 AM	3,135,777
HEU-MET-THERM-003-007	03-25-2015	01:56 AM	23,064	03-25-2015	01:56 AM	4,484,320
HEU-MET-THERM-006-001	03-25-2015	01:57 AM	2,500	03-25-2015	01:57 AM	2,252,615
HEU-MET-THERM-006-002	03-25-2015	01:57 AM	3,822	03-25-2015	01:57 AM	2,890,561
HEU-MET-THERM-006-003	03-25-2015	01:58 AM	3,404	03-25-2015	01:58 AM	2,783,697
HEU-MET-THERM-006-004	03-25-2015	01:58 AM	4,952	03-25-2015	01:58 AM	3,393,449
HEU-MET-THERM-006-005	03-25-2015	01:59 AM	3,808	03-25-2015	01:59 AM	2,873,731
HEU-MET-THERM-006-006	03-25-2015	08:01 AM	3,819	03-25-2015	08:01 AM	3,115,246
HEU-MET-THERM-006-007	03-25-2015	01:59 AM	3,887	03-25-2015	01:59 AM	3,011,468
HEU-MET-THERM-006-008	03-25-2015	02:03 AM	3,865	03-25-2015	02:03 AM	3,087,881
HEU-MET-THERM-006-009	03-25-2015	02:00 AM	3,513	03-25-2015	02:00 AM	2,858,001
HEU-MET-THERM-006-010	03-25-2015	02:00 AM	2,673	03-25-2015	02:00 AM	2,497,045
HEU-MET-THERM-006-011	03-25-2015	02:01 AM	3,308	03-25-2015	02:01 AM	2,809,170
HEU-MET-THERM-006-012	03-25-2015	02:01 AM	2,395	03-25-2015	02:01 AM	2,589,352
HEU-MET-THERM-006-014	03-25-2015	02:02 AM	2,658	03-25-2015	02:02 AM	2,486,185
HEU-MET-THERM-006-015	03-25-2015	02:05 AM	2,699	03-25-2015	02:05 AM	2,439,798
HEU-MET-THERM-006-016	03-25-2015	02:02 AM	2,846	03-25-2015	02:02 AM	2,403,252
HEU-MET-THERM-006-019	03-25-2015	02:03 AM	2,972	03-25-2015	02:03 AM	2,562,571
HEU-MET-THERM-006-020	03-25-2015	02:07 AM	3,069	03-25-2015	02:07 AM	3,158,610
HEU-MET-THERM-006-021	03-25-2015	02:05 AM	2,713	03-25-2015	02:05 AM	3,132,838
HEU-MET-THERM-006-022	03-25-2015	02:12 AM	3,109	03-25-2015	02:12 AM	3,347,899

File Name	Input Files			Output Files		
	Date	Time	Size	Date	Time	Size
HEU-MET-THERM-006-023	03-25-2015	07:57 AM	3,147	03-25-2015	07:57 AM	3,396,016
HEU-MET-THERM-008-001	03-25-2015	02:17 AM	22,862	03-25-2015	02:17 AM	8,319,821
HEU-MET-THERM-009-001	04-08-2015	02:39 PM	2,854	04-08-2015	02:39 PM	3,323,854
HEU-MET-THERM-011-001	03-25-2015	02:21 AM	3,970	03-25-2015	02:21 AM	2,364,982
HEU-MET-THERM-011-002	03-25-2015	02:22 AM	3,246	03-25-2015	02:22 AM	2,240,456
HEU-MET-THERM-011-003	03-25-2015	02:36 AM	3,250	03-25-2015	02:36 AM	2,194,220
HEU-MET-THERM-011-004	03-25-2015	02:36 AM	3,250	03-25-2015	02:36 AM	2,327,343
HEU-MET-THERM-011-005	03-25-2015	02:37 AM	3,989	03-25-2015	02:37 AM	2,473,601
HEU-MET-THERM-011-006	03-25-2015	02:39 AM	3,250	03-25-2015	02:39 AM	2,440,719
HEU-MET-THERM-011-007	03-25-2015	02:43 AM	3,973	03-25-2015	02:43 AM	2,612,266
HEU-MET-THERM-011-008	03-25-2015	02:54 AM	3,993	03-25-2015	02:54 AM	2,568,957
HEU-MET-THERM-011-009	03-25-2015	02:56 AM	3,994	03-25-2015	02:56 AM	2,513,492
HEU-MET-THERM-011-010	03-25-2015	02:57 AM	3,985	03-25-2015	02:57 AM	2,403,457
HEU-MET-THERM-011-011	03-25-2015	02:57 AM	3,987	03-25-2015	02:57 AM	2,460,543
HEU-MET-THERM-011-012	03-25-2015	02:58 AM	3,278	03-25-2015	02:58 AM	2,308,364
HEU-MET-THERM-011-013	03-25-2015	02:58 AM	3,994	03-25-2015	02:58 AM	2,450,722
HEU-MET-THERM-011-014	03-25-2015	02:59 AM	3,992	03-25-2015	02:59 AM	2,388,463
HEU-MET-THERM-011-015	03-25-2015	03:00 AM	3,995	03-25-2015	03:00 AM	2,381,123
HEU-MET-THERM-011-016	03-25-2015	02:59 AM	3,995	03-25-2015	02:59 AM	2,526,893
HEU-MET-THERM-011-017	03-25-2015	03:00 AM	3,996	03-25-2015	03:00 AM	2,470,923
HEU-MET-THERM-011-018	03-25-2015	03:01 AM	3,986	03-25-2015	03:01 AM	2,387,165
HEU-MET-THERM-011-019	03-25-2015	03:01 AM	3,985	03-25-2015	03:01 AM	2,400,039
HEU-MET-THERM-011-020	03-25-2015	03:01 AM	3,243	03-25-2015	03:01 AM	2,175,801
HEU-MET-THERM-011-021	03-25-2015	03:02 AM	3,988	03-25-2015	03:02 AM	2,337,643
HEU-MET-THERM-011-022	03-25-2015	03:02 AM	3,989	03-25-2015	03:02 AM	2,349,019
HEU-MET-THERM-011-023	03-25-2015	03:02 AM	3,991	03-25-2015	03:02 AM	2,519,526
HEU-MET-THERM-011-024	03-25-2015	03:03 AM	3,992	03-25-2015	03:03 AM	2,416,842
HEU-MET-THERM-011-025	03-25-2015	03:07 AM	3,991	03-25-2015	03:07 AM	2,549,607
HEU-MET-THERM-011-026	03-25-2015	03:05 AM	3,240	03-25-2015	03:05 AM	2,383,355
HEU-MET-THERM-011-027	03-25-2015	03:07 AM	3,341	03-25-2015	03:07 AM	2,512,601
HEU-MET-THERM-011-028	03-25-2015	03:14 AM	3,247	03-25-2015	03:14 AM	2,436,908
HEU-MET-THERM-011-029	03-25-2015	03:13 AM	3,247	03-25-2015	03:13 AM	2,284,267
HEU-MET-THERM-011-030	03-25-2015	03:14 AM	3,986	03-25-2015	03:14 AM	2,485,371
HEU-MET-THERM-011-031	03-25-2015	03:17 AM	3,196	03-25-2015	03:17 AM	2,440,890
HEU-MET-THERM-011-032	03-25-2015	03:19 AM	3,926	03-25-2015	03:19 AM	2,596,104
HEU-MET-THERM-011-033	03-25-2015	03:21 AM	3,979	03-25-2015	03:21 AM	2,413,648
HEU-MET-THERM-011-034	03-25-2015	03:23 AM	4,054	03-25-2015	03:23 AM	2,330,034
HEU-MET-THERM-011-035	03-25-2015	03:36 AM	4,131	03-25-2015	03:36 AM	2,398,367

File Name	Input Files			Output Files		
	Date	Time	Size	Date	Time	Size
HEU-MET-THERM-011-036	03-25-2015	03:36 AM	4,132	03-25-2015	03:36 AM	2,320,770
HEU-MET-THERM-011-037	03-25-2015	03:37 AM	4,126	03-25-2015	03:37 AM	2,375,840
HEU-MET-THERM-011-038	03-25-2015	03:42 AM	4,123	03-25-2015	03:42 AM	2,488,304
HEU-MET-THERM-011-039	03-25-2015	03:43 AM	4,111	03-25-2015	03:43 AM	2,418,257
HEU-MET-THERM-011-040	03-25-2015	03:54 AM	4,121	03-25-2015	03:54 AM	2,516,133
HEU-MET-THERM-011-041	03-25-2015	03:56 AM	4,125	03-25-2015	03:56 AM	2,549,186
HEU-MET-THERM-011-042	03-25-2015	03:57 AM	4,068	03-25-2015	03:57 AM	2,545,643
HEU-MET-THERM-011-043	03-25-2015	03:57 AM	4,064	03-25-2015	03:57 AM	2,590,847
HEU-MET-THERM-012-001	03-25-2015	03:58 AM	2,286	03-25-2015	03:58 AM	3,193,914
HEU-MET-THERM-013-001	03-25-2015	03:58 AM	2,795	03-25-2015	03:58 AM	3,959,594
HEU-MET-THERM-013-002	03-25-2015	03:59 AM	2,738	03-25-2015	03:59 AM	3,806,814
HEU-MET-THERM-014-001	03-25-2015	03:59 AM	2,300	03-25-2015	03:59 AM	3,215,659
IEU-MET-FAST-001-001	03-25-2015	03:09 AM	4,276	03-25-2015	03:09 AM	4,781,464
IEU-MET-FAST-001-002	03-25-2015	03:09 AM	4,523	03-25-2015	03:09 AM	4,918,357
IEU-MET-FAST-001-003	03-25-2015	03:11 AM	5,113	03-25-2015	03:11 AM	5,145,041
IEU-MET-FAST-001-004	03-25-2015	03:14 AM	6,618	03-25-2015	03:14 AM	6,345,835
IEU-MET-FAST-002-001	03-25-2015	03:11 AM	589	03-25-2015	03:11 AM	2,006,690
IEU-MET-FAST-003-001	03-25-2015	03:08 AM	3,513	03-25-2015	03:08 AM	3,364,657
IEU-MET-FAST-004-001	03-25-2015	03:09 AM	2,393	03-25-2015	03:09 AM	2,772,065
IEU-MET-FAST-005-001	03-25-2015	03:09 AM	2,766	03-25-2015	03:09 AM	2,798,688
IEU-MET-FAST-006-001	03-25-2015	03:10 AM	2,590	03-25-2015	03:10 AM	2,739,009
IEU-MET-FAST-007-001	03-25-2015	04:06 AM	39,733	03-25-2015	04:06 AM	16,022,039
IEU-MET-FAST-008-001	03-25-2015	03:13 AM	2,455	03-25-2015	03:13 AM	2,731,076
IEU-MET-FAST-009-001	03-25-2015	03:29 AM	1,425	03-25-2015	03:29 AM	2,579,629
IEU-MET-FAST-010-001	03-25-2015	03:30 AM	3,455	03-25-2015	03:30 AM	2,592,678
IEU-MET-FAST-012-001	03-25-2015	03:29 AM	968	03-25-2015	03:29 AM	1,797,569
IEU-MET-FAST-013-001	03-25-2015	03:22 AM	2,813	03-25-2015	03:22 AM	2,000,568
IEU-MET-FAST-014-001	03-25-2015	03:21 AM	2,856	03-25-2015	03:21 AM	2,004,170
IEU-MET-FAST-014-002	03-25-2015	03:23 AM	2,761	03-25-2015	03:23 AM	1,956,319
IEU-MET-FAST-020-001	03-25-2015	03:14 AM	3,247	03-25-2015	03:14 AM	2,436,908
IEU-MET-FAST-020-002	03-25-2015	03:31 AM	1,288	03-25-2015	03:31 AM	1,997,936
IEU-MET-FAST-020-003	03-25-2015	03:27 AM	1,288	03-25-2015	03:27 AM	1,814,209
IEU-MET-FAST-020-004	03-25-2015	03:29 AM	1,288	03-25-2015	03:29 AM	1,966,955
IEU-MET-FAST-020-005	03-25-2015	03:27 AM	1,292	03-25-2015	03:27 AM	1,987,914
IEU-MET-FAST-020-006	03-25-2015	03:25 AM	1,290	03-25-2015	03:25 AM	2,027,215
IEU-MET-FAST-020-007	03-25-2015	03:27 AM	1,292	03-25-2015	03:27 AM	2,208,198
IEU-MET-FAST-021-001	03-25-2015	03:27 AM	1,453	03-25-2015	03:27 AM	2,336,694
IEU-MET-FAST-022-001	03-25-2015	04:17 AM	27,580	03-25-2015	04:17 AM	6,968,471

File Name	Input Files			Output Files		
	Date	Time	Size	Date	Time	Size
IEU-MET-FAST-022-002	03-25-2015	04:19 AM	28,121	03-25-2015	04:19 AM	7,301,323
IEU-MET-FAST-022-003	03-25-2015	04:21 AM	20,740	03-25-2015	04:21 AM	5,453,397
IEU-MET-FAST-022-004	03-25-2015	04:21 AM	21,652	03-25-2015	04:21 AM	5,696,755
IEU-MET-FAST-022-005	03-25-2015	04:22 AM	15,919	03-25-2015	04:22 AM	4,410,843
IEU-MET-FAST-022-007	03-25-2015	04:23 AM	11,275	03-25-2015	04:23 AM	3,231,931
LEU-MET-THERM-006-001	03-25-2015	04:25 AM	4,731	03-25-2015	04:25 AM	1,788,230
LEU-MET-THERM-006-002	03-25-2015	04:29 AM	6,969	03-25-2015	04:29 AM	1,924,670
LEU-MET-THERM-006-003	03-25-2015	04:31 AM	7,221	03-25-2015	04:31 AM	1,977,138
LEU-MET-THERM-006-004	03-25-2015	04:27 AM	4,790	03-25-2015	04:27 AM	1,949,752
LEU-MET-THERM-006-005	03-25-2015	08:01 AM	6,713	03-25-2015	08:01 AM	1,882,286
LEU-MET-THERM-006-006	03-25-2015	04:27 AM	4,780	03-25-2015	04:27 AM	1,989,560
LEU-MET-THERM-006-007	03-25-2015	04:30 AM	4,771	03-25-2015	04:30 AM	1,944,442
LEU-MET-THERM-006-008	03-25-2015	04:30 AM	5,959	03-25-2015	04:30 AM	1,874,670
LEU-MET-THERM-006-009	03-25-2015	04:31 AM	6,266	03-25-2015	04:31 AM	1,831,058
LEU-MET-THERM-006-010	03-25-2015	04:30 AM	6,277	03-25-2015	04:30 AM	1,880,504
LEU-MET-THERM-006-011	03-25-2015	04:31 AM	6,772	03-25-2015	04:31 AM	1,825,595
LEU-MET-THERM-006-012	03-25-2015	04:36 AM	4,814	03-25-2015	04:36 AM	1,918,373
LEU-MET-THERM-006-013	03-25-2015	04:37 AM	6,313	03-25-2015	04:37 AM	1,826,867
LEU-MET-THERM-006-014	03-25-2015	04:37 AM	5,026	03-25-2015	04:37 AM	1,775,563
LEU-MET-THERM-006-015	03-25-2015	04:38 AM	5,060	03-25-2015	04:38 AM	1,766,121
LEU-MET-THERM-006-016	03-25-2015	04:43 AM	6,769	03-25-2015	04:43 AM	1,690,645
LEU-MET-THERM-006-017	03-25-2015	04:43 AM	5,175	03-25-2015	04:43 AM	1,488,783
LEU-MET-THERM-006-018	03-25-2015	04:55 AM	5,709	03-25-2015	04:55 AM	1,647,868
LEU-MET-THERM-006-019	03-25-2015	04:31 AM	3,601	03-25-2015	04:31 AM	2,878,042
LEU-MET-THERM-006-020	03-25-2015	04:33 AM	3,797	03-25-2015	04:33 AM	3,122,884
LEU-MET-THERM-006-021	03-25-2015	04:30 AM	3,721	03-25-2015	04:30 AM	2,914,505
LEU-MET-THERM-006-022	03-25-2015	04:31 AM	3,185	03-25-2015	04:31 AM	2,666,314
LEU-MET-THERM-006-023	03-25-2015	04:33 AM	3,182	03-25-2015	04:33 AM	2,780,286
LEU-MET-THERM-006-024	03-25-2015	07:32 AM	3,611	03-25-2015	07:32 AM	2,752,513
LEU-MET-THERM-006-025	03-25-2015	04:29 AM	3,730	03-25-2015	04:29 AM	2,599,776
LEU-MET-THERM-006-026	03-25-2015	04:43 AM	3,725	03-25-2015	04:43 AM	3,026,118
LEU-MET-THERM-006-027	03-25-2015	04:51 AM	3,821	03-25-2015	04:51 AM	2,992,641
LEU-MET-THERM-006-028	03-25-2015	07:31 AM	3,609	03-25-2015	07:31 AM	2,685,538
LEU-MET-THERM-006-029	03-25-2015	04:51 AM	3,080	03-25-2015	04:51 AM	2,511,972
LEU-MET-THERM-006-030	03-25-2015	04:52 AM	3,742	03-25-2015	04:52 AM	2,848,040
LEU-MET-THERM-007-001	03-25-2015	05:17 AM	1,398	03-25-2015	05:17 AM	2,873,473
LEU-MET-THERM-007-004	03-25-2015	05:22 AM	4,698	03-25-2015	05:22 AM	3,922,144

File Name	Input Files			Output Files		
	Date	Time	Size	Date	Time	Size
HEU-COMP-THERM-010-001	1-21-2016	7:44 PM	2,855	1-21-2016	8:45 PM	2,612,700
HEU-COMP-THERM-010-002	1-5-2016	5:44 PM	4,607	1-5-2016	5:36 PM	2,477,079
HEU-COMP-THERM-010-003	1-5-2016	5:44 PM	2,408	1-5-2016	5:36 PM	2,516,472
HEU-COMP-THERM-010-004	1-5-2016	5:44 PM	3,570	1-5-2016	5:37 PM	2,491,973
HEU-COMP-THERM-010-005	1-5-2016	5:44 PM	2,183	1-5-2016	5:37 PM	2,495,442
HEU-COMP-THERM-010-006	1-5-2016	5:44 PM	3,354	1-5-2016	5:37 PM	2,510,846
HEU-COMP-THERM-010-007	1-5-2016	5:45 PM	2,084	1-5-2016	5:38 PM	2,546,149
HEU-COMP-THERM-010-008	1-5-2016	5:45 PM	3,138	1-5-2016	5:38 PM	2,496,058
HEU-COMP-THERM-010-009	1-5-2016	5:45 PM	3,354	1-5-2016	5:38 PM	2,523,893
HEU-COMP-THERM-010-010	1-21-2016	6:06 PM	2,201	1-21-2016	7:10 PM	2,630,606
HEU-COMP-THERM-010-011	1-5-2016	5:45 PM	3,338	1-5-2016	5:39 PM	2,514,640
HEU-COMP-THERM-010-012	1-5-2016	5:45 PM	3,355	1-5-2016	5:39 PM	2,557,796
HEU-COMP-THERM-010-013	1-21-2016	6:06 PM	3,373	1-21-2016	7:10 PM	2,634,973
HEU-COMP-THERM-010-014	1-5-2016	5:46 PM	3,106	1-5-2016	5:40 PM	2,551,597
HEU-COMP-THERM-010-015	1-5-2016	5:46 PM	3,797	1-5-2016	5:40 PM	1,934,948
HEU-COMP-THERM-011-001	1-5-2016	5:47 PM	9,856	1-5-2016	5:46 PM	2,494,626
HEU-COMP-THERM-011-002	1-5-2016	5:47 PM	10,449	1-5-2016	5:46 PM	2,631,141
HEU-COMP-THERM-011-003	1-5-2016	5:47 PM	10,617	1-5-2016	5:46 PM	2,684,718
HEU-COMP-THERM-012-001	1-5-2016	5:48 PM	13,653	1-5-2016	5:47 PM	2,699,145
HEU-COMP-THERM-012-002	1-5-2016	5:48 PM	13,793	1-5-2016	5:47 PM	2,738,672
HEU-COMP-THERM-013-001	1-5-2016	5:48 PM	11,046	1-5-2016	5:47 PM	2,764,854
HEU-COMP-THERM-013-002	1-5-2016	5:48 PM	11,380	1-5-2016	5:48 PM	2,864,629
HEU-COMP-THERM-014-001	1-5-2016	5:49 PM	9,866	1-5-2016	5:43 PM	3,229,529
HEU-COMP-THERM-014-002	1-5-2016	5:49 PM	10,105	1-5-2016	5:36 PM	2,789,048
IEU-COMP-MIXED-002-004	1-5-2016	5:56 PM	5,473	1-5-2016	5:06 PM	3,222,544
IEU-COMP-MIXED-002-005	1-5-2016	5:57 PM	5,794	1-5-2016	5:06 PM	3,230,683
IEU-COMP-MIXED-002-006	1-5-2016	5:57 PM	5,842	1-5-2016	5:08 PM	2,532,302
IEU-COMP-MIXED-002-007	1-5-2016	5:57 PM	5,728	1-5-2016	5:08 PM	2,857,952
IEU-COMP-MIXED-002-008	1-5-2016	5:57 PM	6,283	1-5-2016	5:09 PM	2,936,866
IEU-COMP-MIXED-002-009	1-5-2016	5:57 PM	8,878	1-5-2016	5:10 PM	2,738,919

USLSTATS input and output files used for USL function computation:

Code: USLSTATS
Version: C00750MNYCP01
Computer System: W-IN-B0281, Altran Technologies India
Files: Secure network initially, then redundant backup

File Name	Input Files			Output Files		
	Date	Time	Size	Date	Time	Size
TN-BGC1-USL_Enrichment	1-22-2016	5:56 PM	7,558	1-22-2016	6:00 PM	26,744
TN-BGC1-USL_EALF	1-22-2016	5:55 PM	8,980	1-22-2016	5:59 PM	28,156
TN-BGC1-USL_MFP	1-22-2016	5:57 PM	7,863	1-22-2016	6:00 PM	27,270
TN-BGC1-USL_Mod-Fuel-Ratio	1-27-2016	12:18 PM	7,352	1-27-2016	12:19 PM	26,603
TN-BGC1-USL_nubar	1-22-2016	5:58 PM	7,865	1-22-2016	6:00 PM	27,041

Excel file used for the trending analysis and USL determination:

File Name	Date	Time	Size
TN-BGC1-0600-R1.xlsx	01-27-2016	01:49 PM	285,313