6.0 CRITICALITY SAFETY EVALUATION

6.1 GENERAL DESCRIPTION

This criticality safety analysis is performed to demonstrate safety of the New Powder Container (NPC). This transport package meets applicable IAEA and 10 CFR 71 requirements for a Type A fissile material-shipping container for homogeneous and heterogeneous uranium compounds enriched to a maximum of 5.00 wt. percent U-235.

The NPC transport package design features include an internal 3x3 array of stainless steel Inner Containment Canister Assemblies (ICCAs) enclosed in a near cubic stainless steel reinforced Outer Confinement Assembly (OCA) as described in Section 1.2, *Package Description*.

The uranium contents are contained within 8.515" (21.63-cm) maximum ID stainless steel canisters internally spaced on nominal 12.0" (30.48-cm) center-to-center positions within the OCA. Manufacturing tolerance effects on package models are addressed in Section 6.3.1, *General Model*.

Water exclusion from the ICCAs is not required for this package design. Each cylindrical inner container within the package is analyzed in both undamaged and damaged container arrays under optimal moderation conditions and is demonstrated to be a favorable geometry.

This analysis is performed at a maximum enrichment of 5.00 wt. percent U-235 for both homogeneous UO_2 powder and heterogeneous UO_2 in the form of pellets, and cylindrical elements to represent unrestricted particle size (e.g., outer diameter, OD, is varied through optimum). The most reactive condition is therefore modeled for each authorized payload to demonstrate safety. The following Table 6.1 summarizes the uranium mass limits per ICCA and per package for the NPC container. Other uranium compounds complying with the requirements stated in Table 6.1 are acceptable for shipment provided that the equivalent uranium payloads are not exceeded.

Table 6.1 - Uranium Equivalent Mass Limits* per NPC Package

Material Form (≤ 5.00 wt.% U-235)	Particle Size Restriction: Minimum OD (Inches)	Maximum Loading per ICCA (kgs)		Maximum Loading per NPC (kgs)	
		Net	Uranium	Net	Uranium
Homogeneous Uranium Oxides/Compounds	N/A	60.0	52.89	540.0	476.1
Heterogeneous UO_2 Pellets (BWR)	0.342	60.0	40.54	540.0	364.8
Heterogeneous UO_2 Pellets (PWR)	0.300	60.0	40.54	540.0	364.8
Heterogeneous Uranium Compounds	Unrestricted particle size	60.0	40.54	540.0	364.8

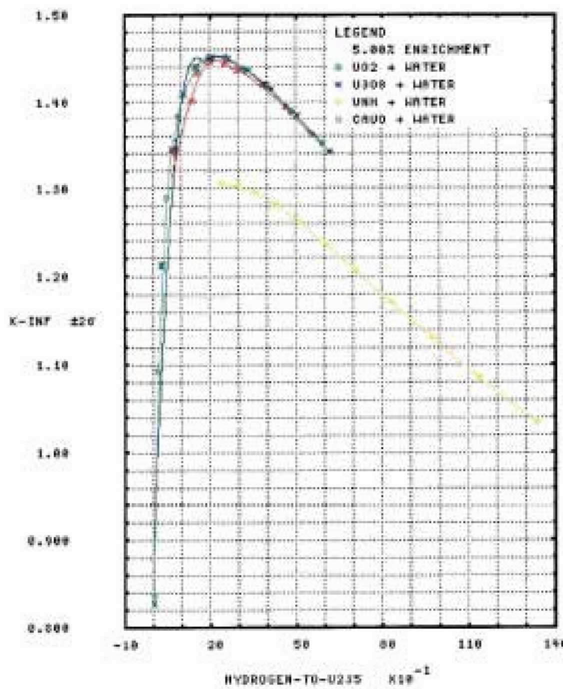
*For U-235 enrichments ≤ 5.00 wt. %.

The "Material Form" column in Table 6.1 includes both homogeneous and heterogeneous uranium compounds in the form of solids, or solidified or dried materials. All homogeneous and heterogeneous compounds are restricted to material forms having a bulk density ≤ 10.96 g/cc (theoretical UO2), with a percent uranium content ≤ 0.88144.

This specifically includes homogneous uranium oxides (UO_2, U_3O_8, or $UO_{x,\ x>2}$). Other homogeneos uranium compounds specifically authorized include dried (calcium containing) sludges, nitrates, uranyl nitrate hexahydrate (UNH, chemical formula $UO_2(NO_3)_2 \bullet 6H_2O$, with a theoretical density of 2.807 gm/cm^3), and uranium oxide bearing ash from combustible waste incineration.

A reactivity comparison between 5% enriched theoretical UO_2, U_3O_8, UNH, and $CaU_6O_{19} \bullet 11H_2O$ compounds with water is provided in Figure 6.0 demonstrating that the theoretical mixture of UO2 and water is conservative relative to other homogeneous uranium compounds. For k-infinite reactivity comparisons, refer Appendix 6.11 for a more complete material specification listing of uranium compounds evaluated.

Figure 6.0 K-infinite Comparison of U-compounds



This also specifically includes heterogeneous uranium oxides (UO_2, U_3O_8, or $UO_{x,\ x>2}$) and UO2 pellets present in standard BWR and PWR reactor fuel assembly lattices designs (e.g., PWR: 17X17; BWR: 10X10, 9X9, 8X8 nuclear fuel assemblies). This analysis demonstrates safety for uranium compounds through optimal heterogeneity (unrestricted or unlimited particle size). As such, the specified pellets having diameters greater than or equal to the "Minimum" value specified in the table may be safely transported in the NPC package provided the tabulated UO_2 (or equivalent uranium) material contents per ICCA and package are met.

Uranium-bearing contents may be moderated by water or carbon to any degree and may be mixed with other non-fissile materials with the exception of deuterium, tritium and beryllium. Materials such as uranium metal and uranium metal alloys are not covered by this analysis.

For this package, undamaged packages have been analyzed in infinite arrays and hence pursuant to 10 CFR §71.59(a)(2) the more restrictive value of "N" is derived from the damaged array calculations. The Criticality Safety Index for criticality control is then derived from this value of "N" per 10 CFR §71.59(b).

This analysis demonstrates safety for 2N–150 packages. The corresponding Criticality Safety Index (CSI) for criticality control of non-exclusive vehicles is given by CSI – 50/N. Since 2N = 150, it follows that N = 75, and CSI – 50/75 = 0.6667 ≈ 0.7 [rounded up to nearest tenth]. Using the rounded Criticality Safety Index result, the maximum allowable number of packages per non-exclusive use vehicle is 50/0.7 = 71.

6.2 PACKAGE DESCRIPTION

6.2.1 CONTENTS

The package shall be used to transport homogeneous or heterogeneous uranium compounds conforming to the requirements stated in Section 6.1 and with uranium enrichments of not greater than than 5.0 weight percent U-235. The uranium isotopic distribution considered in the models used in this criticality safety demonstration is shown in Table 6.2

Table 6.2 - Uranium Isotopic Distribution

Isotope	Modeled wt. %
^{235}U	5.0000
^{238}U	95.0000

This analysis conservatively demonstrates safety for homogeneous UO_2 powder, pellets, and heterogeneous forms of uranium oxides (unlimited particle size) over the entire range of UO_2 densities and degree of moderation by H_2O. The maximum UO_2 equivalent payload demonstrated safe in the NPC is specified in Table 6.1.

Any mass distribution including authorized non-uranium packaging materials such as plastic or metal in the form of bags, bottles, cans etc. within the 3 × 3 array of ICCAs is also acceptable, provided the total uranium content in any one ICCA does not exceed the applicable limit in Table 6.1 and provided that the entire contents meets the applicable total package weight limit.

6.2.2 PACKAGING

A general discussion of the NPC packaging design is provided in Section 1.2.1, *Packaging*. A detailed set of drawings of the NPC packaging is provided in the Appendix 1.3.1, *Packaging General Arrangement Drawings*. The NPC packaging is comprised of two primary components: 1) an Outer Confinement Assembly (OCA) consisting of the body and lid sections, and 2) nine Inner Containment Canister Assemblies (ICCAs). These major components are described below.

Product containment occurs inside an 18 gauge (0.048" wall thickness) Type 304L stainless steel Inner Containment Canister Assembly (ICCA). This ICCA is sequentially wrapped in a 0.020" (minimum) thick cadmium sheath, followed by a 0.570- inch thick polyethylene wrap (minimum), followed by a 24-gauge (.024" wall thickness) outer Type 304L stainless steel containment sheath welded closed to effectively contain the cadmium and polyethylene.

The bottom of an ICCA consists of a 9.72" OD, 7-gauge (0.188" thick) Type 304L stainless steel plate. The top of an ICCA includes 7-gauge (0.188" thick) Type 304L stainless steel upper ring (8.620" ID x 9.72" OD) to facilitate the poly wrap and welding of the 24 gauge outer sheath. The ICCA lid is a 16-gauge (0.0595" thick) Type 304L stainless steel cylinder and contains a molded silicon rubber gasket. The closure of the ICCAs is provided by a stainless steel band clamp assembly that utilizes a 5/16-24 T-bolt and nut.

Each ICCA is placed inside a 22-gauge Type 304L stainless steel cylindrical shield (silo), which is "foamed" in place on 12-inch X,Y centers within the OCA body. The OCA body assembly includes a

10-gauge (0.135" wall thickness) Type 304L stainless steel 42.81x42.81x37.66 inch outer-dimension cubic box. The nominal 37.66-inch height includes the height of eight 6x3x3/16x8.4" Type 304 stainless steel rectangular channels located on each corner of the package to facilitate fork lifting of the package from four sides. The Type 304L stainless steel structures associated with the eight (8) tube channels and the connecting 6" × 1.5" × 3/16" × 19.6" cross member ties are conservatively ignored at the bottom of the body assembly.

The central region of the NPC housing the 3 × 3 array of ICCAs is polyurethane foam with a density of 7 lb/ft^3 (nominal). A 4-inch (X,Y,Z) periphery surrounds the inner 3 × 3 array of ICCAs housed within the stainless steel silos. On the bottom and sides, a 3-inch periphery polyurethane foam with a density of 11 lb/ft^3 (nominal) surrounds the 7 lb/ft^3 region. The upper-most region of the OCA body that mates to the lid includes a rigid 1-3/8" layer of 40 lb/ft^3 polyurethane foam. The final 1-inch periphery of the body assembly contains 1-inch layer of ceramic fiberboard. This material is utilized for its thermal performance (heat resistance) properties.

The modeled OCA lid includes 10 gauge, 43.21" × 43.21" × 5.9" outer dimension Type 304L stainless steel box that is mated to the lower body assembly via 16 guide pins, which ensure proper lid seal alignment during closure. The outermost periphery again includes a modeled 1-inch ceramic fiberboard. The foam layer beneath the ceramic fiberboard includes a 3.5" layer of 15-lb/ft^3 (nominal) density polyurethane foam insulation. The lower 1-3/8" layer is rigid 40-lb/ft^3 (nominal) density polyurethane foam to protect the interface between the OCA body assembly and OCA lid assembly mating surfaces. This higher density 40 lb/ft^3 foam section in the lid includes cutouts to accommodate the upper lock ring closure of the ICCA.

The OCA lid dimensions include additional corner support structures, flanged edges, and ~2.3-inch overlap of 10-gauge stainless steel protecting the OCA body/lid interface (which are ignored in the final model construct). Closure of the OCA is provided by (16) 1/2-13UNC socket head cap screws. The closure is further secured by the OCA closure strips and (24) 7/16-14UNC hex head bolts. The NPC packaging is illustrated in Figure 1.1-1. Full details of the NPC packaging design are provided on the drawings in Appendix 1.3.1, Packaging General Arrangement Drawings. The OCA body containing up to nine loaded ICCAs, coupled with the OCA lid constitutes the entire NPC package assembly.

6.2.2.1 MATERIAL SPECIFICATIONS

One of the important aspects of the criticality safety demonstration for this package is the hydrogen content in the foam and polyethylene regions. Hydrogen is important due to its moderating and neutron capture characteristics.

The minimum specified hydrogen content in the foam is 6.4 weight percent. Likewise, the polyethylene region surrounding the cadmium is based on stoichiometric CH_2, with nominal hydrogen content of 14.3%.

To account for the potential high-temperature off-gassing of hydrogen in the polyurethane foam and polyethylene regions, and to assure the hydrogen content in the modeled regions is no greater than the package after physical testing, sample analysis of both regions were conducted as described in Section 2.10.1, Certification Tests, of this application:

- Polyurethane Foam: The average measured hydrogen content of the foam regions used to fabricate the test units was 6.48%. The average of 12 replicate samples taken from residual foam in the certification test units resulted in measured hydrogen content of 6.40% with the lowest observed value at 6.07% hydrogen. The 6.07% hydrogen value corresponded to a sample taken from what appeared to be one of the hottest areas observed. This criticality safety demonstration is performed using 6.00% hydrogen content in the foam material regions for all undamaged and damaged models and is conservative relative to the observed physical package post HAC testing (refer to Section 2.10.1.2, Summary, regarding the significant results of the hydrogen stability in the foam).

- Polyethylene: The average measured value of the hydrogen content in the polyethylene material use to fabricate the certification test units was 14.23%. The average measured value from four post-test replicate samples strategically withdrawn from what was believed to be the hottest regions observed was 14.09% with the lowest observed value of 14.01%. The average of eight additional replicate samples taken from various locations showing some indications of heating in the moderator averaged 14.20% with the lowest observed value of 14.09%. The measured values show little change in the hydrogen content in the polyethylene region before and after the test even in the hottest regions. This criticality safety demonstration is performed using 14.00% hydrogen content in the polyethylene wrap region surrounding each ICCA for all undamaged and damaged models and is conservative relative to the observed physical package post HAC testing (refer to Section 2.10.1.2, Summary, regarding the significant results of the hydrogen stability in the polyethylene).

Table 6.3 provides a listing of the applicable material specifications used in the NPC model construct. The table conservatively applies the minimum measured hydrogen content of the NPC polyurethane foam (6.00%) and polyethylene wrap (14.00%) in the applicable packaging regions for all normal and damaged model constructs.

The minimum composition values for C, O, N, H shown in Section 8.1.4.1.1.1, Polyurethane Foam Chemical Composition, are applied. Other trace foam constituents (P, Si, Cl, and other) are ignored. Additional package material conservatism is later described in Section 6.3.1.5, Models – Actual Package Differences.

Table 6.3 - Material Specifications for the NPC Shipping Package

Material	Density (g/cm^3)	Constituent	Atomic density (atoms/b-cm)
$U(5.00)O_2$ Fuel[1]	≤10.96	U-235 (max.)	1.2378E-03
		U-238 (max.)	2.3220E-02
		O (max.)	4.8916E-02
304L Stainless Steel	7.9	C	3.1691E-04
		Si	1.6940E-03
		Cr	1.6471E-02
		Fe	6.0360E-02
		NI	6.4834E-03
		Mn	1.7321E-03
Cadmium	8.2175*	Cd	4.4000E-02
Polyethylene	0.92	H	7.6965E-02
		C	3.9504E-02
Polyurethane Foam	0.1122	C	2.8100E-03
($7\ lb/ft^3$)		O	5.9000E-04
		N	1.9000E-04
		H	4.0200E-03
Polyurethane Foam	0.1762	C	4.4200E-03
($11\ lb/ft^3$)		O	9.3000E-04
		N	3.0000E-04
		H	6.3200E-03
Polyurethane Foam	0.2404	C	6.0300E-03
($15\ lb/ft^3$)		O	1.2700E-03
		N	4.1000E-04
		H	8.6100E-03
Polyurethane Foam	0.6407	C	1.6080E-02
($40\ lb/ft^3$)		O	3.3800E-03
		N	1.1000E-03
		H	2.2970E-02
Full Density Water	1.00	H	6.68660E-02
		O	3.34330E-02

- 95% of theoretical density
- [1] Maximum values assumed for heterogeneous contents

6.3 CRITICALITY SAFETY ANALYSIS MODELS

6.3.1 GENERAL MODEL

6.3.1.1 Material Tolerance(s)

Table 6.4 provides sheet metal thickness dimensional tolerance from ASTM A240 and ASTM A480 (the former refers to the latter for specific tolerances). The maximum tolerance reductions in gauge sheet thickness are uniformly applied in all normal and damaged NPC model constructs.

The foam density distribution throughout the body assembly and lid assembly is varied as described in Section 6.2.2, *Packaging*. The manufacturers quality assurance program ensures the tolerance on the actual foam density is +15%/-10% at all times. For conservatism, the maximum 10% reduction in foam density is uniformly applied in all normal and damaged NPC model constructs.

Table 6.4 - Dimensional Tolerances

Type 304L Stainless Steel Sheet Gauge	Nominal Thickness (in.)	Permissible Variations* (in.)	Model Thickness Used (in.) [cm] (description)
7 ga.	0.188	± 0.014	0.1740 [0.4420 cm] (ICCA ring)
10 ga.	0.135	± 0.012	0.1230 [0.3124 cm] (OCA skin)
16 ga.	0.0595	± 0.006	0.0535 [0.1359] (ICCA lid)
18 ga.	0.048	± 0.005	0.0430 [0.1092] (ICCA inner skin)
22 ga.	0.029	± 0.004	0.0250 [0.0635] (ICCA silo)
24 ga.	0.0235	± 0.003	0.0205 [0.0521] (ICCA outer skin)

* ASTM-A240/A240M- 95a, Table A1.2, *Standard Specification for Heat Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels*, August 1995.

6.3.1.2 Inner Containment Canister Assembly (ICCA)

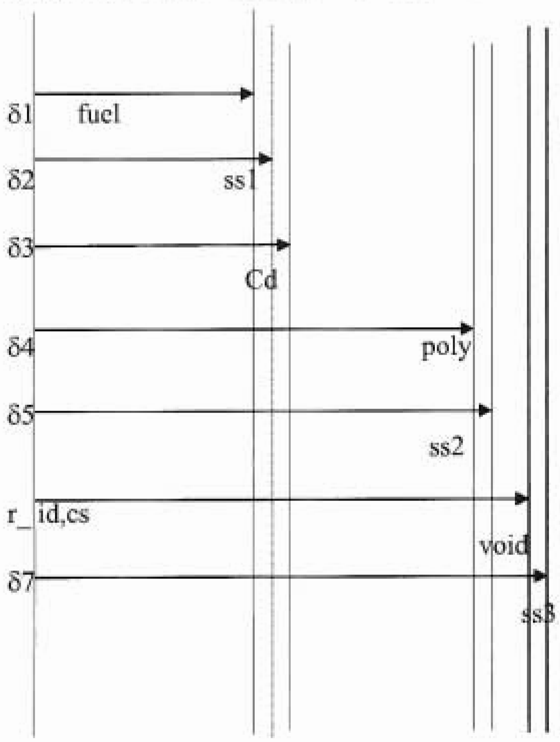
Figure 6.1 shows the material constituent radial dimensions from center of the ICCA ID (δ1) through outer radius of the contamination shield (δ7). Figure 6.2 depicts the axial version of the ICCA and contamination shield. The ICCA model construct consists of a stackup of 11 separate axial pieces. This is performed to explicitly include the 1/8" (0.3175 cm) gaps of the high denisty polyethylene wrap on each end, the maximum axial seam gap tolerance between the three separate 10-1/8" (25.7175 cm) nominal wide cadmium wraps, the axial foam distribution density changes, and the fact that the ICCA silo is installed only in the lower body assembly. The upper section of the ICCA also penetrates the lid assembly to accommodate the vertical ICCA height, lock ring and bolt closure.

The 8.515-inch (21.63 cm) ID of the 18-gauge ICCA includes the maximum manufacturing tolerance. Modeled sheet gauge dimensions incorporate the maximum manufacturing tolerance specified in ASTM–A240 specified in Table 6.3 above. Since iron, chrome, and nickel constituents of stainless steel exhibit thermal and resonance absorption, the use of minimum sheet thickness values is also conservative.

For cadmium, a 25% reduction is applied to the actual 20-mil (minimum) thickness, for a modeled thickness of 15-mils (0.0381 cm)[1] and section width of 10.025" (25.4635 cm). The as-built stackup of the axial cadmium wraps allow for a maximum seam gap of 0.1" (0.254 cm). This gap is conservatively modeled as 0.15" (0.381 cm).

The high density polyethylene (HDP) is 30.3-inch in height and uniformly surrounds the cadmium, with no gaps, and its thickness ensured to be a minimum 0.570" thickness (1.4478 cm) by continuous wrapping of 15-mil (nominal) sheets and a quality control weight confirmation. To account for the small density reduction in the layered polyethylene wrap, the HDP (0.94-0.98 g/cc density) sheet material is conservatively modeled as a uniform low density polyethylene (0.92 g/cc) over the 0.570" thick (1.4478 cm) wrap (min. hydrogen areal density = 0.199 g/cm^2). The minimum required thickness, height, and quality weight measurement confirm this effective poly thickness and density is achieved.

Figure 6.1 Inner Containment Canister Assembly – Radial Dimensions

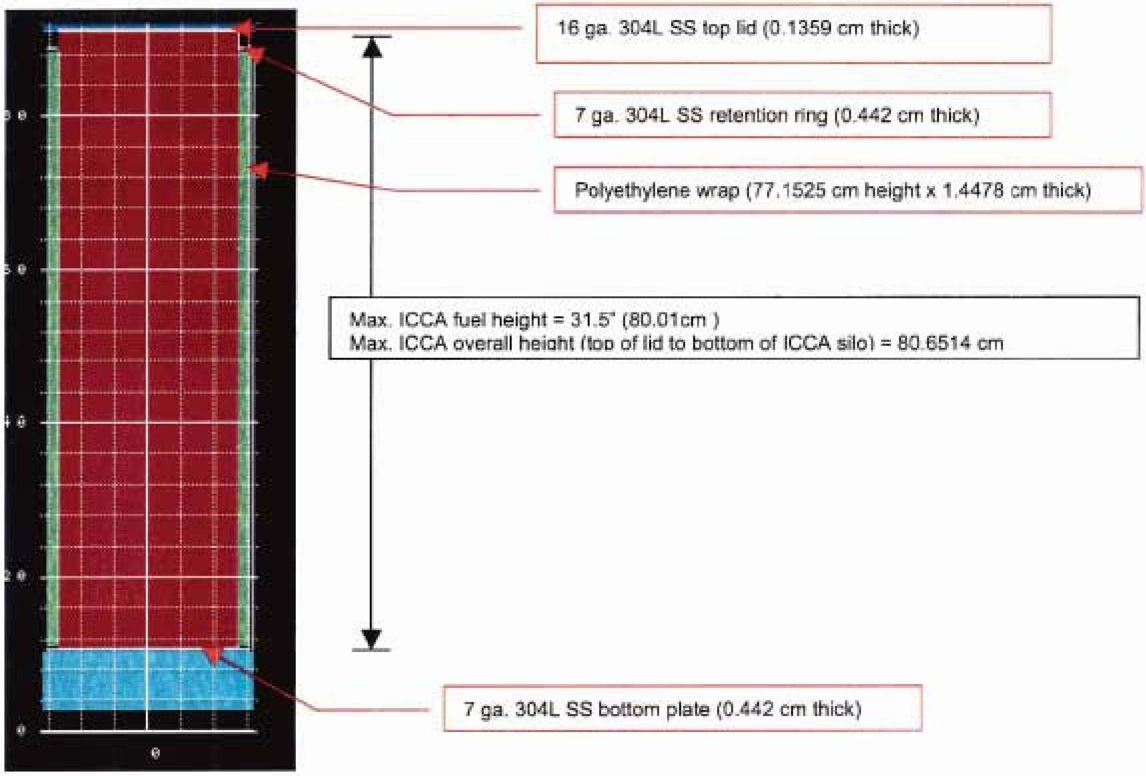


radial/material assignments:

$\delta 1$ = fuel region (e.g., UO_2+H_20)
$\delta 1$ = 10.8141 cm (4.2575")
$\delta 2 = \delta 1 + \delta ss1$ $\delta ss1$ = 0.1092 cm
$\delta 3 = \delta 2 + \delta cadmium$ δcad = 0.0381 cm
$\delta 4 = \delta 3 + \delta poly$ $\delta poly$ = 1.4478 cm
$\delta 5 = \delta 4 + \delta ss2$, $\delta ss2$ = 0.0521 cm
r_id = (10 x 2.54) / 2 = 12.7000 cm
$\delta 7$ = r_id, cs + $\delta ss3$ $\delta ss3$ = 0.0635 cm
beyond $\delta 7$ is polyurethane foam....

[1] Note: Limiting added absorber material credit to 75% without comprehensive tests is based on concerns for potential "streaming" of neutrons due to non-uniformities. The 75% value demonstrated by this work is conservative for several reasons: (1) cadmium is elemental and therefore homogeneous and is not distributed in granular fashion, and (2) the experimental work is based on the use of a monodirectional beam of neutrons, while in this package design, an isotropic neutron source exists, reducing intragranular transmission effects (if any).

Figure 6.2 ICCA Modeled Axial Dimensions



6.3.1.3 Body and Lid Assembly

For the basic model construct, the unit outer dimensions are modeled as a 42.81x42.81 inch square box. The inner height is computed based on the stack-up dimensions of the OCA body 34.573" (87.8154 cm) and lid 5.998" (15.2349 cm) for a total modeled package height of 40.571" (103.0503 cm). These outside dimensions of the near cubic package are conservative for the following reasons:

- the external corner support structure is ignored (x-y, x-z)
- the OCA locating buttons, and 16 ½-13UNC socket head cap screws are ignored (x-z)
- the lid flange overlap, OCA closure strip, and 24 7/16-14UNC hex head bolts are ignored (x-y)
- the heavy duty 6×3×3/16×8.4 rectangular fork-lift channel pocket structure is ignored (x-z)
- the affect of body/lid bowing due to HAC tests is ignored (x-y, x-z)

By ignoring the above effects, the NPC undamaged and damaged package array are modeled as close fitting and in contact, when in fact the aforementioned structure and OCA structure deformation and bowing would provide additional (x-y) and axial (x-z) spacing between individual package units.

The lighter 7-lb/ft^3 internal foam is modeled to encase the 3x3 Inner Containment Canister Assembly (ICCA) array. Important dimensions of the basic body + lid assembly, and foam density assignments are shown in the x-y and x-z cross-sectional slices of Figures 6.3a and 6.3b, respectively.

Figure 6.3a Body Assembly (x,y) Dimensions and Foam Distribution

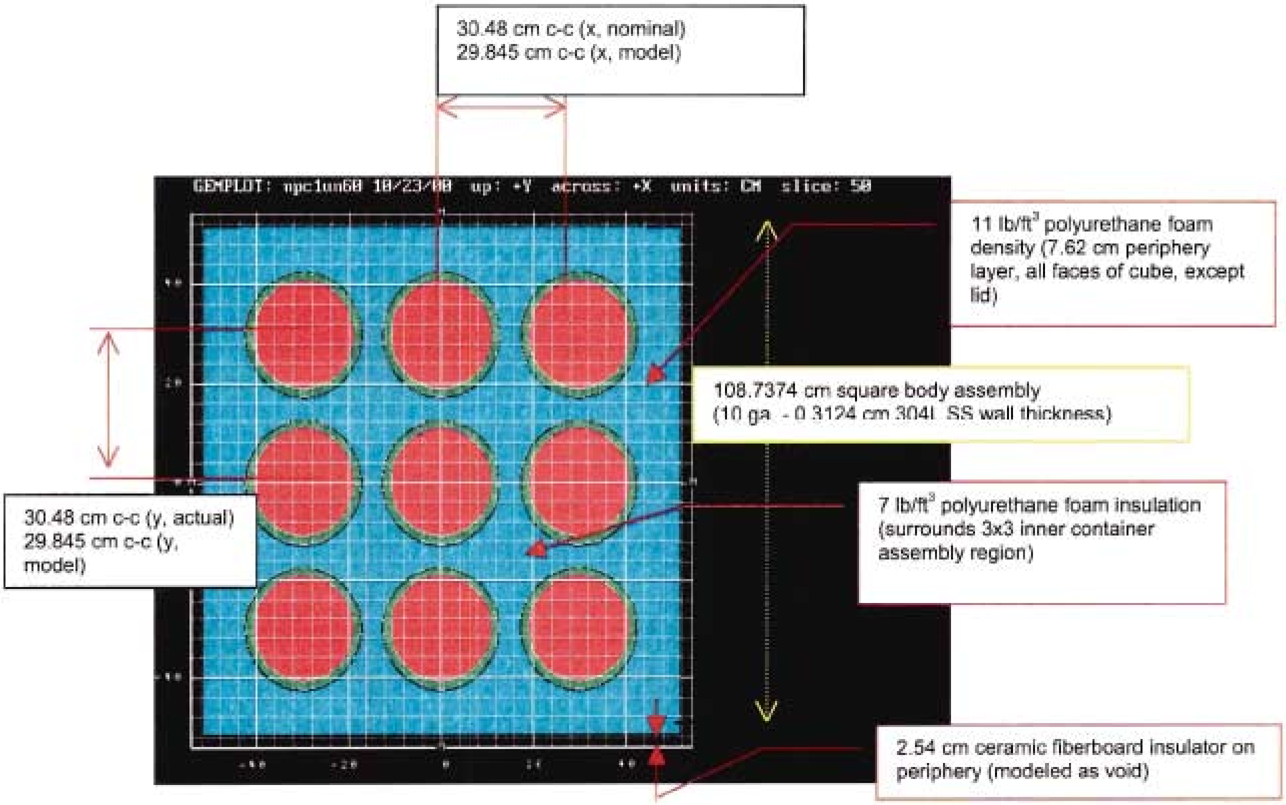
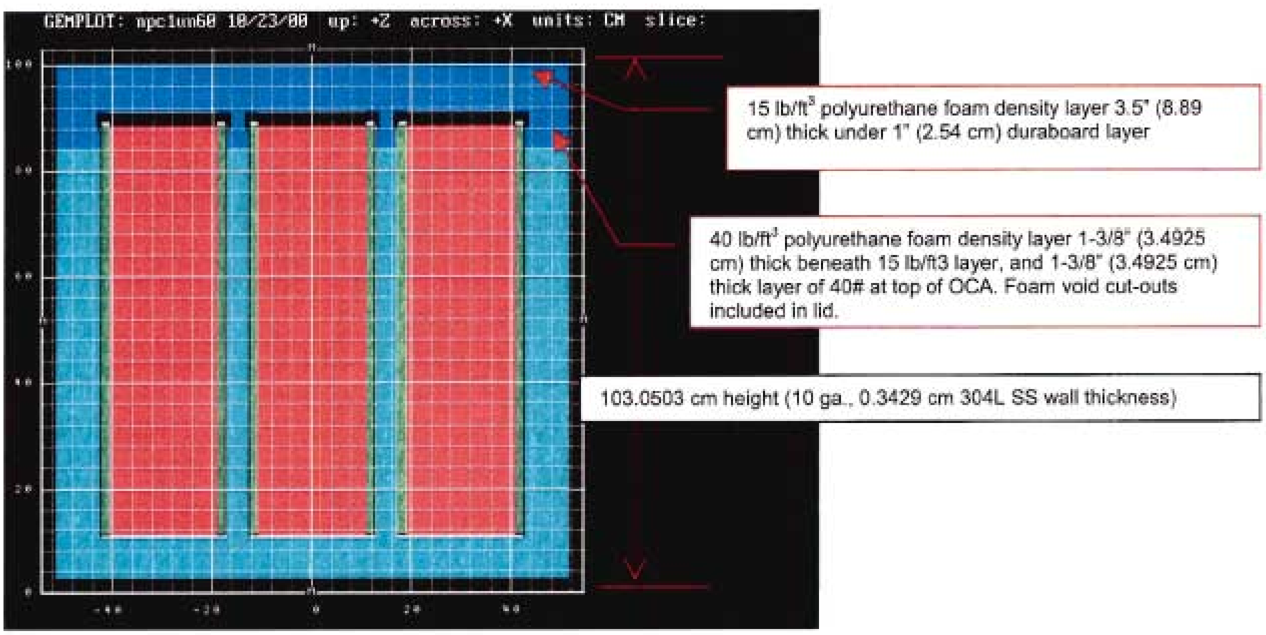


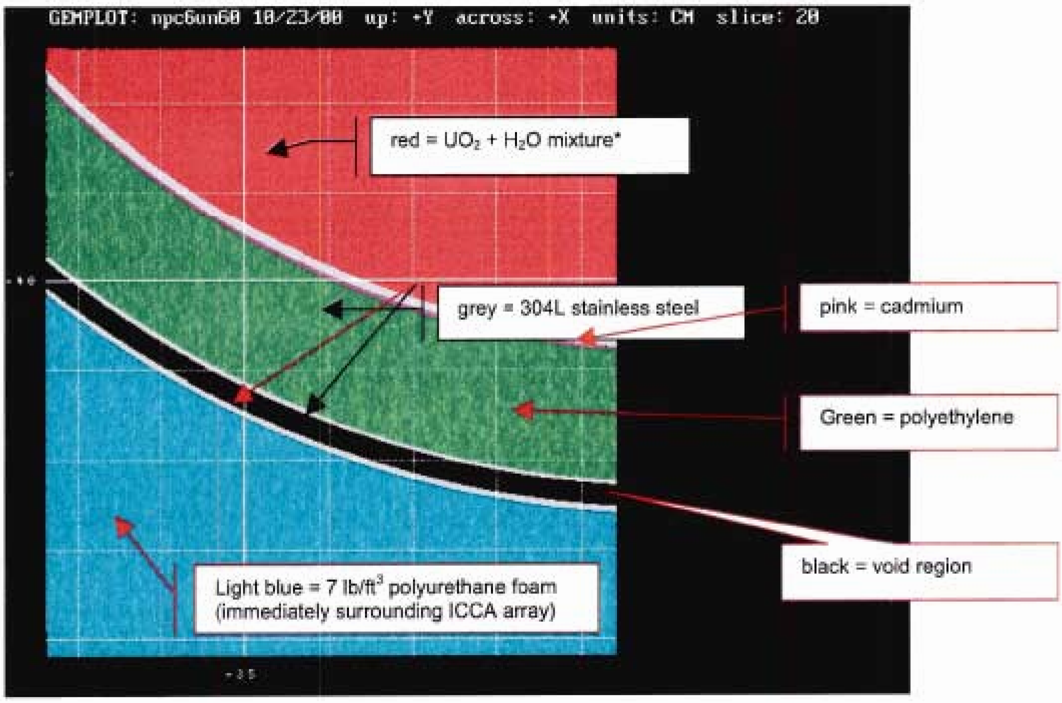
Figure 6.3b Body Assembly (x,z) Dimensions and Foam Distribution



6.3.1.4 Materials

Figure 6.4 shows blown up cross-section material assignment(s) of the ICCA within stainless steel silo. These mixture assignments are shown in color for illustration purposes, and used throughout this report (unless otherwise noted).

Figure 6.4 Inner Containment Canister Assembly (ICCA) within Silo - Mixture Assignments



* For a further description of the fuel regions with homogeneous mixtures and heterogeneous lattices see Section 6.4.3

The UO_2 mixture (fuel) material specifications used in the NPC criticality safety demonstrations are dependent upon the case being modeled. The cases considered in the current analysis are (1) damaged single packages, (2) infinite arrays of undamaged packages and (3) 5X5X6 arrays of damaged packages. Contents include the applicable homogeneous and heterogeneous theoretical density $U(5.00)O_2$ and water mixtures, optimally moderated, and with the specified mass limits given in Table 6.1. Heterogeneous cases have been modeled as lattices of full density $U(5.00)O_2$ vertical fuel rods (with no cladding) in full density H_2O with the specified minimum diameters in column 2 of Table 6.1 and with lattice heights as determined by the lattice water to fuel (W/F) volume ratios, the Table 6.1 mass limits, and the assumed lattice boundary conditions (i.e. either overlap of the rods in the lattice with the ICCA wall, or no overlap).

Table 6.5 provides the resulting mixture data summary derived from an internal utility code called UFACT. For the cases in the table except the first (which is applicable to heterogeneous pellets and rods), a theoretical treatment of the fuel region is used, and the mixture height is not computed as the ICCA volume is modeled full (height fixed at 80.01 cm). Please also note that for theoretical UO_2, all voids are filled at approximately 11.5% water content – thus no density correction is required (e.g., DFACT = 1.0).

The columns in the table with the corresponding compound identification (COM), weight fraction water (WF-W), U-235 fractional enrichment (ENR), density correction factor (DFACT), mixture density (RHOMIX), compound density (RHOC), and uranium density (RHOU), uranium fraction in the compound (UFACT), H/5 (H/U-235) and H/U atom ratios, and HEIGHT are defined as follows (and are equally valid for Table 6.6):

- **DFACT** = density correction factor = [MINIMUM (1.0, $RHOC_{max\ credible}$)]/RHOC
- **RHOMIX** = mixture density = RHO_MIX=DFACT/[(1-WTFR_H_2O)/RHO_FUEL+WTFR_H_2O]

  where, RHO_FUEL = RHOC = RHO_UO_2 = compound density in mixture, and

  WTFR_H_2O = WF-W = weight fraction water in mixture
- **RHOC** = uranium compound density in mixture = (1 – WTFR_H_2O) * RHOMIX
- **$RHOC_{max-credible}$**= maximum credible density of uranium compound
- **RHOU** = uranium density in mixture = UFACT * RHOC = 0.88144 * RHOC
- **UFACT** = uranium fraction of compound = M_U / [M_U + (2*M_O)] = 0.88144 for 5.00% enriched UO_2

  where, Mi is the atomic mass of constituent i
- **H/5=H/U-235** = Atom ratio of hydrogen to U-235 = H_TO_U-235

  H_TO_U-235=W_TO_F*2*235.043928/(18.01534*RHO_FUEL*UFACT*ENR)
  where, W_TO_F=water-to-fuel ratio - WTFR_H2O*RHO_FUEL)/(1-WTFR_H2O)
  ENR=[N_U-235*235.043928]/(#+N_U-238*238.050788)
- **H/U** = Atom ratio of hydrogen to uranium = H_TO_U=WTFR_H_2O*ATM_U/[UFACT*.5*18.0153*(1-WTFR_H_2O)]
- **HEIGHT** = height of mixture in cylinder of specified radius and mixture mass [e.g, HEIGHT= MASS/(PI*RAD**2*RHO_MIX)] or compound mass (e.g. HEIGHT= MASS/(PI*RAD**2*RHOC)]

Table 6.5 Fuel Material Specifications – Damaged Single Package (theoretical UO_2 + H_2O mixture)

COM	WF-W	FR.ENR	DFACT	RHOMIX gm/cc	RHOC gm/cc	RHOU gm/cc	UFACT	H/5	H/U x10	HEIGHT cm
UO2	.000	.05000	1.0000	10.9600	10.9600	9.6606	.88144	104	0	n/a
UO2	.150	.05000	1.0000	4.3945	3.7354	3.2925	.88144	104	53	n/a
UO2	.200	.05000	1.0000	3.6631	2.9305	2.5830	.88144	148	75	n/a
UO2	.250	.05000	1.0000	3.1404	2.3553	2.0761	.88144	197	100	n/a
UO2	.300	.05000	1.0000	2.7482	1.9238	1.6957	.88144	254	128	n/a
UO2	.350	.05000	1.0000	2.4432	1.5881	1.3998	.88144	319	161	n/a
UO2	.400	.05000	1.0000	2.1990	1.3194	1.1630	.88144	395	200	n/a
UO2	.450	.05000	1.0000	1.9993	1.0996	0.9692	.88144	484	245	n/a

In the undamaged and damaged package array cases, homogeneous UO_2 + H_2O mixtures are modeled as mass and geometry limited systems. The UO_2 compound density is treated as theoretical (10.96 g/cc). The weight fraction water is computed such that the UO_2 + water mixture completely fills a volume up to the maximum of the Inner Containment Canister Assembly (ICCA). For the NPC package, these mass and geometry limited conditions are demonstrated to be the most reactive.

Table 6.6 provides the corresponding mixture, compound, and uranium densities for this treatment of the fuel region. The weight fraction of water for each UO_2 fuel mass limit is computed to just fill the ICCA volume. The UO_2 compound mass in the UO_2 + H_2O mixture is varied to determine the maximum acceptable payload of the package under hypothetical accident conditions. In the case of 60 kgs UO_2, additional cases at lower weight fraction water were run to confirm the most reactive condition. Higher weight fraction water conditions resulting in lower UO_2 mass are included in this table.

Table 6.6 Fuel Material Specifications – Undamaged and Damage Package Arrays ($UO_2 + H_2O$, optimal moderation, variable UO_2 mass)

COM	WF-W	FR.ENR	DFACT	RHOMIX gm/cc	RHOC gm/cc	RHOU gm/cc	UFACT	H/5	H/U x10	HEIGHT cm
undamaged package array cases:										
RADIUS = 10.8141 CM				FUEL MASS = 60.000 KG						
UO2	.150	.05000	1.0000	4.3945	3.7354	3.2925	.88144	104	53	43.721
UO2	.200	.05000	1.0000	3.6631	2.9305	2.5830	.88144	148	75	55.729
UO2	.250	.05000	1.0000	3.1404	2.3553	2.0761	.88144	197	100	69.339
UO2	.260	.05000	1.0000	3.0533	2.2594	1.9915	.88144	208	105	72.281
UO2	.270	.05000	1.0000	2.9708	2.1687	1.9116	.88144	219	111	75.304
UO2	.285	.05000	1.0000	2.8549	2.0411	1.7992	.88144	236	119	80.010(*)
damaged package array cases:										
RADIUS = 10.8141 CM				FUEL MASS = 40.000 KG						
UO2	.392	.05000	1.0000	2.2366	1.3608	1.1995	.88144	381	193	80.010
RADIUS = 10.8141 CM				FUEL MASS = 45.000 KG						
UO2	.360	.05000	1.0000	2.3912	1.5309	1.3494	.88144	333	168	80.010
RADIUS = 10.8141 CM				FUEL MASS = 50.000 KG						
UO2	.332	.05000	1.0000	2.5457	1.7009	1.4993	.88144	294	149	80.010
RADIUS = 10.8141 CM				FUEL MASS = 55.000 KG						
UO2	.307	.05000	1.0000	2.7004	1.8711	1.6492	.88144	262	133	80.010
RADIUS = 10.8141 CM				FUEL MASS = 60.000 KG						
UO2	.285	.05000	1.0000	2.8549	2.0411	1.7992	.88144	236	119	80.010 (*)
RADIUS = 10.8141 CM				FUEL MASS = 65.000 KG						
UO2	.265	.05000	1.0000	3.0095	2.2113	1.9491	.88144	214	108	80.010

(*) ICCA full condition, wf-w = 0.28504

6.3.1.5 Models - Actual Package Differences

The criticality safety analysis model of the loaded NPC differs from the actual package in 1) the allowance for water intrusion into the ICCA containment, 2) center-to-center canister spacing, 3) insulating foam distribution, 4) the modeled stainless steel structure, 5) the modeled cadmium thickness, and 6) the modeled poly density.

1) For homogeneous UO_2, the ICCA fuel region is modeled with variable UO_2 compound mass and variable H_2O content as described in the fuel material specifications above. In the limiting (damaged package array) models, the UO_2 compound mass is varied from 40-65 kgs UO_2 per ICCA. The water content is also varied to optimally moderate the ICCA for the mass limited damaged package array. This optimal internal moderation treatment is a known conservatism.

2) For heterogeneous materials, the ICCA fuel region is modeled as a lattice of variably spaced UO_2 fuel in the form of right circular cylindrical elements (rods) having a fixed total (UO_2) mass with full density H_2O in the ICCA region outside of the cylindrical elements. The fixed mass, either 55 kgs, 53 kgs or 46 kgs, is based on the minimum diameter of the pellets or particles size specified in Table 6.1. Similar to the homogeneous case, the degree of moderation in the individual fuel rod lattices is varied through optimum, which is done as a function of the lattice water-to-fuel volume ratios by varying the spacing between the rods. As in the homogeneous case, the modeling of accumulations of pellets or other random oriented high-density clumps or particles as uniform lattices of UO_2 cylindrical elements (rods) is a known conservatism.

3) The center-to-center spacing of the ICCAs is also different from the as-built package. The nominal spacing (X,Y) between the individual ICCA units in the 3 × 3 array is 12-inches (30.48 cm). All models use a nominal conservative ICCA center-to-center spacing of 11.75" (29.845 cm). For the limiting damaged package array models, sensitivity of the canister center-to-center spacing is quantified, by modeling the ICCAs from 11.75" (29.845 cm) to 11.25" (28.575 cm) spacing for a specified foam burn condition. Effects on system reactivity are assessed.

4) The insulating foam distribution within the package also differs from the actual package contents. In all cases, the minimum chemical composition in the foam is assumed. In addition, the density of the polyurethane foam is reduced by the maximum 10% manufacturing tolerance. Thus, the 7, 11, 15, and 40 lb/ft^3 foam densities are actually modeled as 6.3, 9.9, 13.5, and 36 lb/ft^3, respectively. This 10% foam density reduction results in a corresponding reduction in the hydrogen atom density. This is a known conservatism, as sensitivity studies demonstrate the more hydrogen between the ICCAs, the lower the overall system reactivity (due to hydrogen moderating and capture characteristics).

The foam distribution also differs in the mass of foam included. In the damaged single package and arrays, the effects of non-uniform foam burn are based on measured CTU-1 and CTU-2 test results. The limiting condition damaged array reactivity is based on the maximum burn observed in either certification test unit. The maximum burn treatment results in zero residual foam thickness on all 6-faces of the cube, as measured radially and axially from the ICCA centerline (refer to Sections 2.10.1.7.1.6 and 2.10.1.7.2.6).

The maximum burn condition, coupled with the minimum hydrogen content, uniform application of maximum foam density tolerance, and 2% reduction in poly density effectively results in conservative treatment of damaged package physical condition post HAC testing. The maximum foam burn results in minimum interstitial hydrogen between packages – which is shown to increase package reactivity.

The 1-inch periphery ceramic fiberboard is modeled as a void in all models. This material consists of approximately 44% Al_2O_3, and the balance as SiO_2 –both compounds are neutronically insignificant.

4) The amount of stainless steel structure used in the model also differs from the actual package. Since the maximum sheet gauge tolerance reductions were applied (refer to Table 6.4), and significant external structure ignored, the mass of stainless steel in the model is significantly lower than actual. Reducing amount of stainless steel in the model is conservative because there is less material to compete with the uranium for neutron absorption reactions (refer also to Section 6.6.2.7, Sensitivity Study – Damaged Package Array Structure).

5) The nuclear poison cadmium thickness is modeled at 0.015" (0.0381 cm) thick, which represents only 75% of the minimum absorber thickness of 0.020" (0.0508 cm).

6) In all damaged package array models, a 2% reduction in polyethylene density (0.92 * 0.98) is uniformly applied. This reduction in density effectively covers the observed 0.6% weight loss post HAC testing and 0.25% mass allowance for minimum specified poly height of 30.3" verses the modeled 30.375" height (refer also Section 6.6.2.8, Sensitivity Study – Damaged Package Array Poly Gap).

6.3.2 CONTENTS MODEL

A general discussion of the NPC package in the normal (undamaged) transport and hypothetical (damaged) accident condition case is given in Section 6.3.1.4, *Materials*, Tables 6.5 and 6.6. The following sections presents a discussion of the fissile material contents under these conditions of transport, along with an assessment of the foam burn distribution effects in the damaged single and array packages.

6.3.3 DAMAGED SINGLE-PACKAGE MODELS

A model of the single package damaged condition considers unlimited moderator intrusion into the ICCA containing UO_2 product. The single package was subjected to hypothetical accident condition tests per IAEA and 10 CFR §71.73 as specified in Section 2.7, *Hypothetical Accident Conditions*. The UO_2 contents of the single package were analyzed in accord with the Section 6.3.1.4, *Materials*, Table 6.5. The ICCAs within the package were modeled in the homogeneous case containing theoretical UO_2 and water mixtures, and in the heterogeneous case as water moderated lattices of UO_2 cylindrical elements (rods), with the corresponding weight fraction H_2O and water to fuel ratios varied through optimal moderation. In all damaged single package models, the unit is surrounded by a ≥ 30.48-cm thick water reflector.

6.3.3.1 Damaged Single Package with Theoretical UO_2 + H_2O Mixtures

For homogeneous UO_2 and H_2O fuel mixtures, four sets of damaged single package model constructs are considered. Two damage single package models are run using the limiting CTU-1 and CTU-2 observed foam burn conditions in which the average residual foam is modeled on each face of the cube. The third case conservatively applies a maximum observed burn on each face of the cube. The fourth damaged single package model applies a tight water reflector to the package for the limiting condition derived from the first three case sets.

The first three cases replace observed foam burn region with void. The fourth and final case replaces the burned foam region with water to assess the impacts of a fully flooded damaged package (applied to limiting burn condition). Figures 6.5a – 6.5d show vertical slices of the CTU-1, CTU-2, maximum observed burn, and the flooded damaged single package models.

Figure 6.5a – Fully reflected damaged single package, theoretical UO_2 + H_2O mixture, CTU-1 observed burn

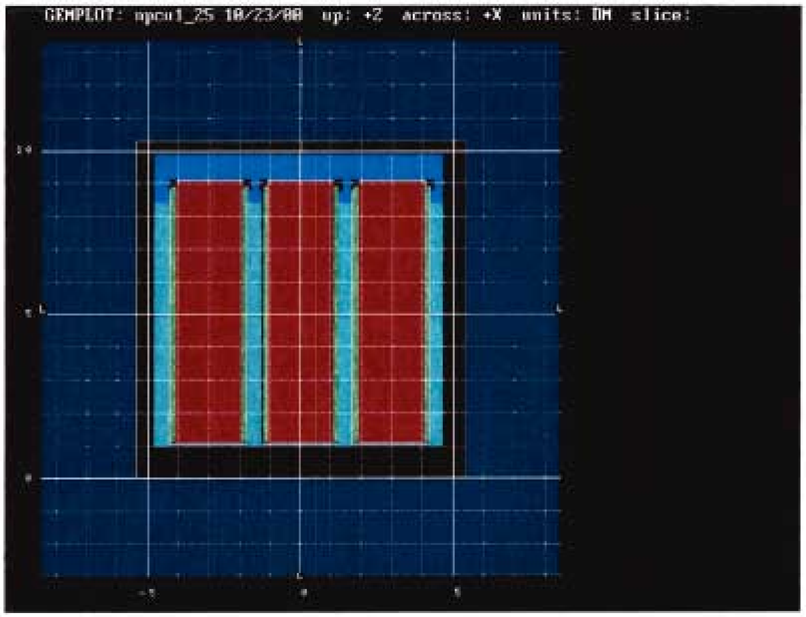


Figure 6.5b – Fully reflected damaged single package, theoretical UO_2 + H_2O mixture, CTU-2 observed burn

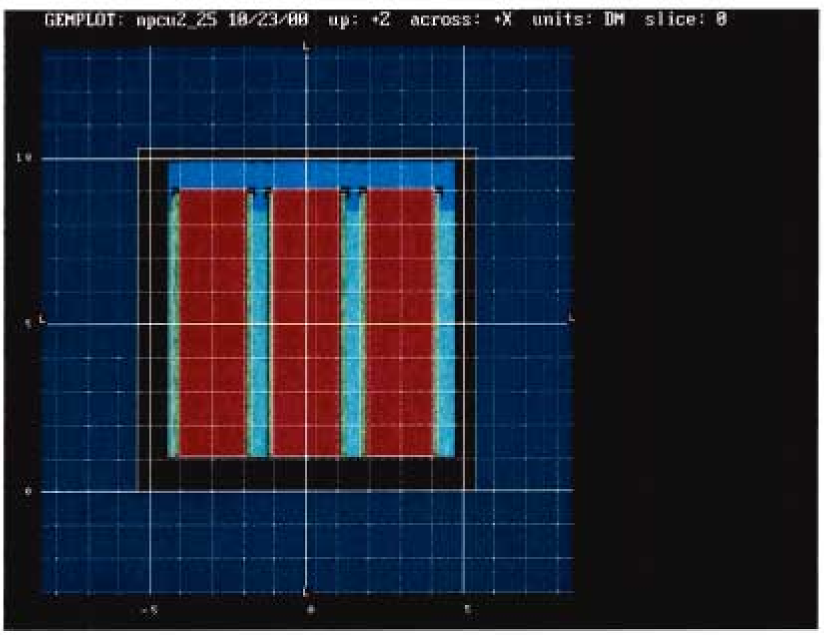


Figure 6.5c – Fully reflected damaged single package, theoretical UO_2 + H_2O mixture, maximum burn

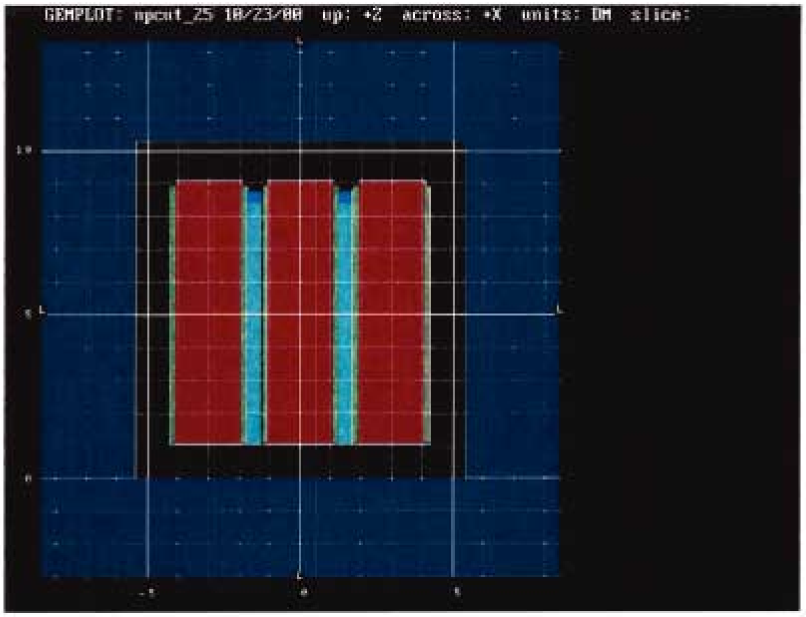
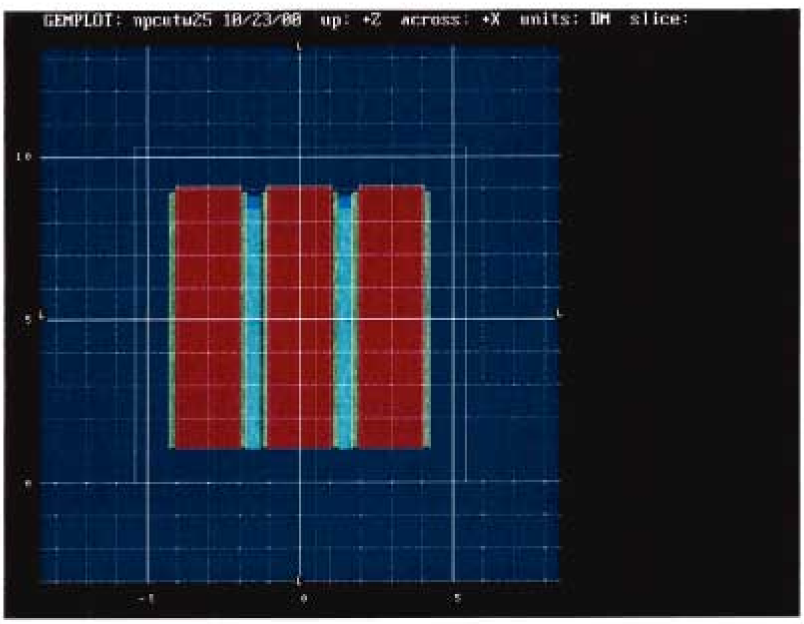


Figure 6.5d – Fully reflected damaged single package, theoretical UO_2 + H_2O mixture, maximum burn, flooded package



6.3.3.2 Damaged Single Package with Heterogeneous UO_2 in H_2O

The package models for damaged single packages with heterogeneous UO_2 cylindrical elements (rods) in H_2O are the same as the worse case configuration as determined in the analyses for homogeneous mixtures, but with the fuel region less than or equal to the maximum ICCA inner height based upon the specified cylindrical rod lattice and UO_2 mass limit. This model is the one shown in Figure 6.5c, the "Fully reflected damaged single package … maximum burn" construct, except for the potentially smaller fuel element lattice height. For less than maximum height lattices, the regions in the ICCAs above the lattice are modeled as voids.

In the evaluation of the NPC package with heterogeneous UO_2 fuel, three different types of model constructs have been used to represent the heterogeneous material contained in the ICCA fuel regions. Each type of model is then evaluated using both square and triangular lattice treatments, covering 26 different W/F ratios (from 0.58 to 8.00) and 4 different pellet outer diameters (ODs).

The first type of model consists of lattices of right circular cylinder elements (rods) in which the rods are permitted to overlap the ICCA boundary, with the parts of the rods internal to the ICCA kept in the model. Figure 6.6a shows XY depictions of the ICCA fuel regions for "17X17" cyclindrical lattices as the W/F ratios of the lattices are increased. Figure 6.6b shows the XZ layout (at Y = 0.0) of the same fuel regions with the decrease in the UO_2 mass in the ICCA noted when the maximum container height is reached. In this exact treatment with overlap, a total of 4 pellet ODs are considered. These include the "17x17", "10X10", "9X9" and "8X8" pellet sizes, each of which has progressively larger pellet diameters. The minimum diameter for the 17X17 PWR pellets is 0.300 inches; that for the BWR 10X10, 9X9 and 8X8 is 0.342 inches, 0.373 inches and 0.408 inches, respectively. In this analysis, pellet diameters which are larger than the 17x17 lattices are shown to be progressively less reactive.

The second type of model is similar to the first type except that right circular cylinder elements (rods) are not permitted to overlap the ICCA boundary and are deleted from the lattice if any part intersects with the ICCA wall. A comparison of the Overlap and Without Overlap models is given in Figure 6.6c. Except for the absence of the overlapping rods (which for the same UO_2 mass and W/F ratio results in a slightly higher lattice height), the Without Overlap models are entirely similar to the Overlap ones and the variation with W/F is the same as illustrated in Figures 6.6a and 6.6b.

The third type of model is one in which the right circular cylinder elements (rod) lattices are modeled in the ICCA using the Virtual Fill Option (VFO - see Section 6.4.3). Using this option, each individual neutron that is tracked in the ICCA fuel region is presented with the virtual equivalent of a rod lattice with overlap (as in the first type of model discussed above), but the rod lattice has its central point randomly displaced from the one seen by all other neutrons tracked in the region. Because of this random effect, the geometry plotting routines do not show the actual lattice geometry but assure that the neutron enters the Big Region at the center of a fuel region. Examples of this are shown in Figure 6.6d, in which the XY plots actually shows a type of pattern resulting from the way the plot routine (GEMPLOT) steps through the XY plane. The same pattern is not seen in the XZ plots because the Fill Region plotting is treated differently when parallel to right circular cylinders in the z-direction.

Figure 6.6a – NPC Container Square and Triangular 17X17 Fuel Rod Lattice XY Models With Overlap

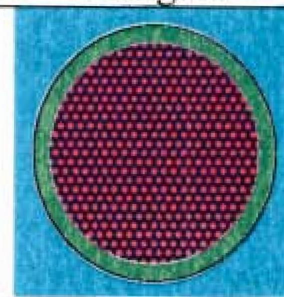
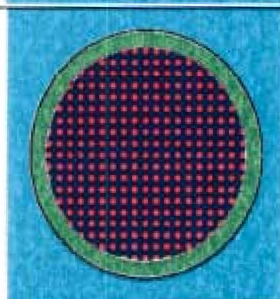
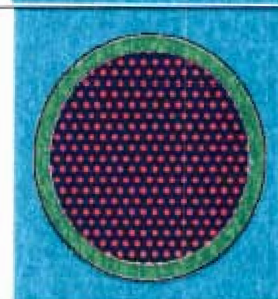
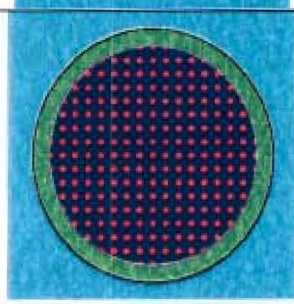
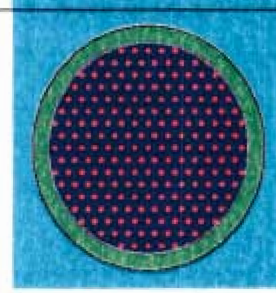
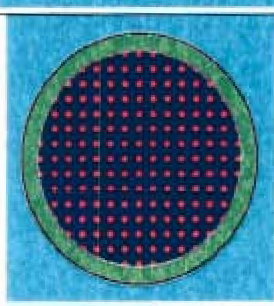
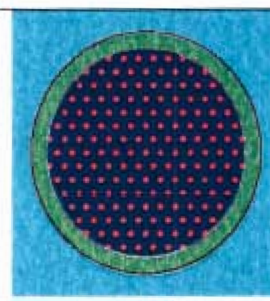
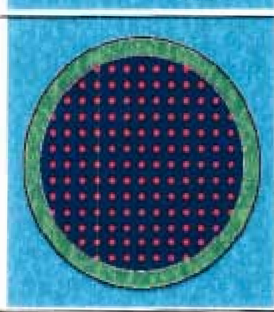
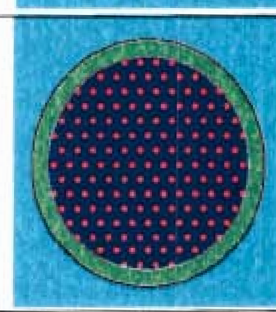
W/F	Square		Triangular
1.00			
2.00			
3.00			
4.00			
4.50			

Figure 6.6a – NPC Container Square and Triangular 17X17 Fuel Rod Lattice XY Models With Overlap - Continued

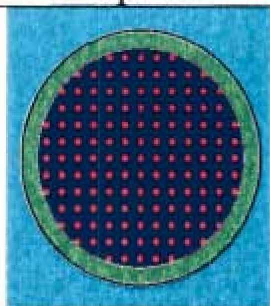
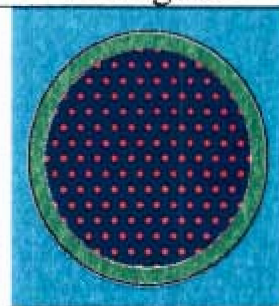
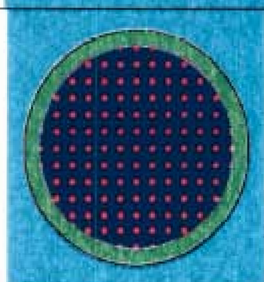
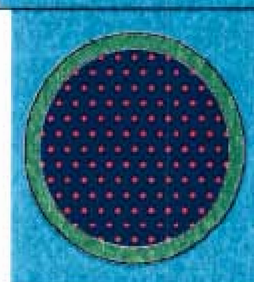
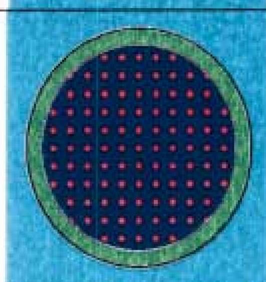
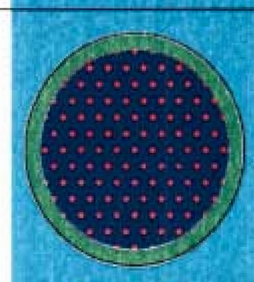
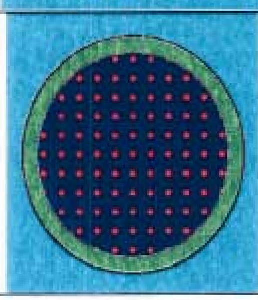
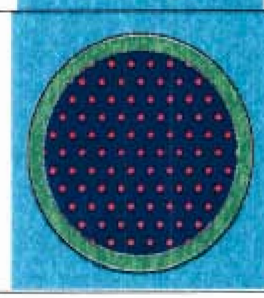
W/F	Square		Triangular
5.00			
6.00			
7.00			
8.00			

Figure 6.6b – NPC Container Square and Triangular 17X17 Fuel Rod Lattice XZ Overlap Models With 55 KG UO_2

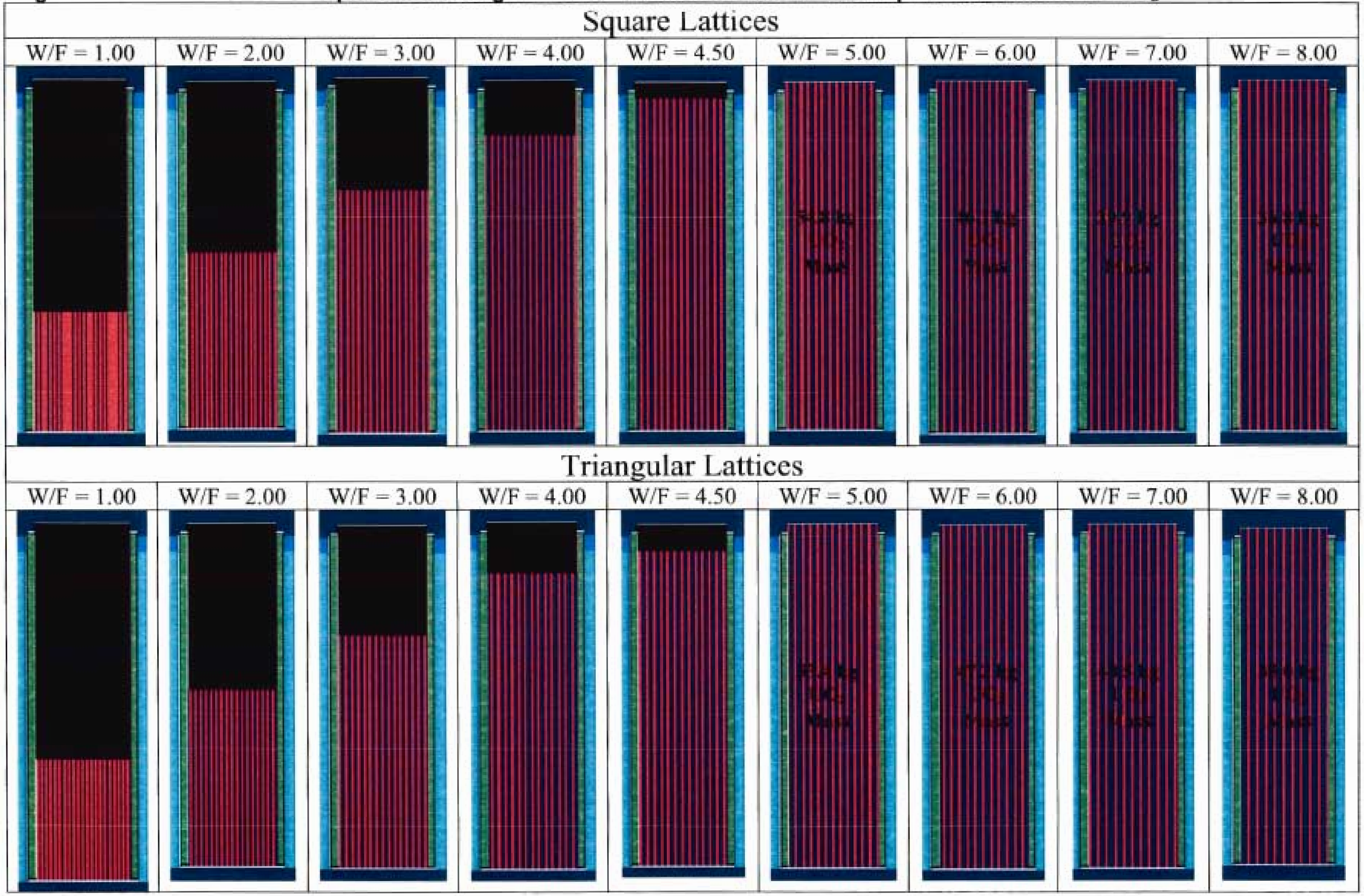
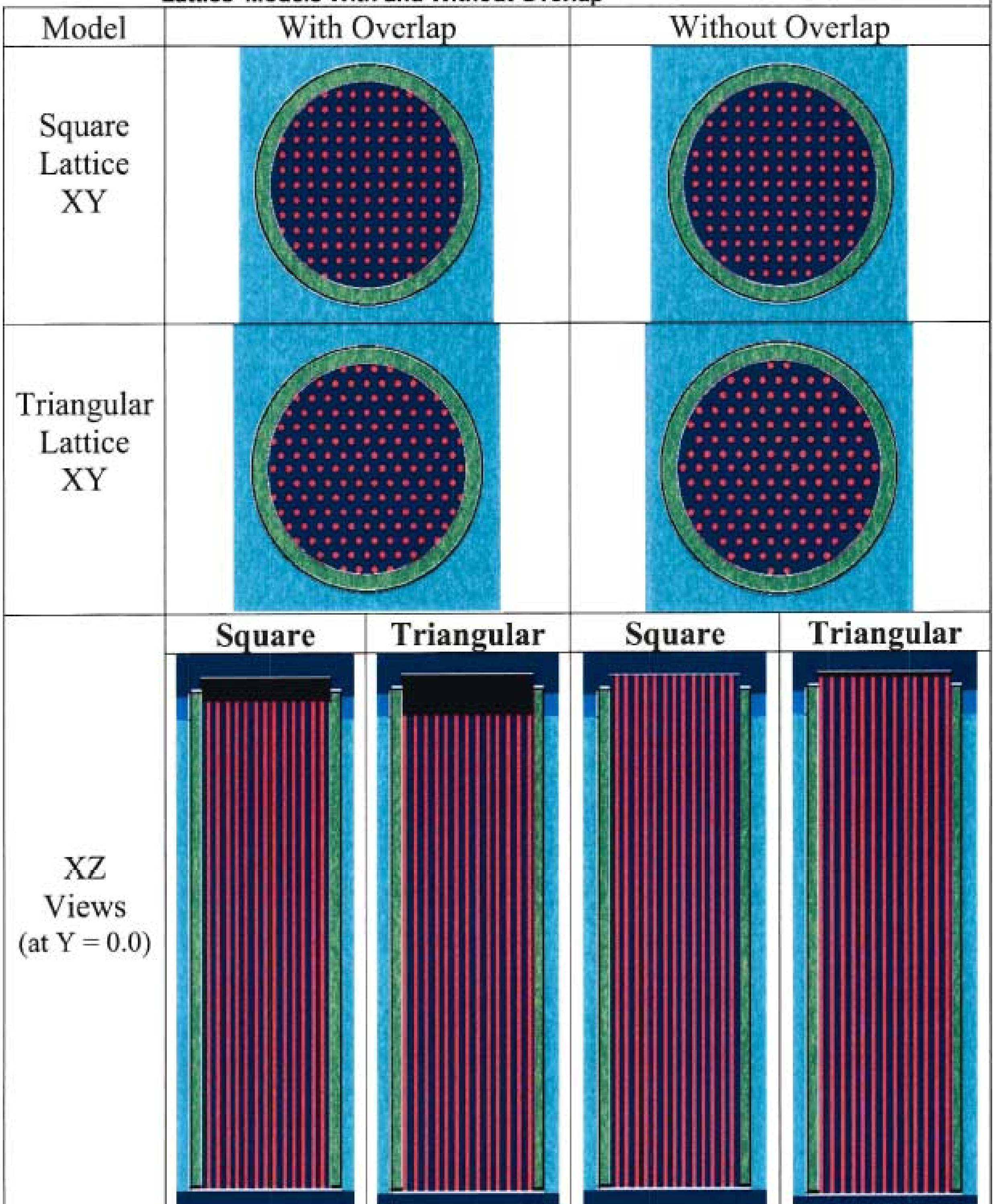


Figure 6.6c – Comparison of NPC Container Square and Triangular 17X17 Fuel Rod Lattice* Models With and Without Overlap



*55kgs UO_2 at a W/F = 4.50

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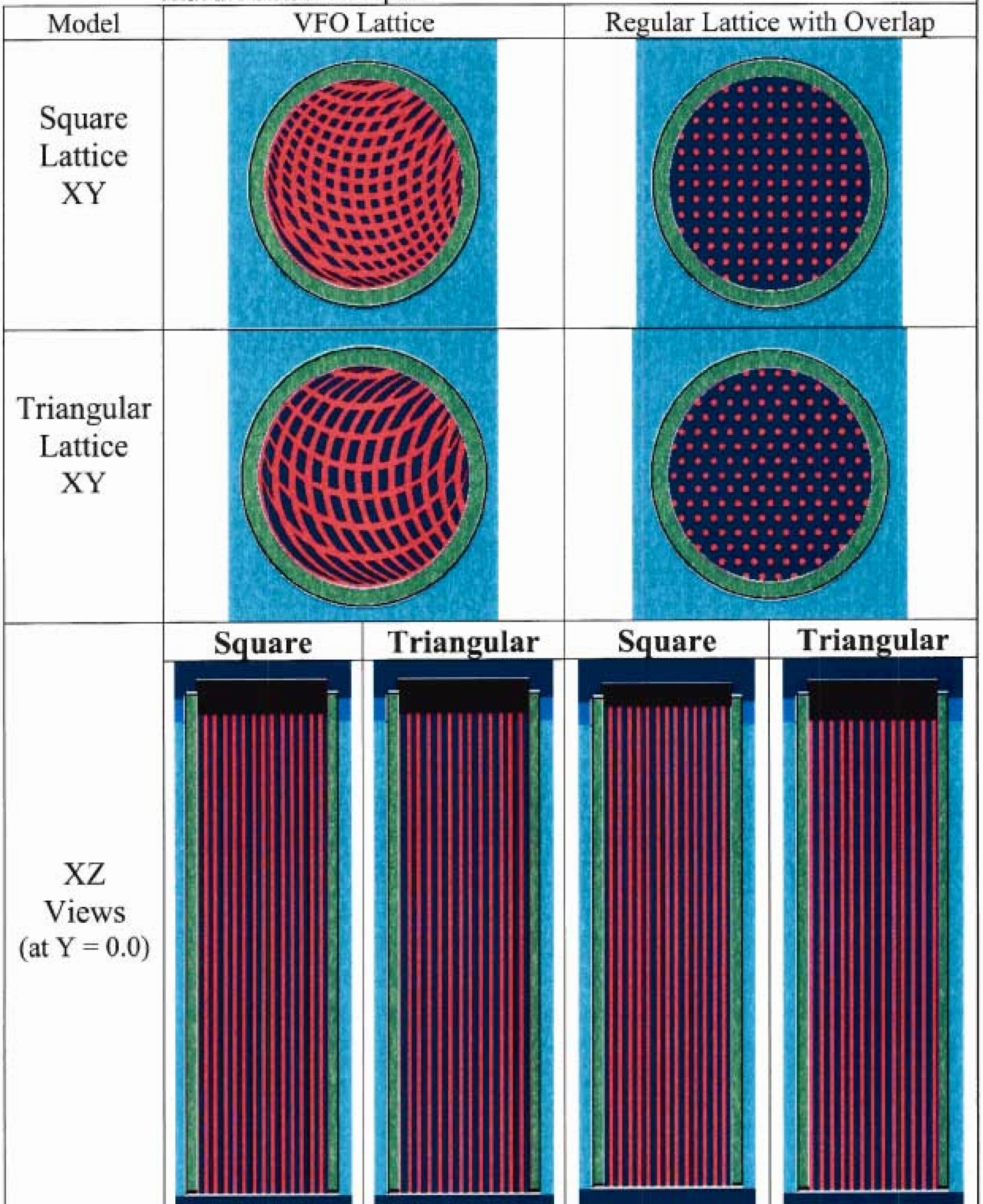
Figure 6.6d –NPC Container Square and Triangular 17X17 Fuel Rod Lattice* Models With the Virtual Fill Option



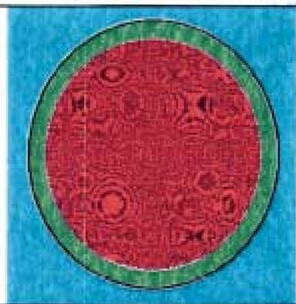
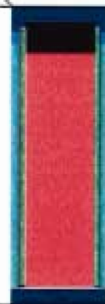
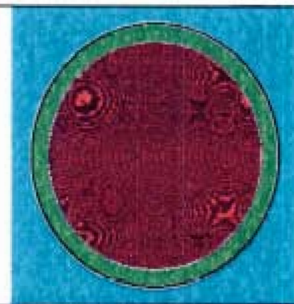
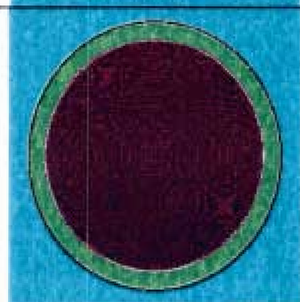
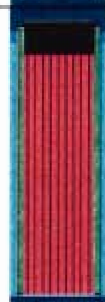
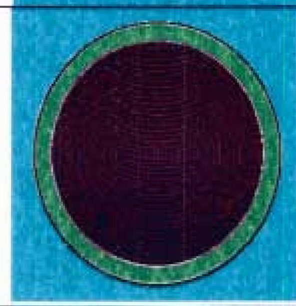
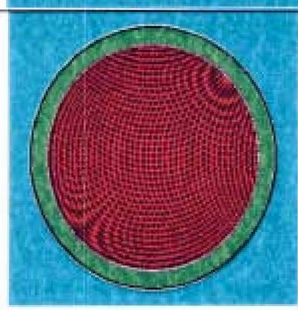
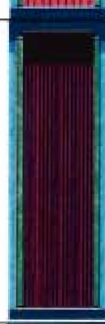
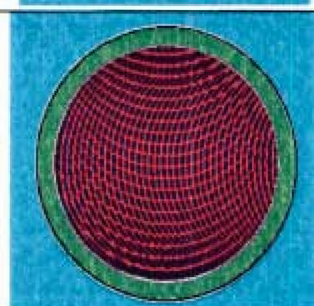
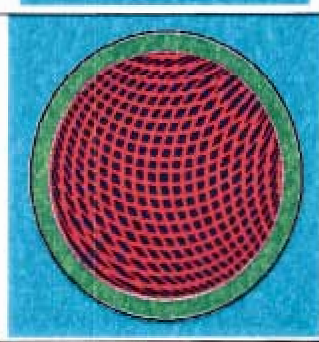
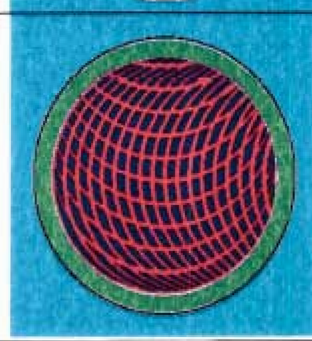
*55kgs UO_2 at a W/F = 4.50

The Virtual Fill Option (VFO) has been used in this analysis because it permits modeling of fuel lattices with a very large number of cylindrical elements (rods). Since only one geometry unit is actually used for the lattice (and the lattice is created by mirror reflection boundary conditions on the unit) the size of the array that can be modeled is essentially unlimited.

This analytic capability is required when analyzing the most reactive fuel lattice without regard to particle size outer diameter (OD) or W/F ratio since the optimum outer rod diameter for 5.00% enriched UO_2 rods is in the range of 0.05 inches to 0.15 inches. Explicit modeling of fixed arrays of these sizes of cylindrical elements in the ICCAs would require hundreds of thousands of elements in the lattice. In the present analysis, the range of cylindrical diameters analyzed for the optimum case is derived from four separate particle size diameters through optimum heterogeneity (e.g., 0.20", 0.10", 0.05", and 0.025" diameters). Example 2D plots for these cases are shown in Figure 6.6c (the XZ models are those for the square lattices; the models for the triangular lattices are similar).

This analysis demonstrates that optimum heterogeneity occurs at (or very near) particle size diameter of 0.100". An actual 'random' array of particles of unrestricted diameter is no more reactive than the 'ordered' arrays of heterogeneous cylindrical elements analyzed herein under optimum diameter and spacing (W/F ratio) conditions. This is the basis of applying these results to heterogeneous fuel mixtures of unrestricted particles sizes.

Figure 6.6e – NPC Container Models for the VFO Analysis of Optimum Rod Diameters*

Rod Diameter (Inches)	XY Square Lattices	XZ Model (Y = 0)	XY Triangular Lattices
0.025			
0.050			
0.100			
0.200			

*46 kgs UO_2 at W/F = 5.2

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6.3.4 UNDAMAGED AND DAMAGED PACKAGE ARRAYS

Two basic package array model constructs are included in this evaluation - undamaged and damaged.

6.3.4.1 Undamaged Package Arrays with Homogeneous UO_2 and H_2O

In the undamaged array case for homogeneous UO_2 and H_2O, 60 kgs theoretical UO_2 compound plus variable water moderation is modeled through optimal moderation conditions in which the ICCA becomes effectively "full". No restriction on water moderation in the undamaged model is required, provided that each ICCA is limited to not greater than 60 kgs total material weight.

Table 6.7 provides the calculated fuel height for 60 kgs UO_2 compound and water mixtures within the ICCA inner canister as a function of weight fraction H_2O added (up through optimum, full ICCA conditions). In these undamaged models, homogeneous theoretical density UO_2 compound density is used (rho_uo2 = 10.96 g/cc). The weight fraction H_2O corresponding to a full ICCA occurs at wt.fr._h2o = 0.28504.

Table 6.7 Fuel Material Specifications – Undamaged Package Array (60 kgs UO_2 + H_2O theoretical mixture, unrestricted H2O)

COM	WF-W	FR.ENR	DFACT	RHOMIX gm/cc	RHOC gm/cc	RHOU gm/cc	UFACT	G-BIAS	K-BIAS	H/5	H/U x10	HEIGHT cm
RADIUS = 10.814 CM				FUEL MASS = 60.000 KG								
UO2	.150	.05000	1.0000	4.3945	3.7354	3.2925	.88144	0.0002	0.0125	104	53	43.721
UO2	.200	.05000	1.0000	3.6631	2.9305	2.5830	.88144	-.0020	0.0098	148	75	55.729
UO2	.250	.05000	1.0000	3.1404	2.3553	2.0761	.88144	-.0044	0.0070	197	100	69.339
UO2	.260	.05000	1.0000	3.0533	2.2594	1.9915	.88144	-.0049	0.0065	208	105	72.281
UO2	.270	.05000	1.0000	2.9708	2.1687	1.9116	.88144	-.0054	0.0059	219	111	75.304
UO2	.280	.05000	1.0000	2.8927	2.0828	1.8358	.88144	-.0059	0.0053	230	117	78.411
UO2	.285	.05000	1.0000	2.8549	2.0411	1.7992	.88144	-.0062	0.0050	236	119	80.01 (*)

(*) ICCA full condition, wf-w - 0.28504

The homogeneous UO_2 and H_2O models for undamaged arrays consist of infinite arrays of normal condition NPC packages. Per the applicable IAEA and 10 CFR §71.59 standards, the undamaged package arrays are evaluated with the individual units close-packed modeling of the 5N = infinite arrays is accomplished by using a single unit with mirror boundary conditions on all 6 sides, which is conservative relative to the model for a fully reflected finite system.

Figures 6.7a-6.7f depict the models used to assess normal conditions of transport, and illustrate the increasing fuel height – up to the 80.01 cm maximum - as the weight fraction of H_2O (WF-W) is increased. These sample plots apply to the 60 kg UO_2 mass limit.

The package was subjected to the tests specified in IAEA and 10 CFR §71.71, normal conditions of transport, and, as reported in Chapters 2, *Structural Evaluation* and Chapter 3, *Thermal*, the geometric form of the package was not substantially altered. No water leakage into the ICCAs occurred, and no substantial reduction in the effectiveness of the packaging was observed. The damage incurred will not affect the technical evaluation, and the package contents under normal conditions of transport will be less reactive than the contents under hypothetical accident (damaged) conditions.

Figure 6.7a – Infinite undamaged array: 60 kgs UO_2 + 15% H2O, theoretical mixture

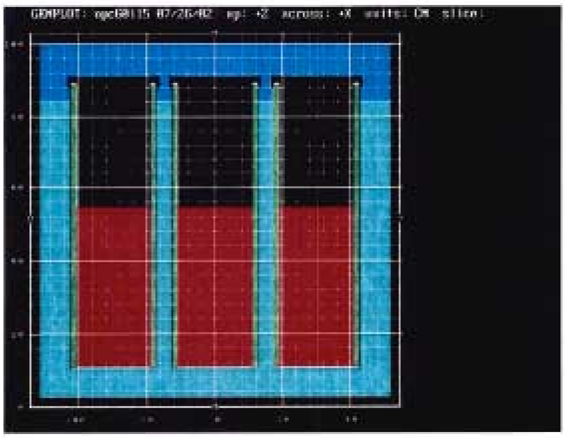


Figure 6.7b – Infinite undamaged array: 60 kgs UO_2 + 20% H_2O, theoretical mixture

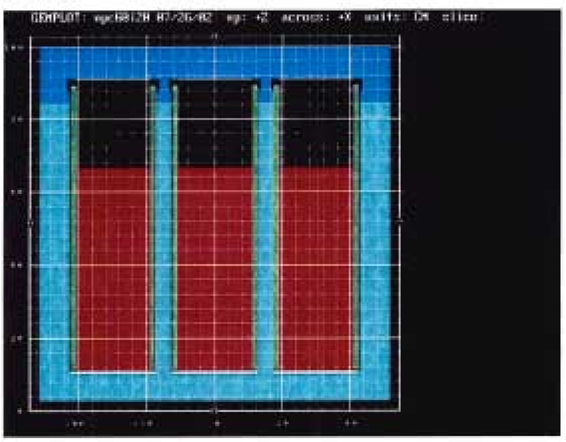


Figure 6.7c – Infinite undamaged array: 60 kgs UO_2 + 25% H_2O, theoretical mixture

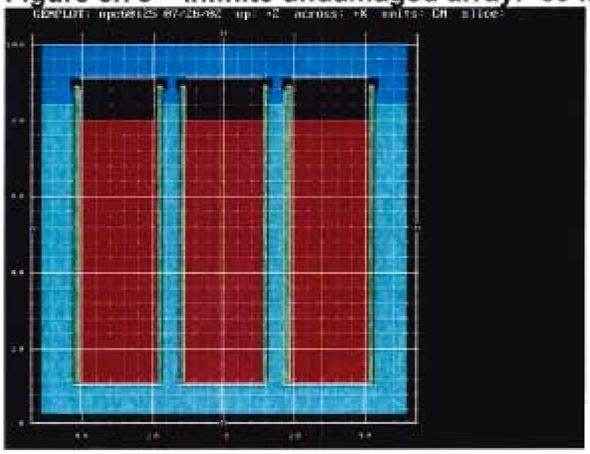


Figure 6.7d – Infinite undamaged array: 60 kgs UO_2 + 26% H_2O, theoretical mixture

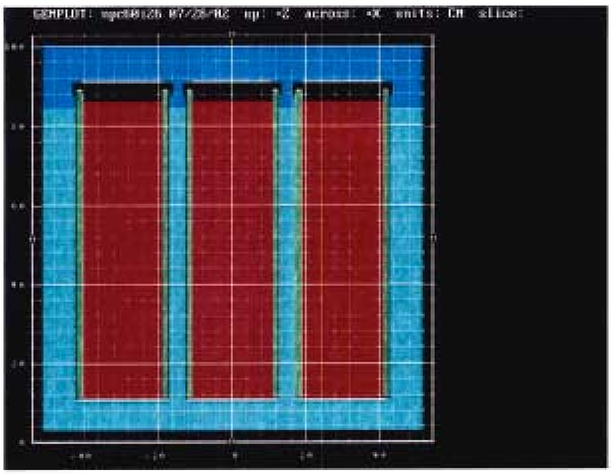


Figure 6.7e – Infinite undamaged array: 60 kgs UO_2 + 27% H_2O, theoretical mixture

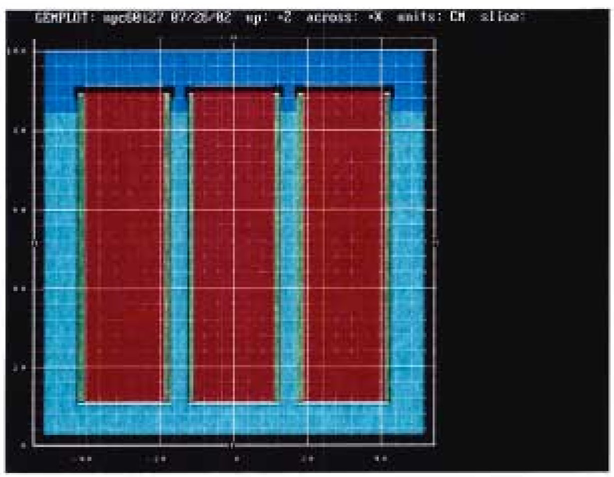
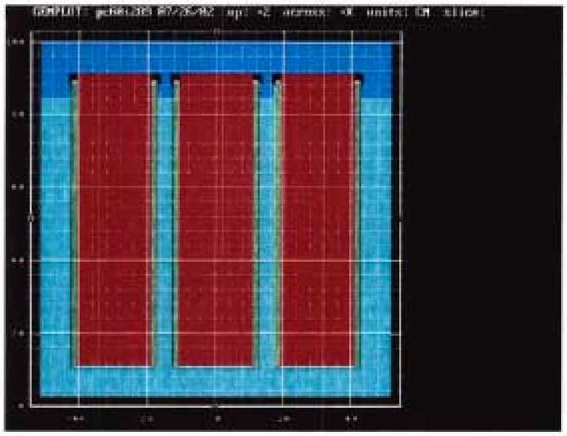


Figure 6.7f – Infinite undamaged array: 60 kgs UO_2 + 28.504% H_2O, theoretical mixture (ICCA full)



6.3.4.2 Undamaged Package Arrays with Heterogeneous UO_2 Rods in H_2O

The container model for undamaged arrays with heterogeneous UO_2 right circular cylinder elements in H_2O is the same as that shown in Figures 6.7a through 6.7f, but with the fuel lattices as described in Section 6.3.3.2. As in the homogeneous case, the undamaged arrays were modeled as infinite by mirror reflecting the single package at its six (6) boundaries.

6.3.5 DAMAGED PACKAGE ARRAYS

6.3.5.1 Damaged Package Arrays with Homogeneous UO_2 and H_2O

The NPC package was subjected to the tests specified in IAEA and 10 CFR §71.73, Hypothetical Accident Condition (HAC) testing and the geometric form of the package was not substantially altered. The four individual Certification Test Units (CTUs) were fabricated that underwent testing summarized in detail in Section 2.7, *Hypothetical Accident Conditions*.

Certification Test Units CTU-1 and CTU-2 were subjected to required IAEA and 10 CFR §71.73(c)(4) thermal excursion with an average flame temperature of 1,475 °F (800 °C) for a period of at least 30 minutes. In both tests, the fuel was ignited and the test item was subjected to a minimum of 30 minutes of a fully engulfing hydrocarbon pool fire.

A modified CTU-1 unit with reinforced corners was retest of the CTU-3 HAC test sequence (CG-over lid-corner orientation). A 10-guage (0.135-inch) doubler plate was added to reinforce the corners. CTU-1 was subjected to a Jet-A pool fire test. The Jet-A fuel was placed in the tank at a level sufficient to initiate the burn. Additional fuel was pumped into the tank during the testing as necessary to maintain the burn for 30-minutes. During the CTU-1 Jet-A burn test, the overall average flame temperature was 1,809 deg. F (in excess of the required 1,475 deg. F). The maximum surface temperature recorded was recorded as 2,319 deg. F.

The CTU-1 residual foam thickness measurements are reported in Appendix 2.10.1.7.1.6. The –x (left), +x (right), -y (rear), and +y (front) average cube face residual foam thickness values were determined to be 1.01, 1.71, 2.19, and 0.89-inches, respectively. The –z (bottom) and +z (top lid) average thickness' were 0.23, and 3.09-inches, respectively. The cube face averages were modeled to assess observed CTU-1 non-uniform foam burn effects on package reactivity.

For CTU-2, a diesel fuel pool fire test was used. During the CTU-2 diesel burn test, the overall average flame temperature was 1,972 °F (in excess of the required 1,475 °F). The maximum surface temperature recorded was recorded as 2,308 °F.

The CTU-2 residual foam thickness measurements are reported in Appendix 2.10.1.7.2.6. The –x (left), +x (right), -y (rear), and +y (front) average cube face residual foam thickness values were determined to be 0.26, 1.41, 0.23, and 0.58-inches, respectively (refer to Appendix 2.10.1.7.2.6). The –z (bottom) and +z (top lid) average thickness' were 0.0, and 3.0-inches, respectively. The cube face averages were modeled to assess observed CTU-2 non-uniform foam burn effects on package reactivity.

For the final damaged package array model, the maximum observed foam burn is uniformly applied on all six faces of the cube. This results in zero residual foam on all six faces of the cube as measured from the ICCA radial and axial centerline. The total face burn model construct conservatively bounds the observed package performance under HAC testing. This is underscored by the fact that the minimum hydrogen content in both the poly and foam regions is used, and the maximum 10% density tolerance is applied in all foam regions.

In all damaged package array models, a 2% reduction in polyethylene density (0.92 * 0.98) is uniformly applied. This reduction in density effectively covers the observed 0.6% weight loss and 0.25% mass allowance for minimum specified poly height of 30.3" verses the modeled 30.375" height.

The minor x-y and x-z movement of the 3 × 3 ICCA array contained within the OCA are compensated by the physical deformation of the OCA body itself, coupled with the conservatism's described in Section 6.3.1.5, Models- Actual Package Differences.

The observed damage incurred to the packaging and its contents did not affect this technical evaluation - as the packaging and its contents post HAC testing is determined to be within the bounding assumptions and analyzed conditions of this evaluation.

The damaged package array models consist of finite, near cubic 5x5x6 close packed arrays (2N = 150) to minimize neutron leakage. Additional close packed arrays using a 6x5x5 (2N = 150) and 9x9x2 (2N =162) are assessed to confirm the aspect ratio of the basic 5x5x6 array is most reactive.

In all cases, the close packed array is surrounded by 12" (30.48-cm) full-density water reflector. As required by IAEA and 10 CFR §71.59, the damaged packages are evaluated as if each package was subjected to the tests specified in 10 CFR §71.73, hypothetical accident conditions, with optimum interspersed moderation, and full water reflection.

The damaged package Inner Containment Canister Assembly (ICCA) contents are modeled per Section 6.3.1.4, *Materials*, Table 6.6.

The UO_2 compound mass per canister, internal moderation, observed foam burn conditions (CTU-1, CTU-2), and maximum foam burn conditions are modeled to determine an acceptable package Transport Index (TI) based on criticality control.

In addition, supplemental NPC damaged package array models are constructed based on the limiting acceptable payload and foam burn conditions derived above to study certain reactivity effects. These sensitivity studies include:

Effect of the package array shape (aspect ratio) on system reactivity. A 6 × 5 × 5 array (2N = 150) and a 9 × 9 ×x 2 array (2N = 162) are both assessed using the limiting burn condition and acceptable payload.

Effect of internal moderator content and payload contained in the UO_2 + H_2O mixture region contained within the ICCA.

Effect of 100% foam burn and subsequent replacement by optimal interspersed water moderation. In this set, the water density is varied from void through 12.5% of full density water to determine the hydrogen content necessary to demonstrate safety of the package, and determine if the damaged package is over or under-moderated.

Effect of ICCA center-to-center movement on reactivity for a specified damaged condition. For these cases, the nominal 11.75" (29.8450 cm) center-to-center ICCA spacing is uniformly reduced by 1/8" (0.3175 cm) increments to 11.25" (28.575 cm) to quantify the effect (if any) on ICCA spacing within the damaged package.

Effect of including external Type 304 stainless steel structure used for fork truck lifting of the package. This structure is quantified and effectively "smeared" onto the bottom layer of the OCA body.

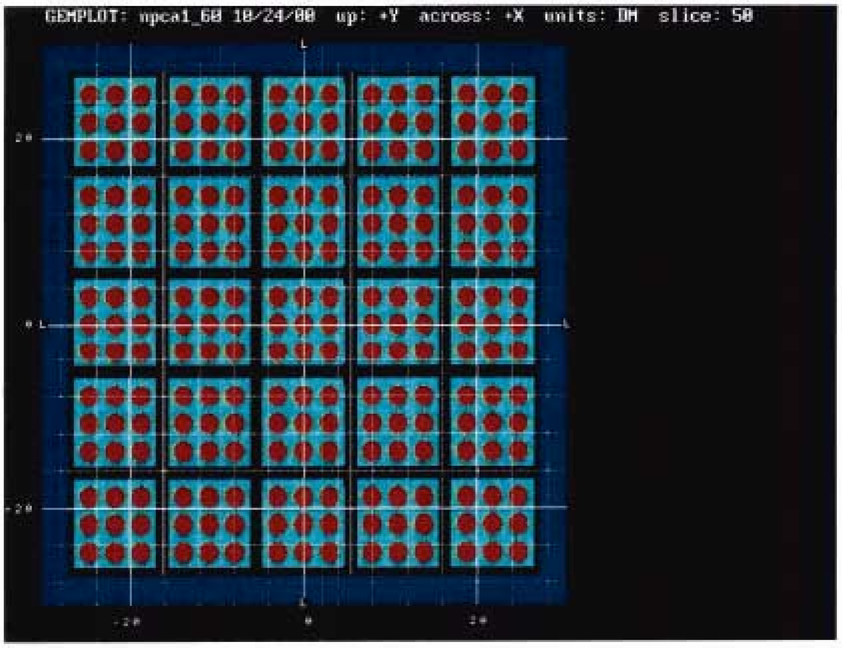
Effect of polyethylene gap as determined from the physical measurements of the ICCA's post HAC testing is assessed to confirm the modeled poly height and density assumptions. The modeled poly height of is reduced by 75 mils to minimum specified height of 30.3". The maximum gap formation at top/bottom is also modeled and compared with the modeled limiting damaged package array calculation.

The following 2D images are provide to clarify the damaged package array model constructs and associated sensitivity studies:

- Figure 6.8a and 6.8b depicts horizontal/vertical slices of the damaged 5 × 5 × 6 package array to determine acceptable UO_2 equivalent payload under postulated damaged conditions of transport, using the observed CTU-1 and CTU-2 non-uniform foam burn conditions, respectively.

- Figure 6.8c depicts horizontal/vertical slices of the damaged 5 × 5 × 6 package array to determine acceptable UO_2 equivalent payload under postulated damaged conditions of transport, applying the maximum burn condition.
- Figures 6.8d and 6.8e depict horizontal/vertical slices of the damaged 6 × 5 × 5 and 9 × 9 × 2 package array size respectively, to confirm the close packed 5 × 5 × 6 aspect ratio is the most reactive array configuration.
- Figure 6.8f depicts horizontal/vertical slices of the damaged 5 × 5 × 6 package array used to quantify the required hydrogen content necessary for demonstrating package safety.
- Figure 6.8g depicts horizontal zoom of the damaged 5 × 5 × 6 package array for the 11.25" (28.575 cm) ICCA center-to-center spacing to quantify the ICCA (x,y) movement effect.
- Figure 6.8h depicts vertical zoom of the damaged 5 × 5 × 6 damaged package array that include the additional external stainless steel structure.
- Figure 6.8i depicts vertical top/bottom zoom of the damaged 5 × 5 × 6 damaged package array that includes the maximum polyethylene gap formation.

Figure 6.8a – Fully reflected damaged 5x5x6 package array: 60 kgs UO_2 + H_2O mixture, CTU-1 observed non-uniform burn (horizontal and vertical views)



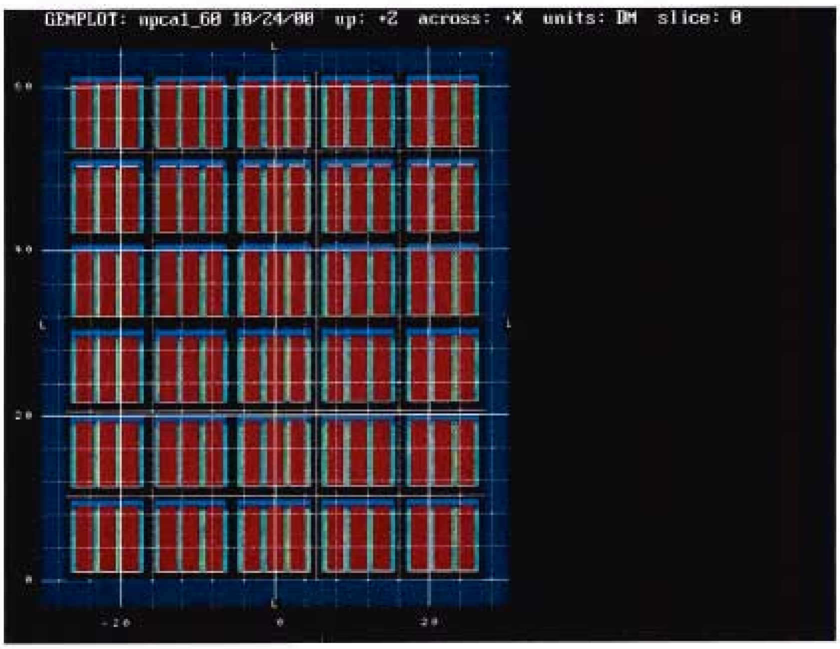
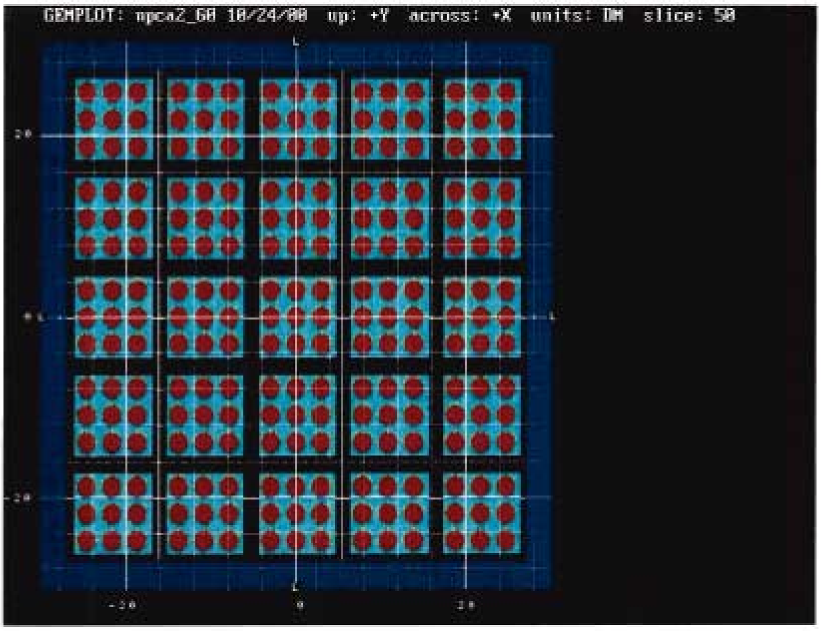


Figure 6.8b – Fully reflected damaged 5x5x6 package array: 60 kgs UO_2 + H_2O mixture, CTU-2 observed non-uniform burn (horizontal and vertical views)



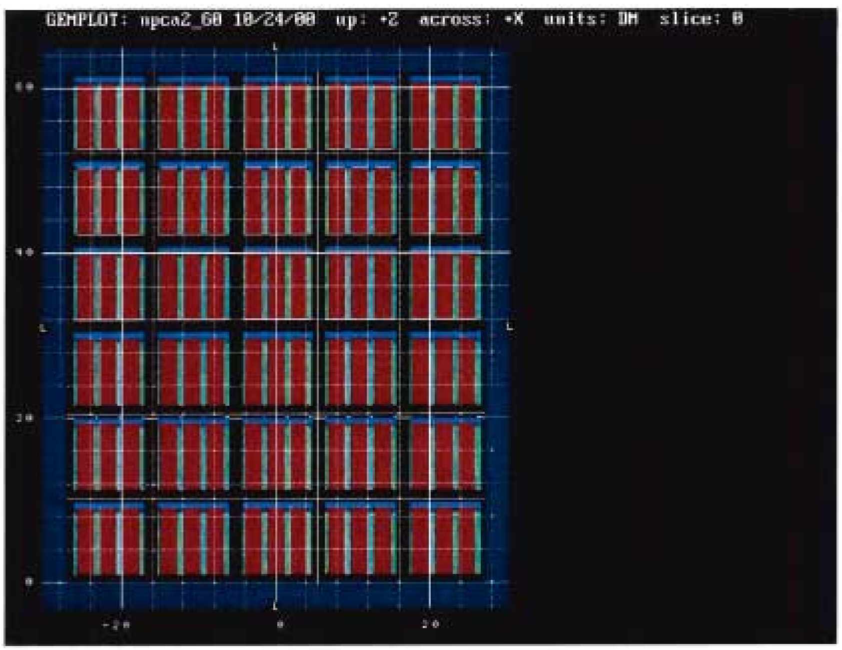
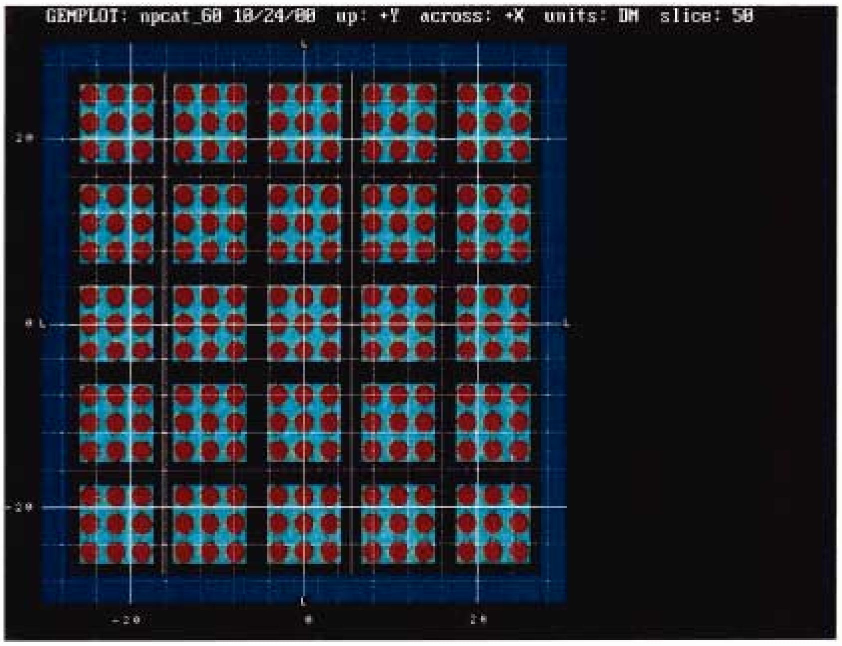


Figure 6.8c – Fully reflected damaged 5x5x6 package array: 60 kgs UO_2 + H_2O mixture, maximum burn (horizontal and vertical views)



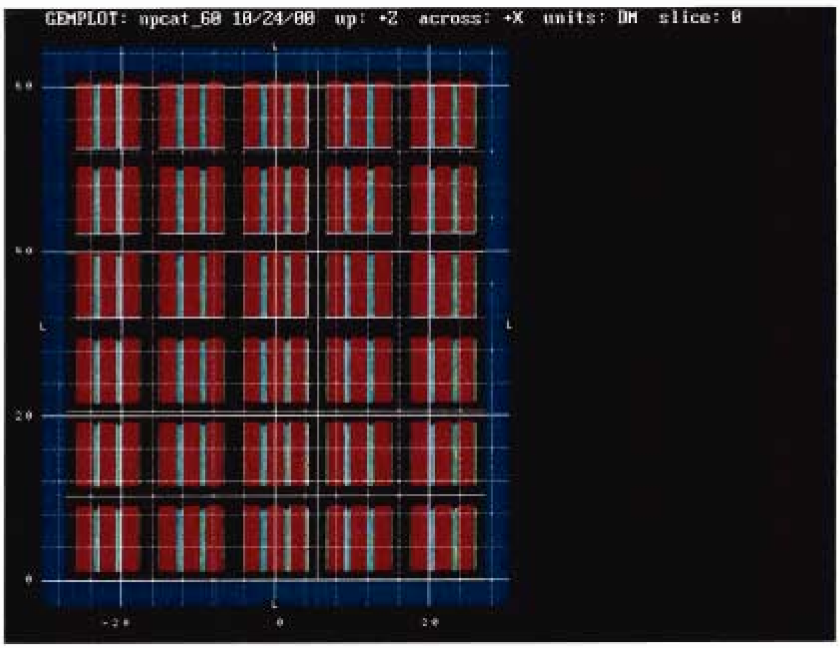


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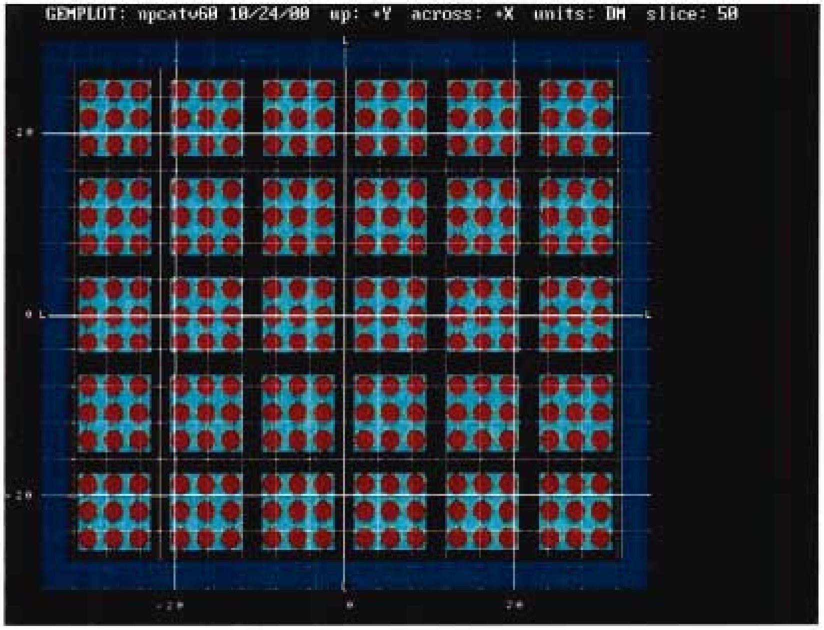
Figure 6.8d – Fully reflected damaged 6 × 5 × 5 package array: 60 kgs UO_2 + H_2O mixture, maximum burn (horizontal and vertical views)



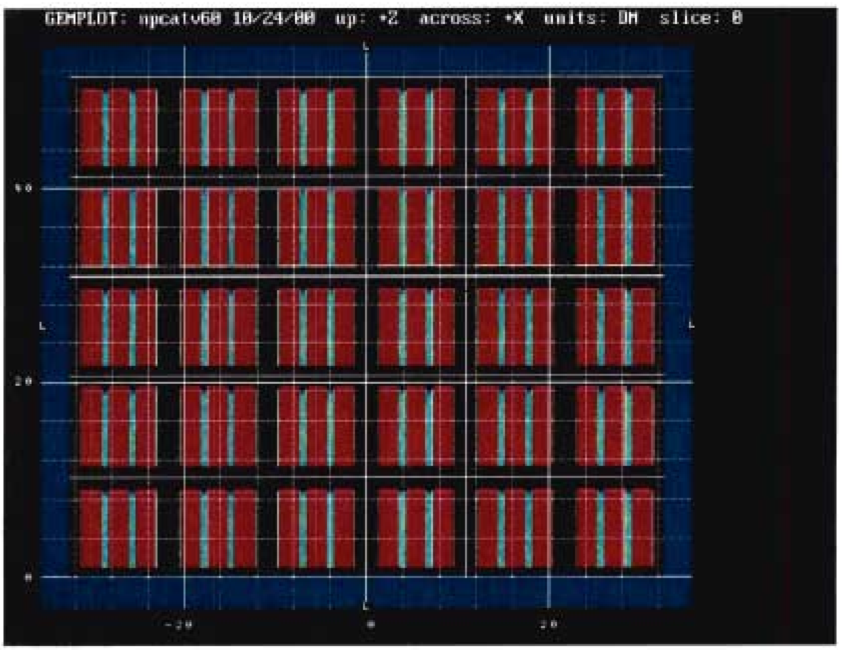


Figure 6.8e – Fully reflected damaged 9 × 9 × 2 package array: 60 kgs UO_2 + H_2O mixture, maximum burn (horizontal and vertical views)

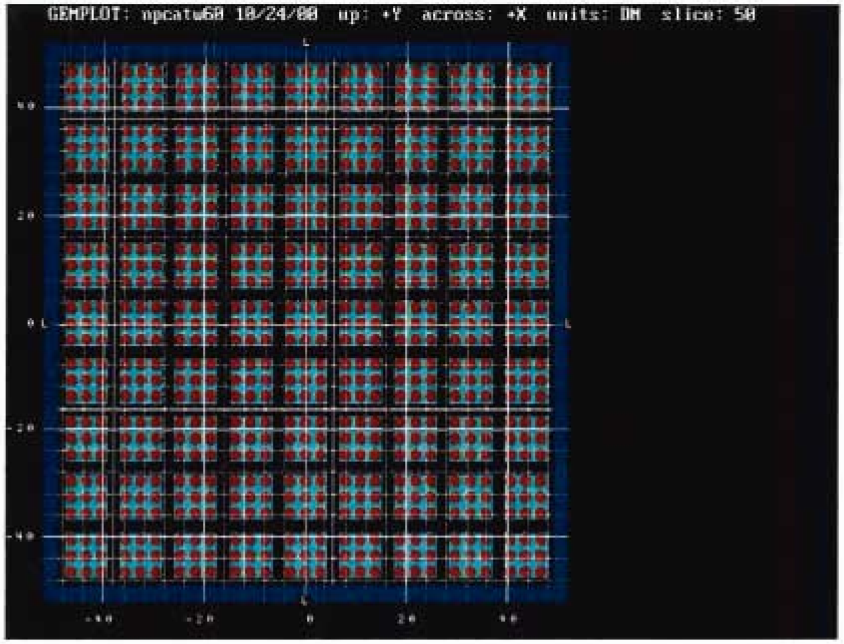
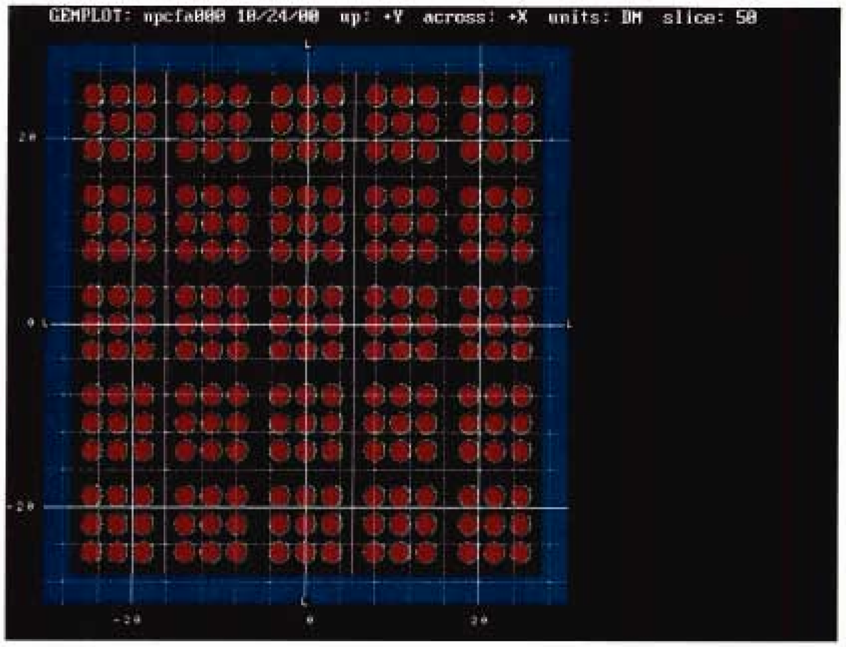


Figure 6.8f – Fully reflected damaged 5 × 5 × 6 package array: 60 kgs UO_2 + H_2O mixture, 100% foam burn, void replacement (horizontal and vertical views)



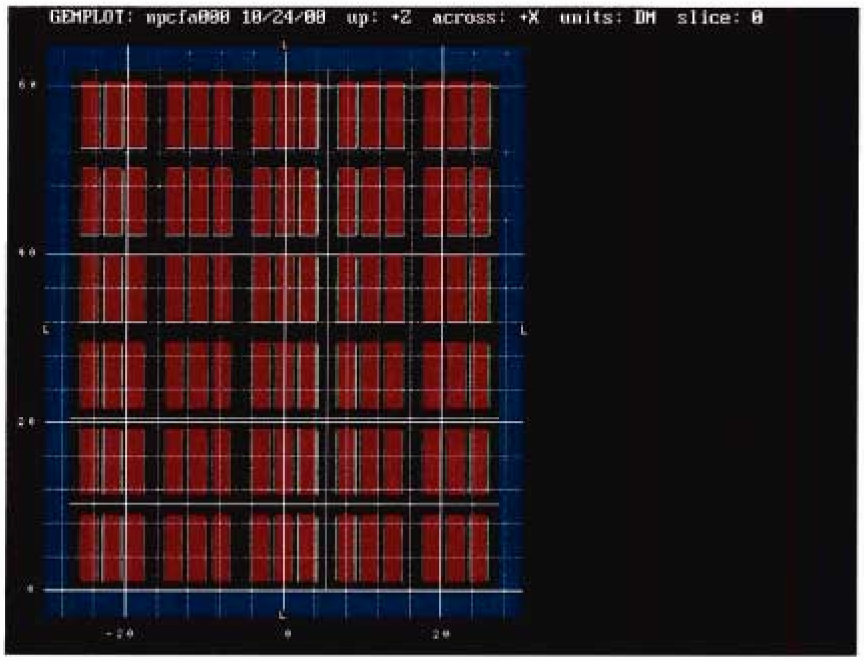


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Figure 6.8g – Fully reflected damaged 5 × 5 × 6 package array: 60 kgs UO_2 + H_2O mixture, maximum burn, 11.25" c-c ICCA spacing (horizontal zoom, lower left array corner)

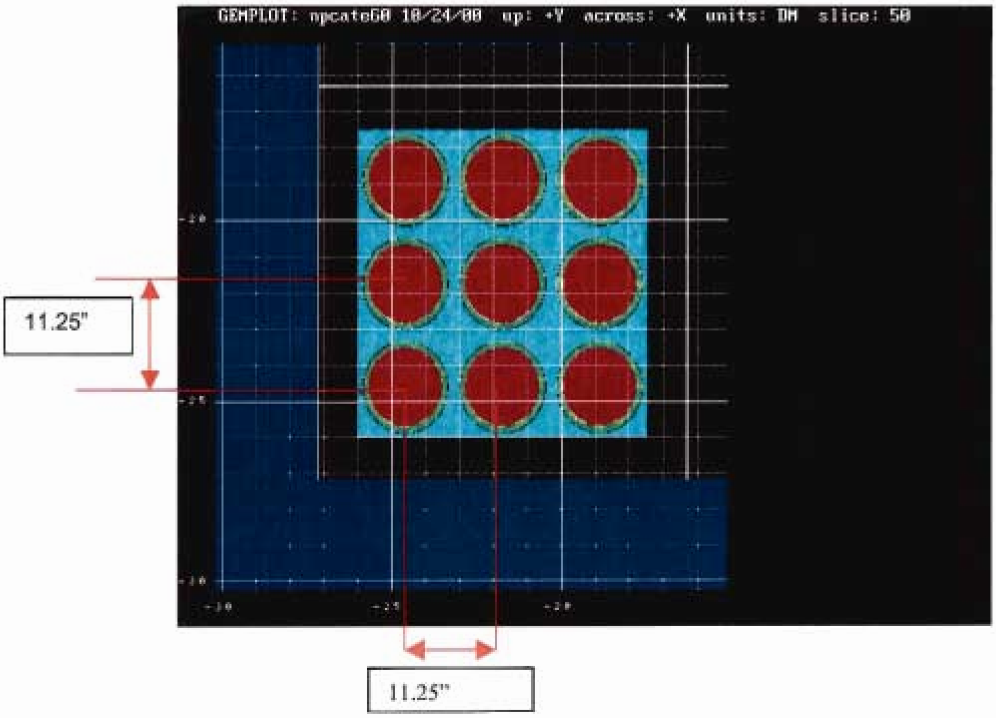


Figure 6.8h – Fully reflected damaged 5 × 5 × 6 package array: 60 kgs UO_2 + H_2O mixture, maximum burn, external structure add-on to bottom of OCA body (vertical zoom, lower left array corner)

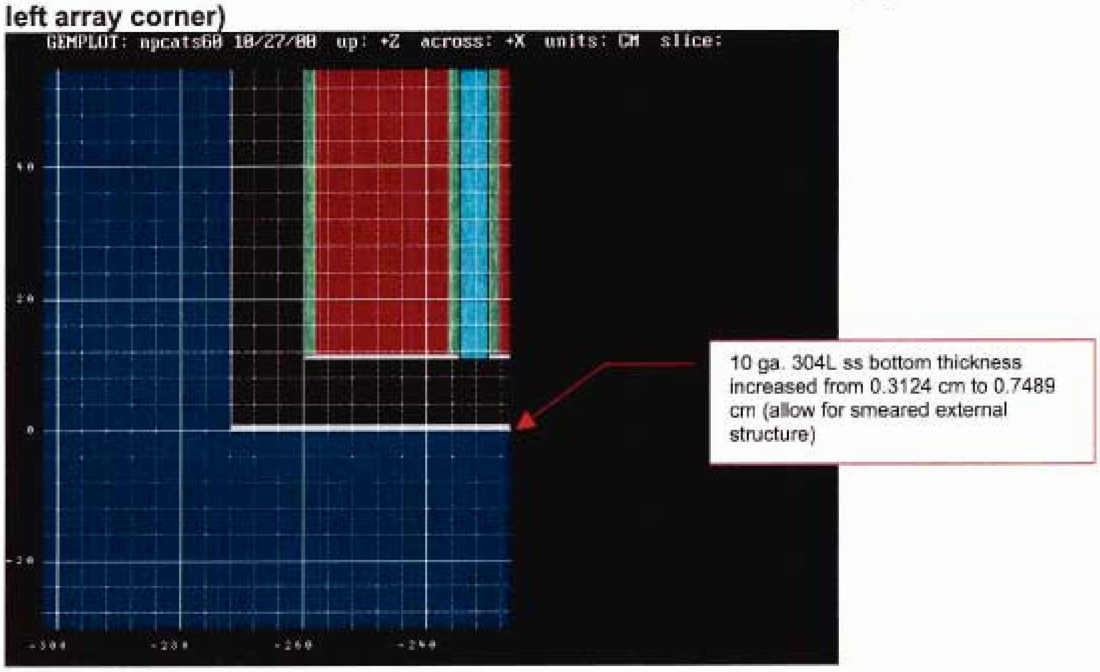
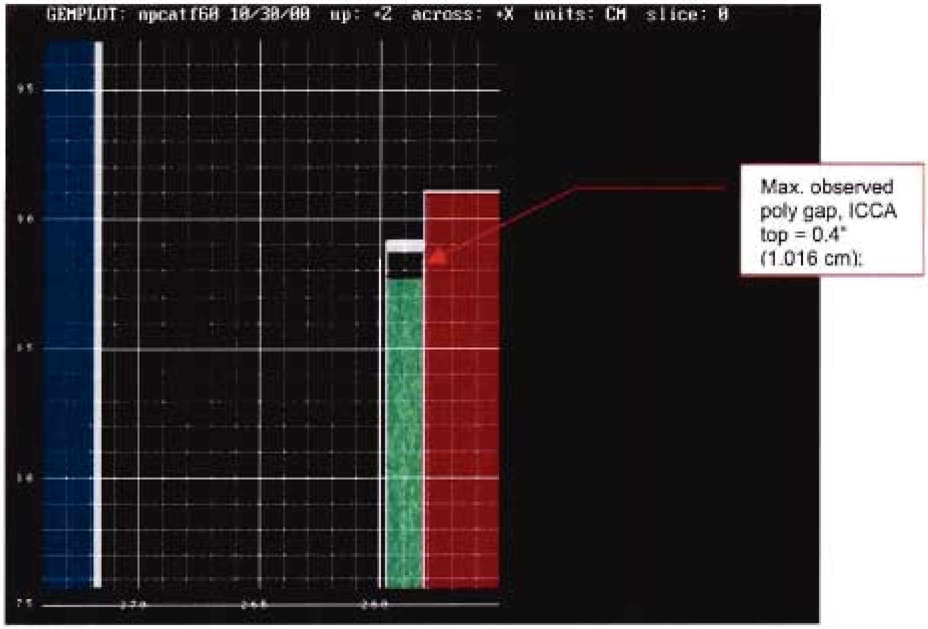
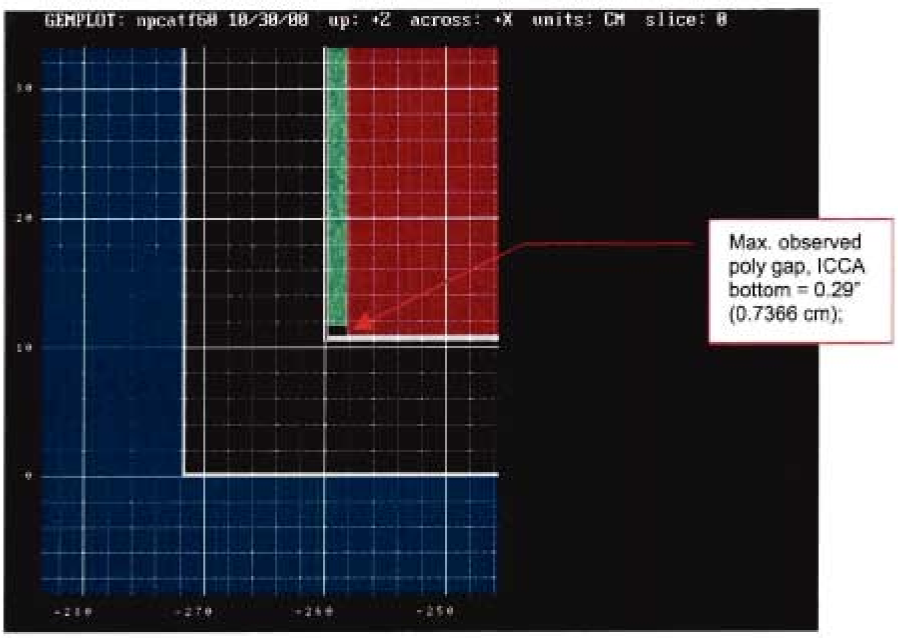


Figure 6.8i – Fully reflected damaged 5x5x6 package array: 60 kgs UO_2 + H_2O mixture, maximum burn, observed maximum poly gap at top/bottom (vertical zoom, ICCA)





6.3.5.2 Damaged Package Arrays with Heterogeneous UO_2 in H_2O

Damaged package arrays with heterogeneous UO_2 cylindrical elements (rods) have been analyzed with the same applicable worse case container array model as used in the homogeneous analyses. This is the array model shown in Figure 6.8c in the preceding section. The models for the heterogeneous lattices for these cases are the same as described in Section 6.3.3.2.

6.4 METHOD OF ANALYSIS

GEMER, a proprietary Global Nuclear Fuel company criticality analysis computer code was used in the analysis of these computational models (Ref. 1). All calculations were performed on verified workstations using Pentium processors running under Windows NT.

6.4.1 COMPUTER CODE SYSTEM

GEMER is a Monte Carlo program, which solves the neutron transport equation as an eigenvalue or a fixed source problem including the neutron-shielding problem. GEMER adds an advanced geometry input package to the problem solving capability of the Monte Carlo code that is very similar in capability to KENO Va.

6.4.2 CROSS SECTIONS AND CROSS-SECTION PROCESSING

GEMER uses cross-sections processed from the ENDF/B-IV library. These cross-sections are prepared in 190-group format and the values in the resonance region may have the form of the resonance parameters or Doppler broadened multigroup cross-section. This treatment of cross-sections with explicit resonance parameters is especially suited to the analysis of uranium compounds in the form of heterogeneous accumulations or lattices. Thermal scattering of hydrogen is represented by the $S(\alpha,\beta)$ data in the ENDF/B-IV library. The types of reactions considered in the Monte Carlo calculation are fission, elastic, inelastic, and (n,2n) reactions; the absorption is implicitly treated by reducing the neutron weight by the non-absorption probability on each collision.

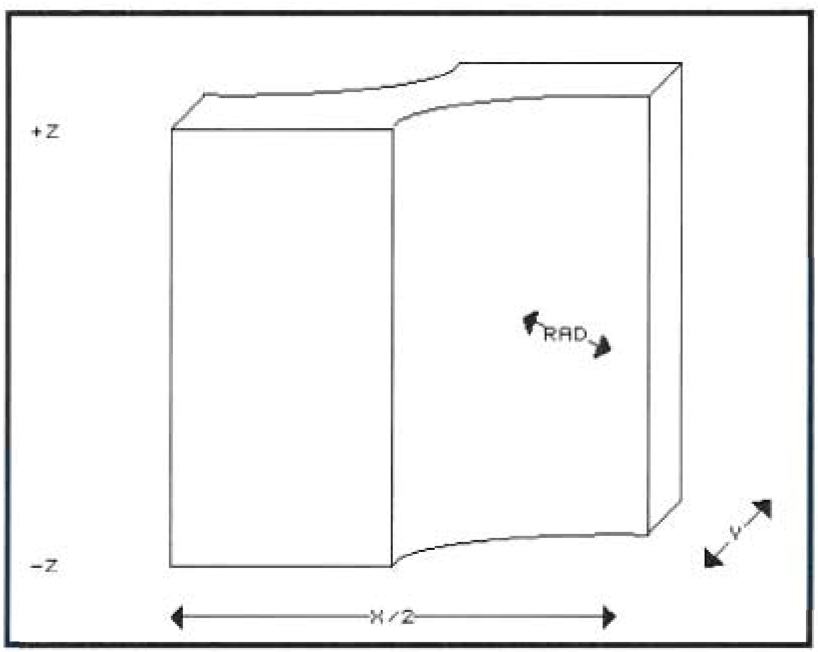
6.4.3 GEOMETRY MODELING OF FUEL REGIONS

The previous Section 6.3 gives a detailed description of the NPC shipping container geometry models used in this analysis. This section expands on the descriptions of the fuel regions, especially regions containing lattices of cylindrical fuel elements (rods). As noted in the prior sections, the provision for heterogeneous fuel in the NPC is conservatively based on the analysis of lattices of UO_2 fuel in the form of right circular cylinder elements (rods) in the ICCAs. Both square and triangular lattices have modeled in the heterogeneous cases, together with consideration of lattice boundary conditions in which cylindrical elements in the lattices are either permitted or not permitted to overlap the internal ICCA wall boundary.

6.4.3.1 The INTERS and GEMER VFO Geometry Options

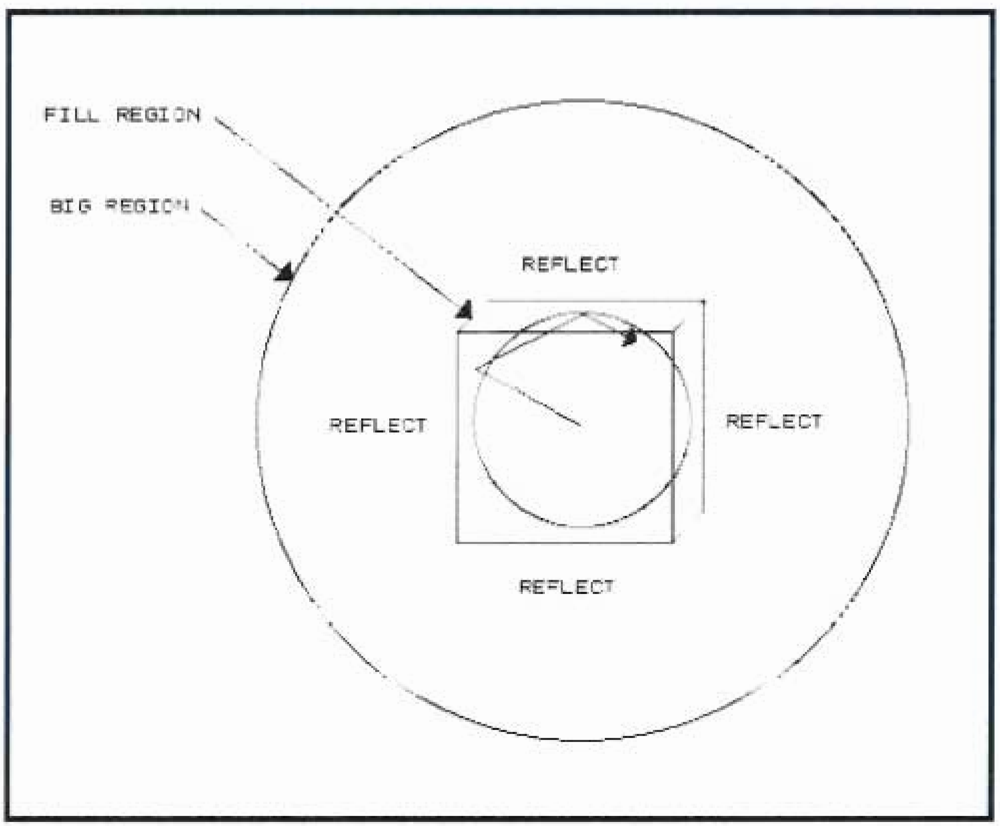
In addition to its standard geometry capabilities, the GEMER Monte Carlo code has two additional geometry options that are particularly useful in modeling rod lattices. The first is a special regular geometry construct called INTERS. As shown in Figure 6.9a, the INTERS region is a CUBOID with quarter cylinders missing along two opposite XY edges. The centerline of this region always passes through the X=0, Y=0 origin. Like regular geometry regions such as CUBOIDs or CYLINDERs, INTERS regions may be nested within each other, but the last region in the Box must be a CUBOID. The purpose of the INTERS region is to permit modeling of a triangular lattice of cylindrical rods by use of simple regular geometry input. This can be done two ways. One is to mirror reflect the INTERS box on its ±X and ±Y axes. (The +Z, -Z dimensions then define the height of the rods in the lattice.) The second way is to use two separate INTERS regions that differ by the location of quarter cylinder cutouts. As provided for by the INTERS input parameters, one region can be described by cutouts onn the –X,+Y and +X,-Y edges, and the second with the cutouts at the –X,-Y and +X,+Y edges. Placing these two regions in alternate X and Y locations in an array will then create a two-dimensional triangular lattice of cylinders. Because of its geometry definition, the INTERS constructs are for all practical purposes limited to use either with infinite triangular lattices, or with lattices in which the geometry is permitted to overlap a region (e.g. an ICCA) that the lattice is contained in. (GEMER does not currently have a boundary condition that would prevent overlap of part of an INTERS region.)

Figure 6.9a – The INTERS Geometry Region



The second GEMER geometry option is the Virtual Fill Option (VFO). This option allows geometry regions to be automatically filled with a virtual representation of a separate region. As depicted in Figure 6.9b, the VFO of a complete Box Type (the "FILL REGION") that is itself mirror reflected on all six of its sides, allows placing in a larger region (the "BIG REGION") which is any regulary geometry region. When a neutron enters the Big Region, it is translated into the Fill Region and tracked via the standard Monte Carlo methods (e.g. importance weighing, splitting, Russian roulette) in the Fill Region until the code determines that the neutron's path has reached one of the Big Region's boundaries. It is then translated back to the Big Region where regular tracking resumes. This option is called "Virtual" because in reality, no Fill Region exists (i.e. is stored in the run-time memory) until a neutron enters the Big Region. When a neutron is translated into the Fill region, it is randomly located and then remains in this region, reflecting from wall to wall, until its track would take it back out of the Big Region. This wall-to-wall reflection effectively presents a fixed array of the Fill Region Boxes to the neutron tracking and hence can be used to model both square pitch and triangular pitch (via the INTERS Box) lattices in the Fill Region. One feature of note about VFO is that since each neutron entering the Big Region is randomly placed in the Fill Region, each neutron sees the same overall Fill Region lattice, but each of these lattices has a different location for its central unit. Over an entire calculation, the effect of this is to average the results of the tracking over all possible central locations.

Figure 6.9b – The Virtual Fill Option



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6.4.3.2 Water to Fuel Volume Ratios and Rod to Rod Spacings in Lattices of Fuel Rods

In uniform but heterogeneous fuel regions, the relative amount of moderator is specified as the Water to Fuel volume ratio (W/F ratio) in the unit cell. For uniform square and triangular pitched arrays of cylindrical (unclad) fuel rods in which the unit cells are two dimensional squares or triangles (since the heights of the rods in a given lattice are all the same), these W/F ratios are determined completely by the radii of the fuel rods and the center-to-center spacings between adjacent units. Figure 6.9c shows examples of the unit cells (the areas bounded by the dotted lines) for these two types of arrays from which it can be seen that the relationship between the W/F ratios and the radii (R_f) and spacings (L) are:

$$\text{Square Lattices: } W/F = \frac{\mathbf{L^2 - \pi \times R_f^2}}{\pi \times R_f^2}$$

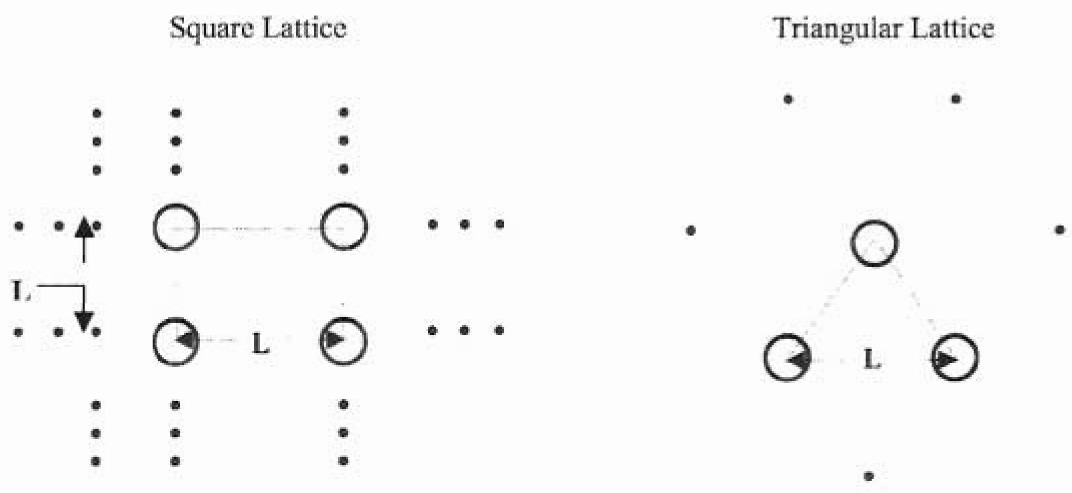
and

$$\text{Triangular Lattices: } W/F = \frac{\mathbf{0.866 \times L^2 - \pi \times R_f^2}}{\pi \times R_f^2}$$

[0.866 in these equations is Sqrt(3.0)/2.0.]

Comparing these two formulas, it can be seen that if a Square and Triangular lattice with the same diameter fuel rods have the same W/F ratios, the triangular lattice will have a greater pitch (i.e. L) between rods. In the ICCAs, this means that for the same W/F ratios, triangular lattices will have fewer rods and thus for the same fissile mass, will be taller.

Figure 6.9c – Square and Triangular Lattices



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6.4.3.3 Fuel Heights of Homogeneous Fuel Mixtures in the ICCAs

A brief description is given is Section 6.3.1.4 of the treatment of homogeneous UO_2 and water mixtures in the ICCA fuel region. In summary, this method is

i. For a (binary) fuel mixture with a given weight fraction of H_2O, determine the corresponding UO_2 density, ρ, assuming a maximum theoretical density of UO_2 of 10.96 gm/cm^3.

ii. For a given mass, M, of UO_2 in the ICCA, determine the Volume, V, of the $UO_2 + H_2O$ mixture by

$$\rho \times V = M$$

iii. Since the ICCA is cylindrical, V is equal to the base area, $\pi \times R_{ICCA}^2$, times the height, h, of the mixture, and hence

$$H = M/(\rho \times \pi \times R_{ICCA}^2).$$

Since the maximum height in the ICCA is 80.01 cm, and its radius is 10.8141 cm, this means that for a given UO_2 mass there is a minimum UO_2 density below which the contents of the ICCA will be less than the specified mass. The following Table 6.8 tabulates these minimum densities for the mass limits applicable to this analysis.

Table 6.8 Minimum UO_2 Densities for Homogeneous UO_2 and H_2O Mixtures in the ICCA

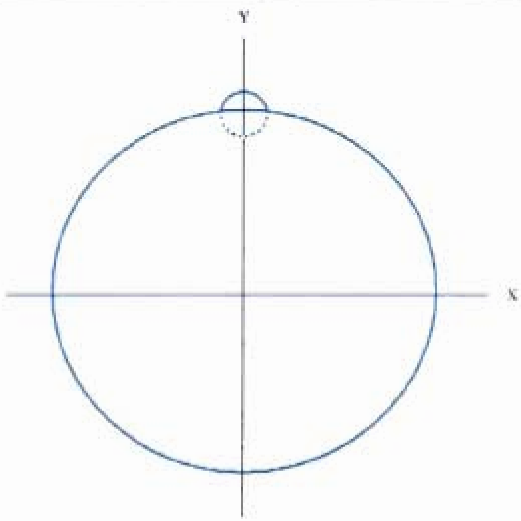
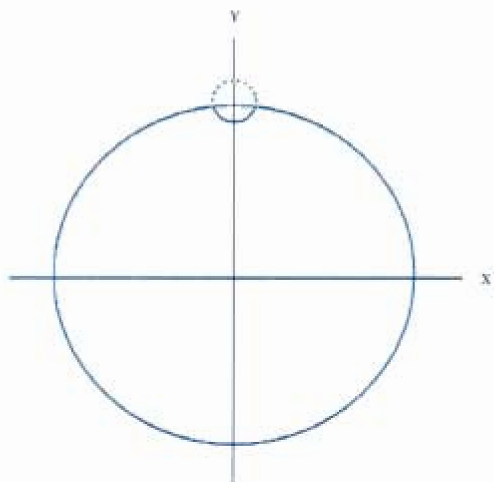
UO_2 Mass Limit (kgs)	Minimum UO_2 Density (gm/cm^3)
60.0	2.041
55.0	1.871
53.0	1.803
46.0	1.565

6.4.3.4 Fuel Heights of Heterogeneous Fuel Lattices in the ICCAs

In heterogeneous uniform square or triangular fuel rod lattices, the fuel heights are still related to the W/F ratios (i.e. the cylinder-to-cylinder or rod-to-rod spacings) and the cylinder diameters via the relationship ρ × Area × Height = Mass, but the formula used to determine the ρ × Area depends on the assumed boundary conditions and the way in which the regions are modeled. In this analysis, three different cases have been considered.

Case 1 is for arrays in which it is assumed that the right circular cylinder fuel elements (rods) can overlap the (ICCA) boundary. This assumption means that if a given fuel element in the lattice is such that part of it overlaps the ICCA region boundary, the external overlap part is deleted from the model but the part internal to the ICCA is kept. For this exact modeling, $\rho = 10.96$ gm/cm^3 and the Area is given by the sum of the partial areas of the rods that overlap the boundary + the sum of the areas of the internal rods that do not intersect the boundary. This latter sum is just $N \times A_R$, with N equal to the number of internal rods and A_R equal to the area of a single cylinder (i.e. $\pi \times R_f^2$). For the first term, the sum is more complicated since individual fuel cylinder elements will intersect the boundary at different points. However, the internal partial area of each cylindrical element can be determined by integration, and the integration can be made simple by considering the ICCA and fuel cylinder (rod) in question to be rotated so that the center of the overlapping rod is at X = 0.0. Figure 6.9d shows a depiction of the two situations that can result.

Figure 6.9d – Partial Areas of Overlapping Fuel Cylinders

Overlapping Fuel Cylinder* More that 50% Internal	**Overlapping Fuel Cylinder* More than 50% External**
	

***Center of fuel rod having radius R_f is assumed to be located at (0.0, Y_0); Center of ICCA is 0.0, 0.0.**

[N.B. "More than 50% Internal" or "More than 50% External" should be interpreted to mean that the curve for the ICCA boundary and the cylindrical fuel element intersects at a value of $Y \leq Y_0$ or $Y > Y_0$, respectively.] Separation into these two situations is necessary since the functional form of the overlapping rod used in the integration can only be the top half of the cylinder [i.e. $Y_{r1} = Y_0 + \text{Sqrt}(R_f^2 - X^2)$] or the bottom half [i.e. $Y_{r2} = Y_0 - \text{Sqrt}(R_f^2 - X^2)$]. The dotted line parts of the partial rods in Figure 6.9d are the parts not included in the area integration. In the "More than 50% Internal" situation, this integration is from X = 0.0 to $X = X_i$ (the +X point of intersection of the ICCA boundary and the cylindrical elment [rod] curve) of the quantity $(Y_{r1} - Y_{ICCA})$, with $Y_{ICCA} = \text{Sqrt}(R_{ICCA}^2 - X^2)$. If the result of this integral is A_p, the corresponding value for the internal partial area for the cylindrical fuel element is $A_R - 2 \times A_p$.

For the situation when more than 50% or the cylindrical fuel element (rod) is external, the integral is made from X = 0.0 to X_i of $Y_{ICCA} - Y_{r2}$, and the internal partial area of the fuel cylinder is equal to two times the value of this integral. Both of these integrals have results that can be expressed in closed form (involving arcsines), and hence the partial fuel cylinder determinations can readily be computed.

The 2nd array case considered is that of fuel element (rod) lattices in which the elements in the lattice are not permitted to overlap the ICCA boundary. If any part of a fuel cylinder intersects the ICCA boundary at any point, it is deleted from the array. All fuel cylinders are thus completely internal, and the total fuel area is just $N \times A_R$. As in case 1, the density ρ for this case is 10.96 gm/cm^3.

The third case is that in which the fuel element (rod) lattices are modeled with the Virtual Fill Option (VFO). In this case, each neutron that enters the internal ICCA fuel region sees a fuel rod lattice with an overlapping boundary condition like that in Case 1, but each lattices of these has a randomly location in the XY plane so that each will have a different number of overlapping and internal rods. Since the effect of this over an entire calculation is to average the arrays over all locations, the method used to determine the lattice heights is that used for the homogeneous case. This is done by correlating the given W/F ratio of the heterogeneous lattice with an equivalent WF H_2O for a homogeneous mixture by the relationship

$$\text{WF } H_2O = \frac{W/F}{10.96 + W/F},$$

which then determines the UO_2 density in the equivalent homogeneous mixture. [Note that this WF H_2O determined by this method is independent of the diameter of the fuel rod.]

6.4.4 CODE INPUT

All problems were started with a flat initial neutron distribution over the fissile material regions only. Except as noted, calculations were run with 200 generations of 2000 neutrons each, skipping the first 10 generations before starting the statistical output processing, for a total of 380,000 histories used in the final eigenvalue calculation. Appendix 6.9 contains sample GEMER input files for both the homogeneous and heterogeneous cases considered in this analysis.

6.4.5 CONVERGENCE OF CALCULATIONS

Problem convergence was determined by examining plots of k_{eff} by generation run and skipped, as well as the final k_{eff} edit tables. No abnormal trends were observed to indicate non-convergence of the eigenvalue solution. Representative convergence plots for the individual damaged single package, undamaged array, and damaged array models are shown in Figures 6.10a- 6.10d. (The plots shown are for cases with homogeneous UO_2 and H_2O mixtures, but the results are also representative of the results for heterogeneous lattices.)

Figure 6.10a – Sample k_{eff} convergence: damaged unit – npcut_25.in

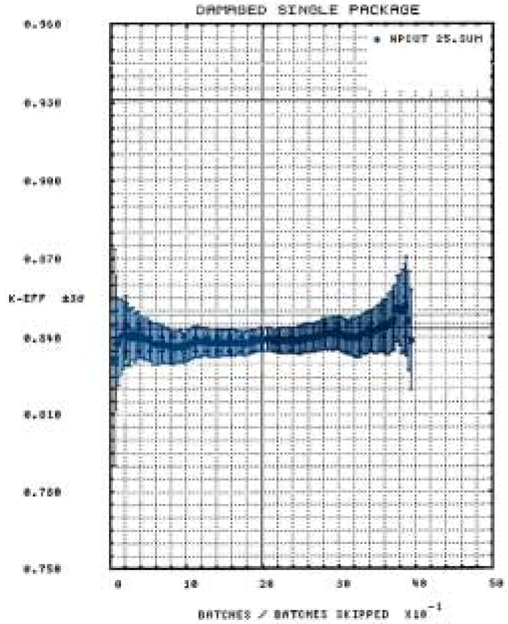


Figure 6.10b – Sample k_{eff} convergence: undamaged array - npc60i28.in

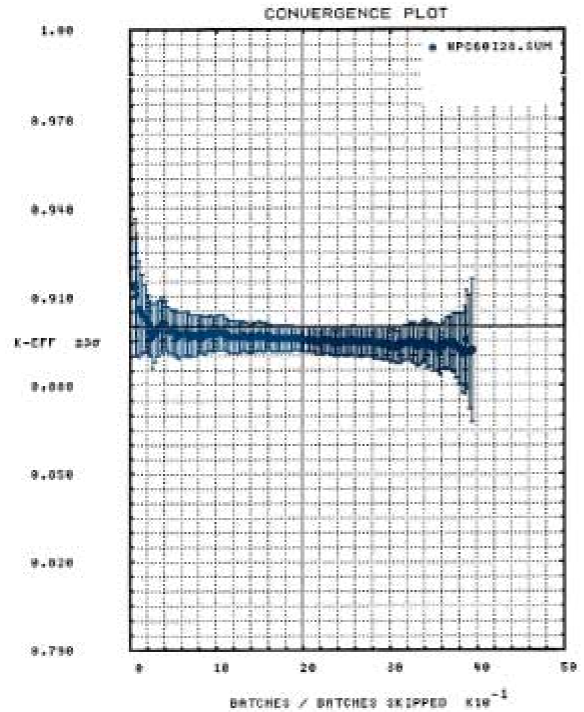


Figure 6.10c – Sample k_{eff} convergence: damaged array – npca2_60.in (CTU-2 observed burn)

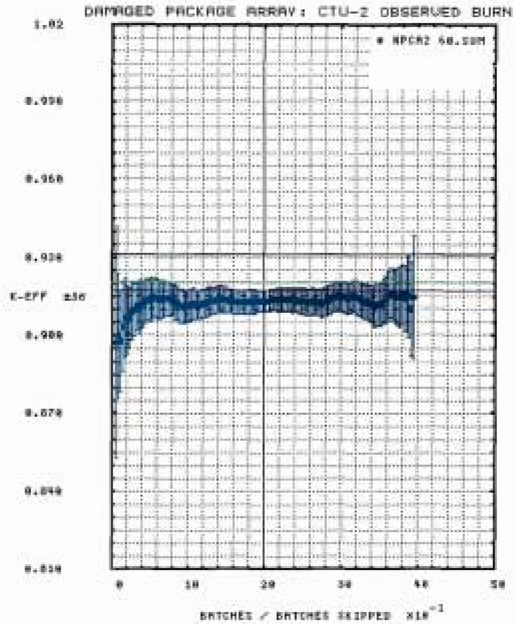
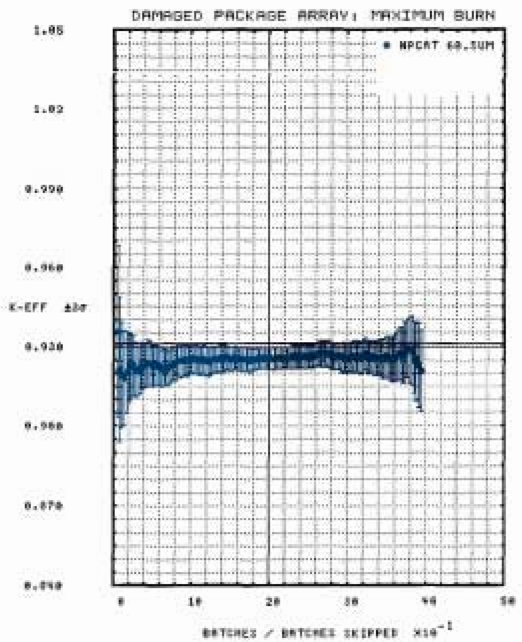


Figure 6.10d – Sample k_{eff} convergence: damaged array - npcat_60.in (maximum burn)



6.5 VALIDATION

The following general relationship for establishing the acceptance criteria for the NPC package (Ref. 4).

$$k_c - \Delta k_u \geq k_{eff} + 2\sigma + \Delta k_m$$

where,

k_c = mean value of *keff* resulting from calculation of benchmark critical experiments
Δk_u = an allowance for the calculational uncertainty
Δk_m = a required margin of subcriticality (0.05 used)
k_{eff} = the calculated value obtained for the package or array of packages
σ = is the standard deviation of the keff value obtain with Monte Carlo analysis

If the calculational bias $\beta = k_c - 1$, the bias is negative if $k_c < 1$, and positive if $k_c > 1$. Thus, the acceptance criteria may be rewritten as,

$$1.00 + \beta - \Delta k_u \geq k_{eff} + 2\sigma + 0.05$$

or

$$k_{eff} + 2\sigma \leq 0.95 - \Delta k_u + \beta.$$

Validation of GEMER consists of performing calculation of benchmark experiments including the area of applicable to the uranium oxides. Bias for GEMER and the ENDF/B-IV library has been established for the area of applicability for the NPC package (refer Appendix). The uranium oxide bias determined is no greater than 0.009 ($\Delta k_u - \beta$) at a 99% confidence level (Ref. 2). For uranium nitrate compounds, the bias determined is not greater than 0.0125 ($\Delta k_u - \beta$) at a 99% confidence level. The uranium oxide bias with cadmium is no greater than 0.01888 ($\Delta k_u - \beta$) at a 95% confidence level (refer Appendix 6.8, Validation of GEMER).

The area of applicability for the homogeneous and heterogeneous uranium oxide benchmark calculations is enrichment ranges from 1.29 to 9.83 weight percent U-235, W/F ratios from 0.5 to 10.0 and H/U-235 ratio 41 to 866. The area of applicability for the uranium oxide with cadmium benchmark calculations is enrichment ranges from 2.35 to 4.98 weight percent U-235 and H/U-235 ratio 260-488.

Using the above general equation for the upper safety limit (USL) and requirements of 10 CFR 71, calculations are considered subcritical, if the following condition is satisfied:

$$k_{eff} + 2\sigma \leq 0.95 - \Delta k_u + \beta$$

For this evaluation, the NPC package and it contents are considered subcritical if the following condition is satisfied:

$$k_{eff} + 2\sigma \leq 0.931$$

6.6 CRITICALITY CALCULATIONS AND RESULTS

This evaluation demonstrates the subcriticality of single packages (Section 6.6.1) and arrays of packages (Section 6.6.2) during both normal and hypothetical accident conditions of transport for fissile material contents that are representable as homogeneous or heterogeneous mixtures of UO_2 and H_2O. For the types of fissile materials listed in Table 6.1, with the specified mass limits, the determined Transport Index (TI) for criticality control of damaged and undamaged shipment is given in Section 6.6.3, *Transport Index*.

All calculations were performed at the maximum allowable U-235 enrichment (5.00 wt %) to ensure optimum reactivity, and the maximum k_{eff}s resulting from these analyses are summarized in Table 6.9. A complete listing of all results is included in Tables 6.16 through 6.20 in Appendix 6.10.

6.6.1 DAMAGED SINGLE PACKAGES

Calculations show that a single package remains subcritical under general requirements for fissile material packages, under both normal conditions of transport, and under hypothetical accident conditions. To meet the general requirements for fissile material package, a package must be designed and its contents so limited, that it would be subcritical under the most reactive configuration of material, optimum moderation, and close reflection of the containment system by water on all sides or surrounding materials of the packaging.

6.6.1.1 Damaged Single Package with Homogeneous UO_2 and H_2O

Figure 6.11 shows the reactivity of a damaged single package for CTU-1, CTU-2, and maximum observed foam burn conditions. A third order regression fit of the Keff $\pm 2\sigma$ results are shown for each fit. The figure demonstrates the damaged single package remains subcritical under the most reactive configuration of material, optimum moderation, and close reflection of the containment system by water on all sides or surrounding materials of the packaging. The damaged single package is demonstrated to be a favorable geometry unit. The limiting condition occurs for the maximum foam burn condition.

The effect of replacing the void (burn region) with full density water is also demonstrated to have a small effect for the damaged single package. This is expected due to optimal internal fuel moderation treatment and close proximity of the water reflector.

From Table 6.16 in Appendix 6.10, the maximum calculated $k_{eff} + 2\sigma$ - bias results for the damaged single package are:

FILENAME	K-EFF	SIGMA	K+2S	BIAS	K+2S-B
npcu1_25	0.8452	0.0013	0.8478	-.0189	0.8666
npcu2_25	0.8407	0.0013	0.8433	-.0189	0.8622
npcut_25	0.8405	0.0014	0.8432	-.0189	0.8621
npcutw25	0.8476	0.0015	0.8506	-.0189	0.8694

Table 6.9 – NPC Calculated Keff Summary

A. Single Container Cases*

Rod Type	Lattice	File Name	k_{eff}	σ	$k_{eff}+2\sigma$	Bias (B)	$k_{eff}+2\sigma$ - B
		60 Kgs Homogeneous Single Container Case					
NA	NA	Npcutw25	0.8475	0.0015	0.8506	-0.0189	0.8694
		55 Kgs Heterogeneous Single Container Case with Overlap					
17X17	Square	ESSP-420	0.85195	0.00143	0.85481	-0.01890	0.87371
17X17	Triangular	ESTP-400	0.85358	0.00141	0.85640	-0.01890	0.87530
10X10	Square	ETSP-410	0.84464	0.00130	0.84724	-0.01890	0.86614
10X10	Triangular	ETTP-430	0.84806	0.00148	0.85102	-0.01890	0.86992
9X9	Square	ENSP-410	0.84113	0.00134	0.84381	-0.01890	0.86271
9X9	Triangular	ENTP-430	0.84217	0.00151	0.84519	-0.01890	0.86409
8X8	Square	EESP-420	0.83597	0.00135	0.83867	-0.01890	0.85757
8X8	Triangular	EETP-410	0.83736	0.00129	0.83994	-0.01890	0.85884
		55 Kgs Heterogeneous Single Container Case without Overlap					
17X17	Square	OSSP-480	0.84764	0.00128	0.85020	-0.01890	0.86910
17X17	Triangular	OSTP-410	0.85091	0.00139	0.85369	-0.01890	0.87259
10X10	Square	OTSP-437	0.84222	0.00134	0.84490	-0.01890	0.86380
10X10	Triangular	OTTP-410	0.84648	0.00142	0.84932	-0.01890	0.86822
9X9	Square	ONSP-400	0.84056	0.00142	0.84340	-0.01890	0.86230
9X9	Triangular	ONTP-470	0.83397	0.00136	0.83669	-0.01890	0.85559
8X8	Square	OESP-400	0.82941	0.00140	0.83221	-0.01890	0.85111
8X8	Triangular	OETP-420	0.83805	0.00148	0.84101	-0.01890	0.85991
		55 Kgs Heterogeneous Single Container Case with VFO					
17X17	Square	VSSP-400	0.85223	0.00144	0.85511	-0.01890	0.87401
17X17	Triangular	VSTP-460	0.85248	0.00154	0.85556	-0.01890	0.87446
10X10	Square	VTSP-410	0.84517	0.00143	0.84803	-0.01890	0.86693
10X10	Triangular	VTTP-410	0.84900	0.00136	0.85172	-0.01890	0.87062
9X9	Square	VNSP-400	0.84079	0.00132	0.84343	-0.01890	0.86233
9X9	Triangular	VNTP-400	0.84181	0.00150	0.84481	-0.01890	0.86371
8X8	Square	VESP-400	0.83521	0.00131	0.83783	-0.01890	0.85673
8X8	Triangular	VETP-430	0.83642	0.00147	0.83936	-0.01890	0.85826

Rod Type	Lattice	File Name	k_{eff}	σ	$k_{eff}+2\sigma$	Bias (B)	$k_{eff}+2\sigma$ - B
		53 Kgs Heterogeneous Single Container Case with Overlap					
17X17	Square	ESSN-437	0.84788	0.00138	0.85064	-0.01890	0.86954
17X17	Triangular	ESTN-437	0.84991	0.00137	0.85265	-0.01890	0.87155
10X10	Square	ETSN-400	0.84441	0.00152	0.84745	-0.01890	0.86635
10X10	Triangular	ETTN-437	0.84546	0.00133	0.84812	-0.01890	0.86702
9X9	Square	ENSN-437	0.83796	0.00140	0.84076	-0.01890	0.85966
9X9	Triangular	ENTN-410	0.83982	0.00135	0.84252	-0.01890	0.86142
8X8	Square	EESN-400	0.83275	0.00139	0.83553	-0.01890	0.85443
8X8	Triangular	EETN-420	0.83385	0.00145	0.83675	-0.01890	0.85565
		53 Kgs Heterogeneous Single Container Case without Overlap					
17X17	Square	OSSN-480	0.84512	0.00143	0.84798	-0.01890	0.86688
17X17	Triangular	OSTN-420	0.84833	0.00157	0.85147	-0.01890	0.87037
10X10	Square	OTSN-437	0.83676	0.00140	0.83956	-0.01890	0.85846
10X10	Triangular	OTTN-410	0.84175	0.00138	0.84451	-0.01890	0.86341
9X9	Square	ONSN-410	0.83529	0.00149	0.83827	-0.01890	0.85717
9X9	Triangular	ONTN-460	0.83184	0.00133	0.83450	-0.01890	0.85340
8X8	Square	OESN-400	0.82773	0.00153	0.83079	-0.01890	0.84969
8X8	Triangular	OETN-420	0.83446	0.00147	0.83740	-0.01890	0.85630
		53 Kgs Heterogeneous Single Container Case with VFO					
17X17	Square	VSSN-400	0.84788	0.00151	0.85090	-0.01890	0.86980
17X17	Triangular	VSTN-400	0.84909	0.00146	0.85201	-0.01890	0.87091
10X10	Square	VTSN-420	0.84343	0.00135	0.84613	-0.01890	0.86503
10X10	Triangular	VTTN-440	0.84402	0.00145	0.84692	-0.01890	0.86582
9X9	Square	VNSN-400	0.83652	0.00143	0.83938	-0.01890	0.85828
9X9	Triangular	VNTN-440	0.83967	0.00144	0.84255	-0.01890	0.86145
8X8	Square	VESN-400	0.83352	0.00135	0.83622	-0.01890	0.85512
8X8	Triangular	VETN-400	0.83305	0.00135	0.83575	-0.01890	0.85465

* Maximum Values Shown with Green Background

B. Undamaged Array Cases*

Rod Type	Lattice	File Name	k_{eff}	σ	k_{eff} +2σ	Bias (B)	k_{eff} +2σ - B
		60 Kgs Homogeneous Undamaged Array Case					
NA	NA	Npcat60i27	0.8956	0.0013	0.8982	-0.0189	0.9171
		55 KGs Heterogeneous Undamaged Array Case with Overlap					
17X17	Square	DSSP-400	**0.89437**	0.00127	0.89691	-0.01890	**0.91581**
17X17	Triangular	DSTP-437	**0.89798**	0.00128	0.90054	-0.01890	**0.91944**
10X10	Square	DTSP-400	**0.88984**	0.00133	0.89250	-0.01890	**0.91140**
10X10	Triangular	DTTP-420	0.89023	0.00139	0.89301	-0.01890	**0.91191**
9X9	Square	DNSP-410	**0.88563**	0.00134	0.88831	-0.01890	**0.90721**
9X9	Triangular	DNTP-400	**0.88619**	0.00149	0.88917	-0.01890	**0.90807**
8X8	Square	DESP-400	**0.88283**	0.00128	0.88539	-0.01890	**0.90429**
8X8	Triangular	DETP-400	**0.88162**	0.00140	0.88442	-0.01890	**0.90332**
		55 KGs Heterogeneous Undamaged Array Case without Overlap					
17X17	Square	CSSP-430	**0.89233**	0.00141	0.89515	-0.01890	**0.91405**
17X17	Triangular	CSTP-430	0.89407	0.00164	0.89735	-0.01890	**0.91625**
10X10	Square	CTSP-437	**0.88294**	0.00138	0.88570	-0.01890	**0.90460**
10X10	Triangular	CTTP-400	**0.89104**	0.00135	0.89374	-0.01890	**0.91264**
9X9	Square	CNSP-420	**0.88232**	0.00137	0.88506	-0.01890	**0.90396**
9X9	Triangular	CNTP-420	**0.87670**	0.00127	0.87924	-0.01890	**0.89814**
8X8	Square	CESP-400	**0.87068**	0.00133	0.87334	-0.01890	**0.89224**
8X8	Triangular	CETP-410	**0.87997**	0.00145	0.88287	-0.01890	**0.90177**
		55 KGs Heterogeneous Undamaged Array Case with VFO					
17X17	Square	BSSP-450	**0.89451**	0.00134	0.89719	-0.01890	**0.91609**
17X17	Triangular	BSTP-420	**0.89628**	0.00146	0.89920	-0.01890	**0.91810**
10X10	Square	BTSP-410	0.88797	0.00151	0.89099	-0.01890	**0.90989**
10X10	Triangular	BTTP-437	**0.88990**	0.00143	0.89276	-0.01890	**0.91166**
9X9	Square	BNSP-420	**0.88459**	0.00131	0.88721	-0.01890	**0.90611**
9X9	Triangular	BNTP-400	**0.88639**	0.00124	0.88887	-0.01890	**0.90777**
8X8	Square	BESP-420	**0.87958**	0.00129	0.88216	-0.01890	**0.90106**
8X8	Triangular	BETP-400	**0.88143**	0.00142	0.88427	-0.01890	**0.90317**

Rod Type	Lattice	File Name	k_{eff}	σ	k_{eff} +2σ	Bias (B)	k_{eff} +2σ - B
		53 KGs Heterogeneous Undamaged Array Case with Overlap					
17X17	Square	DSSN-400	**0.89271**	0.00138	0.89547	-0.01890	**0.91437**
17X17	Triangular	DSTN-400	0.89336	0.00146	0.89628	-0.01890	**0.91518**
10X10	Square	DTSN-410	**0.88681**	0.00144	0.88969	-0.01890	**0.90859**
10X10	Triangular	DTTN-430	**0.88958**	0.00143	0.89244	-0.01890	**0.91134**
9X9	Square	DNSN-410	**0.88232**	0.00130	0.88492	-0.01890	**0.90382**
9X9	Triangular	DNTN-420	**0.88310**	0.00129	0.88568	-0.01890	**0.90458**
8X8	Square	DESN-410	**0.87831**	0.00137	0.88105	-0.01890	**0.89995**
8X8	Triangular	DETN-420	0.87802	0.00147	0.88096	-0.01890	**0.89986**
		53 KGs Heterogeneous Undamaged Array Case without Overlap					
17X17	Square	CSSN-470	0.88851	0.00139	0.89129	-0.01890	**0.91019**
17X17	Triangular	CSTN-430	**0.89308**	0.00129	0.89566	-0.01890	**0.91456**
10X10	Square	CTSN-400	**0.88125**	0.00139	0.88403	-0.01890	**0.90293**
10X10	Triangular	CTTN-410	**0.88590**	0.00141	0.88872	-0.01890	**0.90762**
9X9	Square	CNSN-420	**0.87967**	0.00140	0.88247	-0.01890	**0.90137**
9X9	Triangular	CNTN-420	**0.87457**	0.00125	0.87707	-0.01890	**0.89597**
8X8	Square	CESN-400	**0.86695**	0.00125	0.86945	-0.01890	**0.88835**
8X8	Triangular	CETN-420	**0.87874**	0.00141	0.88156	-0.01890	**0.90046**
		53 KGs Heterogeneous Undamaged Array Case with VFO					
17X17	Square	BSSN-400	**0.89142**	0.00140	0.89422	-0.01890	**0.91312**
17X17	Triangular	BSTN-430	**0.89470**	0.00130	0.89730	-0.01890	**0.91620**
10X10	Square	BTSN-410	**0.88608**	0.00136	0.88880	-0.01890	**0.90770**
10X10	Triangular	BTTN-420	**0.88801**	0.00142	0.89085	-0.01890	**0.90975**
9X9	Square	BNSN-400	**0.88220**	0.00131	0.88482	-0.01890	**0.90372**
9X9	Triangular	BNTN-440	**0.88238**	0.00142	0.88522	-0.01890	**0.90412**
8X8	Square	BESN-410	**0.87553**	0.00139	0.87831	-0.01890	**0.89721**
8X8	Triangular	BETN-400	**0.87932**	0.00131	0.88194	-0.01890	**0.90084**

* Maximum Values Shown with Green Background

C. Damaged Array Cases*

60 Kgs Homogeneous Damaged Array Case

Rod Type	Lattice	File Name	k_{eff}	σ	$k_{eff}+2\sigma$	Bias (B)	$k_{eff}+2\sigma$ - B
NA	NA	Npeat_60	0.9275	0.0012	0.9299	-0.0189	0.9488

55 KGs Heterogeneous Damaged Array Case with Overlap

Rod Type	Lattice	File Name	k_{eff}	σ	$k_{eff}+2\sigma$	Bias (B)	$k_{eff}+2\sigma$ - B
17X17	Square	SS55-470	0.92778	0.00128	0.93034	-0.0189	0.94924
17X17	Triangular	ST55-437	0.92766	0.00118	0.93002	-0.0189	0.94892
10X10	Square	TS55-460	0.91822	0.00144	0.92110	-0.0189	0.94000
10X10	Triangular	TT55-450	0.92071	0.00138	0.92347	-0.0189	0.94237
9X9	Square	NS55-460	0.91434	0.00139	0.91712	-0.0189	0.93602
9X9	Triangular	NT55-430	0.91469	0.00135	0.91739	-0.0189	0.93629
8X8	Square	ES55-410	0.90675	0.00122	0.90919	-0.0189	0.92809
8X8	Triangular	ET55-450	0.90882	0.00139	0.91160	-0.0189	0.93050

55 KGs Heterogeneous Damaged Array Case without Overlap

Rod Type	Lattice	File Name	k_{eff}	σ	$k_{eff}+2\sigma$	Bias (B)	$k_{eff}+2\sigma$ - B
17X17	Square	OSSP-430	0.92607	0.00131	0.92869	-0.0189	0.94759
17X17	Triangular	OSTP-440	0.92629	0.00143	0.92915	-0.0189	0.94805
10X10	Square	OTSP-430	0.91271	0.00138	0.91547	-0.0189	0.93437
10X10	Triangular	OTTP-437	0.91928	0.00126	0.92180	-0.0189	0.94070
9X9	Square	ONSP-410	0.91320	0.00132	0.91584	-0.0189	0.93474
9X9	Triangular	ONTP-520	0.90778	0.00122	0.91022	-0.0189	0.92912
8X8	Square	OESP-400	0.89670	0.00136	0.89942	-0.0189	0.91832
8X8	Triangular	OETP-410	0.90943	0.00128	0.91199	-0.0189	0.93089

55 KGs Heterogeneous Damaged Array Case with VFO

Rod Type	Lattice	File Name	k_{eff}	σ	$k_{eff}+2\sigma$	Bias (B)	$k_{eff}+2\sigma$ - B
17X17	Square	SS55-460	0.92745	0.00144	0.93033	-0.0189	0.94923
17X17	Triangular	ST55-486	0.92801	0.00136	0.93073	-0.0189	0.94963
10X10	Square	TS55-480	0.91840	0.00139	0.92118	-0.0189	0.94008
10X10	Triangular	TT55-470	0.91984	0.00139	0.92262	-0.0189	0.94152
9X9	Square	NS55-420	0.91206	0.00146	0.91498	-0.0189	0.93388
9X9	Triangular	NT55-470	0.91613	0.00144	0.91901	-0.0189	0.93791
8X8	Square	ES55-430	0.90468	0.00141	0.90750	-0.0189	0.92640
8X8	Triangular	ET55-450	0.90883	0.00143	0.91169	-0.0189	0.93059

53 KGs Heterogeneous Damaged Array Case with Overlap

Rod Type	Lattice	File Name	k_{eff}	σ	$k_{eff}+2\sigma$	Bias (B)	$k_{eff}+2\sigma$ - B
17X17	Square	SS53-520	0.92239	0.00143	0.92525	-0.0189	0.94415
17X17	Triangular	ST53-460	0.92417	0.00128	0.92673	-0.0189	0.94563
10X10	Square	TS53-460	0.91475	0.00133	0.91741	-0.0189	0.93631
10X10	Triangular	TT53-440	0.91582	0.00132	0.91846	-0.0189	0.93736
9X9	Square	NS53-440	0.90949	0.00138	0.91225	-0.0189	0.93115
9X9	Triangular	NT53-500	0.90879	0.00128	0.91135	-0.0189	0.93025
8X8	Square	ES53-430	0.90091	0.00123	0.90337	-0.0189	0.92227
8X8	Triangular	ET53-420	0.90444	0.00133	0.90710	-0.0189	0.92600

53 KGs Heterogeneous Damaged Array Case without Overlap

Rod Type	Lattice	File Name	k_{eff}	σ	$k_{eff}+2\sigma$	Bias (B)	$k_{eff}+2\sigma$ - B
17X17	Square	OSSN-480	0.92213	0.00140	0.92493	-0.0189	0.94383
17X17	Triangular	OSTN-430	0.92038	0.00142	0.92322	-0.0189	0.94212
10X10	Square	OTSN-470	0.90916	0.00129	0.91174	-0.0189	0.93064
10X10	Triangular	OTTN-410	0.91296	0.00138	0.91572	-0.0189	0.93462
9X9	Square	ONSN-420	0.90637	0.00140	0.90917	-0.0189	0.92807
9X9	Triangular	ONTN-490	0.90790	0.00136	0.91062	-0.0189	0.92952
8X8	Square	OESN-500	0.89400	0.00149	0.89698	-0.0189	0.91588
8X8	Triangular	OETN-410	0.90299	0.00132	0.90563	-0.0189	0.92453

53 KGs Heterogeneous Damaged Array Case with VFO

Rod Type	Lattice	File Name	k_{eff}	σ	$k_{eff}+2\sigma$	Bias (B)	$k_{eff}+2\sigma$ - B
17X17	Square	SS53-450	0.92132	0.00137	0.92406	-0.0189	0.94296
17X17	Triangular	ST53-470	0.92198	0.00130	0.92458	-0.0189	0.94348
10X10	Square	TS53-486	0.91233	0.00138	0.91509	-0.0189	0.93399
10X10	Triangular	TT53-460	0.91603	0.00138	0.91879	-0.0189	0.93769
9X9	Square	NS53-430	0.90676	0.00121	0.90918	-0.0189	0.92808
9X9	Triangular	NT53-437	0.90957	0.00141	0.91239	-0.0189	0.93129
8X8	Square	ES53-400	0.90223	0.00126	0.90475	-0.0189	0.92365
8X8	Triangular	ET53-440	0.90455	0.00135	0.90725	-0.0189	0.92615

* Maximum Values Shown with Green Background

D. Unrestricted Rod Diameter Cases*

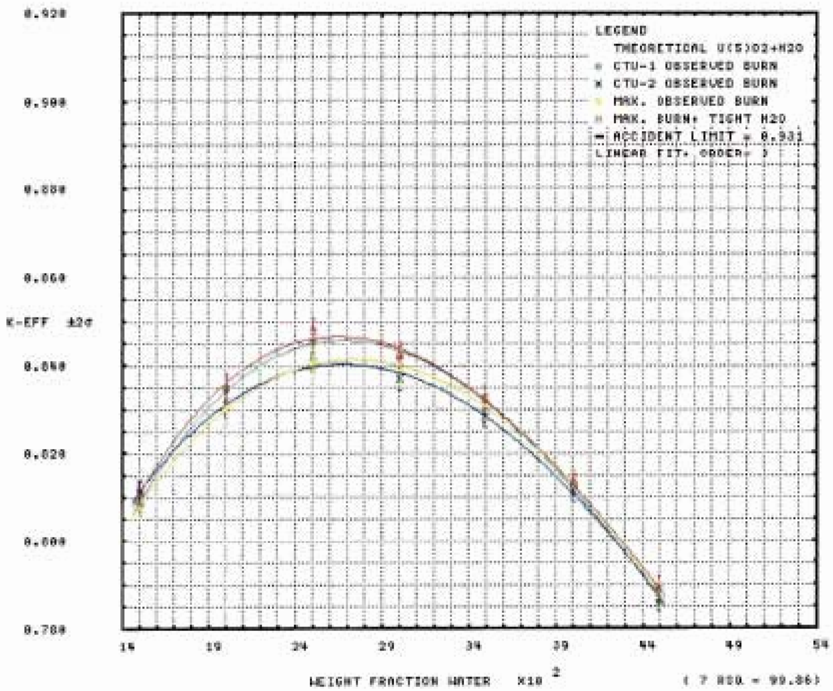
Rod Diameter (Inches)	Lattice	File Name	k_{eff}	σ	$k_{eff} + 2\sigma$	Bias (B)	$k_{eff} + 2\sigma$ - B
		46 Kgs Heterogeneous Single Container Case with VFO					
0.200	Square	MSSL-450	**0.84629**	0.00145	0.84919	-0.01890	**0.86809**
0.200	Triangular	MSTL-500	**0.84902**	0.00134	0.85170	-0.01890	**0.87060**
0.100	Square	MTSL-540	**0.85424**	0.00146	0.85716	-0.01890	**0.87606**
0.100	Triangular	MTTL-600	**0.85120**	0.00146	0.85412	-0.01890	**0.87302**
0.050	Square	MNSL-520	**0.84886**	0.00147	0.85180	-0.01890	**0.87070**
0.050	Triangular	MNTL-600	**0.84713**	0.00141	0.84995	-0.01890	**0.86885**
0.025	Square	MESL-600	**0.84060**	0.00133	0.84326	-0.01890	**0.86216**
0.025	Triangular	METL-560	**0.84035**	0.00141	0.84317	-0.01890	**0.86207**
		46 Kgs Heterogeneous Undamaged Array Case with VFO					
0.200	Square	AASL-486	**0.88897**	0.00142	0.89181	-0.01890	**0.91071**
0.200	Triangular	AATL-437	**0.89076**	0.00145	0.89366	-0.01890	**0.91256**
0.100	Square	ABSL-520	**0.89600**	0.00133	0.89866	-0.01890	**0.91756**
0.100	Triangular	ABTL-490	**0.89307**	0.00152	0.89611	-0.01890	**0.91501**
0.050	Square	ACSL-560	**0.88834**	0.00138	0.89110	-0.01890	**0.91000**
0.050	Triangular	ACTL-600	**0.88882**	0.00126	0.89134	-0.01890	**0.91024**
0.025	Square	ADSL-560	**0.88223**	0.00135	0.88493	-0.01890	**0.90383**
0.025	Triangular	ADTL-544	**0.88161**	0.00152	0.88465	-0.01890	**0.90355**
		46 Kgs Heterogeneous Damaged Array Case with VFO					
0.200	Square	AS46-540	**0.91869**	0.00129	0.92127	-0.01890	**0.94017**
0.200	Triangular	AT46-500	**0.91880**	0.00130	0.92140	-0.01890	**0.94030**
0.100	Square	BS46-600	**0.92574**	0.00128	0.92830	-0.01890	**0.94720**
0.100	Triangular	BT46-600*	**0.92768**	0.00050[1]	0.92868	-0.01890	**0.94758**
0.050	Square	CS46-616	**0.92402**	0.00128	0.92658	-0.01890	**0.94548**
0.050	Triangular	CT46-616	**0.92449**	0.00131	0.92711	-0.01890	**0.94601**
0.025	Square	DS46-616	**0.91810**	0.00124	0.92058	-0.01890	**0.93948**
0.025	Triangular	DT46-600	**0.91908**	0.00127	0.92162	-0.01890	**0.94052**

* Maximum Values Shown with Green Background

[1] 3800000 Neutron Histories

In these cases, homogeneous theoretical UO_2 (max. density = 10.96) of unlimited mass remains subcritical under optimum moderation. The reactivity of the single package system depends the effectiveness of the fuel in competing with other materials, such as the cadmium, hydrogen, stainless steel or water reflector, for absorption of thermal neutrons.

Figure 6.11 – NPC damaged single package results – 60 kgs Homogeneous UO_2 + H_2O



6.6.1.2 Damaged Single Package with Heterogeneous UO_2 in H_2O

Figures 6.12a through 6.12h show the reactivity of damaged single packages for the 55 . 53 and 46 kg UO_2 per ICCA cases described in the preceding sections. These plots (and the other plots of heterogeneous cases presented in the following sections) were generated in the same fashion as the ones for the homogeneous cases, utilizing a third order regression fit of the $k_{eff} \pm 2\sigma$ results. The figures demonstrate that with the specified pellet OD versus ICCA UO_2 mass limits, 0.34" for 55 kg, 0.30" for 53 kg and unlimited pellet diameter for 46 kg, the damaged single package remains subcritical under the most reactive configuration of material, W/F ratio, lattice array type (square or triangular), lattice boundary conditions (overlap or no overlap) and close reflection of the containment system by water on all sides in the surrounding materials in the packaging. As for the homogeneous case, the damaged single package is thus demonstrated to be a favorable geometry unit. The limiting conditions occur for the maximum foam burn condition with W/F ratios ~4 for the 55 and 53 kg case and around W/F ~5 for the 46 kg unlimited particle size diameter case.

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Figure 6.12a – NPC damaged single package k*eff* vs. W/F Ratio (10X10 pellet type, square pitch, 55 kgs UO2 / ICCA)

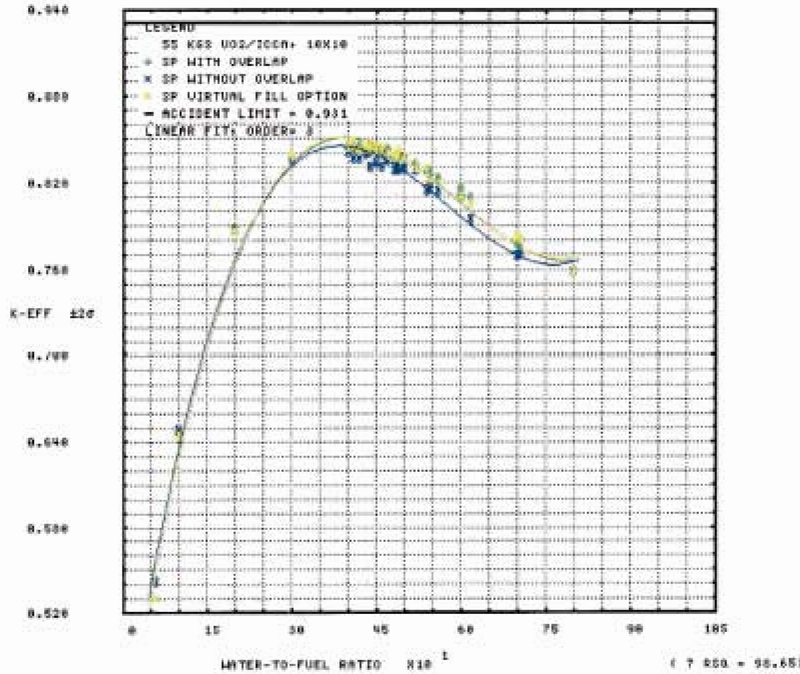


Figure 6.12b – NPC damaged single package k*eff* vs. W/F Ratio (10X10 pellet type, triangular pitch, 55 kgs UO2 / ICCA)

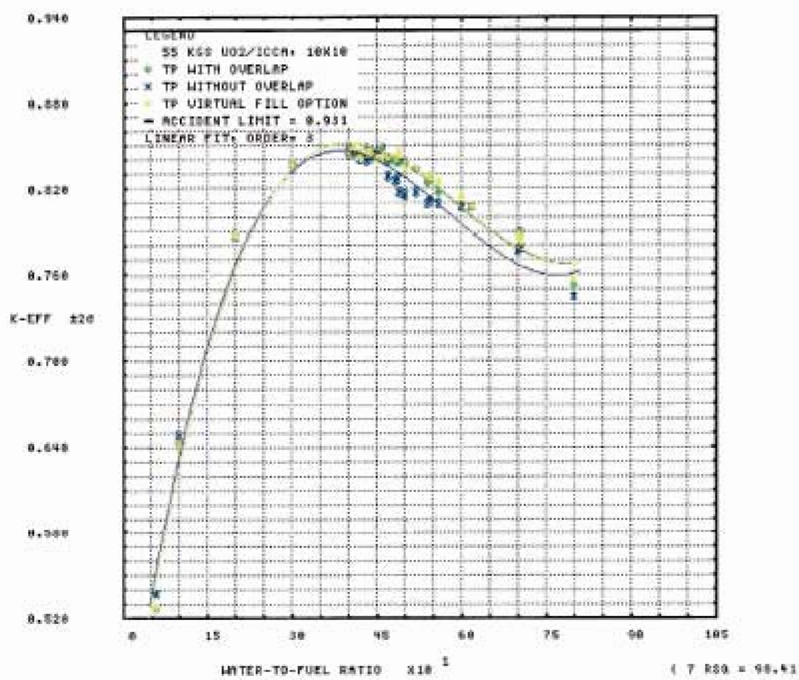


Figure 6.12c – NPC damaged single package k*eff* vs. W/F Ratio (reactivity comparison vs. pellet size, triangular pitch, 55 kgs UO_2/ICCA, VFO)

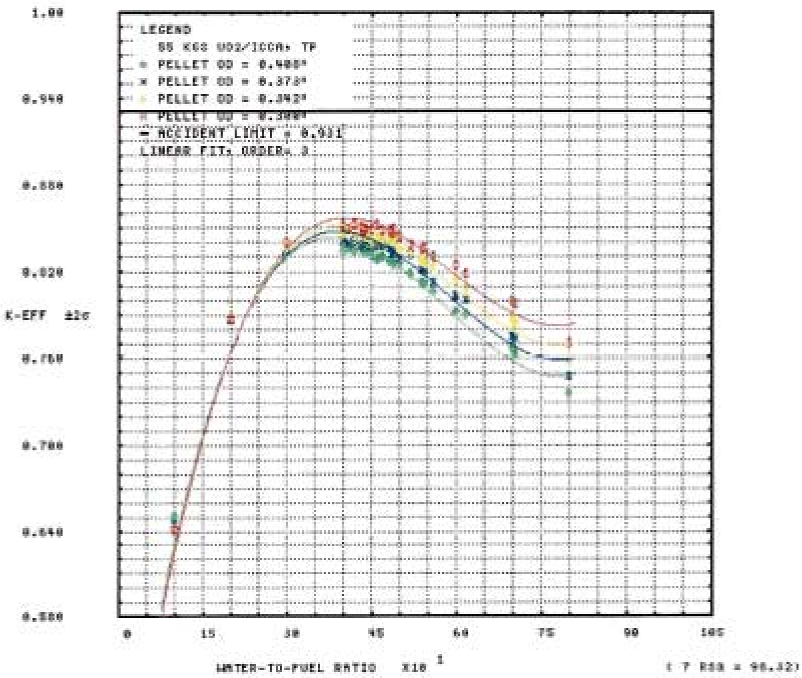


Figure 6.12d – NPC damaged single package k*eff* vs. W/F Ratio (17X17 pellet type, square pitch, 53 kgs UO_2/ICCA)

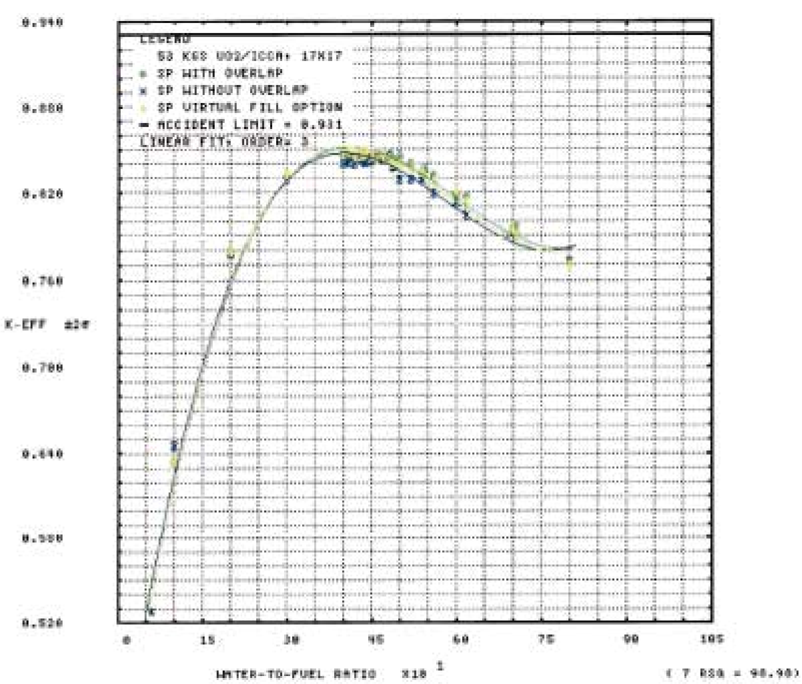


Figure 6.12e – NPC damaged single package k*eff* vs. W/F Ratio (17X17 pellet type, triangular pitch, 53 kgs UO_2/ICCA)

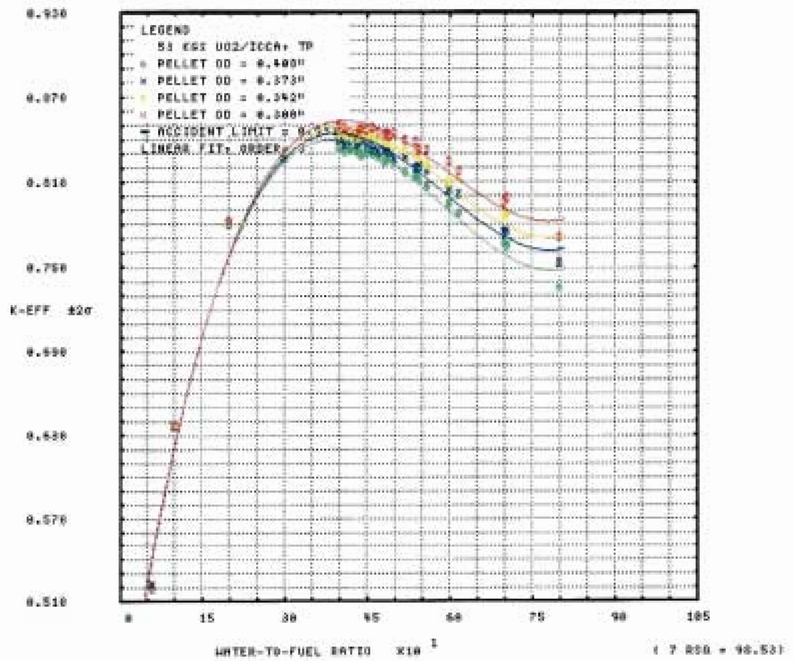


Figure 6.12f – NPC damaged single package k*eff* vs. W/F Ratio (reactivity comparison vs. pellet size for triangular pitch, 53 kgs UO_2/ICCA, VFO)

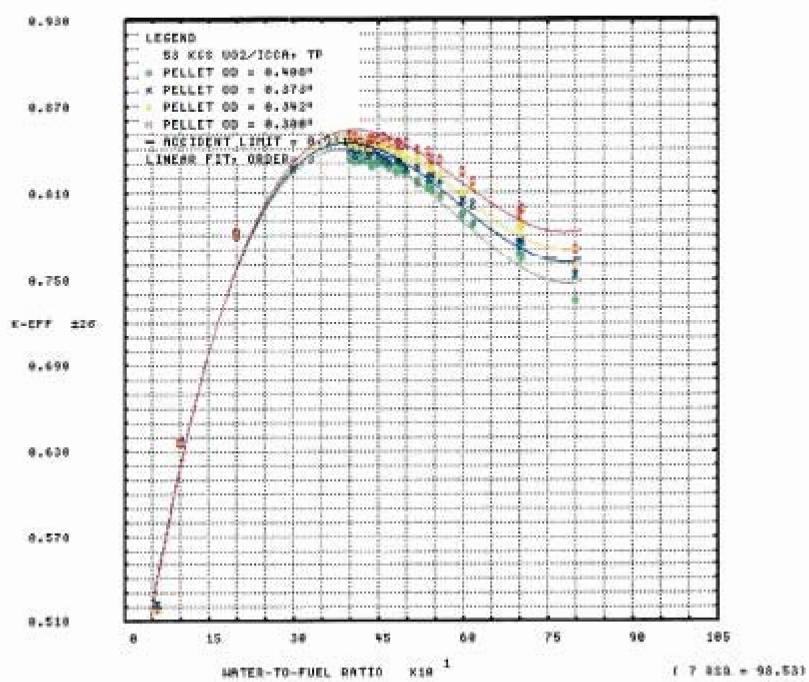


Figure 6.12g – NPC damaged single package k*eff* vs. W/F Ratio (unrestricted particle size, square pitch, 46 kgs UO_2/ICCA)

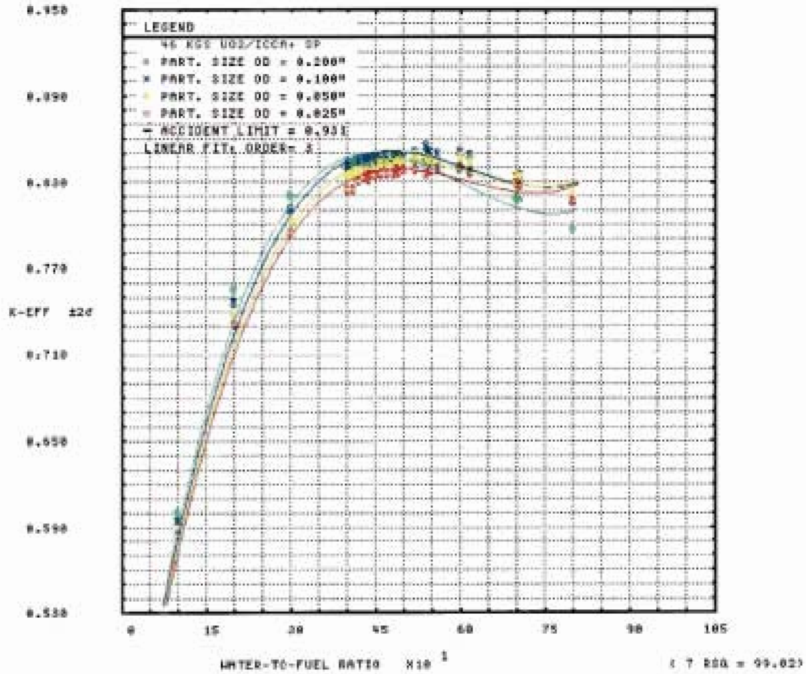
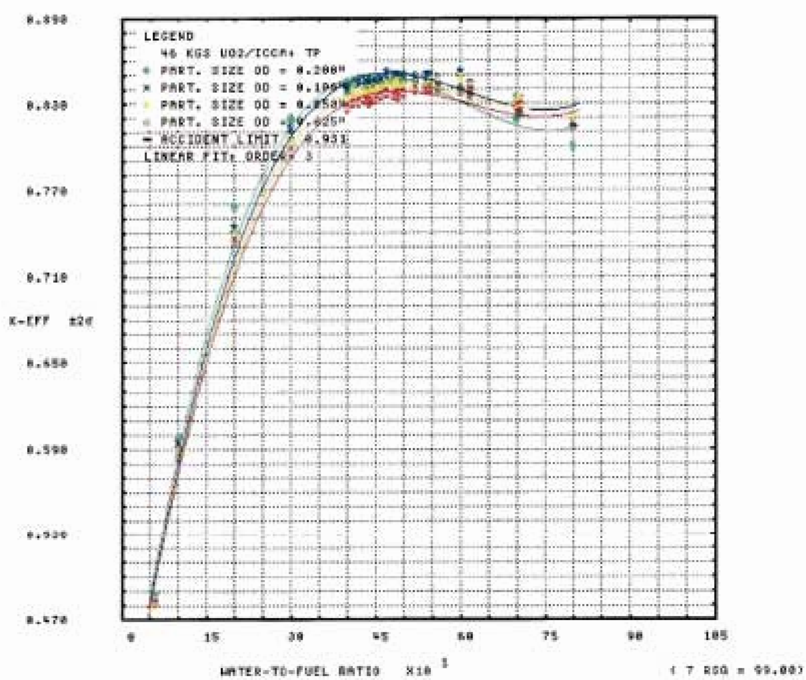


Figure 6.12h – NPC damaged single package k*eff* vs. W/F Ratio (unrestricted particle size, triangular pitch, 46 kgs UO_2/ICCA)



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From tables A and D in Table 6.9 above the maximum calculated $k_{eff} + 2\sigma$ - bias results for the damaged single package are:

FILENAME	UO2 MASS	K-EFF	SIGMA	K+2S	BIAS	K+2S-B
ESTP-400	55 kgs	0.8536	0.0014	0.8564	-.0189	0.8753
ESTN-437	53 kgs	0.8499	0.0014	0.8526	-.0189	0.8712
MTSL-540	46 kgs	0.8542	0.0015	0.8572	-.0189	0.8761

Several results shown in Figures 6.12a through 6.12h are generic to not only the damaged single container case but also the infinite undamaged array and 150 container damaged array cases. These are:

1. For the 55 and 53 kg UO_2 cases, the results using the VFO model are in excellent agreement with the results for the square and triangular lattices with overlap. This good agreement also expected to be even better in the cases for 46 kg UO_2 /ICCA (which cannot at present be explicitly modeled with GEMER's fix geometry capabilities) because of the large number of rods in each of the lattices (for the 0.200:, 0.100", 0.050" and 0.025" rod ODs).
2. The results for the 55 and 53 kg UO_2 cases without overlap are consistent lower than the same cases with overlap. (Note, however, that as described in section 6.4.3.4,the VFO cases are with overlap only.)
3. The entire set of results indicates that the optimum pellet diameter for the heterogeneous lattices is about 0.100". This is the explanation of why the 10X10 rod type results are the minimum allowable OD for the 55 kg UO_2 payload cases and the 17X17 pellet type results are the mimimun allowable OD for the lower 53 kg UO_2 payload cases (i.e. the 17X17 rod type has a 0.30" OD, the 10X10 rod type has a 0.34" OD, and the 9X9 and 8X8 rod types have progressively larger diameters of 0.376" and 0.408", respectively).
4. The triangular lattices usually tend to have the highest k_{eff}s, but their values do not differ greatly from the results for the square lattices. In a few cases the square lattices actually have larger keffs, which suggests that the differences are within statistical limits (2 to 4 σ, based on the number of different calculations made for this analysis).

6.6.2 DAMAGED PACKAGE ARRAYS

Calculations show that a damaged package array remains subcritical under general requirements for fissile material packages, for normal conditions of transport, and under hypothetical accident conditions. To meet the general requirements for fissile material packages, a fissile material package must be controlled to assure that an array of packages remains subcritical.

To enable this control, the designer shall derive a number "N" based on all of the following conditions being satisfied, assuming packages are stacked together in any arrangement and with close full reflection on all sides of the array by water such that: (a) 5N undamaged packages with nothing between the packages would be subcritical; (b) 2N damaged packages, if each package were subjected to tests specified in 10 CFR §71.73 would be subcritical with optimum interspersed hydrogenous moderation..

6.6.2.1 Damaged Package Arrays with Homogeneous UO_2 and H_2O

Figure 6.13 demonstrates a damaged NPC package array of size 5x5x6 (2N = 150) remains subcritical under CTU-1, CTU-2 observed non-uniform foam burn conditions. This figure also demonstrates the damaged package array remains subcritical under maximum foam burn conditions. A third order regression fit of the $k_{eff} \pm 2\sigma$ results are plotted as a function of ICCA payload.

The reactivity of the damaged package array depends on the effectiveness of the fuel in competing with other materials, such as the cadmium, hydrogen, stainless steel or water reflector for absorption of thermal neutrons. For damaged package array conditions, the amount of interstitial foam between packages becomes important to creating the required thermal spectrum necessary for effective thermal capture by cadmium.

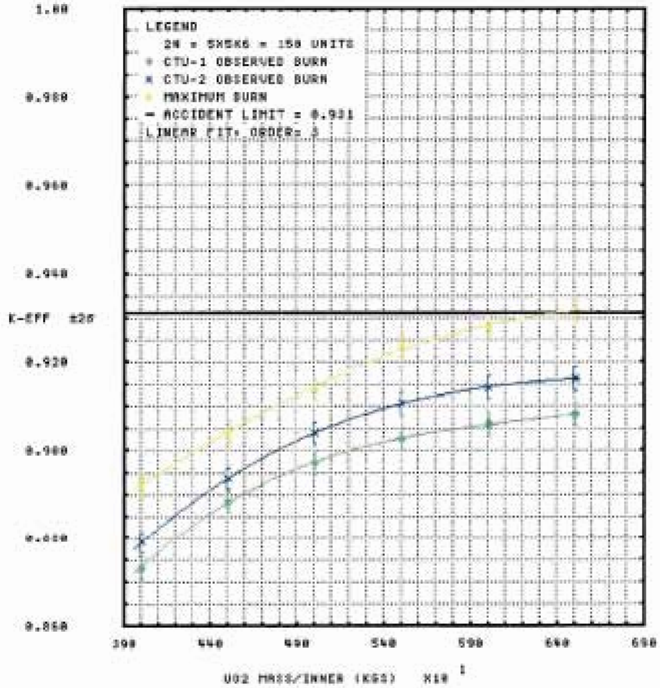
The homogeneous UO_2 payload is varied from 40 - 65 kgs UO_2 equivalent per ICCA (360 – 585 kgs UO_2 per NPC package). In these damaged package array cases, the system becomes mass and geometry limited. The ICCA spacing is modeled at 11.75" (29.845 cm), while the nominal spacing between ICCAs is 12.00" (30.48 cm). All damaged package array models remain below the accident limit $k_{eff,USL} = 0.931$ for up to 60 kgs UO_2 per ICCA.

From Table 6.16 in Section 6.10, the maximum calculated $k_{eff} + 2\sigma$ - bias results for the undamaged package array at 60 kgs UO2 per ICCA are:

FILENAME	K-EFF	SIGMA	K+2S	BIAS	K+2S-B
npca1_60	0.9059	0.0013	0.9084	-.0189	0.9273
npca2_60	0.9141	0.0013	0.9167	-.0189	0.9356
npcat_60	0.9275	0.0012	0.9299	-.0189	0.9488

As expected, the maximum burn condition is demonstrated the most reactive damaged package array model, though the interstitial 7-lb/ft^3 foam region between ICCAs and the 0.570-inch polyethylene are sufficient to maintain the damaged package array subcritical (e.g., $k_{eff} + 2\sigma$ - bias < 0.95).

Figure 6.13 – NPC damaged package array k_{eff} vs. UO_2 mass per canister (CTU-1, CTU-2, and maximum observed foam burn conditions)



6.6.2.2 Damaged Package Arrays with Heterogeneous UO_2 in H_2O

Figures 6.14a through 6.14h show the reactivity of damaged package arrays for the 55.0, 53.0 and 46.0 kgs UO_2 per ICCA cases. The figures demonstrate that with the specified pellet OD versus ICCA UO_2 mass limits, 0.34" (or larger) for 55.0 kg UO2 payload, 0.30" (or larger) for 53.0 kg UO2 payload, and for unrestricted particle diameters, the maximum payload is demonstrated 46.0 kg UO2. In all caes, the damaged package array remains subcritical (i.e., have $k_{eff} + 2\sigma$ - bias < 0.95) under the most reactive configuration of material, W/F ratio, lattice array type (square or triangular), lattice boundary conditions (overlap or no overlap) and close reflection of the containment system by water on all sides in the surrounding materials in the packaging.

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Figure 6.14a – NPC damaged package array keff vs. W/F Ratio (10X10 pellet type, square pitch, 55 kgs UO_2/ICCA)

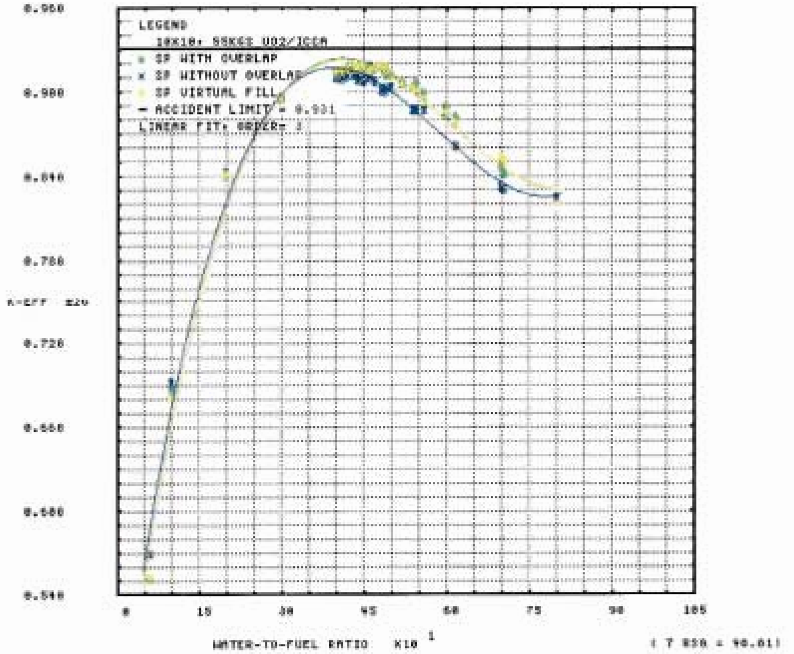


Figure 6.14b – NPC damaged package array keff vs. W/F Ratio (10X10 pellet type, triangular pitch, 55 kgs UO_2/ICCA)

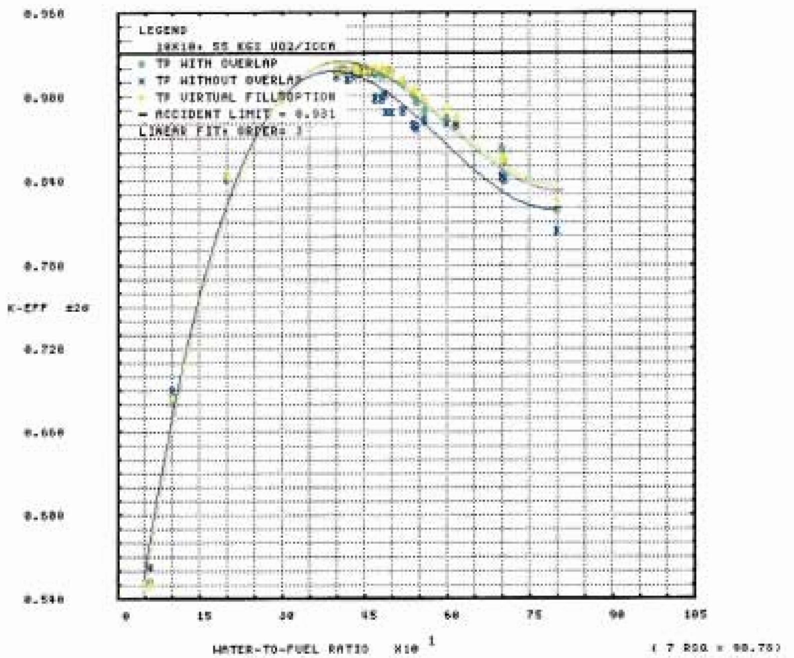


Figure 6.14c – NPC damaged package array k*eff* vs. W/F Ratio (reactivity comparison vs. pellet size, triangular pitch, 55 kgs UO_2/ICCA, VFO)

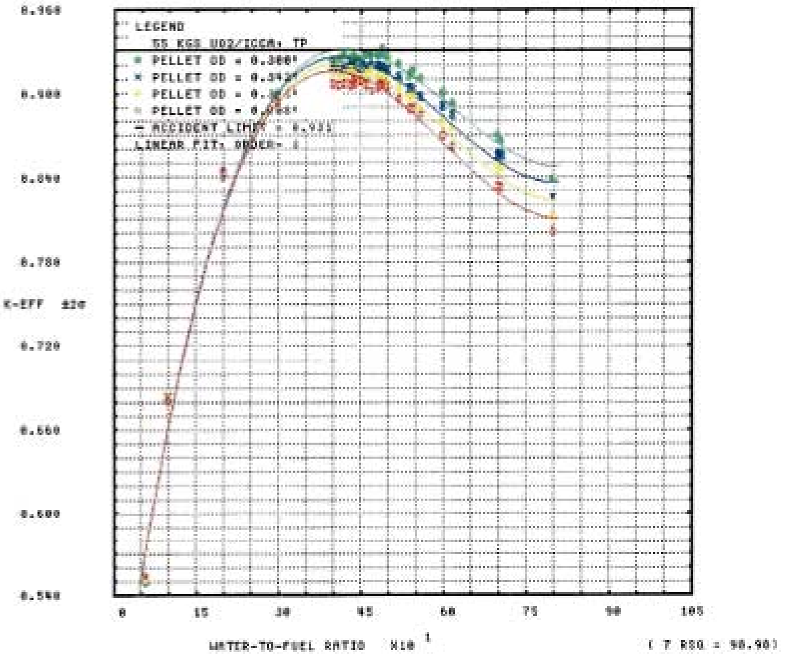


Figure 6.14d – NPC damaged package array k*eff* vs. W/F Ratio (17X17 pellet type, square pitch, 53 kgs UO_2/ICCA)

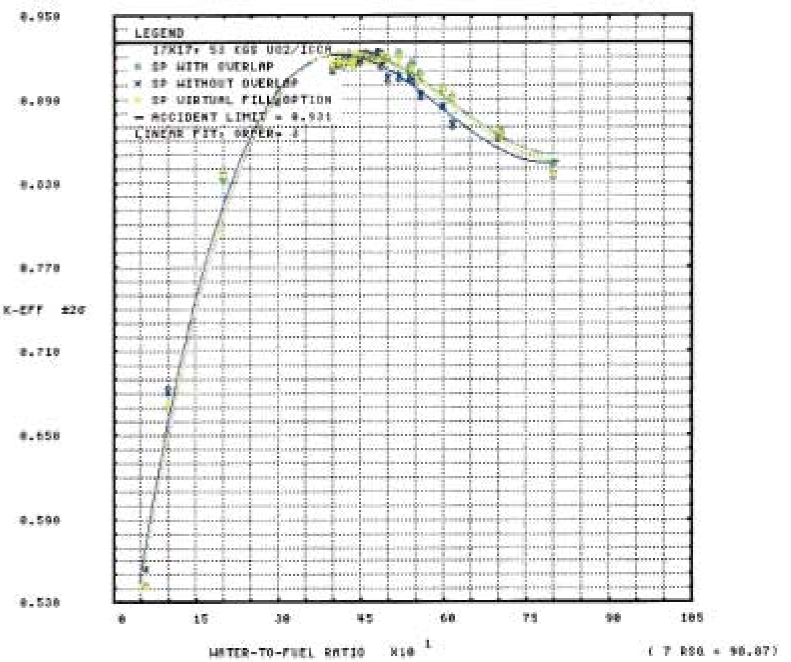


Figure 6.14e – NPC damaged package array keff vs. W/F Ratio (17X17 pellet type, triangular pitch, 53 kgs UO_2/ICCA)

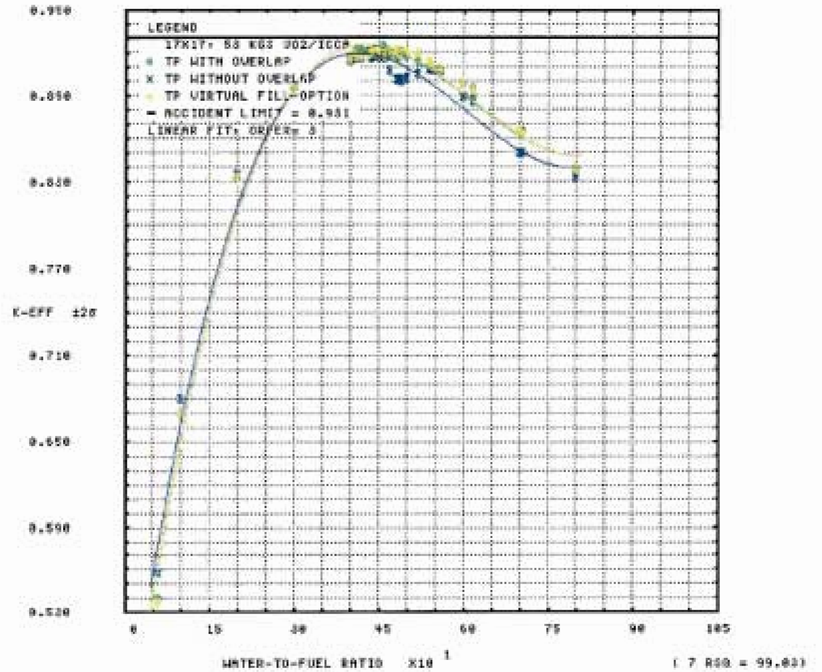


Figure 6.14f – NPC damaged package array keff vs. W/F Ratio (reactivity comparison vs. pellet size for triangular pitch, 53 kgs UO_2/ICCA, VFO)

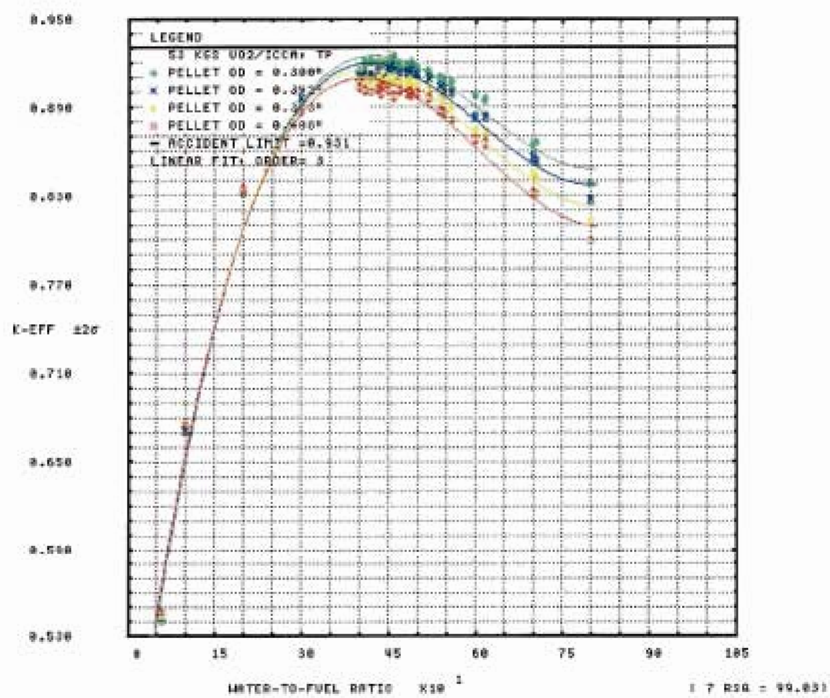


Figure 6.14g – NPC damaged package array k*eff* vs. W/F Ratio (unrestricted particle size, square pitch, 46 kgs UO_2/ICCA)

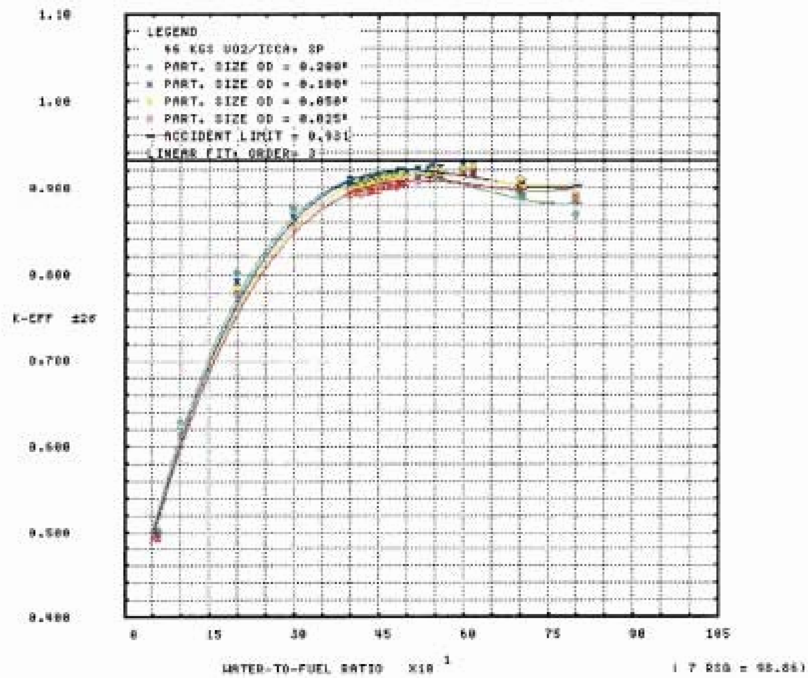
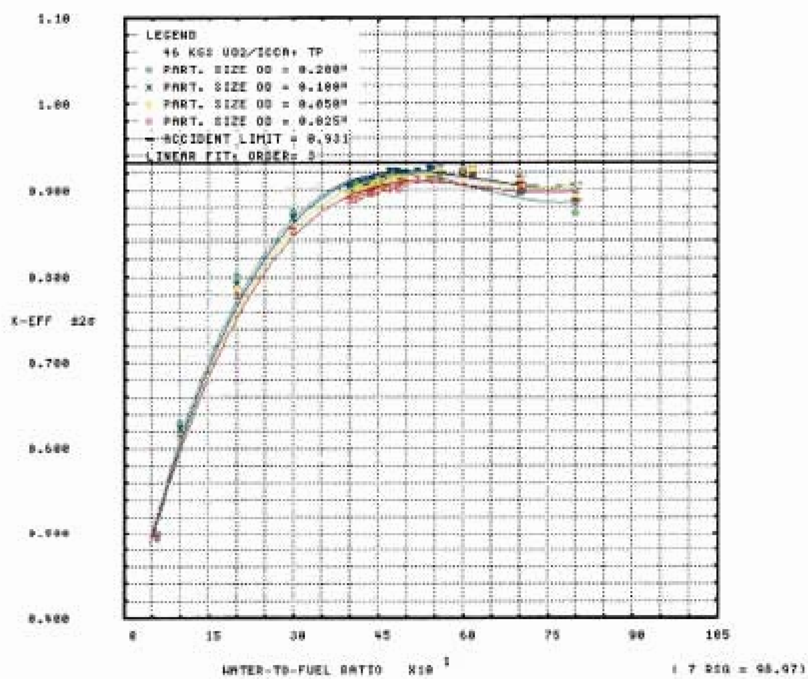


Figure 6.14h – NPC damaged package array k*eff* vs. W/F Ratio (unrestricted particle size, triangular pitch, 46 kgs UO_2/ICCA)



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From tables C and D in Table 6.9 above, the maximum calculated $k_{eff} + 2\sigma$ - bias results for the damaged package arrays are:

FILENAME	UO2 MASS	K-EFF	SIGMA	K+2S	BIAS	K+2S-B	
ST55-486*	55 kgs	0.9280	0.0014	0.9307	-.0189	0.9496	- a 17X17 Case
TT55-450	55 kgs	0.9207	0.0014	0.9235	-.0189	0.9424	- a 10X10 Case
ST53-460	53 kgs	0.9242	0.0013	0.9263	-.0189	0.9456	- a 17x17 Case
BT46-600	46 kgs	0.9277	0.0005	0.9287	-.0189	0.9476	- a 0.1" OD Case

*VFO Case; Also, SIGMA for case BT46-600 is based on 3,800,000 neutron histories

Notes 1-4 in Section 6.6.1.2 also apply to these results.

6.6.3 UNDAMAGED PACKAGE ARRAYS

6.6.3.1 Undamaged Package Arrays with Homogeneous UO_2 and H_2O

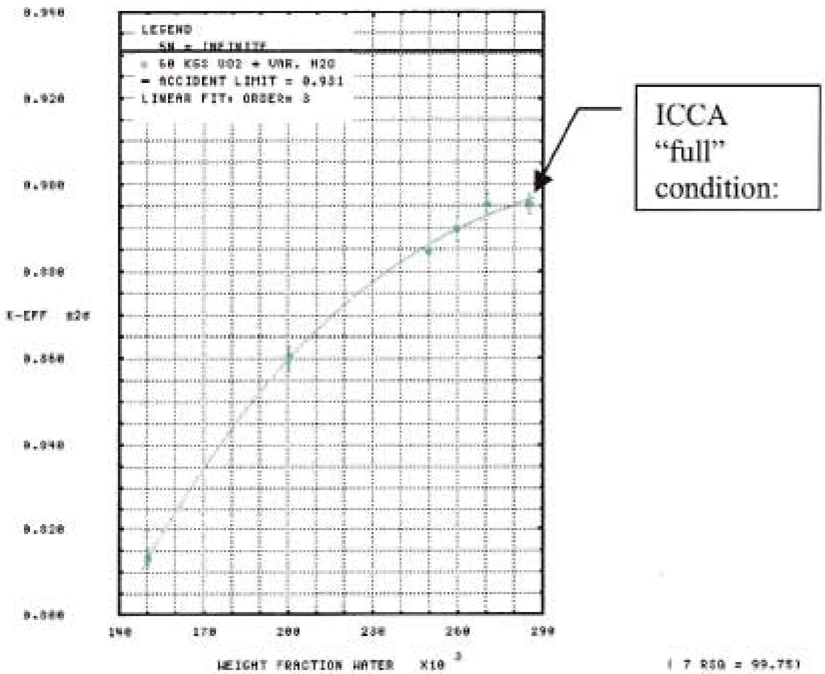
Figure 6.15 demonstrates that an undamaged NPC package array of unlimited size ($5N = \infty$) remains subcritical provided the UO_2 equivalent payload is restricted to 60 kgs per ICCA. The fuel mixture condition with 60 kgs UO_2 fuel containing a varying amount of added H_2O, as described in section 6.3.1.4, *Materials*, Table 6.5, has been evaluated. In this worse case condition, a third order regression fit of the Keff $\pm 2\sigma$ results are plotted as a function of WF H_2O from 0.140 to 0.290. It is noted that prior evaluations have demonstrated that mixtures with the 60 kgs UO_2 mass limit and a varying amount of H_2O are more reactive than mixtures that contain 60 kg total weight of UO_2 and H_2O.

From Table 6.16 in Section 6.10, the maximum calculated $k_{eff} + 2\sigma$ - bias results for the undamaged package array are:

FILENAME	K-EFF	SIGMA	K+2S	BIAS	K+2S-B	
npc60i26	0.8897	0.0014	0.8925	-.0189	0.9114	WF H_2O = 0.260
npc60i27	0.8956	0.0013	0.8982	-.0189	0.9171	WF H_2O = 0.270
npc60i28	0.8954	0.0012	0.8978	-.0189	0.9167	WF H_2O = 0.280

As shown, under normal conditions of transport, the UO_2 equivalent product is subcritical at an optimum WF of H_2O. Therefore, the NPC package is not required to be restricted in moderator content in the individual ICCAs, provided that the type and form of the moderator is no more effective than normal H_2O.

Figure 6.15 – NPC undamaged package array *Keff* vs. Weight Fraction H_2O (60 kgs UO2 compound/ICCA)



6.6.3.2 Undamaged Package Arrays with Heterogeneous UO_2 in H_2O

Figures 6.16a through 6.16h show the reactivity of undamaged package arrays for the 55, 53 and 46 kg UO_2 per ICCA cases described in the preceding sections. The figures demonstrate that with the specified pellet OD versus ICCA UO_2 mass limits, 0.34" for 55 kg, 0.30" for 53 kg and unlimited pellet diameter for 46 kg, the undamaged package arrays remain subcritical under the most reactive configuration of material, W/F ratio, lattice array type (square or triangular), lattice boundary conditions (overlap or no overlap) and close reflection of the containment system by water on all sides in the surrounding materials in the packaging.

Figure 6.16a – NPC undamaged package array keff vs. W/F Ratio (10X10 rod type, square pitch, 55 kgs UO_2/ICCA)

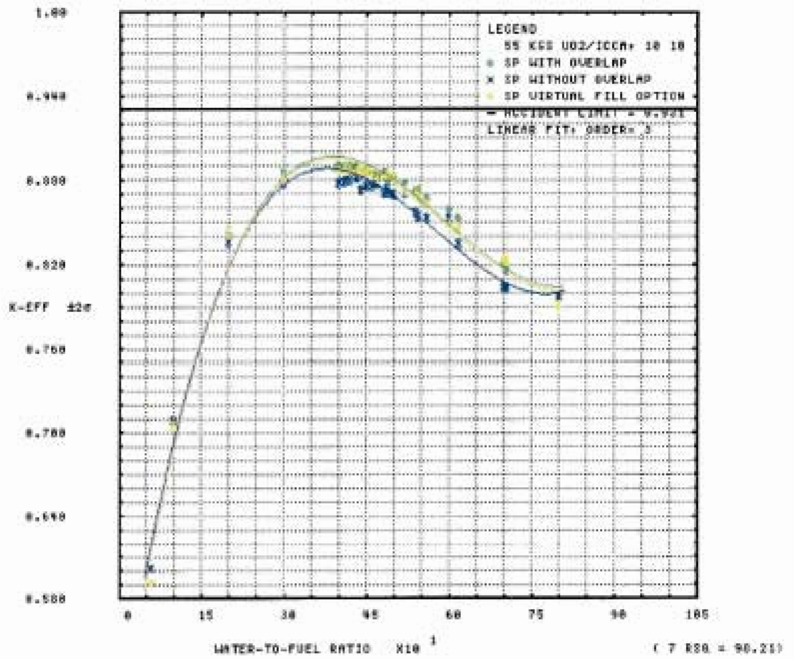


Figure 6.16b – NPC undamaged package array keff vs. W/F Ratio (10X10 rod type, triangular pitch, 55 kgs UO_2/ICCA)

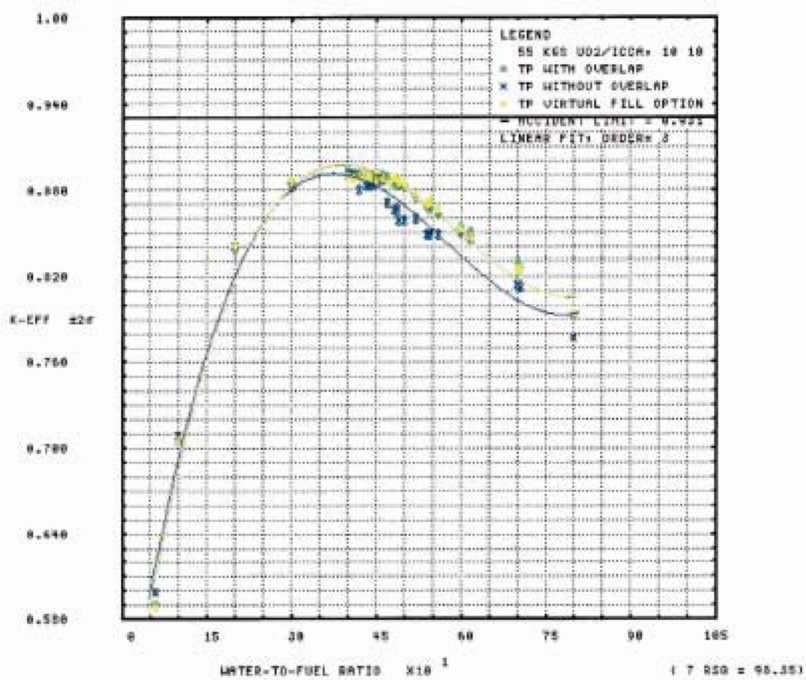


Figure 6.16c – NPC undamaged package array k*eff* vs. W/F Ratio (reactivity comparison vs. pellet size, triangular pitch, 55 kgs UO_2/ICCA, VFO)

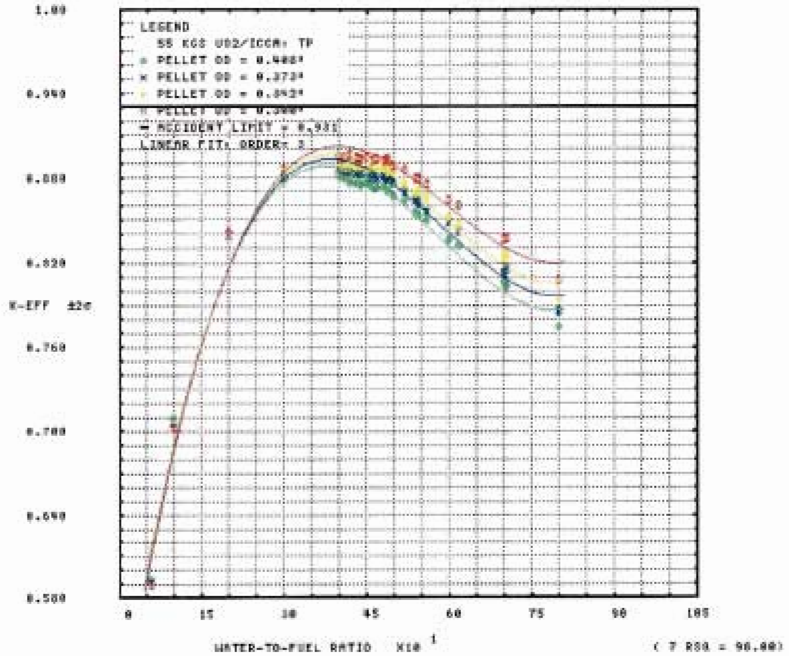


Figure 6.16d – NPC undamaged package array k*eff* vs. W/F Ratio (17X17 rod type, square pitch, 53 kgs UO_2/ICCA)

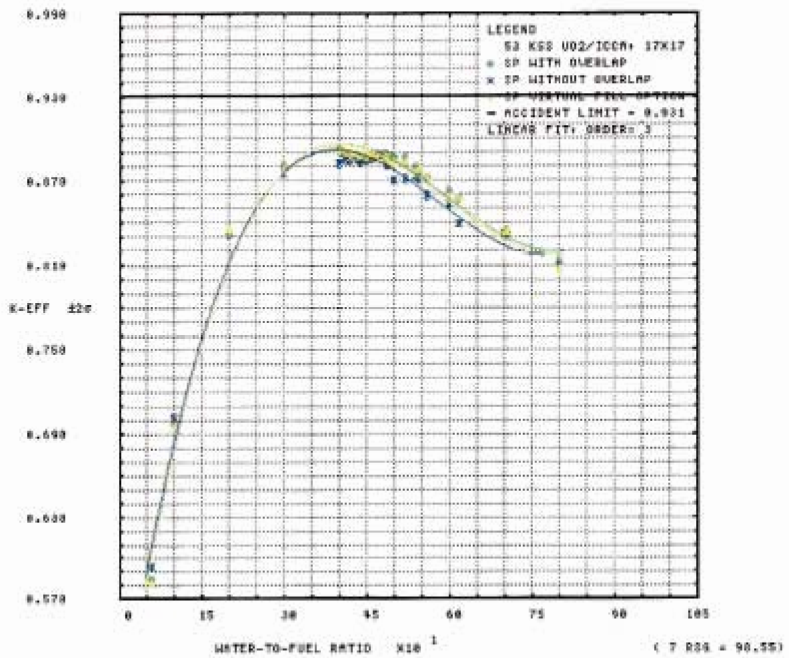


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Figure 6.16e – NPC undamaged package array k*eff* vs. W/F Ratio (17X17 rod type, triangular pitch, 53 kgs UO_2/ICCA)

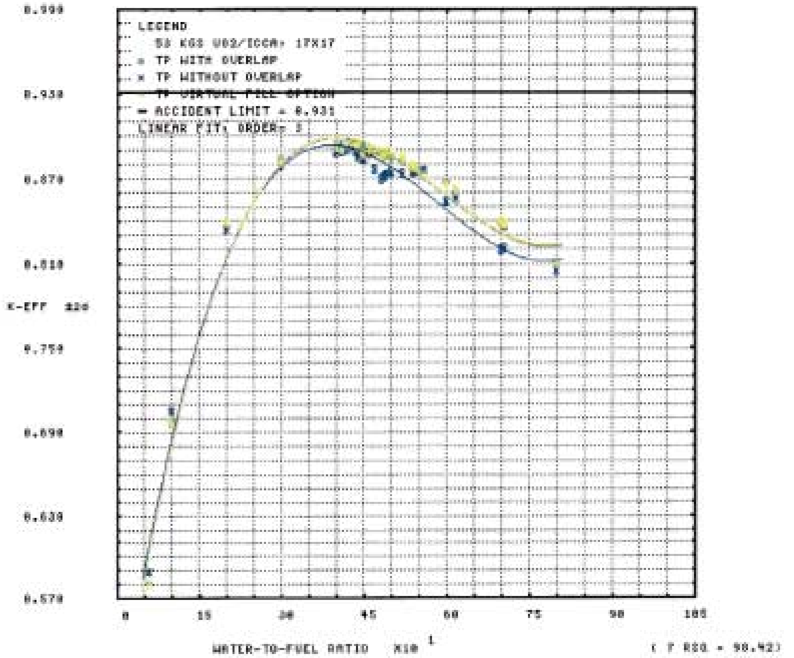


Figure 6.16f – NPC undamaged package array k*eff* vs. W/F Ratio (reactivity comparison vs. pellet size for triangular pitch, 53 kgs UO_2/ICCA, VFO)

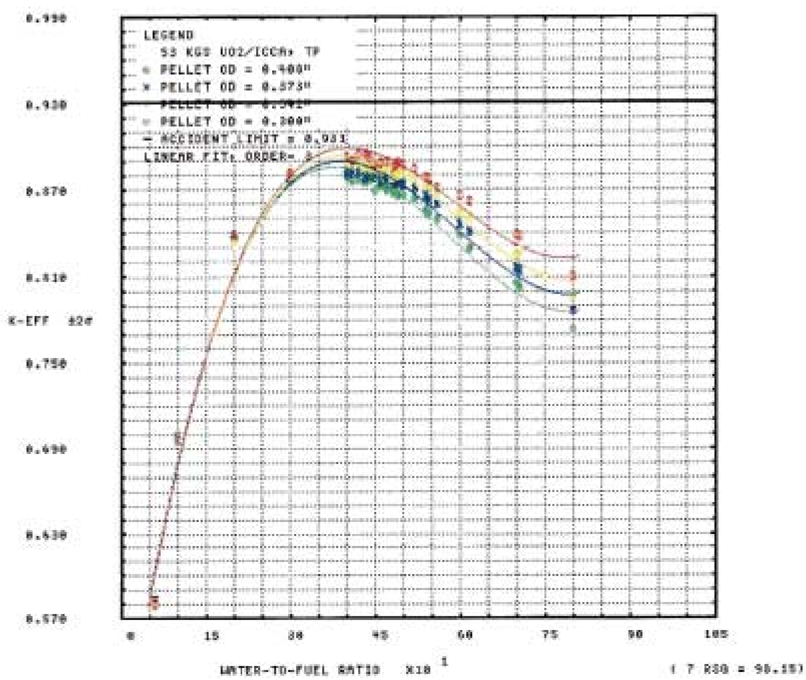


Figure 6.16g – NPC undamaged package array k*eff* vs. W/F Ratio (unrestricted particle size, square pitch, 46 kgs UO_2/ICCA)

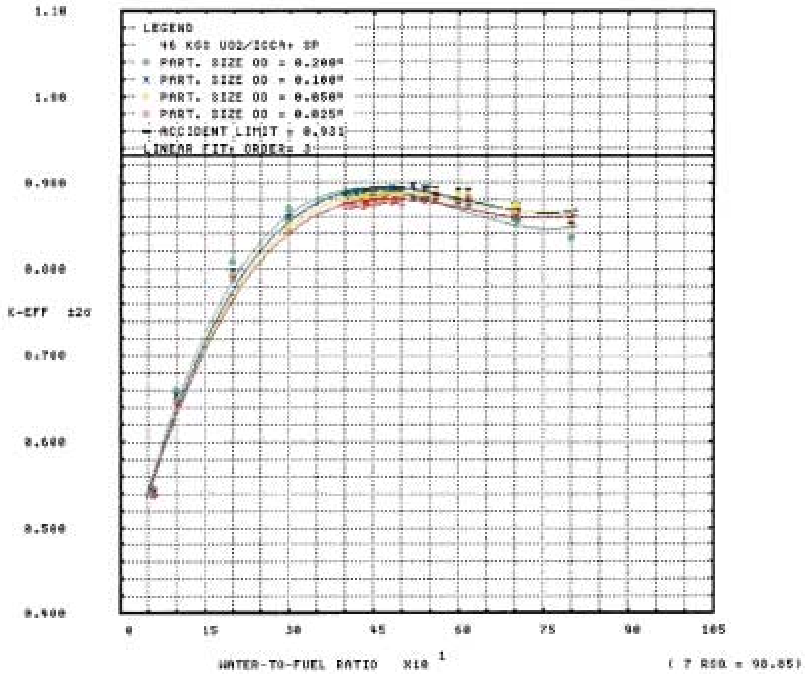
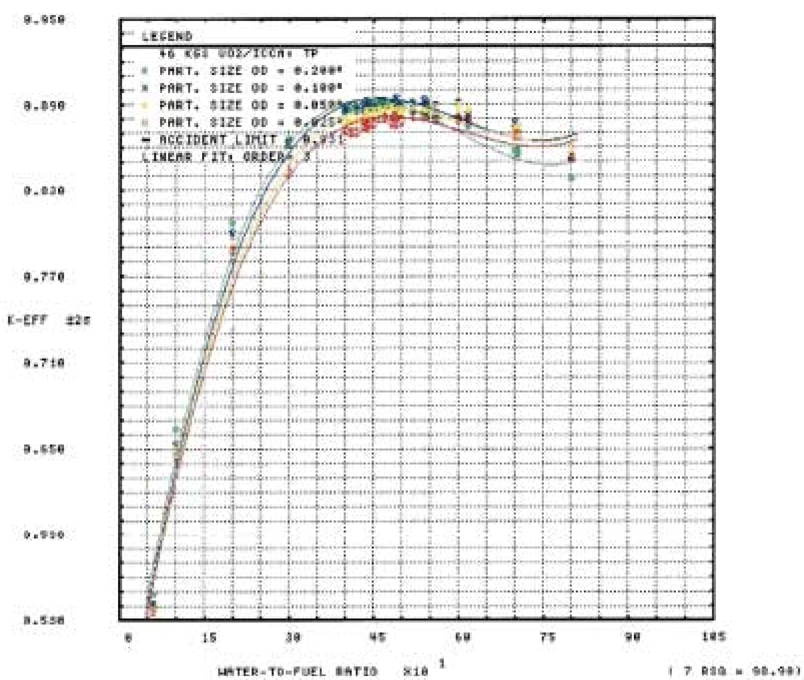


Figure 6.16h – NPC undamaged package array k*eff* vs. W/F Ratio (unrestricted particle size, triangular pitch, 46 kgs UO_2/ICCA)



From tables B and D in Table 6.9 above the maximum calculated $k_{eff} + 2\sigma$ - bias results for the undamaged package arrays are:

FILENAME	UO2 MASS	K-EFF	SIGMA	K+2S	BIAS	K+2S-B
DSTP-437	55 kgs	0.8980	0.0013	0.9005	-.0189	0.9194
BSTN-430*	53 kgs	0.8947	0.0013	0.8973	-.0189	0.9162
ABSL-520	46 kgs	0.8960	0.0013	0.8987	-.0189	0.9176

*VFO Case

Notes 1-4 in Section 6.6.1.2 also apply to these results.

6.6.4 SENSITIVITY STUDIES WITH HOMOGENEOUS UO2 + H2O

6.6.4.1 Sensitivity Study - Damaged Package Array Shape

As described in section 6.3.4.2, cases were run to confirm the most reactive aspect ratio of the damaged package array shape. The standard near cubic 5x5x6 array (case npcat_60.in) is confirmed representative of the most reactive configuration relative to the 6x5x5 (case npcatv60.in) and the 9x9x2 array (case npcatw60.in) for equivalent package payload and foam burn conditions. Though it is noted that there is little statistical difference between the 5x5x6 and 6x5x5 damaged package array models. From summary Table 6.16, the maximum calculated $k_{eff} + 2\sigma$ - bias results for the damaged package array shape study (60 kgs UO_2 per ICCA) are:

FILENAME	K-EFF	SIGMA	K+2S	BIAS	K+2S-B
npcat_60	0.9275	0.0012	0.9299	-.0189	0.9488
npcatv60	0.9274	0.0012	0.9298	-.0189	0.9487
npcatw60	0.9132	0.0012	0.9156	-.0189	0.9345

6.6.4.2 Sensitivity Study - Damaged Package Array Moderator Content and Payload

As described in section 6.3.1.4, Materials, Table 6.6, cases were also run to confirm the most reactive damaged package array internal ICCA moderation condition. Lower weight fraction water cases were run to confirm the most reactive condition occurs when the mixture height for this mass just fills the internal volume of the ICCA. From summary Table 6.16, the results are:

FILENAME	K-EFF	SIGMA	K+2S	BIAS	K+2S-B	
npcatx60	0.8102	0.0013	0.8128	-.0189	0.8317	(wf_h2o=0.15)
npcaty60	0.8671	0.0013	0.8697	-.0189	0.8886	(wf_h2o=0.20)
npcatz60	0.9081	0.0014	0.9108	-.0189	0.9297	(wf_h2o=0.25)
npcat_60	0.9275	0.0012	0.9299	-.0189	0.9488	(wf_h2o=0.28504)

The above results confirm the most reactive condition occurs when the mixture height just fills the ICCA volume (limiting damaged array case npcat_60.in, wtfr. H_2O = 0.28504).

If additional water is added such that UO_2 mass is driven out of the ICCA, Figure 6.13 in Section 6.6.2.2 demonstrates system reactivity will decrease. These results support the fact that any UO_2 payload distribution is acceptable provided the maximum mass in any one of the nine ICCAs does not exceed 60 kgs UO2 (52.9 kgs U). Relative to 60 kgs UO2, by lowering the UO2 payload in any ICCA would result in a less reactive damaged package array.

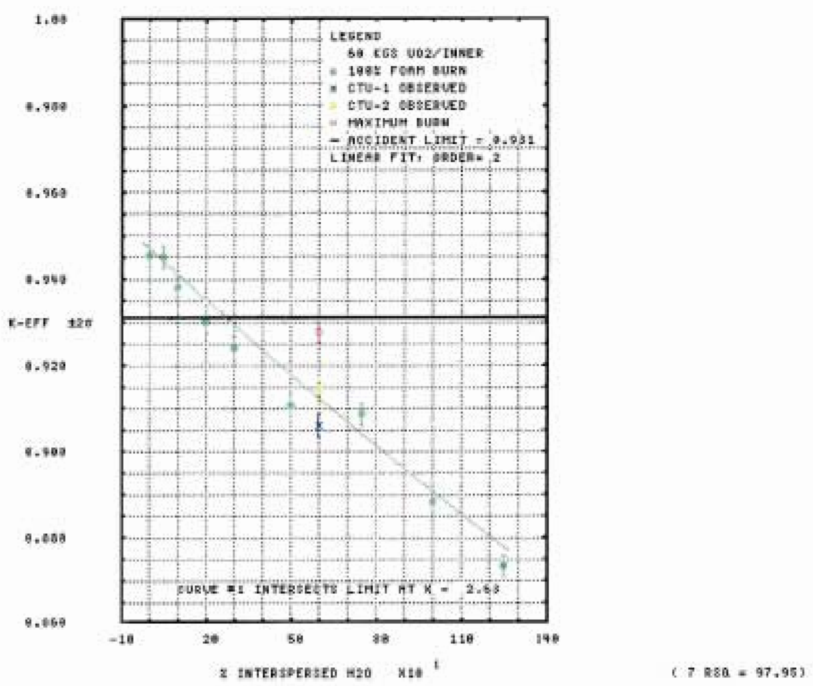
6.6.4.3 Sensitivity Study - Damaged Package Array 100% Foam Burn

Figure 6.17 determines the worth of the foam for the limiting damaged package array determined in Section 6.6.2, Package Arrays. In this figure, 100% internal foam burn is assumed, and replaced with variable density H_2O. The figure shows the void condition is the most reactive, and the damaged package array becomes safe ($k_{eff} + 2\sigma$ - bias < 0.931) when the interspersed hydrogenous reaches ~ 2.63% water equivalent (or greater).

The 60 kg UO_2 per ICCA damaged package array results for CTU-1, CTU-2, and maximum burn models are provided in Figure 6.17 for comparison purposes. The 6% hydrogen content in the inner 7-lb/ft^3-foam region is demonstrated sufficient to maintain the damaged package subcritical. In general, increasing hydrogen content between packages reduces the reactivity of the NPC damaged package containing optimally moderated UO_2 canisters. The damaged package therefore exhibits an over-moderated behavior.

This is substantiated by the fact that package reactivity increases as the foam burn depth (see Figure 6.13) is increased to its maximum observed condition. This effect also underscores the use of void for the ceramic fiberboard around the periphery, and the use of void for the postulated burn regions instead of low interspersed water moderation.

Figure 6.17 – NPC damaged package array k_{eff} vs. interspersed H_2O (100% foam burn condition)

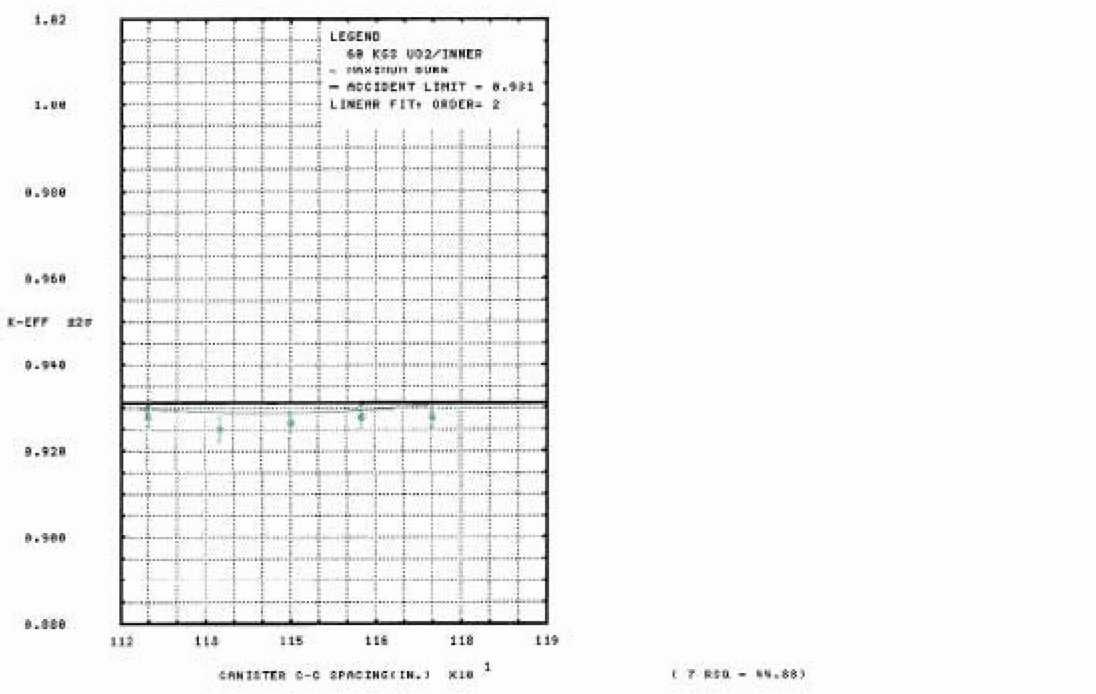


6.6.4.4 Sensitivity Study - Damaged Package Array ICCA Spacing

Figure 6.18 demonstrates the damaged package reactivity behavior as a function of ICCA spacing. A second-order regression fit of the $K \pm 2\sigma$ results is shown. The 60 kg UO_2 per ICCA payload, maximum burn model is used as the basis for the center-to-center canister spacing study.

This figure demonstrates little sensitivity from movement of the ICCA from the standard center-to-center spacing of 11.75" (29.845 cm) to 11.25" (28.575 cm). Therefore, the 11.75" standard spacing is sufficiently conservative representation of the nominal ICCA spacing of 12" (30.48 cm). The reactivity of the damaged package array is not adversely affected by ICCA center-to center movement of up to ¾".

Figure 6.18 – NPC damaged package array k_{eff} vs. canister spacing



6.6.4.5 Sensitivity Study - Damaged Package Array Structure

The effect of adding certain external stainless steel structure into the limiting condition model is made to determine effect package reactivity. In particular the bottom of each NPC package is comprised of eight (8) 6x3x3/16" rectangular tubes, four (4) 6x1-1/2x19.25" connecting channels, and a 16-ga. 18x18" square doubler plate. A conservative estimate that includes maximum manufacturing tolerance of this structure mass associated is determined to be 40.8 kgs.

If this mass of 40.8 kgs is then "smeared" over the bottom layer of the package, an additional thickness of 0.4365 cm may be included in the modeled bottom plate thickness [e.g., δh = mass_ss/(rho_ss*l*w) = 40,800/(7.9*108.7743*108.7743) = 0.4365 cm].
The reactivity comparison is made for the limiting damaged package array case using the acceptable 60 kg UO_2 per ICCA. From Table 6.16, the result is:

FILENAME	K-EFF	SIGMA	K+2S	BIAS	K+2S-B
npcat_60	0.9275	0.0012	0.9299	-.0189	0.9488
npcats60	0.9240	0.0012	0.9264	-.0189	0.9453

Relative to the limiting damaged package array model (npcat_60), the additional external stainless steel (npcats60.in) structure on the bottom of the package results in a ~0.4% delta-k/k reactivity reduction.

6.6.4.6 Sensitivity Study - Damaged Package Array Poly Gap

The effect of polyethylene gap as determined from the physical measurements of the ICCAs post HAC testing is assessed to confirm the modeled poly height and density assumptions.

In the first case (npcatg60.in), the modeled polyethylene height of is reduced by 75 mils to the minimum specified height of 30.3" (the density remains constant at 0.92*0.98 to offset the 0.6 wt% maximum observed poly weight loss under accident conditions). No statistical change in reactivity relative to the limiting condition damaged package array model (npcat_60.in) resulted.

In the second case (npcatf60.in), the modeled polyethylene height surrounding all 9 ICCAs is reduced to correspond to the maximum observed gap conditions post HAC testing. The cumulative gap at the top plus bottom of the polyethylene wrap was measured for all ICCAs in CTU-1 and CTU-2. Maximum gap measurements for CTU-1 and CTU-2 test units are reported in Sections 2.10.1.7.1.6 and 2.10.1.7.2.6, respectively.

The maximum observed total gap was 0.40" top + 0.29" bottom = 0.69" and reported in certification test results Section 2.10.1.2, Summary. For this study, the top gap was increase from 1/8" (0.3175 cm) to its maximum of 0.4" (1.016 cm). The bottom gap was increased from 1/8" (0.3175 cm) to its maximum of 0.29" (0.7366 cm). Since the gap is explicitly modeled, the poly density of 0.92 g/cc is applied. Again, no statistical change in reactivity relative to the limiting condition damaged package array model resulted.

From Table 6.16, reactivity comparisons are as follows:

FILENAME	K-EFF	SIGMA	K+2S	BIAS	K+2S-B
npcat_60	0.9275	0.0012	0.9299	-.0189	0.9488
npcatg60	0.9271	0.0012	0.9296	-.0189	0.9484
npcatf60	0.9273	0.0013	0.9299	-.0189	0.9488

These results support the assumption that the 2% polyethylene density reduction factor applied to the damaged package array models are conservative and adequately address the observed polyethylene weight loss and model height.

6.6.5 CRITICALITY SAFETY INDEX

The number of packages that remain below the upper safety limit determines the Criticality Safety Index (CSI) for criticality control. For normal conditions of transport, an infinite array size ($5N = \infty$) remains subcritical. Under hypothetical accident conditions, the contents of $2N=150$ packages would remain subcritical.

$$CSI = 50/75 = 0.6667 \approx 0.7.$$

6.7 REFERENCES

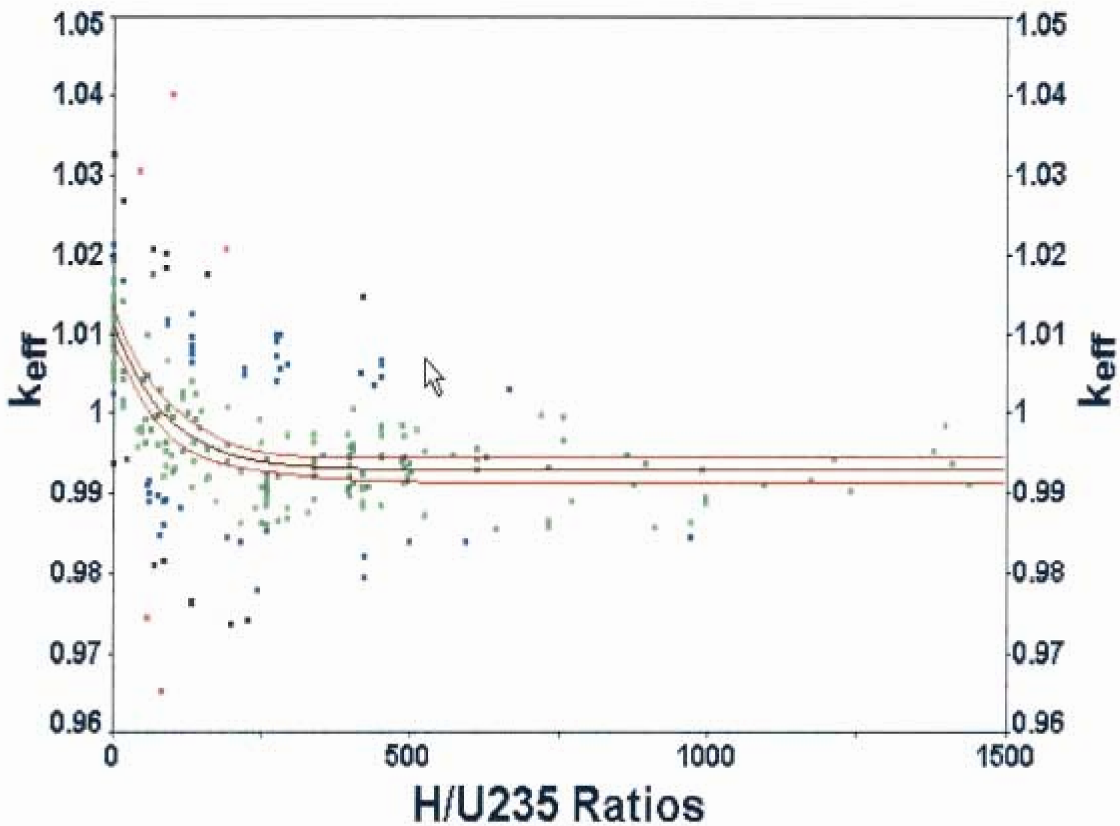
1. "GEMER - Microcomputer Version Users Guide," JT Taylor, 4/20/94.
2. "Validation of the GEMER Monte Carlo Code for Applications with Enriched Uranium Fuels at GE Nuclear Fuels in Wilmington, NC", GENE Technical Report, WC Peters, 12/8/97.
3. "Criticality Safety Analysis: Evaluation of Cadmium Bias in the GEMER Code," Rev. 01, JF Zino, 1/27/2000.
4. "Recommendations for Preparing the Criticality Safety Evaluation of Transportation Packages," NUREG/CR-5661, ORNL/TM-11936, H.R. Dyer, C.V. Parks, April 1997.
5. U.S. Code of Federal Regulations, "Packaging and Transpiration of Radioactive Material," Part 71, Chapter I, Title 10, "Energy".
6. IAEA – Safety Standards Series: Regulations for the Safe Transport of Radioactive Material, Requirements, No. ST-1, 1996 Edition
7. International Handbook of Evaluated Criticality Safety Benchmark Experiments, NEA/NSS/DOC(95)03, NEA Nuclear Science Committee, Vol. IV, September 1999.
8. MCNP4C / MCNPDATA – A General Monte Carlo N-Particle Transport Code System, CCC-200, Radiation Shielding Information Center, Oak Ridge National Laboratory, July 2000.
9. MINITAB, Release 12.1, Minitab for Windows, Minitab Inc., ISBN 0-925636-35-5, 1996.

6.8 APPENDIX – VALIDATION OF GEMER

6.8.1 GEMER URANIUM BIAS

The GEMER Monte Carlo Code has been validated against an extensive set of critical benchmark experiments covering a broad range of enrichments, forms and densities of uranium, degrees of moderation and reflection, and types and amounts of neutron poisons (Ref. 2). Figure 6.19 shows a plot of this benchmark data along with a least square analysis of the code bias and statistical uncertainty.

Figure 6.19 – GEMER K_{eff}s vs. H/U-235 Ratios: 269 Benchmark Validation Set Rank 1 Eqn. 8002 [EXPONENTIAL] y = a + bexp(-x/c), where a= 0.99290588, b= 0.018116949, c= 90.332388



The dark red (center) curve in Figure 6.19 is the least square fit of the data and the bright red curves are the upper and lower 99% confidence intervals for the fit. As indicated, the complete benchmark data consists of the GEMER calculated k_{eff}s of 269 different critical experiments that has been fit with an exponential curve (y = a + b•exp(-b/c), with y = k_{eff} and x = H/U-235 ratio

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and a, b and c as given in the figure). The H/U-235 ratio is the ratio of the average atom densities of hydrogen and U-235 in the fuel region for each of the critical experiments.

For the complete 269-benchmark validation set, the H/U-235 ratios vary between 0.0 and approximately 1450. Optimum moderation is typically in the range of 150 to 500.
From Figure 6.19, the maximum bias + bias uncertainty is 0.00868. Here, the "bias + bias uncertainty" is defined to be the value (1.0 – lower 95% confidence interval of the GEMER critical k_{eff} curve). The σ corresponding to the bias uncertainty is in the range of about 0.0006 to 0.0008. The calculated results are consistent with a constant bias over a broad H/U-235 range. This range starts somewhere between an H/U-235 of 250 to 500 and continues out to the maximum ~1450.

For uranium oxides only, bias for GEMER and the ENDF/B-IV library has been established to be no greater than 0.009 (Δk_u - β) at a 99% confidence level. The area of applicability for the benchmark calculations is enrichment ranges from 1.29 to 9.83 weight percent U-235 and H/U-235 ratio 41 to 866. For uranium nitrate compounds (UN, UNH material forms), bias for GEMER and the ENDF/B-IV library has been established to be 0.0125 (Δk_u - β) at a 99% confidence level. The area of applicability for the UN, UNH benchmark calculations is enrichment ranges from 9.97 to 94.42 weight percent U-235 and H/U-235 ratio 45 to 1437.

6.8.2 GEMER CADMIUM BIAS

The above documents 269 critical experiments used to establish the bias for the GEMER code for a variety of applications involving enriched uranium. Since most of these experiments do not contain cadmium, the effect of cadmium on the bias is significantly diluted by the non-cadmium experiments. Hence, it was considered prudent to quantify any "bias adjustment" required to allow for the presence of cadmium poison in the NPC package.

A total of sixteen (16) benchmark experiments for UO_2 systems containing cadmium have been analyzed and used to derive the cadmium bias in the GEMER computer code. Of these 16, ten were performed by Sid Bierman et. al., and involved clusters of 4.31% enriched UO_2 rods in water with cadmium plates of varying thickness' placed in between the clusters. Of the remaining six experiments, five were also performed by Bierman et. al., and involved 2.35% enriched UO_2 rod clusters in water also with cadmium plates. The last experiment performed by Handley and Hopper involved 4.98% enriched UO_2F_2 solution inside a steel/cadmium/water reflected cylinder. Table 6.10 provides a description of the names of each experiment as described in ICSBEP Vol. IV and Reference 2 for cross-reference comparison purposes.

Table 6.10 - Bierman Experiments with Cadmium Used in GEMER Validation

No.	ICSBEP Vol. IV Identification	ICSBEP Table #	ICSBEP Experiment #	Reference 4 ID
1	LEU-COMP-THERM-009	4	019	BIER-31
2	LEU-COMP-THERM-009	4	020	BIER-32
3	LEU-COMP-THERM-009	5	021	BIER-33
4	LEU-COMP-THERM-009	5	022	BIER-34
5	LEU-COMP-THERM-009	5	023	BIER-35
6	LEU-COMP-THERM-009	5	024	BIER-36
7	LEU-COMP-THERM-009	5	025	BIER-37
8	LEU-COMP-THERM-009	5	026	BIER-38
9	LEU-COMP-THERM-009	5	027	BIER-39
10	LEU-COMP-THERM-009	5	028	BIER-40
11	LEU-COMP-THERM-016	5	036	RSIC-14
12	LEU-COMP-THERM-016	5	037	RSIC-15
13	LEU-COMP-THERM-016	5	050	RSIC-24
14	LEU-COMP-THERM-016	5	052	RSIC-25
15	LEU-COMP-THERM-016	5	054	RSIC-26
16	-	-	-	HH-33

Figure 6.20a provides a diagram of the arrangement of the pin clusters and the absorber plates used for ten of the experiments involving cadmium. This figure is based on data taken from Volume IV (LEU-COMP-THERM-009) of the International Criticality Safety Benchmark Evaluation Project (ICSBEP) handbook (Ref. 7).

Figure 6.20b shows the arrangement of the 2.35% enriched UO_2 fuel pin clusters and the relative locations of the absorber plates for experiments with cadmium plates. Of these seven, five are used for validation of the GEMER code with cadmium. This figure is based on data taken from Volume IV (LEU-COMP-THERM-016) of the International Criticality Safety Benchmark Evaluation Project (ICSBEP) handbook (Ref. 7).

Figure 6.20a – Typical Arrangement of Fuel Pin Clusters and Absorber Plates for 4.31% Enriched Experiments

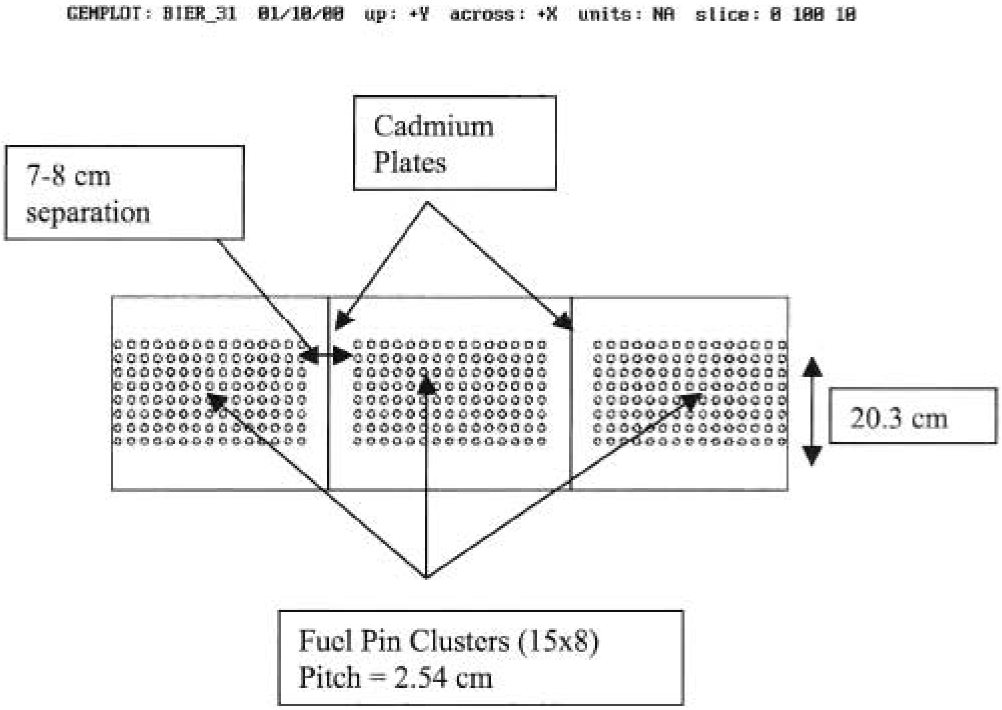
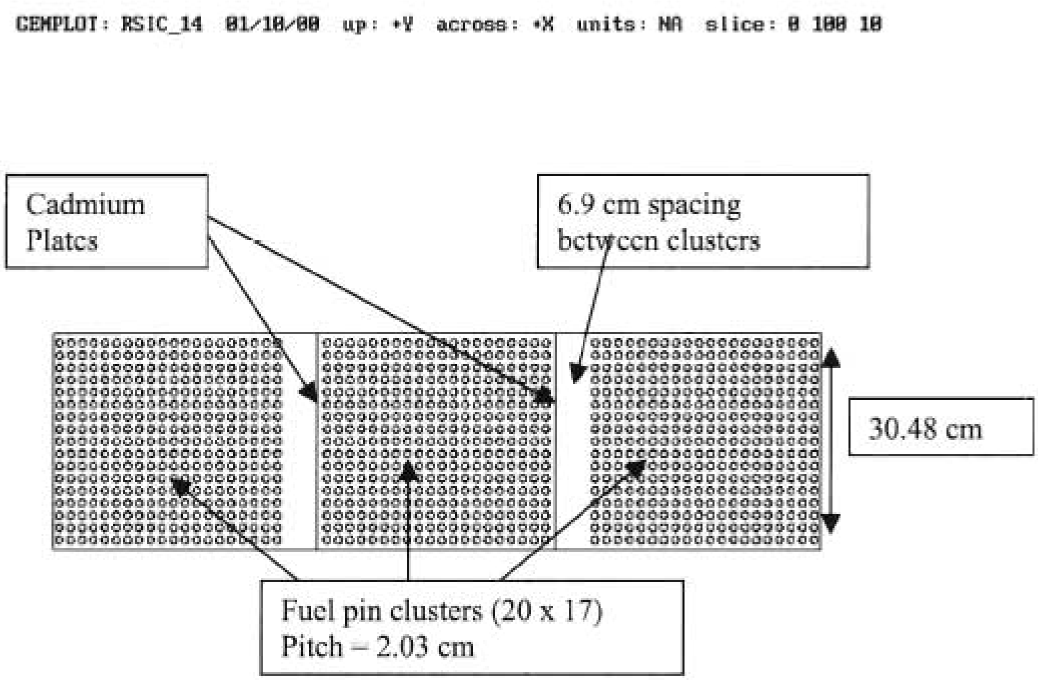


Figure 6.20b - Arrangement of Fuel Pin Clusters and Absorber Plates for 2.35% Enriched Experiments



In order to make a determination of the applicability of the existing 16 benchmark experiments with cadmium to the NPC shipping container, a comparison of important neutron physics properties in made in Table 6.11. This table provides a comparison of enrichment, size, uranium moderation, cadmium plate dimensions, and moderation between uranium units and cadmium for the NPC package. A total of 15 Bierman fuel rod experiments are used as a basis for the benchmark comparison data, while the limiting damaged single package and damaged array results are used for the NPC data.

Table 6.11 - Comparison of Benchmark Experiments to NPC Package

Characteristic	Bierman Experiments	NPC Package
Uranium Enrichment	2.35% – 4.31%	5.00%
Geometry	UO_2 fuel lattice clusters 20.32cm x 38.1 cm x 91.44 cm 32.5 cm x 40.64 cm x 91.44 cm	3x3 cylinder array 21.628 cm dia. 80.01 cm max. height
Moderation of Uranium	Heterogeneous fuel pins in water Pin dia. ~1 cm, pitch ~ 2 cm H/U-235 range: 260 – 488	Homogeneous UO_2 + H_2O wtfr. water ~ 0.29 H/U-235 range: 236-254
Moderation between Uranium and Cd plates	3-6 cm H_2O	~3 cm polyethylene and ~5 cm foam
Absorber Plate thickness	Cadmium plates Thks. 0.30 mm – 2.0 mm	Cadmium wrap Thks. 0.381 mm

By comparing the properties that most directly affect the neutron physics behavior of each system, the following conclusions are reached about the applicability of these benchmark experiments to deriving a GEMER bias for the NPC shipping package.

- Both systems are low enriched, and therefore resonance absorption effects present with systems containing relatively large amounts of U-238 are similar.

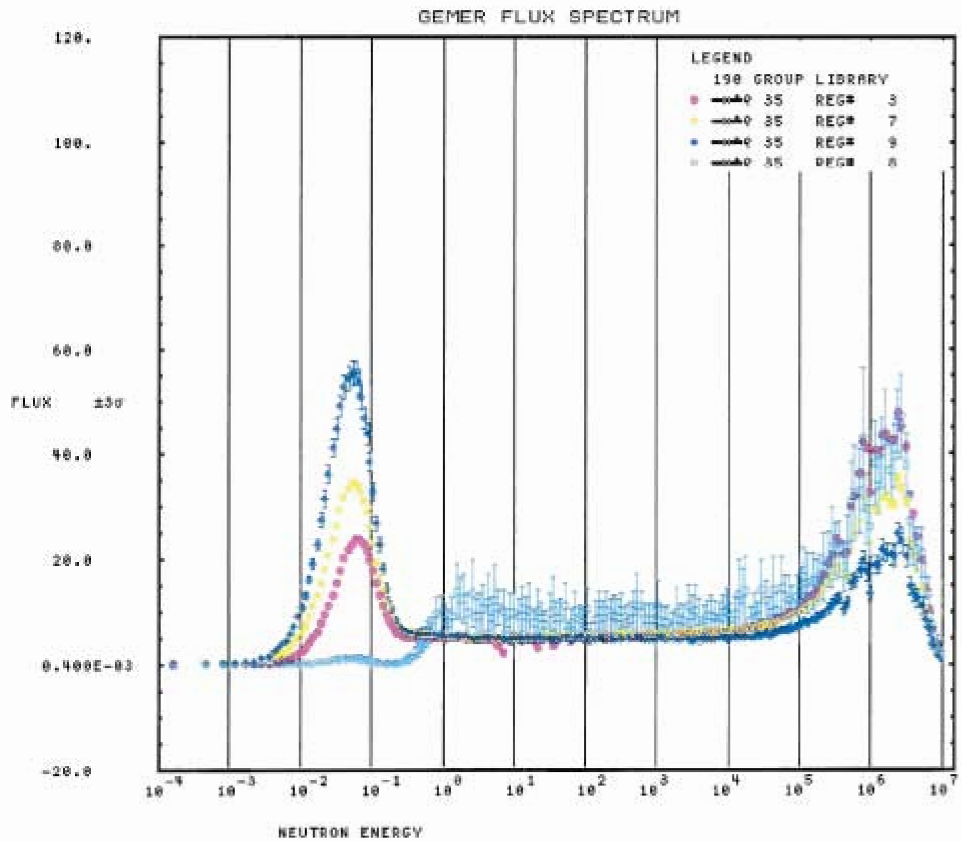
- The overall dimensions of the two systems are similar (e.g., fuel regions are ~3 feet in length). The NPC cadmium wrap thickness is within the range of thickness of the Bierman experiments. This is expected since very thin regions of cadmium provide the same effective neutron absorption properties as thick regions (i.e., large resonance self-shielding absorption).

- The two systems have very similar H/U-235 ratios over the fissile volume. The H/U-235 ratio determines the neutron energy spectrum inside the fissile region. The effectiveness of the cadmium plates to act as thermal neutron absorbers is directly related to the energy spectrum of the neutrons leaving the fissile assemblies. Sample neutron spectra comparisons between critical experiment and the NPC package are provided in Figures 6.21a-6.21d.

- The overall qualitative effect of the hydrogen and carbon in both the polyethylene and foam regions of the NPC package provide some reasonable degree of thermal neutron moderation between ICCAs. Consequently, the effectiveness of the cadmium to act as a thermal neutron absorber in both systems is roughly equivalent (refer also to spectra comparisons).

Based on these observations, the neutron physics properties of the experiments and the NPC package compare favorably. The GEMER cadmium bias resulting from these benchmark experiments can therefore be successfully applied to criticality calculations involving uranium compounds for the NPC shipping package.

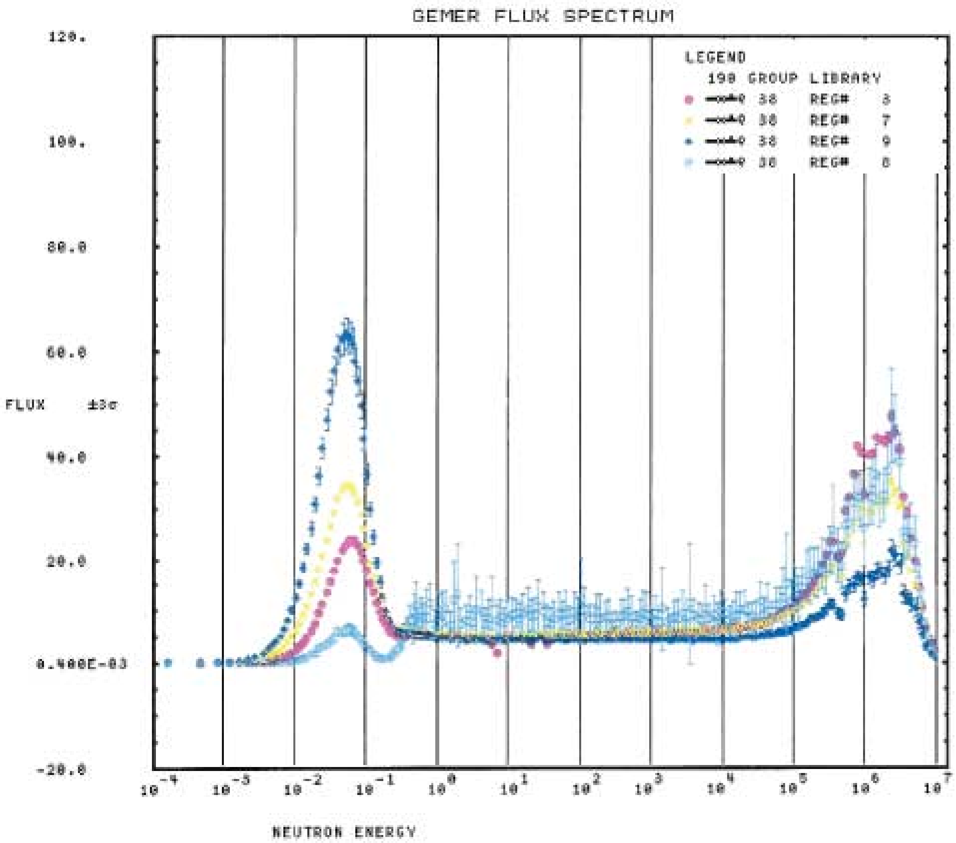
Figure 6.21a - Neutron Energy Spectra for BIER-35 (4.31%)



Legend:

Region 3 – Fuel pins
Region 7 – Moderator surrounding fuel pins
Region 8 – Cadmium plates (2.006 mm)
Region 9 – Moderator between fuel bundles and cadmium plates

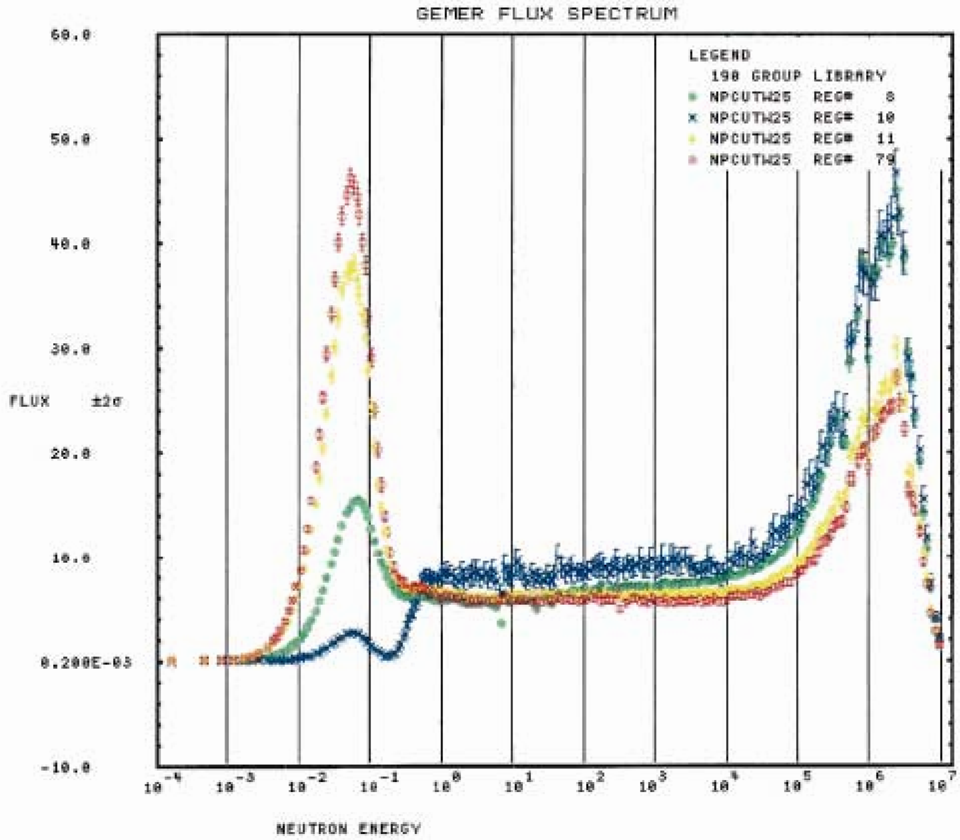
Figure 6.21b - Neutron Energy Spectra for BIER-38 (4.31%)



Legend:

- Region 3 – Fuel pins
- Region 7 – Moderator surrounding fuel pins
- Region 8 – Cadmium plates (0.291 mm)
- Region 9 – Moderator between fuel bundles and cadmium plates

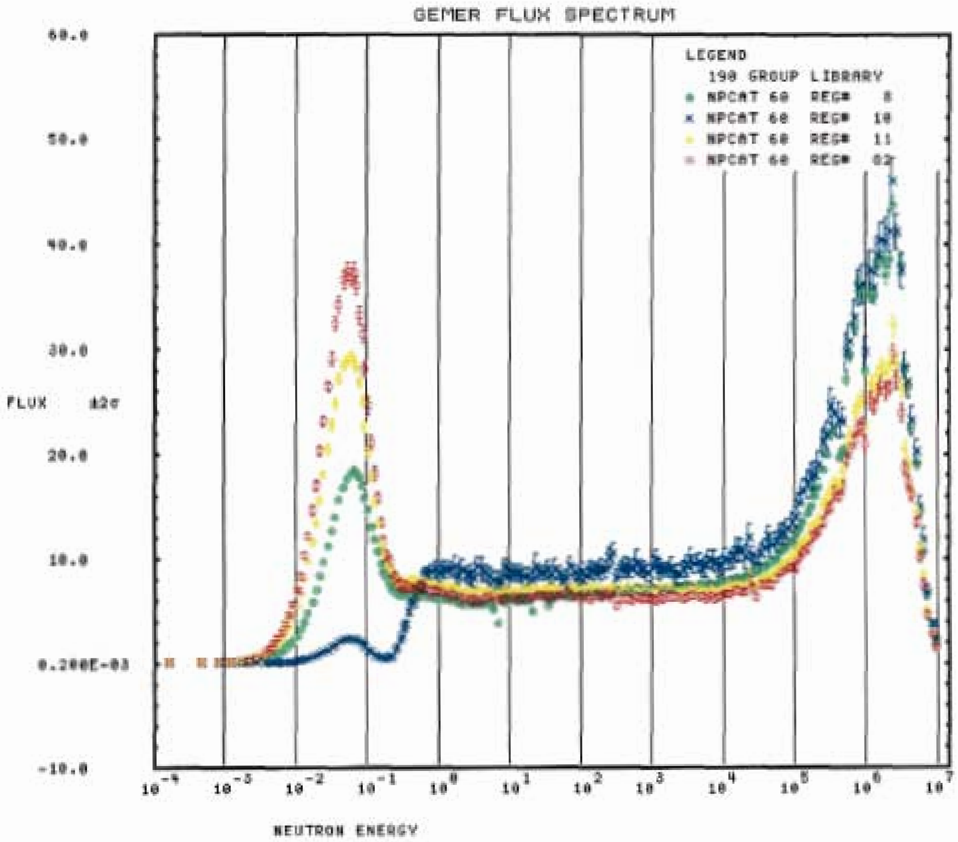
Figure 6.21c - Neutron Energy Spectra for NPC – Damaged Single Package



Legend:

Region 8 – ICCA Fuel Region
Region 10 – Cadmium wrap (0.381 mm)
Region 11 – Poly Region between ICCAs
Region 79 – Foam Region between ICCAs

Figure 6.21d - Neutron Energy Spectra for NPC – Damaged Package Array



Legend:

Region 8 – ICCA Fuel Region
Region 10 – Cadmium wrap (0.381 mm)
Region 11 – Poly Region between ICCAs
Region 82 – Foam Region between ICCAs

6.8.2.1 GEMER Cadmium Bias Determination

Table 6.12 presents the results of the GEMER calculated eigenvalues and 1σ statistical uncertainties for the sixteen benchmark experiments. Bias values for a given computer code and cross-section set are ordinarily tabulated (for a given set of benchmark experiments), as a function of an independent variable, which directly influences the calculated value of k_{eff}. Examples of such variables would be H/U-235 ratio, water-to-fuel ratio, absorber/poison concentration, fuel unit spacing, etc. Due to the limited moderation range, dependence on an independent variable for the 16 benchmark experiments was not performed. Consequently, the 16 data points for each eigenvalue estimator will be treated as continuous statistical data normally distributed about a mean (μ) with a population variance (σ^2) and standard deviation (σ).

Table 6.12 - GEMER Benchmark Validation Results

GEMER Benchmark Experiment	Flux Weighted Calculated Keff	1σ uncertainty
BIER-31	0.99125	0.00122
BIER-32	0.99007	0.00116
BIER-33	0.98951	0.00110
BIER-34	0.98846	0.00112
BIER-35	0.99228	0.00125
BIER-36	0.98938	0.00104
BIER-37	0.99153	0.00114
BIER-38	0.99012	0.00111
BIER-39	0.98603	0.00129
BIER-40	0.98871	0.00126
RSIC-14	0.9945	0.00105
RSIC-15	0.99352	0.00099
RSIC-24	0.99347	0.00109
RSIC-25	0.99598	0.00102
RSIC-26	0.99469	0.00104
HH-33	0.99405	0.00114

[Φ] *BIER-31 and BIER-32 omitted since they involved Cu plates with <1% Cd.*

Based on the data provided in Table 6.11, calculations can be performed with the following equations to derive the population mean (μ), population variance (σ^2) and population standard deviation (σ) for the sixteen calculated eigenvalues (N=16). This is done for the flux weighting distribution. This approach is consistent with the derivation of the existing GEMER bias (ref. 2).

$$\mu = \frac{\sum X_i}{N} \qquad \sigma^2 = \frac{\sum (X_i - \mu)^2}{N} \qquad \sigma = \sqrt{\sigma^2}$$

Having computed these values, the total bias and 2σ uncertainty is computed as:

$$\text{Total Bias} = (\mu - 1.0) - 2\sigma$$

Based on the sixteen data points provided in Table 6.11, the flux weighted mean k_{eff} and σ values are computed to be:

Flux Weighted

$\mu = 0.991472$

$\sigma = 0.002666$

From this, a total bias for the GEMER code with cadmium is computed to be:

Flux Weighted

Bias = – 0.01386

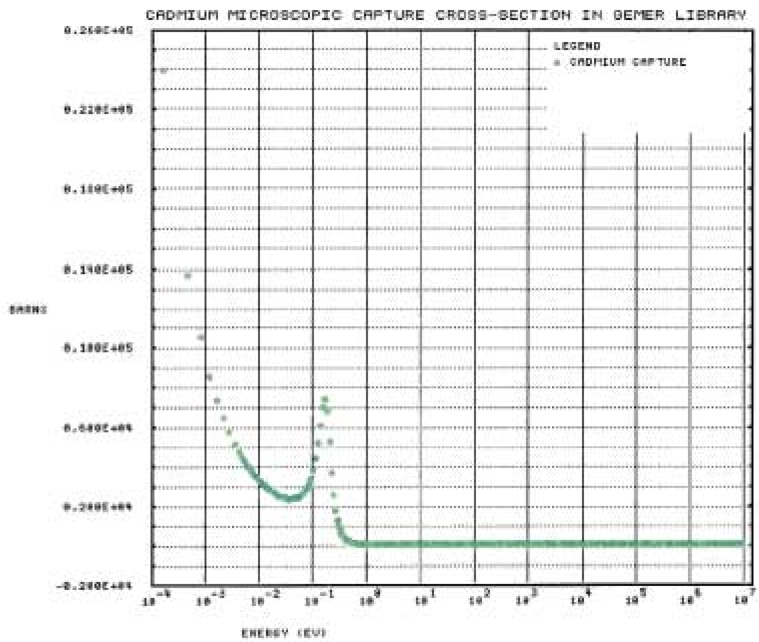
For purposes of the NPC package, the initial estimate of the flux weighted bias based on the critical benchmark data alone is equal to -0.01368.

However, an additional cadmium "bias adjustment" due to the difference between the experimental benchmark reactivity worth of the cadmium and the package reactivity worth is developed in the following sections to account for this extrapolation.

6.8.2.2 Cadmium Worth: Experiments vs. NPC

The GEMER ENDF/B-IV cross-section library treatment of cadmium is based on the 190-multigroup structure, as shown in Figure 6.22. This figure is generated directly from GEMER cross-section library. Explicit resonance parameter solution using single-level Breit-Wigner equation is not used for cadmium in GEMER (Ref. 1).

Figure 6.22 – GEMER Cadmium Total Microscopic Capture Cross-section vs. Neutron Energy



The accuracy of the cadmium cross-section behavior as a function of neutron energy has been well known and published since 1955. The above GEMER cross-section behavior compares well with published data for cadmium for peak resonance, 0.1, and 0.01 eV neutron energies (e.g., pp. 217-219, BNL-325, 2nd Edition, Hughes and Schwartz, 1958).

Table 6.13 presents the results of the GEMER calculated eigenvalues for 14[Φ] of the critical benchmarks and limiting condition cases for the NPC single package and package arrays - with and without cadmium. This table quantifies the relative neutronic "worth" of the cadmium in benchmark experiments and in the NPC package application. As a confirmation, edits of the total captures by cadmium are also summed over appropriate regions and included for both sets of data.

Table 6.13 – Cadmium Benchmark vs. NPC Reactivity Worth Studies

Benchmark experiments – effect of cadmium on Keff						
Case ID	w/ Cd	w/o Cd	%Δk/k	Cd thks.(mm)	Cd captures	Percent Removed
BIER-33	0.9908	1.0009	1.019	0.901	72.3	3.62
BIER-34	0.9887	1.0115	2.306	0.901	69.8	3.49
BIER-35	0.9897	1.0013	1.172	2.006	71.0	3.55
BIER-36	0.9878	1.0124	2.490	2.006	67.4	3.37
BIER-37	0.9891	0.9995	1.051	0.291	72.9	3.64
BIER-38	0.9881	1.0106	2.277	0.291	65.0	3.25
BIER-39	0.9889	1.0006	1.183	0.610	74.1	3.70
BIER-40	0.9879	1.0092	2.156	0.610	68.0	3.40
RSIC-14	0.9931	1.0143	2.135	0.610	50.8	2.54
RSIC-15	0.9913	0.9986	0.736	0.610	58.8	2.94
RSIC-24	0.9947	1.0066	1.195	0.291	50.6	2.53
RSIC-25	0.9951	1.0096	1.452	0.901	56.0	2.80
RSIC-26	0.9921	1.0088	1.683	0.610	50.2	2.51
HH-33	0.9886	1.0072	1.881	0.081	129.4	6.47
NPC package analysis – effect of cadmium on Keff						
Case ID	w/ Cd	w/o Cd	%Δk/k	Cd thks.(mm)	Cd captures	Percent Removed
Damaged single package - limiting cases:						
npcu1_25	0.8452	1.0195	20.622	0.381	434.2	21.710
npcu2_25	0.8407	1.0155	20.792	0.381	433.6	21.680
npcut_25	0.8405	1.0114	20.333	0.381	420.6	21.030
npcutw25	0.8476	1.0344	22.039	0.381	370.4	18.520
Damaged package array – limiting cases:						
npca1_60	0.9059	1.1239	24.064	0.381	420.4	21.020
npca2_60	0.9141	1.1306	23.684	0.381	422.9	21.145
npcat_60	0.9275	1.1468	23.644	0.381	426.2	21.310

Table 6.13 demonstrates the relative worth of the cadmium in the experiments is in the range of ~1-2.5%, while the relative worth for the NPC package is in the range of 20-24%. This suggests that an additional cadmium bias adjustment due to cross-section uncertainty might be warranted due to this extrapolation.

Specifically, the more conservative of the following two approaches are considered an appropriate means to quantify the required "bias adjustment" due to extrapolating the validation benchmarks for low-worth cadmium absorber to a high-worth application such as the NPC package. Both of these methodologies are evaluated.

1. The change in k_{eff} corresponding to substituting the chosen neutron absorber with equivalent boron and reducing the boron by 10 percent; or
2. The difference between the neutron absorber worth calculated by GEMER and an independent continuous-energy code (e.g,. MCNP4C).

6.8.2.3 Boron Substitution Method

The boron substitution methodology was applied to the limiting condition NPC damaged package array (npcat_60.in). To begin the study, the limiting damage package array model was re-run two additional times to allow for statistical comparison of results.

To determine equivalent boron-10 areal density, 1/v-absorber equivalents of 0.008, 0.0085, and 0.009 gB^{10}/cm^2 were modeled in place of the 15-mil cadmium to study the 1/v absorber behavior for the limiting damaged package array. From these cases, the 1/v-absorber cross-section treatment using boron-10 at an areal density of 0.008 gB^{10}/cm^2 was demonstrated to yield statistically equivalent results as shown below. These cases were in turn re-run using a 10% reduction in the boron-10 areal density to quantify the actual bias adjustment using the boron substitution approach.

```
combined statistics for following cases (limiting case - damaged package array)
case     k-eff        sigma            # of batches

   1      0.927480     0.122000e-02    190 (npcat 60.in)
   2      0.927670     0.127000e-02    190 (npcati60.in, repeat)
   3      0.926890     0.127000e-02    190 (npcatj60.in, repeat)

 kbar =  0.927347            sbar =  0.722601e-03
 # of observations =     570

combined statistics for following cases (boron subst. = 0.008 gb10/cm2)
  case     k-eff        sigma            # of batches

   1      0.930150     0.128000e-02    190 (bor08a.in)
   2      0.927430     0.126000e-02    190 (bor08b.in, repeat)
   3      0.928510     0.129000e-02    190 (bor08c.in, repeat)

 kbar =  0.928697           sbar =  0.737314e-03
 # of observations =     570

combined statistics for following cases (boron subst. = (0.90)*(0.008 gb10/cm2)
  case     k-eff        sigma            # of batches

   1      0.932670     0.118000e-02    190 (bor08x.in)
   2      0.931160     0.136000e-02    190 (bor08y.in, repeat)
   3      0.932340     0.122000e-02    190 (bor08z.in, repeat)

 kbar =  0.932057           sbar =  0.724217e-03
 # of observations =     570
```

Using the boron substitution methodology, the following statistical comparison can be made between the equivalent boron (0.008 gB^{10}/cm^2) and the 10% reduced values.

```
statistical comparison - reactivity worth of 10% reduction in b-10

kbar1 =  0.928697
sbar1 = 0.000737314
n1 = 3

kbar2 =  0.932057
sbar2 = 0.000724217
n2 = 3
```

Assuming the true variance of the two distributions is the same, then the 100 (1- α)% confidence interval on the difference between means is:

```
[(xbar2 - xbar1) ± t_{n1+n2-2;α/2} sw * sqrt((1/n1) + (1/n2))]

where,
sw**2 = (n1-1)sbar1**2 + (n2 - 1)sbar2**2
        ---------------------------------
                  n1 + n2 -2

using above data… α = 5, a 95% ci yields…

sw**2 = (3-1)(0.000737314)**2 + (3-1)(0.000724217)**2
        ---------------------------------------------
                        (3+3-2)

sw**2 = 5.34061e-07

sw = 0.0007308

95% ci = (0.932057 - 0.928697) ± t_{4,0.025} *(0.0007308)* sqrt(2/3)
95% ci = (0.932057 - 0.928697) ± 2.776 *(0.0007355)* (0.81650)
95% ci = 0.00336 ± 0.001656
```

Thus, with a 97.5% confidence (upper limit on CI) expect a 10% reduction in b-10 content to yield a difference in k_{eff} that does not exceed

$0.00336 + 0.001656 = 0.005016$

The total cadmium bias from critical benchmarks + bias adjustment due to worth extrapolation is given by:

Total Bias + Bias Adjustment = $-(0.01386 + 0.005016) = -0.01888$

The final adjusted upper spec limit (USL) is therefore,

$k_{eff,\,USL} = 0.95 - (0.01888) = 0.93112$

or

$k_{eff,\,USL} = 0.931$

6.8.2.4 Reactivity Worth Comparison Between GEMER Vs. MCNP4C

A series on Monte Carlo calculations were performed with both the GEMER code and an independent Monte Carlo transport code MCNP4C (ref. 8). The historical lineage and development of both codes and the neutron cross-section data sets are different. As such, a comparison of the results of these two Monte Carlo codes will provide an independent assessment of the evaluated nuclear data used by each.

The GEMER code is based on the Battelle Memorial Institute's MERIT program and utilizes a 190-group cross-section data set (multi-group library) based on ENDF/B-IV evaluated nuclear data for unresolved resonances and a continuous energy treatment based on a first-level Breit-Wigner approximation for resolved resonances.

MCNP4C utilizes a point-wise continuous energy treatment for all cross-sections and is based on ENDF/B-V evaluated nuclear data (for this comparison).

The benchmark problem created to compare the results of these two codes is a 2-D infinite array of ICCAs spaced on a 29.845-cm square pitch. The material and geometric compositions used for both codes was taken from the limiting damaged package array model and is intended to exaggerate the reactivity worth of the cadmium to provide a bounding case comparison. The only minor difference is the treatment of the poly region – the 2% reduction in poly density is not included in this infinite ICCA lattice comparison.

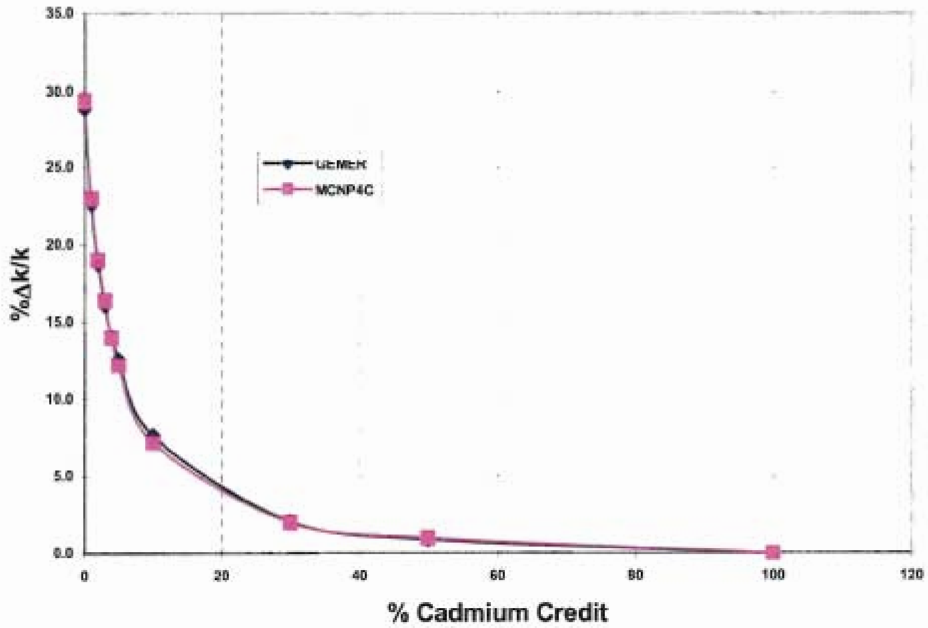
Care was taken to ensure that the input models for both codes numerically simulated the exact same geometric and material compositions. Both codes were executed for the case of 100% cadmium credit (i.e., full cadmium atom density) as a starting point. Nine cases were run with each code simulating a reduction in the cadmium atom density starting with 50% credit and decreasing to 0% credit (i.e., no cadmium). Only the cadmium atom density was changed in each case (i.e., no change to the cadmium region thickness was made) in order to assess the reactivity effects of the removal of absorber atoms only (i.e., no geometry effects). Sample GEMER and MCNP4C input files are also provided.

Table 6.14 and Figure 6.23 shows the results of the GEMER and MCNP4C comparison calculations.

Table 6.14 – Cadmium Reactivity Evaluation Between GEMER and MCNP4C

% Cd Credit	GEMER Keff	GEMER (%Δk/k)	MCNP4C keff	MCNP4C (%Δk/k)	d_i
100	0.9437	0.0000	0.9581	0.0000	0.0000
50	0.9524	0.9219	0.9677	1.0020	-0.0801
30	0.9634	2.0875	0.9774	2.0144	0.0731
10	1.0157	7.6295	1.0268	7.1704	0.4591
5	1.0620	12.5358	1.0748	12.1804	0.3554
4	1.0755	13.9663	1.0915	13.9234	0.0429
3	1.0954	16.0750	1.1147	16.3448	-0.2698
2	1.1206	18.7454	1.1395	18.9333	-0.1879
1	1.1570	22.6025	1.1780	22.9517	-0.3492
0	1.2168	28.9393	1.2397	29.3915	-0.4522

Figure 6.23 – Comparison of GEMER and MCNP4C Reactivity Worth of Cadmium Replacement (0.570" poly wrap)



The results of Figure 6.23 show excellent agreement between the calculated cadmium reactivity worth for GEMER and MCNP4C. However, a paired, one-sample t-test can be performed to determine if there is a statistically significant difference between the reactivity worth calculated by GEMER and that calculated by MCNP4C. The following hypothesis tests can be performed:

- Null hypothesis (H_o): No statistical difference between GEMER and MCNP4C
- Alternative hypothesis (H_a): A statistical difference does exist between the two

In order to test these two hypotheses, a paired one-sample t-test using the following equations can be performed using the MINITAB program (ref. 9). The assumptions include a) n = 9 = number of pairs of data, and b) mean = average values of the difference between the GEMER and MCNP results.

$$\overline{D} = \sum_{i=1}^{N} \frac{d_i}{n} \qquad s_d = \sqrt{\frac{\sum_{i=1}^{n} (d_i - \overline{D})^2}{n-1}}$$

From this, the acceptance region for the (T) value becomes:

$$\overline{D} - t_{\alpha/2,n-1} \frac{s_d}{\sqrt{n}} < T < \overline{D} + t_{\alpha/2,n-1} \frac{s_d}{\sqrt{n}}$$

Where (α) is the confidence interval that the alternative hypothesis is true and t is the student t factor from a standard t-distribution table. Using the MINITAB program, the following is calculated:

T-Test of the Mean

```
Test of mu = 0.000 vs mu not = 0.000

Variable     N      Mean    StDev   SE Mean        T          P
di           9    -0.045    0.310     0.103    -0.44       0.67
```

For $\alpha = 0.05$, a **p value** of 0.67 for the difference of the means ($\mu = 0$) is calculated. Since $p > \alpha$, we can accept the null hypothesis (Ho) and conclude that there is no statistical difference between calculated reactivity worth for the GEMER and MCNP4C computer codes given the sample of paired data evaluated in this study.

The boron substitution methodology is therefore the more conservative approach when compared with the difference between the neutron absorber worth calculated by GEMER and an independent continuous-energy code MCNP4C.

GEMER – sample input

```
2000.NPC,,,,CYL,,UO2,5.00%.WTFR=VAR.,SS,,,CD,CE
/*ECHO
/*TITLE
  200 2000    10     0     0     1     0     0
    0  293     0     0
\CSXSEC\UO2\GUO2-50.285
\CSXSEC\NOU\GNOU-0.SS
\CSXSEC\NOU\GNOU-0.CAD
\CSXSEC\NOU\GNOU-0.POL
\CSXSEC\NOU\GNOU-0.F07 0.90
KENO GEOM
     0  /* # OF REGIONS OR ZERO
     0  /* # OF BOX TYPES OR ZERO
     1  /* # OF BOXES IN X DIRECTION
     1  /* # OF BOXES IN Y DIRECTION
     1  /* # OF BOXES IN Z DIRECTION
     1  /* BOUNDARY CONDITION OPTION
     1  /* STARTING SOURCE OPTION
     1  /* COMPLEX EMBEDDED OPTION
     0  /* # OF PRINT PLOTS
       -1.0       -1.0       -1.0       -1.0       -1.0       -1.0
```

```
BOX TYPE      1  /* Main Body Region
CYLINDER      1  10.8141  73.8505   0.0000                                              16*.5
CYLINDER      2  10.9233  73.8505   0.0000                                              16*.5
CYLINDER      3  10.9614  73.8505   0.0000                                              16*.5
CYLINDER      4  12.4092  73.8505   0.0000                                              16*.5
CYLINDER      2  12.4612  73.8505   0.0000                                              16*.5
CYLINDER      0  12.7000  73.8505   0.0000                                              16*.5
CYLINDER      2  12.7635  73.8505   0.0000                                              16*.5
BOX TYPE      2  /* Unit Cell
CUBOID        5  14.9225  -14.9225  14.9225  -14.9225  73.8505  0.0     16*.5
 2    1  1  1    1  1  1    1  1  1   1
BEGIN COMPLEX
/* Entire System
COMPLEX  2  1  0.00000  0.00000  0.00000   1   1   1  0.0   0.0   0.0
END GEOM
DEFAULTS=YES
END GEMER
```

MCNP4C – sample input

```
Test Input Model for NAS60
1       1 0.09543202  -1        u=1    imp:n=1
2       2 0.08705741   1 -2     u=1    imp:n=1
3       3 0.04400000   2 -3     u=1    imp:n=1
4       4 0.11646900   3 -4     u=1    imp:n=1
5       2 0.08705741   4 -5     u=1    imp:n=1
6       0              5 -6     u=1    imp:n=1
7       2 0.08705741   6 -7     u=1    imp:n=1
8       5 0.00684900   7        u=1    imp:n=1
9       0       -8 9 -10 11 -12 13  fill=1   imp:n=1
10      0        (8:-9:10:-11:12:-13)         imp:n=0

1       cz    10.8141
2       cz    10.9233
3       cz    10.9614
4       cz    12.4092
5       cz    12.4612
6       cz    12.7000
7       cz    12.7635
8*      px    14.9225
9*      px   -14.9225
10*     py    14.9225
11*     py   -14.9225
12*     pz    36.92525
13*     pz   -36.92525

kcode 2000 1.0 10 200
ksrc  0.0 0.0 0.0
m1      92235.50c  2.3052e-04  $ U(5%)O2 + 0.285H2O
        92238.50c  4.3245e-03
         1001.50c  5.4511e-02
         8016.50c  3.6366e-02
mt1     lwtr.01t
m2       6012.50c  3.1691e-04  $ 304SS
        14000.50c  1.6940e-03
        24000.50c  1.6471e-02
        26000.50c  6.0360e-02
        28000.50c  6.4834e-03
        25055.50c  1.7321e-03
m3      48000.50c  4.4000e-02  $ Cd
m4       1001.50c  7.6965e-02  $ Poly
         6012.50c  3.9504e-02
mt4     poly.01t
m5       6012.50c  2.5290e-03  $ 0.90 F07
         8016.50c  5.3100e-04
         7014.50c  1.7100e-04
         1001.50c  3.6180e-03
mt5     poly.01t
```

6.8.3 VALIDATION SUMMARY – NPC PACKAGE

Validation of GEMER and the ENDF/B-IV cross-section library consist of performing calculation of critical benchmark experiments. The range of applicability includes uranium oxides involving the nuclear poison cadmium.

The uranium oxide bias (Δk_u - β) determined is no greater than -0.009 at a 95% confidence level. The area of applicability for the uranium oxide benchmark calculations are enrichment ranges from 1.29 to 9.83 weight percent U-235 and H/U-235 ratio 41 to 866.

The uranium oxide bias from critical benchmarks involving cadmium and bias adjustment due to extrapolating the validation benchmarks for low-worth cadmium absorber to a high-worth application such as the NPC package (Δk_u - β) is demonstrated to be no greater than -0.01888 at a 95% confidence level. The area of applicability for the uranium oxide with cadmium benchmark calculations is enrichment ranges from 2.35 to 4.98 weight percent U-235 and H/U-235 ratio 260-488.

The cadmium bias resulting from these benchmark experiments can therefore be successfully applied to criticality calculations involving uranium compounds for the NPC shipping package. For this evaluation, the NPC package and it contents are considered subcritical if the following condition is satisfied:

$$k_{eff} + 2\sigma \leq 0.95 - 0.01888$$
$$or$$
$$k_{eff} + 2\sigma \leq 0.93112$$

Conservatively rounding this result down, the acceptance criteria becomes:

$$k_{eff} + 2\sigma \leq 0.931$$

6.9 APPENDIX – SAMPLE GEMER INPUT

Table 6.15 – Sample input summary

Figure No.	Case FILE ID	Description
A. Homogeneous UO_2 and H_2O Cases		
6.24a	npcut_25.in	Damaged single package, theoretical UO_2 + H_2O mixture, wtfr H_2O = 0.25, maximum burn
6.24b	npc6um60.in	Infinite undamaged array: 60 kgs theoretical UO_2 + H_2O mixture, wtfr H_2O = 0.28504 (ICCA full)
6.24c	npca2_60.in	Damaged package array: 60 kgs UO_2 + H_2O mixture per canister, CTU-2 observed burn
6.24d	npcat_60.in	Damaged package array: 60 kgs UO_2 + H_2O mixture per canister, maximum burn
B. Heterogeneous 55Kg and 53Kg UO_2 Cylindrical Fuel Element Lattice Cases		
6.25a	ESTP-400.in	Damaged single package, 17X17 pellet type triangular lattice with overlap, 55 kg UO_2, W/F = 4.00
6.25b	CSTN-470.in	Infinite undamaged array, 17X17 pellet type triangular lattice with no overlap, 53 kg UO_2, W/F = 4.70
6.25c	ST55-486.in	Damaged package array, 17X17 pellet type triangular lattice by VFO, 55 kg UO_2, W/F = 4.86
C. Heterogeneous 46 Kg UO_2 Cylindrical Fuel Element Lattice Lattice Cases		
6.26a	MTSL-540.in	Damaged single package, 0.100" cylinder diameter, square lattice by VFO, 46 kg UO_2, W/F = 5.40
6.26b	ABTL-490.in	Infinite undamaged array, 0.100" cylinder diameter, triangular lattice by VFO, 46 kg UO_2, W/F = 4.90
6.26c	BT46-600.in	Damaged package array, , 0.100" cylinder diameter, triangular lattice by VFO, 46 kg UO_2, W/F = 6.00

A. Homogeneous UO_2 and H_2O Cases

Figure 6.24a – Sample input file = npcut_25.in

```
2000.NPC,,,,CYL,,UO2,5.00%,WTFR-VAR,,SS,,,CD,CE
/*ECHO
/*TITLE
  200 2000   10    0    0    1    0    0
    0  293    0    0
\CSXSEC\UO2\GUO2-50.25
\CSXSEC\NOU\GNOU-0.SS
\CSXSEC\NOU\GNOU-0.CAD
\CSXSEC\NOU\GNOU-0.F01 0.98
\CSXSEC\NOU\GNOU-0.F07 0.90
\CSXSEC\NOU\GNOU-0.WAT
\CSXSEC\NOU\GNOU-0.F11 0.90
\CSXSEC\NOU\GNOU-0.F15 0.90
\CSXSEC\NOU\GNOU-0.F40 0.90
\CSXSEC\NOU\GNOU-0.ORC
KENO GEOM
    0  /* # OF REGIONS OR ZERO
    0  /* # OF BOX TYPES OR ZERO
    1  /* # OF BOXES IN X DIRECTION
    1  /* # OF BOXES IN Y DIRECTION
    1  /* # OF BOXES IN Z DIRECTION
    1  /* BOUNDARY CONDITION OPTION
    1  /* STARTING SOURCE OPTION
    1  /* COMPLEX EMBEDDED OPTION
    0  /* # OF PRINT PLOTS
       0.0       0.0       0.0       0.0       0.0       0.0
BOX TYPE     1  /* inner canister: bottom fuel region #1 w/ gap: body assy
CYLINDER     1  10.8141  0.31750  0.00000                               16*.5
CYLINDER     2  10.9233  0.31750  0.00000                               16*.5
CYLINDER     0  12.4092  0.31750  0.00000                               16*.5
CYLINDER     2  12.4092  0.31750 -0.44200                               16*.5
CYLINDER     2  12.6612  0.31750 -0.44200                               16*.5
CYLINDER     0  12.7000  0.31750 -0.44200                               16*.5
```

```
CYLINDER    2  12.7635  0.31750 -0.50550                                16*.5
BOX TYPE    2  /* inner canister: fuel_region #2: body assy
CYLINDER    1  10.8141  25.4635   0.0000                                16*.5
CYLINDER    2  10.9233  25.4635   0.0000                                16*.5
CYLINDER    3  10.9614  25.4635   0.0000                                16*.5
CYLINDER    4  12.4092  25.4635   0.0000                                16*.5
CYLINDER    2  12.4612  25.4635   0.0000                                16*.5
CYLINDER    0  12.7000  25.4635   0.0000                                16*.5
CYLINDER    2  12.7635  25.4635   0.0000                                16*.5
BOX TYPE    3  /* inner canister: fuel_region #3, 0.15" od gap: body assy
CYLINDER    1  10.8141  0.38100  0.00000                                16*.5
CYLINDER    2  10.9233  0.38100  0.00000                                16*.5
CYLINDER    0  10.9614  0.38100  0.00000                                16*.5
CYLINDER    4  12.4092  0.38100  0.00000                                16*.5
CYLINDER    2  12.4612  0.38100  0.00000                                16*.5
CYLINDER    0  12.7000  0.38100  0.00000                                16*.5
CYLINDER    2  12.7635  0.38100  0.00000                                16*.5
BOX TYPE    4  /* inner canister: fuel_region #4: body assy
CYLINDER    1  10.8141  25.4635   0.0000                                16*.5
CYLINDER    2  10.9233  25.4635   0.0000                                16*.5
CYLINDER    3  10.9614  25.4635   0.0000                                16*.5
CYLINDER    4  12.4092  25.4635   0.0000                                16*.5
CYLINDER    2  12.4612  25.4635   0.0000                                16*.5
CYLINDER    0  12.7000  25.4635   0.0000                                16*.5
CYLINDER    2  12.7635  25.4635   0.0000                                16*.5
BOX TYPE    5  /* inner canister: fuel_region #5, 0.15" od gap: body assy
CYLINDER    1  10.8141  0.38100  0.00000                                16*.5
CYLINDER    2  10.9233  0.38100  0.00000                                16*.5
CYLINDER    0  10.9614  0.38100  0.00000                                16*.5
CYLINDER    4  12.4092  0.38100  0.00000                                16*.5
CYLINDER    2  12.4612  0.38100  0.00000                                16*.5
CYLINDER    0  12.7000  0.38100  0.00000                                16*.5
CYLINDER    2  12.7635  0.38100  0.00000                                16*.5
BOX TYPE    6  /* inner canister: fuel region #6: body assy
CYLINDER    1  10.8141  21.3385   0.0000                                16*.5
CYLINDER    0  10.8141  21.3385   0.0000                                16*.5
CYLINDER    2  10.9233  21.3385   0.0000                                16*.5
CYLINDER    3  10.9614  21.3385   0.0000                                16*.5
CYLINDER    4  12.4092  21.3385   0.0000                                16*.5
CYLINDER    2  12.4612  21.3385   0.0000                                16*.5
CYLINDER    0  12.7000  21.3385   0.0000                                16*.5
CYLINDER    2  12.7635  21.3385   0.0000                                16*.5
BOX TYPE    7  /* inner canister: fuel region #7: body assy
CYLINDER    1  10.8141   3.4925   0.0000                                16*.5
CYLINDER    0  10.8141   3.4925   0.0000                                16*.5
CYLINDER    2  10.9233   3.4925   0.0000                                16*.5
CYLINDER    3  10.9614   3.4925   0.0000                                16*.5
CYLINDER    4  12.4092   3.4925   0.0000                                16*.5
CYLINDER    2  12.4612   3.4925   0.0000                                16*.5
CYLINDER    0  12.7000   3.4925   0.0000                                16*.5
CYLINDER    2  12.7635   3.4925   0.0000                                16*.5
BOX TYPE    8  /* inner canister - fuel region #8: lid assy
CYLINDER    1  10.8141  0.63250  0.00000                                16*.5
CYLINDER    0  10.8141  0.63250  0.00000                                16*.5
CYLINDER    2  10.9233  0.63250  0.00000                                16*.5
CYLINDER    3  10.9614  0.63250  0.00000                                16*.5
CYLINDER    4  12.4092  0.63250  0.00000                                16*.5
CYLINDER    2  12.4612  0.63250  0.00000                                16*.5
CYLINDER    0  12.7000  0.63250  0.00000                                16*.5
CYLINDER    2  12.7635  0.63250  0.00000                                16*.5
BOX TYPE    9  /* inner canister - fuel region #9 w/ gap: lid assy
CYLINDER    1  10.8141  0.31750  0.00000                                16*.5
CYLINDER    2  10.9233  0.31750  0.00000                                16*.5
CYLINDER    0  12.4092  0.31750  0.00000                                16*.5
CYLINDER    2  12.4612  0.31750  0.00000                                16*.5
BOX TYPE   10  /* inner canister - fuel region #10 w/ ring: lid assy
CYLINDER    1  10.8141  0.44200  0.00000                                16*.5
CYLINDER    2  10.9233  0.44200  0.00000                                16*.5
CYLINDER    2  12.4092  0.44200  0.00000                                16*.5
CYLINDER    2  12.4612  0.44200  0.00000                                16*.5
BOX TYPE   11  /* inner canister - fuel region #11 w/ top: lid assy
CYLINDER    1  10.8141  1.78090  0.00000                                16*.5
CYLINDER    2  10.9233  1.91640  0.00000                                16*.5
CYLINDER    0  12.4092  1.91640  0.00000                                16*.5
BOX TYPE   12  /* inner canister cuboid: body section (7# region)
CUBOID      5  12.7636 -12.7636  12.7636 -12.7636  73.3450  -0.5055  16*.5
BOX TYPE   13  /* inner canister cuboid: body section (40# region)
CUBOID      9  12.7636 -12.7636  12.7636 -12.7636  3.49260  0.00000  16*.5
BOX TYPE   14  /* inner canister upper cylinder: lid section
CYLINDER    0  12.7636  3.30840  0.00000                                16*.5
BOX TYPE   15  /* foam cutout (void) - 40 #/ft3 foam lid section
CYLINDER    0  13.5510  3.30840  0.00000                                16*.5
BOX TYPE   16  /* npc body or lid - 10 ga. 304ss layer
CUBOID      2  54.3687 -54.3687  54.3687 -54.3687  0.31240  0.00000  16*.5
BOX TYPE   17  /* npc body or lid - 1" duraboard (void) layer, 10 ga. 304ss
CUBOID      0  51.5163 -51.5163  51.5163 -51.5163  2.54000  0.00000  16*.5
CUBOID      0  54.0563 -54.0563  54.0563 -54.0563  2.54000  0.00000  16*.5
CUBOID      2  54.3687 -54.3687  54.3687 -54.3687  2.54000  0.00000  16*.5
BOX TYPE   18  /* npc body - 4" bot. foam layer (11 #/ft3)    - face burn
CUBOID      7  42.6086 -42.6086  42.6086 -42.6086  0.00000  0.00000  16*.5
CUBOID      0  54.0563 -54.0563  54.0563 -54.0563  0.00000 -7.62000  16*.5
CUBOID      2  54.3687 -54.3687  54.3687 -54.3687  0.00000 -7.62000  16*.5
BOX TYPE   19  /* npc body - 29.0750" foam layer (7,11 #/ft3) - face burn
CUBOID      5  42.6086 -42.6086  42.6086 -42.6086  73.8505   0.0000  16*.5
CUBOID      7  42.6086 -42.6086  42.6086 -42.6086  73.8505   0.0000  16*.5
CUBOID      0  54.0563 -54.0563  54.0563 -54.0563  73.8505   0.0000  16*.5
CUBOID      2  54.3687 -54.3687  54.3687 -54.3687  73.8505   0.0000  16*.5
BOX TYPE   20  /* npc body - 1.375 " foam layer (40 #/ft3)    - face burn
CUBOID      9  42.6086 -42.6086  42.6086 -42.6086  3.49250  0.00000  16*.5
CUBOID      0  54.0563 -54.0563  54.0563 -54.0563  3.49250  0.00000  16*.5
```

```
CUBOID        2  54.3687 -54.3687  54.3687 -54.3687  3.49250  0.00000  16*.5
BOX TYPE     21  /* npc body - 30.45" two-part body
CUBOID        0  54.3687 -54.3687  54.3687 -54.3687  77.3430   0.0000  16*.5
BOX TYPE     22  /* npc lid - 1.375 " foam layer (40 #/ft3)  - lid burn
CUBOID        0  43.8963 -43.8963  43.8963 -43.8963  3.49250  0.00000  16*.5
CUBOID        0  54.0563 -54.0563  54.0563 -54.0563  3.49250  0.00000  16*.5
CUBOID        2  54.3687 -54.3687  54.3687 -54.3687  3.49250  0.00000  16*.5
BOX TYPE     23  /* npc lid - 3.5" foam layer (15 #/ft3)       - lid burn
CUBOID        0  43.8963 -43.8963  43.8963 -43.8963  2.54000  0.00000  16*.5
CUBOID        0  54.0563 -54.0563  54.0563 -54.0563  8.89000  0.00000  16*.5
CUBOID        2  54.3687 -54.3687  54.3687 -54.3687  8.89000  0.00000  16*.5
BOX TYPE     24  /* complete npc - body assembly
CUBOID        0  54.3688 -54.3688  54.3688 -54.3688  87.8154   0.0000  16*.5
BOX TYPE     25  /* complete npc - lid assembly
CUBOID        0  54.3688 -54.3688  54.3688 -54.3688  15.2349   0.0000  16*.5
BOX TYPE     26  /* global unit: damaged unit, full h2o reflection
CUBOID        0  54.3688 -54.3688  54.3688 -54.3688  103.0503  0.0000  16*.5
CUBOID        6  84.8488 -84.8488  84.8488 -84.8488  133.5303 -30.480  16*.5
 26    1  1  1    1  1  1    1  1  1   1
BEGIN COMPLEX
/* build inner canister - main body section (7 #/ft3 region)
COMPLEX  12  1  0.00000  0.00000  0.00000   1   1   1  0.0    0.0    0.0
COMPLEX  12  2  0.00000  0.00000  0.31750   1   1   1  0.0    0.0    0.0
COMPLEX  12  3  0.00000  0.00000  25.7810   1   1   1  0.0    0.0    0.0
COMPLEX  12  4  0.00000  0.00000  26.1621   1   1   1  0.0    0.0    0.0
COMPLEX  12  5  0.00000  0.00000  31.6256   1   1   1  0.0    0.0    0.0
COMPLEX  12  6  0.00000  0.00000  32.0066   1   1   1  0.0    0.0    0.0
/* build inner canister - upper body section (40 #/ft3 section)
COMPLEX  13  7  0.00000  0.00000  0.00000   1   1   1  0.0    0.0    0.0
/* build inner canister - lid section
COMPLEX  14  8  0.00000  0.00000  0.00000   1   1   1  0.0    0.0    0.0
COMPLEX  14  9  0.00000  0.00000  0.63250   1   1   1  0.0    0.0    0.0
COMPLEX  14 10  0.00000  0.00000  0.95000   1   1   1  0.0    0.0    0.0
COMPLEX  14 11  0.00000  0.00000  1.39200   1   1   1  0.0    0.0    0.0
/* embed 3x3 array of canisters into lid: 11.75"-centers
COMPLEX  15 14 -29.8450 -29.8450  0.00000   3   3   1  29.8450  29.8450  0.0
/* embed 3x3 array of foam cut outs:11.75"-centers
COMPLEX  22 15 -29.8450 -29.8450  0.00000   3   3   1  29.8450  29.8450  0.0
/* embed 3x3 array of canisters into inner body: 11.75"-centers
COMPLEX  19 12 -29.8450 -29.8450  0.50550   3   3   1  29.8450  29.8450  0.0
COMPLEX  20 13 -29.8450 -29.8450  0.00000   3   3   1  29.8450  29.8450  0.0
/* embed two-part body section stackup
COMPLEX  21 19  0.00000  0.00000  0.00000   1   1   1  0.0    0.0    0.0
COMPLEX  21 20  0.00000  0.00000  73.8505   1   1   1  0.0    0.0    0.0
/* build npc - body assembly
COMPLEX  24 16  0.00000  0.00000  0.00000   1   1   1  0.0    0.0    0.0
COMPLEX  24 17  0.00000  0.00000  0.31240   1   1   1  0.0    0.0    0.0
COMPLEX  24 18  0.00000  0.00000  10.4724   1   1   1  0.0    0.0    0.0
COMPLEX  24 21  0.00000  0.00000  10.4724   1   1   1  0.0    0.0    0.0
/* build npc - lid assembly
COMPLEX  25 22  0.00000  0.00000  0.00000   1   1   1  0.0    0.0    0.0
COMPLEX  25 23  0.00000  0.00000  3.49250   1   1   1  0.0    0.0    0.0
COMPLEX  25 17  0.00000  0.00000  12.3825   1   1   1  0.0    0.0    0.0
COMPLEX  25 16  0.00000  0.00000  14.9225   1   1   1  0.0    0.0    0.0
/* complete npc stackup - single unit
COMPLEX  26 24  0.00000  0.00000  0.00000   1   1   1  0.0    0.0    0.0
COMPLEX  26 25  0.00000  0.00000  87.8154   1   1   1  0.0    0.0    0.0
END GEOM
DEFAULTS=YES
END GEMER
```

Figure 6.24b – Sample input file = npc60i28.in

```
2002.NPC,,,,CYL,,UO2,5.00%,WIFR=VAR.,SS,,,CD,CE
/*ECHO
/*TITLE
  200 2000   10     0     0     1     0     0
    0  293     0     0
\CSXSEC\UX2\UO2-50.Z85
\CSXSEC\NOU\GNOU-0.SS
\CSXSEC\NOU\GNOU-0.CAD
\CSXSEC\NOU\GNOU-0.POL
\CSXSEC\NOU\GNOU-0.F07 0.90
\CSXSEC\NOU\GNOU-0.MAT
\CSXSEC\NOU\GNOU-0.F11 0.90
\CSXSEC\NOU\GNOU-0.F15 0.90
\CSXSEC\NOU\GNOU-0.F40 0.90
\CSXSEC\NOU\GNOU-0.ORC
KENO GEOM
    0   /* # OF REGIONS OR ZERO
    0   /* # OF BOX TYPES OR ZERO
    1   /* # OF BOXES IN X DIRECTION
    1   /* # OF BOXES IN Y DIRECTION
    1   /* # OF BOXES IN Z DIRECTION
    1   /* BOUNDARY CONDITION OPTION
    1   /* STARTING SOURCE OPTION
    1   /* COMPLEX EMBEDDED OPTION
    0   /* # OF PRINT PLOTS
    -1.0      -1.0      -1.0      -1.0      -1.0      -1.0
BOX TYPE     1  /* inner canister: bottom fuel_region #1 w/ gap: body assy
CYLINDER     1  10.8141  0.31750  0.00000                                16*.5
CYLINDER     2  10.9233  0.31750  0.00000                                16*.5
CYLINDER     0  12.4092  0.31750  0.00000                                16*.5
CYLINDER     2  12.4092  0.31750 -0.44200                                16*.5
CYLINDER     2  12.4612  0.31750 -0.44200                                16*.5
CYLINDER     0  12.7000  0.31750 -0.44200                                16*.5
CYLINDER     2  12.7635  0.31750 -0.50550                                16*.5
BOX TYPE     2  /* inner canister: fuel_region #2: body assy
```

```
CYLINDER     1  10.8141  25.4635   0.0000                                    16*.5
CYLINDER     2  10.9233  25.4635   0.0000                                    16*.5
CYLINDER     3  10.9614  25.4635   0.0000                                    16*.5
CYLINDER     4  12.4092  25.4635   0.0000                                    16*.5
CYLINDER     2  12.4612  25.4635   0.0000                                    16*.5
CYLINDER     0  12.7000  25.4635   0.0000                                    16*.5
CYLINDER     2  12.7635  25.4635   0.0000                                    16*.5
BOX TYPE     3  /* inner canister: fuel_region #3, 0.15" od gap: body assy
CYLINDER     1  10.8141  0.38100  0.00000                                    16*.5
CYLINDER     2  10.9233  0.38100  0.00000                                    16*.5
CYLINDER     0  10.9614  0.38100  0.00000                                    16*.5
CYLINDER     4  12.4092  0.38100  0.00000                                    16*.5
CYLINDER     2  12.4612  0.38100  0.00000                                    16*.5
CYLINDER     0  12.7000  0.38100  0.00000                                    16*.5
CYLINDER     2  12.7635  0.38100  0.00000                                    16*.5
BOX TYPE     4  /* inner canister: fuel_region #4: body assy
CYLINDER     1  10.8141  25.4635   0.0000                                    16*.5
CYLINDER     2  10.9233  25.4635   0.0000                                    16*.5
CYLINDER     3  10.9614  25.4635   0.0000                                    16*.5
CYLINDER     4  12.4092  25.4635   0.0000                                    16*.5
CYLINDER     2  12.4612  25.4635   0.0000                                    16*.5
CYLINDER     0  12.7000  25.4635   0.0000                                    16*.5
CYLINDER     2  12.7635  25.4635   0.0000                                    16*.5
BOX TYPE     5  /* inner canister: fuel_region #5, 0.15" od gap: body assy
CYLINDER     1  10.8141  0.38100  0.00000                                    16*.5
CYLINDER     2  10.9233  0.38100  0.00000                                    16*.5
CYLINDER     0  10.9614  0.38100  0.00000                                    16*.5
CYLINDER     4  12.4092  0.38100  0.00000                                    16*.5
CYLINDER     2  12.4612  0.38100  0.00000                                    16*.5
CYLINDER     0  12.7000  0.38100  0.00000                                    16*.5
CYLINDER     2  12.7635  0.38100  0.00000                                    16*.5
BOX TYPE     6  /* inner canister: fuel region #6: body assy
CYLINDER     1  10.8141  21.3385   0.0000                                    16*.5
CYLINDER     2  10.9233  21.3385   0.0000                                    16*.5
CYLINDER     3  10.9614  21.3385   0.0000                                    16*.5
CYLINDER     4  12.4092  21.3385   0.0000                                    16*.5
CYLINDER     2  12.4612  21.3385   0.0000                                    16*.5
CYLINDER     0  12.7000  21.3385   0.0000                                    16*.5
CYLINDER     2  12.7635  21.3385   0.0000                                    16*.5
BOX TYPE     7  /* inner canister: fuel region #7: body assy
CYLINDER     1  10.8141   3.4925   0.0000                                    16*.5
CYLINDER     2  10.9233   3.4925   0.0000                                    16*.5
CYLINDER     3  10.9614   3.4925   0.0000                                    16*.5
CYLINDER     4  12.4092   3.4925   0.0000                                    16*.5
CYLINDER     2  12.4612   3.4925   0.0000                                    16*.5
CYLINDER     0  12.7000   3.4925   0.0000                                    16*.5
CYLINDER     2  12.7635   3.4925   0.0000                                    16*.5
BOX TYPE     8  /* inner canister - fuel region #8: lid assy
CYLINDER     1  10.8141  0.63250  0.00000                                    16*.5
CYLINDER     2  10.9233  0.63250  0.00000                                    16*.5
CYLINDER     3  10.9614  0.63250  0.00000                                    16*.5
CYLINDER     4  12.4092  0.63250  0.00000                                    16*.5
CYLINDER     2  12.4612  0.63250  0.00000                                    16*.5
CYLINDER     0  12.7000  0.63250  0.00000                                    16*.5
CYLINDER     2  12.7635  0.63250  0.00000                                    16*.5
BOX TYPE     9  /* inner canister - fuel region #9 w/ gap: lid assy
CYLINDER     1  10.8141  0.31750  0.00000                                    16*.5
CYLINDER     2  10.9233  0.31750  0.00000                                    16*.5
CYLINDER     0  12.4092  0.31750  0.00000                                    16*.5
CYLINDER     2  12.4612  0.31750  0.00000                                    16*.5
BOX TYPE    10  /* inner canister - fuel region #10 w/ ring: lid assy
CYLINDER     1  10.8141  0.44200  0.00000                                    16*.5
CYLINDER     2  10.9233  0.44200  0.00000                                    16*.5
CYLINDER     2  12.4092  0.44200  0.00000                                    16*.5
CYLINDER     2  12.4612  0.44200  0.00000                                    16*.5
BOX TYPE    11  /* inner canister - fuel region #11 w/ top: lid assy
CYLINDER     1  10.8141  1.78050  0.00000                                    16*.5
CYLINDER     2  10.9233  1.91640  0.00000                                    16*.5
CYLINDER     0  12.4092  1.91640  0.00000                                    16*.5
BOX TYPE    12  /* inner canister cuboid: body section (7# region)
CUBOID       5  12.7636 -12.7636  12.7636 -12.7636  73.3050  -0.5055  16*.5
BOX TYPE    13  /* inner canister cuboid. body section (40# region)
CUBOID       9  12.7636 -12.7636  12.7636 -12.7636  3.49260  0.00000  16*.5
BOX TYPE    14  /* inner canister upper cylinder: lid section
CYLINDER     0  12.7636  3.30840  0.00000                                    16*.5
BOX TYPE    15  /* foam cutout (void) - 40 #/ft3 foam lid section
CYLINDER     0  13.5510  3.30840  0.00000                                    16*.5
BOX TYPE    16  /* npc body or lid - 10 ga. 304ss layer
CUBOID       2  54.3687 -54.3687  54.3687 -54.3687  0.31240  0.00000  16*.5
BOX TYPE    17  /* npc body or lid - 1" duraboard (void) layer, 10 ga. 304ss
CUBOID       0  51.5163 -51.5163  51.5163 -51.5163  2.54000  0.00000  16*.5
CUBOID       0  54.0563 -54.0563  54.0563 -54.0563  2.54000  0.00000  16*.5
CUBOID       2  54.3687 -54.3687  54.3687 -54.3687  2.54000  0.00000  16*.5
BOX TYPE    18  /* npc body - 3" bot. foam layer (11 #/ft3), 10 ga. 304ss
CUBOID       7  51.5163 -51.5163  51.5163 -51.5163  7.62000  0.00000  16*.5
CUBOID       0  54.0563 -54.0563  54.0563 -54.0563  7.62000  0.00000  16*.5
CUBOID       2  54.3687 -54.3687  54.3687 -54.3687  7.62000  0.00000  16*.5
BOX TYPE    19  /* npc body - 29.0750" foam layer (7,11 #/ft3),10 ga. 304ss
CUBOID       5  43.8963 -43.8963  43.8963 -43.8963  73.8505   0.0000  16*.5
CUBOID       7  51.5163 -51.5163  51.5163 -51.5163  73.8505   0.0000  16*.5
CUBOID       0  54.0563 -54.0563  54.0563 -54.0563  73.8505   0.0000  16*.5
CUBOID       2  54.3687 -54.3687  54.3687 -54.3687  73.8505   0.0000  16*.5
BOX TYPE    20  /* npc body - 1.375 " foam layer (40 #/ft3), 10 ga. 304ss
CUBOID       9  51.5163 -51.5163  51.5163 -51.5163  3.49250  0.00000  16*.5
CUBOID       0  54.0563 -54.0563  54.0563 -54.0563  3.49250  0.00000  16*.5
CUBOID       2  54.3687 -54.3687  54.3687 -54.3687  3.49250  0.00000  16*.5
BOX TYPE    21  /* npc body - 30.45" two-part body
CUBOID       0  54.3687 -54.3687  54.3687 -54.3687  77.3430   0.0000  16*.5
BOX TYPE    22  /* npc lid - 1.375 " foam layer (40 #/ft3), 10 ga. 304ss
CUBOID       9  51.5163 -51.5163  51.5163 -51.5163  3.49250  0.00000  16*.5
```

```
CUBOID       0  54.0563 -54.0563  54.0563 -54.0563  3.49250  0.00000  16*.5
CUBOID       2  54.3687 -54.3687  54.3687 -54.3687  3.49250  0.00000  16*.5
BOX TYPE    23  /* npc lid - 3.5" foam layer (15 #/ft3), 10 ga. 304ss
CUBOID       8  51.5163 -51.5163  51.5163 -51.5163  8.89000  0.00000  16*.5
CUBOID       0  54.0563 -54.0563  54.0563 -54.0563  8.89000  0.00000  16*.5
CUBOID       2  54.3687 -54.3687  54.3687 -54.3687  8.89000  0.00000  16*.5
BOX TYPE    24  /* complete npc - body assembly
CUBOID       0  54.3688 -54.3688  54.3688 -54.3688  87.8154   0.0000  16*.5
BOX TYPE    25  /* complete npc - lid assembly
CUBOID       0  54.3688 -54.3688  54.3688 -54.3688  15.2349   0.0000  16*.5
BOX TYPE    26  /* global unit: npc infinite system
CUBOID       0  54.3700 -54.3700  54.3700 -54.3700  103.051     0.000  16*.5
 26    1  1  1    1  1  1    1  1  1  1
BEGIN COMPLEX
/* build inner canister - main body section (7 #/ft3 region)
COMPLEX  12  1  0.00000  0.00000  0.00000   1   1   1  0.0   0.0   0.0
COMPLEX  12  2  0.00000  0.00000  0.31750   1   1   1  0.0   0.0   0.0
COMPLEX  12  3  0.00000  0.00000  25.7810   1   1   1  0.0   0.0   0.0
COMPLEX  12  4  0.00000  0.00000  26.1621   1   1   1  0.0   0.0   0.0
COMPLEX  12  5  0.00000  0.00000  51.6256   1   1   1  0.0   0.0   0.0
COMPLEX  12  6  0.00000  0.00000  52.0066   1   1   1  0.0   0.0   0.0
/* build inner canister - upper body section (40 #/ft3 section)
COMPLEX  13  7  0.00000  0.00000  0.00000   1   1   1  0.0   0.0   0.0
/* build inner canister - lid section
COMPLEX  14  8  0.00000  0.00000  0.00000   1   1   1  0.0   0.0   0.0
COMPLEX  14  9  0.00000  0.00000  0.63250   1   1   1  0.0   0.0   0.0
COMPLEX  14 10  0.00000  0.00000  0.95000   1   1   1  0.0   0.0   0.0
COMPLEX  14 11  0.00000  0.00000  1.39200   1   1   1  0.0   0.0   0.0
/* embed 3x3 array of canisters into lid: 11.75"-centers
COMPLEX  15 14 -29.8450 -29.8450  0.00000   3   3   1  29.8450  29.8450  0.0
/* embed 3x3 array of foam cut_outs:11.75"-centers
COMPLEX  22 15 -29.8450 -29.8450  0.00000   3   3   1  29.8450  29.8450  0.0
/* embed 3x3 array of canisters into inner body: 11.75"-centers
COMPLEX  19 12 -29.8450 -29.8450  0.50550   3   3   1  29.8450  29.8450  0.0
COMPLEX  20 13 -29.8450 -29.8450  0.00000   3   3   1  29.8450  29.8450  0.0
/* embed two-part body section stackup
COMPLEX  21 19  0.00000  0.00000  0.00000   1   1   1  0.0   0.0   0.0
COMPLEX  21 20  0.00000  0.00000  73.8505   1   1   1  0.0   0.0   0.0
/* build npc - body assembly
COMPLEX  24 16  0.00000  0.00000  0.00000   1   1   1  0.0   0.0   0.0
COMPLEX  24 17  0.00000  0.00000  0.31240   1   1   1  0.0   0.0   0.0
COMPLEX  24 18  0.00000  0.00000  2.85240   1   1   1  0.0   0.0   0.0
COMPLEX  24 21  0.00000  0.00000  10.4724   1   1   1  0.0   0.0   0.0
/* build npc - lid assembly
COMPLEX  25 22  0.00000  0.00000  0.00000   1   1   1  0.0   0.0   0.0
COMPLEX  25 23  0.00000  0.00000  3.49250   1   1   1  0.0   0.0   0.0
COMPLEX  25 17  0.00000  0.00000  12.3825   1   1   1  0.0   0.0   0.0
COMPLEX  25 16  0.00000  0.00000  14.9225   1   1   1  0.0   0.0   0.0
/* complete npc stackup - single unit
COMPLEX  26 24  0.00000  0.00000  0.00000   1   1   1  0.0   0.0   0.0
COMPLEX  26 25  0.00000  0.00000  87.8154   1   1   1  0.0   0.0   0.0
END GEOM
DEFAULTS=YES
END GEMER
```

Figure 6.24c – Sample input file = npca2_60.in

```
2000.NPC,,,,CYL,,UO2,5.00%,WITH-VAR,,SS,,,CD,CH
/*ECHO
/*TITLE
  200 2000   10    0    0    1    0    0
    0  293    0    0
\CSKSKC\UO2\GUO2-50.285
\CSKSKC\NOU\GNOU-0.SS
\CSKSKC\NOU\GNOU-0.CAD
\CSKSKC\NOU\GNOU-0.POL 0.90
\CSKSKC\NOU\GNOU-0.F07 0.90
\CSKSKC\NOU\GNOU-0.WAT
\CSKSKC\NOU\GNOU-0.F11 0.90
\CSKSKC\NOU\GNOU-0.F15 0.90
\CSKSKC\NOU\GNOU-0.F40 0.90
\CSKSKC\NOU\GNOU-0.ORC
KENO GEOM
    0   /* # OF REGIONS OR ZERO
    0   /* # OF BOX TYPES OR ZERO
    1   /* # OF BOXES IN X DIRECTION
    1   /* # OF BOXES IN Y DIRECTION
    1   /* # OF BOXES IN Z DIRECTION
    1   /* BOUNDARY CONDITION OPTION
    1   /* STARTING SOURCE OPTION
    1   /* COMPLEX EMBEDDED OPTION
    0   /* # OF PRINT PLOTS
      0.0       0.0       0.0       0.0       0.0       0.0
BOX TYPE     1  /* inner canister: bottom fuel region #1 w/ gap: body assy
CYLINDER     1  10.8141  0.31750  0.00000                              16*.5
CYLINDER     2  10.9233  0.31750  0.00000                              16*.5
CYLINDER     0  12.4092  0.31750  0.00000                              16*.5
CYLINDER     2  12.4092  0.31750 -0.44200                              16*.5
CYLINDER     2  12.4612  0.31750 -0.44200                              16*.5
CYLINDER     0  12.7000  0.31750 -0.44200                              16*.5
CYLINDER     2  12.7635  0.31750 -0.50550                              16*.5
BOX TYPE     2  /* inner canister: fuel region #2: body assy
CYLINDER     1  10.8141  25.4635   0.0000                              16*.5
CYLINDER     2  10.9233  25.4635   0.0000                              16*.5
CYLINDER     3  10.9614  25.4635   0.0000                              16*.5
CYLINDER     4  12.4092  25.4635   0.0000                              16*.5
CYLINDER     2  12.4612  25.4635   0.0000                              16*.5
CYLINDER     0  12.7000  25.4635   0.0000                              16*.5
```

```
CYLINDER    2  12.7635  25.4635   0.0000                          16*.5
BOX TYPE    3  /* inner canister: fuel_region #3, 0.15" od gap: body assy
CYLINDER    1  10.8141  0.38100  0.00000                          16*.5
CYLINDER    2  10.9233  0.38100  0.00000                          16*.5
CYLINDER    0  10.9614  0.38100  0.00000                          16*.5
CYLINDER    4  12.4092  0.38100  0.00000                          16*.5
CYLINDER    2  12.4612  0.38100  0.00000                          16*.5
CYLINDER    0  12.7000  0.38100  0.00000                          16*.5
CYLINDER    2  12.7635  0.38100  0.00000                          16*.5
BOX TYPE    4  /* inner canister: fuel_region #4: body assy
CYLINDER    1  10.8141  25.4635   0.0000                          16*.5
CYLINDER    2  10.9233  25.4635   0.0000                          16*.5
CYLINDER    3  10.9614  25.4635   0.0000                          16*.5
CYLINDER    4  12.4092  25.4635   0.0000                          16*.5
CYLINDER    2  12.4612  25.4635   0.0000                          16*.5
CYLINDER    0  12.7000  25.4635   0.0000                          16*.5
CYLINDER    2  12.7635  25.4635   0.0000                          16*.5
BOX TYPE    5  /* inner canister: fuel_region #5, 0.15" od gap: body assy
CYLINDER    1  10.8141  0.38100  0.00000                          16*.5
CYLINDER    2  10.9233  0.38100  0.00000                          16*.5
CYLINDER    0  10.9614  0.38100  0.00000                          16*.5
CYLINDER    4  12.4092  0.38100  0.00000                          16*.5
CYLINDER    2  12.4612  0.38100  0.00000                          16*.5
CYLINDER    0  12.7000  0.38100  0.00000                          16*.5
CYLINDER    2  12.7635  0.38100  0.00000                          16*.5
BOX TYPE    6  /* inner canister: fuel region #6: body assy
CYLINDER    1  10.8141  21.3385   0.0000                          16*.5
CYLINDER    0  10.8141  21.3385   0.0000                          16*.5
CYLINDER    2  10.9233  21.3385   0.0000                          16*.5
CYLINDER    3  10.9614  21.3385   0.0000                          16*.5
CYLINDER    4  12.4092  21.3385   0.0000                          16*.5
CYLINDER    2  12.4612  21.3385   0.0000                          16*.5
CYLINDER    0  12.7000  21.3385   0.0000                          16*.5
CYLINDER    2  12.7635  21.3385   0.0000                          16*.5
BOX TYPE    7  /* inner canister: fuel region #7: body assy
CYLINDER    1  10.8141   3.4925   0.0000                          16*.5
CYLINDER    0  10.8141   3.4925   0.0000                          16*.5
CYLINDER    2  10.9233   3.4925   0.0000                          16*.5
CYLINDER    3  10.9614   3.4925   0.0000                          16*.5
CYLINDER    4  12.4092   3.4925   0.0000                          16*.5
CYLINDER    2  12.4612   3.4925   0.0000                          16*.5
CYLINDER    0  12.7000   3.4925   0.0000                          16*.5
CYLINDER    2  12.7635   3.4925   0.0000                          16*.5
BOX TYPE    8  /* inner canister - fuel region #8: lid assy
CYLINDER    1  10.8141  0.63250  0.00000                          16*.5
CYLINDER    0  10.8141  0.63250  0.00000                          16*.5
CYLINDER    2  10.9233  0.63250  0.00000                          16*.5
CYLINDER    3  10.9614  0.63250  0.00000                          16*.5
CYLINDER    4  12.4092  0.63250  0.00000                          16*.5
CYLINDER    2  12.4612  0.63250  0.00000                          16*.5
CYLINDER    0  12.7000  0.63250  0.00000                          16*.5
CYLINDER    2  12.7635  0.63250  0.00000                          16*.5
BOX TYPE    9  /* inner canister - fuel region #9 w/ gap: lid assy
CYLINDER    1  10.8141  0.31750  0.00000                          16*.5
CYLINDER    2  10.9233  0.31750  0.00000                          16*.5
CYLINDER    0  12.4092  0.31750  0.00000                          16*.5
CYLINDER    2  12.4612  0.31750  0.00000                          16*.5
BOX TYPE   10  /* inner canister - fuel region #10 w/ ring: lid assy
CYLINDER    1  10.8141  0.44200  0.00000                          16*.5
CYLINDER    2  10.9233  0.44200  0.00000                          16*.5
CYLINDER    2  12.4092  0.44200  0.00000                          16*.5
CYLINDER    2  12.4612  0.44200  0.00000                          16*.5
BOX TYPE   11  /* inner canister - fuel region #11 w/ top: lid assy
CYLINDER    1  10.8141  1.78050  0.00000                          16*.5
CYLINDER    2  10.9233  1.91640  0.00000                          16*.5
CYLINDER    0  12.4092  1.91640  0.00000                          16*.5
BOX TYPE   12  /* inner canister cuboid: body section (7# region)
CUBOID      5  12.7636 -12.7636  12.7636 -12.7636  73.3450  -0.5055  16*.5
BOX TYPE   13  /* inner canister cuboid: body section (40# region)
CUBOID      9  12.7636 -12.7636  12.7636 -12.7636  3.49260  0.00000  16*.5
BOX TYPE   14  /* inner canister upper cylinder: lid section
CYLINDER    0  12.7636  3.30840  0.00000                          16*.5
BOX TYPE   15  /* foam cutout (void) - 40 #/ft3 foam lid section
CYLINDER    0  13.5510  3.30840  0.00000                          16*.5
BOX TYPE   16  /* npc body or lid - 10 ga. 304ss layer
CUBOID      2  54.3687 -54.3687  54.3687 -54.3687  0.31240  0.00000  16*.5
BOX TYPE   17  /* npc body or lid  1" duraboard (void) layer, 10 ga. 304ss
CUBOID      0  51.5163 -51.5163  51.5163 -51.5163  2.54000  0.00000  16*.5
CUBOID      0  54.0563 -54.0563  54.0563 -54.0563  2.54000  0.00000  16*.5
CUBOID      2  54.3687 -54.3687  54.3687 -54.3687  2.54000  0.00000  16*.5
BOX TYPE   18  /* npc body - 3" bot. foam layer (11 #/ft3)  *** SN002 burn
CUBOID      7  47.4777 -44.5567  45.3695 -44.4805  0.00000  0.00000  16*.5
CUBOID      0  54.0563 -54.0563  54.0563 -54.0563  0.00000 -7.62000  16*.5
CUBOID      2  54.3687 -54.3687  54.3687 -54.3687  0.00000 -7.62000  16*.5
BOX TYPE   19  /* npc body - 29.0750" foam layer (7,11 #/ft3)***SN002 burn
CUBOID      5  43.8963 -43.8963  43.8963 -43.8963  73.8505   0.0000  16*.5
CUBOID      7  47.4777 -44.5567  45.3695 -44.4805  73.8505   0.0000  16*.5
CUBOID      0  54.0563 -54.0563  54.0563 -54.0563  73.8505   0.0000  16*.5
CUBOID      2  54.3687 -54.3687  54.3687 -54.3687  73.8505   0.0000  16*.5
BOX TYPE   20  /* npc body - 1.375 " foam layer (40 #/ft3)  *** SN002 burn
CUBOID      9  47.4777 -44.5567  45.3695 -44.4805  3.49250  0.00000  16*.5
CUBOID      0  54.0563 -54.0563  54.0563 -54.0563  3.49250  0.00000  16*.5
CUBOID      2  54.3687 -54.3687  54.3687 -54.3687  3.49250  0.00000  16*.5
BOX TYPE   21  /* npc body - 30.45" two-part body
CUBOID      0  54.3687 -54.3687  54.3687 -54.3687  77.3430   0.0000  16*.5
BOX TYPE   22  /* npc lid - 1.375 " foam layer (40 #/ft3)   *** SN002 burn
CUBOID      9  47.4777 -44.5567  45.3695 -44.4805  3.49250  0.00000  16*.5
CUBOID      0  54.0563 -54.0563  54.0563 -54.0563  3.49250  0.00000  16*.5
CUBOID      2  54.3687 -54.3687  54.3687 -54.3687  3.49250  0.00000  16*.5
BOX TYPE   23  /* npc lid - 3.5" foam layer (15 #/ft3)      *** SN002 burn
```

```
CUBOID       8  47.4777 -44.5567  45.3695 -44.4805  7.62000  0.00000  16*.5
CUBOID       0  54.0563 -54.0563  54.0563 -54.0563  8.89000  0.00000  16*.5
CUBOID       2  54.3687 -54.3687  54.3687 -54.3687  8.89000  0.00000  16*.5
BOX TYPE    24  /* complete npc - body assembly
CUBOID       0  54.3688 -54.3688  54.3688 -54.3688  87.8154   0.0000  16*.5
BOX TYPE    25  /* complete npc - lid assembly
CUBOID       0  54.3688 -54.3688  54.3688 -54.3688  15.2349   0.0000  16*.5
BOX TYPE    26  /* npc single-unit cuboid
CUBOID       0  54.3688 -54.3688  54.3688 -54.3688  103.0503  0.0000  16*.5
BOX TYPE    27  /* global unit: 2N-150:5x5x6 cuboid, 30.48-cm h2o refl.
CUBOID       0  271.8440 -271.8440 271.8440 -271.8440 618.3018  0.000  16*.5
CUBOID       6  302.3240 -302.3240 302.3240 -302.3240 648.7818 -30.48  16*.5
 27   1  1  1    1  1  1   1  1  1  1
BEGIN COMPLEX
/* build inner canister - main body section (7 #/ft3 region)
COMPLEX  12  1  0.00000  0.00000  3.00000   1   1   1  0.0   0.0   0.0
COMPLEX  12  2  0.00000  0.00000  3.31750   1   1   1  0.0   0.0   0.0
COMPLEX  12  3  0.00000  0.00000  25.7810   1   1   1  0.0   0.0   0.0
COMPLEX  12  4  0.00000  0.00000  26.1621   1   1   1  0.0   0.0   0.0
COMPLEX  12  5  0.00000  0.00000  31.6256   1   1   1  0.0   0.0   0.0
COMPLEX  12  6  0.00000  0.00000  32.0066   1   1   1  0.0   0.0   0.0
/* build inner canister - upper body section (40 #/ft3 section)
COMPLEX  13  7  0.00000  0.00000  3.00000   1   1   1  0.0   0.0   0.0
/* build inner canister - lid section
COMPLEX  14  8  0.00000  0.00000  3.00000   1   1   1  0.0   0.0   0.0
COMPLEX  14  9  0.00000  0.00000  3.63250   1   1   1  0.0   0.0   0.0
COMPLEX  14 10  0.00000  0.00000  0.95000   1   1   1  0.0   0.0   0.0
COMPLEX  14 11  0.00000  0.00000  1.39200   1   1   1  0.0   0.0   0.0
/* embed 3x3 array of canisters into lid: 11.75"-centers
COMPLEX  16 14  29.8450  29.8450  0.00000   3   3   1  29.8450  29.8450  0.0
/* embed 3x3 array of foam cut_outs:11.75"-centers
COMPLEX  22 15 -29.8450 -29.8450  0.00000   3   3   1  29.8450  29.8450  0.0
/* embed 3x3 array of canisters into inner body: 11.75"-centers
COMPLEX  19 12 -29.8450 -29.8450  0.50550   3   3   1  29.8450  29.8450  0.0
COMPLEX  20 13 -29.8450 -29.8450  0.00000   3   3   1  29.8450  29.8450  0.0
/* embed two-part body section stackup
COMPLEX  21 19  0.00000  0.00000  0.00000   1   1   1  0.0   0.0   0.0
COMPLEX  21 20  0.00000  0.00000  73.8505   1   1   1  0.0   0.0   0.0
/* build npc - body assembly
COMPLEX  24 16  0.00000  0.00000  0.00000   1   1   1  0.0   0.0   0.0
COMPLEX  24 17  0.00000  0.00000  0.31240   1   1   1  0.0   0.0   0.0
COMPLEX  24 18  0.00000  0.00000  10.4724   1   1   1  0.0   0.0   0.0
COMPLEX  24 21  0.00000  0.00000  10.4724   1   1   1  0.0   0.0   0.0
/* build npc - lid assembly
COMPLEX  25 22  0.00000  0.00000  0.00000   1   1   1  0.0   0.0   0.0
COMPLEX  25 23  0.00000  0.00000  3.49250   1   1   1  0.0   0.0   0.0
COMPLEX  25 17  0.00000  0.00000  12.3825   1   1   1  0.0   0.0   0.0
COMPLEX  25 16  0.00000  0.00000  14.9225   1   1   1  0.0   0.0   0.0
/* complete npc stackup - single unit
COMPLEX  26 24  0.00000  0.00000  0.00000   1   1   1  0.0   0.0   0.0
COMPLEX  26 25  0.00000  0.00000  87.8154   1   1   1  0.0   0.0   0.0
/* embed 5x5x6 cloued packed array
COMPLEX  27 26  -217.4752 -217.4752 0.000  5 5 6 108.7376 108.7376 103.0503
END GEOM
DEFAULTS=YES
END GEMER
```

Figure 6.24d – Sample input file = npcat_60.in

```
2000.NPC,,,,CYL,,UO2,5.00%,WTFR=VAR.,SS,,,CD,CE
/*ECHO
/*TITLE
  200 2000   10    0    0    1    0    0
    0  293    0    0
\CSXSEC\UO2\GUO2-50.285
\CSXSEC\NOU\GNOU-0.SS
\CSXSEC\NOU\GNOU-0.CAB
\CSXSEC\NOU\GNOU-0.POL 0.98
\CSXSEC\NOU\GNOU-0.F07 0.90
\CSXSEC\NOU\GNOU-0.WAT
\CSXSEC\NOU\GNOU-0.F11 0.90
\CSXSEC\NOU\GNOU-0.F15 0.90
\CSXSEC\NOU\GNOU-0.F40 0.90
\CSXSEC\NOU\GNOU-0.ONC
KENO GEOM
    0  /* # OF REGIONS OR ZERO
    0  /* # OF BOX TYPES OR ZERO
    1  /* # OF BOXES IN X DIRECTION
    1  /* # OF BOXES IN Y DIRECTION
    1  /* # OF BOXES IN Z DIRECTION
    1  /* BOUNDARY CONDITION OPTION
    1  /* STARTING SOURCE OPTION
    1  /* COMPLEX EMBEDDED OPTION
    0  /* # OF PRINT PLOTS
      0.0       0.0       0.0       0.0       0.0       0.0
BOX TYPE     1  /* inner canister: bottom fuel region #1 w/ gap: body assy
CYLINDER     1  10.8141  0.31750  0.00000                                 16*.5
CYLINDER     2  10.9233  0.31750  0.00000                                 16*.5
CYLINDER     0  12.4092  0.31750  0.00000                                 16*.5
CYLINDER     2  12.4092  0.31750 -0.44200                                 16*.5
CYLINDER     2  12.4612  0.31750 -0.44200                                 16*.5
CYLINDER     0  12.7000  0.31750 -0.44200                                 16*.5
CYLINDER     2  12.7635  0.31750 -0.50550                                 16*.5
BOX TYPE     2  /* inner canister: fuel region #2: body assy
CYLINDER     1  10.8141  25.4635   0.0000                                 16*.5
CYLINDER     2  10.9233  25.4635   0.0000                                 16*.5
CYLINDER     3  10.9614  25.4635   0.0000                                 16*.5
```

```
CYLINDER     4  12.4092  25.4635   0.0000                                16*.5
CYLINDER     2  12.4612  25.4635   0.0000                                16*.5
CYLINDER     0  12.7000  25.4635   0.0000                                16*.5
CYLINDER     2  12.7635  25.4635   0.0000                                16*.5
BOX TYPE     3  /* inner canister: fuel region #3, 0.15" od gap: body assy
CYLINDER     1  10.8141  0.38100  0.00000                                16*.5
CYLINDER     2  10.9233  0.38100  0.00000                                16*.5
CYLINDER     0  10.9614  0.38100  0.00000                                16*.5
CYLINDER     4  12.4092  0.38100  0.00000                                16*.5
CYLINDER     2  12.4612  0.38100  0.00000                                16*.5
CYLINDER     0  12.7000  0.38100  0.00000                                16*.5
CYLINDER     2  12.7635  0.38100  0.00000                                16*.5
BOX TYPE     4  /* inner canister: fuel region #4: body assy
CYLINDER     1  10.8141  25.4635   0.0000                                16*.5
CYLINDER     2  10.9233  25.4635   0.0000                                16*.5
CYLINDER     3  10.9614  25.4635   0.0000                                16*.5
CYLINDER     4  12.4092  25.4635   0.0000                                16*.5
CYLINDER     2  12.4612  25.4635   0.0000                                16*.5
CYLINDER     0  12.7000  25.4635   0.0000                                16*.5
CYLINDER     2  12.7635  25.4635   0.0000                                16*.5
BOX TYPE     5  /* inner canister: fuel region #5, 0.15" od gap: body assy
CYLINDER     1  10.8141  0.38100  0.00000                                16*.5
CYLINDER     2  10.9233  0.38100  0.00000                                16*.5
CYLINDER     0  10.9614  0.38100  0.00000                                16*.5
CYLINDER     4  12.4092  0.38100  0.00000                                16*.5
CYLINDER     2  12.4612  0.38100  0.00000                                16*.5
CYLINDER     0  12.7000  0.38100  0.00000                                16*.5
CYLINDER     2  12.7635  0.38100  0.00000                                16*.5
BOX TYPE     6  /* inner canister: fuel region #6: body assy
CYLINDER     1  10.8141  21.3385   0.0000                                16*.5
CYLINDER     0  10.8141  21.3385   0.0000                                16*.5
CYLINDER     2  10.9233  21.3385   0.0000                                16*.5
CYLINDER     3  10.9614  21.3385   0.0000                                16*.5
CYLINDER     4  12.4092  21.3385   0.0000                                16*.5
CYLINDER     2  12.4612  21.3385   0.0000                                16*.5
CYLINDER     0  12.7000  21.3385   0.0000                                16*.5
CYLINDER     2  12.7635  21.3385   0.0000                                16*.5
BOX TYPE     7  /* inner canister: fuel region #7: body assy
CYLINDER     1  10.8141   3.4925   0.0000                                16*.5
CYLINDER     0  10.8141   3.4925   0.0000                                16*.5
CYLINDER     2  10.9233   3.4925   0.0000                                16*.5
CYLINDER     3  10.9614   3.4925   0.0000                                16*.5
CYLINDER     4  12.4092   3.4925   0.0000                                16*.5
CYLINDER     2  12.4612   3.4925   0.0000                                16*.5
CYLINDER     0  12.7000   3.4925   0.0000                                16*.5
CYLINDER     2  12.7635   3.4925   0.0000                                16*.5
BOX TYPE     8  /* inner canister - fuel region #8: lid assy
CYLINDER     1  10.8141  0.63250  0.00000                                16*.5
CYLINDER     0  10.8141  0.63250  0.00000                                16*.5
CYLINDER     2  10.9233  0.63250  0.00000                                16*.5
CYLINDER     3  10.9614  0.63250  0.00000                                16*.5
CYLINDER     4  12.4092  0.63250  0.00000                                16*.5
CYLINDER     2  12.4612  0.63250  0.00000                                16*.5
CYLINDER     0  12.7000  0.63250  0.00000                                16*.5
CYLINDER     2  12.7635  0.63250  0.00000                                16*.5
BOX TYPE     9  /* inner canister - fuel region #9 w/ gap: lid assy
CYLINDER     1  10.8141  0.31750  0.00000                                16*.5
CYLINDER     2  10.9233  0.31750  0.00000                                16*.5
CYLINDER     0  12.4092  0.31750  0.00000                                16*.5
CYLINDER     2  12.4612  0.31750  0.00000                                16*.5
BOX TYPE    10  /* inner canister - fuel region #10 w/ ring: lid assy
CYLINDER     1  10.8141  0.44200  0.00000                                16*.5
CYLINDER     2  10.9233  0.44200  0.00000                                16*.5
CYLINDER     2  12.4092  0.44200  0.00000                                16*.5
CYLINDER     2  12.4612  0.44200  0.00000                                16*.5
BOX TYPE    11  /* inner canister - fuel region #11 w/ top: lid assy
CYLINDER     1  10.8141  1.78050  0.00000                                16*.5
CYLINDER     2  10.9233  1.91640  0.00000                                16*.5
CYLINDER     0  12.4092  1.91640  0.00000                                16*.5
BOX TYPE    12  /* inner canister cuboid: body section (7# region)
CUBOID       5  12.7636 -12.7636  12.7636 -12.7636  73.3450  -0.5055  16*.5
BOX TYPE    13  /* inner canister cuboid: body section (40# region)
CUBOID       9  12.7636 -12.7636  12.7636 -12.7636  3.49260  0.00000  16*.5
BOX TYPE    14  /* inner canister upper cylinder: lid section
CYLINDER     0  12.7636  3.30840  0.00000                                16*.5
BOX TYPE    15  /* foam cutout (void) - 40 #/ft3 foam lid section
CYLINDER     0  13.5510  3.30840  0.00000                                16*.5
BOX TYPE    16  /* npc body or lid - 10 ga. 304ss layer
CUBOID       2  54.3687 -54.3687  54.3687 -54.3687  0.31240  0.00000  16*.5
BOX TYPE    17  /* npc body or lid - 1" duraboard (void) layer, 10 ga. 304ss
CUBOID       0  51.5163 -51.5163  51.5163 -51.5163  2.54000  0.00000  16*.5
CUBOID       0  54.0563 -54.0563  54.0563 -54.0563  2.54000  0.00000  16*.5
CUBOID       2  54.3687 -54.3687  54.3687 -54.3687  2.54000  0.00000  16*.5
BOX TYPE    18  /* npc body - 4" bot. foam layer (11 #/ft3)     - face burn
CUBOID       7  42.6086 -42.6086  42.6086 -42.6086  0.00000  0.00000  16*.5
CUBOID       0  54.0563 -54.0563  54.0563 -54.0563  0.00000 -7.62000  16*.5
CUBOID       2  54.3687 -54.3687  54.3687 -54.3687  0.00000 -7.62000  16*.5
BOX TYPE    19  /* npc body - 29.0750" foam layer (7.11 #/ft3) - face burn
CUBOID       5  42.6086 -42.6086  42.6086 -42.6086  73.8505   0.0000  16*.5
CUBOID       7  42.6086 -42.6086  42.6086 -42.6086  73.8505   0.0000  16*.5
CUBOID       0  54.0563 -54.0563  54.0563 -54.0563  73.8505   0.0000  16*.5
CUBOID       2  54.3687 -54.3687  54.3687 -54.3687  73.8505   0.0000  16*.5
BOX TYPE    20  /* npc body - 1.375 " foam layer (40 #/ft3)     - face burn
CUBOID       9  42.6086 -42.6086  42.6086 -42.6086  3.49250  0.00000  16*.5
CUBOID       0  54.0563 -54.0563  54.0563 -54.0563  3.49250  0.00000  16*.5
CUBOID       2  54.3687 -54.3687  54.3687 -54.3687  3.49250  0.00000  16*.5
BOX TYPE    21  /* npc body - 30.45" two-part body
CUBOID       0  54.3687 -54.3687  54.3687 -54.3687  77.3430   0.0000  16*.5
BOX TYPE    22  /* npc lid - 1.375 " foam layer (40 #/ft3)  - lid burn
CUBOID       0  43.8963 -43.8963  43.8963 -43.8963  3.49250  0.00000  16*.5
```

```
CUBOID       0  54.0563 -54.0563  54.0563 -54.0563  3.49250  0.00000  16*.5
CUBOID       2  54.3687 -54.3687  54.3687 -54.3687  3.49250  0.00000  16*.5
BOX TYPE    23  /* npc lid - 3.5" foam layer (15 #/ft3)      - lid burn
CUBOID       0  43.8963  43.8963  43.8963 -43.8963  2.54000  0.00000  16*.5
CUBOID       0  54.0563 -54.0563  54.0563 -54.0563  8.89000  0.00000  16*.5
CUBOID       2  54.3687 -54.3687  54.3687 -54.3687  8.89000  0.00000  16*.5
BOX TYPE    24  /* complete npc - body assembly
CUBOID       0  54.3688 -54.3688  54.3688 -54.3688  87.8154   0.0000  16*.5
BOX TYPE    25  /* complete npc - lid assembly
CUBOID       0  54.3688 -54.3688  54.3688 -54.3688  15.2349   0.0000  16*.5
BOX TYPE    26  /* npc single-unit cuboid
CUBOID       0  54.3688 -54.3688  54.3688 -54.3688  103.0503  0.0000  16*.5
BOX TYPE    27  /* global unit: 2N-150:5x5x6 cuboid, 30.48-cm h2o refl.
CUBOID       0  271.8440 -271.8440 271.8440 -271.8440 618.3018  0.000  16*.5
CUBOID       6  302.3240 -302.3240 302.3240 -302.3240 648.7818 -30.48  16*.5
 27    1  1  1    1  1  1    1  1  1   1
BEGIN COMPLEX
/* build inner canister - main body section (7 #/ft3 region)
COMPLEX  12  1  0.00000  0.00000  0.00000   1   1   1  0.0   0.0   0.0
COMPLEX  12  2  0.00000  0.00000  0.31750   1   1   1  0.0   0.0   0.0
COMPLEX  12  3  0.00000  0.00000  25.7810   1   1   1  0.0   0.0   0.0
COMPLEX  12  4  0.00000  0.00000  26.1621   1   1   1  0.0   0.0   0.0
COMPLEX  12  5  0.00000  0.00000  51.6256   1   1   1  0.0   0.0   0.0
COMPLEX  12  6  0.00000  0.00000  52.0066   1   1   1  0.0   0.0   0.0
/* build inner canister - upper body section (40 #/ft3 section)
COMPLEX  13  7  0.00000  0.00000  0.00000   1   1   1  0.0   0.0   0.0
/* build inner canister - lid section
COMPLEX  14  8  0.00000  0.00000  0.00000   1   1   1  0.0   0.0   0.0
COMPLEX  14  9  0.00000  0.00000  0.63250   1   1   1  0.0   0.0   0.0
COMPLEX  14 10  0.00000  0.00000  0.99000   1   1   1  0.0   0.0   0.0
COMPLEX  14 11  0.00000  0.00000  1.39200   1   1   1  0.0   0.0   0.0
/* embed 3x3 array of canisters into lid: 11.75"-centers
COMPLEX  15 14 -29.8450 -29.8450  0.00000   3   3   1  29.8450  29.8450  0.0
/* embed 3x3 array of foam cut outs:11.75"-centers
COMPLEX  22 15 -29.8450 -29.8450  0.00000   3   3   1  29.8450  29.8450  0.0
/* embed 3x3 array of canisters into inner body: 11.75"-centers
COMPLEX  19 12 -29.8450 -29.8450  0.50550   3   3   1  29.8450  29.8450  0.0
COMPLEX  20 13 -29.8450 -29.8450  0.00000   3   3   1  29.8450  29.8450  0.0
/* embed two-part body section stackup
COMPLEX  21 19  0.00000  0.00000  0.00000   1   1   1  0.0   0.0   0.0
COMPLEX  21 20  0.00000  0.00000  73.8505   1   1   1  0.0   0.0   0.0
/* build npc - body assembly
COMPLEX  24 16  0.00000  0.00000  3.00000   1   1   1  0.0   0.0   0.0
COMPLEX  24 17  0.00000  0.00000  3.31240   1   1   1  0.0   0.0   0.0
COMPLEX  24 18  0.00000  0.00000  10.4724   1   1   1  0.0   0.0   0.0
COMPLEX  24 21  0.00000  0.00000  10.4724   1   1   1  0.0   0.0   0.0
/* build npc - lid assembly
COMPLEX  25 22  0.00000  0.00000  3.00000   1   1   1  0.0   0.0   0.0
COMPLEX  25 23  0.00000  0.00000  3.49250   1   1   1  0.0   0.0   0.0
COMPLEX  25 17  0.00000  0.00000  12.3825   1   1   1  0.0   0.0   0.0
COMPLEX  25 16  0.00000  0.00000  14.9225   1   1   1  0.0   0.0   0.0
/* complete npc stackup - single unit
COMPLEX  26 24  0.00000  0.00000  3.00000   1   1   1  0.0   0.0   0.0
COMPLEX  26 25  0.00000  0.00000  87.8154   1   1   1  0.0   0.0   0.0
/* embed 5x5x6 closed packed array
COMPLEX  27 26  -217.4752 -217.4752 0.000  5 5 6 108.7376 108.7376 103.0503
END GEOM
DEFAULTS=YES
END GEMER
```

B. Heterogeneous 55Kg and 53Kg UO_2 Rod Lattice Cases

Figure 6.25a – Sample input file = ESTP-400.in

```
2002 NPC SC, HET Lat,FRad=0.3810,55.0kg U(5.00)O2,WTF=4.00,MixHt=48.432cm
   200  /* # BATCHES
  2000  /* # NEUTRONS PER BATCH
    10  /* # BATCHES TO SKIP
     0  /* # INITIAL 'SEED' (IF NON-ZERO)
     0  /* # 'IDUMP'
     1  /* # 'NRSTRT'
     0  /* # 'NBTED' (NON-ZERO IS PRINT EDITS)
     0  /* # 'KRED' (NUMBER OF COMBINED REGIONS IN EDITS)
  0  293   0   0
\CSXSEC\UO2\GUO2-50.00
\CSXSEC\NOU\GNOU-0.SS
\CSXSEC\NOU\GNOU-0.CAD
\CSXSEC\NOU\GNOU-0.POL 0.98
\CSXSEC\NOU\GNOU-0.F07 0.90
\CSXSEC\NOU\GNOU-0.WAT
\CSXSEC\NOU\GNOU-0.F11 0.90
\CSXSEC\NOU\GNOU-0.F15 0.90
\CSXSEC\NOU\GNOU-0.F40 0.90
\CSXSEC\NOU\GNOU-0.ORC
\CSXSEC\NOU\GNOU-0.WAT 1.00
KENO GEOM
     0  /* 'KREFM'
     0  /* 'NBOX'
     1  /* 'NBXMAX'
     1  /* 'NBYMAX'
     1  /* 'NBZMAX'
     1  /* 'NXX'
     1  /* 'NTYPST'
     1  /* 'NEMBRG'
     0  /* 'NGMCHK'
     0.0     0.0     0.0     0.0     0.0     0.0
BOX TYPE      1  /* 17X17 pellet, var. W/F
CYLINDER      1  0.42940   1.04140  0.00000  16*0.5
CUBOID        6  0.90234  -0.90234  0.90234 -0.90234   1.04140  0.00000 16*0.5
BOX TYPE      2  /*  inner canister: bottom fuel_region # 1 w/ gap: body assy
CYLINDER      6  10.8141    0.31750   0.00        16*0.5
CYLINDER      2  10.9233    0.31750   0.00        16*0.5
CYLINDER      0  12.40920   0.31750   0.00000     16*0.5
CYLINDER      2  12.40920   0.31750  -0.44200     16*0.5
CYLINDER      2  12.46120   0.31750  -0.44200     16*0.5
CYLINDER      0  12.70000   0.31750  -0.44200     16*0.5
CYLINDER      2  12.76350   0.31750  -0.50550     16*0.5
BOX TYPE      3  /*  inner canister: fuel_region # 2: body assy
CYLINDER      6  10.8141   25.46350   0.00        16*0.5
CYLINDER      2  10.9233   25.46350   0.00        16*0.5
CYLINDER      3  10.96140  25.46350   0.00000     16*0.5
CYLINDER      4  12.40920  25.46350   0.00000     16*0.5
CYLINDER      2  12.46120  25.46350   0.00000     16*0.5
CYLINDER      0  12.70000  25.46350   0.00000     16*0.5
CYLINDER      2  12.76350  25.46350   0.00000     16*0.5
BOX TYPE      4  /*  inner canister: fuel_region # 3: 0.15 in od gap: body assy
CYLINDER      6  10.8141    0.38100   0.00        16*0.5
CYLINDER      2  10.9233    0.38100   0.00        16*0.5
CYLINDER      0  10.96140   0.38100   0.00000     16*0.5
CYLINDER      4  12.40920   0.38100   0.00000     16*0.5
CYLINDER      2  12.46120   0.38100   0.00000     16*0.5
CYLINDER      0  12.70000   0.38100   0.00000     16*0.5
CYLINDER      2  12.76350   0.38100   0.00000     16*0.5
BOX TYPE      5  /*  inner canister: fuel_region # 4: body assy
CYLINDER      6  10.8141   25.46350   0.00        16*0.5
CYLINDER      2  10.9233   25.46350   0.00        16*0.5
CYLINDER      3  10.96140  25.46350   0.00000     16*0.5
CYLINDER      4  12.40920  25.46350   0.00000     16*0.5
CYLINDER      2  12.46120  25.46350   0.00000     16*0.5
CYLINDER      0  12.70000  25.46350   0.00000     16*0.5
CYLINDER      2  12.76350  25.46350   0.00000     16*0.5
BOX TYPE      6  /*  inner canister: fuel_region # 5: 0.15 in od gap: body assy
CYLINDER      6  10.8141    0.38100   0.00        16*0.5
CYLINDER      2  10.9233    0.38100   0.00        16*0.5
CYLINDER      0  10.96140   0.38100   0.00000     16*0.5
CYLINDER      4  12.40920   0.38100   0.00000     16*0.5
CYLINDER      2  12.46120   0.38100   0.00000     16*0.5
CYLINDER      0  12.70000   0.38100   0.00000     16*0.5
CYLINDER      2  12.76350   0.38100   0.00000     16*0.5
BOX TYPE      7  /*  inner canister: fuel_region # 6: body assy
CYLINDER      6  10.8141   16.42593   0.00        16*0.5
CYLINDER      0  10.8141   21.33840   0.00        16*0.5
CYLINDER      2  10.9233   21.33840   0.00        16*0.5
CYLINDER      3  10.96140  21.33840   0.00000     16*0.5
CYLINDER      4  12.40920  21.33840   0.00000     16*0.5
CYLINDER      2  12.46120  21.33840   0.00000     16*0.5
CYLINDER      0  12.70000  21.33840   0.00000     16*0.5
CYLINDER      2  12.76350  21.33840   0.00000     16*0.5
BOX TYPE      8  /*  inner canister: fuel_region # 7: body assy
CYLINDER      0  10.8141    3.49250   0.00        16*0.5
CYLINDER      2  10.9233    3.49250   0.00        16*0.5
CYLINDER      3  10.96140   3.49250   0.00000     16*0.5
CYLINDER      4  12.40920   3.49250   0.00000     16*0.5
CYLINDER      2  12.46120   3.49250   0.00000     16*0.5
CYLINDER      0  12.70000   3.49250   0.00000     16*0.5
CYLINDER      2  12.76350   3.49250   0.00000     16*0.5
```

```
BOX TYPE      9  /*  inner canister: fuel_region # 8: lid assy
CYLINDER      0  10.8141     0.63250   0.00        16*0.5
CYLINDER      2  10.9233     0.63250   0.00        16*0.5
CYLINDER      3  10.96140    0.63250   0.00000     16*0.5
CYLINDER      4  12.40920    0.63250   0.00000     16*0.5
CYLINDER      2  12.46120    0.63250   0.00000     16*0.5
CYLINDER      0  12.70000    0.63250   0.00000     16*0.5
CYLINDER      2  12.76350    0.63250   0.00000     16*0.5
BOX TYPE     10  /*  inner canister: fuel_region # 9 w/ gap: lid assy
CYLINDER      0  10.8141     0.31750   0.00        16*0.5
CYLINDER      2  10.9233     0.31750   0.00        16*0.5
CYLINDER     11  12.40920    0.31750   0.00000     16*0.5
CYLINDER      2  12.46120    0.31750   0.00000     16*0.5
BOX TYPE     11  /*  inner canister: fuel_region #10 w/ ring: lid assy
CYLINDER      0  10.8141     0.44200   0.00        16*0.5
CYLINDER      2  10.9233     0.44200   0.00        16*0.5
CYLINDER      2  12.40920    0.44200   0.00000     16*0.5
CYLINDER      2  12.46120    0.44200   0.00000     16*0.5
BOX TYPE     12  /*  inner canister: fuel_region #11 w/ top: lid assy
CYLINDER      0  10.8141     1.78050   0.00        16*0.5
CYLINDER      2  10.9233     1.91640   0.00        16*0.5
CYLINDER     11  12.40920    1.91640   0.00000     16*0.5
BOX TYPE      13  /*  inner canister cuboid: body section (7# region)
CUBOID         5  12.7636 -12.7636  12.7636 -12.7636  73.3450  -0.5055  16*0.5
BOX TYPE      14  /*  inner canister cuboid: body section (40# region)
CUBOID         9  12.7636 -12.7636  12.7636 -12.7636  3.49260   0.0000  16*0.5
BOX TYPE      15  /*  inner canister upper cylinder: lid section
CYLINDER      11  12.7636  3.30840   0.0000  16*0.5
BOX TYPE      16  /*  foam cutout  (void) - 40 #/ft3 foam lid section
CYLINDER      11  13.5510  3.30840   0.0000  16*0.5
BOX TYPE      17  /*  npc body or lid - 10 ga. 304ss layer
CUBOID         2  54.3687 -54.3687  54.3687 -54.3687  0.31240   0.0000  16*0.5
BOX TYPE      18  /*  npc body or lid - 1 inch duraboard (void) layer, 10 ga. 304ss
CUBOID        11  51.5163 -51.5163  51.5163 -51.5163  2.54000   0.0000  16*0.5
CUBOID        11  54.0563 -54.0563  54.0563 -54.0563  2.54000   0.0000  16*0.5
CUBOID         2  54.3687 -54.3687  54.3687 -54.3687  2.54000   0.0000  16*0.5
BOX TYPE      19  /*  npc body - 4 inch bot. foam layer (11 #/ft3)  - face burn
CUBOID         7  42.6086 -42.6086  42.6086 -42.6086  0.00000   0.0000  16*0.5
CUBOID        11  54.0563 -54.0563  54.0563 -54.0563  0.00000  -7.6200  16*0.5
CUBOID         2  54.3687 -54.3687  54.3687 -54.3687  0.00000  -7.6200  16*0.5
BOX TYPE      20  /*  npc body - 25.0750 inch foam layer (7,11 #/ft3) - face burn
CUBOID         5  42.6086 -42.6086  42.6086 -42.6086 73.85050   0.0000  16*0.5
CUBOID         7  42.6086 -42.6086  42.6086 -42.6086 73.85050   0.0000  16*0.5
CUBOID        11  54.0563 -54.0563  54.0563 -54.0563 73.85050   0.0000  16*0.5
CUBOID         2  54.3687 -54.3687  54.3687 -54.3687 73.85050   0.0000  16*0.5
BOX TYPE      21  /*  npc body - 1.375 inch foam layer (40 #/ft3) - face burn
CUBOID         9  42.6086 -42.6086  42.6086 -42.6086  3.49250   0.0000  16*0.5
CUBOID        11  54.0563 -54.0563  54.0563 -54.0563  3.49250   0.0000  16*0.5
CUBOID         2  54.3687 -54.3687  54.3687 -54.3687  3.49250   0.0000  16*0.5
BOX TYPE      22  /*  npc body - 30.45 inch two-part body
CUBOID        11  54.3687 -54.3687  54.3687 -54.3687 77.34300   0.0000  16*0.5
BOX TYPE      23  /*  npc lid - 1.375 inch foam layer (40 #/ft3) - lid burn
CUBOID        11  43.8963 -43.8963  43.8963 -43.8963  3.49250   0.0000  16*0.5
CUBOID        11  54.0563 -54.0563  54.0563 -54.0563  3.49250   0.0000  16*0.5
CUBOID         2  54.3687 -54.3687  54.3687 -54.3687  3.49250   0.0000  16*0.5
BOX TYPE      24  /*  npc lid - 3.5 inch foam layer (15 #/ft3) - lid burn
CUBOID        11  43.8963 -43.8963  43.8963 -43.8963  2.54000   0.0000  16*0.5
CUBOID        11  54.0563 -54.0563  54.0563 -54.0563  8.89000   0.0000  16*0.5
CUBOID         2  54.3687 -54.3687  54.3687 -54.3687  8.89000   0.0000  16*0.5
BOX TYPE      25  /*  complete npc - body assembly
CUBOID        11  54.3688 -54.3688  54.3688 -54.3688 87.81540   0.0000  16*0.5
BOX TYPE      26  /*  complete npc - lid assembly
CUBOID        11  54.3688 -54.3688  54.3688 -54.3688 15.23490   0.0000  16*0.5
BOX TYPE      27  /*  npc water-reflected single-unit cuboid
CUBOID         0  54.3688 -54.3688  54.3688 -54.3688 103.0503   0.0000  16*0.5
CUBOID         6  84.8488 -84.8488  84.8488 -84.8488 133.5303 -30.4800  16*0.5
BOX TYPE      28  /*  global unit: Damaged Unit, Full H2O Reflection
CUBOID         0  54.3688 -54.3688  54.3688 -54.3688 103.0500   0.0000  16*0.5
CUBOID         6  84.8488 -84.8488  84.8488 -84.8488 133.5303 -30.4800  16*0.5
BOX TYPE      29  /* Region  1 embedded rod
CYLINDER      1   0.38100   0.31750   0.00000    16*0.5
BOX TYPE      30  /* Region  2 embedded rod
CYLINDER      1   0.38100  25.46350   0.00000    16*0.5
BOX TYPE      31  /* Region  3 embedded rod
CYLINDER      1   0.38100   0.38100   0.00000    16*0.5
BOX TYPE      32  /* Region  4 embedded rod
CYLINDER      1   0.38100  25.46350   0.00000    16*0.5
BOX TYPE      33  /* Region  5 embedded rod
CYLINDER      1   0.38100   0.38100   0.00000    16*0.5
BOX TYPE      34  /* Region  6 embedded rod
CYLINDER      1   0.38100  16.42592   0.00000    16*0.5
BOX TYPE      35  /* Region  7 embedded rod
CYLINDER      1   0.38100   3.49250   0.00000    16*0.5
CUBOID        0   0.3810  -0.3810   0.3810  -0.3810   3.4925   0.0000  16*0.5
BOX TYPE      36  /* Region  8 embedded rod
CYLINDER      1   0.38100   0.63250   0.00000    16*0.5
CUBOID        0   0.3810  -0.3810   0.3810  -0.3810   0.6325   0.0000  16*0.5
BOX TYPE      37  /* Region  9 embedded rod
CYLINDER      1   0.38100   0.31750   0.00000    16*0.5
CUBOID        0   0.3810  -0.3810   0.3810  -0.3810   0.3175   0.0000  16*0.5
BOX TYPE      38  /* Region 10 embedded rod
CYLINDER      1   0.38100   0.44200   0.00000    16*0.5
CUBOID        0   0.3810  -0.3810   0.3810  -0.3810   0.4420   0.0000  16*0.5
BOX TYPE      39  /* Region 11 embedded rod
CYLINDER      1   0.38100   1.78050   0.00000    16*0.5
CUBOID        0   0.3810  -0.3810   0.3810  -0.3810   1.7805   0.0000  16*0.5
27  1 1 1  1 1 1  1 1 1  1
BEGIN COMPLEX
COMPLEX   2 29   0.0000   0.0000   0.0000 -16 -10  1   1.6226   2.8105 0.0
COMPLEX   2 29   0.8113   1.4052   0.0000 -16 -10  1   1.6226   2.8105 0.0
```

```
COMPLEX   3 30   0.0000    0.0000    0.0000 -16 -10  1   1.6224   2.8105 0.0
COMPLEX   3 30   0.8113    1.4052    0.0000 -16 -10  1   1.6226   2.8105 0.0
COMPLEX   4 31   0.0000    0.0000    0.0000 -16 -10  1   1.6226   2.8105 0.0
COMPLEX   4 31   0.8113    1.4052    0.0000 -16 -10  1   1.6226   2.8105 0.0
COMPLEX   5 32   0.0000    0.0000    0.0000 -16 -10  1   1.6226   2.8105 0.0
COMPLEX   5 32   0.8113    1.4052    0.0000 -16 -10  1   1.6226   2.8105 0.0
COMPLEX   6 33   0.0000    0.0000    0.0000 -16 -10  1   1.6226   2.8105 0.0
COMPLEX   6 33   0.8113    1.4052    0.0000 -16 -10  1   1.6226   2.8105 0.0
COMPLEX   7 34   0.0000    0.0000    0.0000 -16 -10  1   1.6226   2.8105 0.0
COMPLEX   7 34   0.8113    1.4052    0.0000 -16 -10  1   1.6226   2.8105 0.0
/*  build inner canister - main body sections (7 #/ft3 region)
COMPLEX  13  2  0.00000  0.00000  0.00000   1   1   1  0.0  0.0  0.0
COMPLEX  13  3  0.00000  0.00000  0.31750   1   1   1  0.0  0.0  0.0
COMPLEX  13  4  0.00000  0.00000  25.7810   1   1   1  0.0  0.0  0.0
COMPLEX  13  5  0.00000  0.00000  26.1621   1   1   1  0.0  0.0  0.0
COMPLEX  13  6  0.00000  0.00000  51.6256   1   1   1  0.0  0.0  0.0
COMPLEX  13  7  0.00000  0.00000  52.0066   1   1   1  0.0  0.0  0.0
/*  build inner canister - upper body section (40 #/ft3 section)
COMPLEX  14  8  0.00000  0.00000  0.00000   1   1   1  0.0  0.0  0.0
/*  build inner canister - lid section
COMPLEX  15  9  0.00000  0.00000  0.00000   1   1   1  0.0  0.0  0.0
COMPLEX  15 10  0.00000  0.00000  0.63250   1   1   1  0.0  0.0  0.0
COMPLEX  15 11  0.00000  0.00000  0.95000   1   1   1  0.0  0.0  0.0
COMPLEX  15 12  0.00000  0.00000  1.39200   1   1   1  0.0  0.0  0.0
/*  embed 3x3 array of canisters into lid:  11.75 inch - centers
COMPLEX  16 15 -29.8450 -29.8450  0.00000   3   3   1 29.8450  29.8450  0.0
/*  embed 3x3 array of foam cut_outs: 11.75 inch - centers
COMPLEX  23 16 -29.8450 -29.8450  0.00000   3   3   1 29.8450  29.8450  0.0
/*  embed 3x3 array of canisters into inner body: 11.75 inch - centers
COMPLEX  20 13 -29.8450 -29.8450  0.50550   3   3   1 29.8450  29.8450  0.0
COMPLEX  21 14 -29.8450 -29.8450  0.00000   3   3   1 29.8450  29.8450  0.0
/*  embed two-part body section stackup
COMPLEX  22 20   0.0000   0.0000  0.00000   1   1   1  0.0  0.0  0.0
COMPLEX  22 21   0.0000   0.0000 73.85050   1   1   1  0.0  0.0  0.0
/*  build npc - body assembly
COMPLEX  25 17   0.0000   0.0000  0.00000   1   1   1  0.0  0.0  0.0
COMPLEX  25 18   0.0000   0.0000  0.31240   1   1   1  0.0  0.0  0.0
COMPLEX  25 19   0.0000   0.0000  10.4724   1   1   1  0.0  0.0  0.0
COMPLEX  25 22   0.0000   0.0000  10.4724   1   1   1  0.0  0.0  0.0
/*  build npc - lid assembly
COMPLEX  26 23   0.0000   0.0000  0.00000   1   1   1  0.0  0.0  0.0
COMPLEX  26 24   0.0000   0.0000  3.49250   1   1   1  0.0  0.0  0.0
COMPLEX  26 18   0.0000   0.0000  12.3825   1   1   1  0.0  0.0  0.0
COMPLEX  26 17   0.0000   0.0000  14.9225   1   1   1  0.0  0.0  0.0
/*  complete npc stackup - water reflected single unit
COMPLEX  27 25   0.0000   0.0000  0.00000   1   1   1  0.0  0.0  0.0
COMPLEX  27 26   0.0000   0.0000  87.8154   1   1   1  0.0  0.0  0.0
END GEOM
END GEMER
```

Figure 6.25b – Sample input file = CSTN-470.in

```
2002 NPC 1A,HET Lat,FRad-0.3810, 50.8 kg U(5.00)O2,WTF-4.70,MixHt-80.010cm
   200  /* # BATCHES
  2000  /* # NEUTRONS PER BATCH
    10  /* # BATCHES TO SKIP
     0  /* # INITIAL 'SEED' (IF NON-ZERO)
     0  /* # 'IDUMP'
     1  /* # 'NRSTRT'
     0  /* # 'NBTED' (NON-ZERO IS PRINT EDITS)
     0  /* # 'KRED' (NUMBER OF COMBINED REGIONS IN EDITS)
  0  293   0   0
\CSXSEC\UO2\GUO2-50.00
\CSXSEC\NOU\GNOU-0.SS
\CSXSEC\NOU\GNOU-0.CAD
\CSXSEC\NOU\GNOU-0.POL
\CSXSEC\NOU\GNOU-0.F07 0.90
\CSXSEC\NOU\GNOU-0.WAT
\CSXSEC\NOU\GNOU-0.F11 0.90
\CSXSEC\NOU\GNOU-0.F15 0.90
\CSXSEC\NOU\GNOU-0.F40 0.90
\CSXSEC\NOU\GNOU-0.ORC
\CSXSEC\NOU\GNOU-0.WAT 0.0001
KENO GEOM
     0  /* 'KREFM'
     0  /* 'NBOX'
     1  /* 'NBXMAX'
     1  /* 'NBYMAX'
     1  /* 'NBZMAX'
     1  /* 'NXX'
     1  /* 'NTYPST'
     1  /* 'NEMBRG'
     0  /* 'NGMCHK'
    -1.0    -1.0    -1.0    -1.0    -1.0    -1.0
BOX TYPE       1  /* 17X17 pellet, var. W/F
CYLINDER       1  0.42940   1.04140  0.00000  16*0.5
CUBOID         6  0.90234  -0.90234  0.90234 -0.90234   1.04140  0.00000 16*0.5
BOX TYPE       2  /*  inner canister: bottom fuel_region # 1 w/ gap: body assy
CYLINDER       6  10.8141    0.31750   0.00        16*0.5
CYLINDER       2  10.9233    0.31750   0.00        16*0.5
CYLINDER       0  12.40920   0.31750   0.00000     16*0.5
CYLINDER       2  12.40920   0.31750  -0.44200     16*0.5
CYLINDER       2  12.46120   0.31750  -0.44200     16*0.5
CYLINDER       0  12.70000   0.31750  -0.44200     16*0.5
CYLINDER       2  12.76350   0.31750  -0.50550     16*0.5
BOX TYPE       3  /*  inner canister: fuel_region # 2: body assy
CYLINDER       6  10.8141   25.46350   0.00        16*0.5
```

```
CYLINDER      2  10.9233   25.46350  0.00      16*0.5
CYLINDER      3  10.96140  25.46350  0.00000   16*0.5
CYLINDER      4  12.40920  25.46350  0.00000   16*0.5
CYLINDER      2  12.46120  25.46350  0.00000   16*0.5
CYLINDER      0  12.70000  25.46350  0.00000   16*0.5
CYLINDER      2  12.76350  25.46350  0.00000   16*0.5
BOX TYPE      4  /*  inner canister: fuel_region # 3: 0.15 in od gap: body assy
CYLINDER      6  10.8141    0.38100  0.00      16*0.5
CYLINDER      2  10.9233    0.38100  0.00      16*0.5
CYLINDER      0  10.96140   0.38100  0.00000   16*0.5
CYLINDER      4  12.40920   0.38100  0.00000   16*0.5
CYLINDER      2  12.46120   0.38100  0.00000   16*0.5
CYLINDER      0  12.70000   0.38100  0.00000   16*0.5
CYLINDER      2  12.76350   0.38100  0.00000   16*0.5
BOX TYPE      5  /*  inner canister: fuel_region # 4: body assy
CYLINDER      6  10.8141   25.46350  0.00      16*0.5
CYLINDER      2  10.9233   25.46350  0.00      16*0.5
CYLINDER      3  10.96140  25.46350  0.00000   16*0.5
CYLINDER      4  12.40920  25.46350  0.00000   16*0.5
CYLINDER      2  12.46120  25.46350  0.00000   16*0.5
CYLINDER      0  12.70000  25.46350  0.00000   16*0.5
CYLINDER      2  12.76350  25.46350  0.00000   16*0.5
BOX TYPE      6  /*  inner canister: fuel_region # 5: 0.15 in od gap: body assy
CYLINDER      6  10.8141    0.38100  0.00      16*0.5
CYLINDER      2  10.9233    0.38100  0.00      16*0.5
CYLINDER      0  10.96140   0.38100  0.00000   16*0.5
CYLINDER      4  12.40920   0.38100  0.00000   16*0.5
CYLINDER      2  12.46120   0.38100  0.00000   16*0.5
CYLINDER      0  12.70000   0.38100  0.00000   16*0.5
CYLINDER      2  12.76350   0.38100  0.00000   16*0.5
BOX TYPE      7  /*  inner canister: fuel_region # 6: body assy
CYLINDER      6  10.8141   21.33840  0.00      16*0.5
CYLINDER      2  10.9233   21.33840  0.00      16*0.5
CYLINDER      3  10.96140  21.33840  0.00000   16*0.5
CYLINDER      4  12.40920  21.33840  0.00000   16*0.5
CYLINDER      2  12.46120  21.33840  0.00000   16*0.5
CYLINDER      0  12.70000  21.33840  0.00000   16*0.5
CYLINDER      2  12.76350  21.33840  0.00000   16*0.5
BOX TYPE      8  /*  inner canister: fuel_region # 7: body assy
CYLINDER      6  10.8141    3.49250  0.00      16*0.5
CYLINDER      2  10.9233    3.49250  0.00      16*0.5
CYLINDER      3  10.96140   3.49250  0.00000   16*0.5
CYLINDER      4  12.40920   3.49250  0.00000   16*0.5
CYLINDER      2  12.46120   3.49250  0.00000   16*0.5
CYLINDER      0  12.70000   3.49250  0.00000   16*0.5
CYLINDER      2  12.76350   3.49250  0.00000   16*0.5
BOX TYPE      9  /*  inner canister: fuel_region # 8: lid assy
CYLINDER      6  10.8141    0.63250  0.00      16*0.5
CYLINDER      2  10.9233    0.63250  0.00      16*0.5
CYLINDER      3  10.96140   0.63250  0.00000   16*0.5
CYLINDER      4  12.40920   0.63250  0.00000   16*0.5
CYLINDER      2  12.46120   0.63250  0.00000   16*0.5
CYLINDER      0  12.70000   0.63250  0.00000   16*0.5
CYLINDER      2  12.76350   0.63250  0.00000   16*0.5
BOX TYPE     10  /*  inner canister: fuel region # 9 w/ gap: lid assy
CYLINDER      6  10.8141    0.31750  0.00      16*0.5
CYLINDER      2  10.9233    0.31750  0.00      16*0.5
CYLINDER     11  12.40920   0.31750  0.00000   16*0.5
CYLINDER      2  12.46120   0.31750  0.00000   16*0.5
BOX TYPE     11  /*  inner canister: fuel_region #10 w/ ring: lid assy
CYLINDER      6  10.8141    0.44200  0.00      16*0.5
CYLINDER      2  10.9233    0.44200  0.00      16*0.5
CYLINDER      2  12.40920   0.44200  0.00000   16*0.5
CYLINDER      2  12.46120   0.44200  0.00000   16*0.5
BOX TYPE     12  /*  inner canister: fuel_region #11 w/ top: lid assy
CYLINDER      6  10.8141    1.78050  0.00      16*0.5
CYLINDER      2  10.9233    1.91640  0.00      16*0.5
CYLINDER     11  12.40920   1.91640  0.00000   16*0.5
BOX TYPE      13  /*  inner canister cuboid: body section (7# region)
CUBOID         5  12.7636 -12.7636  12.7636 -12.7636  73.3450  -0.5055  16*0.5
BOX TYPE      14  /*  inner canister cuboid: body section (40# region)
CUBOID         9  12.7636 -12.7636  12.7636 -12.7636  3.49260   0.0000  16*0.5
BOX TYPE      15  /*  inner canister upper cylinder: lid section
CYLINDER      11  12.7636  3.30840   0.0000  16*0.5
BOX TYPE      16  /*  foam cutout  (void) - 40 #/ft3 foam lid section
CYLINDER      11  13.5510  3.30840   0.0000  16*0.5
BOX TYPE      17  /*  npc body or lid - 10 ga. 304ss layer
CUBOID         2  54.3687 -54.3687  54.3687 -54.3687  0.31240   0.0000  16*0.5
BOX TYPE      18  /*  npc body or lid - 1 inch duraboard (void) layer, 10 ga. 304ss
CUBOID        11  51.5163 -51.5163  51.5163 -51.5163  2.54000   0.0000  16*0.5
CUBOID        11  54.0563 -54.0563  54.0563 -54.0563  2.54000   0.0000  16*0.5
CUBOID         2  54.3687 -54.3687  54.3687 -54.3687  2.54000   0.0000  16*0.5
BOX TYPE      19  /*  npc body - 3 inch bot. foam layer (11 #/ft3)  - face burn
CUBOID         7  51.5163 -51.5163  51.5163 -51.5163  7.62000   0.0000  16*0.5
CUBOID        11  54.0563 -54.0563  54.0563 -54.0563  7.62000   0.0000  16*0.5
CUBOID         2  54.3687 -54.3687  54.3687 -54.3687  7.62000   0.0000  16*0.5
BOX TYPE      20  /*  npc body - 29.0750 inch foam layer (7,11 #/ft3) - face burn
CUBOID         5  43.8963 -43.8963  43.8963 -43.8963 73.85050   0.0000  16*0.5
CUBOID         7  51.5163 -51.5163  51.5163 -51.5163 73.85050   0.0000  16*0.5
CUBOID        11  54.0563 -54.0563  54.0563 -54.0563 73.85050   0.0000  16*0.5
CUBOID         2  54.3687 -54.3687  54.3687 -54.3687 73.85050   0.0000  16*0.5
BOX TYPE      21  /*  npc body - 1.375 inch foam layer (40 #/ft3) - face burn
CUBOID         9  51.5163 -51.5163  51.5163 -51.5163  3.49250   0.0000  16*0.5
CUBOID        11  54.0563 -54.0563  54.0563 -54.0563  3.49250   0.0000  16*0.5
CUBOID         2  54.3687 -54.3687  54.3687 -54.3687  3.49250   0.0000  16*0.5
BOX TYPE      22  /*  npc body - 30.45 inch two-part body
CUBOID        11  54.3687 -54.3687  54.3687 -54.3687 77.34300   0.0000  16*0.5
BOX TYPE      23  /*  npc lid - 1.375 inch foam layer (40 #/ft3) - lid burn
CUBOID         9  51.5163 -51.5163  51.5163 -51.5163  3.49250   0.0000  16*0.5
CUBOID        11  54.0563 -54.0563  54.0563 -54.0563  3.49250   0.0000  16*0.5
```

```
CUBOID        2  54.3687 -54.3687  54.3687 -54.3687  3.49250   0.0000  16*0.5
BOX TYPE     24  /*  npc lid - 3.5 inch foam layer (15 #/ft3) - lid burn
CUBOID        8  51.5163 -51.5163  51.5163 -51.5163  8.89000   0.0000  16*0.5
CUBOID       11  54.0563 -54.0563  54.0563 -54.0563  8.89000   0.0000  16*0.5
CUBOID        2  54.3687 -54.3687  54.3687 -54.3687  8.89000   0.0000  16*0.5
BOX TYPE     25  /*  complete npc - body assembly
CUBOID       11  54.3688 -54.3688  54.3688 -54.3688 87.81540   0.0000  16*0.5
BOX TYPE     26  /*  complete npc - lid assembly
CUBOID       11  54.3688 -54.3688  54.3688 -54.3688 15.23490   0.0000  16*0.5
BOX TYPE     27  /*  npc water reflected single-unit
CUBOID        0  54.3688 -54.3688  54.3688 -54.3688 103.0503   0.0000  16*0.5
BOX TYPE     28  /*  global unit: 2N=150:5x5x6 cuboid, 30.48-cm h2o refl.
CUBOID        0  271.844 -271.844  271.844 -271.844 618.3020   0.0000  16*0.5
CUBOID        6  302.324 -302.324  302.324 -302.324 648.7820 -30.4800  16*0.5
BOX TYPE     29  /* Region  1 embedded rod
CYLINDER     1   0.38100   0.31750   0.00000    16*0.5
BOX TYPE     30  /* Region  2 embedded rod
CYLINDER     1   0.38100  25.46350   0.00000    16*0.5
BOX TYPE     31  /* Region  3 embedded rod
CYLINDER     1   0.38100   0.38100   0.00000    16*0.5
BOX TYPE     32  /* Region  4 embedded rod
CYLINDER     1   0.38100  25.46350   0.00000    16*0.5
BOX TYPE     33  /* Region  5 embedded rod
CYLINDER     1   0.38100   0.38100   0.00000    16*0.5
BOX TYPE     34  /* Region  6 embedded rod
CYLINDER     1   0.38100  21.33850   0.00000    16*0.5
BOX TYPE     35  /* Region  7 embedded rod
CYLINDER     1   0.38100   3.49250   0.00000    16*0.5
BOX TYPE     36  /* Region  8 embedded rod
CYLINDER     1   0.38100   0.63250   0.00000    16*0.5
BOX TYPE     37  /* Region  9 embedded rod
CYLINDER     1   0.38100   0.31750   0.00000    16*0.5
BOX TYPE     38  /* Region 10 embedded rod
CYLINDER     1   0.38100   0.44200   0.00000    16*0.5
BOX TYPE     39  /* Region 11 embedded rod
CYLINDER     1   0.38100   1.78050   0.00000    16*0.5
27  1 1 1  1 1 1  1 1 1  1
BEGIN COMPLEX
COMPLEX   2 29 -10.3950   0.0000   0.0000  13   1  1   1.7325   0.0000 0.0
COMPLEX   2 29  -9.5287  -1.5004   0.0000  12   2  1   1.7325   3.0008 0.0
COMPLEX   2 29  -8.6625  -3.0008   0.0000  11   2  1   1.7325   6.0015 0.0
COMPLEX   2 29  -7.7962  -4.5012   0.0000  10   2  1   1.7325   9.0023 0.0
COMPLEX   2 29  -6.9300  -6.0015   0.0000   9   2  1   1.7325  12.0031 0.0
COMPLEX   2 29  -6.0637  -7.5019   0.0000   8   2  1   1.7326  15.0038 0.0
COMPLEX   2 29  -5.1975  -9.0023   0.0000   7   2  1   1.7325  18.0046 0.0
COMPLEX   3 30 -10.3950   0.0000   0.0000  13   1  1   1.7325   0.0000 0.0
COMPLEX   3 30  -9.5287  -1.5004   0.0000  12   2  1   1.7325   3.0008 0.0
COMPLEX   3 30  -8.6625  -3.0008   0.0000  11   2  1   1.7325   6.0015 0.0
COMPLEX   3 30  -7.7962  -4.5012   0.0000  10   2  1   1.7325   9.0023 0.0
COMPLEX   3 30  -6.9300  -6.0015   0.0000   9   2  1   1.7325  12.0031 0.0
COMPLEX   3 30  -6.0637  -7.5019   0.0000   8   2  1   1.7325  15.0038 0.0
COMPLEX   3 30  -5.1975  -9.0023   0.0000   7   2  1   1.7325  18.0046 0.0
COMPLEX   4 31 -10.3950   0.0000   0.0000  13   1  1   1.7325   0.0000 0.0
COMPLEX   4 31  -9.5287  -1.5004   0.0000  12   2  1   1.7325   3.0008 0.0
COMPLEX   4 31  -8.6625  -3.0008   0.0000  11   2  1   1.7325   6.0015 0.0
COMPLEX   4 31  -7.7962  -4.5012   0.0000  10   2  1   1.7325   9.0023 0.0
COMPLEX   4 31  -6.9300  -6.0015   0.0000   9   2  1   1.7325  12.0031 0.0
COMPLEX   4 31  -6.0637  -7.5019   0.0000   8   2  1   1.7325  15.0038 0.0
COMPLEX   4 31  -5.1975  -9.0023   0.0000   7   2  1   1.7325  18.0046 0.0
COMPLEX   5 32 -10.3950   0.0000   0.0000  13   1  1   1.7325   0.0000 0.0
COMPLEX   5 32  -9.5287  -1.5004   0.0000  12   2  1   1.7325   3.0008 0.0
COMPLEX   5 32  -8.6625  -3.0008   0.0000  11   2  1   1.7325   6.0015 0.0
COMPLEX   5 32  -7.7962  -4.5012   0.0000  10   2  1   1.7325   9.0023 0.0
COMPLEX   5 32  -6.9300  -6.0015   0.0000   9   2  1   1.7325  12.0031 0.0
COMPLEX   5 32  -6.0637  -7.5019   0.0000   8   2  1   1.7325  15.0038 0.0
COMPLEX   5 32  -5.1975  -9.0023   0.0000   7   2  1   1.7325  18.0046 0.0
COMPLEX   6 33 -10.3950   0.0000   0.0000  13   1  1   1.7325   0.0000 0.0
COMPLEX   6 33  -9.5287  -1.5004   0.0000  12   2  1   1.7325   3.0008 0.0
COMPLEX   6 33  -8.6625  -3.0008   0.0000  11   2  1   1.7325   6.0015 0.0
COMPLEX   6 33  -7.7962  -4.5012   0.0000  10   2  1   1.7325   9.0023 0.0
COMPLEX   6 33  -6.9300  -6.0015   0.0000   9   2  1   1.7325  12.0031 0.0
COMPLEX   6 33  -6.0637  -7.5019   0.0000   8   2  1   1.7325  15.0038 0.0
COMPLEX   6 33  -5.1975  -9.0023   0.0000   7   2  1   1.7325  18.0046 0.0
COMPLEX   7 34 -10.3950   0.0000   0.0000  13   1  1   1.7325   0.0000 0.0
COMPLEX   7 34  -9.5287  -1.5004   0.0000  12   2  1   1.7325   3.0008 0.0
COMPLEX   7 34  -8.6625  -3.0008   0.0000  11   2  1   1.7325   6.0015 0.0
COMPLEX   7 34  -7.7962  -4.5012   0.0000  10   2  1   1.7325   9.0023 0.0
COMPLEX   7 34  -6.9300  -6.0015   0.0000   9   2  1   1.7325  12.0031 0.0
COMPLEX   7 34  -6.0637  -7.5019   0.0000   8   2  1   1.7325  15.0038 0.0
COMPLEX   7 34  -5.1975  -9.0023   0.0000   7   2  1   1.7325  18.0046 0.0
COMPLEX   8 35 -10.3950   0.0000   0.0000  13   1  1   1.7325   0.0000 0.0
COMPLEX   8 35  -9.5287  -1.5004   0.0000  12   2  1   1.7325   3.0008 0.0
COMPLEX   8 35  -8.6625  -3.0008   0.0000  11   2  1   1.7325   6.0015 0.0
COMPLEX   8 35  -7.7962  -4.5012   0.0000  10   2  1   1.7325   9.0023 0.0
COMPLEX   8 35  -6.9300  -6.0015   0.0000   9   2  1   1.7325  12.0031 0.0
COMPLEX   8 35  -6.0637  -7.5019   0.0000   8   2  1   1.7325  15.0038 0.0
COMPLEX   8 35  -5.1975  -9.0023   0.0000   7   2  1   1.7325  18.0046 0.0
COMPLEX   9 36 -10.3950   0.0000   0.0000  13   1  1   1.7325   0.0000 0.0
COMPLEX   9 36  -9.5287  -1.5004   0.0000  12   2  1   1.7325   3.0008 0.0
COMPLEX   9 36  -8.6625  -3.0008   0.0000  11   2  1   1.7325   6.0015 0.0
COMPLEX   9 36  -7.7962  -4.5012   0.0000  10   2  1   1.7325   9.0023 0.0
COMPLEX   9 36  -6.9300  -6.0015   0.0000   9   2  1   1.7325  12.0031 0.0
COMPLEX   9 36  -6.0637  -7.5019   0.0000   8   2  1   1.7325  15.0038 0.0
COMPLEX   9 36  -5.1975  -9.0023   0.0000   7   2  1   1.7325  18.0046 0.0
COMPLEX  10 37 -10.3950   0.0000   0.0000  13   1  1   1.7325   0.0000 0.0
COMPLEX  10 37  -9.5287  -1.5004   0.0000  12   2  1   1.7325   3.0008 0.0
COMPLEX  10 37  -8.6625  -3.0008   0.0000  11   2  1   1.7325   6.0015 0.0
COMPLEX  10 37  -7.7962  -4.5012   0.0000  10   2  1   1.7325   9.0023 0.0
COMPLEX  10 37  -6.9300  -6.0015   0.0000   9   2  1   1.7325  12.0031 0.0
COMPLEX  10 37  -6.0637  -7.5019   0.0000   8   2  1   1.7325  15.0038 0.0
```

```
COMPLEX  10 37  -5.1975  -9.0023   0.0000   7   2  1   1.7325  18.0046 0.0
COMPLEX  11 38 -10.3950   0.0000   0.0000  13   1  1   1.7325   0.0000 0.0
COMPLEX  11 38  -9.5287  -1.5004   0.0000  12   2  1   1.7325   3.0008 0.0
COMPLEX  11 38  -8.6625  -3.0008   0.0000  11   2  1   1.7325   6.0015 0.0
COMPLEX  11 38  -7.7962  -4.5012   0.0000  10   2  1   1.7325   9.0023 0.0
COMPLEX  11 38  -6.9300  -6.0015   0.0000   9   2  1   1.7325  12.0031 0.0
COMPLEX  11 38  -6.0637  -7.5019   0.0000   8   2  1   1.7325  15.0038 0.0
COMPLEX  11 38  -5.1975  -9.0023   0.0000   7   2  1   1.7325  18.0046 0.0
COMPLEX  12 39 -10.3950   0.0000   0.0000  13   1  1   1.7325   0.0000 0.0
COMPLEX  12 39  -9.5287  -1.5004   0.0000  12   2  1   1.7325   3.0008 0.0
COMPLEX  12 39  -8.6625  -3.0008   0.0000  11   2  1   1.7325   6.0015 0.0
COMPLEX  12 39  -7.7962  -4.5012   0.0000  10   2  1   1.7325   9.0023 0.0
COMPLEX  12 39  -6.9300  -6.0015   0.0000   9   2  1   1.7325  12.0031 0.0
COMPLEX  12 39  -6.0637  -7.5019   0.0000   8   2  1   1.7325  15.0038 0.0
COMPLEX  12 39  -5.1975  -9.0023   0.0000   7   2  1   1.7325  18.0046 0.0
/*  build inner canister - main body sections (7 #/ft3 region)
COMPLEX  13  2  0.00000  0.00000  0.00000   1   1   1  0.0   0.0   0.0
COMPLEX  13  3  0.00000  0.00000  0.31750   1   1   1  0.0   0.0   0.0
COMPLEX  13  4  0.00000  0.00000  25.7810   1   1   1  0.0   0.0   0.0
COMPLEX  13  5  0.00000  0.00000  26.1621   1   1   1  0.0   0.0   0.0
COMPLEX  13  6  0.00000  0.00000  51.6256   1   1   1  0.0   0.0   0.0
COMPLEX  13  7  0.00000  0.00000  52.0066   1   1   1  0.0   0.0   0.0
/*  build inner canister - upper body section (40 #/ft3 section)
COMPLEX  14  8  0.00000  0.00000  0.00000   1   1   1  0.0   0.0   0.0
/*  build inner canister - lid section
COMPLEX  15  9  0.00000  0.00000  0.00000   1   1   1  0.0   0.0   0.0
COMPLEX  15 10  0.00000  0.00000  0.63250   1   1   1  0.0   0.0   0.0
COMPLEX  15 11  0.00000  0.00000  0.95000   1   1   1  0.0   0.0   0.0
COMPLEX  15 12  0.00000  0.00000  1.39200   1   1   1  0.0   0.0   0.0
/*  embed 3x3 array of canisters into lid:  11.75 inch - centers
COMPLEX  16 15 -29.8450 -29.8450  0.00000   3   3   1 29.8450  29.8450  0.0
/*  embed 3x3 array of foam cut_outs: 11.75 inch - centers
COMPLEX  23 16 -29.8450 -29.8450  0.00000   3   3   1 29.8450  29.8450  0.0
/*  embed 3x3 array of canisters into inner body: 11.75 inch - centers
COMPLEX  20 13 -29.8450 -29.8450  0.50550   3   3   1 29.8450  29.8450  0.0
COMPLEX  21 14 -29.8450 -29.8450  0.00000   3   3   1 29.8450  29.8450  0.0
/*  embed two-part body section stackup
COMPLEX  22 20   0.0000   0.0000  0.00000   1   1   1  0.0   0.0   0.0
COMPLEX  22 21   0.0000   0.0000 73.85050   1   1   1  0.0   0.0   0.0
/*  build npc - body assembly
COMPLEX  25 17   0.0000   0.0000  0.00000   1   1   1  0.0   0.0   0.0
COMPLEX  25 18   0.0000   0.0000  0.31240   1   1   1  0.0   0.0   0.0
COMPLEX  25 19   0.0000   0.0000  2.85240   1   1   1  0.0   0.0   0.0
COMPLEX  25 22   0.0000   0.0000  10.4724   1   1   1  0.0   0.0   0.0
/*  build npc - lid assembly
COMPLEX  26 23   0.0000   0.0000  0.00000   1   1   1  0.0   0.0   0.0
COMPLEX  26 24   0.0000   0.0000  3.49250   1   1   1  0.0   0.0   0.0
COMPLEX  26 18   0.0000   0.0000  12.3825   1   1   1  0.0   0.0   0.0
COMPLEX  26 17   0.0000   0.0000  14.9225   1   1   1  0.0   0.0   0.0
/*  complete npc stackup - water reflected single unit
COMPLEX  27 25   0.0000   0.0000  0.00000   1   1   1  0.0   0.0   0.0
COMPLEX  27 26   0.0000   0.0000  87.8154   1   1   1  0.0   0.0   0.0
END GEOM
END GENER
```

Figure 6.25c – Sample input file = S55-486.in

```
2002 NPC,HET Lat,FRad-0.3810,U(5.00)O2 MASS-55.0kg,WTF-4.86,MixHt-79.645cm
   200  /* # BATCHES
  2000  /* # NEUTRONS PER BATCH
    10  /* # BATCHES TO SKIP
     0  /* # INITIAL 'SEED' (IF NON-ZERO)
     0  /* # 'IDUMP'
     1  /* # 'NRSTRT'
     0  /* # 'NRTED' (NON-ZERO IS PRINT EDITS)
     0  /* # 'KRED' (NUMBER OF COMBINED REGIONS IN EDITS)
  0  293   0   0
\CSXSEC\UO2\GUO2-50.00
\CSXSEC\NOU\GNOU-0.SS
\CSXSEC\NOU\GNOU-0.CAD
\CSXSEC\NOU\GNOU-0.POL 0.98
\CSXSEC\NOU\GNOU-0.F07 0.90
\CSXSEC\NOU\GNOU-0.WAT
\CSXSEC\NOU\GNOU-0.F11 0.90
\CSXSEC\NOU\GNOU-0.F15 0.90
\CSXSEC\NOU\GNOU-0.F40 0.90
\CSXSEC\NOU\GNOU-0.ORC
KENO GEOM
     0  /* 'KREFM'
     0  /* 'NBOX'
     1  /* 'NBXMAX'
     1  /* 'NBYMAX'
     1  /* 'NBZMAX'
     1  /* 'NXX'
     1  /* 'NTYPST'
     1  /* 'NEMBRG'
     0  /* 'NGMCHK'
     0.0      0.0      0.0      0.0      0.0      0.0
BOX TYPE       1  /* 17X17 pellet, var. W/F
INTERS         6  0.439161  0.760649  0.381000 +1.00 30.48 -30.48 16*0.5
CUBOID         1  0.439161 -0.439161  0.760649 -0.760649 30.48 -30.48 16*0.5
BOX TYPE       2  /*  inner canister: bottom fuel_region # 1 w/ gap: body assy
CYLINDER      -1  10.8141    0.31750   0.00        16*0.5
CYLINDER       2  10.9233    0.31750   0.00        16*0.5
CYLINDER       0  12.40920   0.31750   0.00000     16*0.5
CYLINDER       2  12.40920   0.31750  -0.44200     16*0.5
CYLINDER       2  12.46120   0.31750  -0.44200     16*0.5
```

```
CYLINDER     0  12.70000   0.31750  -0.44200    16*0.5
CYLINDER     2  12.76350   0.31750  -0.50550    16*0.5
BOX TYPE     3  /*  inner canister: fuel_region # 2: body assy
CYLINDER    -1  10.8141   25.46350   0.00       16*0.5
CYLINDER     2  10.9233   25.46350   0.00       16*0.5
CYLINDER     3  10.96140  25.46350   0.00000    16*0.5
CYLINDER     4  12.40920  25.46350   0.00000    16*0.5
CYLINDER     2  12.46120  25.46350   0.00000    16*0.5
CYLINDER     0  12.70000  25.46350   0.00000    16*0.5
CYLINDER     2  12.76350  25.46350   0.00000    16*0.5
BOX TYPE     4  /*  inner canister: fuel_region # 3: 0.15 in od gap: body assy
CYLINDER    -1  10.8141    0.38100   0.00       16*0.5
CYLINDER     2  10.9233    0.38100   0.00       16*0.5
CYLINDER     0  10.96140   0.38100   0.00000    16*0.5
CYLINDER     4  12.40920   0.38100   0.00000    16*0.5
CYLINDER     2  12.46120   0.38100   0.00000    16*0.5
CYLINDER     0  12.70000   0.38100   0.00000    16*0.5
CYLINDER     2  12.76350   0.38100   0.00000    16*0.5
BOX TYPE     5  /*  inner canister: fuel_region # 4: body assy
CYLINDER    -1  10.8141   25.46350   0.00       16*0.5
CYLINDER     2  10.9233   25.46350   0.00       16*0.5
CYLINDER     3  10.96140  25.46350   0.00000    16*0.5
CYLINDER     4  12.40920  25.46350   0.00000    16*0.5
CYLINDER     2  12.46120  25.46350   0.00000    16*0.5
CYLINDER     0  12.70000  25.46350   0.00000    16*0.5
CYLINDER     2  12.76350  25.46350   0.00000    16*0.5
BOX TYPE     6  /*  inner canister: fuel_region # 5: 0.15 in od gap: body assy
CYLINDER    -1  10.8141    0.38100   0.00       16*0.5
CYLINDER     2  10.9233    0.38100   0.00       16*0.5
CYLINDER     0  10.96140   0.38100   0.00000    16*0.5
CYLINDER     4  12.40920   0.38100   0.00000    16*0.5
CYLINDER     2  12.46120   0.38100   0.00000    16*0.5
CYLINDER     0  12.70000   0.38100   0.00000    16*0.5
CYLINDER     2  12.76350   0.38100   0.00000    16*0.5
BOX TYPE     7  /*  inner canister: fuel_region # 6: body assy
CYLINDER    -1  10.8141   21.33840   0.00       16*0.5
CYLINDER     2  10.9233   21.33840   0.00       16*0.5
CYLINDER     3  10.96140  21.33840   0.00000    16*0.5
CYLINDER     4  12.40920  21.33840   0.00000    16*0.5
CYLINDER     2  12.46120  21.33840   0.00000    16*0.5
CYLINDER     0  12.70000  21.33840   0.00000    16*0.5
CYLINDER     2  12.76350  21.33840   0.00000    16*0.5
BOX TYPE     8  /*  inner canister: fuel_region # 7: body assy
CYLINDER    -1  10.8141    3.49250   0.00       16*0.5
CYLINDER     2  10.9233    3.49250   0.00       16*0.5
CYLINDER     3  10.96140   3.49250   0.00000    16*0.5
CYLINDER     4  12.40920   3.49250   0.00000    16*0.5
CYLINDER     2  12.46120   3.49250   0.00000    16*0.5
CYLINDER     0  12.70000   3.49250   0.00000    16*0.5
CYLINDER     2  12.76350   3.49250   0.00000    16*0.5
BOX TYPE     9  /*  inner canister: fuel_region # 8: lid assy
CYLINDER    -1  10.8141    0.63250   0.00       16*0.5
CYLINDER     2  10.9233    0.63250   0.00       16*0.5
CYLINDER     3  10.96140   0.63250   0.00000    16*0.5
CYLINDER     4  12.40920   0.63250   0.00000    16*0.5
CYLINDER     2  12.46120   0.63250   0.00000    16*0.5
CYLINDER     0  12.70000   0.63250   0.00000    16*0.5
CYLINDER     2  12.76350   0.63250   0.00000    16*0.5
BOX TYPE    10  /*  inner canister: fuel_region # 9 w/ gap: lid assy
CYLINDER    -1  10.8141    0.31750   0.00       16*0.5
CYLINDER     2  10.9233    0.31750   0.00       16*0.5
CYLINDER     0  12.40920   0.31750   0.00000    16*0.5
CYLINDER     2  12.46120   0.31750   0.00000    16*0.5
BOX TYPE    11  /*  inner canister: fuel_region #10 w/ ring: lid assy
CYLINDER    -1  10.8141    0.44200   0.00       16*0.5
CYLINDER     2  10.9233    0.44200   0.00       16*0.5
CYLINDER     2  12.40920   0.44200   0.00000    16*0.5
CYLINDER     2  12.46120   0.44200   0.00000    16*0.5
BOX TYPE    12  /*  inner canister: fuel_region #11 w/ top: lid assy
CYLINDER    -1  10.8141    1.41599   0.00       16*0.5
CYLINDER     0  10.8141    1.78050   0.00       16*0.5
CYLINDER     2  10.9233    1.91640   0.00       16*0.5
CYLINDER     0  12.40920   1.91640   0.00000    16*0.5
BOX TYPE    13  /*  inner canister cuboid: body section (7# region)
CUBOID       5  12.7636 -12.7636  12.7636 -12.7636  73.3450  -0.5055  16*0.5
BOX TYPE    14  /*  inner canister cuboid: body section (40# region)
CUBOID       9  12.7636 -12.7636  12.7636 -12.7636  3.49260   0.0000  16*0.5
BOX TYPE    15  /*  inner canister upper cylinder: lid section
CYLINDER     0  12.7636  3.30840   0.0000  16*0.5
BOX TYPE    16  /*  foam cutout  (void) - 40 #/ft3 foam lid section
CYLINDER     0  13.5510  3.30840   0.0000  16*0.5
BOX TYPE    17  /*  npc body or lid - 10 ga. 304ss layer
CUBOID       2  54.3687 -54.3687  54.3687 -54.3687  0.31240   0.0000  16*0.5
BOX TYPE    18  /*  npc body or lid - 1 inch duraboard (void) layer, 10 ga. 304ss
CUBOID       0  51.5163 -51.5163  51.5163 -51.5163  2.54000   0.0000  16*0.5
CUBOID       0  54.0563 -54.0563  54.0563 -54.0563  2.54000   0.0000  16*0.5
CUBOID       2  54.3687 -54.3687  54.3687 -54.3687  2.54000   0.0000  16*0.5
BOX TYPE    19  /*  npc body - 4 inch bot. foam layer (11 #/ft3)  - face burn
CUBOID       7  42.6086 -42.6086  42.6086 -42.6086  0.00000   0.0000  16*0.5
CUBOID       0  54.0563 -54.0563  54.0563 -54.0563  0.00000  -7.6200  16*0.5
CUBOID       2  54.3687 -54.3687  54.3687 -54.3687  0.00000  -7.6200  16*0.5
BOX TYPE    20  /*  npc body - 29.0750 inch foam layer (7,11 #/ft3) - face burn
CUBOID       5  42.6086 -42.6086  42.6086 -42.6086 73.85050   0.0000  16*0.5
CUBOID       7  42.6086 -42.6086  42.6086 -42.6086 73.85050   0.0000  16*0.5
CUBOID       0  54.0563 -54.0563  54.0563 -54.0563 73.85050   0.0000  16*0.5
CUBOID       2  54.3687 -54.3687  54.3687 -54.3687 73.85050   0.0000  16*0.5
BOX TYPE    21  /*  npc body - 1.375 inch foam layer (40 #/ft3) - face burn
CUBOID       9  42.6086 -42.6086  42.6086 -42.6086  3.49250   0.0000  16*0.5
CUBOID       0  54.0563 -54.0563  54.0563 -54.0563  3.49250   0.0000  16*0.5
CUBOID       2  54.3687 -54.3687  54.3687 -54.3687  3.49250   0.0000  16*0.5
```

```
BOX TYPE       22  /*  npc body - 30.45 inch two-part body
CUBOID          0  54.3687 -54.3687  54.3687 -54.3687 77.34300   0.0000  16*0.5
BOX TYPE       23  /*  npc lid - 1.375 inch foam layer (40 #/ft3) - lid burn
CUBOID          0  43.8963 -43.8963  43.8963 -43.8963  3.49250   0.0000  16*0.5
CUBOID          0  54.0563 -54.0563  54.0563 -54.0563  3.49250   0.0000  16*0.5
CUBOID          2  54.3687 -54.3687  54.3687 -54.3687  3.49250   0.0000  16*0.5
BOX TYPE       24  /*  npc lid - 3.5 inch foam layer (15 #/ft3) - lid burn
CUBOID          0  43.8963 -43.8963  43.8963 -43.8963  2.54000   0.0000  16*0.5
CUBOID          0  54.0563 -54.0563  54.0563 -54.0563  8.89000   0.0000  16*0.5
CUBOID          2  54.3687 -54.3687  54.3687 -54.3687  8.89000   0.0000  16*0.5
BOX TYPE       25  /*  complete npc - body assembly
CUBOID          0  54.3688 -54.3688  54.3688 -54.3688 87.81540   0.0000  16*0.5
BOX TYPE       26  /*  complete npc - lid assembly
CUBOID          0  54.3688 -54.3688  54.3688 -54.3688 15.23490   0.0000  16*0.5
BOX TYPE       27  /*  npc single-unit cuboid
CUBOID          0  54.3688 -54.3688  54.3688 -54.3688 103.0500   0.0000  16*0.5
BOX TYPE       28  /*  global unit: 2N-150:5x5x6 cuboid, 30.48-cm h2o refl.
CUBOID          0  271.844 -271.844  271.844 -271.844 618.3020   0.0000  16*0.5
CUBOID          6  302.324 -302.324  302.324 -302.324 648.7820 -30.4800  16*0.5
28  1 1 1  1 1 1  1 1 1  1
BEGIN COMPLEX
/*  build inner canister - main body sections (7 #/ft3 region)
COMPLEX  13  2  0.00000  0.00000  0.00000   1   1   1  0.0  0.0  0.0
COMPLEX  13  3  0.00000  0.00000  0.31750   1   1   1  0.0  0.0  0.0
COMPLEX  13  4  0.00000  0.00000  25.7810   1   1   1  0.0  0.0  0.0
COMPLEX  13  5  0.00000  0.00000  26.1621   1   1   1  0.0  0.0  0.0
COMPLEX  13  6  0.00000  0.00000  51.6256   1   1   1  0.0  0.0  0.0
COMPLEX  13  7  0.00000  0.00000  52.0066   1   1   1  0.0  0.0  0.0
/*  build inner canister - upper body section (40 #/ft3 section)
COMPLEX  14  8  0.00000  0.00000  0.00000   1   1   1  0.0  0.0  0.0
/*  build inner canister - lid section
COMPLEX  15  9  0.00000  0.00000  0.00000   1   1   1  0.0  0.0  0.0
COMPLEX  15 10  0.00000  0.00000  0.63250   1   1   1  0.0  0.0  0.0
COMPLEX  15 11  0.00000  0.00000  0.95000   1   1   1  0.0  0.0  0.0
COMPLEX  15 12  0.00000  0.00000  1.39200   1   1   1  0.0  0.0  0.0
/*  embed 3x3 array of canisters into lid:  11.75 inch - centers
COMPLEX  16 15 -29.8450 -29.8450  0.00000   3   3   1 29.8450  29.8450  0.0
/*  embed 3x3 array of foam cut_outs: 11.75 inch - centers
COMPLEX  23 16 -29.8450 -29.8450  0.00000   3   3   1 29.8450  29.8450  0.0
/*  embed 3x3 array of canisters into inner body: 11.75 inch - centers
COMPLEX  20 13 -29.8450 -29.8450  0.50550   3   3   1 29.8450  29.8450  0.0
COMPLEX  21 14 -29.8450 -29.8450  0.00000   3   3   1 29.8450  29.8450  0.0
/*  embed two-part body section stackup
COMPLEX  22 20   0.0000   0.0000  0.00000   1   1   1  0.0  0.0  0.0
COMPLEX  22 21   0.0000   0.0000 73.85050   1   1   1  0.0  0.0  0.0
/*  build npc - body assembly
COMPLEX  25 17   0.0000   0.0000  0.00000   1   1   1  0.0  0.0  0.0
COMPLEX  25 18   0.0000   0.0000  0.31240   1   1   1  0.0  0.0  0.0
COMPLEX  25 19   0.0000   0.0000  10.4724   1   1   1  0.0  0.0  0.0
COMPLEX  25 22   0.0000   0.0000  10.4724   1   1   1  0.0  0.0  0.0
/*  build npc - lid assembly
COMPLEX  26 23   0.0000   0.0000  0.00000   1   1   1  0.0  0.0  0.0
COMPLEX  26 24   0.0000   0.0000  3.49250   1   1   1  0.0  0.0  0.0
COMPLEX  26 18   0.0000   0.0000  12.3825   1   1   1  0.0  0.0  0.0
COMPLEX  26 17   0.0000   0.0000  14.9225   1   1   1  0.0  0.0  0.0
/*  complete npc stackup - single unit
COMPLEX  27 25   0.0000   0.0000  0.00000   1   1   1  0.0  0.0  0.0
COMPLEX  27 26   0.0000   0.0000  87.8154   1   1   1  0.0  0.0  0.0
/*  embed 5x5x6 closed packed array
COMPLEX  28 27  -217.475 -217.475 0.00000  5  5  6  108.738 108.738 103.05
END GEOM
END GEMER
```

C. Heterogeneous 46 Kg UO_2 Rod Lattice Cases

Figure 6.26a – Sample input file = MTSL-540.in

```
2002 NPC SC,HET Lat,FRad 0.1270, 46.0kg U(5.00)O2,WTF=5.40,MixHt-72.75]cm
   200  /* # BATCHES
  2000  /* # NEUTRONS PER BATCH
    10  /* # BATCHES TO SKIP
     0  /* # INITIAL 'SEED' (IF NON-ZERO)
     0  /* # 'IDUMP'
     1  /* # 'NRSTRT'
     0  /* # 'NBTED' (NON-ZERO IS PRINT EDITS)
     0  /* # 'KRED' (NUMBER OF COMBINED REGIONS IN EDITS)
  0  293   0   0
\CSXSEC\UO2\GUO2-50.00
\CSXSEC\NOU\GNOU-0.SS
\CSXSEC\NOU\GNOU-0.CAD
\CSXSEC\NOU\GNOU-0.POL 0.98
\CSXSEC\NOU\GNOU-0.F07 0.90
\CSXSEC\NOU\GNOU-0.WAT
\CSXSEC\NOU\GNOU-0.F11 0.90
\CSXSEC\NOU\GNOU-0.F15 0.90
\CSXSEC\NOU\GNOU-0.F40 0.90
\CSXSEC\NOU\GNOU-0.ORC
\CSXSEC\NOU\GNOU-0.WAT 1.00
KENO GEOM
     0  /* 'KREFM'
     0  /* 'NBOX'
     1  /* 'NBXMAX'
     1  /* 'NBYMAX'
     1  /* 'NBZMAX'
     1  /* 'NKX'
     1  /* 'NTYPST'
     1  /* 'NEMBRG'
     0  /* 'NGMCHK'
     0.0      0.0      0.0      0.0      0.0      0.0
BOX TYPE      1  /* 0.100 pellet, var. W/F
CYLINDER      1  0.127000  30.48  -30.48  16*0.5
CUBOID        6 0.284734 -.284734 0.284734 -.284734 30.48 -30.48 16*0.5
BOX TYPE      2  /*  inner canister: bottom fuel_region # 1 w/ gap: body assy
CYLINDER     -1  10.8141    0.31750   0.00       16*0.5
CYLINDER      2  10.9233    0.31750   0.00       16*0.5
CYLINDER      0  12.40920   0.31750   0.00000    16*0.5
CYLINDER      3  12.40920   0.31750  -0.44200    16*0.5
CYLINDER      2  12.46120   0.31750  -0.44200    16*0.5
CYLINDER      0  12.70000   0.31750  -0.44200    16*0.5
CYLINDER      2  12.76350   0.31750  -0.50550    16*0.5
BOX TYPE      3  /*  inner canister: fuel region # 2: body assy
CYLINDER     -1  10.8141   25.46350   0.00       16*0.5
CYLINDER      2  10.9233   25.46350   0.00       16*0.5
CYLINDER      3  10.96140  25.46350   0.00000    16*0.5
CYLINDER      4  12.40920  25.46350   0.00000    16*0.5
CYLINDER      2  12.46120  25.46350   0.00000    16*0.5
CYLINDER      0  12.70000  25.46350   0.00000    16*0.5
CYLINDER      2  12.76350  25.46350   0.00000    16*0.5
BOX TYPE      4  /*  inner canister: fuel_region # 3: 0.15 in od gap: body assy
CYLINDER     -1  10.8141    0.38100   0.00       16*0.5
CYLINDER      2  10.9233    0.38100   0.00       16*0.5
CYLINDER      0  10.96140   0.38100   0.00000    16*0.5
CYLINDER      4  12.40920   0.38100   0.00000    16*0.5
CYLINDER      2  12.46120   0.38100   0.00000    16*0.5
CYLINDER      0  12.70000   0.38100   0.00000    16*0.5
CYLINDER      2  12.76350   0.38100   0.00000    16*0.5
BOX TYPE      5  /*  inner canister: fuel_region # 4: body assy
CYLINDER     -1  10.8141   25.46350   0.00       16*0.5
CYLINDER      2  10.9233   25.46350   0.00       16*0.5
CYLINDER      3  10.96140  25.46350   0.00000    16*0.5
CYLINDER      4  12.40920  25.46350   0.00000    16*0.5
CYLINDER      2  12.46120  25.46350   0.00000    16*0.5
CYLINDER      0  12.70000  25.46350   0.00000    16*0.5
CYLINDER      2  12.76350  25.46350   0.00000    16*0.5
BOX TYPE      6  /*  inner canister: fuel_region # 5: 0.15 in od gap: body assy
CYLINDER     -1  10.8141    0.38100   0.00       16*0.5
CYLINDER      2  10.9233    0.38100   0.00       16*0.5
CYLINDER      0  10.96140   0.38100   0.00000    16*0.5
CYLINDER      4  12.40920   0.38100   0.00000    16*0.5
CYLINDER      2  12.46120   0.38100   0.00000    16*0.5
CYLINDER      0  12.70000   0.38100   0.00000    16*0.5
CYLINDER      2  12.76350   0.38100   0.00000    16*0.5
BOX TYPE      7  /*  inner canister: fuel_region # 6: body assy
CYLINDER     -1  10.8141   20.74445   0.00       16*0.5
CYLINDER      0  10.8141   21.33840   0.00       16*0.5
CYLINDER      2  10.9233   21.33840   0.00       16*0.5
CYLINDER      3  10.96140  21.33840   0.00000    16*0.5
CYLINDER      4  12.40920  21.33840   0.00000    16*0.5
CYLINDER      2  12.46120  21.33840   0.00000    16*0.5
CYLINDER      0  12.70000  21.33840   0.00000    16*0.5
CYLINDER      2  12.76350  21.33840   0.00000    16*0.5
BOX TYPE      8  /*  inner canister: fuel_region # 7: body assy
CYLINDER      0  10.8141    3.49250   0.00       16*0.5
CYLINDER      2  10.9233    3.49250   0.00       16*0.5
CYLINDER      3  10.96140   3.49250   0.00000    16*0.5
CYLINDER      4  12.40920   3.49250   0.00000    16*0.5
CYLINDER      2  12.46120   3.49250   0.00000    16*0.5
CYLINDER      0  12.70000   3.49250   0.00000    16*0.5
CYLINDER      2  12.76350   3.49250   0.00000    16*0.5
```

```
BOX TYPE      9  /*  inner canister: fuel_region # 8: lid assy
CYLINDER      0  10.8141    0.63250   0.00       16*0.5
CYLINDER      2  10.9233    0.63250   0.00       16*0.5
CYLINDER      3  10.96140   0.63250   0.00000    16*0.5
CYLINDER      4  12.40920   0.63250   0.00000    16*0.5
CYLINDER      2  12.46120   0.63250   0.00000    16*0.5
CYLINDER      0  12.70000   0.63250   0.00000    16*0.5
CYLINDER      2  12.76350   0.63250   0.00000    16*0.5
BOX TYPE     10  /*  inner canister: fuel_region # 9 w/ gap: lid assy
CYLINDER      0  10.8141    0.31750   0.00       16*0.5
CYLINDER      2  10.9233    0.31750   0.00       16*0.5
CYLINDER     11  12.40920   0.31750   0.00000    16*0.5
CYLINDER      2  12.46120   0.31750   0.00000    16*0.5
BOX TYPE     11  /*  inner canister: fuel_region #10 w/ ring: lid assy
CYLINDER      0  10.8141    0.44200   0.00       16*0.5
CYLINDER      2  10.9233    0.44200   0.00       16*0.5
CYLINDER      2  12.40920   0.44200   0.00000    16*0.5
CYLINDER      2  12.46120   0.44200   0.00000    16*0.5
BOX TYPE     12  /*  inner canister: fuel_region #11 w/ top: lid assy
CYLINDER      0  10.8141    1.78050   0.00       16*0.5
CYLINDER      2  10.9233    1.91640   0.00       16*0.5
CYLINDER     11  12.40920   1.91640   0.00000    16*0.5
BOX TYPE      13  /*  inner canister cuboid: body section (7# region)
CUBOID         5  12.7636 -12.7636  12.7636 -12.7636  73.3450  -0.5055  16*0.5
BOX TYPE      14  /*  inner canister cuboid: body section (40# region)
CUBOID         9  12.7636 -12.7636  12.7636 -12.7636  3.49260   0.0000  16*0.5
BOX TYPE      15  /*  inner canister upper cylinder: lid section
CYLINDER      11  12.7636  3.30840   0.0000  16*0.5
BOX TYPE      16  /*  foam cutout  (void) - 40 #/ft3 foam lid section
CYLINDER      11  13.5510  3.30840   0.0000  16*0.5
BOX TYPE      17  /*  npc body or lid - 10 ga. 304ss layer
CUBOID         2  54.3687 -54.3687  54.3687 -54.3687  0.31240   0.0000  16*0.5
BOX TYPE      18  /*  npc body or lid - 1 inch duraboard (void) layer, 10 ga. 304ss
CUBOID        11  51.5163 -51.5163  51.5163 -51.5163  2.54000   0.0000  16*0.5
CUBOID        11  54.0563 -54.0563  54.0563 -54.0563  2.54000   0.0000  16*0.5
CUBOID         2  54.3687 -54.3687  54.3687 -54.3687  2.54000   0.0000  16*0.5
BOX TYPE      19  /*  npc body - 4 inch bot. foam layer (11 #/ft3)  - face burn
CUBOID         7  42.6086 -42.6086  42.6086 -42.6086  0.00000   0.0000  16*0.5
CUBOID        11  54.0563 -54.0563  54.0563 -54.0563  0.00000  -7.6200  16*0.5
CUBOID         2  54.3687 -54.3687  54.3687 -54.3687  0.00000  -7.6200  16*0.5
BOX TYPE      20  /*  npc body - 29.0750 inch foam layer (7,11 #/ft3) - face burn
CUBOID         5  42.6086 -42.6086  42.6086 -42.6086 73.85050   0.0000  16*0.5
CUBOID         7  42.6086 -42.6086  42.6086 -42.6086 73.85050   0.0000  16*0.5
CUBOID        11  54.0563 -54.0563  54.0563 -54.0563 73.85050   0.0000  16*0.5
CUBOID         2  54.3687 -54.3687  54.3687 -54.3687 73.85050   0.0000  16*0.5
BOX TYPE      21  /*  npc body - 1.375 inch foam layer (40 #/ft3) - face burn
CUBOID         9  42.6086 -42.6086  42.6086 -42.6086  3.49250   0.0000  16*0.5
CUBOID        11  54.0563 -54.0563  54.0563 -54.0563  3.49250   0.0000  16*0.5
CUBOID         2  54.3687 -54.3687  54.3687 -54.3687  3.49250   0.0000  16*0.5
BOX TYPE      22  /*  npc body - 30.45 inch two-part body
CUBOID        11  54.3687 -54.3687  54.3687 -54.3687 77.34300   0.0000  16*0.5
BOX TYPE      23  /*  npc lid - 1.375 inch foam layer (40 #/ft3) - lid burn
CUBOID        11  43.8963 -43.8963  43.8963 -43.8963  3.49250   0.0000  16*0.5
CUBOID        11  54.0563 -54.0563  54.0563 -54.0563  3.49250   0.0000  16*0.5
CUBOID         2  54.3687 -54.3687  54.3687 -54.3687  3.49250   0.0000  16*0.5
BOX TYPE      24  /*  npc lid - 3.5 inch foam layer (15 #/ft3) - lid burn
CUBOID        11  43.8963 -43.8963  43.8963 -43.8963  2.54000   0.0000  16*0.5
CUBOID        11  54.0563 -54.0563  54.0563 -54.0563  8.89000   0.0000  16*0.5
CUBOID         2  54.3687 -54.3687  54.3687 -54.3687  8.89000   0.0000  16*0.5
BOX TYPE      25  /*  complete npc - body assembly
CUBOID        11  54.3688 -54.3688  54.3688 -54.3688 87.81540   0.0000  16*0.5
BOX TYPE      26  /*  complete npc - lid assembly
CUBOID        11  54.3688 -54.3688  54.3688 -54.3688 15.23490   0.0000  16*0.5
BOX TYPE      27  /*  npc water reflected single-unit
CUBOID         0  54.3688 -54.3688  54.3688 -54.3688 103.0503   0.0000  16*0.5
CUBOID         6  84.8488 -84.8488  84.8488 -84.8488 133.5303 -30.4800  16*0.5
BOX TYPE      28  /*  global unit: 2N=150:5x5x6 cuboid, 30.48-cm h2o refl.
CUBOID         0  271.844 -271.844  271.844 -271.844 618.3020   0.0000  16*0.5
CUBOID         6  302.324 -302.324  302.324 -302.324 648.7820 -30.4800  16*0.5
27  1 1 1  1 1 1  1 1 1  1
BEGIN COMPLEX
/*  build inner canister - main body sections (7 #/ft3 region)
COMPLEX  13  2  0.00000  0.00000  0.00000   1   1   1  0.0  0.0  0.0
COMPLEX  13  3  0.00000  0.00000  0.31750   1   1   1  0.0  0.0  0.0
COMPLEX  13  4  0.00000  0.00000  25.7810   1   1   1  0.0  0.0  0.0
COMPLEX  13  5  0.00000  0.00000  26.1621   1   1   1  0.0  0.0  0.0
COMPLEX  13  6  0.00000  0.00000  51.6256   1   1   1  0.0  0.0  0.0
COMPLEX  13  7  0.00000  0.00000  52.0066   1   1   1  0.0  0.0  0.0
/*  build inner canister - upper body section (40 #/ft3 section)
COMPLEX  14  8  0.00000  0.00000  0.00000   1   1   1  0.0  0.0  0.0
/*  build inner canister - lid section
COMPLEX  15  9  0.00000  0.00000  0.00000   1   1   1  0.0  0.0  0.0
COMPLEX  15 10  0.00000  0.00000  0.63250   1   1   1  0.0  0.0  0.0
COMPLEX  15 11  0.00000  0.00000  0.95000   1   1   1  0.0  0.0  0.0
COMPLEX  15 12  0.00000  0.00000  1.39200   1   1   1  0.0  0.0  0.0
/*  embed 3x3 array of canisters into lid:  11.75 inch - centers
COMPLEX  16 15 -29.8450 -29.8450  0.00000   3   3   1 29.8450  29.8450  0.0
/*  embed 3x3 array of foam cut outs: 11.75 inch - centers
COMPLEX  23 16 -29.8450 -29.8450  0.00000   3   3   1 29.8450  29.8450  0.0
/*  embed 3x3 array of canisters into inner body: 11.75 inch - centers
COMPLEX  20 13 -29.8450 -29.8450  0.50550   3   3   1 29.8450  29.8450  0.0
COMPLEX  21 14 -29.8450 -29.8450  0.00000   3   3   1 29.8450  29.8450  0.0
/*  embed two-part body section stackup
COMPLEX  22 20   0.0000   0.0000  0.00000   1   1   1  0.0  0.0  0.0
COMPLEX  22 21   0.0000   0.0000 73.85050   1   1   1  0.0  0.0  0.0
/*  build npc - body assembly
COMPLEX  25 17   0.0000   0.0000  0.00000   1   1   1  0.0  0.0  0.0
COMPLEX  25 18   0.0000   0.0000  0.31240   1   1   1  0.0  0.0  0.0
COMPLEX  25 19   0.0000   0.0000  10.4724   1   1   1  0.0  0.0  0.0
COMPLEX  25 22   0.0000   0.0000  10.4724   1   1   1  0.0  0.0  0.0
```

```
/*  build npc - lid assembly
COMPLEX  26 23   0.0000   0.0000  0.00000   1   1   1  0.0  0.0  0.0
COMPLEX  26 24   0.0000   0.0000  3.49250   1   1   1  0.0  0.0  0.0
COMPLEX  26 18   0.0000   0.0000  12.3825   1   1   1  0.0  0.0  0.0
COMPLEX  26 17   0.0000   0.0000  14.9225   1   1   1  0.0  0.0  0.0
/*  complete npc stackup - water reflected single unit
COMPLEX  27 25   0.0000   0.0000  0.00000   1   1   1  0.0  0.0  0.0
COMPLEX  27 26   0.0000   0.0000  87.8154   1   1   1  0.0  0.0  0.0
END GEOM
END GEMER
```

Figure 6.26b – Sample input file = ABTL-490.in

```
2002 NPC 1A,HET Lat,FRad=0.1270, 46.0kg U(5.00)O2,WTF=4.90,MixHt=67.067cm
   200  /* # BATCHES
  2000  /* # NEUTRONS PER BATCH
    10  /* # BATCHES TO SKIP
     0  /* # INITIAL 'SEED' (IF NON-ZERO)
     0  /* # 'IDUMP'
     1  /* # 'NRSTRT'
     0  /* # 'NBTED' (NON-ZERO IS PRINT EDITS)
     0  /* # 'KRED' (NUMBER OF COMBINED REGIONS IN EDITS)
  0  293   0   0
\CSXSEC\UO2\GUO2=50.00
\CSXSEC\NOU\GNOU-0.SS
\CSXSEC\NOU\GNOU-0.CAD
\CSXSEC\NOU\GNOU-0.POL
\CSXSEC\NOU\GNOU-0.F07 0.90
\CSXSEC\NOU\GNOU-0.WAT
\CSXSEC\NOU\GNOU-0.F11 0.90
\CSXSEC\NOU\GNOU-0.F15 0.90
\CSXSEC\NOU\GNOU-0.F40 0.90
\CSXSEC\NOU\GNOU-0.ORC
\CSXSEC\NOU\GNOU-0.WAT 0.0001
KENO GEOM
     0  /* 'KREFM'
     0  /* 'NBOX'
     1  /* 'NBXMAX'
     1  /* 'NBYMAX'
     1  /* 'NBZMAX'
     1  /* 'NXX'
     1  /* 'NTYPST'
     1  /* 'NEMBRG'
     0  /* 'NGMCHK'
    -1.0    -1.0    -1.0    -1.0    -1.0    -1.0
BOX TYPE      1  /* 0.100 pellet, var. W/F
INTERS        6 0.146886 0.254413 0.127000 +1.00 30.48 -30.48 16*0.5
CUBOID        1 0.146886 -.146886 0.254413 -.254413 30.48 -30.48 16*0.5
BOX TYPE      2  /*  inner canister: bottom fuel_region # 1 w/ gap: body assy
CYLINDER     -1  10.8141    0.31750   0.00       16*0.5
CYLINDER      2  10.9233    0.31750   0.00       16*0.5
CYLINDER      0  12.40920   0.31750   0.00000    16*0.5
CYLINDER      2  12.40920   0.31750  -0.44200    16*0.5
CYLINDER      2  12.46120   0.31750  -0.44200    16*0.5
CYLINDER      0  12.70000   0.31750  -0.44200    16*0.5
CYLINDER      2  12.76350   0.31750  -0.50550    16*0.5
BOX TYPE      3  /*  inner canister: fuel_region # 2: body assy
CYLINDER     -1  10.8141    25.46350  0.00       16*0.5
CYLINDER      2  10.9233    25.46350  0.00       16*0.5
CYLINDER      3  10.96140   25.46350  0.00000    16*0.5
CYLINDER      4  12.40920   25.46350  0.00000    16*0.5
CYLINDER      2  12.46120   25.46350  0.00000    16*0.5
CYLINDER      0  12.70000   25.46350  0.00000    16*0.5
CYLINDER      2  12.76350   25.46350  0.00000    16*0.5
BOX TYPE      4  /*  inner canister: fuel_region # 3: 0.15 in od gap: body assy
CYLINDER     -1  10.8141    0.38100   0.00       16*0.5
CYLINDER      2  10.9233    0.38100   0.00       16*0.5
CYLINDER      0  10.96140   0.38100   0.00000    16*0.5
CYLINDER      4  12.40920   0.38100   0.00000    16*0.5
CYLINDER      2  12.46120   0.38100   0.00000    16*0.5
CYLINDER      0  12.70000   0.38100   0.00000    16*0.5
CYLINDER      2  12.76350   0.38100   0.00000    16*0.5
BOX TYPE      5  /*  inner canister: fuel_region # 4: body assy
CYLINDER     -1  10.8141    25.46350  0.00       16*0.5
CYLINDER      2  10.9233    25.46350  0.00       16*0.5
CYLINDER      3  10.96140   25.46350  0.00000    16*0.5
CYLINDER      4  12.40920   25.46350  0.00000    16*0.5
CYLINDER      2  12.46120   25.46350  0.00000    16*0.5
CYLINDER      0  12.70000   25.46350  0.00000    16*0.5
CYLINDER      2  12.76350   25.46350  0.00000    16*0.5
BOX TYPE      6  /*  inner canister: fuel_region # 5: 0.15 in od gap: body assy
CYLINDER     -1  10.8141    0.38100   0.00       16*0.5
CYLINDER      2  10.9233    0.38100   0.00       16*0.5
CYLINDER      0  10.96140   0.38100   0.00000    16*0.5
CYLINDER      4  12.40920   0.38100   0.00000    16*0.5
CYLINDER      2  12.46120   0.38100   0.00000    16*0.5
CYLINDER      0  12.70000   0.38100   0.00000    16*0.5
CYLINDER      2  12.76350   0.38100   0.00000    16*0.5
BOX TYPE      7  /*  inner canister: fuel_region # 6: body assy
CYLINDER     -1  10.8141    15.06078  0.00       16*0.5
CYLINDER      0  10.8141    21.33840  0.00       16*0.5
CYLINDER      2  10.9233    21.33840  0.00       16*0.5
CYLINDER      3  10.96140   21.33840  0.00000    16*0.5
CYLINDER      4  12.40920   21.33840  0.00000    16*0.5
CYLINDER      2  12.46120   21.33840  0.00000    16*0.5
CYLINDER      0  12.70000   21.33840  0.00000    16*0.5
CYLINDER      2  12.76350   21.33840  0.00000    16*0.5
```

```
BOX TYPE      8  /*  inner canister: fuel_region # 7: body assy
CYLINDER      0  10.8141    3.49250   0.00        16*0.5
CYLINDER      2  10.9233    3.49250   0.00        16*0.5
CYLINDER      3  10.96140   3.49250   0.00000     16*0.5
CYLINDER      4  12.40920   3.49250   0.00000     16*0.5
CYLINDER      2  12.46120   3.49250   0.00000     16*0.5
CYLINDER      0  12.70000   3.49250   0.00000     16*0.5
CYLINDER      2  12.76350   3.49250   0.00000     16*0.5
BOX TYPE      9  /*  inner canister: fuel_region # 8: lid assy
CYLINDER      0  10.8141    0.63250   0.00        16*0.5
CYLINDER      2  10.9233    0.63250   0.00        16*0.5
CYLINDER      3  10.96140   0.63250   0.00000     16*0.5
CYLINDER      4  12.40920   0.63250   0.00000     16*0.5
CYLINDER      2  12.46120   0.63250   0.00000     16*0.5
CYLINDER      0  12.70000   0.63250   0.00000     16*0.5
CYLINDER      2  12.76350   0.63250   0.00000     16*0.5
BOX TYPE     10  /*  inner canister: fuel_region # 9 w/ gap: lid assy
CYLINDER      0  10.8141    0.31750   0.00        16*0.5
CYLINDER      2  10.9233    0.31750   0.00        16*0.5
CYLINDER     11  12.40920   0.31750   0.00000     16*0.5
CYLINDER      2  12.46120   0.31750   0.00000     16*0.5
BOX TYPE     11  /*  inner canister: fuel_region #10 w/ ring: lid assy
CYLINDER      0  10.8141    0.44200   0.00        16*0.5
CYLINDER      2  10.9233    0.44200   0.00        16*0.5
CYLINDER      2  12.40920   0.44200   0.00000     16*0.5
CYLINDER      2  12.46120   0.44200   0.00000     16*0.5
BOX TYPE     12  /*  inner canister: fuel_region #11 w/ top: lid assy
CYLINDER      0  10.8141    1.78050   0.00        16*0.5
CYLINDER      2  10.9233    1.91640   0.00        16*0.5
CYLINDER     11  12.40920   1.91640   0.00000     16*0.5
BOX TYPE      13  /*  inner canister cuboid: body section (7# region)
CUBOID         5  12.7636 -12.7636  12.7636 -12.7636  73.3450   -0.5035  16*0.5
BOX TYPE      14  /*  inner canister cuboid: body section (40# region)
CUBOID         9  12.7636 -12.7636  12.7636 -12.7636  3.49260   0.0000  16*0.5
BOX TYPE      15  /*  inner canister upper cylinder: lid section
CYLINDER      11  12.7636  3.30840   0.0000  16*0.5
BOX TYPE      16  /*  foam cutout  (void) - 40 #/ft3 foam lid section
CYLINDER      11  13.5510  3.30840   0.0000  16*0.5
BOX TYPE      17  /*  npc body or lid - 10 ga. 304ss layer
CUBOID         2  54.3687 -54.3687  54.3687 -54.3687  0.31240   0.0000  16*0.5
BOX TYPE      18  /*  npc body or lid - 1 inch duraboard (void) layer, 10 ga. 304ss
CUBOID        11  51.5163 -51.5163  51.5163 -51.5163  2.54000   0.0000  16*0.5
CUBOID        11  54.0563 -54.0563  54.0563 -54.0563  2.54000   0.0000  16*0.5
CUBOID         2  54.3687 -54.3687  54.3687 -54.3687  2.54000   0.0000  16*0.5
BOX TYPE      19  /*  npc body - 3 inch bot. foam layer (11 #/ft3)  - face burn
CUBOID         7  51.5163 -51.5163  51.5163 -51.5163  7.62000   0.0000  16*0.5
CUBOID        11  54.0563 -54.0563  54.0563 -54.0563  7.62000   0.0000  16*0.5
CUBOID         2  54.3687 -54.3687  54.3687 -54.3687  7.62000   0.0000  16*0.5
BOX TYPE      20  /*  npc body - 29.0750 inch foam layer (7,11 #/ft3) - face burn
CUBOID         5  43.8963 -43.8963  43.8963 -43.8963 73.85050   0.0000  16*0.5
CUBOID         7  51.5163 -51.5163  51.5163 -51.5163 73.85050   0.0000  16*0.5
CUBOID        11  54.0563 -54.0563  54.0563 -54.0563 73.85050   0.0000  16*0.5
CUBOID         2  54.3687 -54.3687  54.3687 -54.3687 73.85050   0.0000  16*0.5
BOX TYPE      21  /*  npc body - 1.375 inch foam layer (40 #/ft3) - face burn
CUBOID         9  51.5163 -51.5163  51.5163 -51.5163  3.49250   0.0000  16*0.5
CUBOID        11  54.0563 -54.0563  54.0563 -54.0563  3.49250   0.0000  16*0.5
CUBOID         2  54.3687 -54.3687  54.3687 -54.3687  3.49250   0.0000  16*0.5
BOX TYPE      22  /*  npc body - 30.45 inch two-part body
CUBOID        11  54.3687 -54.3687  54.3687 -54.3687 77.34300   0.0000  16*0.5
BOX TYPE      23  /*  npc lid - 1.375 inch foam layer (40 #/ft3) - lid burn
CUBOID         9  51.5163 -51.5163  51.5163 -51.5163  3.49250   0.0000  16*0.5
CUBOID        11  54.0563 -54.0563  54.0563 -54.0563  3.49250   0.0000  16*0.5
CUBOID         2  54.3687 -54.3687  54.3687 -54.3687  3.49250   0.0000  16*0.5
BOX TYPE      24  /*  npc lid - 3.5 inch foam layer (15 #/ft3) - lid burn
CUBOID         9  51.5163 -51.5163  51.5163 -51.5163  8.89000   0.0000  16*0.5
CUBOID        11  54.0563 -54.0563  54.0563 -54.0563  8.89000   0.0000  16*0.5
CUBOID         2  54.3687 -54.3687  54.3687 -54.3687  8.89000   0.0000  16*0.5
BOX TYPE      25  /*  complete npc - body assembly
CUBOID        11  54.3688 -54.3688  54.3688 -54.3688 87.81540   0.0000  16*0.5
BOX TYPE      26  /*  complete npc - lid assembly
CUBOID        11  54.3688 -54.3688  54.3688 -54.3688 15.23490   0.0000  16*0.5
BOX TYPE      27  /*  npc single-unit
CUBOID         0  54.3688 -54.3688  54.3688 -54.3688 103.0503   0.0000  16*0.5
BOX TYPE      28  /*  global unit: 2N-150:5x5x6 cuboid, 30.48-cm h2o refl.
CUBOID         0  271.844 -271.844  271.844 -271.844 618.3020   0.0000  16*0.5
CUBOID         6  302.324 -302.324  302.324 -302.324 648.7820 -30.4800  16*0.5
27  1 1 1  1 1 1  1 1 1  1
BEGIN COMPLEX
/*  build inner canister - main body sections (7 #/ft3 region)
COMPLEX  13  2  0.00000  0.00000  0.00000   1   1   1  0.0  0.0  0.0
COMPLEX  13  3  0.00000  0.00000  0.31750   1   1   1  0.0  0.0  0.0
COMPLEX  13  4  0.00000  0.00000  25.7810   1   1   1  0.0  0.0  0.0
COMPLEX  13  5  0.00000  0.00000  26.1621   1   1   1  0.0  0.0  0.0
COMPLEX  13  6  0.00000  0.00000  51.6256   1   1   1  0.0  0.0  0.0
COMPLEX  13  7  0.00000  0.00000  52.0066   1   1   1  0.0  0.0  0.0
/*  build inner canister - upper body section (40 #/ft3 section)
COMPLEX  14  8  0.00000  0.00000  0.00000   1   1   1  0.0  0.0  0.0
/*  build inner canister - lid section
COMPLEX  15  9  0.00000  0.00000  0.00000   1   1   1  0.0  0.0  0.0
COMPLEX  15 10  0.00000  0.00000  0.63250   1   1   1  0.0  0.0  0.0
COMPLEX  15 11  0.00000  0.00000  0.95000   1   1   1  0.0  0.0  0.0
COMPLEX  15 12  0.00000  0.00000  1.39200   1   1   1  0.0  0.0  0.0
/*  embed 3x3 array of canisters into lid:  11.75 inch - centers
COMPLEX  16 15 -29.8450 -29.8450  0.00000   3   3   1 29.8450  29.8450  0.0
/*  embed 3x3 array of foam cut_outs: 11.75 inch - centers
COMPLEX  23 16 -29.8450 -29.8450  0.00000   3   3   1 29.8450  29.8450  0.0
/*  embed 3x3 array of canisters into inner body: 11.75 inch - centers
COMPLEX  20 13 -29.8450 -29.8450  0.50550   3   3   1 29.8450  29.8450  0.0
COMPLEX  21 14 -29.8450 -29.8450  0.00000   3   3   1 29.8450  29.8450  0.0
/*  embed two-part body section stackup
```

```
COMPLEX  22 20   0.0000   0.0000  0.00000   1   1   1  0.0  0.0  0.0
COMPLEX  22 21   0.0000   0.0000 73.85050   1   1   1  0.0  0.0  0.0
/*  build npc - body assembly
COMPLEX  25 17   0.0000   0.0000  0.00000   1   1   1  0.0  0.0  0.0
COMPLEX  25 18   0.0000   0.0000  0.31240   1   1   1  0.0  0.0  0.0
COMPLEX  25 19   0.0000   0.0000  2.85240   1   1   1  0.0  0.0  0.0
COMPLEX  25 22   0.0000   0.0000 10.4724    1   1   1  0.0  0.0  0.0
/*  build npc - lid assembly
COMPLEX  26 23   0.0000   0.0000  0.00000   1   1   1  0.0  0.0  0.0
COMPLEX  26 24   0.0000   0.0000  3.49250   1   1   1  0.0  0.0  0.0
COMPLEX  26 18   0.0000   0.0000 12.3825    1   1   1  0.0  0.0  0.0
COMPLEX  26 17   0.0000   0.0000 14.9225    1   1   1  0.0  0.0  0.0
/*  complete npc stackup - water reflected single unit
COMPLEX  27 25   0.0000   0.0000  0.00000   1   1   1  0.0  0.0  0.0
COMPLEX  27 26   0.0000   0.0000 87.8154    1   1   1  0.0  0.0  0.0
END GEOM
END GEMER
```

Figure 6.26c – Sample input file = BT46-600.in

```
2002 NPC,HET Lat,FRad=0.1270,U(5.00)O2 MASS=46.0kg,WTF=6.00,MixHt=79.571cm
   200  /* # BATCHES
  2000  /* # NEUTRONS PER BATCH
    10  /* # BATCHES TO SKIP
     0  /* # INITIAL 'SEED' (IF NON-ZERO)
     0  /* # 'IDUMP'
     1  /* # 'NRSTRT'
     0  /* # 'NBTED' (NON-ZERO IS PRINT EDITS)
     0  /* # 'KRED' (NUMBER OF COMBINED REGIONS IN EDITS)
  0  293   0   0
\CSXSEC\UO2\GUO2-50.00
\CSXSEC\NOU\GNOU-0.SS
\CSXSEC\NOU\GNOU-0.CAD
\CSXSEC\NOU\GNOU-0.POL 0.98
\CSXSEC\NOU\GNOU-0.F07 0.90
\CSXSEC\NOU\GNOU-0.WAT
\CSXSEC\NOU\GNOU-0.F11 0.90
\CSXSEC\NOU\GNOU-0.F15 0.90
\CSXSEC\NOU\GNOU-0.F40 0.90
\CSXSEC\NOU\GNOU-0.ORC
KENO GEOM
     0  /* 'KREFM'
     0  /* 'NBOX'
     1  /* 'NBXMAX'
     1  /* 'NBYMAX'
     1  /* 'NBZMAX'
     1  /* 'NKX'
     1  /* 'NTYPST'
     1  /* 'NEMBRG'
     0  /* 'NGMCHK'
     0.0     0.0     0.0     0.0     0.0     0.0
BOX TYPE       1  /* 0.100 pellet, var. W/F
INTERS         6 0.159994 0.277117 0.127000 +1.00 30.48 -30.48 16*0.5
CUBOID         1 0.159994 -.159994 0.277117 -.277117 30.48 -30.48 16*0.5
BOX TYPE       2  /*  inner canister: bottom fuel_region # 1 w/ gap: body assy
CYLINDER      -1  10.8141    0.31750   0.00        16*0.5
CYLINDER       2  10.9233    0.31750   0.00        16*0.5
CYLINDER       0  12.40920   0.31750   0.00000     16*0.5
CYLINDER       2  12.40920   0.31750  -0.44200     16*0.5
CYLINDER       2  12.46120   0.31750  -0.44200     16*0.5
CYLINDER       0  12.70000   0.31750  -0.44200     16*0.5
CYLINDER       2  12.76350   0.31750  -0.50550     16*0.5
BOX TYPE       3  /*  inner canister: fuel_region # 2: body assy
CYLINDER      -1  10.8141   25.46350   0.00        16*0.5
CYLINDER       2  10.9233   25.46350   0.00        16*0.5
CYLINDER       3  10.96140  25.46350   0.00000     16*0.5
CYLINDER       4  12.40920  25.46350   0.00000     16*0.5
CYLINDER       2  12.46120  25.46350   0.00000     16*0.5
CYLINDER       0  12.70000  25.46350   0.00000     16*0.5
CYLINDER       2  12.76350  25.46350   0.00000     16*0.5
BOX TYPE       4  /*  inner canister: fuel_region # 3: 0.15 in cd gap: body assy
CYLINDER      -1  10.8141    0.38100   0.00        16*0.5
CYLINDER       2  10.9233    0.38100   0.00        16*0.5
CYLINDER       0  10.96140   0.38100   0.00000     16*0.5
CYLINDER       4  12.40920   0.38100   0.00000     16*0.5
CYLINDER       2  12.46120   0.38100   0.00000     16*0.5
CYLINDER       0  12.70000   0.38100   0.00000     16*0.5
CYLINDER       2  12.76350   0.38100   0.00000     16*0.5
BOX TYPE       5  /*  inner canister: fuel_region # 4: body assy
CYLINDER      -1  10.8141   25.46350   0.00        16*0.5
CYLINDER       2  10.9233   25.46350   0.00        16*0.5
CYLINDER       3  10.96140  25.46350   0.00000     16*0.5
CYLINDER       4  12.40920  25.46350   0.00000     16*0.5
CYLINDER       2  12.46120  25.46350   0.00000     16*0.5
CYLINDER       0  12.70000  25.46350   0.00000     16*0.5
CYLINDER       2  12.76350  25.46350   0.00000     16*0.5
BOX TYPE       6  /*  inner canister: fuel_region # 5: 0.15 in cd gap: body assy
CYLINDER      -1  10.8141    0.38100   0.00        16*0.5
CYLINDER       2  10.9233    0.38100   0.00        16*0.5
CYLINDER       0  10.96140   0.38100   0.00000     16*0.5
CYLINDER       4  12.40920   0.38100   0.00000     16*0.5
CYLINDER       2  12.46120   0.38100   0.00000     16*0.5
CYLINDER       0  12.70000   0.38100   0.00000     16*0.5
CYLINDER       2  12.76350   0.38100   0.00000     16*0.5
BOX TYPE       7  /*  inner canister: fuel_region # 6: body assy
CYLINDER      -1  10.8141   21.33840   0.00        16*0.5
CYLINDER       2  10.9233   21.33840   0.00        16*0.5
```

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CYLINDER      3  10.96140  21.33840   0.00000    16*0.5
CYLINDER      4  12.40920  21.33840   0.00000    16*0.5
CYLINDER      2  12.46120  21.33840   0.00000    16*0.5
CYLINDER      0  12.70000  21.33840   0.00000    16*0.5
CYLINDER      2  12.76350  21.33840   0.00000    16*0.5
BOX TYPE      8  /*  inner canister: fuel region # 7: body assy
CYLINDER     -1  10.8141    3.49250   0.00       16*0.5
CYLINDER      2  10.9233    3.49250   0.00       16*0.5
CYLINDER      3  10.96140   3.49250   0.00000    16*0.5
CYLINDER      4  12.40920   3.49250   0.00000    16*0.5
CYLINDER      2  12.46120   3.49250   0.00000    16*0.5
CYLINDER      0  12.70000   3.49250   0.00000    16*0.5
CYLINDER      2  12.76350   3.49250   0.00000    16*0.5
BOX TYPE      9  /*  inner canister: fuel_region # 8: lid assy
CYLINDER     -1  10.8141    0.63250   0.00       16*0.5
CYLINDER      2  10.9233    0.63250   0.00       16*0.5
CYLINDER      3  10.96140   0.63250   0.00000    16*0.5
CYLINDER      4  12.40920   0.63250   0.00000    16*0.5
CYLINDER      2  12.46120   0.63250   0.00000    16*0.5
CYLINDER      0  12.70000   0.63250   0.00000    16*0.5
CYLINDER      2  12.76350   0.63250   0.00000    16*0.5
BOX TYPE     10  /*  inner canister: fuel_region # 9 w/ gap: lid assy
CYLINDER     -1  10.8141    0.31750   0.00       16*0.5
CYLINDER      2  10.9233    0.31750   0.00       16*0.5
CYLINDER      0  12.40920   0.31750   0.00000    16*0.5
CYLINDER      2  12.46120   0.31750   0.00000    16*0.5
BOX TYPE     11  /*  inner canister: fuel_region #10 w/ ring: lid assy
CYLINDER     -1  10.8141    0.44200   0.00       16*0.5
CYLINDER      2  10.9233    0.44200   0.00       16*0.5
CYLINDER      2  12.40920   0.44200   0.00000    16*0.5
CYLINDER      2  12.46120   0.44200   0.00000    16*0.5
BOX TYPE     12  /*  inner canister: fuel_region #11 w/ top: lid assy
CYLINDER     -1  10.8141    1.34186   0.00       16*0.5
CYLINDER      0  10.8141    1.78050   0.00       16*0.5
CYLINDER      2  10.9233    1.91640   0.00       16*0.5
CYLINDER      0  12.40920   1.91640   0.00000    16*0.5
BOX TYPE      13  /*  inner canister cuboid: body section (7# region)
CUBOID         5  12.7636 -12.7636  12.7636 -12.7636  73.3450  -0.5055  16*0.5
BOX TYPE      14  /*  inner canister cuboid: body section (40# region)
CUBOID         9  12.7636 -12.7636  12.7636 -12.7636  3.49260   0.0000  16*0.5
BOX TYPE      15  /*  inner canister upper cylinder: lid section
CYLINDER       0  12.7636  3.30840   0.0000  16*0.5
BOX TYPE      16  /*  foam cutout  (void) - 40 #/ft3 foam lid section
CYLINDER       0  13.5510  3.30840   0.0000  16*0.5
BOX TYPE      17  /*  npc body or lid - 10 ga. 304ss layer
CUBOID         2  54.3687 -54.3687  54.3687 -54.3687  0.31240   0.0000  16*0.5
BOX TYPE      18  /*  npc body or lid - 1 inch duraboard (void) layer, 10 ga. 304ss
CUBOID         0  51.5163 -51.5163  51.5163 -51.5163  2.54000   0.0000  16*0.5
CUBOID         0  54.0563 -54.0563  54.0563 -54.0563  2.54000   0.0000  16*0.5
CUBOID         2  54.3687 -54.3687  54.3687 -54.3687  2.54000   0.0000  16*0.5
BOX TYPE      19  /*  npc body - 4 inch bot. foam layer (11 #/ft3)  - face burn
CUBOID         7  42.6086 -42.6086  42.6086 -42.6086  0.00000   0.0000  16*0.5
CUBOID         0  54.0563 -54.0563  54.0563 -54.0563  0.00000  -7.6200  16*0.5
CUBOID         2  54.3687 -54.3687  54.3687 -54.3687  0.00000  -7.6200  16*0.5
BOX TYPE      20  /*  npc body - 29.0750 inch foam layer (7,11 #/ft3) - face burn
CUBOID         5  42.6086 -42.6086  42.6086 -42.6086 73.85050   0.0000  16*0.5
CUBOID         7  42.6086 -42.6086  42.6086 -42.6086 73.85050   0.0000  16*0.5
CUBOID         0  54.0563 -54.0563  54.0563 -54.0563 73.85050   0.0000  16*0.5
CUBOID         2  54.3687 -54.3687  54.3687 -54.3687 73.85050   0.0000  16*0.5
BOX TYPE      21  /*  npc body - 1.375 inch foam layer (40 #/ft3) - face burn
CUBOID         9  42.6086 -42.6086  42.6086 -42.6086  3.49250   0.0000  16*0.5
CUBOID         0  54.0563 -54.0563  54.0563 -54.0563  3.49250   0.0000  16*0.5
CUBOID         2  54.3687 -54.3687  54.3687 -54.3687  3.49250   0.0000  16*0.5
BOX TYPE      22  /*  npc body - 30.45 inch two-part body
CUBOID         0  54.3687 -54.3687  54.3687 -54.3687 77.34300   0.0000  16*0.5
BOX TYPE      23  /*  npc lid - 1.375 inch foam layer (40 #/ft3) - lid burn
CUBOID         0  43.8963 -43.8963  43.8963 -43.8963  3.49250   0.0000  16*0.5
CUBOID         0  54.0563 -54.0563  54.0563 -54.0543  3.49250   0.0000  16*0.5
CUBOID         2  54.3687 -54.3687  54.3687 -54.3687  3.49250   0.0000  16*0.5
BOX TYPE      24  /*  npc lid - 3.5 inch foam layer (15 #/ft3) - lid burn
CUBOID         0  43.8963 -43.8963  43.8963 -43.8963  2.54000   0.0000  16*0.5
CUBOID         0  54.0563 -54.0563  54.0563 -54.0563  8.89000   0.0000  16*0.5
CUBOID         2  54.3687 -54.3687  54.3687 -54.3687  8.89000   0.0000  16*0.5
BOX TYPE      25  /*  complete npc - body assembly
CUBOID         0  54.3688 -54.3688  54.3688 -54.3688 87.81540   0.0000  16*0.5
BOX TYPE      26  /*  complete npc - lid assembly
CUBOID         0  54.3688 -54.3688  54.3688 -54.3688 15.23490   0.0000  16*0.5
BOX TYPE      27  /*  npc single-unit cuboid
CUBOID         0  54.3688 -54.3688  54.3688 -54.3688 103.0500   0.0000  16*0.5
BOX TYPE      28  /*  global unit: 2N=150:5x5x6 cuboid, 30.48-cm h2o refl.
CUBOID         0  271.844 -271.844  271.844 -271.844 618.3020   0.0000  16*0.5
CUBOID         6  302.324 -302.324  302.324 -302.324 648.7820 -30.4800  16*0.5
28  1 1 1  1 1 1  1 1 1  1
BEGIN COMPLEX
/*  build inner canister - main body sections (7 #/ft3 region)
COMPLEX  13  2  0.00000  0.00000  0.00000   1   1   1  0.0  0.0  0.0
COMPLEX  13  3  0.00000  0.00000  0.31750   1   1   1  0.0  0.0  0.0
COMPLEX  13  4  0.00000  0.00000  25.7810   1   1   1  0.0  0.0  0.0
COMPLEX  13  5  0.00000  0.00000  26.1621   1   1   1  0.0  0.0  0.0
COMPLEX  13  6  0.00000  0.00000  51.6256   1   1   1  0.0  0.0  0.0
COMPLEX  13  7  0.00000  0.00000  52.0066   1   1   1  0.0  0.0  0.0
/*  build inner canister - upper body section (40 #/ft3 section)
COMPLEX  14  8  0.00000  0.00000  0.00000   1   1   1  0.0  0.0  0.0
/*  build inner canister - lid section
COMPLEX  15  9  0.00000  0.00000  0.00000   1   1   1  0.0  0.0  0.0
COMPLEX  15 10  0.00000  0.00000  0.63250   1   1   1  0.0  0.0  0.0
COMPLEX  15 11  0.00000  0.00000  0.95000   1   1   1  0.0  0.0  0.0
COMPLEX  15 12  0.00000  0.00000  1.39200   1   1   1  0.0  0.0  0.0
/*  embed 3x3 array of canisters into lid:  11.75 inch - centers
COMPLEX  16 15 -29.8450 -29.8450  0.00000   3   3   1 29.8450  29.8450  0.0
```

```
/*  embed 3x3 array of foam cut_outs: 11.75 inch - centers
COMPLEX  23 16 -29.8450 -29.8450  0.00000   3   3   1 29.8450  29.8450  0.0
/*  embed 3x3 array of canisters into inner body: 11.75 inch - centers
COMPLEX  20 13 -29.8450 -29.8450  0.50550   3   3   1 29.8450  29.8450  0.0
COMPLEX  21 14 -29.8450 -29.8450  0.00000   3   3   1 29.8450  29.8450  0.0
/*  embed two-part body section stackup
COMPLEX  22 20   0.0000   0.0000  0.00000   1   1   1  0.0  0.0  0.0
COMPLEX  22 21   0.0000   0.0000 73.85050   1   1   1  0.0  0.0  0.0
/*  build npc - body assembly
COMPLEX  25 17   0.0000   0.0000  0.00000   1   1   1  0.0  0.0  0.0
COMPLEX  25 18   0.0000   0.0000  0.31740   1   1   1  0.0  0.0  0.0
COMPLEX  25 19   0.0000   0.0000  10.4724   1   1   1  0.0  0.0  0.0
COMPLEX  25 22   0.0000   0.0000  10.4724   1   1   1  0.0  0.0  0.0
/*  build npc - lid assembly
COMPLEX  26 23   0.0000   0.0000  0.00000   1   1   1  0.0  0.0  0.0
COMPLEX  26 24   0.0000   0.0000  3.49250   1   1   1  0.0  0.0  0.0
COMPLEX  26 18   0.0000   0.0000  12.3825   1   1   1  0.0  0.0  0.0
COMPLEX  26 17   0.0000   0.0000  14.9225   1   1   1  0.0  0.0  0.0
/*  complete npc stackup - single unit
COMPLEX  27 25   0.0000   0.0000  0.00000   1   1   1  0.0  0.0  0.0
COMPLEX  27 26   0.0000   0.0000  87.8154   1   1   1  0.0  0.0  0.0
/*  embed 5x5x6 closed packed array
COMPLEX  28 27  -217.475 -217.475 0.00000  5  5  6  108.738 108.738 103.05
END GEOM
END GEMER
```

6.10 APPENDIX – TABULATION OF GEMER RESULTS

A. GEMER Results for Homogeneous UO_2 and H_2O Cases

Table 6.16 –Listing of GEMER Calculations for Homogeneouse Cases

FILENAME	K-EFF	SIGMA	K+2S	BIAS	K+2S-B
damaged single unit, CTU-1 observed burn, theoretical uo2+h2o mixture					
npcu1_15	0.80850	0.00140	0.81130	-0.0189	0.83010
npcu1_20	0.83440	0.00130	0.83700	-0.0189	0.85580
npcu1_25	0.84520	0.00130	0.84780	-0.0189	0.86660
npcu1_30	0.84160	0.00130	0.84430	-0.0189	0.86320
npcu1_35	0.83180	0.00140	0.83460	-0.0189	0.85350
npcu1_40	0.81260	0.00120	0.81510	-0.0189	0.83390
npcu1_45	0.78600	0.00120	0.78840	-0.0189	0.80730
damaged single unit, CTU-1 observed burn, theoretical uo2+h2o mixture					
npcu2_15	0.81120	0.00130	0.81390	-0.0189	0.83280
npcu2_20	0.83070	0.00140	0.83360	-0.0189	0.85250
npcu2_25	0.84070	0.00130	0.84330	-0.0189	0.86220
npcu2_30	0.83690	0.00140	0.83970	-0.0189	0.85860
npcu2_35	0.82800	0.00120	0.83050	-0.0189	0.84940
npcu2_40	0.81150	0.00140	0.81420	-0.0189	0.83310
npcu2_45	0.78660	0.00130	0.78930	-0.0189	0.80820
damaged single unit, maximum burn, theoretical uo2+h2o mixture					
npcut_15	0.80780	0.00120	0.81030	-0.0189	0.82920
npcut_20	0.83010	0.00140	0.83280	-0.0189	0.85170
npcut_25	0.84050	0.00140	0.84320	-0.0189	0.86210
npcut_30	0.83860	0.00150	0.84160	-0.0189	0.86050
npcut_35	0.83020	0.00140	0.83290	-0.0189	0.85180
npcut_40	0.81340	0.00140	0.81620	-0.0189	0.83510
npcut_45	0.78720	0.00130	0.78980	-0.0189	0.80870

FILENAME	K-EFF	SIGMA	K+2S	BIAS	K+2S-B
undamaged array, 5N = infinite (60 kgs uo2 + h2o mixture)					
npc60i15	0.81280	0.00120	0.81520	-0.0189	0.83410
npc60i20	0.85990	0.00140	0.86270	-0.0189	0.88160
npc60i25	0.88440	0.00130	0.88710	-0.0189	0.90600
npc60i26	0.88970	0.00140	0.89250	-0.0189	0.91140
npc60i27	0.89560	0.00130	0.89820	-0.0189	0.91710
npc60i28	0.89540	0.00120	0.89780	-0.0189	0.91670
undamaged array, 5N = infinite (60 kgs uo2 + 5% h2o mixture)					
npc1un60	0.34760	0.00080	0.34910	-0.0189	0.36800
npc2un60	0.36990	0.00090	0.37170	-0.0189	0.39060
npc3un60	0.40130	0.00090	0.40320	-0.0189	0.42200
npc4un60	0.43390	0.00100	0.43590	-0.0189	0.45480
npc5un60	0.45880	0.00100	0.46080	-0.0189	0.47970
npc6un60	0.48630	0.00090	0.48820	-0.0189	0.50710
undamaged array, 5N = infinite (60 kgs uo2 compound, 5% h2o added)					
npc1um60	0.36360	0.00080	0.36520	-0.0189	0.38410
npc2um60	0.37780	0.00090	0.37950	-0.0189	0.39840
npc3um60	0.40940	0.00090	0.41110	-0.0189	0.43000
npc4um60	0.43840	0.00090	0.44030	-0.0189	0.45920
npc5um60	0.46830	0.00100	0.47030	-0.0189	0.48920
npc6um60	0.48990	0.00110	0.49200	-0.0189	0.51090

Table 6.16 – Listing of GEMER Calculations for Homogeneouse Cases - Continued

FILENAME	K-EFF	SIGMA	K+2S	BIAS	K+2S-B
damaged single unit, maximum burn, theoretical uo2+h2o mixture, tight h2o					
npcutw15	0.81100	0.00130	0.81360	-0.0189	0.83250
npcutw20	0.83490	0.00150	0.83790	-0.0189	0.85680
npcutw25	0.84760	0.00150	0.85060	-0.0189	0.86940
npcutw30	0.84200	0.00140	0.84480	-0.0189	0.86360
npcutw35	0.83240	0.00130	0.83490	-0.0189	0.85380
npcutw40	0.81270	0.00120	0.81510	-0.0189	0.83400
npcutw45	0.78870	0.00130	0.79120	-0.0189	0.81010
damaged 5x5x6 array (2N = 150), CTU-1 observed burn, uo2 mass/ICCA					
npca1_40	0.87300	0.00130	0.87560	-0.0189	0.89450
npca1_50	0.89700	0.00130	0.89970	-0.0189	0.91850
npca1_55	0.90260	0.00130	0.90520	-0.0189	0.92410
npca1_60	0.90590	0.00130	0.90840	-0.0189	0.92730
npca1_65	0.90810	0.00130	0.91060	-0.0189	0.92950
damaged 5x5x6 array (2N = 150), CTU-2 observed burn, uo2 mass/ICCA					
npca2_40	0.87870	0.00110	0.88090	-0.0189	0.89980
npca2_45	0.89330	0.00120	0.89580	-0.0189	0.91470
npca2_50	0.90390	0.00120	0.90630	-0.0189	0.92520
npca2_55	0.91060	0.00140	0.91330	-0.0189	0.93220
npca2_60	0.91410	0.00130	0.91670	-0.0189	0.93560
npca2_65	0.91620	0.00130	0.91890	-0.0189	0.93770
damaged 5x5x6 array (2N = 150), maximum burn, uo2 mass/ICCA					
npcat_40	0.89200	0.00130	0.89460	-0.0189	0.91350
npcat_45	0.90400	0.00130	0.90650	-0.0189	0.92540
npcat_50	0.91350	0.00140	0.91620	-0.0189	0.93510
npcat_55	0.92370	0.00130	0.92630	-0.0189	0.94520
npcat_60	0.92750	0.00120	0.92990	-0.0189	0.94880
npcat_65	0.93160	0.00130	0.93420	-0.0189	095310

FILENAME	K-EFF	SIGMA	K+2S	BIAS	K+2S-B
damaged 9x9x2 array (2N = 162), max. burn, shape study (60 kgs uo2/ICCA)					
npcatw60	0.91320	0.00120	0.91560	-0.0189	0.93450
damaged 5x5x6 array (2N =150), max. burn, c-c spacing study (60 kgs uo2/ICCA)					
npcat_60	0.92750	0.00120	0.92990	-0.0189	0.94880
npcatb60	0.92740	0.00140	0.93010	-0.0189	0.94900
npcatc60	0.92630	0.00120	0.92870	-0.0189	0.94760
npcatd60	0.92480	0.00140	0.92760	-0.0189	0.94640
npcate60	0.92750	0.00130	0.93010	-0.0189	0.94890
damaged array, 100% foam burn vs. interspersed h2o (60 kgs uo2/ICCA)					
npcfa000	0.94510	0.00130	0.94770	-0.0189	0.96660
npcfa005	0.94480	0.00130	0.94730	-0.0189	0.96620
npcfa010	0.93770	0.00120	0.94010	-0.0189	0.95900
npcfa020	0.92980	0.00130	0.93240	-0.0189	0.95130
npcfa030	0.92370	0.00140	0.92650	-0.0189	0.94540
npcfa050	0.91040	0.00130	0.91300	-0.0189	0.93180
npcfa075	0.89830	0.00140	0.90110	-0.0189	0.92000
npcfa100	0.88830	0.00130	0.89090	-0.0189	0.90980
npcfa125	0.87340	0.00120	0.87590	-0.0189	0.89470

Table 6.16 – Listing of GEMER Calculations for Homogeneouse Cases

FILENAME	K-EFF	SIGMA	K+2S	BIAS	K+2S-B
damaged 5x5x6 array (2N = 150), max.burn, var. h2o content (60 kgs UO2/ICCA)					
npcatx60	0.81020	0.00130	0.81280	-0.0189	0.83170
npcaty60	0.86710	0.00130	0.86970	-0.0189	0.88860
npcatz60	0.90810	0.00140	0.91080	-0.0189	0.92970
damaged 6x5x5 array (2N = 150), max. burn, shape study (60 kgs uo2/ICCA)					
npcatv60	0.92740	0.00120	0.92980	-0.0189	0.94870

FILENAME	K-EFF	SIGMA	K+2S	BIAS	K+2S-B
damaged 5x5x6 array (2N =150), max. burn, structure study (60 kgs uo2/ICCA)					
npcats60	0.92400	0.00120	0.92640	-0.0189	0.94530
damaged 5x5x6 array (2N =150), max. burn, poly gap study (60 kgs uo2/ICCA)					
npcat_60	0.92750	0.00120	0.92990	-0.0189	0.94880
npcatg60	0.92710	0.00120	0.92960	-0.0189	0.94840
npcatf60	0.92730	0.00130	0.92990	-0.0189	0.94880

B. GEMER Results for 55 Kg and 53 Kg UO_2 and H_2O Cases with 17X17, 10X10, 9X9 and 8X8 Pellet Types

Table 6.17 –Listing of GEMER Calculations for Single Container 55Kg and 53 Kg Heterogeneous Cases

Name	KEFF	SIGMA	K+2S	Bias	K+2S - B	Name	KEFF	SIGMA	K+2S	Bias	K+2S - B
55 KGs Single Case with Overlap						53 KGs Single Case without Overlap					
17X17 Square Lattice						8X8 Square Lattice					
ESSP-058	0.52763	0.00113	0.52989	-0.01890	0.54879	ESSN-058	0.52000	0.00116	0.52232	-0.01890	0.54122
ESSP-100	0.64235	0.00121	0.64477	-0.01890	0.66367	ESSN-100	0.63328	0.00115	0.63558	-0.01890	0.65448
ESSP-200	0.78507	0.00135	0.78777	-0.01890	0.80667	ESSN-200	0.77683	0.00142	0.77967	-0.01890	0.79857
ESSP-300	0.83680	0.00147	0.83974	-0.01890	0.85864	ESSN-300	0.83110	0.00148	0.83406	-0.01890	0.85296
ESSP-400	0.84672	0.00143	0.84958	-0.01890	0.86848	ESSN-400	0.84688	0.00135	0.84958	-0.01890	0.86848
ESSP-410	0.84848	0.00144	0.85136	-0.01890	0.87026	ESSN-410	0.84691	0.00131	0.84953	-0.01890	0.86843
ESSP-420	**0.85195**	0.00143	0.85481	-0.01890	**0.87371**	ESSN-420	0.84524	0.00139	0.84802	-0.01890	0.86692
ESSP-430	0.84592	0.00132	0.84856	-0.01890	0.86746	ESSN-430	0.84554	0.00151	0.84856	-0.01890	0.86746
ESSP-437	0.84752	0.00134	0.85020	-0.01890	0.86910	ESSN-437	**0.84788**	0.00138	0.85064	-0.01890	**0.86954**
ESSP-440	0.84628	0.00135	0.84898	-0.01890	0.86788	ESSN-440	0.84652	0.00132	0.84916	-0.01890	0.86806
ESSP-450	0.84985	0.00149	0.85283	-0.01890	0.87173	ESSN-450	0.84683	0.00136	0.84955	-0.01890	0.86845
ESSP-460	0.84916	0.00134	0.85184	-0.01890	0.87074	ESSN-460	0.84536	0.00141	0.84818	-0.01890	0.86708
ESSP-470	0.84950	0.00140	0.85230	-0.01890	0.87120	ESSN-470	0.84482	0.00134	0.84750	-0.01890	0.86640
ESSP-480	0.84960	0.00140	0.85240	-0.01890	0.87130	ESSN-480	0.84770	0.00137	0.85044	-0.01890	0.86934
ESSP-486	0.84746	0.00136	0.85018	-0.01890	0.86908	ESSN-486	0.84195	0.00135	0.84465	-0.01890	0.86355
ESSP-490	0.84454	0.00129	0.84712	-0.01890	0.86602	ESSN-490	0.84212	0.00131	0.84474	-0.01890	0.86364
ESSP-500	0.84543	0.00123	0.84789	-0.01890	0.86679	ESSN-500	0.84504	0.00134	0.84772	-0.01890	0.86662
ESSP-520	0.84268	0.00129	0.84526	-0.01890	0.86416	ESSN-520	0.84026	0.00129	0.84284	-0.01890	0.86174
ESSP-540	0.83709	0.00138	0.83985	-0.01890	0.85875	ESSN-540	0.83416	0.00141	0.83698	-0.01890	0.85588
ESSP-544	0.83545	0.00140	0.83825	-0.01890	0.85715	ESSN-544	0.83694	0.00139	0.83972	-0.01890	0.85862
ESSP-560	0.82760	0.00137	0.83034	-0.01890	0.84924	ESSN-560	0.83201	0.00148	0.83497	-0.01890	0.85387
ESSP-600	0.81883	0.00139	0.82161	-0.01890	0.84051	ESSN-600	0.81876	0.00116	0.82108	-0.01890	0.83998
ESSP-616	0.81436	0.00135	0.81706	-0.01890	0.83596	ESSN-616	0.81752	0.00128	0.82008	-0.01890	0.83898
ESSP-700	0.79511	0.00127	0.79765	-0.01890	0.81655	ESSN-700	0.79481	0.00143	0.79767	-0.01890	0.81657
ESSP-705	0.79466	0.00134	0.79734	-0.01890	0.81624	ESSN-705	0.79703	0.00126	0.79955	-0.01890	0.81845
ESSP-800	0.77394	0.00139	0.77672	-0.01890	0.79562	ESSN-800	0.77155	0.00147	0.77449	-0.01890	0.79339
17X17 Triangular Lattice				Max	0.87371	17X17 Triangular Lattice				Max	0.86954
ESTP-058	0.52325	0.00118	0.52561	-0.01890	0.54451	ESTN-058	0.51991	0.00119	0.52229	-0.01890	0.54119
ESTP-100	0.63807	0.00132	0.64071	-0.01890	0.65961	ESTN-100	0.63377	0.00135	0.63647	-0.01890	0.65537
ESTP-200	0.78504	0.00149	0.78802	-0.01890	0.80692	ESTN-200	0.78191	0.00143	0.78477	-0.01890	0.80367

ESTP-300	0.83849	0.00152	0.84153	-0.01890	0.86043	ESTN-300	0.83296	0.00141	0.83578	-0.01890	0.85468
ESTP-400	**0.85358**	0.00141	0.85640	-0.01890	**0.87530**	ESTN-400	0.84943	0.00147	0.85237	-0.01890	0.87127
ESTP-410	0.84925	0.00149	0.85223	-0.01890	0.87113	ESTN-410	0.84609	0.00136	0.84881	-0.01890	0.86771
ESTP-420	0.84924	0.00141	0.85206	-0.01890	0.87096	ESTN-420	0.84792	0.00138	0.85068	-0.01890	0.86958
ESTP-430	0.85188	0.00145	0.85478	-0.01890	0.87368	ESTN-430	0.84743	0.00136	0.85015	-0.01890	0.86905
ESTP-437	0.84887	0.00149	0.85185	-0.01890	0.87075	ESTN-437	**0.84991**	0.00137	0.85265	-0.01890	**0.87155**
ESTP-440	0.84986	0.00144	0.85274	-0.01890	0.87164	ESTN-440	0.84864	0.00152	0.85168	-0.01890	0.87058
ESTP-450	0.84616	0.00149	0.84914	-0.01890	0.86804	ESTN-450	0.84649	0.00134	0.84917	-0.01890	0.86807
ESTP-460	0.85219	0.00136	0.85491	-0.01890	0.87381	ESTN-460	0.84517	0.00132	0.84781	-0.01890	0.86671
ESTP-470	0.84727	0.00144	0.85015	-0.01890	0.86905	ESTN-470	0.84531	0.00138	0.84807	-0.01890	0.86697
ESTP-480	0.84585	0.00140	0.84865	-0.01890	0.86755	ESTN-480	0.84310	0.00140	0.84590	-0.01890	0.86480
ESTP-486	0.84450	0.00142	0.84734	-0.01890	0.86624	ESTN-486	0.84133	0.00128	0.84389	-0.01890	0.86279
ESTP-490	0.84438	0.00130	0.84698	-0.01890	0.86588	ESTN-490	0.84160	0.00142	0.84444	-0.01890	0.86334
ESTP-500	0.84284	0.00149	0.84582	-0.01890	0.86472	ESTN-500	0.84286	0.00140	0.84566	-0.01890	0.86456
ESTP-520	0.83902	0.00125	0.84152	-0.01890	0.86042	ESTN-520	0.83537	0.00151	0.83839	-0.01890	0.85729
ESTP-540	0.83375	0.00150	0.83675	-0.01890	0.85565	ESTN-540	0.83456	0.00133	0.83722	-0.01890	0.85612
ESTP-544	0.83219	0.00145	0.83509	-0.01890	0.85399	ESTN-544	0.83293	0.00130	0.83553	-0.01890	0.85443
ESTP-560	0.82938	0.00131	0.83200	-0.01890	0.85090	ESTN-560	0.82972	0.00125	0.83222	-0.01890	0.85112
ESTP-600	0.82478	0.00135	0.82748	-0.01890	0.84638	ESTN-600	0.82655	0.00140	0.82935	-0.01890	0.84825
ESTP-616	0.82316	0.00133	0.82582	-0.01890	0.84472	ESTN-616	0.82113	0.00135	0.82383	-0.01890	0.84273
ESTP-700	0.79699	0.00141	0.79981	-0.01890	0.81871	ESTN-700	0.79368	0.00125	0.79618	-0.01890	0.81508
ESTP-705	0.79422	0.00145	0.79712	-0.01890	0.81602	ESTN-705	0.79440	0.00127	0.79694	-0.01890	0.81584
ESTP-800	0.77140	0.00127	0.77394	-0.01890	0.79284	ESTN-800	0.77090	0.00129	0.77348	-0.01890	0.79238
	10X10 Square Lattice			Max	0.87530		10X10 Square Lattice			Max	0.87155
ETSP-058	0.52919	0.00099	0.53117	-0.01890	0.55007	ETSN-058	0.51805	0.00107	0.52019	-0.01890	0.53909
ETSP-100	0.64509	0.00118	0.64745	-0.01890	0.66635	ETSN-100	0.63753	0.00134	0.64021	-0.01890	0.65911
ETSP-200	0.78549	0.00142	0.78833	-0.01890	0.80723	ETSN-200	0.78319	0.00146	0.78611	-0.01890	0.80501
ETSP-300	0.83535	0.00150	0.83835	-0.01890	0.85725	ETSN-300	0.82891	0.00146	0.83183	-0.01890	0.85073
ETSP-400	0.84431	0.00137	0.84705	-0.01890	0.86595	ETSN-400	**0.84441**	0.00152	0.84745	-0.01890	**0.86635**
ETSP-410	**0.84464**	0.00130	0.84724	-0.01890	**0.86614**	ETSN-410	0.84094	0.00146	0.84386	-0.01890	0.86276
ETSP-420	0.84403	0.00134	0.84671	-0.01890	0.86561	ETSN-420	0.84083	0.00139	0.84361	-0.01890	0.86251
ETSP-430	0.84013	0.00134	0.84281	-0.01890	0.86171	ETSN-430	0.84005	0.00137	0.84279	-0.01890	0.86169
ETSP-437	0.84329	0.00124	0.84577	-0.01890	0.86467	ETSN-437	0.83844	0.00140	0.84124	-0.01890	0.86014
ETSP-440	0.84048	0.00151	0.84350	-0.01890	0.86240	ETSN-440	0.83905	0.00146	0.84197	-0.01890	0.86087
ETSP-450	0.84368	0.00149	0.84666	-0.01890	0.86556	ETSN-450	0.83776	0.00145	0.84066	-0.01890	0.85956
ETSP-460	0.84014	0.00130	0.84274	-0.01890	0.86164	ETSN-460	0.84026	0.00128	0.84282	-0.01890	0.86172

ETSP-470	0.84296	0.00137	0.84570	-0.01890	0.86460	ETSN-470	0.83745	0.00141	0.84027	-0.01890	0.85917
ETSP-480	0.83681	0.00144	0.83969	-0.01890	0.85859	ETSN-480	0.83640	0.00138	0.83916	-0.01890	0.85806
ETSP-486	0.83572	0.00132	0.83836	-0.01890	0.85726	ETSN-486	0.83710	0.00133	0.83976	-0.01890	0.85866
ETSP-490	0.83708	0.00139	0.83986	-0.01890	0.85876	ETSN-490	0.83539	0.00140	0.83819	-0.01890	0.85709
ETSP-500	0.83748	0.00129	0.84006	-0.01890	0.85896	ETSN-500	0.83617	0.00138	0.83893	-0.01890	0.85783
ETSP-520	0.83236	0.00144	0.83524	-0.01890	0.85414	ETSN-520	0.83092	0.00130	0.83352	-0.01890	0.85242
ETSP-540	0.82724	0.00146	0.83016	-0.01890	0.84906	ETSN-540	0.82497	0.00135	0.82767	-0.01890	0.84657
ETSP-544	0.82729	0.00136	0.83001	-0.01890	0.84891	ETSN-544	0.82766	0.00138	0.83042	-0.01890	0.84932
ETSP-560	0.82285	0.00137	0.82559	-0.01890	0.84449	ETSN-560	0.82677	0.00127	0.82931	-0.01890	0.84821
ETSP-600	0.81565	0.00128	0.81821	-0.01890	0.83711	ETSN-600	0.81199	0.00140	0.81479	-0.01890	0.83369
ETSP-616	0.80975	0.00140	0.81255	-0.01890	0.83145	ETSN-616	0.81226	0.00133	0.81492	-0.01890	0.83382
ETSP-700	0.77799	0.00129	0.78057	-0.01890	0.79947	ETSN-700	0.77734	0.00126	0.77986	-0.01890	0.79876
ETSP-705	0.77547	0.00130	0.77807	-0.01890	0.79697	ETSN-705	0.77755	0.00148	0.78051	-0.01890	0.79941
ETSP-800	0.75761	0.00131	0.76023	-0.01890	0.77913	ETSN-800	0.75918	0.00135	0.76188	-0.01890	0.78078
	10X10 Triangular Lattice			Max	0.86614		10X10 Triangular Lattice			Max	0.86635
ETTP-058	0.52642	0.00111	0.52864	-0.01890	0.54754	ETTN-058	0.52110	0.00110	0.52330	-0.01890	0.54220
ETTP-100	0.64258	0.00121	0.64500	-0.01890	0.66390	ETTN-100	0.63764	0.00123	0.64010	-0.01890	0.65900
ETTP-200	0.78809	0.00128	0.79065	-0.01890	0.80955	ETTN-200	0.78244	0.00142	0.78528	-0.01890	0.80418
ETTP-300	0.83701	0.00140	0.83981	-0.01890	0.85871	ETTN-300	0.83282	0.00149	0.83580	-0.01890	0.85470
ETTP-400	0.84313	0.00121	0.84555	-0.01890	0.86445	ETTN-400	0.84263	0.00140	0.84543	-0.01890	0.86433
ETTP-410	0.84350	0.00134	0.84618	-0.01890	0.86508	ETTN-410	0.84101	0.00134	0.84369	-0.01890	0.86259
ETTP-420	0.84380	0.00129	0.84638	-0.01890	0.86528	ETTN-420	0.84343	0.00146	0.84635	-0.01890	0.86525
ETTP-430	0.84806	0.00148	0.85102	-0.01890	**0.86992**	ETTN-430	0.84117	0.00145	0.84407	-0.01890	0.86297
ETTP-437	0.84361	0.00140	0.84641	-0.01890	0.86531	ETTN-437	**0.84546**	0.00133	0.84812	-0.01890	**0.86702**
ETTP-440	0.84448	0.00136	0.84720	-0.01890	0.86610	ETTN-440	0.84327	0.00136	0.84599	-0.01890	0.86489
ETTP-450	0.84541	0.00130	0.84801	-0.01890	0.86691	ETTN-450	0.84138	0.00140	0.84418	-0.01890	0.86308
ETTP-460	**0.84836**	0.00130	0.85096	-0.01890	0.86986	ETTN-460	0.84102	0.00138	0.84378	-0.01890	0.86268
ETTP-470	0.83877	0.00127	0.84131	-0.01890	0.86021	ETTN-470	0.83886	0.00144	0.84174	-0.01890	0.86064
ETTP-480	0.83995	0.00126	0.84247	-0.01890	0.86137	ETTN-480	0.83793	0.00154	0.84101	-0.01890	0.85991
ETTP-486	0.83885	0.00132	0.84149	-0.01890	0.86039	ETTN-486	0.83650	0.00139	0.83928	-0.01890	0.85818
ETTP-490	0.83821	0.00144	0.84109	-0.01890	0.85999	ETTN-490	0.83383	0.00144	0.83671	-0.01890	0.85561
ETTP-500	0.83831	0.00137	0.84105	-0.01890	0.85995	ETTN-500	0.83468	0.00146	0.83760	-0.01890	0.85650
ETTP-520	0.83383	0.00126	0.83635	-0.01890	0.85525	ETTN-520	0.82686	0.00134	0.82954	-0.01890	0.84844
ETTP-540	0.82480	0.00142	0.82764	-0.01890	0.84654	ETTN-540	0.82432	0.00133	0.82698	-0.01890	0.84588
ETTP-544	0.82734	0.00143	0.83020	-0.01890	0.84910	ETTN-544	0.82320	0.00128	0.82576	-0.01890	0.84466
ETTP-560	0.81713	0.00147	0.82007	-0.01890	0.83897	ETTN-560	0.81805	0.00137	0.82079	-0.01890	0.83969

ETTP-600	0.80825	0.00138	0.81101	-0.01890	0.82991	ETTN-600	0.80959	0.00127	0.81213	-0.01890	0.83103
ETTP-616	0.80755	0.00140	0.81035	-0.01890	0.82925	ETTN-616	0.81032	0.00135	0.81302	-0.01890	0.83192
ETTP-700	0.78947	0.00123	0.79193	-0.01890	0.81083	ETTN-700	0.78569	0.00116	0.78801	-0.01890	0.80691
ETTP-705	0.78910	0.00132	0.79174	-0.01890	0.81064	ETTN-705	0.78889	0.00126	0.79141	-0.01890	0.81031
ETTP-800	0.75263	0.00127	0.75517	-0.01890	0.77407	ETTN-800	0.75192	0.00128	0.75448	-0.01890	0.77338
	9X9 Square Lattice			Max	0.86992		9X9 Square Lattice			Max	0.86702
ENSP-058	0.52795	0.00109	0.53013	-0.01890	0.54903	ENSN-058	0.52039	0.00116	0.52271	-0.01890	0.54161
ENSP-100	0.64543	0.00126	0.64795	-0.01890	0.66685	ENSN-100	0.63720	0.00121	0.63962	-0.01890	0.65852
ENSP-200	0.78800	0.00134	0.79068	-0.01890	0.80958	ENSN-200	0.78125	0.00151	0.78427	-0.01890	0.80317
ENSP-300	0.83166	0.00143	0.83452	-0.01890	0.85342	ENSN-300	0.82725	0.00140	0.83005	-0.01890	0.84895
ENSP-400	0.84059	0.00151	0.84361	-0.01890	0.86251	ENSN-400	0.83697	0.00145	0.83987	-0.01890	0.85877
ENSP-410	**0.84113**	0.00134	0.84381	-0.01890	**0.86271**	ENSN-410	0.83636	0.00141	0.83918	-0.01890	0.85808
ENSP-420	0.84028	0.00144	0.84316	-0.01890	0.86206	ENSN-420	0.83554	0.00142	0.83838	-0.01890	0.85728
ENSP-430	0.83946	0.00142	0.84230	-0.01890	0.86120	ENSN-430	0.83393	0.00123	0.83639	-0.01890	0.85529
ENSP-437	0.83482	0.00141	0.83764	-0.01890	0.85654	ENSN-437	**0.83796**	0.00140	0.84076	-0.01890	**0.85966**
ENSP-440	0.83878	0.00126	0.84130	-0.01890	0.86020	ENSN-440	0.83782	0.00137	0.84056	-0.01890	0.85946
ENSP-450	0.83706	0.00143	0.83992	-0.01890	0.85882	ENSN-450	0.83443	0.00148	0.83739	-0.01890	0.85629
ENSP-460	0.83759	0.00145	0.84049	-0.01890	0.85939	ENSN-460	0.83291	0.00135	0.83561	-0.01890	0.85451
ENSP-470	0.83765	0.00132	0.84029	-0.01890	0.85919	ENSN-470	0.83294	0.00133	0.83560	-0.01890	0.85450
ENSP-480	0.83762	0.00125	0.84012	-0.01890	0.85902	ENSN-480	0.83352	0.00136	0.83624	-0.01890	0.85514
ENSP-486	0.83523	0.00145	0.83813	-0.01890	0.85703	ENSN-486	0.83623	0.00138	0.83899	-0.01890	0.85789
ENSP-490	0.83436	0.00128	0.83692	-0.01890	0.85582	ENSN-490	0.83200	0.00127	0.83454	-0.01890	0.85344
ENSP-500	0.83292	0.00127	0.83546	-0.01890	0.85436	ENSN-500	0.82740	0.00127	0.82994	-0.01890	0.84884
ENSP-520	0.82705	0.00135	0.82975	-0.01890	0.84865	ENSN-520	0.82510	0.00137	0.82784	-0.01890	0.84674
ENSP-540	0.82325	0.00136	0.82597	-0.01890	0.84487	ENSN-540	0.81908	0.00137	0.82182	-0.01890	0.84072
ENSP-544	0.81644	0.00124	0.81892	-0.01890	0.83782	ENSN-544	0.81702	0.00138	0.81978	-0.01890	0.83868
ENSP-560	0.81194	0.00124	0.81442	-0.01890	0.83332	ENSN-560	0.81249	0.00130	0.81509	-0.01890	0.83399
ENSP-600	0.79801	0.00128	0.80057	-0.01890	0.81947	ENSN-600	0.79903	0.00139	0.80181	-0.01890	0.82071
ENSP-616	0.79315	0.00134	0.79583	-0.01890	0.81473	ENSN-616	0.79383	0.00125	0.79633	-0.01890	0.81523
ENSP-700	0.78121	0.00129	0.78379	-0.01890	0.80269	ENSN-700	0.78049	0.00140	0.78329	-0.01890	0.80219
ENSP-705	0.77720	0.00126	0.77972	-0.01890	0.79862	ENSN-705	0.77693	0.00135	0.77963	-0.01890	0.79853
ENSP-800	0.74898	0.00123	0.75144	-0.01890	0.77034	ENSN-800	0.74788	0.00127	0.75042	-0.01890	0.76932
	9X9 Triangular Lattice			Max	0.86271		9X9 Triangular Lattice			Max	0.85966
ENTP-058	0.52877	0.00117	0.53111	-0.01890	0.55001	ENTN-058	0.52091	0.00113	0.52317	-0.01890	0.54207
ENTP-100	0.64507	0.00130	0.64767	-0.01890	0.66657	ENTN-100	0.63681	0.00129	0.63939	-0.01890	0.65829
ENTP-200	0.78689	0.00138	0.78965	-0.01890	0.80855	ENTN-200	0.78189	0.00132	0.78453	-0.01890	0.80343

ENTP-300	0.83201	0.00138	0.83477	-0.01890	0.85367	ENTN-300	0.83026	0.00141	0.83308	-0.01890	0.85198
ENTP-400	0.84097	0.00122	0.84341	-0.01890	0.86231	ENTN-400	0.83540	0.00131	0.83802	-0.01890	0.85692
ENTP-410	0.84107	0.00146	0.84399	-0.01890	0.86289	ENTN-410	**0.83982**	0.00135	0.84252	-0.01890	**0.86142**
ENTP-420	0.83961	0.00145	0.84251	-0.01890	0.86141	ENTN-420	0.83527	0.00129	0.83785	-0.01890	0.85675
ENTP-430	**0.84217**	0.00151	0.84519	-0.01890	**0.86409**	ENTN-430	0.83279	0.00137	0.83553	-0.01890	0.85443
ENTP-437	0.83891	0.00148	0.84187	-0.01890	0.86077	ENTN-437	0.83543	0.00143	0.83829	-0.01890	0.85719
ENTP-440	0.83747	0.00143	0.84033	-0.01890	0.85923	ENTN-440	0.83322	0.00147	0.83616	-0.01890	0.85506
ENTP-450	0.83710	0.00140	0.83990	-0.01890	0.85880	ENTN-450	0.83314	0.00135	0.83584	-0.01890	0.85474
ENTP-460	0.83761	0.00149	0.84059	-0.01890	0.85949	ENTN-460	0.83340	0.00139	0.83618	-0.01890	0.85508
ENTP-470	0.83666	0.00141	0.83948	-0.01890	0.85838	ENTN-470	0.83370	0.00135	0.83640	-0.01890	0.85530
ENTP-480	0.83707	0.00139	0.83985	-0.01890	0.85875	ENTN-480	0.83362	0.00140	0.83642	-0.01890	0.85532
ENTP-486	0.83300	0.00138	0.83576	-0.01890	0.85466	ENTN-486	0.83191	0.00145	0.83481	-0.01890	0.85371
ENTP-490	0.83569	0.00133	0.83835	-0.01890	0.85725	ENTN-490	0.83294	0.00136	0.83566	-0.01890	0.85456
ENTP-500	0.83044	0.00127	0.83298	-0.01890	0.85188	ENTN-500	0.83171	0.00138	0.83447	-0.01890	0.85337
ENTP-520	0.82757	0.00139	0.83035	-0.01890	0.84925	ENTN-520	0.82694	0.00123	0.82940	-0.01890	0.84830
ENTP-540	0.82723	0.00129	0.82981	-0.01890	0.84871	ENTN-540	0.82441	0.00133	0.82707	-0.01890	0.84597
ENTP-544	0.82238	0.00141	0.82520	-0.01890	0.84410	ENTN-544	0.82395	0.00141	0.82677	-0.01890	0.84567
ENTP-560	0.82024	0.00131	0.82286	-0.01890	0.84176	ENTN-560	0.81948	0.00139	0.82226	-0.01890	0.84116
ENTP-600	0.80406	0.00128	0.80662	-0.01890	0.82552	ENTN-600	0.80746	0.00134	0.81014	-0.01890	0.82904
ENTP-616	0.79660	0.00133	0.79926	-0.01890	0.81816	ENTN-616	0.79990	0.00130	0.80250	-0.01890	0.82140
ENTP-700	0.77114	0.00141	0.77396	-0.01890	0.79286	ENTN-700	0.77107	0.00135	0.77377	-0.01890	0.79267
ENTP-705	0.77019	0.00127	0.77273	-0.01890	0.79163	ENTN-705	0.76972	0.00131	0.77234	-0.01890	0.79124
ENTP-800	0.75055	0.00131	0.75317	-0.01890	0.77207	ENTN-800	0.74875	0.00129	0.75133	-0.01890	0.77023
	8X8 Square Lattice			Max	0.86409		8X8 Square Lattice			Max	0.86142
EESP-058	0.52867	0.00122	0.53111	-0.01890	0.55001	EESN-058	0.52286	0.00115	0.52516	-0.01890	0.54406
EESP-100	0.64634	0.00134	0.64902	-0.01890	0.66792	EESN-100	0.63879	0.00135	0.64149	-0.01890	0.66039
EESP-200	0.78718	0.00134	0.78986	-0.01890	0.80876	EESN-200	0.78284	0.00145	0.78574	-0.01890	0.80464
EESP-300	0.83115	0.00141	0.83397	-0.01890	0.85287	EESN-300	0.82532	0.00134	0.82800	-0.01890	0.84690
EESP-400	0.83488	0.00140	0.83768	-0.01890	0.85658	EESN-400	**0.83275**	0.00139	0.83553	-0.01890	**0.85443**
EESP-410	0.83342	0.00146	0.83634	-0.01890	0.85524	EESN-410	0.83247	0.00145	0.83537	-0.01890	0.85427
EESP-420	**0.83597**	0.00135	0.83867	-0.01890	**0.85757**	EESN-420	0.83082	0.00144	0.83370	-0.01890	0.85260
EESP-430	0.83230	0.00136	0.83502	-0.01890	0.85392	EESN-430	0.82975	0.00141	0.83257	-0.01890	0.85147
EESP-437	0.83195	0.00136	0.83467	-0.01890	0.85357	EESN-437	0.82972	0.00145	0.83262	-0.01890	0.85152
EESP-440	0.83026	0.00133	0.83292	-0.01890	0.85182	EESN-440	0.83140	0.00144	0.83428	-0.01890	0.85318
EESP-450	0.83381	0.00125	0.83631	-0.01890	0.85521	EESN-450	0.82779	0.00137	0.83053	-0.01890	0.84943
EESP-460	0.82725	0.00141	0.83007	-0.01890	0.84897	EESN-460	0.82817	0.00139	0.83095	-0.01890	0.84985

EESP-470	0.82495	0.00137	0.82769	-0.01890	0.84659	EESN-470	0.82302	0.00149	0.82600	-0.01890	0.84490
EESP-480	0.82152	0.00144	0.82440	-0.01890	0.84330	EESN-480	0.82123	0.00129	0.82381	-0.01890	0.84271
EESP-486	0.82403	0.00128	0.82659	-0.01890	0.84549	EESN-486	0.82040	0.00136	0.82312	-0.01890	0.84202
EESP-490	0.81964	0.00132	0.82228	-0.01890	0.84118	EESN-490	0.82081	0.00137	0.82355	-0.01890	0.84245
EESP-500	0.81651	0.00148	0.81947	-0.01890	0.83837	EESN-500	0.81777	0.00127	0.82031	-0.01890	0.83921
EESP-520	0.81448	0.00146	0.81740	-0.01890	0.83630	EESN-520	0.81568	0.00149	0.81866	-0.01890	0.83756
EESP-540	0.81374	0.00139	0.81652	-0.01890	0.83542	EESN-540	0.81119	0.00135	0.81389	-0.01890	0.83279
EESP-544	0.81182	0.00144	0.81470	-0.01890	0.83360	EESN-544	0.81424	0.00143	0.81710	-0.01890	0.83600
EESP-560	0.80986	0.00130	0.81246	-0.01890	0.83136	EESN-560	0.81001	0.00134	0.81269	-0.01890	0.83159
EESP-600	0.80198	0.00143	0.80484	-0.01890	0.82374	EESN-600	0.79913	0.00125	0.80163	-0.01890	0.82053
EESP-616	0.79233	0.00129	0.79491	-0.01890	0.81381	EESN-616	0.79338	0.00135	0.79608	-0.01890	0.81498
EESP-700	0.76305	0.00140	0.76585	-0.01890	0.78475	EESN-700	0.76337	0.00128	0.76593	-0.01890	0.78483
EESP-705	0.75989	0.00122	0.76233	-0.01890	0.78123	EESN-705	0.76327	0.00138	0.76603	-0.01890	0.78493
EESP-800	0.72616	0.00131	0.72878	-0.01890	0.74768	EESN-800	0.72949	0.00132	0.73213	-0.01890	0.75103
	8X8 Triangular Lattice			Max	0.85757		8X8 Triangular Lattice			Max	0.85443
EETP-058	0.52787	0.00108	0.53003	-0.01890	0.54893	EETN-058	0.52529	0.00108	0.52745	-0.01890	0.54635
EETP-100	0.64733	0.00138	0.65009	-0.01890	0.66899	EETN-100	0.63944	0.00135	0.64214	-0.01890	0.66104
EETP-200	0.78450	0.00132	0.78714	-0.01890	0.80604	EETN-200	0.78020	0.00146	0.78312	-0.01890	0.80202
EETP-300	0.83129	0.00145	0.83419	-0.01890	0.85309	EETN-300	0.82881	0.00137	0.83155	-0.01890	0.85045
EETP-400	0.83465	0.00136	0.83737	-0.01890	0.85627	EETN-400	0.83382	0.00143	0.83668	-0.01890	0.85558
EETP-410	**0.83736**	0.00129	0.83994	-0.01890	**0.85884**	EETN-410	0.83306	0.00156	0.83618	-0.01890	0.85508
EETP-420	0.83687	0.00125	0.83937	-0.01890	0.85827	EETN-420	**0.83385**	0.00145	0.83675	-0.01890	**0.85565**
EETP-430	0.83590	0.00132	0.83854	-0.01890	0.85744	EETN-430	0.83229	0.00132	0.83493	-0.01890	0.85383
EETP-437	0.83531	0.00146	0.83823	-0.01890	0.85713	EETN-437	0.83367	0.00139	0.83645	-0.01890	0.85535
EETP-440	0.83203	0.00145	0.83493	-0.01890	0.85383	EETN-440	0.83144	0.00131	0.83406	-0.01890	0.85296
EETP-450	0.83478	0.00135	0.83748	-0.01890	0.85638	EETN-450	0.82992	0.00152	0.83296	-0.01890	0.85186
EETP-460	0.83330	0.00150	0.83630	-0.01890	0.85520	EETN-460	0.82918	0.00155	0.83228	-0.01890	0.85118
EETP-470	0.83344	0.00133	0.83610	-0.01890	0.85500	EETN-470	0.83033	0.00128	0.83289	-0.01890	0.85179
EETP-480	0.82582	0.00135	0.82852	-0.01890	0.84742	EETN-480	0.82429	0.00132	0.82693	-0.01890	0.84583
EETP-486	0.82713	0.00142	0.82997	-0.01890	0.84887	EETN-486	0.82494	0.00119	0.82732	-0.01890	0.84622
EETP-490	0.82548	0.00124	0.82796	-0.01890	0.84686	EETN-490	0.82204	0.00133	0.82470	-0.01890	0.84360
EETP-500	0.82183	0.00130	0.82443	-0.01890	0.84333	EETN-500	0.82005	0.00141	0.82287	-0.01890	0.84177
EETP-520	0.81697	0.00137	0.81971	-0.01890	0.83861	EETN-520	0.81552	0.00138	0.81828	-0.01890	0.83718
EETP-540	0.80792	0.00132	0.81056	-0.01890	0.82946	EETN-540	0.80707	0.00130	0.80967	-0.01890	0.82857
EETP-544	0.80531	0.00124	0.80779	-0.01890	0.82669	EETN-544	0.80605	0.00128	0.80861	-0.01890	0.82751
EETP-560	0.80047	0.00134	0.80315	-0.01890	0.82205	EETN-560	0.80121	0.00140	0.80401	-0.01890	0.82291

EETP-600	0.79255	0.00137	0.79529	-0.01890	0.81419	EETN-600	0.79279	0.00145	0.79569	-0.01890	0.81459
EETP-616	0.79213	0.00130	0.79473	-0.01890	0.81363	EETN-616	0.79067	0.00124	0.79315	-0.01890	0.81205
EETP-700	0.76687	0.00134	0.76955	-0.01890	0.78845	EETN-700	0.76947	0.00135	0.77217	-0.01890	0.79107
EETP-705	0.77086	0.00124	0.77334	-0.01890	0.79224	EETN-705	0.76714	0.00128	0.76970	-0.01890	0.78860
EETP-800	0.73683	0.00130	0.73943	-0.01890	0.75833	EETN-800	0.73784	0.00137	0.74058	-0.01890	0.75948
55 KGs Single Case without Overlap				Max	0.85884	53 KGs Single Case without Overlap				Max	0.85565
	17X17 Square Lattice			Max OL	0.87530		17X17 Square Lattice			Max OL	0.87155
OSSP-058	0.53515	0.00108	0.53731	-0.01890	0.55621	OSSN-058	0.52711	0.00107	0.52925	-0.01890	0.54815
OSSP-100	0.65011	0.00132	0.65275	-0.01890	0.67165	OSSN-100	0.64479	0.00131	0.64741	-0.01890	0.66631
OSSP-200	0.78878	0.00132	0.79142	-0.01890	0.81032	OSSN-200	0.77802	0.00144	0.78090	-0.01890	0.79980
OSSP-300	0.83274	0.00145	0.83564	-0.01890	0.85454	OSSN-300	0.82923	0.00127	0.83177	-0.01890	0.85067
OSSP-400	0.84496	0.00150	0.84796	-0.01890	0.86686	OSSN-400	0.84043	0.00157	0.84357	-0.01890	0.86247
OSSP-410	0.84281	0.00139	0.84559	-0.01890	0.86449	OSSN-410	0.84186	0.00142	0.84470	-0.01890	0.86360
OSSP-420	0.84371	0.00146	0.84663	-0.01890	0.86553	OSSN-420	0.84010	0.00136	0.84282	-0.01890	0.86172
OSSP-430	0.84609	0.00138	0.84885	-0.01890	0.86775	OSSN-430	0.84396	0.00135	0.84666	-0.01890	0.86556
OSSP-437	0.84465	0.00141	0.84747	-0.01890	0.86637	OSSN-437	0.84196	0.00141	0.84478	-0.01890	0.86368
OSSP-440	0.84495	0.00143	0.84781	-0.01890	0.86671	OSSN-440	0.84128	0.00145	0.84418	-0.01890	0.86308
OSSP-450	0.84567	0.00143	0.84853	-0.01890	0.86743	OSSN-450	0.84223	0.00144	0.84511	-0.01890	0.86401
OSSP-460	0.84576	0.00140	0.84856	-0.01890	0.86746	OSSN-460	0.84360	0.00155	0.84670	-0.01890	0.86560
OSSP-470	0.84653	0.00140	0.84933	-0.01890	0.86823	OSSN-470	0.84331	0.00137	0.84605	-0.01890	0.86495
OSSP-480	**0.84764**	0.00128	0.85020	-0.01890	**0.86910**	OSSN-480	**0.84512**	0.00143	0.84798	-0.01890	**0.86688**
OSSP-486	0.83826	0.00151	0.84128	-0.01890	0.86018	OSSN-486	0.83889	0.00137	0.84163	-0.01890	0.86053
OSSP-490	0.83677	0.00129	0.83935	-0.01890	0.85825	OSSN-490	0.83930	0.00147	0.84224	-0.01890	0.86114
OSSP-500	0.82953	0.00145	0.83243	-0.01890	0.85133	OSSN-500	0.82964	0.00141	0.83246	-0.01890	0.85136
OSSP-520	0.82988	0.00134	0.83256	-0.01890	0.85146	OSSN-520	0.82926	0.00133	0.83192	-0.01890	0.85082
OSSP-540	0.83196	0.00136	0.83468	-0.01890	0.85358	OSSN-540	0.82872	0.00142	0.83156	-0.01890	0.85046
OSSP-544	0.83125	0.00144	0.83413	-0.01890	0.85303	OSSN-544	0.83272	0.00127	0.83526	-0.01890	0.85416
OSSP-560	0.82024	0.00128	0.82280	-0.01890	0.84170	OSSN-560	0.81960	0.00142	0.82244	-0.01890	0.84134
OSSP-600	0.81096	0.00136	0.81368	-0.01890	0.83258	OSSN-600	0.81345	0.00134	0.81613	-0.01890	0.83503
OSSP-616	0.80437	0.00144	0.80725	-0.01890	0.82615	OSSN-616	0.80435	0.00125	0.80685	-0.01890	0.82575
OSSP-700	0.79053	0.00134	0.79321	-0.01890	0.81211	OSSN-700	0.79297	0.00151	0.79599	-0.01890	0.81489
OSSP-705	0.79133	0.00127	0.79387	-0.01890	0.81277	OSSN-705	0.79059	0.00129	0.79317	-0.01890	0.81207
OSSP-800	0.77210	0.00132	0.77474	-0.01890	0.79364	OSSN-800	0.77256	0.00132	0.77520	-0.01890	0.79410
	17X17 Triangular Lattice			Max	0.86910		17X17 Triangular Lattice			Max	0.86688
OSTP-058	0.53860	0.00128	0.54116	-0.01890	0.56006	OSTN-058	0.52932	0.00123	0.53178	-0.01890	0.55068
OSTP-100	0.64567	0.00143	0.64853	-0.01890	0.66743	OSTN-100	0.64044	0.00132	0.64308	-0.01890	0.66198

OSTP-200	0.78434	0.00133	0.78700	-0.01890	0.80590	OSTN-200	0.78565	0.00134	0.78833	-0.01890	0.80723
OSTP-300	0.83433	0.00151	0.83735	-0.01890	0.85625	OSTN-300	0.83332	0.00149	0.83630	-0.01890	0.85520
OSTP-400	0.84762	0.00137	0.85036	-0.01890	0.86926	OSTN-400	0.84576	0.00139	0.84854	-0.01890	0.86744
OSTP-410	**0.85091**	0.00139	0.85369	-0.01890	**0.87259**	OSTN-410	0.84693	0.00151	0.84995	-0.01890	0.86885
OSTP-420	0.84919	0.00132	0.85183	-0.01890	0.87073	OSTN-420	0.84833	0.00157	0.85147	-0.01890	**0.87037**
OSTP-430	0.84915	0.00139	0.85193	-0.01890	0.87083	OSTN-430	**0.84845**	0.00139	0.85123	-0.01890	0.87013
OSTP-437	0.84993	0.00119	0.85231	-0.01890	0.87121	OSTN-437	0.84211	0.00139	0.84489	-0.01890	0.86379
OSTP-440	0.84432	0.00137	0.84706	-0.01890	0.86596	OSTN-440	0.84253	0.00140	0.84533	-0.01890	0.86423
OSTP-450	0.84720	0.00135	0.84990	-0.01890	0.86880	OSTN-450	0.84322	0.00156	0.84634	-0.01890	0.86524
OSTP-460	0.84623	0.00145	0.84913	-0.01890	0.86803	OSTN-460	0.84425	0.00134	0.84693	-0.01890	0.86583
OSTP-470	0.83697	0.00139	0.83975	-0.01890	0.85865	OSTN-470	0.83381	0.00140	0.83661	-0.01890	0.85551
OSTP-480	0.82826	0.00139	0.83104	-0.01890	0.84994	OSTN-480	0.82804	0.00145	0.83094	-0.01890	0.84984
OSTP-486	0.83146	0.00154	0.83454	-0.01890	0.85344	OSTN-486	0.82880	0.00130	0.83140	-0.01890	0.85030
OSTP-490	0.83007	0.00153	0.83313	-0.01890	0.85203	OSTN-490	0.82990	0.00144	0.83278	-0.01890	0.85168
OSTP-500	0.83165	0.00132	0.83429	-0.01890	0.85319	OSTN-500	0.82960	0.00136	0.83232	-0.01890	0.85122
OSTP-520	0.82761	0.00130	0.83021	-0.01890	0.84911	OSTN-520	0.83331	0.00149	0.83629	-0.01890	0.85519
OSTP-540	0.83301	0.00132	0.83565	-0.01890	0.85455	OSTN-540	0.82895	0.00125	0.83145	-0.01890	0.85035
OSTP-544	0.82886	0.00130	0.83146	-0.01890	0.85036	OSTN-544	0.83203	0.00143	0.83489	-0.01890	0.85379
OSTP-560	0.83002	0.00136	0.83274	-0.01890	0.85164	OSTN-560	0.83049	0.00146	0.83341	-0.01890	0.85231
OSTP-600	0.81210	0.00131	0.81472	-0.01890	0.83362	OSTN-600	0.81570	0.00135	0.81840	-0.01890	0.83730
OSTP-616	0.81153	0.00135	0.81423	-0.01890	0.83313	OSTN-616	0.81178	0.00131	0.81440	-0.01890	0.83330
OSTP-700	0.78252	0.00139	0.78530	-0.01890	0.80420	OSTN-700	0.78255	0.00132	0.78519	-0.01890	0.80409
OSTP-705	0.78334	0.00133	0.78600	-0.01890	0.80490	OSTN-705	0.78318	0.00128	0.78574	-0.01890	0.80464
OSTP-800	0.76745	0.00137	0.77019	-0.01890	0.78909	OSTN-800	0.77037	0.00134	0.77305	-0.01890	0.79195
	10X10 Square Lattice			Max	0.87259		10X10 Square Lattice			Max	0.87037
OTSP-058	0.54154	0.00127	0.54408	-0.01890	0.56298	OTSN-058	0.53788	0.00106	0.54000	-0.01890	0.55890
OTSP-100	0.64851	0.00126	0.65103	-0.01890	0.66993	OTSN-100	0.64278	0.00132	0.64542	-0.01890	0.66432
OTSP-200	0.78707	0.00150	0.79007	-0.01890	0.80897	OTSN-200	0.78225	0.00148	0.78521	-0.01890	0.80411
OTSP-300	0.83337	0.00146	0.83629	-0.01890	0.85519	OTSN-300	0.82890	0.00141	0.83172	-0.01890	0.85062
OTSP-400	0.84047	0.00138	0.84323	-0.01890	0.86213	OTSN-400	0.83598	0.00148	0.83894	-0.01890	0.85784
OTSP-410	0.83605	0.00139	0.83883	-0.01890	0.85773	OTSN-410	0.83195	0.00132	0.83459	-0.01890	0.85349
OTSP-420	0.83604	0.00134	0.83872	-0.01890	0.85762	OTSN-420	0.83583	0.00138	0.83859	-0.01890	0.85749
OTSP-430	0.83968	0.00133	0.84234	-0.01890	0.86124	OTSN-430	0.83399	0.00146	0.83691	-0.01890	0.85581
OTSP-437	**0.84222**	0.00134	0.84490	-0.01890	**0.86380**	OTSN-437	**0.83676**	0.00140	0.83956	-0.01890	**0.85846**
OTSP-440	0.83062	0.00151	0.83364	-0.01890	0.85254	OTSN-440	0.83069	0.00125	0.83319	-0.01890	0.85209
OTSP-450	0.83386	0.00143	0.83672	-0.01890	0.85562	OTSN-450	0.83339	0.00147	0.83633	-0.01890	0.85523

OTSP-460	0.83026	0.00148	0.83322	-0.01890	0.85212	OTSN-460	0.83406	0.00137	0.83680	-0.01890	0.85570
OTSP-470	0.83518	0.00136	0.83790	-0.01890	0.85680	OTSN-470	0.83486	0.00130	0.83746	-0.01890	0.85636
OTSP-480	0.82839	0.00145	0.83129	-0.01890	0.85019	OTSN-480	0.82811	0.00143	0.83097	-0.01890	0.84987
OTSP-486	0.82907	0.00135	0.83177	-0.01890	0.85067	OTSN-486	0.82975	0.00140	0.83255	-0.01890	0.85145
OTSP-490	0.82894	0.00133	0.83160	-0.01890	0.85050	OTSN-490	0.82703	0.00140	0.82983	-0.01890	0.84873
OTSP-500	0.82901	0.00132	0.83165	-0.01890	0.85055	OTSN-500	0.83070	0.00148	0.83366	-0.01890	0.85256
OTSP-520	0.82854	0.00127	0.83108	-0.01890	0.84998	OTSN-520	0.82515	0.00135	0.82785	-0.01890	0.84675
OTSP-540	0.81462	0.00135	0.81732	-0.01890	0.83622	OTSN-540	0.81597	0.00122	0.81841	-0.01890	0.83731
OTSP-544	0.81505	0.00138	0.81781	-0.01890	0.83671	OTSN-544	0.81872	0.00138	0.82148	-0.01890	0.84038
OTSP-560	0.81416	0.00146	0.81708	-0.01890	0.83598	OTSN-560	0.81418	0.00137	0.81692	-0.01890	0.83582
OTSP-600	0.80999	0.00132	0.81263	-0.01890	0.83153	OTSN-600	0.81147	0.00133	0.81413	-0.01890	0.83303
OTSP-616	0.79433	0.00139	0.79711	-0.01890	0.81601	OTSN-616	0.79280	0.00137	0.79554	-0.01890	0.81444
OTSP-700	0.76982	0.00132	0.77246	-0.01890	0.79136	OTSN-700	0.77119	0.00129	0.77377	-0.01890	0.79267
OTSP-705	0.76972	0.00122	0.77216	-0.01890	0.79106	OTSN-705	0.76692	0.00129	0.76950	-0.01890	0.78840
OTSP-800	0.75841	0.00123	0.76087	-0.01890	0.77977	OTSN-800	0.75958	0.00129	0.76216	-0.01890	0.78106
	10X10 Triangular Lattice			Max	0.86380		10X10 Triangular Lattice			Max	0.85846
OTTP-058	0.53656	0.00123	0.53902	-0.01890	0.55792	OTTN-058	0.53183	0.00123	0.53429	-0.01890	0.55319
OTTP-100	0.64808	0.00137	0.65082	-0.01890	0.66972	OTTN-100	0.64333	0.00144	0.64621	-0.01890	0.66511
OTTP-200	0.78678	0.00135	0.78948	-0.01890	0.80838	OTTN-200	0.78362	0.00147	0.78656	-0.01890	0.80546
OTTP-300	0.83392	0.00157	0.83706	-0.01890	0.85596	OTTN-300	0.82879	0.00133	0.83145	-0.01890	0.85035
OTTP-400	0.84635	0.00136	0.84907	-0.01890	0.86797	OTTN-400	0.84044	0.00137	0.84318	-0.01890	0.86208
OTTP-410	**0.84648**	0.00142	0.84932	-0.01890	**0.86822**	OTTN-410	**0.84175**	0.00138	0.84451	-0.01890	**0.86341**
OTTP-420	0.84041	0.00152	0.84345	-0.01890	0.86235	OTTN-420	0.84068	0.00136	0.84340	-0.01890	0.86230
OTTP-430	0.83933	0.00131	0.84195	-0.01890	0.86085	OTTN-430	0.83812	0.00157	0.84126	-0.01890	0.86016
OTTP-437	0.84099	0.00147	0.84393	-0.01890	0.86283	OTTN-437	0.83787	0.00138	0.84063	-0.01890	0.85953
OTTP-440	0.84404	0.00144	0.84692	-0.01890	0.86582	OTTN-440	0.83866	0.00131	0.84128	-0.01890	0.86018
OTTP-450	0.84402	0.00143	0.84688	-0.01890	0.86578	OTTN-450	0.83773	0.00129	0.84031	-0.01890	0.85921
OTTP-460	0.84209	0.00136	0.84481	-0.01890	0.86371	OTTN-460	0.83957	0.00129	0.84215	-0.01890	0.86105
OTTP-470	0.82837	0.00145	0.83127	-0.01890	0.85017	OTTN-470	0.82576	0.00150	0.82876	-0.01890	0.84766
OTTP-480	0.82542	0.00151	0.82844	-0.01890	0.84734	OTTN-480	0.82932	0.00139	0.83210	-0.01890	0.85100
OTTP-486	0.82686	0.00134	0.82954	-0.01890	0.84844	OTTN-486	0.82669	0.00139	0.82947	-0.01890	0.84837
OTTP-490	0.81763	0.00133	0.82029	-0.01890	0.83919	OTTN-490	0.81605	0.00145	0.81895	-0.01890	0.83785
OTTP-500	0.81509	0.00140	0.81789	-0.01890	0.83679	OTTN-500	0.81493	0.00129	0.81751	-0.01890	0.83641
OTTP-520	0.81784	0.00131	0.82046	-0.01890	0.83936	OTTN-520	0.81735	0.00136	0.82007	-0.01890	0.83897
OTTP-540	0.80957	0.00137	0.81231	-0.01890	0.83121	OTTN-540	0.80784	0.00145	0.81074	-0.01890	0.82964
OTTP-544	0.81120	0.00128	0.81376	-0.01890	0.83266	OTTN-544	0.80830	0.00137	0.81104	-0.01890	0.82994

OTTP-560	0.80972	0.00134	0.81240	-0.01890	0.83130	OTTN-560	0.80824	0.00141	0.81106	-0.01890	0.82996
OTTP-600	0.80708	0.00128	0.80964	-0.01890	0.82854	OTTN-600	0.80814	0.00132	0.81078	-0.01890	0.82968
OTTP-616	0.80752	0.00129	0.81010	-0.01890	0.82900	OTTN-616	0.80894	0.00142	0.81178	-0.01890	0.83068
OTTP-700	0.77640	0.00127	0.77894	-0.01890	0.79784	OTTN-700	0.77613	0.00118	0.77849	-0.01890	0.79739
OTTP-705	0.77849	0.00133	0.78115	-0.01890	0.80005	OTTN-705	0.77715	0.00118	0.77951	-0.01890	0.79841
OTTP-800	0.74412	0.00122	0.74656	-0.01890	0.76546	OTTN-800	0.74239	0.00132	0.74503	-0.01890	0.76393
9X9 Square Lattice				Max	0.86822	9X9 Square Lattice				Max	0.86341
ONSP-058	0.54446	0.00108	0.54662	-0.01890	0.56552	ONSN-058	0.53964	0.00127	0.54218	-0.01890	0.56108
ONSP-100	0.65495	0.00141	0.65777	-0.01890	0.67667	ONSN-100	0.64716	0.00118	0.64952	-0.01890	0.66842
ONSP-200	0.78438	0.00134	0.78706	-0.01890	0.80596	ONSN-200	0.78282	0.00137	0.78556	-0.01890	0.80446
ONSP-300	0.82896	0.00142	0.83180	-0.01890	0.85070	ONSN-300	0.82805	0.00144	0.83093	-0.01890	0.84983
ONSP-400	**0.84056**	0.00142	0.84340	-0.01890	**0.86230**	ONSN-400	0.83404	0.00140	0.83684	-0.01890	0.85574
ONSP-410	0.83671	0.00134	0.83939	-0.01890	0.85829	ONSN-410	**0.83529**	0.00149	0.83827	-0.01890	**0.85717**
ONSP-420	0.83587	0.00148	0.83883	-0.01890	0.85773	ONSN-420	0.83518	0.00134	0.83786	-0.01890	0.85676
ONSP-430	0.83161	0.00142	0.83445	-0.01890	0.85335	ONSN-430	0.82877	0.00137	0.83151	-0.01890	0.85041
ONSP-437	0.83239	0.00145	0.83529	-0.01890	0.85419	ONSN-437	0.82991	0.00142	0.83275	-0.01890	0.85165
ONSP-440	0.83258	0.00150	0.83558	-0.01890	0.85448	ONSN-440	0.82864	0.00139	0.83142	-0.01890	0.85032
ONSP-450	0.83575	0.00147	0.83869	-0.01890	0.85759	ONSN-450	0.83110	0.00127	0.83364	-0.01890	0.85254
ONSP-460	0.83326	0.00132	0.83590	-0.01890	0.85480	ONSN-460	0.83058	0.00131	0.83320	-0.01890	0.85210
ONSP-470	0.83469	0.00140	0.83749	-0.01890	0.85639	ONSN-470	0.83036	0.00140	0.83316	-0.01890	0.85206
ONSP-480	0.82939	0.00132	0.83203	-0.01890	0.85093	ONSN-480	0.82894	0.00147	0.83188	-0.01890	0.85078
ONSP-486	0.83287	0.00135	0.83557	-0.01890	0.85447	ONSN-486	0.83093	0.00134	0.83361	-0.01890	0.85251
ONSP-490	0.81823	0.00141	0.82105	-0.01890	0.83995	ONSN-490	0.81702	0.00132	0.81966	-0.01890	0.83856
ONSP-500	0.81756	0.00131	0.82018	-0.01890	0.83908	ONSN-500	0.81915	0.00138	0.82191	-0.01890	0.84081
ONSP-520	0.79440	0.00134	0.79708	-0.01890	0.81598	ONSN-520	0.79414	0.00132	0.79678	-0.01890	0.81568
ONSP-540	0.79535	0.00142	0.79819	-0.01890	0.81709	ONSN-540	0.79598	0.00137	0.79872	-0.01890	0.81762
ONSP-544	0.79540	0.00155	0.79850	-0.01890	0.81740	ONSN-544	0.79399	0.00146	0.79691	-0.01890	0.81581
ONSP-560	0.79513	0.00132	0.79777	-0.01890	0.81667	ONSN-560	0.79666	0.00136	0.79938	-0.01890	0.81828
ONSP-600	0.79101	0.00136	0.79373	-0.01890	0.81263	ONSN-600	0.79412	0.00134	0.79680	-0.01890	0.81570
ONSP-616	0.79665	0.00132	0.79929	-0.01890	0.81819	ONSN-616	0.79394	0.00147	0.79688	-0.01890	0.81578
ONSP-700	0.76429	0.00133	0.76695	-0.01890	0.78585	ONSN-700	0.76529	0.00129	0.76787	-0.01890	0.78677
ONSP-705	0.76545	0.00127	0.76799	-0.01890	0.78689	ONSN-705	0.76516	0.00119	0.76754	-0.01890	0.78644
ONSP-800	0.72250	0.00121	0.72492	-0.01890	0.74382	ONSN-800	0.72234	0.00128	0.72490	-0.01890	0.74380
9X9 Triangular Lattice				Max	0.86230	9X9 Triangular Lattice				Max	0.85717
ONTP-058	0.54377	0.00111	0.54599	-0.01890	0.56489	ONTN-058	0.53694	0.00115	0.53924	-0.01890	0.55814
ONTP-100	0.65148	0.00143	0.65434	-0.01890	0.67324	ONTN-100	0.64687	0.00142	0.64971	-0.01890	0.66861

ONTP-200	0.78631	0.00141	0.78913	-0.01890	0.80803	ONTN-200	0.78202	0.00135	0.78472	-0.01890	0.80362
ONTP-300	0.83351	0.00138	0.83627	-0.01890	0.85517	ONTN-300	0.82806	0.00141	0.83088	-0.01890	0.84978
ONTP-400	0.83025	0.00143	0.83311	-0.01890	0.85201	ONTN-400	0.82584	0.00134	0.82852	-0.01890	0.84742
ONTP-410	0.83204	0.00144	0.83492	-0.01890	0.85382	ONTN-410	0.83120	0.00141	0.83402	-0.01890	0.85292
ONTP-420	0.83283	0.00139	0.83561	-0.01890	0.85451	ONTN-420	0.83061	0.00136	0.83333	-0.01890	0.85223
ONTP-430	0.82749	0.00143	0.83035	-0.01890	0.84925	ONTN-430	0.82506	0.00133	0.82772	-0.01890	0.84662
ONTP-437	0.82614	0.00135	0.82884	-0.01890	0.84774	ONTN-437	0.82748	0.00134	0.83016	-0.01890	0.84906
ONTP-440	0.82835	0.00150	0.83135	-0.01890	0.85025	ONTN-440	0.82799	0.00146	0.83091	-0.01890	0.84981
ONTP-450	0.83133	0.00141	0.83415	-0.01890	0.85305	ONTN-450	0.82909	0.00138	0.83185	-0.01890	0.85075
ONTP-460	0.82875	0.00126	0.83127	-0.01890	0.85017	ONTN-460	**0.83184**	0.00133	0.83450	-0.01890	**0.85340**
ONTP-470	**0.83397**	0.00136	0.83669	-0.01890	**0.85559**	ONTN-470	0.83073	0.00147	0.83367	-0.01890	0.85257
ONTP-480	0.83189	0.00153	0.83495	-0.01890	0.85385	ONTN-480	0.83058	0.00141	0.83340	-0.01890	0.85230
ONTP-486	0.82989	0.00130	0.83249	-0.01890	0.85139	ONTN-486	0.82795	0.00131	0.83057	-0.01890	0.84947
ONTP-490	0.83001	0.00138	0.83277	-0.01890	0.85167	ONTN-490	0.83021	0.00143	0.83307	-0.01890	0.85197
ONTP-500	0.83177	0.00153	0.83483	-0.01890	0.85373	ONTN-500	0.82966	0.00134	0.83234	-0.01890	0.85124
ONTP-520	0.82703	0.00142	0.82987	-0.01890	0.84877	ONTN-520	0.82792	0.00128	0.83048	-0.01890	0.84938
ONTP-540	0.80202	0.00129	0.80460	-0.01890	0.82350	ONTN-540	0.80326	0.00127	0.80580	-0.01890	0.82470
ONTP-544	0.80245	0.00142	0.80529	-0.01890	0.82419	ONTN-544	0.80602	0.00144	0.80890	-0.01890	0.82780
ONTP-560	0.80282	0.00133	0.80548	-0.01890	0.82438	ONTN-560	0.80470	0.00132	0.80734	-0.01890	0.82624
ONTP-600	0.77571	0.00130	0.77831	-0.01890	0.79721	ONTN-600	0.77310	0.00140	0.77590	-0.01890	0.79480
ONTP-616	0.77411	0.00136	0.77683	-0.01890	0.79573	ONTN-616	0.77387	0.00138	0.77663	-0.01890	0.79553
ONTP-700	0.76585	0.00129	0.76843	-0.01890	0.78733	ONTN-700	0.76902	0.00144	0.77190	-0.01890	0.79080
ONTP-705	0.76715	0.00133	0.76981	-0.01890	0.78871	ONTN-705	0.76956	0.00126	0.77208	-0.01890	0.79098
ONTP-800	0.74149	0.00133	0.74415	-0.01890	0.76305	ONTN-800	0.74193	0.00123	0.74439	-0.01890	0.76329
	8X8 Square Lattice			Max	0.85559		8X8 Square Lattice			Max	0.85340
OESP-058	0.54631	0.00113	0.54857	-0.01890	0.56747	OESN-058	0.54335	0.00113	0.54561	-0.01890	0.56451
OESP-100	0.65750	0.00130	0.66010	-0.01890	0.67900	OESN-100	0.65199	0.00141	0.65481	-0.01890	0.67371
OESP-200	0.78835	0.00145	0.79125	-0.01890	0.81015	OESN-200	0.78414	0.00132	0.78678	-0.01890	0.80568
OESP-300	0.82644	0.00143	0.82930	-0.01890	0.84820	OESN-300	0.82164	0.00148	0.82460	-0.01890	0.84350
OESP-400	**0.82941**	0.00140	0.83221	-0.01890	**0.85111**	OESN-400	**0.82773**	0.00153	0.83079	-0.01890	**0.84969**
OESP-410	0.81282	0.00140	0.81562	-0.01890	0.83452	OESN-410	0.81042	0.00146	0.81334	-0.01890	0.83224
OESP-420	0.81236	0.00147	0.81530	-0.01890	0.83420	OESN-420	0.81377	0.00150	0.81677	-0.01890	0.83567
OESP-430	0.81426	0.00134	0.81694	-0.01890	0.83584	OESN-430	0.81388	0.00139	0.81666	-0.01890	0.83556
OESP-437	0.81518	0.00138	0.81794	-0.01890	0.83684	OESN-437	0.81509	0.00144	0.81797	-0.01890	0.83687
OESP-440	0.81183	0.00144	0.81471	-0.01890	0.83361	OESN-440	0.81496	0.00142	0.81780	-0.01890	0.83670
OESP-450	0.81511	0.00142	0.81795	-0.01890	0.83685	OESN-450	0.81605	0.00152	0.81909	-0.01890	0.83799

OESP-460	0.82112	0.00128	0.82368	-0.01890	0.84258	OESN-460	0.81443	0.00143	0.81729	-0.01890	0.83619
OESP-470	0.81909	0.00138	0.82185	-0.01890	0.84075	OESN-470	0.81712	0.00140	0.81992	-0.01890	0.83882
OESP-480	0.81856	0.00127	0.82110	-0.01890	0.84000	OESN-480	0.81783	0.00129	0.82041	-0.01890	0.83931
OESP-486	0.81948	0.00136	0.82220	-0.01890	0.84110	OESN-486	0.81711	0.00144	0.81999	-0.01890	0.83889
OESP-490	0.81578	0.00137	0.81852	-0.01890	0.83742	OESN-490	0.81727	0.00146	0.82019	-0.01890	0.83909
OESP-500	0.81746	0.00135	0.82016	-0.01890	0.83906	OESN-500	0.81515	0.00141	0.81797	-0.01890	0.83687
OESP-520	0.81736	0.00132	0.82000	-0.01890	0.83890	OESN-520	0.81692	0.00132	0.81956	-0.01890	0.83846
OESP-540	0.79534	0.00129	0.79792	-0.01890	0.81682	OESN-540	0.79642	0.00132	0.79906	-0.01890	0.81796
OESP-544	0.79704	0.00140	0.79984	-0.01890	0.81874	OESN-544	0.79528	0.00140	0.79808	-0.01890	0.81698
OESP-560	0.79554	0.00133	0.79820	-0.01890	0.81710	OESN-560	0.79580	0.00129	0.79838	-0.01890	0.81728
OESP-600	0.79103	0.00130	0.79363	-0.01890	0.81253	OESN-600	0.79091	0.00120	0.79331	-0.01890	0.81221
OESP-616	0.77768	0.00127	0.78022	-0.01890	0.79912	OESN-616	0.77779	0.00126	0.78031	-0.01890	0.79921
OESP-700	0.73721	0.00131	0.73983	-0.01890	0.75873	OESN-700	0.73684	0.00122	0.73928	-0.01890	0.75818
OESP-705	0.73963	0.00127	0.74217	-0.01890	0.76107	OESN-705	0.73610	0.00130	0.73870	-0.01890	0.75760
OESP-800	0.72681	0.00122	0.72925	-0.01890	0.74815	OESN-800	0.72573	0.00134	0.72841	-0.01890	0.74731
	8X8 Triangular Lattice			Max	0.85111		8X8 Triangular Lattice			Max	0.84969
OETP-058	0.54106	0.00112	0.54330	-0.01890	0.56220	OETN-058	0.53595	0.00116	0.53827	-0.01890	0.55717
OETP-100	0.65342	0.00132	0.65606	-0.01890	0.67496	OETN-100	0.65067	0.00136	0.65339	-0.01890	0.67229
OETP-200	0.78711	0.00145	0.79001	-0.01890	0.80891	OETN-200	0.78345	0.00143	0.78631	-0.01890	0.80521
OETP-300	0.82746	0.00140	0.83026	-0.01890	0.84916	OETN-300	0.82001	0.00156	0.82313	-0.01890	0.84203
OETP-400	0.83788	0.00143	0.84074	-0.01890	0.85964	OETN-400	0.83129	0.00128	0.83385	-0.01890	0.85275
OETP-410	0.83776	0.00146	0.84068	-0.01890	0.85958	OETN-410	0.83204	0.00133	0.83470	-0.01890	0.85360
OETP-420	**0.83805**	0.00148	0.84101	-0.01890	**0.85991**	OETN-420	**0.83446**	0.00147	0.83740	-0.01890	**0.85630**
OETP-430	0.82374	0.00153	0.82680	-0.01890	0.84570	OETN-430	0.82317	0.00139	0.82595	-0.01890	0.84485
OETP-437	0.82580	0.00139	0.82858	-0.01890	0.84748	OETN-437	0.82214	0.00123	0.82460	-0.01890	0.84350
OETP-440	0.82161	0.00136	0.82433	-0.01890	0.84323	OETN-440	0.82184	0.00136	0.82456	-0.01890	0.84346
OETP-450	0.82303	0.00132	0.82567	-0.01890	0.84457	OETN-450	0.82284	0.00136	0.82556	-0.01890	0.84446
OETP-460	0.82364	0.00150	0.82664	-0.01890	0.84554	OETN-460	0.82198	0.00143	0.82484	-0.01890	0.84374
OETP-470	0.82167	0.00138	0.82443	-0.01890	0.84333	OETN-470	0.82130	0.00138	0.82406	-0.01890	0.84296
OETP-480	0.79395	0.00139	0.79673	-0.01890	0.81563	OETN-480	0.79529	0.00145	0.79819	-0.01890	0.81709
OETP-486	0.79467	0.00146	0.79759	-0.01890	0.81649	OETN-486	0.79638	0.00134	0.79906	-0.01890	0.81796
OETP-490	0.79788	0.00134	0.80056	-0.01890	0.81946	OETN-490	0.79513	0.00139	0.79791	-0.01890	0.81681
OETP-500	0.79739	0.00147	0.80033	-0.01890	0.81923	OETN-500	0.79668	0.00131	0.79930	-0.01890	0.81820
OETP-520	0.79475	0.00139	0.79753	-0.01890	0.81643	OETN-520	0.79555	0.00140	0.79835	-0.01890	0.81725
OETP-540	0.79869	0.00145	0.80159	-0.01890	0.82049	OETN-540	0.79636	0.00138	0.79912	-0.01890	0.81802
OETP-544	0.79722	0.00143	0.80008	-0.01890	0.81898	OETN-544	0.80053	0.00133	0.80319	-0.01890	0.82209

OETP-560	0.79583	0.00134	0.79851	-0.01890	0.81741	OETN-560	0.79630	0.00136	0.79902	-0.01890	0.81792
OETP-600	0.77813	0.00133	0.78079	-0.01890	0.79969	OETN-600	0.77520	0.00130	0.77780	-0.01890	0.79670
OETP-616	0.77734	0.00140	0.78014	-0.01890	0.79904	OETN-616	0.77838	0.00126	0.78090	-0.01890	0.79980
OETP-700	0.76551	0.00127	0.76805	-0.01890	0.78695	OETN-700	0.76568	0.00128	0.76824	-0.01890	0.78714
OETP-705	0.76599	0.00124	0.76847	-0.01890	0.78737	OETN-705	0.76840	0.00126	0.77092	-0.01890	0.78982
OETP-800	0.71518	0.00136	0.71790	-0.01890	0.73680	OETN-800	0.71715	0.00134	0.71983	-0.01890	0.73873
55 KGs Single Case with VFO				Max	0.85991	53 KGs Single Case with VFO				Max	0.85630
	17X17 Square Lattice			Max NO	0.87259		17X17 Square Lattice			Max NO	0.87037
VSSP-058	0.52672	0.00116	0.52904	-0.01890	0.54794	VSSN-058	0.51939	0.00114	0.52167	-0.01890	0.54057
VSSP-100	0.64202	0.00131	0.64464	-0.01890	0.66354	VSSN-100	0.63311	0.00130	0.63571	-0.01890	0.65461
VSSP-200	0.78343	0.00144	0.78631	-0.01890	0.80521	VSSN-200	0.77990	0.00145	0.78280	-0.01890	0.80170
VSSP-300	0.83596	0.00146	0.83888	-0.01890	0.85778	VSSN-300	0.83342	0.00148	0.83638	-0.01890	0.85528
VSSP-400	0.85223	0.00144	0.85511	-0.01890	**0.87401**	VSSN-400	0.84788	0.00151	0.85090	-0.01890	**0.86980**
VSSP-410	**0.85243**	0.00132	0.85507	-0.01890	0.87397	VSSN-410	**0.84811**	0.00135	0.85081	-0.01890	0.86971
VSSP-420	0.84854	0.00131	0.85116	-0.01890	0.87006	VSSN-420	0.84537	0.00142	0.84821	-0.01890	0.86711
VSSP-430	0.84985	0.00136	0.85257	-0.01890	0.87147	VSSN-430	0.84661	0.00143	0.84947	-0.01890	0.86837
VSSP-437	0.84658	0.00134	0.84926	-0.01890	0.86816	VSSN-437	0.84625	0.00138	0.84901	-0.01890	0.86791
VSSP-440	0.84599	0.00140	0.84879	-0.01890	0.86769	VSSN-440	0.84786	0.00135	0.85056	-0.01890	0.86946
VSSP-450	0.84958	0.00134	0.85226	-0.01890	0.87116	VSSN-450	0.84536	0.00135	0.84806	-0.01890	0.86696
VSSP-460	0.84732	0.00135	0.85002	-0.01890	0.86892	VSSN-460	0.84324	0.00142	0.84608	-0.01890	0.86498
VSSP-470	0.84780	0.00138	0.85056	-0.01890	0.86946	VSSN-470	0.84565	0.00153	0.84871	-0.01890	0.86761
VSSP-480	0.84688	0.00131	0.84950	-0.01890	0.86840	VSSN-480	0.84421	0.00134	0.84689	-0.01890	0.86579
VSSP-486	0.84700	0.00142	0.84984	-0.01890	0.86874	VSSN-486	0.84053	0.00140	0.84333	-0.01890	0.86223
VSSP-490	0.84380	0.00135	0.84650	-0.01890	0.86540	VSSN-490	0.84118	0.00137	0.84392	-0.01890	0.86282
VSSP-500	0.84494	0.00132	0.84758	-0.01890	0.86648	VSSN-500	0.84007	0.00132	0.84271	-0.01890	0.86161
VSSP-520	0.83942	0.00136	0.84214	-0.01890	0.86104	VSSN-520	0.83899	0.00131	0.84161	-0.01890	0.86051
VSSP-540	0.83877	0.00120	0.84117	-0.01890	0.86007	VSSN-540	0.83520	0.00135	0.83790	-0.01890	0.85680
VSSP-544	0.83499	0.00128	0.83755	-0.01890	0.85645	VSSN-544	0.83150	0.00137	0.83424	-0.01890	0.85314
VSSP-560	0.82968	0.00133	0.83234	-0.01890	0.85124	VSSN-560	0.82943	0.00130	0.83203	-0.01890	0.85093
VSSP-600	0.82174	0.00135	0.82444	-0.01890	0.84334	VSSN-600	0.82084	0.00125	0.82334	-0.01890	0.84224
VSSP-616	0.81714	0.00134	0.81982	-0.01890	0.83872	VSSN-616	0.81484	0.00143	0.81770	-0.01890	0.83660
VSSP-700	0.79610	0.00118	0.79846	-0.01890	0.81736	VSSN-700	0.79417	0.00126	0.79669	-0.01890	0.81559
VSSP-705	0.79612	0.00143	0.79898	-0.01890	0.81788	VSSN-705	0.79012	0.00138	0.79288	-0.01890	0.81178
VSSP-800	0.76746	0.00132	0.77010	-0.01890	0.78900	VSSN-800	0.76944	0.00133	0.77210	-0.01890	0.79100
	17X17 Triangular Lattice			Max	0.87401		17X17 Triangular Lattice			Max	0.86980
VSTP-058	0.52423	0.00101	0.52625	-0.01890	0.54515	VSTN-058	0.51790	0.00119	0.52028	-0.01890	0.53918

VSTP-100	0.64086	0.00128	0.64342	-0.01890	0.66232	VSTN-100	0.63521	0.00128	0.63777	-0.01890	0.65667
VSTP-200	0.78681	0.00143	0.78967	-0.01890	0.80857	VSTN-200	0.78282	0.00134	0.78550	-0.01890	0.80440
VSTP-300	0.84006	0.00135	0.84276	-0.01890	0.86166	VSTN-300	0.83343	0.00159	0.83661	-0.01890	0.85551
VSTP-400	0.85158	0.00141	0.85440	-0.01890	0.87330	VSTN-400	**0.84909**	0.00146	0.85201	-0.01890	**0.87091**
VSTP-410	0.84982	0.00153	0.85288	-0.01890	0.87178	VSTN-410	0.84806	0.00141	0.85088	-0.01890	0.86978
VSTP-420	**0.85253**	0.00136	0.85525	-0.01890	0.87415	VSTN-420	0.84574	0.00142	0.84858	-0.01890	0.86748
VSTP-430	0.85012	0.00163	0.85338	-0.01890	0.87228	VSTN-430	0.84469	0.00143	0.84755	-0.01890	0.86645
VSTP-437	0.84776	0.00151	0.85078	-0.01890	0.86968	VSTN-437	0.84751	0.00126	0.85003	-0.01890	0.86893
VSTP-440	0.84959	0.00146	0.85251	-0.01890	0.87141	VSTN-440	0.84755	0.00137	0.85029	-0.01890	0.86919
VSTP-450	0.84892	0.00129	0.85150	-0.01890	0.87040	VSTN-450	0.84687	0.00138	0.84963	-0.01890	0.86853
VSTP-460	0.85248	0.00154	0.85556	-0.01890	**0.87446**	VSTN-460	0.84807	0.00140	0.85087	-0.01890	0.86977
VSTP-470	0.84876	0.00133	0.85142	-0.01890	0.87032	VSTN-470	0.84410	0.00127	0.84664	-0.01890	0.86554
VSTP-480	0.84850	0.00142	0.85134	-0.01890	0.87024	VSTN-480	0.84265	0.00133	0.84531	-0.01890	0.86421
VSTP-486	0.84611	0.00139	0.84889	-0.01890	0.86779	VSTN-486	0.84439	0.00144	0.84727	-0.01890	0.86617
VSTP-490	0.84977	0.00138	0.85253	-0.01890	0.87143	VSTN-490	0.84238	0.00136	0.84510	-0.01890	0.86400
VSTP-500	0.84474	0.00129	0.84732	-0.01890	0.86622	VSTN-500	0.84455	0.00147	0.84749	-0.01890	0.86639
VSTP-520	0.83850	0.00149	0.84148	-0.01890	0.86038	VSTN-520	0.83989	0.00140	0.84269	-0.01890	0.86159
VSTP-540	0.83591	0.00136	0.83863	-0.01890	0.85753	VSTN-540	0.83817	0.00138	0.84093	-0.01890	0.85983
VSTP-544	0.83675	0.00136	0.83947	-0.01890	0.85837	VSTN-544	0.83247	0.00144	0.83535	-0.01890	0.85425
VSTP-560	0.83030	0.00132	0.83294	-0.01890	0.85184	VSTN-560	0.83277	0.00136	0.83549	-0.01890	0.85439
VSTP-600	0.82435	0.00138	0.82711	-0.01890	0.84601	VSTN-600	0.82432	0.00135	0.82702	-0.01890	0.84592
VSTP-616	0.81860	0.00142	0.82144	-0.01890	0.84034	VSTN-616	0.81747	0.00136	0.82019	-0.01890	0.83909
VSTP-700	0.79919	0.00134	0.80187	-0.01890	0.82077	VSTN-700	0.79508	0.00133	0.79774	-0.01890	0.81664
VSTP-705	0.79798	0.00143	0.80084	-0.01890	0.81974	VSTN-705	0.79812	0.00137	0.80086	-0.01890	0.81976
VSTP-800	0.77030	0.00135	0.77300	-0.01890	0.79190	VSTN-800	0.77066	0.00125	0.77316	-0.01890	0.79206
	10X10 Square Lattice			Max	0.87446		10X10 Square Lattice			Max	0.87091
VTSP-058	0.52992	0.00110	0.53212	-0.01890	0.55102	VTSN-058	0.51917	0.00111	0.52139	-0.01890	0.54029
VTSP-100	0.64323	0.00133	0.64589	-0.01890	0.66479	VTSN-100	0.63652	0.00120	0.63892	-0.01890	0.65782
VTSP-200	0.78527	0.00148	0.78823	-0.01890	0.80713	VTSN-200	0.78009	0.00134	0.78277	-0.01890	0.80167
VTSP-300	0.83833	0.00140	0.84113	-0.01890	0.86003	VTSN-300	0.83220	0.00131	0.83482	-0.01890	0.85372
VTSP-400	0.84474	0.00131	0.84736	-0.01890	0.86626	VTSN-400	0.84173	0.00144	0.84461	-0.01890	0.86351
VTSP-410	**0.84517**	0.00143	0.84803	-0.01890	**0.86693**	VTSN-410	0.84188	0.00122	0.84432	-0.01890	0.86322
VTSP-420	0.84179	0.00137	0.84453	-0.01890	0.86343	VTSN-420	**0.84343**	0.00135	0.84613	-0.01890	**0.86503**
VTSP-430	0.84313	0.00139	0.84591	-0.01890	0.86481	VTSN-430	0.84160	0.00147	0.84454	-0.01890	0.86344
VTSP-437	0.84299	0.00135	0.84569	-0.01890	0.86459	VTSN-437	0.83705	0.00132	0.83969	-0.01890	0.85859
VTSP-440	0.84374	0.00143	0.84660	-0.01890	0.86550	VTSN-440	0.83829	0.00136	0.84101	-0.01890	0.85991

VTSP-450	0.84292	0.00132	0.84556	-0.01890	0.86446	VTSN-450	0.83729	0.00144	0.84017	-0.01890	0.85907
VTSP-460	0.84265	0.00141	0.84547	-0.01890	0.86437	VTSN-460	0.83685	0.00147	0.83979	-0.01890	0.85869
VTSP-470	0.83875	0.00148	0.84171	-0.01890	0.86061	VTSN-470	0.83819	0.00133	0.84085	-0.01890	0.85975
VTSP-480	0.83776	0.00127	0.84030	-0.01890	0.85920	VTSN-480	0.83767	0.00138	0.84043	-0.01890	0.85933
VTSP-486	0.83728	0.00131	0.83990	-0.01890	0.85880	VTSN-486	0.83723	0.00132	0.83987	-0.01890	0.85877
VTSP-490	0.84166	0.00134	0.84434	-0.01890	0.86324	VTSN-490	0.83355	0.00143	0.83641	-0.01890	0.85531
VTSP-500	0.83675	0.00125	0.83925	-0.01890	0.85815	VTSN-500	0.83666	0.00129	0.83924	-0.01890	0.85814
VTSP-520	0.83017	0.00126	0.83269	-0.01890	0.85159	VTSN-520	0.83088	0.00127	0.83342	-0.01890	0.85232
VTSP-540	0.82824	0.00146	0.83116	-0.01890	0.85006	VTSN-540	0.82630	0.00128	0.82886	-0.01890	0.84776
VTSP-544	0.82283	0.00124	0.82531	-0.01890	0.84421	VTSN-544	0.82464	0.00145	0.82754	-0.01890	0.84644
VTSP-560	0.81973	0.00121	0.82215	-0.01890	0.84105	VTSN-560	0.81965	0.00129	0.82223	-0.01890	0.84113
VTSP-600	0.80936	0.00132	0.81200	-0.01890	0.83090	VTSN-600	0.80861	0.00137	0.81135	-0.01890	0.83025
VTSP-616	0.80567	0.00132	0.80831	-0.01890	0.82721	VTSN-616	0.80402	0.00144	0.80690	-0.01890	0.82580
VTSP-700	0.78280	0.00134	0.78548	-0.01890	0.80438	VTSN-700	0.78260	0.00128	0.78516	-0.01890	0.80406
VTSP-705	0.78054	0.00132	0.78318	-0.01890	0.80208	VTSN-705	0.77932	0.00117	0.78166	-0.01890	0.80056
VTSP-800	0.75709	0.00126	0.75961	-0.01890	0.77851	VTSN-800	0.75668	0.00132	0.75932	-0.01890	0.77822
	10X10 Triangular Lattice			Max	0.86693		10X10 Triangular Lattice			Max	0.86503
VTTP-058	0.52750	0.00118	0.52986	-0.01890	0.54876	VTTN-058	0.51748	0.00115	0.51978	-0.01890	0.53868
VTTP-100	0.64138	0.00135	0.64408	-0.01890	0.66298	VTTN-100	0.63549	0.00117	0.63783	-0.01890	0.65673
VTTP-200	0.78728	0.00146	0.79020	-0.01890	0.80910	VTTN-200	0.78118	0.00141	0.78400	-0.01890	0.80290
VTTP-300	0.83624	0.00136	0.83896	-0.01890	0.85786	VTTN-300	0.83204	0.00146	0.83496	-0.01890	0.85386
VTTP-400	0.84532	0.00133	0.84798	-0.01890	0.86688	VTTN-400	0.84205	0.00152	0.84509	-0.01890	0.86399
VTTP-410	**0.84900**	0.00136	0.85172	-0.01890	**0.87062**	VTTN-410	0.84260	0.00139	0.84538	-0.01890	0.86428
VTTP-420	0.84257	0.00144	0.84545	-0.01890	0.86435	VTTN-420	0.84165	0.00143	0.84451	-0.01890	0.86341
VTTP-430	0.84550	0.00123	0.84796	-0.01890	0.86686	VTTN-430	0.84199	0.00151	0.84501	-0.01890	0.86391
VTTP-437	0.84473	0.00136	0.84745	-0.01890	0.86635	VTTN-437	0.84138	0.00138	0.84414	-0.01890	0.86304
VTTP-440	0.84498	0.00147	0.84792	-0.01890	0.86682	VTTN-440	**0.84402**	0.00145	0.84692	-0.01890	**0.86582**
VTTP-450	0.84019	0.00138	0.84295	-0.01890	0.86185	VTTN-450	0.84182	0.00142	0.84466	-0.01890	0.86356
VTTP-460	0.84244	0.00127	0.84498	-0.01890	0.86388	VTTN-460	0.84291	0.00148	0.84587	-0.01890	0.86477
VTTP-470	0.84168	0.00124	0.84416	-0.01890	0.86306	VTTN-470	0.84015	0.00124	0.84263	-0.01890	0.86153
VTTP-480	0.84193	0.00144	0.84481	-0.01890	0.86371	VTTN-480	0.83751	0.00138	0.84027	-0.01890	0.85917
VTTP-486	0.84165	0.00140	0.84445	-0.01890	0.86335	VTTN-486	0.83712	0.00136	0.83984	-0.01890	0.85874
VTTP-490	0.84450	0.00130	0.84710	-0.01890	0.86600	VTTN-490	0.83780	0.00137	0.84054	-0.01890	0.85944
VTTP-500	0.83550	0.00127	0.83804	-0.01890	0.85694	VTTN-500	0.83346	0.00129	0.83604	-0.01890	0.85494
VTTP-520	0.83325	0.00137	0.83599	-0.01890	0.85489	VTTN-520	0.83313	0.00126	0.83565	-0.01890	0.85455
VTTP-540	0.82776	0.00140	0.83056	-0.01890	0.84946	VTTN-540	0.82918	0.00141	0.83200	-0.01890	0.85090

VTTP-544	0.82606	0.00133	0.82872	-0.01890	0.84762	VTTN-544	0.82721	0.00145	0.83011	-0.01890	0.84901
VTTP-560	0.82414	0.00144	0.82702	-0.01890	0.84592	VTTN-560	0.82223	0.00133	0.82489	-0.01890	0.84379
VTTP-600	0.81429	0.00128	0.81685	-0.01890	0.83575	VTTN-600	0.80975	0.00128	0.81231	-0.01890	0.83121
VTTP-616	0.80703	0.00133	0.80969	-0.01890	0.82859	VTTN-616	0.81102	0.00123	0.81348	-0.01890	0.83238
VTTP-700	0.78779	0.00132	0.79043	-0.01890	0.80933	VTTN-700	0.78531	0.00130	0.78791	-0.01890	0.80681
VTTP-705	0.78330	0.00139	0.78608	-0.01890	0.80498	VTTN-705	0.78607	0.00135	0.78877	-0.01890	0.80767
VTTP-800	0.75638	0.00129	0.75896	-0.01890	0.77786	VTTN-800	0.75847	0.00122	0.76091	-0.01890	0.77981
	9X9 Square Lattice			Max	0.87062		9X9 Square Lattice			Max	0.86582
VNSP-058	0.52821	0.00110	0.53041	-0.01890	0.54931	VNSN-058	0.51939	0.00115	0.52169	-0.01890	0.54059
VNSP-100	0.64457	0.00117	0.64691	-0.01890	0.66581	VNSN-100	0.63748	0.00130	0.64008	-0.01890	0.65898
VNSP-200	0.78882	0.00164	0.79210	-0.01890	0.81100	VNSN-200	0.78220	0.00142	0.78504	-0.01890	0.80394
VNSP-300	0.83421	0.00136	0.83693	-0.01890	0.85583	VNSN-300	0.82865	0.00141	0.83147	-0.01890	0.85037
VNSP-400	**0.84079**	0.00132	0.84343	-0.01890	**0.86233**	VNSN-400	**0.83652**	0.00143	0.83938	-0.01890	**0.85828**
VNSP-410	0.83998	0.00143	0.84284	-0.01890	0.86174	VNSN-410	0.83445	0.00139	0.83723	-0.01890	0.85613
VNSP-420	0.83699	0.00137	0.83973	-0.01890	0.85863	VNSN-420	0.83424	0.00137	0.83698	-0.01890	0.85588
VNSP-430	0.83830	0.00142	0.84114	-0.01890	0.86004	VNSN-430	0.83501	0.00138	0.83777	-0.01890	0.85667
VNSP-437	0.83956	0.00132	0.84220	-0.01890	0.86110	VNSN-437	0.83485	0.00132	0.83749	-0.01890	0.85639
VNSP-440	0.83527	0.00144	0.83815	-0.01890	0.85705	VNSN-440	0.83236	0.00164	0.83564	-0.01890	0.85454
VNSP-450	0.83756	0.00126	0.84008	-0.01890	0.85898	VNSN-450	0.83427	0.00121	0.83669	-0.01890	0.85559
VNSP-460	0.83595	0.00136	0.83867	-0.01890	0.85757	VNSN-460	0.83555	0.00142	0.83839	-0.01890	0.85729
VNSP-470	0.83551	0.00148	0.83847	-0.01890	0.85737	VNSN-470	0.83134	0.00144	0.83422	-0.01890	0.85312
VNSP-480	0.83250	0.00134	0.83518	-0.01890	0.85408	VNSN-480	0.82961	0.00144	0.83249	-0.01890	0.85139
VNSP-486	0.83405	0.00125	0.83655	-0.01890	0.85545	VNSN-486	0.82831	0.00149	0.83129	-0.01890	0.85019
VNSP-490	0.83258	0.00135	0.83528	-0.01890	0.85418	VNSN-490	0.82936	0.00132	0.83200	-0.01890	0.85090
VNSP-500	0.83097	0.00133	0.83363	-0.01890	0.85253	VNSN-500	0.82629	0.00150	0.82929	-0.01890	0.84819
VNSP-520	0.82567	0.00136	0.82839	-0.01890	0.84729	VNSN-520	0.82284	0.00134	0.82552	-0.01890	0.84442
VNSP-540	0.81806	0.00137	0.82080	-0.01890	0.83970	VNSN-540	0.81970	0.00136	0.82242	-0.01890	0.84132
VNSP-544	0.81764	0.00143	0.82050	-0.01890	0.83940	VNSN-544	0.81655	0.00146	0.81947	-0.01890	0.83837
VNSP-560	0.81561	0.00122	0.81805	-0.01890	0.83695	VNSN-560	0.81272	0.00129	0.81530	-0.01890	0.83420
VNSP-600	0.79987	0.00130	0.80247	-0.01890	0.82137	VNSN-600	0.79967	0.00142	0.80251	-0.01890	0.82141
VNSP-616	0.79926	0.00127	0.80180	-0.01890	0.82070	VNSN-616	0.79810	0.00141	0.80092	-0.01890	0.81982
VNSP-700	0.77086	0.00121	0.77328	-0.01890	0.79218	VNSN-700	0.77336	0.00130	0.77596	-0.01890	0.79486
VNSP-705	0.77227	0.00137	0.77501	-0.01890	0.79391	VNSN-705	0.77064	0.00138	0.77340	-0.01890	0.79230
VNSP-800	0.74564	0.00132	0.74828	-0.01890	0.76718	VNSN-800	0.74559	0.00116	0.74791	-0.01890	0.76681
	9X9 Triangular Lattice			Max	0.86233		9X9 Triangular Lattice			Max	0.85828
VNTP-058	0.52709	0.00111	0.52931	-0.01890	0.54821	VNTN-058	0.52185	0.00120	0.52425	-0.01890	0.54315

VNTP-100	0.64436	0.00130	0.64696	-0.01890	0.66586	VNTN-100	0.63506	0.00138	0.63782	-0.01890	0.65672
VNTP-200	0.78680	0.00140	0.78960	-0.01890	0.80850	VNTN-200	0.78041	0.00129	0.78299	-0.01890	0.80189
VNTP-300	0.83482	0.00139	0.83760	-0.01890	0.85650	VNTN-300	0.82682	0.00139	0.82960	-0.01890	0.84850
VNTP-400	**0.84181**	0.00150	0.84481	-0.01890	**0.86371**	VNTN-400	0.83906	0.00139	0.84184	-0.01890	0.86074
VNTP-410	0.83974	0.00143	0.84260	-0.01890	0.86150	VNTN-410	0.83619	0.00141	0.83901	-0.01890	0.85791
VNTP-420	0.84147	0.00135	0.84417	-0.01890	0.86307	VNTN-420	0.83951	0.00133	0.84217	-0.01890	0.86107
VNTP-430	0.83820	0.00134	0.84088	-0.01890	0.85978	VNTN-430	0.83667	0.00140	0.83947	-0.01890	0.85837
VNTP-437	0.83703	0.00125	0.83953	-0.01890	0.85843	VNTN-437	0.83843	0.00139	0.84121	-0.01890	0.86011
VNTP-440	0.84012	0.00132	0.84276	-0.01890	0.86166	VNTN-440	**0.83967**	0.00144	0.84255	-0.01890	**0.86145**
VNTP-450	0.83775	0.00137	0.84049	-0.01890	0.85939	VNTN-450	0.83661	0.00134	0.83929	-0.01890	0.85819
VNTP-460	0.83858	0.00137	0.84132	-0.01890	0.86022	VNTN-460	0.83367	0.00141	0.83649	-0.01890	0.85539
VNTP-470	0.83823	0.00147	0.84117	-0.01890	0.86007	VNTN-470	0.83170	0.00143	0.83456	-0.01890	0.85346
VNTP-480	0.83631	0.00136	0.83903	-0.01890	0.85793	VNTN-480	0.83273	0.00134	0.83541	-0.01890	0.85431
VNTP-486	0.83209	0.00132	0.83473	-0.01890	0.85363	VNTN-486	0.83340	0.00140	0.83620	-0.01890	0.85510
VNTP-490	0.83308	0.00142	0.83592	-0.01890	0.85482	VNTN-490	0.83108	0.00136	0.83380	-0.01890	0.85270
VNTP-500	0.82915	0.00131	0.83177	-0.01890	0.85067	VNTN-500	0.82663	0.00148	0.82959	-0.01890	0.84849
VNTP-520	0.83205	0.00136	0.83477	-0.01890	0.85367	VNTN-520	0.82765	0.00127	0.83019	-0.01890	0.84909
VNTP-540	0.82191	0.00144	0.82479	-0.01890	0.84369	VNTN-540	0.81984	0.00139	0.82262	-0.01890	0.84152
VNTP-544	0.82085	0.00140	0.82365	-0.01890	0.84255	VNTN-544	0.82153	0.00137	0.82427	-0.01890	0.84317
VNTP-560	0.81296	0.00136	0.81568	-0.01890	0.83458	VNTN-560	0.81836	0.00129	0.82094	-0.01890	0.83984
VNTP-600	0.80353	0.00140	0.80633	-0.01890	0.82523	VNTN-600	0.80406	0.00128	0.80662	-0.01890	0.82552
VNTP-616	0.80082	0.00124	0.80330	-0.01890	0.82220	VNTN-616	0.80111	0.00128	0.80367	-0.01890	0.82257
VNTP-700	0.77529	0.00122	0.77773	-0.01890	0.79663	VNTN-700	0.77449	0.00131	0.77711	-0.01890	0.79601
VNTP-705	0.77491	0.00131	0.77753	-0.01890	0.79643	VNTN-705	0.77510	0.00136	0.77782	-0.01890	0.79672
VNTP-800	0.74714	0.00110	0.74934	-0.01890	0.76824	VNTN-800	0.75276	0.00140	0.75556	-0.01890	0.77446
	8X8 Square Lattice			Max	0.86371		8X8 Square Lattice			Max	0.86145
VESP-058	0.52816	0.00110	0.53036	-0.01890	0.54926	VESN-058	0.52199	0.00114	0.52427	-0.01890	0.54317
VESP-100	0.64697	0.00133	0.64963	-0.01890	0.66853	VESN-100	0.63519	0.00125	0.63769	-0.01890	0.65659
VESP-200	0.78655	0.00143	0.78941	-0.01890	0.80831	VESN-200	0.78353	0.00146	0.78645	-0.01890	0.80535
VESP-300	0.83040	0.00138	0.83316	-0.01890	0.85206	VESN-300	0.82996	0.00138	0.83272	-0.01890	0.85162
VESP-400	**0.83521**	0.00131	0.83783	-0.01890	**0.85673**	VESN-400	**0.83352**	0.00135	0.83622	-0.01890	**0.85512**
VESP-410	0.83473	0.00137	0.83747	-0.01890	0.85637	VESN-410	0.83120	0.00148	0.83416	-0.01890	0.85306
VESP-420	0.83390	0.00140	0.83670	-0.01890	0.85560	VESN-420	0.83208	0.00136	0.83480	-0.01890	0.85370
VESP-430	0.83292	0.00149	0.83590	-0.01890	0.85480	VESN-430	0.83144	0.00121	0.83386	-0.01890	0.85276
VESP-437	0.83105	0.00141	0.83387	-0.01890	0.85277	VESN-437	0.82847	0.00142	0.83131	-0.01890	0.85021
VESP-440	0.83115	0.00137	0.83389	-0.01890	0.85279	VESN-440	0.82807	0.00123	0.83053	-0.01890	0.84943

VESP-450	0.82958	0.00125	0.83208	-0.01890	0.85098	VESN-450	0.82945	0.00131	0.83207	-0.01890	0.85097
VESP-460	0.82837	0.00138	0.83113	-0.01890	0.85003	VESN-460	0.82696	0.00136	0.82968	-0.01890	0.84858
VESP-470	0.82820	0.00136	0.83092	-0.01890	0.84982	VESN-470	0.82439	0.00135	0.82709	-0.01890	0.84599
VESP-480	0.82265	0.00141	0.82547	-0.01890	0.84437	VESN-480	0.81938	0.00130	0.82198	-0.01890	0.84088
VESP-486	0.82749	0.00146	0.83041	-0.01890	0.84931	VESN-486	0.82556	0.00137	0.82830	-0.01890	0.84720
VESP-490	0.82684	0.00136	0.82956	-0.01890	0.84846	VESN-490	0.82339	0.00145	0.82629	-0.01890	0.84519
VESP-500	0.82588	0.00143	0.82874	-0.01890	0.84764	VESN-500	0.82023	0.00133	0.82289	-0.01890	0.84179
VESP-520	0.81789	0.00139	0.82067	-0.01890	0.83957	VESN-520	0.81719	0.00134	0.81987	-0.01890	0.83877
VESP-540	0.80739	0.00133	0.81005	-0.01890	0.82895	VESN-540	0.81040	0.00135	0.81310	-0.01890	0.83200
VESP-544	0.81006	0.00136	0.81278	-0.01890	0.83168	VESN-544	0.80919	0.00131	0.81181	-0.01890	0.83071
VESP-560	0.80412	0.00132	0.80676	-0.01890	0.82566	VESN-560	0.80409	0.00144	0.80697	-0.01890	0.82587
VESP-600	0.79321	0.00124	0.79569	-0.01890	0.81459	VESN-600	0.79410	0.00140	0.79690	-0.01890	0.81580
VESP-616	0.78699	0.00141	0.78981	-0.01890	0.80871	VESN-616	0.78832	0.00135	0.79102	-0.01890	0.80992
VESP-700	0.76175	0.00119	0.76413	-0.01890	0.78303	VESN-700	0.76097	0.00128	0.76353	-0.01890	0.78243
VESP-705	0.76086	0.00132	0.76350	-0.01890	0.78240	VESN-705	0.76342	0.00133	0.76608	-0.01890	0.78498
VESP-800	0.73397	0.00139	0.73675	-0.01890	0.75565	VESN-800	0.73512	0.00122	0.73756	-0.01890	0.75646
	8X8 Triangular Lattice			Max	0.85673		8X8 Triangular Lattice			Max	0.85512
VETP-058	0.52948	0.00119	0.53186	-0.01890	0.55076	VETN-058	0.52090	0.00126	0.52342	-0.01890	0.54232
VETP-100	0.64935	0.00138	0.65211	-0.01890	0.67101	VETN-100	0.63770	0.00124	0.64018	-0.01890	0.65908
VETP-200	0.78855	0.00145	0.79145	-0.01890	0.81035	VETN-200	0.77984	0.00153	0.78290	-0.01890	0.80180
VETP-300	0.83304	0.00153	0.83610	-0.01890	0.85500	VETN-300	0.82685	0.00132	0.82949	-0.01890	0.84839
VETP-400	0.83415	0.00129	0.83673	-0.01890	0.85563	VETN-400	**0.83305**	0.00135	0.83575	-0.01890	**0.85465**
VETP-410	0.83637	0.00138	0.83913	-0.01890	0.85803	VETN-410	0.83109	0.00140	0.83389	-0.01890	0.85279
VETP-420	0.83407	0.00126	0.83659	-0.01890	0.85549	VETN-420	0.83203	0.00133	0.83469	-0.01890	0.85359
VETP-430	**0.83642**	0.00147	0.83936	-0.01890	**0.85826**	VETN-430	0.83214	0.00142	0.83498	-0.01890	0.85388
VETP-437	0.83334	0.00141	0.83616	-0.01890	0.85506	VETN-437	0.83017	0.00140	0.83297	-0.01890	0.85187
VETP-440	0.83385	0.00138	0.83661	-0.01890	0.85551	VETN-440	0.82779	0.00124	0.83027	-0.01890	0.84917
VETP-450	0.83277	0.00149	0.83575	-0.01890	0.85465	VETN-450	0.83156	0.00134	0.83424	-0.01890	0.85314
VETP-460	0.82878	0.00138	0.83154	-0.01890	0.85044	VETN-460	0.83045	0.00143	0.83331	-0.01890	0.85221
VETP-470	0.83032	0.00151	0.83334	-0.01890	0.85224	VETN-470	0.82740	0.00141	0.83022	-0.01890	0.84912
VETP-480	0.82786	0.00133	0.83052	-0.01890	0.84942	VETN-480	0.82481	0.00143	0.82767	-0.01890	0.84657
VETP-486	0.82778	0.00148	0.83074	-0.01890	0.84964	VETN-486	0.82440	0.00124	0.82688	-0.01890	0.84578
VETP-490	0.82564	0.00134	0.82832	-0.01890	0.84722	VETN-490	0.82731	0.00139	0.83009	-0.01890	0.84899
VETP-500	0.82580	0.00131	0.82842	-0.01890	0.84732	VETN-500	0.82369	0.00133	0.82635	-0.01890	0.84525
VETP-520	0.81880	0.00141	0.82162	-0.01890	0.84052	VETN-520	0.81608	0.00135	0.81878	-0.01890	0.83768
VETP-540	0.81211	0.00136	0.81483	-0.01890	0.83373	VETN-540	0.81433	0.00142	0.81717	-0.01890	0.83607

VETP-544	0.81138	0.00130	0.81398	-0.01890	0.83288	VETN-544	0.81134	0.00135	0.81404	-0.01890	0.83294
VETP-560	0.80636	0.00143	0.80922	-0.01890	0.82812	VETN-560	0.80617	0.00126	0.80869	-0.01890	0.82759
VETP-600	0.79228	0.00137	0.79502	-0.01890	0.81392	VETN-600	0.79471	0.00127	0.79725	-0.01890	0.81615
VETP-616	0.79018	0.00136	0.79290	-0.01890	0.81180	VETN-616	0.78766	0.00128	0.79022	-0.01890	0.80912
VETP-700	0.76792	0.00130	0.77052	-0.01890	0.78942	VETN-700	0.76635	0.00132	0.76899	-0.01890	0.78789
VETP-705	0.76295	0.00129	0.76553	-0.01890	0.78443	VETN-705	0.76411	0.00131	0.76673	-0.01890	0.78563
VETP-800	0.73507	0.00131	0.73769	-0.01890	0.75659	VETN-800	0.73467	0.00132	0.73731	-0.01890	0.75621
				Max	0.85826		0.83305			Max	0.85465
				Max VFO	0.87446		0.84909			Max VFO	0.87091

Table 6.18 –Listing of GEMER Calculations for Undamaged Arrays 55Kg and 53 Kg Heterogeneous Cases

Name	KEFF	SIGMA	K+2S	Bias	K+2S - B	Name	KEFF	SIGMA	K+2S	Bias	K+2S - B
55 KGs Infinite Case with Overlap						53 KGs Infinite Case with Overlap					
	17X17 Square Lattice						17X17 Square Lattice				
DSSP-058	0.58749	0.00117	0.58983	-0.01890	0.60873	DSSN-058	0.58341	0.00110	0.58561	-0.01890	0.60451
DSSP-100	0.70180	0.00128	0.70436	-0.01890	0.72326	DSSN-100	0.69537	0.00120	0.69777	-0.01890	0.71667
DSSP-200	0.83905	0.00137	0.84179	-0.01890	0.86069	DSSN-200	0.83194	0.00137	0.83468	-0.01890	0.85358
DSSP-300	0.88536	0.00129	0.88794	-0.01890	0.90684	DSSN-300	0.88084	0.00147	0.88378	-0.01890	0.90268
DSSP-400	**0.89437**	0.00127	0.89691	-0.01890	**0.91581**	DSSN-400	**0.89271**	0.00138	0.89547	-0.01890	**0.91437**
DSSP-410	0.89215	0.00145	0.89505	-0.01890	0.91395	DSSN-410	0.88994	0.00140	0.89274	-0.01890	0.91164
DSSP-420	0.89221	0.00129	0.89479	-0.01890	0.91369	DSSN-420	0.88754	0.00145	0.89044	-0.01890	0.90934
DSSP-430	0.89264	0.00144	0.89552	-0.01890	0.91442	DSSN-430	0.88748	0.00152	0.89052	-0.01890	0.90942
DSSP-437	0.89283	0.00133	0.89549	-0.01890	0.91439	DSSN-437	0.88880	0.00139	0.89158	-0.01890	0.91048
DSSP-440	0.89141	0.00141	0.89423	-0.01890	0.91313	DSSN-440	0.88753	0.00146	0.89045	-0.01890	0.90935
DSSP-450	0.89304	0.00133	0.89570	-0.01890	0.91460	DSSN-450	0.88602	0.00139	0.88880	-0.01890	0.90770
DSSP-460	0.88917	0.00135	0.89187	-0.01890	0.91077	DSSN-460	0.88718	0.00143	0.89004	-0.01890	0.90894
DSSP-470	0.89393	0.00136	0.89665	-0.01890	0.91555	DSSN-470	0.88783	0.00136	0.89055	-0.01890	0.90945
DSSP-480	0.89181	0.00131	0.89443	-0.01890	0.91333	DSSN-480	0.88881	0.00133	0.89147	-0.01890	0.91037
DSSP-486	0.89043	0.00150	0.89343	-0.01890	0.91233	DSSN-486	0.88860	0.00138	0.89136	-0.01890	0.91026
DSSP-490	0.89314	0.00132	0.89578	-0.01890	0.91468	DSSN-490	0.88644	0.00139	0.88922	-0.01890	0.90812
DSSP-500	0.89163	0.00128	0.89419	-0.01890	0.91309	DSSN-500	0.88763	0.00129	0.89021	-0.01890	0.90911
DSSP-520	0.88768	0.00124	0.89016	-0.01890	0.90906	DSSN-520	0.88779	0.00135	0.89049	-0.01890	0.90939
DSSP-540	0.88123	0.00142	0.88407	-0.01890	0.90297	DSSN-540	0.87967	0.00132	0.88231	-0.01890	0.90121
DSSP-544	0.87758	0.00133	0.88024	-0.01890	0.89914	DSSN-544	0.87817	0.00119	0.88055	-0.01890	0.89945
DSSP-560	0.87402	0.00133	0.87668	-0.01890	0.89558	DSSN-560	0.87277	0.00130	0.87537	-0.01890	0.89427
DSSP-600	0.86276	0.00134	0.86544	-0.01890	0.88434	DSSN-600	0.86356	0.00142	0.86640	-0.01890	0.88530
DSSP-616	0.85796	0.00132	0.86060	-0.01890	0.87950	DSSN-616	0.85709	0.00136	0.85981	-0.01890	0.87871
DSSP-700	0.83493	0.00141	0.83775	-0.01890	0.85665	DSSN-700	0.83241	0.00127	0.83495	-0.01890	0.85385
DSSP-705	0.83303	0.00120	0.83543	-0.01890	0.85433	DSSN-705	0.83327	0.00126	0.83579	-0.01890	0.85469
DSSP-800	0.81324	0.00125	0.81574	-0.01890	0.83464	DSSN-800	0.81215	0.00131	0.81477	-0.01890	0.83367
	17X17 Triangular Lattice			Max	0.91581		17X17 Triangular Lattice			Max	0.91437
DSTP-058	0.58829	0.00116	0.59061	-0.01890	0.60951	DSTN-058	0.58093	0.00113	0.58319	-0.01890	0.60209
DSTP-100	0.70259	0.00133	0.70525	-0.01890	0.72415	DSTN-100	0.69657	0.00133	0.69923	-0.01890	0.71813
DSTP-200	0.83790	0.00145	0.84080	-0.01890	0.85970	DSTN-200	0.83523	0.00139	0.83801	-0.01890	0.85691
DSTP-300	0.88530	0.00133	0.88796	-0.01890	0.90686	DSTN-300	0.88378	0.00145	0.88668	-0.01890	0.90558

DSTP-400	0.89598	0.00148	0.89894	-0.01890	0.91784	DSTN-400	0.89336	0.00146	0.89628	-0.01890	**0.91518**
DSTP-410	0.89452	0.00134	0.89720	-0.01890	0.91610	DSTN-410	**0.89368**	0.00128	0.89624	-0.01890	0.91514
DSTP-420	0.89513	0.00136	0.89785	-0.01890	0.91675	DSTN-420	0.89304	0.00127	0.89558	-0.01890	0.91448
DSTP-430	0.89444	0.00146	0.89736	-0.01890	0.91626	DSTN-430	0.89094	0.00138	0.89370	-0.01890	0.91260
DSTP-437	**0.89798**	0.00128	0.90054	-0.01890	**0.91944**	DSTN-437	0.89032	0.00130	0.89292	-0.01890	0.91182
DSTP-440	0.89242	0.00126	0.89494	-0.01890	0.91384	DSTN-440	0.89035	0.00140	0.89315	-0.01890	0.91205
DSTP-450	0.89367	0.00136	0.89639	-0.01890	0.91529	DSTN-450	0.89166	0.00133	0.89432	-0.01890	0.91322
DSTP-460	0.89327	0.00139	0.89605	-0.01890	0.91495	DSTN-460	0.88790	0.00136	0.89062	-0.01890	0.90952
DSTP-470	0.89334	0.00142	0.89618	-0.01890	0.91508	DSTN-470	0.88821	0.00137	0.89095	-0.01890	0.90985
DSTP-480	0.89044	0.00137	0.89318	-0.01890	0.91208	DSTN-480	0.88664	0.00124	0.88912	-0.01890	0.90802
DSTP-486	0.89146	0.00136	0.89418	-0.01890	0.91308	DSTN-486	0.88577	0.00124	0.88825	-0.01890	0.90715
DSTP-490	0.89073	0.00136	0.89345	-0.01890	0.91235	DSTN-490	0.88864	0.00135	0.89134	-0.01890	0.91024
DSTP-500	0.88821	0.00143	0.89107	-0.01890	0.90997	DSTN-500	0.88526	0.00129	0.88784	-0.01890	0.90674
DSTP-520	0.87896	0.00139	0.88174	-0.01890	0.90064	DSTN-520	0.88221	0.00135	0.88491	-0.01890	0.90381
DSTP-540	0.87611	0.00138	0.87887	-0.01890	0.89777	DSTN-540	0.87586	0.00134	0.87854	-0.01890	0.89744
DSTP-544	0.87760	0.00121	0.88002	-0.01890	0.89892	DSTN-544	0.87585	0.00129	0.87843	-0.01890	0.89733
DSTP-560	0.87308	0.00140	0.87588	-0.01890	0.89478	DSTN-560	0.87551	0.00126	0.87803	-0.01890	0.89693
DSTP-600	0.86759	0.00131	0.87021	-0.01890	0.88911	DSTN-600	0.86772	0.00123	0.87018	-0.01890	0.88908
DSTP-616	0.86460	0.00137	0.86734	-0.01890	0.88624	DSTN-616	0.86015	0.00126	0.86267	-0.01890	0.88157
DSTP-700	0.83709	0.00135	0.83979	-0.01890	0.85869	DSTN-700	0.83805	0.00124	0.84053	-0.01890	0.85943
DSTP-705	0.83294	0.00131	0.83556	-0.01890	0.85446	DSTN-705	0.83479	0.00124	0.83727	-0.01890	0.85617
DSTP-800	0.80836	0.00126	0.81088	-0.01890	0.82978	DSTN-800	0.80914	0.00137	0.81188	-0.01890	0.83078
	10X10 Square Lattice			Max	0.91944		10X10 Square Lattice			Max	0.91518
DTSP-058	0.59096	0.00109	0.59314	-0.01890	0.61204	DTSN-058	0.58473	0.00119	0.58711	-0.01890	0.60601
DTSP-100	0.70645	0.00139	0.70923	-0.01890	0.72813	DTSN-100	0.69872	0.00132	0.70136	-0.01890	0.72026
DTSP-200	0.84093	0.00145	0.84383	-0.01890	0.86273	DTSN-200	0.83485	0.00133	0.83751	-0.01890	0.85641
DTSP-300	0.88501	0.00137	0.88775	-0.01890	0.90665	DTSN-300	0.87718	0.00152	0.88022	-0.01890	0.89912
DTSP-400	**0.88984**	0.00133	0.89250	-0.01890	**0.91140**	DTSN-400	0.88344	0.00131	0.88606	-0.01890	0.90496
DTSP-410	0.88857	0.00135	0.89127	-0.01890	0.91017	DTSN-410	**0.88681**	0.00144	0.88969	-0.01890	**0.90859**
DTSP-420	0.88826	0.00139	0.89104	-0.01890	0.90994	DTSN-420	0.88346	0.00130	0.88606	-0.01890	0.90496
DTSP-430	0.88821	0.00134	0.89089	-0.01890	0.90979	DTSN-430	0.88454	0.00133	0.88720	-0.01890	0.90610
DTSP-437	0.88783	0.00146	0.89075	-0.01890	0.90965	DTSN-437	0.88277	0.00132	0.88541	-0.01890	0.90431
DTSP-440	0.88553	0.00142	0.88837	-0.01890	0.90727	DTSN-440	0.88469	0.00144	0.88757	-0.01890	0.90647
DTSP-450	0.88505	0.00140	0.88785	-0.01890	0.90675	DTSN-450	0.88277	0.00131	0.88539	-0.01890	0.90429
DTSP-460	0.88495	0.00119	0.88733	-0.01890	0.90623	DTSN-460	0.88268	0.00135	0.88538	-0.01890	0.90428
DTSP-470	0.88226	0.00129	0.88484	-0.01890	0.90374	DTSN-470	0.87869	0.00141	0.88151	-0.01890	0.90041

DTSP-480	0.88488	0.00136	0.88760	-0.01890	0.90650	DTSN-480	0.87747	0.00127	0.88001	-0.01890	0.89891
DTSP-486	0.88493	0.00142	0.88777	-0.01890	0.90667	DTSN-486	0.88065	0.00132	0.88329	-0.01890	0.90219
DTSP-490	0.87986	0.00130	0.88246	-0.01890	0.90136	DTSN-490	0.87905	0.00141	0.88187	-0.01890	0.90077
DTSP-500	0.88150	0.00117	0.88384	-0.01890	0.90274	DTSN-500	0.87621	0.00133	0.87887	-0.01890	0.89777
DTSP-520	0.87778	0.00120	0.88018	-0.01890	0.89908	DTSN-520	0.87439	0.00132	0.87703	-0.01890	0.89593
DTSP-540	0.87169	0.00131	0.87431	-0.01890	0.89321	DTSN-540	0.86859	0.00123	0.87105	-0.01890	0.88995
DTSP-544	0.87216	0.00133	0.87482	-0.01890	0.89372	DTSN-544	0.86967	0.00132	0.87231	-0.01890	0.89121
DTSP-560	0.86606	0.00137	0.86880	-0.01890	0.88770	DTSN-560	0.86651	0.00134	0.86919	-0.01890	0.88809
DTSP-600	0.85801	0.00131	0.86063	-0.01890	0.87953	DTSN-600	0.85408	0.00138	0.85684	-0.01890	0.87574
DTSP-616	0.85299	0.00133	0.85565	-0.01890	0.87455	DTSN-616	0.85305	0.00130	0.85565	-0.01890	0.87455
DTSP-700	0.81949	0.00121	0.82191	-0.01890	0.84081	DTSN-700	0.81892	0.00126	0.82144	-0.01890	0.84034
DTSP-705	0.81575	0.00133	0.81841	-0.01890	0.83731	DTSN-705	0.81213	0.00116	0.81445	-0.01890	0.83335
DTSP-800	0.79555	0.00124	0.79803	-0.01890	0.81693	DTSN-800	0.79392	0.00126	0.79644	-0.01890	0.81534
	10X10 Triangular Lattice			Max	0.91140		10X10 Triangular Lattice			Max	0.90859
DTTP-058	0.59027	0.00122	0.59271	-0.01890	0.61161	DTTN-058	0.58057	0.00118	0.58293	-0.01890	0.60183
DTTP-100	0.70448	0.00138	0.70724	-0.01890	0.72614	DTTN-100	0.69725	0.00137	0.69999	-0.01890	0.71889
DTTP-200	0.83845	0.00148	0.84141	-0.01890	0.86031	DTTN-200	0.83601	0.00142	0.83885	-0.01890	0.85775
DTTP-300	0.88513	0.00144	0.88801	-0.01890	0.90691	DTTN-300	0.88341	0.00144	0.88629	-0.01890	0.90519
DTTP-400	0.88828	0.00144	0.89116	-0.01890	0.91006	DTTN-400	0.88657	0.00131	0.88919	-0.01890	0.90809
DTTP-410	0.89029	0.00125	0.89279	-0.01890	0.91169	DTTN-410	0.88424	0.00135	0.88694	-0.01890	0.90584
DTTP-420	0.89023	0.00139	0.89301	-0.01890	**0.91191**	DTTN-420	0.88728	0.00134	0.88996	-0.01890	0.90886
DTTP-430	0.88951	0.00135	0.89221	-0.01890	0.91111	DTTN-430	**0.88958**	0.00143	0.89244	-0.01890	**0.91134**
DTTP-437	0.88789	0.00126	0.89041	-0.01890	0.90931	DTTN-437	0.88466	0.00139	0.88744	-0.01890	0.90634
DTTP-440	0.89007	0.00127	0.89261	-0.01890	0.91151	DTTN-440	0.88478	0.00125	0.88728	-0.01890	0.90618
DTTP-450	0.88648	0.00134	0.88916	-0.01890	0.90806	DTTN-450	0.88348	0.00139	0.88626	-0.01890	0.90516
DTTP-460	**0.89030**	0.00134	0.89298	-0.01890	0.91188	DTTN-460	0.88392	0.00138	0.88668	-0.01890	0.90558
DTTP-470	0.88858	0.00139	0.89136	-0.01890	0.91026	DTTN-470	0.88279	0.00146	0.88571	-0.01890	0.90461
DTTP-480	0.88243	0.00137	0.88517	-0.01890	0.90407	DTTN-480	0.88144	0.00135	0.88414	-0.01890	0.90304
DTTP-486	0.88350	0.00135	0.88620	-0.01890	0.90510	DTTN-486	0.87791	0.00126	0.88043	-0.01890	0.89933
DTTP-490	0.88261	0.00145	0.88551	-0.01890	0.90441	DTTN-490	0.88070	0.00133	0.88336	-0.01890	0.90226
DTTP-500	0.88197	0.00141	0.88479	-0.01890	0.90369	DTTN-500	0.87702	0.00131	0.87964	-0.01890	0.89854
DTTP-520	0.87493	0.00135	0.87763	-0.01890	0.89653	DTTN-520	0.87256	0.00139	0.87534	-0.01890	0.89424
DTTP-540	0.86782	0.00118	0.87018	-0.01890	0.88908	DTTN-540	0.86714	0.00130	0.86974	-0.01890	0.88864
DTTP-544	0.86545	0.00141	0.86827	-0.01890	0.88717	DTTN-544	0.86750	0.00134	0.87018	-0.01890	0.88908
DTTP-560	0.86119	0.00120	0.86359	-0.01890	0.88249	DTTN-560	0.86068	0.00130	0.86328	-0.01890	0.88218
DTTP-600	0.85354	0.00126	0.85606	-0.01890	0.87496	DTTN-600	0.85084	0.00127	0.85338	-0.01890	0.87228

DTTP-616	0.85010	0.00127	0.85264	-0.01890	0.87154	DTTN-616	0.85097	0.00121	0.85339	-0.01890	0.87229
DTTP-700	0.82968	0.00123	0.83214	-0.01890	0.85104	DTTN-700	0.82624	0.00118	0.82860	-0.01890	0.84750
DTTP-705	0.82508	0.00125	0.82758	-0.01890	0.84648	DTTN-705	0.82757	0.00128	0.83013	-0.01890	0.84903
DTTP-800	0.79061	0.00124	0.79309	-0.01890	0.81199	DTTN-800	0.79086	0.00129	0.79344	-0.01890	0.81234
	9X9 Square Lattice			Max	0.91191		9X9 Square Lattice			Max	0.91134
DNSP-058	0.58986	0.00121	0.59228	-0.01890	0.61118	DNSN-058	0.58467	0.00116	0.58699	-0.01890	0.60589
DNSP-100	0.70483	0.00132	0.70747	-0.01890	0.72637	DNSN-100	0.70055	0.00132	0.70319	-0.01890	0.72209
DNSP-200	0.84181	0.00147	0.84475	-0.01890	0.86365	DNSN-200	0.83598	0.00135	0.83868	-0.01890	0.85758
DNSP-300	0.88346	0.00145	0.88636	-0.01890	0.90526	DNSN-300	0.87789	0.00140	0.88069	-0.01890	0.89959
DNSP-400	0.88225	0.00148	0.88521	-0.01890	0.90411	DNSN-400	0.87870	0.00142	0.88154	-0.01890	0.90044
DNSP-410	**0.88563**	0.00134	0.88831	-0.01890	**0.90721**	DNSN-410	**0.88232**	0.00130	0.88492	-0.01890	**0.90382**
DNSP-420	0.88253	0.00142	0.88537	-0.01890	0.90427	DNSN-420	0.87999	0.00133	0.88265	-0.01890	0.90155
DNSP-430	0.88484	0.00139	0.88762	-0.01890	0.90652	DNSN-430	0.87779	0.00145	0.88069	-0.01890	0.89959
DNSP-437	0.88240	0.00137	0.88514	-0.01890	0.90404	DNSN-437	0.88092	0.00134	0.88360	-0.01890	0.90250
DNSP-440	0.88383	0.00140	0.88663	-0.01890	0.90553	DNSN-440	0.87868	0.00139	0.88146	-0.01890	0.90036
DNSP-450	0.88101	0.00137	0.88375	-0.01890	0.90265	DNSN-450	0.87975	0.00136	0.88247	-0.01890	0.90137
DNSP-460	0.88275	0.00149	0.88573	-0.01890	0.90463	DNSN-460	0.87840	0.00142	0.88124	-0.01890	0.90014
DNSP-470	0.87832	0.00133	0.88098	-0.01890	0.89988	DNSN-470	0.87401	0.00140	0.87681	-0.01890	0.89571
DNSP-480	0.88087	0.00130	0.88347	-0.01890	0.90237	DNSN-480	0.87646	0.00136	0.87918	-0.01890	0.89808
DNSP-486	0.87753	0.00140	0.88033	-0.01890	0.89923	DNSN-486	0.87331	0.00124	0.87579	-0.01890	0.89469
DNSP-490	0.87555	0.00112	0.87779	-0.01890	0.89669	DNSN-490	0.87201	0.00127	0.87455	-0.01890	0.89345
DNSP-500	0.87722	0.00147	0.88016	-0.01890	0.89906	DNSN-500	0.87295	0.00134	0.87563	-0.01890	0.89453
DNSP-520	0.87190	0.00133	0.87456	-0.01890	0.89346	DNSN-520	0.86759	0.00132	0.87023	-0.01890	0.88913
DNSP-540	0.86528	0.00141	0.86810	-0.01890	0.88700	DNSN-540	0.86004	0.00136	0.86276	-0.01890	0.88166
DNSP-544	0.86060	0.00139	0.86338	-0.01890	0.88228	DNSN-544	0.86030	0.00132	0.86294	-0.01890	0.88184
DNSP-560	0.85088	0.00135	0.85358	-0.01890	0.87248	DNSN-560	0.85359	0.00125	0.85609	-0.01890	0.87499
DNSP-600	0.83590	0.00135	0.83860	-0.01890	0.85750	DNSN-600	0.83731	0.00127	0.83985	-0.01890	0.85875
DNSP-616	0.83390	0.00117	0.83624	-0.01890	0.85514	DNSN-616	0.83328	0.00123	0.83574	-0.01890	0.85464
DNSP-700	0.81840	0.00133	0.82106	-0.01890	0.83996	DNSN-700	0.82004	0.00125	0.82254	-0.01890	0.84144
DNSP-705	0.81697	0.00134	0.81965	-0.01890	0.83855	DNSN-705	0.81621	0.00130	0.81881	-0.01890	0.83771
DNSP-800	0.78293	0.00120	0.78533	-0.01890	0.80423	DNSN-800	0.78373	0.00135	0.78643	-0.01890	0.80533
	9X9 Triangular Lattice			Max	0.90721		9X9 Triangular Lattice			Max	0.90382
DNTP-058	0.59131	0.00113	0.59357	-0.01890	0.61247	DNTN-058	0.58400	0.00126	0.58652	-0.01890	0.60542
DNTP-100	0.70372	0.00143	0.70658	-0.01890	0.72548	DNTN-100	0.69936	0.00115	0.70166	-0.01890	0.72056
DNTP-200	0.84008	0.00144	0.84296	-0.01890	0.86186	DNTN-200	0.83490	0.00140	0.83770	-0.01890	0.85660
DNTP-300	0.87884	0.00144	0.88172	-0.01890	0.90062	DNTN-300	0.87475	0.00138	0.87751	-0.01890	0.89641

DNTP-400	**0.88619**	0.00149	0.88917	-0.01890	**0.90807**	DNTN-400	0.88035	0.00146	0.88327	-0.01890	0.90217
DNTP-410	0.88601	0.00133	0.88867	-0.01890	0.90757	DNTN-410	0.87957	0.00134	0.88225	-0.01890	0.90115
DNTP-420	0.88370	0.00129	0.88628	-0.01890	0.90518	DNTN-420	**0.88310**	0.00129	0.88568	-0.01890	**0.90458**
DNTP-430	0.88187	0.00133	0.88453	-0.01890	0.90343	DNTN-430	0.87550	0.00145	0.87840	-0.01890	0.89730
DNTP-437	0.88168	0.00127	0.88422	-0.01890	0.90312	DNTN-437	0.87743	0.00140	0.88023	-0.01890	0.89913
DNTP-440	0.87968	0.00146	0.88260	-0.01890	0.90150	DNTN-440	0.87683	0.00145	0.87973	-0.01890	0.89863
DNTP-450	0.88051	0.00132	0.88315	-0.01890	0.90205	DNTN-450	0.87530	0.00144	0.87818	-0.01890	0.89708
DNTP-460	0.87962	0.00133	0.88228	-0.01890	0.90118	DNTN-460	0.87474	0.00126	0.87726	-0.01890	0.89616
DNTP-470	0.87825	0.00136	0.88097	-0.01890	0.89987	DNTN-470	0.87549	0.00144	0.87837	-0.01890	0.89727
DNTP-480	0.87778	0.00150	0.88078	-0.01890	0.89968	DNTN-480	0.87364	0.00143	0.87650	-0.01890	0.89540
DNTP-486	0.88151	0.00129	0.88409	-0.01890	0.90299	DNTN-486	0.87490	0.00122	0.87734	-0.01890	0.89624
DNTP-490	0.87717	0.00132	0.87981	-0.01890	0.89871	DNTN-490	0.87417	0.00132	0.87681	-0.01890	0.89571
DNTP-500	0.87686	0.00135	0.87956	-0.01890	0.89846	DNTN-500	0.87310	0.00139	0.87588	-0.01890	0.89478
DNTP-520	0.87028	0.00150	0.87328	-0.01890	0.89218	DNTN-520	0.87207	0.00136	0.87479	-0.01890	0.89369
DNTP-540	0.86980	0.00146	0.87272	-0.01890	0.89162	DNTN-540	0.86884	0.00118	0.87120	-0.01890	0.89010
DNTP-544	0.86887	0.00130	0.87147	-0.01890	0.89037	DNTN-544	0.86765	0.00122	0.87009	-0.01890	0.88899
DNTP-560	0.86284	0.00122	0.86528	-0.01890	0.88418	DNTN-560	0.86587	0.00137	0.86861	-0.01890	0.88751
DNTP-600	0.84742	0.00128	0.84998	-0.01890	0.86888	DNTN-600	0.84680	0.00123	0.84926	-0.01890	0.86816
DNTP-616	0.84060	0.00120	0.84300	-0.01890	0.86190	DNTN-616	0.84160	0.00124	0.84408	-0.01890	0.86298
DNTP-700	0.80927	0.00130	0.81187	-0.01890	0.83077	DNTN-700	0.80817	0.00126	0.81069	-0.01890	0.82959
DNTP-705	0.80594	0.00125	0.80844	-0.01890	0.82734	DNTN-705	0.80772	0.00122	0.81016	-0.01890	0.82906
DNTP-800	0.78723	0.00123	0.78969	-0.01890	0.80859	DNTN-800	0.78699	0.00136	0.78971	-0.01890	0.80861
	8X8 Square Lattice			Max	0.90807		8X8 Square Lattice			Max	0.90458
DESP-058	0.59325	0.00126	0.59577	-0.01890	0.61467	DESN-058	0.58427	0.00116	0.58659	-0.01890	0.60549
DESP-100	0.70741	0.00128	0.70997	-0.01890	0.72887	DESN-100	0.70106	0.00129	0.70364	-0.01890	0.72254
DESP-200	0.83800	0.00138	0.84076	-0.01890	0.85966	DESN-200	0.83705	0.00130	0.83965	-0.01890	0.85855
DESP-300	0.87587	0.00142	0.87871	-0.01890	0.89761	DESN-300	0.87410	0.00147	0.87704	-0.01890	0.89594
DESP-400	**0.88283**	0.00128	0.88539	-0.01890	**0.90429**	DESN-400	0.87787	0.00138	0.88063	-0.01890	0.89953
DESP-410	0.87828	0.00144	0.88116	-0.01890	0.90006	DESN-410	**0.87831**	0.00137	0.88105	-0.01890	**0.89995**
DESP-420	0.87693	0.00132	0.87957	-0.01890	0.89847	DESN-420	0.87494	0.00153	0.87800	-0.01890	0.89690
DESP-430	0.87601	0.00126	0.87853	-0.01890	0.89743	DESN-430	0.87266	0.00126	0.87518	-0.01890	0.89408
DESP-437	0.87189	0.00142	0.87473	-0.01890	0.89363	DESN-437	0.87057	0.00134	0.87325	-0.01890	0.89215
DESP-440	0.87232	0.00133	0.87498	-0.01890	0.89388	DESN-440	0.86988	0.00136	0.87260	-0.01890	0.89150
DESP-450	0.87365	0.00142	0.87649	-0.01890	0.89539	DESN-450	0.86967	0.00134	0.87235	-0.01890	0.89125
DESP-460	0.86991	0.00133	0.87257	-0.01890	0.89147	DESN-460	0.86583	0.00137	0.86857	-0.01890	0.88747
DESP-470	0.86757	0.00143	0.87043	-0.01890	0.88933	DESN-470	0.86570	0.00123	0.86816	-0.01890	0.88706

DESP-480	0.86500	0.00138	0.86776	-0.01890	0.88666	DESN-480	0.86490	0.00130	0.86750	-0.01890	0.88640
DESP-486	0.86316	0.00119	0.86554	-0.01890	0.88444	DESN-486	0.86177	0.00135	0.86447	-0.01890	0.88337
DESP-490	0.86027	0.00136	0.86299	-0.01890	0.88189	DESN-490	0.86324	0.00124	0.86572	-0.01890	0.88462
DESP-500	0.85793	0.00138	0.86069	-0.01890	0.87959	DESN-500	0.85989	0.00126	0.86241	-0.01890	0.88131
DESP-520	0.85976	0.00129	0.86234	-0.01890	0.88124	DESN-520	0.85967	0.00137	0.86241	-0.01890	0.88131
DESP-540	0.85832	0.00127	0.86086	-0.01890	0.87976	DESN-540	0.85507	0.00135	0.85777	-0.01890	0.87667
DESP-544	0.85742	0.00130	0.86002	-0.01890	0.87892	DESN-544	0.85636	0.00129	0.85894	-0.01890	0.87784
DESP-560	0.85066	0.00131	0.85328	-0.01890	0.87218	DESN-560	0.85258	0.00134	0.85526	-0.01890	0.87416
DESP-600	0.84197	0.00132	0.84461	-0.01890	0.86351	DESN-600	0.84018	0.00129	0.84276	-0.01890	0.86166
DESP-616	0.83314	0.00124	0.83562	-0.01890	0.85452	DESN-616	0.83478	0.00126	0.83730	-0.01890	0.85620
DESP-700	0.79910	0.00128	0.80166	-0.01890	0.82056	DESN-700	0.80089	0.00126	0.80341	-0.01890	0.82231
DESP-705	0.79985	0.00121	0.80227	-0.01890	0.82117	DESN-705	0.79614	0.00132	0.79878	-0.01890	0.81768
DESP-800	0.76559	0.00132	0.76823	-0.01890	0.78713	DESN-800	0.76506	0.00119	0.76744	-0.01890	0.78634
	8X8 Triangular Lattice			Max	0.90429		8X8 Triangular Lattice			Max	0.89995
DETP-058	0.59303	0.00118	0.59539	-0.01890	0.61429	DETN-058	0.58353	0.00116	0.58585	-0.01890	0.60475
DETP-100	0.70846	0.00122	0.71090	-0.01890	0.72980	DETN-100	0.70079	0.00133	0.70345	-0.01890	0.72235
DETP-200	0.83927	0.00134	0.84195	-0.01890	0.86085	DETN-200	0.83517	0.00140	0.83797	-0.01890	0.85687
DETP-300	0.87795	0.00144	0.88083	-0.01890	0.89973	DETN-300	0.87449	0.00145	0.87739	-0.01890	0.89629
DETP-400	**0.88162**	0.00140	0.88442	-0.01890	**0.90332**	DETN-400	0.87731	0.00144	0.88019	-0.01890	0.89909
DETP-410	0.87813	0.00143	0.88099	-0.01890	0.89989	DETN-410	**0.87818**	0.00137	0.88092	-0.01890	0.89982
DETP-420	0.87958	0.00137	0.88232	-0.01890	0.90122	DETN-420	0.87802	0.00147	0.88096	-0.01890	**0.89986**
DETP-430	0.87763	0.00131	0.88025	-0.01890	0.89915	DETN-430	0.87570	0.00142	0.87854	-0.01890	0.89744
DETP-437	0.87700	0.00134	0.87968	-0.01890	0.89858	DETN-437	0.87415	0.00131	0.87677	-0.01890	0.89567
DETP-440	0.87894	0.00125	0.88144	-0.01890	0.90034	DETN-440	0.87311	0.00120	0.87551	-0.01890	0.89441
DETP-450	0.87784	0.00129	0.88042	-0.01890	0.89932	DETN-450	0.87430	0.00138	0.87706	-0.01890	0.89596
DETP-460	0.87691	0.00133	0.87957	-0.01890	0.89847	DETN-460	0.87294	0.00132	0.87558	-0.01890	0.89448
DETP-470	0.87739	0.00134	0.88007	-0.01890	0.89897	DETN-470	0.87002	0.00135	0.87272	-0.01890	0.89162
DETP-480	0.87109	0.00124	0.87357	-0.01890	0.89247	DETN-480	0.86977	0.00150	0.87277	-0.01890	0.89167
DETP-486	0.86984	0.00141	0.87266	-0.01890	0.89156	DETN-486	0.86384	0.00128	0.86640	-0.01890	0.88530
DETP-490	0.87297	0.00137	0.87571	-0.01890	0.89461	DETN-490	0.86592	0.00136	0.86864	-0.01890	0.88754
DETP-500	0.86839	0.00146	0.87131	-0.01890	0.89021	DETN-500	0.86209	0.00130	0.86469	-0.01890	0.88359
DETP-520	0.85624	0.00134	0.85892	-0.01890	0.87782	DETN-520	0.85458	0.00136	0.85730	-0.01890	0.87620
DETP-540	0.85046	0.00134	0.85314	-0.01890	0.87204	DETN-540	0.84868	0.00125	0.85118	-0.01890	0.87008
DETP-544	0.84884	0.00131	0.85146	-0.01890	0.87036	DETN-544	0.84804	0.00132	0.85068	-0.01890	0.86958
DETP-560	0.84557	0.00125	0.84807	-0.01890	0.86697	DETN-560	0.84250	0.00127	0.84504	-0.01890	0.86394
DETP-600	0.83198	0.00128	0.83454	-0.01890	0.85344	DETN-600	0.83368	0.00142	0.83652	-0.01890	0.85542

DETP-616	0.82784	0.00134	0.83052	-0.01890	0.84942	DETN-616	0.83190	0.00126	0.83442	-0.01890	0.85332
DETP-700	0.80825	0.00125	0.81075	-0.01890	0.82965	DETN-700	0.80730	0.00129	0.80988	-0.01890	0.82878
DETP-705	0.80811	0.00119	0.81049	-0.01890	0.82939	DETN-705	0.80718	0.00133	0.80984	-0.01890	0.82874
DETP-800	0.77441	0.00144	0.77729	-0.01890	0.79619	DETN-800	0.77462	0.00118	0.77698	-0.01890	0.79588
55 KGs Infinite Case with No Overlap				Max	0.90332	53 KGs Infinite Case with No Overlap				Max	0.89986
17X17 Square Lattice				Max OL	0.91944	17X17 Square Lattice				Max OL	0.91518
CSSP-058	0.59701	0.00118	0.59937	-0.01890	0.61827	CSSN-058	0.59201	0.00108	0.59417	-0.01890	0.61307
CSSP-100	0.70805	0.00148	0.71101	-0.01890	0.72991	CSSN-100	0.70072	0.00140	0.70352	-0.01890	0.72242
CSSP-200	0.83579	0.00141	0.83861	-0.01890	0.85751	CSSN-200	0.83282	0.00148	0.83578	-0.01890	0.85468
CSSP-300	0.87895	0.00139	0.88173	-0.01890	0.90063	CSSN-300	0.87585	0.00142	0.87869	-0.01890	0.89759
CSSP-400	0.88675	0.00163	0.89001	-0.01890	0.90891	CSSN-400	0.88249	0.00137	0.88523	-0.01890	0.90413
CSSP-410	0.88837	0.00150	0.89137	-0.01890	0.91027	CSSN-410	0.88514	0.00138	0.88790	-0.01890	0.90680
CSSP-420	0.89196	0.00149	0.89494	-0.01890	0.91384	CSSN-420	0.88429	0.00143	0.88715	-0.01890	0.90605
CSSP-430	**0.89233**	0.00141	0.89515	-0.01890	**0.91405**	CSSN-430	0.88691	0.00148	0.88987	-0.01890	0.90877
CSSP-437	0.88711	0.00142	0.88995	-0.01890	0.90885	CSSN-437	0.88477	0.00137	0.88751	-0.01890	0.90641
CSSP-440	0.88868	0.00137	0.89142	-0.01890	0.91032	CSSN-440	0.88374	0.00147	0.88668	-0.01890	0.90558
CSSP-450	0.88980	0.00124	0.89228	-0.01890	0.91118	CSSN-450	0.88548	0.00137	0.88822	-0.01890	0.90712
CSSP-460	0.88935	0.00133	0.89201	-0.01890	0.91091	CSSN-460	0.88677	0.00143	0.88963	-0.01890	0.90853
CSSP-470	0.89051	0.00134	0.89319	-0.01890	0.91209	CSSN-470	0.88851	0.00139	0.89129	-0.01890	**0.91019**
CSSP-480	0.89200	0.00139	0.89478	-0.01890	0.91368	CSSN-480	**0.88853**	0.00136	0.89125	-0.01890	0.91015
CSSP-486	0.88068	0.00126	0.88320	-0.01890	0.90210	CSSN-486	0.88156	0.00130	0.88416	-0.01890	0.90306
CSSP-490	0.88199	0.00137	0.88473	-0.01890	0.90363	CSSN-490	0.88214	0.00138	0.88490	-0.01890	0.90380
CSSP-500	0.86862	0.00134	0.87130	-0.01890	0.89020	CSSN-500	0.87008	0.00117	0.87242	-0.01890	0.89132
CSSP-520	0.87277	0.00120	0.87517	-0.01890	0.89407	CSSN-520	0.87101	0.00126	0.87353	-0.01890	0.89243
CSSP-540	0.87165	0.00148	0.87461	-0.01890	0.89351	CSSN-540	0.87315	0.00127	0.87569	-0.01890	0.89459
CSSP-544	0.87062	0.00128	0.87318	-0.01890	0.89208	CSSN-544	0.87173	0.00136	0.87445	-0.01890	0.89335
CSSP-560	0.85908	0.00135	0.86178	-0.01890	0.88068	CSSN-560	0.85919	0.00125	0.86169	-0.01890	0.88059
CSSP-600	0.85485	0.00137	0.85759	-0.01890	0.87649	CSSN-600	0.85367	0.00130	0.85627	-0.01890	0.87517
CSSP-616	0.84177	0.00117	0.84411	-0.01890	0.86301	CSSN-616	0.83933	0.00118	0.84169	-0.01890	0.86059
CSSP-700	0.83112	0.00129	0.83370	-0.01890	0.85260	CSSN-700	0.83206	0.00125	0.83456	-0.01890	0.85346
CSSP-705	0.83146	0.00136	0.83418	-0.01890	0.85308	CSSN-705	0.83062	0.00132	0.83326	-0.01890	0.85216
CSSP-800	0.80781	0.00131	0.81043	-0.01890	0.82933	CSSN-800	0.80853	0.00125	0.81103	-0.01890	0.82993
17X17 Triangular Lattice				Max	0.91405	17X17 Triangular Lattice				Max	0.91019
CSTP-058	0.59722	0.00122	0.59966	-0.01890	0.61856	CSTN-058	0.58812	0.00113	0.59038	-0.01890	0.60928
CSTP-100	0.70831	0.00128	0.71087	-0.01890	0.72977	CSTN-100	0.70439	0.00118	0.70675	-0.01890	0.72565
CSTP-200	0.83925	0.00143	0.84211	-0.01890	0.86101	CSTN-200	0.83373	0.00142	0.83657	-0.01890	0.85547

CSTP-300	0.88137	0.00135	0.88407	-0.01890	0.90297	CSTN-300	0.87924	0.00144	0.88212	-0.01890	0.90102
CSTP-400	0.89226	0.00130	0.89486	-0.01890	0.91376	CSTN-400	0.88811	0.00150	0.89111	-0.01890	0.91001
CSTP-410	**0.89410**	0.00135	0.89680	-0.01890	0.91570	CSTN-410	0.88976	0.00138	0.89252	-0.01890	0.91142
CSTP-420	0.89234	0.00131	0.89496	-0.01890	0.91386	CSTN-420	0.89066	0.00149	0.89364	-0.01890	0.91254
CSTP-430	0.89407	0.00164	0.89735	-0.01890	**0.91625**	CSTN-430	**0.89308**	0.00129	0.89566	-0.01890	**0.91456**
CSTP-437	0.88717	0.00140	0.88997	-0.01890	0.90887	CSTN-437	0.88808	0.00139	0.89086	-0.01890	0.90976
CSTP-440	0.88899	0.00139	0.89177	-0.01890	0.91067	CSTN-440	0.88521	0.00144	0.88809	-0.01890	0.90699
CSTP-450	0.89191	0.00132	0.89455	-0.01890	0.91345	CSTN-450	0.88313	0.00130	0.88573	-0.01890	0.90463
CSTP-460	0.88784	0.00138	0.89060	-0.01890	0.90950	CSTN-460	0.88837	0.00122	0.89081	-0.01890	0.90971
CSTP-470	0.87698	0.00131	0.87960	-0.01890	0.89850	CSTN-470	0.87684	0.00146	0.87976	-0.01890	0.89866
CSTP-480	0.86779	0.00128	0.87035	-0.01890	0.88925	CSTN-480	0.86904	0.00135	0.87174	-0.01890	0.89064
CSTP-486	0.86992	0.00152	0.87296	-0.01890	0.89186	CSTN-486	0.87122	0.00143	0.87408	-0.01890	0.89298
CSTP-490	0.87201	0.00144	0.87489	-0.01890	0.89379	CSTN-490	0.87206	0.00138	0.87482	-0.01890	0.89372
CSTP-500	0.87075	0.00140	0.87355	-0.01890	0.89245	CSTN-500	0.87400	0.00146	0.87692	-0.01890	0.89582
CSTP-520	0.87320	0.00145	0.87610	-0.01890	0.89500	CSTN-520	0.87340	0.00145	0.87630	-0.01890	0.89520
CSTP-540	0.87377	0.00124	0.87625	-0.01890	0.89515	CSTN-540	0.87439	0.00142	0.87723	-0.01890	0.89613
CSTP-544	0.87441	0.00136	0.87713	-0.01890	0.89603	CSTN-544	0.87504	0.00131	0.87766	-0.01890	0.89656
CSTP-560	0.87437	0.00130	0.87697	-0.01890	0.89587	CSTN-560	0.87503	0.00134	0.87771	-0.01890	0.89661
CSTP-600	0.85379	0.00128	0.85635	-0.01890	0.87525	CSTN-600	0.85301	0.00126	0.85553	-0.01890	0.87443
CSTP-616	0.85498	0.00131	0.85760	-0.01890	0.87650	CSTN-616	0.85563	0.00131	0.85825	-0.01890	0.87715
CSTP-700	0.82217	0.00126	0.82469	-0.01890	0.84359	CSTN-700	0.81958	0.00139	0.82236	-0.01890	0.84126
CSTP-705	0.82128	0.00131	0.82390	-0.01890	0.84280	CSTN-705	0.82048	0.00126	0.82300	-0.01890	0.84190
CSTP-800	0.80617	0.00124	0.80865	-0.01890	0.82755	CSTN-800	0.80406	0.00127	0.80660	-0.01890	0.82550
	10X10 Square Lattice			Max	0.91625		10X10 Square Lattice			Max	0.91456
CTSP-058	0.60198	0.00120	0.60438	-0.01890	0.62328	CTSN-058	0.59522	0.00123	0.59768	-0.01890	0.61658
CTSP-100	0.70877	0.00136	0.71149	-0.01890	0.73039	CTSN-100	0.70279	0.00130	0.70539	-0.01890	0.72429
CTSP-200	0.83579	0.00140	0.83859	-0.01890	0.85749	CTSN-200	0.83198	0.00152	0.83502	-0.01890	0.85392
CTSP-300	0.87720	0.00133	0.87986	-0.01890	0.89876	CTSN-300	0.87520	0.00148	0.87816	-0.01890	0.89706
CTSP-400	0.87787	0.00137	0.88061	-0.01890	0.89951	CTSN-400	**0.88125**	0.00139	0.88403	-0.01890	**0.90293**
CTSP-410	0.87826	0.00131	0.88088	-0.01890	0.89978	CTSN-410	0.87478	0.00130	0.87738	-0.01890	0.89628
CTSP-420	0.87981	0.00142	0.88265	-0.01890	0.90155	CTSN-420	0.87533	0.00132	0.87797	-0.01890	0.89687
CTSP-430	0.88153	0.00133	0.88419	-0.01890	0.90309	CTSN-430	0.87828	0.00148	0.88124	-0.01890	0.90014
CTSP-437	**0.88294**	0.00138	0.88570	-0.01890	**0.90460**	CTSN-437	0.87712	0.00128	0.87968	-0.01890	0.89858
CTSP-440	0.87231	0.00129	0.87489	-0.01890	0.89379	CTSN-440	0.87379	0.00139	0.87657	-0.01890	0.89547
CTSP-450	0.87518	0.00145	0.87808	-0.01890	0.89698	CTSN-450	0.86987	0.00140	0.87267	-0.01890	0.89157
CTSP-460	0.87545	0.00140	0.87825	-0.01890	0.89715	CTSN-460	0.87563	0.00142	0.87847	-0.01890	0.89737

CTSP-470	0.87770	0.00146	0.88062	-0.01890	0.89952	CTSN-470	0.87494	0.00148	0.87790	-0.01890	0.89680
CTSP-480	0.87093	0.00146	0.87385	-0.01890	0.89275	CTSN-480	0.87241	0.00139	0.87519	-0.01890	0.89409
CTSP-486	0.87392	0.00139	0.87670	-0.01890	0.89560	CTSN-486	0.87015	0.00143	0.87301	-0.01890	0.89191
CTSP-490	0.87088	0.00145	0.87378	-0.01890	0.89268	CTSN-490	0.86984	0.00150	0.87284	-0.01890	0.89174
CTSP-500	0.86916	0.00139	0.87194	-0.01890	0.89084	CTSN-500	0.87227	0.00135	0.87497	-0.01890	0.89387
CTSP-520	0.87011	0.00137	0.87285	-0.01890	0.89175	CTSN-520	0.86990	0.00141	0.87272	-0.01890	0.89162
CTSP-540	0.85611	0.00137	0.85885	-0.01890	0.87775	CTSN-540	0.85343	0.00136	0.85615	-0.01890	0.87505
CTSP-544	0.85348	0.00126	0.85600	-0.01890	0.87490	CTSN-544	0.85793	0.00145	0.86083	-0.01890	0.87973
CTSP-560	0.85228	0.00133	0.85494	-0.01890	0.87384	CTSN-560	0.85356	0.00137	0.85630	-0.01890	0.87520
CTSP-600	0.85298	0.00132	0.85562	-0.01890	0.87452	CTSN-600	0.85286	0.00127	0.85540	-0.01890	0.87430
CTSP-616	0.83405	0.00141	0.83687	-0.01890	0.85577	CTSN-616	0.83533	0.00131	0.83795	-0.01890	0.85685
CTSP-700	0.80384	0.00128	0.80640	-0.01890	0.82530	CTSN-700	0.80506	0.00130	0.80766	-0.01890	0.82656
CTSP-705	0.80388	0.00139	0.80666	-0.01890	0.82556	CTSN-705	0.80421	0.00126	0.80673	-0.01890	0.82563
CTSP-800	0.79654	0.00124	0.79902	-0.01890	0.81792	CTSN-800	0.79565	0.00137	0.79839	-0.01890	0.81729
	10X10 Triangular Lattice			Max	0.90460		10X10 Triangular Lattice			Max	0.90293
CTTP-058	0.59815	0.00113	0.60041	-0.01890	0.61931	CTTN-058	0.59095	0.00118	0.59331	-0.01890	0.61221
CTTP-100	0.70886	0.00116	0.71118	-0.01890	0.73008	CTTN-100	0.70089	0.00129	0.70347	-0.01890	0.72237
CTTP-200	0.84083	0.00152	0.84387	-0.01890	0.86277	CTTN-200	0.83478	0.00150	0.83778	-0.01890	0.85668
CTTP-300	0.88198	0.00151	0.88500	-0.01890	0.90390	CTTN-300	0.87808	0.00141	0.88090	-0.01890	0.89980
CTTP-400	**0.89104**	0.00135	0.89374	-0.01890	**0.91264**	CTTN-400	0.88405	0.00148	0.88701	-0.01890	0.90591
CTTP-410	0.89099	0.00137	0.89373	-0.01890	0.91263	CTTN-410	**0.88590**	0.00141	0.88872	-0.01890	**0.90762**
CTTP-420	0.87928	0.00136	0.88200	-0.01890	0.90090	CTTN-420	0.87818	0.00139	0.88096	-0.01890	0.89986
CTTP-430	0.88265	0.00130	0.88525	-0.01890	0.90415	CTTN-430	0.87847	0.00134	0.88115	-0.01890	0.90005
CTTP-437	0.88559	0.00132	0.88823	-0.01890	0.90713	CTTN-437	0.87944	0.00153	0.88250	-0.01890	0.90140
CTTP-440	0.88250	0.00139	0.88528	-0.01890	0.90418	CTTN-440	0.88032	0.00140	0.88312	-0.01890	0.90202
CTTP-450	0.88484	0.00144	0.88772	-0.01890	0.90662	CTTN-450	0.88229	0.00149	0.88527	-0.01890	0.90417
CTTP-460	0.88640	0.00141	0.88922	-0.01890	0.90812	CTTN-460	0.88187	0.00151	0.88489	-0.01890	0.90379
CTTP-470	0.87015	0.00140	0.87295	-0.01890	0.89185	CTTN-470	0.86834	0.00136	0.87106	-0.01890	0.88996
CTTP-480	0.86569	0.00133	0.86835	-0.01890	0.88725	CTTN-480	0.86615	0.00122	0.86859	-0.01890	0.88749
CTTP-486	0.86649	0.00145	0.86939	-0.01890	0.88829	CTTN-486	0.87018	0.00135	0.87288	-0.01890	0.89178
CTTP-490	0.85884	0.00132	0.86148	-0.01890	0.88038	CTTN-490	0.85855	0.00138	0.86131	-0.01890	0.88021
CTTP-500	0.85887	0.00130	0.86147	-0.01890	0.88037	CTTN-500	0.85986	0.00130	0.86246	-0.01890	0.88136
CTTP-520	0.85949	0.00126	0.86201	-0.01890	0.88091	CTTN-520	0.85985	0.00138	0.86261	-0.01890	0.88151
CTTP-540	0.84844	0.00136	0.85116	-0.01890	0.87006	CTTN-540	0.84653	0.00149	0.84951	-0.01890	0.86841
CTTP-544	0.84883	0.00131	0.85145	-0.01890	0.87035	CTTN-544	0.85169	0.00129	0.85427	-0.01890	0.87317
CTTP-560	0.84858	0.00134	0.85126	-0.01890	0.87016	CTTN-560	0.84982	0.00129	0.85240	-0.01890	0.87130

CTTP-600	0.85088	0.00132	0.85352	-0.01890	0.87242	CTTN-600	0.84992	0.00145	0.85282	-0.01890	0.87172
CTTP-616	0.84595	0.00128	0.84851	-0.01890	0.86741	CTTN-616	0.84721	0.00126	0.84973	-0.01890	0.86863
CTTP-700	0.81326	0.00129	0.81584	-0.01890	0.83474	CTTN-700	0.81235	0.00131	0.81497	-0.01890	0.83387
CTTP-705	0.81151	0.00125	0.81401	-0.01890	0.83291	CTTN-705	0.81009	0.00129	0.81267	-0.01890	0.83157
CTTP-800	0.77634	0.00121	0.77876	-0.01890	0.79766	CTTN-800	0.77554	0.00142	0.77838	-0.01890	0.79728
	9X9 Square Lattice			Max	0.91264		9X9 Square Lattice			Max	0.90762
CNSP-058	0.60462	0.00122	0.60706	-0.01890	0.62596	CNSN-058	0.59831	0.00122	0.60075	-0.01890	0.61965
CNSP-100	0.71111	0.00142	0.71395	-0.01890	0.73285	CNSN-100	0.70525	0.00132	0.70789	-0.01890	0.72679
CNSP-200	0.83768	0.00135	0.84038	-0.01890	0.85928	CNSN-200	0.83055	0.00130	0.83315	-0.01890	0.85205
CNSP-300	0.87393	0.00147	0.87687	-0.01890	0.89577	CNSN-300	0.87228	0.00149	0.87526	-0.01890	0.89416
CNSP-400	0.87967	0.00126	0.88219	-0.01890	0.90109	CNSN-400	0.87891	0.00135	0.88161	-0.01890	0.90051
CNSP-410	0.87818	0.00134	0.88086	-0.01890	0.89976	CNSN-410	0.87862	0.00142	0.88146	-0.01890	0.90036
CNSP-420	**0.88232**	0.00137	0.88506	-0.01890	**0.90396**	CNSN-420	**0.87967**	0.00140	0.88247	-0.01890	**0.90137**
CNSP-430	0.87656	0.00140	0.87936	-0.01890	0.89826	CNSN-430	0.87164	0.00137	0.87438	-0.01890	0.89328
CNSP-437	0.87502	0.00136	0.87774	-0.01890	0.89664	CNSN-437	0.87333	0.00140	0.87613	-0.01890	0.89503
CNSP-440	0.87524	0.00135	0.87794	-0.01890	0.89684	CNSN-440	0.87000	0.00130	0.87260	-0.01890	0.89150
CNSP-450	0.87837	0.00134	0.88105	-0.01890	0.89995	CNSN-450	0.87312	0.00131	0.87574	-0.01890	0.89464
CNSP-460	0.87603	0.00133	0.87869	-0.01890	0.89759	CNSN-460	0.87420	0.00138	0.87696	-0.01890	0.89586
CNSP-470	0.87815	0.00137	0.88089	-0.01890	0.89979	CNSN-470	0.87235	0.00130	0.87495	-0.01890	0.89385
CNSP-480	0.87678	0.00127	0.87932	-0.01890	0.89822	CNSN-480	0.87075	0.00136	0.87347	-0.01890	0.89237
CNSP-486	0.87752	0.00129	0.88010	-0.01890	0.89900	CNSN-486	0.87141	0.00124	0.87389	-0.01890	0.89279
CNSP-490	0.85832	0.00134	0.86100	-0.01890	0.87990	CNSN-490	0.86006	0.00130	0.86266	-0.01890	0.88156
CNSP-500	0.85874	0.00117	0.86108	-0.01890	0.87998	CNSN-500	0.85686	0.00136	0.85958	-0.01890	0.87848
CNSP-520	0.83322	0.00137	0.83596	-0.01890	0.85486	CNSN-520	0.83056	0.00139	0.83334	-0.01890	0.85224
CNSP-540	0.83383	0.00138	0.83659	-0.01890	0.85549	CNSN-540	0.83276	0.00145	0.83566	-0.01890	0.85456
CNSP-544	0.83071	0.00134	0.83339	-0.01890	0.85229	CNSN-544	0.83553	0.00138	0.83829	-0.01890	0.85719
CNSP-560	0.83779	0.00137	0.84053	-0.01890	0.85943	CNSN-560	0.83344	0.00138	0.83620	-0.01890	0.85510
CNSP-600	0.83773	0.00131	0.84035	-0.01890	0.85925	CNSN-600	0.83516	0.00134	0.83784	-0.01890	0.85674
CNSP-616	0.83323	0.00131	0.83585	-0.01890	0.85475	CNSN-616	0.83109	0.00130	0.83369	-0.01890	0.85259
CNSP-700	0.80318	0.00126	0.80570	-0.01890	0.82460	CNSN-700	0.80244	0.00134	0.80512	-0.01890	0.82402
CNSP-705	0.80135	0.00130	0.80395	-0.01890	0.82285	CNSN-705	0.80499	0.00133	0.80765	-0.01890	0.82655
CNSP-800	0.75295	0.00126	0.75547	-0.01890	0.77437	CNSN-800	0.75473	0.00119	0.75711	-0.01890	0.77601
	9X9 Triangular Lattice			Max	0.90396		9X9 Triangular Lattice			Max	0.90137
CNTP-058	0.60308	0.00117	0.60542	-0.01890	0.62432	CNTN-058	0.59338	0.00126	0.59590	-0.01890	0.61480
CNTP-100	0.71358	0.00130	0.71618	-0.01890	0.73508	CNTN-100	0.70597	0.00141	0.70879	-0.01890	0.72769
CNTP-200	0.83811	0.00135	0.84081	-0.01890	0.85971	CNTN-200	0.83611	0.00147	0.83905	-0.01890	0.85795

CNTP-300	0.87617	0.00125	0.87867	-0.01890	0.89757	CNTN-300	0.87376	0.00141	0.87658	-0.01890	0.89548
CNTP-400	0.87449	0.00151	0.87751	-0.01890	0.89641	CNTN-400	0.86897	0.00156	0.87209	-0.01890	0.89099
CNTP-410	0.87430	0.00131	0.87692	-0.01890	0.89582	CNTN-410	0.86807	0.00131	0.87069	-0.01890	0.88959
CNTP-420	**0.87670**	0.00127	0.87924	-0.01890	**0.89814**	CNTN-420	**0.87457**	0.00125	0.87707	-0.01890	**0.89597**
CNTP-430	0.86698	0.00134	0.86966	-0.01890	0.88856	CNTN-430	0.86965	0.00127	0.87219	-0.01890	0.89109
CNTP-437	0.87313	0.00142	0.87597	-0.01890	0.89487	CNTN-437	0.86826	0.00131	0.87088	-0.01890	0.88978
CNTP-440	0.86860	0.00132	0.87124	-0.01890	0.89014	CNTN-440	0.87088	0.00146	0.87380	-0.01890	0.89270
CNTP-450	0.87182	0.00133	0.87448	-0.01890	0.89338	CNTN-450	0.87224	0.00135	0.87494	-0.01890	0.89384
CNTP-460	0.87277	0.00127	0.87531	-0.01890	0.89421	CNTN-460	0.86945	0.00131	0.87207	-0.01890	0.89097
CNTP-470	0.87263	0.00141	0.87545	-0.01890	0.89435	CNTN-470	0.87273	0.00137	0.87547	-0.01890	0.89437
CNTP-480	0.87065	0.00137	0.87339	-0.01890	0.89229	CNTN-480	0.87374	0.00134	0.87642	-0.01890	0.89532
CNTP-486	0.87408	0.00138	0.87684	-0.01890	0.89574	CNTN-486	0.87247	0.00140	0.87527	-0.01890	0.89417
CNTP-490	0.87385	0.00135	0.87655	-0.01890	0.89545	CNTN-490	0.87221	0.00123	0.87467	-0.01890	0.89357
CNTP-500	0.87548	0.00139	0.87826	-0.01890	0.89716	CNTN-500	0.87248	0.00139	0.87526	-0.01890	0.89416
CNTP-520	0.87154	0.00137	0.87428	-0.01890	0.89318	CNTN-520	0.87044	0.00128	0.87300	-0.01890	0.89190
CNTP-540	0.84344	0.00148	0.84640	-0.01890	0.86530	CNTN-540	0.84302	0.00127	0.84556	-0.01890	0.86446
CNTP-544	0.84155	0.00134	0.84423	-0.01890	0.86313	CNTN-544	0.84380	0.00138	0.84656	-0.01890	0.86546
CNTP-560	0.84142	0.00127	0.84396	-0.01890	0.86286	CNTN-560	0.84365	0.00124	0.84613	-0.01890	0.86503
CNTP-600	0.80987	0.00135	0.81257	-0.01890	0.83147	CNTN-600	0.80875	0.00121	0.81117	-0.01890	0.83007
CNTP-616	0.80821	0.00140	0.81101	-0.01890	0.82991	CNTN-616	0.80749	0.00133	0.81015	-0.01890	0.82905
CNTP-700	0.80398	0.00125	0.80648	-0.01890	0.82538	CNTN-700	0.80535	0.00127	0.80789	-0.01890	0.82679
CNTP-705	0.80651	0.00137	0.80925	-0.01890	0.82815	CNTN-705	0.80704	0.00130	0.80964	-0.01890	0.82854
CNTP-800	0.77918	0.00126	0.78170	-0.01890	0.80060	CNTN-800	0.77860	0.00136	0.78132	-0.01890	0.80022
	8X8 Square Lattice			Max	0.89814		8X8 Square Lattice			Max	0.89597
CESP-058	0.60791	0.00113	0.61017	-0.01890	0.62907	CESN-058	0.60245	0.00121	0.60487	-0.01890	0.62377
CESP-100	0.71488	0.00134	0.71756	-0.01890	0.73646	CESN-100	0.70646	0.00120	0.70886	-0.01890	0.72776
CESP-200	0.83779	0.00139	0.84057	-0.01890	0.85947	CESN-200	0.83356	0.00137	0.83630	-0.01890	0.85520
CESP-300	0.86841	0.00151	0.87143	-0.01890	0.89033	CESN-300	0.86277	0.00146	0.86569	-0.01890	0.88459
CESP-400	**0.87068**	0.00133	0.87334	-0.01890	**0.89224**	CESN-400	**0.86695**	0.00125	0.86945	-0.01890	**0.88835**
CESP-410	0.84837	0.00125	0.85087	-0.01890	0.86977	CESN-410	0.84894	0.00135	0.85164	-0.01890	0.87054
CESP-420	0.84968	0.00142	0.85252	-0.01890	0.87142	CESN-420	0.85167	0.00139	0.85445	-0.01890	0.87335
CESP-430	0.85517	0.00127	0.85771	-0.01890	0.87661	CESN-430	0.85362	0.00146	0.85654	-0.01890	0.87544
CESP-437	0.85521	0.00144	0.85809	-0.01890	0.87699	CESN-437	0.85528	0.00124	0.85776	-0.01890	0.87666
CESP-440	0.85626	0.00134	0.85894	-0.01890	0.87784	CESN-440	0.85441	0.00151	0.85743	-0.01890	0.87633
CESP-450	0.85699	0.00137	0.85973	-0.01890	0.87863	CESN-450	0.85904	0.00147	0.86198	-0.01890	0.88088
CESP-460	0.85472	0.00128	0.85728	-0.01890	0.87618	CESN-460	0.85563	0.00144	0.85851	-0.01890	0.87741

CESP-470	0.85973	0.00135	0.86243	-0.01890	0.88133	CESN-470	0.85993	0.00127	0.86247	-0.01890	0.88137
CESP-480	0.85884	0.00134	0.86152	-0.01890	0.88042	CESN-480	0.85877	0.00134	0.86145	-0.01890	0.88035
CESP-486	0.85782	0.00124	0.86030	-0.01890	0.87920	CESN-486	0.85776	0.00131	0.86038	-0.01890	0.87928
CESP-490	0.85814	0.00134	0.86082	-0.01890	0.87972	CESN-490	0.85692	0.00131	0.85954	-0.01890	0.87844
CESP-500	0.86067	0.00140	0.86347	-0.01890	0.88237	CESN-500	0.85975	0.00134	0.86243	-0.01890	0.88133
CESP-520	0.85816	0.00130	0.86076	-0.01890	0.87966	CESN-520	0.85814	0.00133	0.86080	-0.01890	0.87970
CESP-540	0.83566	0.00128	0.83822	-0.01890	0.85712	CESN-540	0.83426	0.00138	0.83702	-0.01890	0.85592
CESP-544	0.83537	0.00145	0.83827	-0.01890	0.85717	CESN-544	0.83268	0.00126	0.83520	-0.01890	0.85410
CESP-560	0.83402	0.00137	0.83676	-0.01890	0.85566	CESN-560	0.83413	0.00135	0.83683	-0.01890	0.85573
CESP-600	0.82942	0.00134	0.83210	-0.01890	0.85100	CESN-600	0.83090	0.00125	0.83340	-0.01890	0.85230
CESP-616	0.81658	0.00127	0.81912	-0.01890	0.83802	CESN-616	0.81493	0.00137	0.81767	-0.01890	0.83657
CESP-700	0.76682	0.00137	0.76956	-0.01890	0.78846	CESN-700	0.76509	0.00129	0.76767	-0.01890	0.78657
CESP-705	0.76988	0.00130	0.77248	-0.01890	0.79138	CESN-705	0.76841	0.00132	0.77105	-0.01890	0.78995
CESP-800	0.76140	0.00140	0.76420	-0.01890	0.78310	CESN-800	0.75919	0.00130	0.76179	-0.01890	0.78069
	8X8 Triangular Lattice			Max	0.89224		8X8 Triangular Lattice			Max	0.88835
CETP-058	0.60321	0.00121	0.60563	-0.01890	0.62453	CETN-058	0.59729	0.00119	0.59967	-0.01890	0.61857
CETP-100	0.71556	0.00127	0.71810	-0.01890	0.73700	CETN-100	0.70718	0.00119	0.70956	-0.01890	0.72846
CETP-200	0.83302	0.00148	0.83598	-0.01890	0.85488	CETN-200	0.83069	0.00148	0.83365	-0.01890	0.85255
CETP-300	0.86707	0.00150	0.87007	-0.01890	0.88897	CETN-300	0.86357	0.00133	0.86623	-0.01890	0.88513
CETP-400	0.87799	0.00139	0.88077	-0.01890	0.89967	CETN-400	0.87849	0.00135	0.88119	-0.01890	0.90009
CETP-410	**0.87997**	0.00145	0.88287	-0.01890	**0.90177**	CETN-410	0.87748	0.00137	0.88022	-0.01890	0.89912
CETP-420	0.87789	0.00137	0.88063	-0.01890	0.89953	CETN-420	**0.87874**	0.00141	0.88156	-0.01890	**0.90046**
CETP-430	0.86585	0.00145	0.86875	-0.01890	0.88765	CETN-430	0.86380	0.00142	0.86664	-0.01890	0.88554
CETP-437	0.86709	0.00144	0.86997	-0.01890	0.88887	CETN-437	0.86544	0.00138	0.86820	-0.01890	0.88710
CETP-440	0.86329	0.00127	0.86583	-0.01890	0.88473	CETN-440	0.86448	0.00148	0.86744	-0.01890	0.88634
CETP-450	0.86468	0.00140	0.86748	-0.01890	0.88638	CETN-450	0.86332	0.00134	0.86600	-0.01890	0.88490
CETP-460	0.86710	0.00137	0.86984	-0.01890	0.88874	CETN-460	0.86351	0.00146	0.86643	-0.01890	0.88533
CETP-470	0.86721	0.00138	0.86997	-0.01890	0.88887	CETN-470	0.86393	0.00128	0.86649	-0.01890	0.88539
CETP-480	0.83389	0.00127	0.83643	-0.01890	0.85533	CETN-480	0.83493	0.00132	0.83757	-0.01890	0.85647
CETP-486	0.83386	0.00139	0.83664	-0.01890	0.85554	CETN-486	0.83283	0.00137	0.83557	-0.01890	0.85447
CETP-490	0.83441	0.00133	0.83707	-0.01890	0.85597	CETN-490	0.83428	0.00136	0.83700	-0.01890	0.85590
CETP-500	0.83472	0.00139	0.83750	-0.01890	0.85640	CETN-500	0.83509	0.00135	0.83779	-0.01890	0.85669
CETP-520	0.83689	0.00136	0.83961	-0.01890	0.85851	CETN-520	0.83610	0.00127	0.83864	-0.01890	0.85754
CETP-540	0.83594	0.00142	0.83878	-0.01890	0.85768	CETN-540	0.83569	0.00134	0.83837	-0.01890	0.85727
CETP-544	0.83459	0.00126	0.83711	-0.01890	0.85601	CETN-544	0.83600	0.00136	0.83872	-0.01890	0.85762
CETP-560	0.83526	0.00139	0.83804	-0.01890	0.85694	CETN-560	0.83665	0.00134	0.83933	-0.01890	0.85823

CETP-600	0.81738	0.00126	0.81990	-0.01890	0.83880	CETN-600	0.81555	0.00130	0.81815	-0.01890	0.83705
CETP-616	0.81630	0.00135	0.81900	-0.01890	0.83790	CETN-616	0.81625	0.00135	0.81895	-0.01890	0.83785
CETP-700	0.80700	0.00134	0.80968	-0.01890	0.82858	CETN-700	0.80622	0.00126	0.80874	-0.01890	0.82764
CETP-705	0.80326	0.00131	0.80588	-0.01890	0.82478	CETN-705	0.80784	0.00127	0.81038	-0.01890	0.82928
CETP-800	0.74844	0.00133	0.75110	-0.01890	0.77000	CETN-800	0.74737	0.00132	0.75001	-0.01890	0.76891
55 KGs Infinite Case with VFO				Max	0.90177	53 KGs Infinite Case with VFO				Max	0.90046
	17X17 Square Lattice			Max NO	0.91625		17X17 Square Lattice			Max NO	0.91456
BSSP-058	0.58773	0.00113	0.58999	-0.01890	0.60889	BSSN-058	0.58019	0.00123	0.58265	-0.01890	0.60155
BSSP-100	0.70533	0.00135	0.70803	-0.01890	0.72693	BSSN-100	0.69484	0.00137	0.69758	-0.01890	0.71648
BSSP-200	0.83929	0.00140	0.84209	-0.01890	0.86099	BSSN-200	0.83476	0.00146	0.83768	-0.01890	0.85658
BSSP-300	0.88517	0.00139	0.88795	-0.01890	0.90685	BSSN-300	0.87897	0.00141	0.88179	-0.01890	0.90069
BSSP-400	0.89216	0.00149	0.89514	-0.01890	0.91404	BSSN-400	**0.89142**	0.00140	0.89422	-0.01890	**0.91312**
BSSP-410	0.89188	0.00144	0.89476	-0.01890	0.91366	BSSN-410	0.89039	0.00136	0.89311	-0.01890	0.91201
BSSP-420	0.89375	0.00132	0.89639	-0.01890	0.91529	BSSN-420	0.88886	0.00144	0.89174	-0.01890	0.91064
BSSP-430	0.89193	0.00132	0.89457	-0.01890	0.91347	BSSN-430	0.88855	0.00137	0.89129	-0.01890	0.91019
BSSP-437	0.89420	0.00136	0.89692	-0.01890	0.91582	BSSN-437	0.88809	0.00127	0.89063	-0.01890	0.90953
BSSP-440	0.89175	0.00138	0.89451	-0.01890	0.91341	BSSN-440	0.88819	0.00136	0.89091	-0.01890	0.90981
BSSP-450	**0.89451**	0.00134	0.89719	-0.01890	**0.91609**	BSSN-450	0.88751	0.00135	0.89021	-0.01890	0.90911
BSSP-460	0.89083	0.00143	0.89369	-0.01890	0.91259	BSSN-460	0.88885	0.00152	0.89189	-0.01890	0.91079
BSSP-470	0.89132	0.00141	0.89414	-0.01890	0.91304	BSSN-470	0.88719	0.00132	0.88983	-0.01890	0.90873
BSSP-480	0.89139	0.00129	0.89397	-0.01890	0.91287	BSSN-480	0.88726	0.00132	0.88990	-0.01890	0.90880
BSSP-486	0.88795	0.00133	0.89061	-0.01890	0.90951	BSSN-486	0.88757	0.00117	0.88991	-0.01890	0.90881
BSSP-490	0.89004	0.00125	0.89254	-0.01890	0.91144	BSSN-490	0.88386	0.00137	0.88660	-0.01890	0.90550
BSSP-500	0.88847	0.00137	0.89121	-0.01890	0.91011	BSSN-500	0.88355	0.00131	0.88617	-0.01890	0.90507
BSSP-520	0.88134	0.00122	0.88378	-0.01890	0.90268	BSSN-520	0.88398	0.00125	0.88648	-0.01890	0.90538
BSSP-540	0.87849	0.00133	0.88115	-0.01890	0.90005	BSSN-540	0.87700	0.00133	0.87966	-0.01890	0.89856
BSSP-544	0.87797	0.00121	0.88039	-0.01890	0.89929	BSSN-544	0.87849	0.00139	0.88127	-0.01890	0.90017
BSSP-560	0.87383	0.00138	0.87659	-0.01890	0.89549	BSSN-560	0.87279	0.00137	0.87553	-0.01890	0.89443
BSSP-600	0.86222	0.00129	0.86480	-0.01890	0.88370	BSSN-600	0.85792	0.00134	0.86060	-0.01890	0.87950
BSSP-616	0.85767	0.00140	0.86047	-0.01890	0.87937	BSSN-616	0.85759	0.00118	0.85995	-0.01890	0.87885
BSSP-700	0.83425	0.00122	0.83669	-0.01890	0.85559	BSSN-700	0.83293	0.00130	0.83553	-0.01890	0.85443
BSSP-705	0.83111	0.00138	0.83387	-0.01890	0.85277	BSSN-705	0.83425	0.00135	0.83695	-0.01890	0.85585
BSSP-800	0.80770	0.00137	0.81044	-0.01890	0.82934	BSSN-800	0.80678	0.00134	0.80946	-0.01890	0.82836
	17X17 Triangular Lattice			Max	0.91609		17X17 Triangular Lattice			Max	0.91312
BSTP-058	0.58759	0.00114	0.58987	-0.01890	0.60877	BSTN-058	0.57991	0.00126	0.58243	-0.01890	0.60133
BSTP-100	0.70189	0.00133	0.70455	-0.01890	0.72345	BSTN-100	0.69501	0.00137	0.69775	-0.01890	0.71665

BSTP-200	0.84181	0.00149	0.84479	-0.01890	0.86369	BSTN-200	0.83876	0.00143	0.84162	-0.01890	0.86052
BSTP-300	0.88625	0.00146	0.88917	-0.01890	0.90807	BSTN-300	0.88119	0.00133	0.88385	-0.01890	0.90275
BSTP-400	0.89598	0.00148	0.89894	-0.01890	0.91784	BSTN-400	0.89274	0.00152	0.89578	-0.01890	0.91468
BSTP-410	0.89454	0.00142	0.89738	-0.01890	0.91628	BSTN-410	0.89035	0.00139	0.89313	-0.01890	0.91203
BSTP-420	**0.89628**	0.00146	0.89920	-0.01890	**0.91810**	BSTN-420	0.89426	0.00142	0.89710	-0.01890	0.91600
BSTP-430	0.89466	0.00135	0.89736	-0.01890	0.91626	BSTN-430	**0.89470**	0.00130	0.89730	-0.01890	**0.91620**
BSTP-437	0.89392	0.00151	0.89694	-0.01890	0.91584	BSTN-437	0.89357	0.00133	0.89623	-0.01890	0.91513
BSTP-440	0.89322	0.00143	0.89608	-0.01890	0.91498	BSTN-440	0.89257	0.00131	0.89519	-0.01890	0.91409
BSTP-450	0.89457	0.00130	0.89717	-0.01890	0.91607	BSTN-450	0.88799	0.00146	0.89091	-0.01890	0.90981
BSTP-460	0.89252	0.00132	0.89516	-0.01890	0.91406	BSTN-460	0.88881	0.00133	0.89147	-0.01890	0.91037
BSTP-470	0.89333	0.00134	0.89601	-0.01890	0.91491	BSTN-470	0.88997	0.00137	0.89271	-0.01890	0.91161
BSTP-480	0.89267	0.00139	0.89545	-0.01890	0.91435	BSTN-480	0.88573	0.00133	0.88839	-0.01890	0.90729
BSTP-486	0.89316	0.00128	0.89572	-0.01890	0.91462	BSTN-486	0.88700	0.00135	0.88970	-0.01890	0.90860
BSTP-490	0.89295	0.00139	0.89573	-0.01890	0.91463	BSTN-490	0.88812	0.00146	0.89104	-0.01890	0.90994
BSTP-500	0.88894	0.00127	0.89148	-0.01890	0.91038	BSTN-500	0.88713	0.00135	0.88983	-0.01890	0.90873
BSTP-520	0.88539	0.00134	0.88807	-0.01890	0.90697	BSTN-520	0.88496	0.00148	0.88792	-0.01890	0.90682
BSTP-540	0.87926	0.00127	0.88180	-0.01890	0.90070	BSTN-540	0.87807	0.00130	0.88067	-0.01890	0.89957
BSTP-544	0.87925	0.00137	0.88199	-0.01890	0.90089	BSTN-544	0.87758	0.00128	0.88014	-0.01890	0.89904
BSTP-560	0.87573	0.00134	0.87841	-0.01890	0.89731	BSTN-560	0.87111	0.00137	0.87385	-0.01890	0.89275
BSTP-600	0.86495	0.00125	0.86745	-0.01890	0.88635	BSTN-600	0.86592	0.00127	0.86846	-0.01890	0.88736
BSTP-616	0.86053	0.00133	0.86319	-0.01890	0.88209	BSTN-616	0.86116	0.00130	0.86376	-0.01890	0.88266
BSTP-700	0.83643	0.00130	0.83903	-0.01890	0.85793	BSTN-700	0.83838	0.00126	0.84090	-0.01890	0.85980
BSTP-705	0.83773	0.00131	0.84035	-0.01890	0.85925	BSTN-705	0.83759	0.00128	0.84015	-0.01890	0.85905
BSTP-800	0.80792	0.00131	0.81054	-0.01890	0.82944	BSTN-800	0.80983	0.00139	0.81261	-0.01890	0.83151
	10X10 Square Lattice			Max	0.91810		10X10 Square Lattice			Max	0.91620
BTSP-058	0.59018	0.00116	0.59250	-0.01890	0.61140	BTSN-058	0.58195	0.00107	0.58409	-0.01890	0.60299
BTSP-100	0.70492	0.00134	0.70760	-0.01890	0.72650	BTSN-100	0.69632	0.00125	0.69882	-0.01890	0.71772
BTSP-200	0.84004	0.00138	0.84280	-0.01890	0.86170	BTSN-200	0.83343	0.00143	0.83629	-0.01890	0.85519
BTSP-300	0.87925	0.00141	0.88207	-0.01890	0.90097	BTSN-300	0.87815	0.00135	0.88085	-0.01890	0.89975
BTSP-400	0.88693	0.00139	0.88971	-0.01890	0.90861	BTSN-400	0.88477	0.00148	0.88773	-0.01890	0.90663
BTSP-410	0.88797	0.00151	0.89099	-0.01890	**0.90989**	BTSN-410	**0.88608**	0.00136	0.88880	-0.01890	**0.90770**
BTSP-420	0.88695	0.00148	0.88991	-0.01890	0.90881	BTSN-420	0.88308	0.00135	0.88578	-0.01890	0.90468
BTSP-430	0.88599	0.00127	0.88853	-0.01890	0.90743	BTSN-430	0.88014	0.00127	0.88268	-0.01890	0.90158
BTSP-437	**0.88809**	0.00133	0.89075	-0.01890	0.90965	BTSN-437	0.88449	0.00141	0.88731	-0.01890	0.90621
BTSP-440	0.88474	0.00144	0.88762	-0.01890	0.90652	BTSN-440	0.88068	0.00122	0.88312	-0.01890	0.90202
BTSP-450	0.88519	0.00128	0.88775	-0.01890	0.90665	BTSN-450	0.88224	0.00137	0.88498	-0.01890	0.90388

BTSP-460	0.88337	0.00134	0.88605	-0.01890	0.90495	BTSN-460	0.88319	0.00143	0.88605	-0.01890	0.90495
BTSP-470	0.88068	0.00136	0.88340	-0.01890	0.90230	BTSN-470	0.88099	0.00132	0.88363	-0.01890	0.90253
BTSP-480	0.88284	0.00138	0.88560	-0.01890	0.90450	BTSN-480	0.87739	0.00128	0.87995	-0.01890	0.89885
BTSP-486	0.88335	0.00132	0.88599	-0.01890	0.90489	BTSN-486	0.87859	0.00137	0.88133	-0.01890	0.90023
BTSP-490	0.88344	0.00142	0.88628	-0.01890	0.90518	BTSN-490	0.87817	0.00139	0.88095	-0.01890	0.89985
BTSP-500	0.88000	0.00128	0.88256	-0.01890	0.90146	BTSN-500	0.87587	0.00130	0.87847	-0.01890	0.89737
BTSP-520	0.87221	0.00134	0.87489	-0.01890	0.89379	BTSN-520	0.87790	0.00141	0.88072	-0.01890	0.89962
BTSP-540	0.86926	0.00142	0.87210	-0.01890	0.89100	BTSN-540	0.86924	0.00132	0.87188	-0.01890	0.89078
BTSP-544	0.86747	0.00134	0.87015	-0.01890	0.88905	BTSN-544	0.86660	0.00125	0.86910	-0.01890	0.88800
BTSP-560	0.86225	0.00134	0.86493	-0.01890	0.88383	BTSN-560	0.86414	0.00125	0.86664	-0.01890	0.88554
BTSP-600	0.84859	0.00137	0.85133	-0.01890	0.87023	BTSN-600	0.85179	0.00134	0.85447	-0.01890	0.87337
BTSP-616	0.84569	0.00127	0.84823	-0.01890	0.86713	BTSN-616	0.84732	0.00129	0.84990	-0.01890	0.86880
BTSP-700	0.82237	0.00140	0.82517	-0.01890	0.84407	BTSN-700	0.82240	0.00142	0.82524	-0.01890	0.84414
BTSP-705	0.82156	0.00127	0.82410	-0.01890	0.84300	BTSN-705	0.81990	0.00130	0.82250	-0.01890	0.84140
BTSP-800	0.78960	0.00126	0.79212	-0.01890	0.81102	BTSN-800	0.79022	0.00136	0.79294	-0.01890	0.81184
	10X10 Triangular Lattice			Max	0.90989		10X10 Triangular Lattice			Max	0.90770
BTTP-058	0.58791	0.00114	0.59019	-0.01890	0.60909	BTTN-058	0.58175	0.00117	0.58409	-0.01890	0.60299
BTTP-100	0.70453	0.00135	0.70723	-0.01890	0.72613	BTTN-100	0.69716	0.00138	0.69992	-0.01890	0.71882
BTTP-200	0.84027	0.00130	0.84287	-0.01890	0.86177	BTTN-200	0.83333	0.00141	0.83615	-0.01890	0.85505
BTTP-300	0.88517	0.00146	0.88809	-0.01890	0.90699	BTTN-300	0.87909	0.00133	0.88175	-0.01890	0.90065
BTTP-400	0.88814	0.00145	0.89104	-0.01890	0.90994	BTTN-400	0.88724	0.00132	0.88988	-0.01890	0.90878
BTTP-410	0.88717	0.00145	0.89007	-0.01890	0.90897	BTTN-410	0.88782	0.00135	0.89052	-0.01890	0.90942
BTTP-420	0.88788	0.00136	0.89060	-0.01890	0.90950	BTTN-420	**0.88801**	0.00142	0.89085	-0.01890	**0.90975**
BTTP-430	0.88868	0.00133	0.89134	-0.01890	0.91024	BTTN-430	0.88533	0.00127	0.88787	-0.01890	0.90677
BTTP-437	**0.88990**	0.00143	0.89276	-0.01890	**0.91166**	BTTN-437	0.88559	0.00135	0.88829	-0.01890	0.90719
BTTP-440	0.88857	0.00137	0.89131	-0.01890	0.91021	BTTN-440	0.88360	0.00140	0.88640	-0.01890	0.90530
BTTP-450	0.88566	0.00124	0.88814	-0.01890	0.90704	BTTN-450	0.88391	0.00142	0.88675	-0.01890	0.90565
BTTP-460	0.88709	0.00144	0.88997	-0.01890	0.90887	BTTN-460	0.88246	0.00145	0.88536	-0.01890	0.90426
BTTP-470	0.88574	0.00130	0.88834	-0.01890	0.90724	BTTN-470	0.88361	0.00140	0.88641	-0.01890	0.90531
BTTP-480	0.88715	0.00136	0.88987	-0.01890	0.90877	BTTN-480	0.87894	0.00126	0.88146	-0.01890	0.90036
BTTP-486	0.88488	0.00131	0.88750	-0.01890	0.90640	BTTN-486	0.87925	0.00135	0.88195	-0.01890	0.90085
BTTP-490	0.88633	0.00140	0.88913	-0.01890	0.90803	BTTN-490	0.88090	0.00131	0.88352	-0.01890	0.90242
BTTP-500	0.88311	0.00138	0.88587	-0.01890	0.90477	BTTN-500	0.88203	0.00138	0.88479	-0.01890	0.90369
BTTP-520	0.87593	0.00148	0.87889	-0.01890	0.89779	BTTN-520	0.87772	0.00131	0.88034	-0.01890	0.89924
BTTP-540	0.86906	0.00131	0.87168	-0.01890	0.89058	BTTN-540	0.87291	0.00132	0.87555	-0.01890	0.89445
BTTP-544	0.87159	0.00131	0.87421	-0.01890	0.89311	BTTN-544	0.87263	0.00136	0.87535	-0.01890	0.89425

BTTP-560	0.86668	0.00130	0.86928	-0.01890	0.88818	BTTN-560	0.86748	0.00127	0.87002	-0.01890	0.88892
BTTP-600	0.85274	0.00123	0.85520	-0.01890	0.87410	BTTN-600	0.85497	0.00128	0.85753	-0.01890	0.87643
BTTP-616	0.84611	0.00143	0.84897	-0.01890	0.86787	BTTN-616	0.85059	0.00131	0.85321	-0.01890	0.87211
BTTP-700	0.82360	0.00140	0.82640	-0.01890	0.84530	BTTN-700	0.82416	0.00119	0.82654	-0.01890	0.84544
BTTP-705	0.82457	0.00142	0.82741	-0.01890	0.84631	BTTN-705	0.82435	0.00124	0.82683	-0.01890	0.84573
BTTP-800	0.79351	0.00124	0.79599	-0.01890	0.81489	BTTN-800	0.79471	0.00118	0.79707	-0.01890	0.81597
	9X9 Square Lattice			Max	0.91166		9X9 Square Lattice			Max	0.90975
BNSP-058	0.58929	0.00116	0.59161	-0.01890	0.61051	BNSN-058	0.58140	0.00111	0.58362	-0.01890	0.60252
BNSP-100	0.70597	0.00125	0.70847	-0.01890	0.72737	BNSN-100	0.70011	0.00132	0.70275	-0.01890	0.72165
BNSP-200	0.84182	0.00147	0.84476	-0.01890	0.86366	BNSN-200	0.83354	0.00133	0.83620	-0.01890	0.85510
BNSP-300	0.87875	0.00142	0.88159	-0.01890	0.90049	BNSN-300	0.87629	0.00141	0.87911	-0.01890	0.89801
BNSP-400	0.88259	0.00154	0.88567	-0.01890	0.90457	BNSN-400	**0.88220**	0.00131	0.88482	-0.01890	**0.90372**
BNSP-410	0.88099	0.00138	0.88375	-0.01890	0.90265	BNSN-410	0.88168	0.00139	0.88446	-0.01890	0.90336
BNSP-420	**0.88459**	0.00131	0.88721	-0.01890	**0.90611**	BNSN-420	0.87794	0.00138	0.88070	-0.01890	0.89960
BNSP-430	0.88045	0.00139	0.88323	-0.01890	0.90213	BNSN-430	0.87955	0.00140	0.88235	-0.01890	0.90125
BNSP-437	0.88002	0.00138	0.88278	-0.01890	0.90168	BNSN-437	0.87866	0.00139	0.88144	-0.01890	0.90034
BNSP-440	0.87928	0.00143	0.88214	-0.01890	0.90104	BNSN-440	0.87734	0.00142	0.88018	-0.01890	0.89908
BNSP-450	0.87680	0.00130	0.87940	-0.01890	0.89830	BNSN-450	0.87643	0.00132	0.87907	-0.01890	0.89797
BNSP-460	0.87854	0.00136	0.88126	-0.01890	0.90016	BNSN-460	0.87413	0.00149	0.87711	-0.01890	0.89601
BNSP-470	0.87842	0.00135	0.88112	-0.01890	0.90002	BNSN-470	0.87131	0.00138	0.87407	-0.01890	0.89297
BNSP-480	0.87791	0.00133	0.88057	-0.01890	0.89947	BNSN-480	0.87152	0.00133	0.87418	-0.01890	0.89308
BNSP-486	0.87823	0.00133	0.88089	-0.01890	0.89979	BNSN-486	0.87055	0.00138	0.87331	-0.01890	0.89221
BNSP-490	0.87653	0.00142	0.87937	-0.01890	0.89827	BNSN-490	0.87053	0.00151	0.87355	-0.01890	0.89245
BNSP-500	0.87323	0.00138	0.87599	-0.01890	0.89489	BNSN-500	0.87068	0.00138	0.87344	-0.01890	0.89234
BNSP-520	0.86921	0.00145	0.87211	-0.01890	0.89101	BNSN-520	0.86476	0.00130	0.86736	-0.01890	0.88626
BNSP-540	0.86475	0.00126	0.86727	-0.01890	0.88617	BNSN-540	0.85989	0.00132	0.86253	-0.01890	0.88143
BNSP-544	0.85973	0.00136	0.86245	-0.01890	0.88135	BNSN-544	0.85771	0.00126	0.86023	-0.01890	0.87913
BNSP-560	0.85553	0.00130	0.85813	-0.01890	0.87703	BNSN-560	0.85398	0.00135	0.85668	-0.01890	0.87558
BNSP-600	0.84115	0.00131	0.84377	-0.01890	0.86267	BNSN-600	0.84526	0.00122	0.84770	-0.01890	0.86660
BNSP-616	0.84059	0.00141	0.84341	-0.01890	0.86231	BNSN-616	0.83880	0.00131	0.84142	-0.01890	0.86032
BNSP-700	0.81209	0.00126	0.81461	-0.01890	0.83351	BNSN-700	0.81118	0.00141	0.81400	-0.01890	0.83290
BNSP-705	0.80763	0.00134	0.81031	-0.01890	0.82921	BNSN-705	0.81088	0.00121	0.81330	-0.01890	0.83220
BNSP-800	0.78173	0.00118	0.78409	-0.01890	0.80299	BNSN-800	0.78082	0.00139	0.78360	-0.01890	0.80250
	9X9 Triangular Lattice			Max	0.90611		9X9 Triangular Lattice			Max	0.90372
BNTP-058	0.58911	0.00118	0.59147	-0.01890	0.61037	BNTN-058	0.58349	0.00117	0.58583	-0.01890	0.60473
BNTP-100	0.70589	0.00129	0.70847	-0.01890	0.72737	BNTN-100	0.69824	0.00132	0.70088	-0.01890	0.71978

BNTP-200	0.83982	0.00137	0.84256	-0.01890	0.86146	BNTN-200	0.83599	0.00148	0.83895	-0.01890	0.85785
BNTP-300	0.88004	0.00143	0.88290	-0.01890	0.90180	BNTN-300	0.87816	0.00132	0.88080	-0.01890	0.89970
BNTP-400	**0.88639**	0.00124	0.88887	-0.01890	**0.90777**	BNTN-400	0.88094	0.00138	0.88370	-0.01890	0.90260
BNTP-410	0.88546	0.00139	0.88824	-0.01890	0.90714	BNTN-410	0.88174	0.00155	0.88484	-0.01890	0.90374
BNTP-420	0.88486	0.00138	0.88762	-0.01890	0.90652	BNTN-420	0.88192	0.00137	0.88466	-0.01890	0.90356
BNTP-430	0.88373	0.00116	0.88605	-0.01890	0.90495	BNTN-430	0.87892	0.00137	0.88166	-0.01890	0.90056
BNTP-437	0.88356	0.00138	0.88632	-0.01890	0.90522	BNTN-437	0.88054	0.00140	0.88334	-0.01890	0.90224
BNTP-440	0.88261	0.00124	0.88509	-0.01890	0.90399	BNTN-440	**0.88238**	0.00142	0.88522	-0.01890	**0.90412**
BNTP-450	0.88371	0.00129	0.88629	-0.01890	0.90519	BNTN-450	0.87862	0.00141	0.88144	-0.01890	0.90034
BNTP-460	0.88007	0.00140	0.88287	-0.01890	0.90177	BNTN-460	0.87560	0.00135	0.87830	-0.01890	0.89720
BNTP-470	0.87936	0.00133	0.88202	-0.01890	0.90092	BNTN-470	0.87636	0.00125	0.87886	-0.01890	0.89776
BNTP-480	0.88101	0.00129	0.88359	-0.01890	0.90249	BNTN-480	0.87224	0.00139	0.87502	-0.01890	0.89392
BNTP-486	0.87964	0.00129	0.88222	-0.01890	0.90112	BNTN-486	0.87527	0.00138	0.87803	-0.01890	0.89693
BNTP-490	0.88050	0.00134	0.88318	-0.01890	0.90208	BNTN-490	0.87472	0.00132	0.87736	-0.01890	0.89626
BNTP-500	0.87759	0.00136	0.88031	-0.01890	0.89921	BNTN-500	0.87387	0.00135	0.87657	-0.01890	0.89547
BNTP-520	0.87058	0.00127	0.87312	-0.01890	0.89202	BNTN-520	0.87066	0.00140	0.87346	-0.01890	0.89236
BNTP-540	0.86483	0.00134	0.86751	-0.01890	0.88641	BNTN-540	0.86514	0.00142	0.86798	-0.01890	0.88688
BNTP-544	0.86211	0.00130	0.86471	-0.01890	0.88361	BNTN-544	0.86163	0.00130	0.86423	-0.01890	0.88313
BNTP-560	0.85607	0.00122	0.85851	-0.01890	0.87741	BNTN-560	0.85945	0.00124	0.86193	-0.01890	0.88083
BNTP-600	0.84825	0.00114	0.85053	-0.01890	0.86943	BNTN-600	0.84530	0.00126	0.84782	-0.01890	0.86672
BNTP-616	0.84257	0.00126	0.84509	-0.01890	0.86399	BNTN-616	0.84057	0.00133	0.84323	-0.01890	0.86213
BNTP-700	0.81286	0.00136	0.81558	-0.01890	0.83448	BNTN-700	0.81505	0.00133	0.81771	-0.01890	0.83661
BNTP-705	0.81536	0.00137	0.81810	-0.01890	0.83700	BNTN-705	0.81387	0.00127	0.81641	-0.01890	0.83531
BNTP-800	0.78562	0.00136	0.78834	-0.01890	0.80724	BNTN-800	0.78510	0.00123	0.78756	-0.01890	0.80646
	8X8 Square Lattice			Max	0.90777		8X8 Square Lattice			Max	0.90412
BESP-058	0.59300	0.00122	0.59544	-0.01890	0.61434	BESN-058	0.58533	0.00114	0.58761	-0.01890	0.60651
BESP-100	0.70576	0.00132	0.70840	-0.01890	0.72730	BESN-100	0.70118	0.00138	0.70394	-0.01890	0.72284
BESP-200	0.83754	0.00157	0.84068	-0.01890	0.85958	BESN-200	0.83293	0.00145	0.83583	-0.01890	0.85473
BESP-300	0.87708	0.00136	0.87980	-0.01890	0.89870	BESN-300	0.87152	0.00138	0.87428	-0.01890	0.89318
BESP-400	0.87665	0.00143	0.87951	-0.01890	0.89841	BESN-400	0.87479	0.00148	0.87775	-0.01890	0.89665
BESP-410	0.87596	0.00136	0.87868	-0.01890	0.89758	BESN-410	**0.87553**	0.00139	0.87831	-0.01890	**0.89721**
BESP-420	**0.87958**	0.00129	0.88216	-0.01890	**0.90106**	BESN-420	0.87455	0.00128	0.87711	-0.01890	0.89601
BESP-430	0.87472	0.00129	0.87730	-0.01890	0.89620	BESN-430	0.87152	0.00127	0.87406	-0.01890	0.89296
BESP-437	0.87619	0.00149	0.87917	-0.01890	0.89807	BESN-437	0.87264	0.00141	0.87546	-0.01890	0.89436
BESP-440	0.87604	0.00139	0.87882	-0.01890	0.89772	BESN-440	0.87056	0.00131	0.87318	-0.01890	0.89208
BESP-450	0.87223	0.00136	0.87495	-0.01890	0.89385	BESN-450	0.87102	0.00141	0.87384	-0.01890	0.89274

BESP-460	0.87103	0.00152	0.87407	-0.01890	0.89297
BESP-470	0.87046	0.00129	0.87304	-0.01890	0.89194
BESP-480	0.86959	0.00136	0.87231	-0.01890	0.89121
BESP-486	0.86925	0.00129	0.87183	-0.01890	0.89073
BESP-490	0.86820	0.00136	0.87092	-0.01890	0.88982
BESP-500	0.86621	0.00128	0.86877	-0.01890	0.88767
BESP-520	0.85955	0.00142	0.86239	-0.01890	0.88129
BESP-540	0.85187	0.00130	0.85447	-0.01890	0.87337
BESP-544	0.85259	0.00127	0.85513	-0.01890	0.87403
BESP-560	0.84862	0.00124	0.85110	-0.01890	0.87000
BESP-600	0.83474	0.00139	0.83752	-0.01890	0.85642
BESP-616	0.82950	0.00142	0.83234	-0.01890	0.85124
BESP-700	0.80155	0.00138	0.80431	-0.01890	0.82321
BESP-705	0.79997	0.00126	0.80249	-0.01890	0.82139
BESP-800	0.76845	0.00111	0.77067	-0.01890	0.78957
8X8 Triangular Lattice				Max	0.90106
BETP-058	0.59213	0.00114	0.59441	-0.01890	0.61331
BETP-100	0.70837	0.00130	0.71097	-0.01890	0.72987
BETP-200	0.84175	0.00138	0.84451	-0.01890	0.86341
BETP-300	0.87842	0.00134	0.88110	-0.01890	0.90000
BETP-400	**0.88143**	0.00142	0.88427	-0.01890	**0.90317**
BETP-410	0.88016	0.00133	0.88282	-0.01890	0.90172
BETP-420	0.87735	0.00131	0.87997	-0.01890	0.89887
BETP-430	0.87640	0.00145	0.87930	-0.01890	0.89820
BETP-437	0.87684	0.00150	0.87984	-0.01890	0.89874
BETP-440	0.87543	0.00132	0.87807	-0.01890	0.89697
BETP-450	0.87666	0.00136	0.87938	-0.01890	0.89828
BETP-460	0.87355	0.00138	0.87631	-0.01890	0.89521
BETP-470	0.87339	0.00148	0.87635	-0.01890	0.89525
BETP-480	0.87311	0.00133	0.87577	-0.01890	0.89467
BETP-486	0.87116	0.00129	0.87374	-0.01890	0.89264
BETP-490	0.87220	0.00139	0.87498	-0.01890	0.89388
BETP-500	0.86766	0.00132	0.87030	-0.01890	0.88920
BETP-520	0.86415	0.00144	0.86703	-0.01890	0.88593
BETP-540	0.85538	0.00136	0.85810	-0.01890	0.87700
BETP-544	0.85481	0.00144	0.85769	-0.01890	0.87659

BESN-460	0.87006	0.00137	0.87280	-0.01890	0.89170
BESN-470	0.86695	0.00130	0.86955	-0.01890	0.88845
BESN-480	0.86540	0.00130	0.86800	-0.01890	0.88690
BESN-486	0.86538	0.00135	0.86808	-0.01890	0.88698
BESN-490	0.86210	0.00135	0.86480	-0.01890	0.88370
BESN-500	0.86349	0.00133	0.86615	-0.01890	0.88505
BESN-520	0.85814	0.00126	0.86066	-0.01890	0.87956
BESN-540	0.85273	0.00142	0.85557	-0.01890	0.87447
BESN-544	0.85236	0.00143	0.85522	-0.01890	0.87412
BESN-560	0.84689	0.00128	0.84945	-0.01890	0.86835
BESN-600	0.83340	0.00126	0.83592	-0.01890	0.85482
BESN-616	0.82904	0.00130	0.83164	-0.01890	0.85054
BESN-700	0.80032	0.00129	0.80290	-0.01890	0.82180
BESN-705	0.79777	0.00116	0.80009	-0.01890	0.81899
BESN-800	0.76865	0.00132	0.77129	-0.01890	0.79019
8X8 Triangular Lattice				Max	0.89721
BETN-058	0.58271	0.00117	0.58505	-0.01890	0.60395
BETN-100	0.69924	0.00121	0.70166	-0.01890	0.72056
BETN-200	0.83533	0.00137	0.83807	-0.01890	0.85697
BETN-300	0.87525	0.00137	0.87799	-0.01890	0.89689
BETN-400	**0.87932**	0.00131	0.88194	-0.01890	**0.90084**
BETN-410	0.87583	0.00134	0.87851	-0.01890	0.89741
BETN-420	0.87769	0.00142	0.88053	-0.01890	0.89943
BETN-430	0.87443	0.00145	0.87733	-0.01890	0.89623
BETN-437	0.87652	0.00144	0.87940	-0.01890	0.89830
BETN-440	0.87611	0.00129	0.87869	-0.01890	0.89759
BETN-450	0.86851	0.00131	0.87113	-0.01890	0.89003
BETN-460	0.87265	0.00141	0.87547	-0.01890	0.89437
BETN-470	0.86997	0.00139	0.87275	-0.01890	0.89165
BETN-480	0.86712	0.00138	0.86988	-0.01890	0.88878
BETN-486	0.86759	0.00131	0.87021	-0.01890	0.88911
BETN-490	0.86564	0.00137	0.86838	-0.01890	0.88728
BETN-500	0.86593	0.00146	0.86885	-0.01890	0.88775
BETN-520	0.86334	0.00134	0.86602	-0.01890	0.88492
BETN-540	0.85474	0.00129	0.85732	-0.01890	0.87622
BETN-544	0.85290	0.00128	0.85546	-0.01890	0.87436

BETP-560	0.85006	0.00143	0.85292	-0.01890	0.87182	BETN-560	0.84837	0.00137	0.85111	-0.01890	0.87001
BETP-600	0.83689	0.00136	0.83961	-0.01890	0.85851	BETN-600	0.83757	0.00118	0.83993	-0.01890	0.85883
BETP-616	0.83288	0.00127	0.83542	-0.01890	0.85432	BETN-616	0.82811	0.00133	0.83077	-0.01890	0.84967
BETP-700	0.80646	0.00125	0.80896	-0.01890	0.82786	BETN-700	0.80417	0.00109	0.80635	-0.01890	0.82525
BETP-705	0.80335	0.00133	0.80601	-0.01890	0.82491	BETN-705	0.80160	0.00142	0.80444	-0.01890	0.82334
BETP-800	0.77430	0.00116	0.77662	-0.01890	0.79552	BETN-800	0.77280	0.00123	0.77526	-0.01890	0.79416
				Max	0.90317					Max	0.90084
				Max VFO	0.91810					Max VFO	0.91620

Table 6.19 –Listing of GEMER Calculations for Damaged Arrays 55Kg and 53 Kg Heterogeneous Cases

Name	KEFF	SIGMA	K+2S	Bias	K+2S - B	Name	KEFF	SIGMA	K+2S	Bias	K+2S - B
55 KGs Accident Case with Overlap						53 KGs Accident Case with Overlap					
	17X17 Square Lattice						17X17 Square Lattice				
SS55-058	0.55155	0.00108	0.55371	-0.01890	0.57261	SS53-058	0.54163	0.00116	0.54395	-0.01890	0.56285
SS55-100	0.67872	0.00142	0.68156	-0.01890	0.70046	SS53-100	0.67038	0.00138	0.67314	-0.01890	0.69204
SS55-200	0.83886	0.00133	0.84152	-0.01890	0.86042	SS53-200	0.83156	0.00141	0.83438	-0.01890	0.85328
SS55-300	0.89887	0.00141	0.90169	-0.01890	0.92059	SS53-300	0.89393	0.00134	0.89661	-0.01890	0.91551
SS55-400	0.91994	0.00130	0.92254	-0.01890	0.94144	SS53-400	0.91291	0.00147	0.91585	-0.01890	0.93475
SS55-410	0.91913	0.00135	0.92183	-0.01890	0.94073	SS53-410	0.91448	0.00133	0.91714	-0.01890	0.93604
SS55-420	0.92427	0.00132	0.92691	-0.01890	0.94581	SS53-420	0.91418	0.00145	0.91708	-0.01890	0.93598
SS55-430	0.92572	0.00128	0.92828	-0.01890	0.94718	SS53-430	0.91643	0.00128	0.91899	-0.01890	0.93789
SS55-437	0.92261	0.00133	0.92527	-0.01890	0.94417	SS53-437	0.91556	0.00138	0.91832	-0.01890	0.93722
SS55-440	0.92302	0.00145	0.92592	-0.01890	0.94482	SS53-440	0.91765	0.00143	0.92051	-0.01890	0.93941
SS55-450	0.92574	0.00139	0.92852	-0.01890	0.94742	SS53-450	0.91854	0.00142	0.92138	-0.01890	0.94028
SS55-460	0.92537	0.00123	0.92783	-0.01890	0.94673	SS53-460	0.92134	0.00147	0.92428	-0.01890	0.94318
SS55-470	**0.92778**	0.00128	0.93034	-0.01890	**0.94924**	SS53-470	0.91849	0.00126	0.92101	-0.01890	0.93991
SS55-480	0.92684	0.00027	0.92739	-0.01890	0.94629	SS53-480	0.92185	0.00138	0.92461	-0.01890	0.94351
SS55-486	0.92707	0.00148	0.93003	-0.01890	0.94893	SS53-486	0.92163	0.00136	0.92435	-0.01890	0.94325
SS55-490	0.92454	0.00143	0.92740	-0.01890	0.94630	SS53-490	0.92080	0.00131	0.92342	-0.01890	0.94232
SS55-500	0.92627	0.00130	0.92887	-0.01890	0.94777	SS53-500	0.91871	0.00141	0.92153	-0.01890	0.94043
SS55-520	0.92159	0.00143	0.92445	-0.01890	0.94335	SS53-520	**0.92239**	0.00143	0.92525	-0.01890	**0.94415**
SS55-540	0.91496	0.00123	0.91742	-0.01890	0.93632	SS53-540	0.91253	0.00131	0.91515	-0.01890	0.93405
SS55-544	0.91192	0.00134	0.91460	-0.01890	0.93350	SS53-544	0.91412	0.00129	0.91670	-0.01890	0.93560
SS55-560	0.90772	0.00131	0.91034	-0.01890	0.92924	SS53-560	0.90784	0.00127	0.91038	-0.01890	0.92928
SS55-600	0.89574	0.00146	0.89866	-0.01890	0.91756	SS53-600	0.89635	0.00137	0.89909	-0.01890	0.91799
SS55-616	0.89321	0.00136	0.89593	-0.01890	0.91483	SS53-616	0.89146	0.00127	0.89400	-0.01890	0.91290
SS55-700	0.86142	0.00137	0.86416	-0.01890	0.88306	SS53-700	0.86447	0.00120	0.86687	-0.01890	0.88577
SS55-705	0.86547	0.00117	0.86781	-0.01890	0.88671	SS53-705	0.86678	0.00134	0.86946	-0.01890	0.88836
SS55-800	0.84312	0.00133	0.84578	-0.01890	0.86468	SS53-800	0.84267	0.00114	0.84495	-0.01890	0.86385
	17X17 Triangular Lattice			Max	0.94924		17X17 Triangular Lattice			Max	0.94415
ST55-058	0.55079	0.00117	0.55313	-0.01890	0.57203	ST53-058	0.53996	0.00111	0.54218	-0.01890	0.56108
ST55-100	0.67799	0.00133	0.68065	-0.01890	0.69955	ST53-100	0.66850	0.00121	0.67092	-0.01890	0.68982
ST55-200	0.83787	0.00150	0.84087	-0.01890	0.85977	ST53-200	0.83255	0.00140	0.83535	-0.01890	0.85425
ST55-300	0.90249	0.00142	0.90533	-0.01890	0.92423	ST53-300	0.89419	0.00144	0.89707	-0.01890	0.91597

ST55-400	0.92041	0.00140	0.92321	-0.01890	0.94211	ST53-400	0.91467	0.00133	0.91733	-0.01890	0.93623
ST55-410	0.92383	0.00146	0.92675	-0.01890	0.94565	ST53-410	0.92043	0.00149	0.92341	-0.01890	0.94231
ST55-420	0.92471	0.00122	0.92715	-0.01890	0.94605	ST53-420	0.92103	0.00136	0.92375	-0.01890	0.94265
ST55-430	0.92301	0.00133	0.92567	-0.01890	0.94457	ST53-430	0.92089	0.00137	0.92363	-0.01890	0.94253
ST55-437	**0.92766**	0.00118	0.93002	-0.01890	**0.94892**	ST53-437	0.91926	0.00128	0.92182	-0.01890	0.94072
ST55-440	0.92573	0.00139	0.92851	-0.01890	0.94741	ST53-440	0.91979	0.00144	0.92267	-0.01890	0.94157
ST55-450	0.92466	0.00140	0.92746	-0.01890	0.94636	ST53-450	0.92023	0.00124	0.92271	-0.01890	0.94161
ST55-460	0.92306	0.00136	0.92578	-0.01890	0.94468	ST53-460	**0.92417**	0.00128	0.92673	-0.01890	**0.94563**
ST55-470	0.92535	0.00148	0.92831	-0.01890	0.94721	ST53-470	0.91889	0.00133	0.92155	-0.01890	0.94045
ST55-480	0.92635	0.00132	0.92899	-0.01890	0.94789	ST53-480	0.91698	0.00131	0.91960	-0.01890	0.93850
ST55-486	0.92378	0.00132	0.92642	-0.01890	0.94532	ST53-486	0.91792	0.00142	0.92076	-0.01890	0.93966
ST55-490	0.92645	0.00040	0.92725	-0.01890	0.94615	ST53-490	0.92008	0.00148	0.92304	-0.01890	0.94194
ST55-500	0.92189	0.00130	0.92449	-0.01890	0.94339	ST53-500	0.91733	0.00133	0.91999	-0.01890	0.93889
ST55-520	0.91365	0.00129	0.91623	-0.01890	0.93513	ST53-520	0.91467	0.00131	0.91729	-0.01890	0.93619
ST55-540	0.90665	0.00133	0.90931	-0.01890	0.92821	ST53-540	0.91046	0.00136	0.91318	-0.01890	0.93208
ST55-544	0.90885	0.00127	0.91139	-0.01890	0.93029	ST53-544	0.90893	0.00135	0.91163	-0.01890	0.93053
ST55-560	0.90504	0.00141	0.90786	-0.01890	0.92676	ST53-560	0.90733	0.00145	0.91023	-0.01890	0.92913
ST55-600	0.89998	0.00121	0.90240	-0.01890	0.92130	ST53-600	0.89888	0.00121	0.90130	-0.01890	0.92020
ST55-616	0.89815	0.00126	0.90067	-0.01890	0.91957	ST53-616	0.89505	0.00126	0.89757	-0.01890	0.91647
ST55-700	0.86578	0.00126	0.86830	-0.01890	0.88720	ST53-700	0.86549	0.00130	0.86809	-0.01890	0.88699
ST55-705	0.86445	0.00130	0.86705	-0.01890	0.88595	ST53-705	0.86699	0.00123	0.86945	-0.01890	0.88835
ST55-800	0.83487	0.00127	0.83741	-0.01890	0.85631	ST53-800	0.83827	0.00132	0.84091	-0.01890	0.85981
	10X10 Square Lattice			Max	0.94892		10X10 Square Lattice			Max	0.94563
TS55-058	0.55002	0.00104	0.55210	-0.01890	0.57100	TS53-058	0.54191	0.00109	0.54409	-0.01890	0.56299
TS55-100	0.68425	0.00141	0.68707	-0.01890	0.70597	TS53-100	0.67380	0.00124	0.67628	-0.01890	0.69518
TS55-200	0.83992	0.00144	0.84280	-0.01890	0.86170	TS53-200	0.83618	0.00149	0.83916	-0.01890	0.85806
TS55-300	0.89697	0.00139	0.89975	-0.01890	0.91865	TS53-300	0.89221	0.00129	0.89479	-0.01890	0.91369
TS55-400	0.91570	0.00121	0.91812	-0.01890	0.93702	TS53-400	0.90845	0.00129	0.91103	-0.01890	0.92993
TS55-410	0.91447	0.00138	0.91723	-0.01890	0.93613	TS53-410	0.91139	0.00137	0.91413	-0.01890	0.93303
TS55-420	0.91783	0.00133	0.92049	-0.01890	0.93939	TS53-420	0.90921	0.00129	0.91179	-0.01890	0.93069
TS55-430	0.91614	0.00139	0.91892	-0.01890	0.93782	TS53-430	0.91178	0.00138	0.91454	-0.01890	0.93344
TS55-437	0.91764	0.00138	0.92040	-0.01890	0.93930	TS53-437	0.91146	0.00124	0.91394	-0.01890	0.93284
TS55-440	0.91798	0.00132	0.92062	-0.01890	0.93952	TS53-440	0.91241	0.00144	0.91529	-0.01890	0.93419
TS55-450	0.91610	0.00131	0.91872	-0.01890	0.93762	TS53-450	0.90989	0.00126	0.91241	-0.01890	0.93131
TS55-460	**0.91822**	0.00144	0.92110	-0.01890	**0.94000**	TS53-460	**0.91475**	0.00133	0.91741	-0.01890	**0.93631**
TS55-470	0.91681	0.00131	0.91943	-0.01890	0.93833	TS53-470	0.91247	0.00133	0.91513	-0.01890	0.93403

TS55-480	0.91757	0.00129	0.92015	-0.01890	0.93905	TS53-480	0.90935	0.00138	0.91211	-0.01890	0.93101
TS55-486	0.91580	0.00135	0.91850	-0.01890	0.93740	TS53-486	0.91333	0.00132	0.91597	-0.01890	0.93487
TS55-490	0.91250	0.00142	0.91534	-0.01890	0.93424	TS53-490	0.91063	0.00154	0.91371	-0.01890	0.93261
TS55-500	0.91294	0.00129	0.91552	-0.01890	0.93442	TS53-500	0.91261	0.00148	0.91557	-0.01890	0.93447
TS55-520	0.90682	0.00129	0.90940	-0.01890	0.92830	TS53-520	0.90724	0.00121	0.90966	-0.01890	0.92856
TS55-540	0.90386	0.00134	0.90654	-0.01890	0.92544	TS53-540	0.90403	0.00122	0.90647	-0.01890	0.92537
TS55-544	0.90728	0.00131	0.90990	-0.01890	0.92880	TS53-544	0.90097	0.00120	0.90337	-0.01890	0.92227
TS55-560	0.89937	0.00134	0.90205	-0.01890	0.92095	TS53-560	0.90050	0.00132	0.90314	-0.01890	0.92204
TS55-600	0.88960	0.00128	0.89216	-0.01890	0.91106	TS53-600	0.89120	0.00136	0.89392	-0.01890	0.91282
TS55-616	0.88297	0.00133	0.88563	-0.01890	0.90453	TS53-616	0.88222	0.00132	0.88486	-0.01890	0.90376
TS55-700	0.84668	0.00133	0.84934	-0.01890	0.86824	TS53-700	0.84873	0.00118	0.85109	-0.01890	0.86999
TS55-705	0.84200	0.00133	0.84466	-0.01890	0.86356	TS53-705	0.84614	0.00130	0.84874	-0.01890	0.86764
TS55-800	0.82579	0.00129	0.82837	-0.01890	0.84727	TS53-800	0.82584	0.00117	0.82818	-0.01890	0.84708
	10X10 Triangular Lattice			Max	0.94000		10X10 Triangular Lattice			Max	0.93631
TT55-058	0.55210	0.00113	0.55436	-0.01890	0.57326	TT53-058	0.54057	0.00124	0.54305	-0.01890	0.56195
TT55-100	0.67954	0.00122	0.68198	-0.01890	0.70088	TT53-100	0.67548	0.00129	0.67806	-0.01890	0.69696
TT55-200	0.84317	0.00127	0.84571	-0.01890	0.86461	TT53-200	0.83538	0.00144	0.83826	-0.01890	0.85716
TT55-300	0.90077	0.00131	0.90339	-0.01890	0.92229	TT53-300	0.89167	0.00133	0.89433	-0.01890	0.91323
TT55-400	0.91759	0.00131	0.92021	-0.01890	0.93911	TT53-400	0.90968	0.00138	0.91244	-0.01890	0.93134
TT55-410	0.91750	0.00120	0.91990	-0.01890	0.93880	TT53-410	0.91259	0.00146	0.91551	-0.01890	0.93441
TT55-420	0.91796	0.00141	0.92078	-0.01890	0.93968	TT53-420	0.90812	0.00127	0.91066	-0.01890	0.92956
TT55-430	0.91742	0.00145	0.92032	-0.01890	0.93922	TT53-430	0.91473	0.00143	0.91759	-0.01890	0.93649
TT55-437	0.91711	0.00144	0.91999	-0.01890	0.93889	TT53-437	0.90937	0.00139	0.91215	-0.01890	0.93105
TT55-440	0.91703	0.00141	0.91985	-0.01890	0.93875	TT53-440	**0.91582**	0.00132	0.91846	-0.01890	**0.93736**
TT55-450	**0.92071**	0.00138	0.92347	-0.01890	**0.94237**	TT53-450	0.91356	0.00121	0.91598	-0.01890	0.93488
TT55-460	0.91867	0.00118	0.92103	-0.01890	0.93993	TT53-460	0.91171	0.00144	0.91459	-0.01890	0.93349
TT55-470	0.91624	0.00127	0.91878	-0.01890	0.93768	TT53-470	0.91277	0.00131	0.91539	-0.01890	0.93429
TT55-480	0.91570	0.00140	0.91850	-0.01890	0.93740	TT53-480	0.91180	0.00135	0.91450	-0.01890	0.93340
TT55-486	0.91735	0.00129	0.91993	-0.01890	0.93883	TT53-486	0.91089	0.00122	0.91333	-0.01890	0.93223
TT55-490	0.91664	0.00132	0.91928	-0.01890	0.93818	TT53-490	0.91436	0.00147	0.91730	-0.01890	0.93620
TT55-500	0.91769	0.00129	0.92027	-0.01890	0.93917	TT53-500	0.91076	0.00137	0.91350	-0.01890	0.93240
TT55-520	0.90962	0.00135	0.91232	-0.01890	0.93122	TT53-520	0.90707	0.00124	0.90955	-0.01890	0.92845
TT55-540	0.90183	0.00133	0.90449	-0.01890	0.92339	TT53-540	0.90128	0.00133	0.90394	-0.01890	0.92284
TT55-544	0.89689	0.00137	0.89963	-0.01890	0.91853	TT53-544	0.90105	0.00132	0.90369	-0.01890	0.92259
TT55-560	0.88939	0.00130	0.89199	-0.01890	0.91089	TT53-560	0.89251	0.00130	0.89511	-0.01890	0.91401
TT55-600	0.88336	0.00129	0.88594	-0.01890	0.90484	TT53-600	0.88214	0.00116	0.88446	-0.01890	0.90336

TT55-616	0.87921	0.00123	0.88167	-0.01890	0.90057	TT53-616	0.87844	0.00136	0.88116	-0.01890	0.90006
TT55-700	0.86261	0.00129	0.86519	-0.01890	0.88409	TT53-700	0.86128	0.00133	0.86394	-0.01890	0.88284
TT55-705	0.85449	0.00127	0.85703	-0.01890	0.87593	TT53-705	0.85849	0.00137	0.86123	-0.01890	0.88013
TT55-800	0.81805	0.00116	0.82037	-0.01890	0.83927	TT53-800	0.82163	0.00121	0.82405	-0.01890	0.84295
	9X9 Square Lattice			Max	0.94237		9X9 Square Lattice			Max	0.93736
NS55-058	0.55231	0.00109	0.55449	-0.01890	0.57339	NS53-058	0.54266	0.00114	0.54494	-0.01890	0.56384
NS55-100	0.68417	0.00133	0.68683	-0.01890	0.70573	NS53-100	0.67369	0.00128	0.67625	-0.01890	0.69515
NS55-200	0.84246	0.00144	0.84534	-0.01890	0.86424	NS53-200	0.83030	0.00153	0.83336	-0.01890	0.85226
NS55-300	0.89471	0.00142	0.89755	-0.01890	0.91645	NS53-300	0.89279	0.00136	0.89551	-0.01890	0.91441
NS55-400	0.91182	0.00141	0.91464	-0.01890	0.93354	NS53-400	0.90669	0.00125	0.90919	-0.01890	0.92809
NS55-410	0.90814	0.00130	0.91074	-0.01890	0.92964	NS53-410	0.90746	0.00130	0.91006	-0.01890	0.92896
NS55-420	0.91099	0.00143	0.91385	-0.01890	0.93275	NS53-420	0.90804	0.00136	0.91076	-0.01890	0.92966
NS55-430	0.90992	0.00125	0.91242	-0.01890	0.93132	NS53-430	0.90936	0.00137	0.91210	-0.01890	0.93100
NS55-437	0.91142	0.00136	0.91414	-0.01890	0.93304	NS53-437	0.90760	0.00130	0.91020	-0.01890	0.92910
NS55-440	0.91216	0.00124	0.91464	-0.01890	0.93354	NS53-440	**0.90949**	0.00138	0.91225	-0.01890	**0.93115**
NS55-450	0.91320	0.00135	0.91590	-0.01890	0.93480	NS53-450	0.90782	0.00133	0.91048	-0.01890	0.92938
NS55-460	**0.91434**	0.00139	0.91712	-0.01890	**0.93602**	NS53-460	0.90540	0.00136	0.90812	-0.01890	0.92702
NS55-470	0.91196	0.00140	0.91476	-0.01890	0.93366	NS53-470	0.90776	0.00126	0.91028	-0.01890	0.92918
NS55-480	0.91138	0.00132	0.91402	-0.01890	0.93292	NS53-480	0.90238	0.00136	0.90510	-0.01890	0.92400
NS55-486	0.90978	0.00131	0.91240	-0.01890	0.93130	NS53-486	0.90514	0.00136	0.90786	-0.01890	0.92676
NS55-490	0.91240	0.00141	0.91522	-0.01890	0.93412	NS53-490	0.90607	0.00138	0.90883	-0.01890	0.92773
NS55-500	0.90991	0.00136	0.91263	-0.01890	0.93153	NS53-500	0.90268	0.00129	0.90526	-0.01890	0.92416
NS55-520	0.90356	0.00125	0.90606	-0.01890	0.92496	NS53-520	0.90408	0.00135	0.90678	-0.01890	0.92568
NS55-540	0.89595	0.00121	0.89837	-0.01890	0.91727	NS53-540	0.89325	0.00132	0.89589	-0.01890	0.91479
NS55-544	0.88982	0.00114	0.89210	-0.01890	0.91100	NS53-544	0.89232	0.00138	0.89508	-0.01890	0.91398
NS55-560	0.88701	0.00142	0.88985	-0.01890	0.90875	NS53-560	0.88397	0.00124	0.88645	-0.01890	0.90535
NS55-600	0.86922	0.00132	0.87186	-0.01890	0.89076	NS53-600	0.86833	0.00132	0.87097	-0.01890	0.88987
NS55-616	0.86191	0.00133	0.86457	-0.01890	0.88347	NS53-616	0.86534	0.00128	0.86790	-0.01890	0.88680
NS55-700	0.84986	0.00132	0.85250	-0.01890	0.87140	NS53-700	0.84982	0.00126	0.85234	-0.01890	0.87124
NS55-705	0.84628	0.00121	0.84870	-0.01890	0.86760	NS53-705	0.84846	0.00114	0.85074	-0.01890	0.86964
NS55-800	0.81371	0.00129	0.81629	-0.01890	0.83519	NS53-800	0.81251	0.00137	0.81525	-0.01890	0.83415
	9X9 Triangular Lattice			Max	0.93602		9X9 Triangular Lattice			Max	0.93115
NT55-058	0.54875	0.00109	0.55093	-0.01890	0.56983	NT53-058	0.54409	0.00122	0.54653	-0.01890	0.56543
NT55-100	0.68549	0.00131	0.68811	-0.01890	0.70701	NT53-100	0.67508	0.00136	0.67780	-0.01890	0.69670
NT55-200	0.83973	0.00140	0.84253	-0.01890	0.86143	NT53-200	0.83496	0.00135	0.83766	-0.01890	0.85656
NT55-300	0.89734	0.00145	0.90024	-0.01890	0.91914	NT53-300	0.88913	0.00145	0.89203	-0.01890	0.91093

NT55-400	0.90861	0.00136	0.91133	-0.01890	0.93023	NT53-400	0.90420	0.00141	0.90702	-0.01890	0.92592
NT55-410	0.91049	0.00138	0.91325	-0.01890	0.93215	NT53-410	0.90662	0.00124	0.90910	-0.01890	0.92800
NT55-420	0.91284	0.00142	0.91568	-0.01890	0.93458	NT53-420	0.90696	0.00146	0.90988	-0.01890	0.92878
NT55-430	**0.91469**	0.00135	0.91739	-0.01890	**0.93629**	NT53-430	0.90401	0.00134	0.90669	-0.01890	0.92559
NT55-437	0.91307	0.00132	0.91571	-0.01890	0.93461	NT53-437	0.90810	0.00136	0.91082	-0.01890	0.92972
NT55-440	0.91155	0.00134	0.91423	-0.01890	0.93313	NT53-440	0.90489	0.00131	0.90751	-0.01890	0.92641
NT55-450	0.91355	0.00139	0.91633	-0.01890	0.93523	NT53-450	0.90548	0.00129	0.90806	-0.01890	0.92696
NT55-460	0.91409	0.00132	0.91673	-0.01890	0.93563	NT53-460	0.90779	0.00137	0.91053	-0.01890	0.92943
NT55-470	0.91449	0.00144	0.91737	-0.01890	0.93627	NT53-470	0.90652	0.00144	0.90940	-0.01890	0.92830
NT55-480	0.91078	0.00142	0.91362	-0.01890	0.93252	NT53-480	0.90671	0.00134	0.90939	-0.01890	0.92829
NT55-486	0.91286	0.00119	0.91524	-0.01890	0.93414	NT53-486	0.90779	0.00142	0.91063	-0.01890	0.92953
NT55-490	0.91206	0.00136	0.91478	-0.01890	0.93368	NT53-490	0.90693	0.00121	0.90935	-0.01890	0.92825
NT55-500	0.90554	0.00134	0.90822	-0.01890	0.92712	NT53-500	**0.90879**	0.00128	0.91135	-0.01890	**0.93025**
NT55-520	0.90613	0.00145	0.90903	-0.01890	0.92793	NT53-520	0.90454	0.00132	0.90718	-0.01890	0.92608
NT55-540	0.90143	0.00125	0.90393	-0.01890	0.92283	NT53-540	0.90577	0.00134	0.90845	-0.01890	0.92735
NT55-544	0.90314	0.00134	0.90582	-0.01890	0.92472	NT53-544	0.90067	0.00139	0.90345	-0.01890	0.92235
NT55-560	0.89811	0.00124	0.90059	-0.01890	0.91949	NT53-560	0.89524	0.00129	0.89782	-0.01890	0.91672
NT55-600	0.87734	0.00124	0.87982	-0.01890	0.89872	NT53-600	0.87990	0.00129	0.88248	-0.01890	0.90138
NT55-616	0.87316	0.00121	0.87558	-0.01890	0.89448	NT53-616	0.86952	0.00130	0.87212	-0.01890	0.89102
NT55-700	0.83674	0.00132	0.83938	-0.01890	0.85828	NT53-700	0.83766	0.00120	0.84006	-0.01890	0.85896
NT55-705	0.83475	0.00134	0.83743	-0.01890	0.85633	NT53-705	0.83823	0.00128	0.84079	-0.01890	0.85969
NT55-800	0.81256	0.00127	0.81510	-0.01890	0.83400	NT53-800	0.81514	0.00124	0.81762	-0.01890	0.83652
	8X8 Square Lattice			Max	0.93629		8X8 Square Lattice			Max	0.93025
ES55-058	0.55119	0.00120	0.55359	-0.01890	0.57249	ES53-058	0.54298	0.00103	0.54504	-0.01890	0.56394
ES55-100	0.68494	0.00134	0.68762	-0.01890	0.70652	ES53-100	0.67585	0.00124	0.67833	-0.01890	0.69723
ES55-200	0.84361	0.00150	0.84661	-0.01890	0.86551	ES53-200	0.83593	0.00149	0.83891	-0.01890	0.85781
ES55-300	0.89473	0.00139	0.89751	-0.01890	0.91641	ES53-300	0.88740	0.00142	0.89024	-0.01890	0.90914
ES55-400	0.90482	0.00127	0.90736	-0.01890	0.92626	ES53-400	0.89811	0.00135	0.90081	-0.01890	0.91971
ES55-410	**0.90675**	0.00122	0.90919	-0.01890	**0.92809**	ES53-410	0.89811	0.00129	0.90069	-0.01890	0.91959
ES55-420	0.90069	0.00143	0.90355	-0.01890	0.92245	ES53-420	0.89740	0.00132	0.90004	-0.01890	0.91894
ES55-430	0.90390	0.00130	0.90650	-0.01890	0.92540	ES53-430	**0.90091**	0.00123	0.90337	-0.01890	**0.92227**
ES55-437	0.90393	0.00132	0.90657	-0.01890	0.92547	ES53-437	0.89829	0.00127	0.90083	-0.01890	0.91973
ES55-440	0.90404	0.00136	0.90676	-0.01890	0.92566	ES53-440	0.89815	0.00132	0.90079	-0.01890	0.91969
ES55-450	0.90076	0.00137	0.90350	-0.01890	0.92240	ES53-450	0.89805	0.00130	0.90065	-0.01890	0.91955
ES55-460	0.90180	0.00130	0.90440	-0.01890	0.92330	ES53-460	0.90026	0.00137	0.90300	-0.01890	0.92190
ES55-470	0.90308	0.00126	0.90560	-0.01890	0.92450	ES53-470	0.89662	0.00135	0.89932	-0.01890	0.91822

ES55-480	0.89865	0.00135	0.90135	-0.01890	0.92025	ES53-480	0.89926	0.00135	0.90196	-0.01890	0.92086
ES55-486	0.89596	0.00121	0.89838	-0.01890	0.91728	ES53-486	0.89857	0.00137	0.90131	-0.01890	0.92021
ES55-490	0.89779	0.00132	0.90043	-0.01890	0.91933	ES53-490	0.89481	0.00135	0.89751	-0.01890	0.91641
ES55-500	0.89328	0.00130	0.89588	-0.01890	0.91478	ES53-500	0.89433	0.00128	0.89689	-0.01890	0.91579
ES55-520	0.88961	0.00125	0.89211	-0.01890	0.91101	ES53-520	0.89235	0.00123	0.89481	-0.01890	0.91371
ES55-540	0.88642	0.00124	0.88890	-0.01890	0.90780	ES53-540	0.88675	0.00131	0.88937	-0.01890	0.90827
ES55-544	0.89090	0.00119	0.89328	-0.01890	0.91218	ES53-544	0.88796	0.00127	0.89050	-0.01890	0.90940
ES55-560	0.88449	0.00135	0.88719	-0.01890	0.90609	ES53-560	0.88324	0.00114	0.88552	-0.01890	0.90442
ES55-600	0.87203	0.00133	0.87469	-0.01890	0.89359	ES53-600	0.87050	0.00127	0.87304	-0.01890	0.89194
ES55-616	0.86633	0.00121	0.86875	-0.01890	0.88765	ES53-616	0.86384	0.00134	0.86652	-0.01890	0.88542
ES55-700	0.82896	0.00129	0.83154	-0.01890	0.85044	ES53-700	0.82947	0.00124	0.83195	-0.01890	0.85085
ES55-705	0.83020	0.00124	0.83268	-0.01890	0.85158	ES53-705	0.82918	0.00124	0.83166	-0.01890	0.85056
ES55-800	0.78910	0.00129	0.79168	-0.01890	0.81058	ES53-800	0.79452	0.00134	0.79720	-0.01890	0.81610
	8X8 Triangular Lattice			Max	0.92809		8X8 Triangular Lattice			Max	0.92227
ET55-058	0.55425	0.00119	0.55663	-0.01890	0.57553	ET53-058	0.54549	0.00120	0.54789	-0.01890	0.56679
ET55-100	0.68374	0.00133	0.68640	-0.01890	0.70530	ET53-100	0.67405	0.00125	0.67655	-0.01890	0.69545
ET55-200	0.83874	0.00130	0.84134	-0.01890	0.86024	ET53-200	0.83264	0.00136	0.83536	-0.01890	0.85426
ET55-300	0.89471	0.00137	0.89745	-0.01890	0.91635	ET53-300	0.88582	0.00129	0.88840	-0.01890	0.90730
ET55-400	0.90736	0.00142	0.91020	-0.01890	0.92910	ET53-400	0.90341	0.00137	0.90615	-0.01890	0.92505
ET55-410	0.90718	0.00151	0.91020	-0.01890	0.92910	ET53-410	0.90039	0.00133	0.90305	-0.01890	0.92195
ET55-420	0.90682	0.00131	0.90944	-0.01890	0.92834	ET53-420	**0.90444**	0.00133	0.90710	-0.01890	**0.92600**
ET55-430	0.90668	0.00132	0.90932	-0.01890	0.92822	ET53-430	0.90272	0.00128	0.90528	-0.01890	0.92418
ET55-437	0.90666	0.00132	0.90930	-0.01890	0.92820	ET53-437	0.90261	0.00140	0.90541	-0.01890	0.92431
ET55-440	0.90689	0.00127	0.90943	-0.01890	0.92833	ET53-440	0.89811	0.00129	0.90069	-0.01890	0.91959
ET55-450	**0.90882**	0.00139	0.91160	-0.01890	**0.93050**	ET53-450	0.90019	0.00122	0.90263	-0.01890	0.92153
ET55-460	0.90351	0.00133	0.90617	-0.01890	0.92507	ET53-460	0.89937	0.00142	0.90221	-0.01890	0.92111
ET55-470	0.90607	0.00128	0.90863	-0.01890	0.92753	ET53-470	0.89846	0.00137	0.90120	-0.01890	0.92010
ET55-480	0.90168	0.00137	0.90442	-0.01890	0.92332	ET53-480	0.89988	0.00132	0.90252	-0.01890	0.92142
ET55-486	0.90285	0.00128	0.90541	-0.01890	0.92431	ET53-486	0.89916	0.00121	0.90158	-0.01890	0.92048
ET55-490	0.90150	0.00131	0.90412	-0.01890	0.92302	ET53-490	0.89434	0.00127	0.89688	-0.01890	0.91578
ET55-500	0.89914	0.00135	0.90184	-0.01890	0.92074	ET53-500	0.89392	0.00140	0.89672	-0.01890	0.91562
ET55-520	0.88825	0.00131	0.89087	-0.01890	0.90977	ET53-520	0.88848	0.00135	0.89118	-0.01890	0.91008
ET55-540	0.88223	0.00127	0.88477	-0.01890	0.90367	ET53-540	0.87958	0.00127	0.88212	-0.01890	0.90102
ET55-544	0.87975	0.00144	0.88263	-0.01890	0.90153	ET53-544	0.87973	0.00135	0.88243	-0.01890	0.90133
ET55-560	0.87646	0.00119	0.87884	-0.01890	0.89774	ET53-560	0.87629	0.00121	0.87871	-0.01890	0.89761
ET55-600	0.86388	0.00122	0.86632	-0.01890	0.88522	ET53-600	0.86246	0.00134	0.86514	-0.01890	0.88404

ET55-616	0.86419	0.00126	0.86671	-0.01890	0.88561	ET53-616	0.86131	0.00123	0.86377	-0.01890	0.88267
ET55-700	0.83771	0.00125	0.84021	-0.01890	0.85911	ET53-700	0.83805	0.00123	0.84051	-0.01890	0.85941
ET55-705	0.83472	0.00124	0.83720	-0.01890	0.85610	ET53-705	0.83424	0.00126	0.83676	-0.01890	0.85566
ET55-800	0.80525	0.00114	0.80753	-0.01890	0.82643	ET53-800	0.80103	0.00125	0.80353	-0.01890	0.82243
55 KGs Accident Case without Overlap				Max	0.93050	53 KGs Accident Case without Overlap				Max	0.92600
	17X17 Square Lattice			Max OL	0.94924		17X17 Square Lattice			Max OL	0.94563
OSSP-058	0.56307	0.00112	0.56531	-0.01890	0.58421	OSSN-058	0.55328	0.00111	0.55550	-0.01890	0.57440
OSSP-100	0.69287	0.00136	0.69559	-0.01890	0.71449	OSSN-100	0.68136	0.00138	0.68412	-0.01890	0.70302
OSSP-200	0.84394	0.00142	0.84678	-0.01890	0.86568	OSSN-200	0.83584	0.00145	0.83874	-0.01890	0.85764
OSSP-300	0.89907	0.00139	0.90185	-0.01890	0.92075	OSSN-300	0.88855	0.00150	0.89155	-0.01890	0.91045
OSSP-400	0.91937	0.00149	0.92235	-0.01890	0.94125	OSSN-400	0.91008	0.00140	0.91288	-0.01890	0.93178
OSSP-410	0.92177	0.00139	0.92455	-0.01890	0.94345	OSSN-410	0.91631	0.00133	0.91897	-0.01890	0.93787
OSSP-420	0.91939	0.00137	0.92213	-0.01890	0.94103	OSSN-420	0.91658	0.00139	0.91936	-0.01890	0.93826
OSSP-430	0.92607	0.00131	0.92869	-0.01890	**0.94759**	OSSN-430	0.91781	0.00142	0.92065	-0.01890	0.93955
OSSP-437	0.92035	0.00134	0.92303	-0.01890	0.94193	OSSN-437	0.91562	0.00134	0.91830	-0.01890	0.93720
OSSP-440	0.92193	0.00139	0.92471	-0.01890	0.94361	OSSN-440	0.91652	0.00143	0.91938	-0.01890	0.93828
OSSP-450	0.92537	0.00133	0.92803	-0.01890	0.94693	OSSN-450	0.91797	0.00143	0.92083	-0.01890	0.93973
OSSP-460	0.92316	0.00131	0.92578	-0.01890	0.94468	OSSN-460	0.92146	0.00139	0.92424	-0.01890	0.94314
OSSP-470	0.92635	0.00045	0.92724	-0.01890	0.94614	OSSN-470	0.92041	0.00133	0.92307	-0.01890	0.94197
OSSP-480	**0.92670**	0.00046	0.92761	-0.01890	0.94651	OSSN-480	**0.92213**	0.00140	0.92493	-0.01890	**0.94383**
OSSP-486	0.91449	0.00125	0.91699	-0.01890	0.93589	OSSN-486	0.91465	0.00141	0.91747	-0.01890	0.93637
OSSP-490	0.91690	0.00143	0.91976	-0.01890	0.93866	OSSN-490	0.91739	0.00118	0.91975	-0.01890	0.93865
OSSP-500	0.90525	0.00144	0.90813	-0.01890	0.92703	OSSN-500	0.90428	0.00133	0.90694	-0.01890	0.92584
OSSP-520	0.90573	0.00138	0.90849	-0.01890	0.92739	OSSN-520	0.90591	0.00138	0.90867	-0.01890	0.92757
OSSP-540	0.90338	0.00130	0.90598	-0.01890	0.92488	OSSN-540	0.90552	0.00127	0.90806	-0.01890	0.92696
OSSP-544	0.90605	0.00139	0.90883	-0.01890	0.92773	OSSN-544	0.90400	0.00127	0.90654	-0.01890	0.92544
OSSP-560	0.89456	0.00140	0.89736	-0.01890	0.91626	OSSN-560	0.89251	0.00134	0.89519	-0.01890	0.91409
OSSP-600	0.88401	0.00135	0.88671	-0.01890	0.90561	OSSN-600	0.88405	0.00119	0.88643	-0.01890	0.90533
OSSP-616	0.87479	0.00134	0.87747	-0.01890	0.89637	OSSN-616	0.87159	0.00140	0.87439	-0.01890	0.89329
OSSP-700	0.86288	0.00132	0.86552	-0.01890	0.88442	OSSN-700	0.86264	0.00134	0.86532	-0.01890	0.88422
OSSP-705	0.86128	0.00123	0.86374	-0.01890	0.88264	OSSN-705	0.86219	0.00129	0.86477	-0.01890	0.88367
OSSP-800	0.83545	0.00143	0.83831	-0.01890	0.85721	OSSN-800	0.83547	0.00136	0.83819	-0.01890	0.85709
	17X17 Triangular Lattice			Max	0.94759		17X17 Triangular Lattice			Max	0.94383
OSTP-058	0.56250	0.00115	0.56480	-0.01890	0.58370	OSTN-058	0.55606	0.00116	0.55838	-0.01890	0.57728
OSTP-100	0.68945	0.00120	0.69185	-0.01890	0.71075	OSTN-100	0.67982	0.00137	0.68256	-0.01890	0.70146
OSTP-200	0.84162	0.00132	0.84426	-0.01890	0.86316	OSTN-200	0.83566	0.00147	0.83860	-0.01890	0.85750

OSTP-300	0.90070	0.00148	0.90366	-0.01890	0.92256	OSTN-300	0.89208	0.00142	0.89492	-0.01890	0.91382
OSTP-400	0.92008	0.00131	0.92270	-0.01890	0.94160	OSTN-400	0.91439	0.00141	0.91721	-0.01890	0.93611
OSTP-410	0.92128	0.00131	0.92390	-0.01890	0.94280	OSTN-410	0.91621	0.00143	0.91907	-0.01890	0.93797
OSTP-420	0.92341	0.00140	0.92621	-0.01890	0.94511	OSTN-420	0.91635	0.00136	0.91907	-0.01890	0.93797
OSTP-430	0.92477	0.00146	0.92769	-0.01890	0.94659	OSTN-430	**0.92038**	0.00142	0.92322	-0.01890	**0.94212**
OSTP-437	0.91890	0.00136	0.92162	-0.01890	0.94052	OSTN-437	0.91618	0.00133	0.91884	-0.01890	0.93774
OSTP-440	**0.92629**	0.00143	0.92915	-0.01890	**0.94805**	OSTN-440	0.91778	0.00137	0.92052	-0.01890	0.93942
OSTP-450	0.92443	0.00134	0.92711	-0.01890	0.94601	OSTN-450	0.91787	0.00146	0.92079	-0.01890	0.93969
OSTP-460	0.92315	0.00120	0.92555	-0.01890	0.94445	OSTN-460	0.91697	0.00143	0.91983	-0.01890	0.93873
OSTP-470	0.90753	0.00140	0.91033	-0.01890	0.92923	OSTN-470	0.90776	0.00148	0.91072	-0.01890	0.92962
OSTP-480	0.90091	0.00133	0.90357	-0.01890	0.92247	OSTN-480	0.90191	0.00136	0.90463	-0.01890	0.92353
OSTP-486	0.90237	0.00139	0.90515	-0.01890	0.92405	OSTN-486	0.90150	0.00128	0.90406	-0.01890	0.92296
OSTP-490	0.90391	0.00141	0.90673	-0.01890	0.92563	OSTN-490	0.90070	0.00134	0.90338	-0.01890	0.92228
OSTP-500	0.90670	0.00136	0.90942	-0.01890	0.92832	OSTN-500	0.90241	0.00134	0.90509	-0.01890	0.92399
OSTP-520	0.90598	0.00140	0.90878	-0.01890	0.92768	OSTN-520	0.90548	0.00125	0.90798	-0.01890	0.92688
OSTP-540	0.90945	0.00143	0.91231	-0.01890	0.93121	OSTN-540	0.90800	0.00128	0.91056	-0.01890	0.92946
OSTP-544	0.90945	0.00138	0.91221	-0.01890	0.93111	OSTN-544	0.90885	0.00139	0.91163	-0.01890	0.93053
OSTP-560	0.90670	0.00137	0.90944	-0.01890	0.92834	OSTN-560	0.90748	0.00123	0.90994	-0.01890	0.92884
OSTP-600	0.88769	0.00130	0.89029	-0.01890	0.90919	OSTN-600	0.88927	0.00125	0.89177	-0.01890	0.91067
OSTP-616	0.88540	0.00130	0.88800	-0.01890	0.90690	OSTN-616	0.88616	0.00134	0.88884	-0.01890	0.90774
OSTP-700	0.85110	0.00126	0.85362	-0.01890	0.87252	OSTN-700	0.85044	0.00129	0.85302	-0.01890	0.87192
OSTP-705	0.85035	0.00116	0.85267	-0.01890	0.87157	OSTN-705	0.85084	0.00125	0.85334	-0.01890	0.87224
OSTP-800	0.83176	0.00117	0.83410	-0.01890	0.85300	OSTN-800	0.83357	0.00125	0.83607	-0.01890	0.85497
10X10 Square Lattice				Max	0.94805	10X10 Square Lattice				Max	0.94212
OTSP-058	0.56810	0.00113	0.57036	-0.01890	0.58926	OTSN-058	0.56332	0.00125	0.56582	-0.01890	0.58472
OTSP-100	0.69088	0.00136	0.69360	-0.01890	0.71250	OTSN-100	0.68577	0.00132	0.68841	-0.01890	0.70731
OTSP-200	0.84222	0.00130	0.84482	-0.01890	0.86372	OTSN-200	0.83805	0.00140	0.84085	-0.01890	0.85975
OTSP-300	0.89570	0.00144	0.89858	-0.01890	0.91748	OTSN-300	0.89239	0.00142	0.89523	-0.01890	0.91413
OTSP-400	0.91004	0.00129	0.91262	-0.01890	0.93152	OTSN-400	0.90551	0.00145	0.90841	-0.01890	0.92731
OTSP-410	0.90967	0.00139	0.91245	-0.01890	0.93135	OTSN-410	0.90645	0.00132	0.90909	-0.01890	0.92799
OTSP-420	0.91126	0.00139	0.91404	-0.01890	0.93294	OTSN-420	0.90577	0.00137	0.90851	-0.01890	0.92741
OTSP-430	**0.91271**	0.00138	0.91547	-0.01890	**0.93437**	OTSN-430	0.90675	0.00137	0.90949	-0.01890	0.92839
OTSP-437	0.91171	0.00136	0.91443	-0.01890	0.93333	OTSN-437	0.90746	0.00147	0.91040	-0.01890	0.92930
OTSP-440	0.90882	0.00126	0.91134	-0.01890	0.93024	OTSN-440	0.90532	0.00135	0.90802	-0.01890	0.92692
OTSP-450	0.90771	0.00141	0.91053	-0.01890	0.92943	OTSN-450	0.90694	0.00144	0.90982	-0.01890	0.92872
OTSP-460	0.91032	0.00132	0.91296	-0.01890	0.93186	OTSN-460	0.90721	0.00132	0.90985	-0.01890	0.92875

OTSP-470	0.90778	0.00138	0.91054	-0.01890	0.92944	OTSN-470	**0.90916**	0.00129	0.91174	-0.01890	**0.93064**
OTSP-480	0.90173	0.00141	0.90455	-0.01890	0.92345	OTSN-480	0.90393	0.00128	0.90649	-0.01890	0.92539
OTSP-486	0.90095	0.00144	0.90383	-0.01890	0.92273	OTSN-486	0.90414	0.00125	0.90664	-0.01890	0.92554
OTSP-490	0.90239	0.00141	0.90521	-0.01890	0.92411	OTSN-490	0.90332	0.00125	0.90582	-0.01890	0.92472
OTSP-500	0.90338	0.00139	0.90616	-0.01890	0.92506	OTSN-500	0.90407	0.00144	0.90695	-0.01890	0.92585
OTSP-520	0.90531	0.00141	0.90813	-0.01890	0.92703	OTSN-520	0.90304	0.00118	0.90540	-0.01890	0.92430
OTSP-540	0.88738	0.00131	0.89000	-0.01890	0.90890	OTSN-540	0.88742	0.00135	0.89012	-0.01890	0.90902
OTSP-544	0.88774	0.00130	0.89034	-0.01890	0.90924	OTSN-544	0.88742	0.00129	0.89000	-0.01890	0.90890
OTSP-560	0.88782	0.00124	0.89030	-0.01890	0.90920	OTSN-560	0.88835	0.00131	0.89097	-0.01890	0.90987
OTSP-600	0.88219	0.00122	0.88463	-0.01890	0.90353	OTSN-600	0.88447	0.00127	0.88701	-0.01890	0.90591
OTSP-616	0.86189	0.00127	0.86443	-0.01890	0.88333	OTSN-616	0.86454	0.00129	0.86712	-0.01890	0.88602
OTSP-700	0.83270	0.00136	0.83542	-0.01890	0.85432	OTSN-700	0.83555	0.00142	0.83839	-0.01890	0.85729
OTSP-705	0.83083	0.00129	0.83341	-0.01890	0.85231	OTSN-705	0.83284	0.00130	0.83544	-0.01890	0.85434
OTSP-800	0.82403	0.00127	0.82657	-0.01890	0.84547	OTSN-800	0.82313	0.00135	0.82583	-0.01890	0.84473
	10X10 Triangular Lattice			Max	0.93437		10X10 Triangular Lattice			Max	0.93064
OTTP-058	0.56299	0.00124	0.56547	-0.01890	0.58437	OTTN-058	0.55571	0.00125	0.55821	-0.01890	0.57711
OTTP-100	0.68846	0.00139	0.69124	-0.01890	0.71014	OTTN-100	0.68089	0.00143	0.68375	-0.01890	0.70265
OTTP-200	0.84196	0.00139	0.84474	-0.01890	0.86364	OTTN-200	0.83751	0.00141	0.84033	-0.01890	0.85923
OTTP-300	0.90017	0.00140	0.90297	-0.01890	0.92187	OTTN-300	0.89644	0.00140	0.89924	-0.01890	0.91814
OTTP-400	0.91426	0.00136	0.91698	-0.01890	0.93588	OTTN-400	0.90981	0.00147	0.91275	-0.01890	0.93165
OTTP-410	0.91911	0.00124	0.92159	-0.01890	0.94049	OTTN-410	**0.91296**	0.00138	0.91572	-0.01890	**0.93462**
OTTP-420	0.91297	0.00133	0.91563	-0.01890	0.93453	OTTN-420	0.90911	0.00124	0.91159	-0.01890	0.93049
OTTP-430	0.91515	0.00133	0.91781	-0.01890	0.93671	OTTN-430	0.91049	0.00138	0.91325	-0.01890	0.93215
OTTP-437	**0.91928**	0.00126	0.92180	-0.01890	**0.94070**	OTTN-437	0.91148	0.00126	0.91400	-0.01890	0.93290
OTTP-440	*0.91657*	*0.00131*	*0.91919*	*-0.01890*	*0.93809*	*OTTN-440*	*0.91156*	*0.00136*	*0.91428*	*-0.01890*	*0.93318*
OTTP-450	0.91724	0.00134	0.91992	-0.01890	0.93882	OTTN-450	0.91089	0.00141	0.91371	-0.01890	0.93261
OTTP-460	0.91756	0.00125	0.92006	-0.01890	0.93896	OTTN-460	0.91245	0.00144	0.91533	-0.01890	0.93423
OTTP-470	0.89862	0.00134	0.90130	-0.01890	0.92020	OTTN-470	0.89979	0.00125	0.90229	-0.01890	0.92119
OTTP-480	0.89827	0.00141	0.90109	-0.01890	0.91999	OTTN-480	0.90313	0.00139	0.90591	-0.01890	0.92481
OTTP-486	0.90149	0.00126	0.90401	-0.01890	0.92291	OTTN-486	0.90117	0.00129	0.90375	-0.01890	0.92265
OTTP-490	0.88892	0.00123	0.89138	-0.01890	0.91028	OTTN-490	0.88995	0.00128	0.89251	-0.01890	0.91141
OTTP-500	0.88835	0.00124	0.89083	-0.01890	0.90973	OTTN-500	0.88861	0.00143	0.89147	-0.01890	0.91037
OTTP-520	0.88932	0.00129	0.89190	-0.01890	0.91080	OTTN-520	0.89036	0.00141	0.89318	-0.01890	0.91208
OTTP-540	0.87972	0.00146	0.88264	-0.01890	0.90154	OTTN-540	0.87943	0.00139	0.88221	-0.01890	0.90111
OTTP-544	0.87766	0.00140	0.88046	-0.01890	0.89936	OTTN-544	0.87956	0.00163	0.88282	-0.01890	0.90172

OTTP-560	0.88207	0.00132	0.88471	-0.01890	0.90361	OTTN-560	0.88212	0.00124	0.88460	-0.01890	0.90350
OTTP-600	0.88084	0.00122	0.88328	-0.01890	0.90218	OTTN-600	0.88275	0.00138	0.88551	-0.01890	0.90441
OTTP-616	0.87930	0.00126	0.88182	-0.01890	0.90072	OTTN-616	0.88207	0.00134	0.88475	-0.01890	0.90365
OTTP-700	0.84280	0.00132	0.84544	-0.01890	0.86434	OTTN-700	0.84317	0.00132	0.84581	-0.01890	0.86471
OTTP-705	0.84089	0.00133	0.84355	-0.01890	0.86245	OTTN-705	0.84311	0.00137	0.84585	-0.01890	0.86475
OTTP-800	0.80332	0.00125	0.80582	-0.01890	0.82472	OTTN-800	0.80228	0.00133	0.80494	-0.01890	0.82384
	9X9 Square Lattice			Max	0.94070		9X9 Square Lattice			Max	0.93462
ONSP-058	0.57376	0.00116	0.57608	-0.01890	0.59498	ONSN-058	0.56816	0.00119	0.57054	-0.01890	0.58944
ONSP-100	0.69872	0.00146	0.70164	-0.01890	0.72054	ONSN-100	0.68507	0.00139	0.68785	-0.01890	0.70675
ONSP-200	0.84075	0.00134	0.84343	-0.01890	0.86233	ONSN-200	0.83667	0.00147	0.83961	-0.01890	0.85851
ONSP-300	0.89156	0.00138	0.89432	-0.01890	0.91322	ONSN-300	0.88845	0.00139	0.89123	-0.01890	0.91013
ONSP-400	0.91066	0.00144	0.91354	-0.01890	0.93244	ONSN-400	0.90492	0.00130	0.90752	-0.01890	0.92642
ONSP-410	**0.91320**	0.00132	0.91584	-0.01890	**0.93474**	ONSN-410	0.90499	0.00142	0.90783	-0.01890	0.92673
ONSP-420	0.91176	0.00126	0.91428	-0.01890	0.93318	ONSN-420	**0.90637**	0.00140	0.90917	-0.01890	**0.92807**
ONSP-430	0.91086	0.00129	0.91344	-0.01890	0.93234	ONSN-430	0.90073	0.00127	0.90327	-0.01890	0.92217
ONSP-437	0.90716	0.00141	0.90998	-0.01890	0.92888	ONSN-437	0.90325	0.00141	0.90607	-0.01890	0.92497
ONSP-440	0.90965	0.00142	0.91249	-0.01890	0.93139	ONSN-440	0.90306	0.00134	0.90574	-0.01890	0.92464
ONSP-450	0.90962	0.00138	0.91238	-0.01890	0.93128	ONSN-450	0.90202	0.00147	0.90496	-0.01890	0.92386
ONSP-460	0.91115	0.00128	0.91371	-0.01890	0.93261	ONSN-460	0.90485	0.00132	0.90749	-0.01890	0.92639
ONSP-470	0.91043	0.00134	0.91311	-0.01890	0.93201	ONSN-470	0.90196	0.00137	0.90470	-0.01890	0.92360
ONSP-480	0.91126	0.00125	0.91376	-0.01890	0.93266	ONSN-480	0.90518	0.00124	0.90766	-0.01890	0.92656
ONSP-486	0.90716	0.00136	0.90988	-0.01890	0.92878	ONSN-486	0.90604	0.00145	0.90894	-0.01890	0.92784
ONSP-490	0.89004	0.00132	0.89268	-0.01890	0.91158	ONSN-490	0.89124	0.00141	0.89406	-0.01890	0.91296
ONSP-500	0.89363	0.00130	0.89623	-0.01890	0.91513	ONSN-500	0.88850	0.00121	0.89092	-0.01890	0.90982
ONSP-520	0.86256	0.00137	0.86530	-0.01890	0.88420	ONSN-520	0.85768	0.00146	0.86060	-0.01890	0.87950
ONSP-540	0.86171	0.00132	0.86435	-0.01890	0.88325	ONSN-540	0.86018	0.00140	0.86298	-0.01890	0.88188
ONSP-544	0.86434	0.00115	0.86664	-0.01890	0.88554	ONSN-544	0.85995	0.00139	0.86273	-0.01890	0.88163
ONSP-560	0.86447	0.00137	0.86721	-0.01890	0.88611	ONSN-560	0.86424	0.00146	0.86716	-0.01890	0.88606
ONSP-600	0.86207	0.00139	0.86485	-0.01890	0.88375	ONSN-600	0.86625	0.00144	0.86913	-0.01890	0.88803
ONSP-616	0.86102	0.00121	0.86344	-0.01890	0.88234	ONSN-616	0.86257	0.00125	0.86507	-0.01890	0.88397
ONSP-700	0.83076	0.00124	0.83324	-0.01890	0.85214	ONSN-700	0.83375	0.00129	0.83633	-0.01890	0.85523
ONSP-705	0.83248	0.00128	0.83504	-0.01890	0.85394	ONSN-705	0.83095	0.00129	0.83353	-0.01890	0.85243
ONSP-800	0.77949	0.00116	0.78181	-0.01890	0.80071	ONSN-800	0.77742	0.00125	0.77992	-0.01890	0.79882
	9X9 Triangular Lattice			Max	0.93474		9X9 Triangular Lattice			Max	0.92807
ONTP-058	0.56955	0.00121	0.57197	-0.01890	0.59087	ONTN-058	0.55950	0.00123	0.56196	-0.01890	0.58086
ONTP-100	0.69611	0.00128	0.69867	-0.01890	0.71757	ONTN-100	0.68390	0.00136	0.68662	-0.01890	0.70552

ONTP-200	0.84344	0.00141	0.84626	-0.01890	0.86516	ONTN-200	0.83661	0.00146	0.83953	-0.01890	0.85843
ONTP-300	0.89460	0.00136	0.89732	-0.01890	0.91622	ONTN-300	0.89096	0.00139	0.89374	-0.01890	0.91264
ONTP-400	0.90426	0.00131	0.90688	-0.01890	0.92578	ONTN-400	0.89970	0.00142	0.90254	-0.01890	0.92144
ONTP-410	0.90570	0.00140	0.90850	-0.01890	0.92740	ONTN-410	0.90090	0.00140	0.90370	-0.01890	0.92260
ONTP-420	0.90638	0.00141	0.90920	-0.01890	0.92810	ONTN-420	0.90309	0.00138	0.90585	-0.01890	0.92475
ONTP-430	0.89545	0.00138	0.89821	-0.01890	0.91711	ONTN-430	0.90003	0.00147	0.90297	-0.01890	0.92187
ONTP-437	0.89990	0.00141	0.90272	-0.01890	0.92162	ONTN-437	0.90364	0.00145	0.90654	-0.01890	0.92544
ONTP-440	0.90083	0.00125	0.90333	-0.01890	0.92223	ONTN-440	0.90072	0.00132	0.90336	-0.01890	0.92226
ONTP-450	0.90374	0.00134	0.90642	-0.01890	0.92532	ONTN-450	0.90444	0.00131	0.90706	-0.01890	0.92596
ONTP-460	0.90417	0.00131	0.90679	-0.01890	0.92569	ONTN-460	0.90241	0.00134	0.90509	-0.01890	0.92399
ONTP-470	0.90389	0.00133	0.90655	-0.01890	0.92545	ONTN-470	0.90534	0.00132	0.90798	-0.01890	0.92688
ONTP-480	0.90658	0.00124	0.90906	-0.01890	0.92796	ONTN-480	0.90308	0.00135	0.90578	-0.01890	0.92468
ONTP-486	0.90722	0.00148	0.91018	-0.01890	0.92908	ONTN-486	0.90657	0.00131	0.90919	-0.01890	0.92809
ONTP-490	0.90431	0.00136	0.90703	-0.01890	0.92593	ONTN-490	**0.90790**	0.00136	0.91062	-0.01890	**0.92952**
ONTP-500	0.90356	0.00142	0.90640	-0.01890	0.92530	ONTN-500	0.90452	0.00135	0.90722	-0.01890	0.92612
ONTP-520	**0.90778**	0.00122	0.91022	-0.01890	**0.92912**	ONTN-520	0.90652	0.00135	0.90922	-0.01890	0.92812
ONTP-540	0.87296	0.00129	0.87554	-0.01890	0.89444	ONTN-540	0.87250	0.00136	0.87522	-0.01890	0.89412
ONTP-544	0.87467	0.00132	0.87731	-0.01890	0.89621	ONTN-544	0.87464	0.00135	0.87734	-0.01890	0.89624
ONTP-560	0.87389	0.00133	0.87655	-0.01890	0.89545	ONTN-560	0.87272	0.00130	0.87532	-0.01890	0.89422
ONTP-600	0.83252	0.00134	0.83520	-0.01890	0.85410	ONTN-600	0.83829	0.00142	0.84113	-0.01890	0.86003
ONTP-616	0.83599	0.00137	0.83873	-0.01890	0.85763	ONTN-616	0.83783	0.00140	0.84063	-0.01890	0.85953
ONTP-700	0.83253	0.00125	0.83503	-0.01890	0.85393	ONTN-700	0.83345	0.00118	0.83581	-0.01890	0.85471
ONTP-705	0.83294	0.00124	0.83542	-0.01890	0.85432	ONTN-705	0.83432	0.00116	0.83664	-0.01890	0.85554
ONTP-800	0.80405	0.00117	0.80639	-0.01890	0.82529	ONTN-800	0.80590	0.00124	0.80838	-0.01890	0.82728
	8X8 Square Lattice			Max	0.92912		8X8 Square Lattice			Max	0.92952
OESP-058	0.57888	0.00114	0.58116	-0.01890	0.60006	OESN-058	0.57122	0.00119	0.57360	-0.01890	0.59250
OESP-100	0.69630	0.00137	0.69904	-0.01890	0.71794	OESN-100	0.68898	0.00136	0.69170	-0.01890	0.71060
OESP-200	0.84068	0.00140	0.84348	-0.01890	0.86238	OESN-200	0.83683	0.00145	0.83973	-0.01890	0.85863
OESP-300	0.88811	0.00147	0.89105	-0.01890	0.90995	OESN-300	0.88486	0.00142	0.88770	-0.01890	0.90660
OESP-400	**0.89670**	0.00136	0.89942	-0.01890	**0.91832**	OESN-400	0.89352	0.00142	0.89636	-0.01890	0.91526
OESP-410	0.87869	0.00139	0.88147	-0.01890	0.90037	OESN-410	0.87801	0.00136	0.88073	-0.01890	0.89963
OESP-420	0.88159	0.00128	0.88415	-0.01890	0.90305	OESN-420	0.88134	0.00153	0.88440	-0.01890	0.90330
OESP-430	0.88017	0.00129	0.88275	-0.01890	0.90165	OESN-430	0.88424	0.00150	0.88724	-0.01890	0.90614
OESP-437	0.88536	0.00139	0.88814	-0.01890	0.90704	OESN-437	0.88786	0.00138	0.89062	-0.01890	0.90952
OESP-440	0.88478	0.00132	0.88742	-0.01890	0.90632	OESN-440	0.88441	0.00125	0.88691	-0.01890	0.90581
OESP-450	0.88919	0.00137	0.89193	-0.01890	0.91083	OESN-450	0.88910	0.00144	0.89198	-0.01890	0.91088

OESP-460	0.89160	0.00134	0.89428	-0.01890	0.91318	OESN-460	0.88989	0.00141	0.89271	-0.01890	0.91161
OESP-470	0.89184	0.00142	0.89468	-0.01890	0.91358	OESN-470	0.89205	0.00125	0.89455	-0.01890	0.91345
OESP-480	0.89048	0.00134	0.89316	-0.01890	0.91206	OESN-480	0.88958	0.00133	0.89224	-0.01890	0.91114
OESP-486	0.88876	0.00150	0.89176	-0.01890	0.91066	OESN-486	0.89194	0.00126	0.89446	-0.01890	0.91336
OESP-490	0.89080	0.00135	0.89350	-0.01890	0.91240	OESN-490	0.89026	0.00129	0.89284	-0.01890	0.91174
OESP-500	0.89104	0.00134	0.89372	-0.01890	0.91262	OESN-500	**0.89400**	0.00149	0.89698	-0.01890	**0.91588**
OESP-520	0.88894	0.00121	0.89136	-0.01890	0.91026	OESN-520	0.88988	0.00136	0.89260	-0.01890	0.91150
OESP-540	0.86470	0.00146	0.86762	-0.01890	0.88652	OESN-540	0.86490	0.00136	0.86762	-0.01890	0.88652
OESP-544	0.86530	0.00141	0.86812	-0.01890	0.88702	OESN-544	0.86531	0.00144	0.86819	-0.01890	0.88709
OESP-560	0.86383	0.00134	0.86651	-0.01890	0.88541	OESN-560	0.86282	0.00131	0.86544	-0.01890	0.88434
OESP-600	0.85979	0.00130	0.86239	-0.01890	0.88129	OESN-600	0.86076	0.00134	0.86344	-0.01890	0.88234
OESP-616	0.84794	0.00136	0.85066	-0.01890	0.86956	OESN-616	0.84640	0.00128	0.84896	-0.01890	0.86786
OESP-700	0.79120	0.00130	0.79380	-0.01890	0.81270	OESN-700	0.79598	0.00129	0.79856	-0.01890	0.81746
OESP-705	0.79311	0.00117	0.79545	-0.01890	0.81435	OESN-705	0.79228	0.00126	0.79480	-0.01890	0.81370
OESP-800	0.78672	0.00132	0.78936	-0.01890	0.80826	OESN-800	0.78772	0.00132	0.79036	-0.01890	0.80926
	8X8 Triangular Lattice			Max	0.91832		8X8 Triangular Lattice			Max	0.91588
OETP-058	0.56928	0.00126	0.57180	-0.01890	0.59070	OETN-058	0.56119	0.00135	0.56389	-0.01890	0.58279
OETP-100	0.69811	0.00138	0.70087	-0.01890	0.71977	OETN-100	0.68949	0.00145	0.69239	-0.01890	0.71129
OETP-200	0.83743	0.00140	0.84023	-0.01890	0.85913	OETN-200	0.83401	0.00151	0.83703	-0.01890	0.85593
OETP-300	0.88323	0.00131	0.88585	-0.01890	0.90475	OETN-300	0.88249	0.00141	0.88531	-0.01890	0.90421
OETP-400	0.90418	0.00143	0.90704	-0.01890	0.92594	OETN-400	0.90074	0.00135	0.90344	-0.01890	0.92234
OETP-410	**0.90943**	0.00128	0.91199	-0.01890	**0.93089**	OETN-410	**0.90299**	0.00132	0.90563	-0.01890	**0.92453**
OETP-420	0.90726	0.00133	0.90992	-0.01890	0.92882	OETN-420	0.90083	0.00134	0.90351	-0.01890	0.92241
OETP-430	0.89872	0.00136	0.90144	-0.01890	0.92034	OETN-430	0.89507	0.00139	0.89785	-0.01890	0.91675
OETP-437	0.89895	0.00131	0.90157	-0.01890	0.92047	OETN-437	0.89562	0.00135	0.89832	-0.01890	0.91722
OETP-440	0.89615	0.00135	0.89885	-0.01890	0.91775	OETN-440	0.89427	0.00145	0.89717	-0.01890	0.91607
OETP-450	0.89927	0.00152	0.90231	-0.01890	0.92121	OETN-450	0.89451	0.00148	0.89747	-0.01890	0.91637
OETP-460	0.90000	0.00134	0.90268	-0.01890	0.92158	OETN-460	0.89555	0.00128	0.89811	-0.01890	0.91701
OETP-470	0.89991	0.00135	0.90261	-0.01890	0.92151	OETN-470	0.89450	0.00122	0.89694	-0.01890	0.91584
OETP-480	0.86045	0.00135	0.86315	-0.01890	0.88205	OETN-480	0.86182	0.00134	0.86450	-0.01890	0.88340
OETP-486	0.86313	0.00140	0.86593	-0.01890	0.88483	OETN-486	0.86546	0.00141	0.86828	-0.01890	0.88718
OETP-490	0.86572	0.00138	0.86848	-0.01890	0.88738	OETN-490	0.86254	0.00138	0.86530	-0.01890	0.88420
OETP-500	0.86467	0.00122	0.86711	-0.01890	0.88601	OETN-500	0.85998	0.00128	0.86254	-0.01890	0.88144
OETP-520	0.86727	0.00121	0.86969	-0.01890	0.88859	OETN-520	0.86364	0.00142	0.86648	-0.01890	0.88538
OETP-540	0.86678	0.00131	0.86940	-0.01890	0.88830	OETN-540	0.86609	0.00139	0.86887	-0.01890	0.88777
OETP-544	0.86603	0.00127	0.86857	-0.01890	0.88747	OETN-544	0.86655	0.00127	0.86909	-0.01890	0.88799

OETP-560	0.86697	0.00138	0.86973	-0.01890	0.88863	OETN-560	0.86676	0.00138	0.86952	-0.01890	0.88842
OETP-600	0.84535	0.00132	0.84799	-0.01890	0.86689	OETN-600	0.84778	0.00141	0.85060	-0.01890	0.86950
OETP-616	0.84702	0.00138	0.84978	-0.01890	0.86868	OETN-616	0.84323	0.00119	0.84561	-0.01890	0.86451
OETP-700	0.83659	0.00126	0.83911	-0.01890	0.85801	OETN-700	0.83402	0.00128	0.83658	-0.01890	0.85548
OETP-705	0.83429	0.00133	0.83695	-0.01890	0.85585	OETN-705	0.83457	0.00130	0.83717	-0.01890	0.85607
OETP-800	0.77175	0.00132	0.77439	-0.01890	0.79329	OETN-800	0.77290	0.00139	0.77568	-0.01890	0.79458
55 KGs Accident Case with VFO				Max	0.93089	53 KGs Accident Case with VFO				Max	0.92453
	17X17 Square Lattice			Max NO	0.94805		17X17 Square Lattice			Max NO	0.94383
SS55-058	0.54912	0.00113	0.55138	-0.01890	0.57028	SS53-058	0.54074	0.00113	0.54300	-0.01890	0.56190
SS55-100	0.68063	0.00133	0.68329	-0.01890	0.70219	SS53-100	0.67141	0.00125	0.67391	-0.01890	0.69281
SS55-200	0.83888	0.00146	0.84180	-0.01890	0.86070	SS53-200	0.83509	0.00133	0.83775	-0.01890	0.85665
SS55-300	0.89895	0.00136	0.90167	-0.01890	0.92057	SS53-300	0.89237	0.00122	0.89481	-0.01890	0.91371
SS55-400	0.92197	0.00144	0.92485	-0.01890	0.94375	SS53-400	0.91365	0.00127	0.91619	-0.01890	0.93509
SS55-410	0.92149	0.00130	0.92409	-0.01890	0.94299	SS53-410	0.91615	0.00147	0.91909	-0.01890	0.93799
SS55-420	0.92181	0.00134	0.92449	-0.01890	0.94339	SS53-420	0.91528	0.00135	0.91798	-0.01890	0.93688
SS55-430	0.91972	0.00136	0.92244	-0.01890	0.94134	SS53-430	0.91510	0.00128	0.91766	-0.01890	0.93656
SS55-437	0.92482	0.00128	0.92738	-0.01890	0.94628	SS53-437	0.91492	0.00151	0.91794	-0.01890	0.93684
SS55-440	0.92487	0.00123	0.92733	-0.01890	0.94623	SS53-440	0.91898	0.00136	0.92170	-0.01890	0.94060
SS55-450	0.92362	0.00128	0.92618	-0.01890	0.94508	SS53-450	**0.92132**	0.00137	0.92406	-0.01890	**0.94296**
SS55-460	**0.92745**	0.00144	0.93033	-0.01890	**0.94923**	SS53-460	0.91810	0.00142	0.92094	-0.01890	0.93984
SS55-470	0.92295	0.00149	0.92593	-0.01890	0.94483	SS53-470	0.91701	0.00145	0.91991	-0.01890	0.93881
SS55-480	0.92503	0.00149	0.92801	-0.01890	0.94691	SS53-480	0.91689	0.00130	0.91949	-0.01890	0.93839
SS55-486	0.92626	0.00131	0.92888	-0.01890	0.94778	SS53-486	0.91926	0.00135	0.92196	-0.01890	0.94086
SS55-490	0.92367	0.00126	0.92619	-0.01890	0.94509	SS53-490	0.91967	0.00136	0.92239	-0.01890	0.94129
SS55-500	0.92051	0.00126	0.92303	-0.01890	0.94193	SS53-500	0.91865	0.00140	0.92145	-0.01890	0.94035
SS55-520	0.91715	0.00140	0.91995	-0.01890	0.93885	SS53-520	0.91811	0.00125	0.92061	-0.01890	0.93951
SS55-540	0.91139	0.00137	0.91413	-0.01890	0.93303	SS53-540	0.91020	0.00131	0.91282	-0.01890	0.93172
SS55-544	0.90791	0.00136	0.91063	-0.01890	0.92953	SS53-544	0.91044	0.00130	0.91304	-0.01890	0.93194
SS55-560	0.90851	0.00127	0.91105	-0.01890	0.92995	SS53-560	0.90466	0.00131	0.90728	-0.01890	0.92618
SS55-600	0.89446	0.00132	0.89710	-0.01890	0.91600	SS53-600	0.89646	0.00134	0.89914	-0.01890	0.91804
SS55-616	0.88801	0.00129	0.89059	-0.01890	0.90949	SS53-616	0.89008	0.00132	0.89272	-0.01890	0.91162
SS55-700	0.86351	0.00119	0.86589	-0.01890	0.88479	SS53-700	0.86674	0.00127	0.86928	-0.01890	0.88818
SS55-705	0.86729	0.00127	0.86983	-0.01890	0.88873	SS53-705	0.86327	0.00132	0.86591	-0.01890	0.88481
SS55-800	0.83666	0.00124	0.83914	-0.01890	0.85804	SS53-800	0.83631	0.00137	0.83905	-0.01890	0.85795
	17X17 Triangular Lattice			Max	0.94923		17X17 Triangular Lattice			Max	0.94296

ST55-058	0.54886	0.00111	0.55108	-0.01890	0.56998	ST53-058	0.53599	0.00118	0.53835	-0.01890	0.55725
ST55-100	0.68029	0.00131	0.68291	-0.01890	0.70181	ST53-100	0.66875	0.00126	0.67127	-0.01890	0.69017
ST55-200	0.83943	0.00140	0.84223	-0.01890	0.86113	ST53-200	0.83257	0.00140	0.83537	-0.01890	0.85427
ST55-300	0.89905	0.00143	0.90191	-0.01890	0.92081	ST53-300	0.89343	0.00146	0.89635	-0.01890	0.91525
ST55-400	0.92279	0.00146	0.92571	-0.01890	0.94461	ST53-400	0.91547	0.00142	0.91831	-0.01890	0.93721
ST55-410	0.92399	0.00135	0.92669	-0.01890	0.94559	ST53-410	0.91835	0.00134	0.92103	-0.01890	0.93993
ST55-420	0.92637	0.00139	0.92915	-0.01890	0.94805	ST53-420	0.91799	0.00143	0.92085	-0.01890	0.93975
ST55-430	0.92495	0.00131	0.92757	-0.01890	0.94647	ST53-430	0.91828	0.00134	0.92096	-0.01890	0.93986
ST55-437	0.92360	0.00133	0.92626	-0.01890	0.94516	ST53-437	0.91935	0.00125	0.92185	-0.01890	0.94075
ST55-440	0.92524	0.00127	0.92778	-0.01890	0.94668	ST53-440	0.92067	0.00150	0.92367	-0.01890	0.94257
ST55-450	0.92381	0.00142	0.92665	-0.01890	0.94555	ST53-450	0.92124	0.00141	0.92406	-0.01890	0.94296
ST55-460	0.92750	0.00144	0.93038	-0.01890	0.94928	ST53-460	0.91884	0.00146	0.92176	-0.01890	0.94066
ST55-470	0.92650	0.00141	0.92932	-0.01890	0.94822	ST53-470	**0.92198**	0.00130	0.92458	-0.01890	**0.94348**
ST55-480	0.92685	0.00044	0.92773	-0.01890	0.94663	ST53-480	0.92136	0.00133	0.92402	-0.01890	0.94292
ST55-486	**0.92801**	0.00136	0.93073	-0.01890	**0.94963**	ST53-486	0.91895	0.00129	0.92153	-0.01890	0.94043
ST55-490	0.92732	0.00047	0.92827	-0.01890	0.94717	ST53-490	0.91919	0.00133	0.92185	-0.01890	0.94075
ST55-500	0.92540	0.00141	0.92822	-0.01890	0.94712	ST53-500	0.92150	0.00131	0.92412	-0.01890	0.94302
ST55-520	0.92066	0.00136	0.92338	-0.01890	0.94228	ST53-520	0.91923	0.00142	0.92207	-0.01890	0.94097
ST55-540	0.91233	0.00130	0.91493	-0.01890	0.93383	ST53-540	0.91374	0.00136	0.91646	-0.01890	0.93536
ST55-544	0.91529	0.00138	0.91805	-0.01890	0.93695	ST53-544	0.91140	0.00137	0.91414	-0.01890	0.93304
ST55-560	0.91014	0.00137	0.91288	-0.01890	0.93178	ST53-560	0.90820	0.00129	0.91078	-0.01890	0.92968
ST55-600	0.90030	0.00141	0.90312	-0.01890	0.92202	ST53-600	0.89889	0.00129	0.90147	-0.01890	0.92037
ST55-616	0.89257	0.00125	0.89507	-0.01890	0.91397	ST53-616	0.89495	0.00126	0.89747	-0.01890	0.91637
ST55-700	0.86992	0.00132	0.87256	-0.01890	0.89146	ST53-700	0.86625	0.00116	0.86857	-0.01890	0.88747
ST55-705	0.86512	0.00129	0.86770	-0.01890	0.88660	ST53-705	0.86395	0.00128	0.86651	-0.01890	0.88541
ST55-800	0.83830	0.00116	0.84062	-0.01890	0.85952	ST53-800	0.83951	0.00130	0.84211	-0.01890	0.86101
	10X10 Square Lattice			Max	0.94963		10X10 Square Lattice			Max	0.94348
TS55-058	0.55127	0.00124	0.55375	-0.01890	0.57265	TS53-058	0.54148	0.00113	0.54374	-0.01890	0.56264
TS55-100	0.68097	0.00139	0.68375	-0.01890	0.70265	TS53-100	0.67590	0.00122	0.67834	-0.01890	0.69724
TS55-200	0.84016	0.00134	0.84284	-0.01890	0.86174	TS53-200	0.83292	0.00147	0.83586	-0.01890	0.85476
TS55-300	0.89475	0.00148	0.89771	-0.01890	0.91661	TS53-300	0.89077	0.00139	0.89355	-0.01890	0.91245
TS55-400	0.91450	0.00140	0.91730	-0.01890	0.93620	TS53-400	0.90738	0.00145	0.91028	-0.01890	0.92918
TS55-410	0.91556	0.00139	0.91834	-0.01890	0.93724	TS53-410	0.91104	0.00131	0.91366	-0.01890	0.93256
TS55-420	0.91645	0.00139	0.91923	-0.01890	0.93813	TS53-420	0.91130	0.00148	0.91426	-0.01890	0.93316
TS55-430	0.91685	0.00142	0.91969	-0.01890	0.93859	TS53-430	0.91047	0.00139	0.91325	-0.01890	0.93215
TS55-437	0.91726	0.00135	0.91996	-0.01890	0.93886	TS53-437	0.91199	0.00142	0.91483	-0.01890	0.93373

TS55-440	0.91657	0.00136	0.91929	-0.01890	0.93819	TS53-440	0.90978	0.00135	0.91248	-0.01890	0.93138
TS55-450	0.91811	0.00140	0.92091	-0.01890	0.93981	TS53-450	0.91097	0.00145	0.91387	-0.01890	0.93277
TS55-460	0.91689	0.00132	0.91953	-0.01890	0.93843	TS53-460	0.90979	0.00143	0.91265	-0.01890	0.93155
TS55-470	0.91762	0.00120	0.92002	-0.01890	0.93892	TS53-470	0.91023	0.00137	0.91297	-0.01890	0.93187
TS55-480	**0.91840**	0.00139	0.92118	-0.01890	**0.94008**	TS53-480	0.90962	0.00128	0.91218	-0.01890	0.93108
TS55-486	0.91593	0.00135	0.91863	-0.01890	0.93753	TS53-486	**0.91233**	0.00138	0.91509	-0.01890	**0.93399**
TS55-490	0.91704	0.00132	0.91968	-0.01890	0.93858	TS53-490	0.91015	0.00134	0.91283	-0.01890	0.93173
TS55-500	0.91197	0.00131	0.91459	-0.01890	0.93349	TS53-500	0.91095	0.00130	0.91355	-0.01890	0.93245
TS55-520	0.90540	0.00140	0.90820	-0.01890	0.92710	TS53-520	0.90662	0.00130	0.90922	-0.01890	0.92812
TS55-540	0.90357	0.00118	0.90593	-0.01890	0.92483	TS53-540	0.90162	0.00124	0.90410	-0.01890	0.92300
TS55-544	0.90034	0.00134	0.90302	-0.01890	0.92192	TS53-544	0.90014	0.00134	0.90282	-0.01890	0.92172
TS55-560	0.89540	0.00129	0.89798	-0.01890	0.91688	TS53-560	0.89480	0.00132	0.89744	-0.01890	0.91634
TS55-600	0.88531	0.00144	0.88819	-0.01890	0.90709	TS53-600	0.88256	0.00129	0.88514	-0.01890	0.90404
TS55-616	0.87722	0.00137	0.87996	-0.01890	0.89886	TS53-616	0.87863	0.00147	0.88157	-0.01890	0.90047
TS55-700	0.85289	0.00141	0.85571	-0.01890	0.87461	TS53-700	0.85299	0.00116	0.85531	-0.01890	0.87421
TS55-705	0.85073	0.00128	0.85329	-0.01890	0.87219	TS53-705	0.84810	0.00125	0.85060	-0.01890	0.86950
TS55-800	0.82054	0.00118	0.82290	-0.01890	0.84180	TS53-800	0.82193	0.00128	0.82449	-0.01890	0.84339
	10X10 Triangular Lattice			Max	0.94008		10X10 Triangular Lattice			Max	0.93399
TT55-058	0.55040	0.00127	0.55294	-0.01890	0.57184	TT53-058	0.54266	0.00108	0.54482	-0.01890	0.56372
TT55-100	0.68374	0.00131	0.68636	-0.01890	0.70526	TT53-100	0.67055	0.00128	0.67311	-0.01890	0.69201
TT55-200	0.84400	0.00145	0.84690	-0.01890	0.86580	TT53-200	0.83215	0.00151	0.83517	-0.01890	0.85407
TT55-300	0.89799	0.00138	0.90075	-0.01890	0.91965	TT53-300	0.89615	0.00148	0.89911	-0.01890	0.91801
TT55-400	0.91855	0.00128	0.92111	-0.01890	0.94001	TT53-400	0.91061	0.00144	0.91349	-0.01890	0.93239
TT55-410	0.91788	0.00132	0.92052	-0.01890	0.93942	TT53-410	0.91317	0.00127	0.91571	-0.01890	0.93461
TT55-420	0.91832	0.00137	0.92106	-0.01890	0.93996	TT53-420	0.91332	0.00122	0.91576	-0.01890	0.93466
TT55-430	0.91930	0.00145	0.92220	-0.01890	0.94110	TT53-430	0.91418	0.00148	0.91714	-0.01890	0.93604
TT55-437	0.91945	0.00137	0.92219	-0.01890	0.94109	TT53-437	0.91182	0.00127	0.91436	-0.01890	0.93326
TT55-440	0.91708	0.00134	0.91976	-0.01890	0.93866	TT53-440	0.90957	0.00123	0.91203	-0.01890	0.93093
TT55-450	0.91764	0.00132	0.92028	-0.01890	0.93918	TT53-450	0.91411	0.00134	0.91679	-0.01890	0.93569
TT55-460	0.91804	0.00136	0.92076	-0.01890	0.93966	TT53-460	**0.91603**	0.00138	0.91879	-0.01890	**0.93769**
TT55-470	**0.91984**	0.00139	0.92262	-0.01890	**0.94152**	TT53-470	0.91177	0.00139	0.91455	-0.01890	0.93345
TT55-480	0.91913	0.00142	0.92197	-0.01890	0.94087	TT53-480	0.91352	0.00136	0.91624	-0.01890	0.93514
TT55-486	0.91814	0.00127	0.92068	-0.01890	0.93958	TT53-486	0.91204	0.00127	0.91458	-0.01890	0.93348
TT55-490	0.91853	0.00135	0.92123	-0.01890	0.94013	TT53-490	0.91423	0.00129	0.91681	-0.01890	0.93571
TT55-500	0.91626	0.00141	0.91908	-0.01890	0.93798	TT53-500	0.91291	0.00126	0.91543	-0.01890	0.93433

TT55-520	0.91116	0.00135	0.91386	-0.01890	0.93276	TT53-520	0.90925	0.00127	0.91179	-0.01890	0.93069
TT55-540	0.90390	0.00125	0.90640	-0.01890	0.92530	TT53-540	0.90431	0.00143	0.90717	-0.01890	0.92607
TT55-544	0.90261	0.00125	0.90511	-0.01890	0.92401	TT53-544	0.90282	0.00127	0.90536	-0.01890	0.92426
TT55-560	0.89714	0.00130	0.89974	-0.01890	0.91864	TT53-560	0.90016	0.00126	0.90268	-0.01890	0.92158
TT55-600	0.89041	0.00139	0.89319	-0.01890	0.91209	TT53-600	0.88381	0.00137	0.88655	-0.01890	0.90545
TT55-616	0.88483	0.00140	0.88763	-0.01890	0.90653	TT53-616	0.88351	0.00130	0.88611	-0.01890	0.90501
TT55-700	0.85564	0.00126	0.85816	-0.01890	0.87706	TT53-700	0.85671	0.00139	0.85949	-0.01890	0.87839
TT55-705	0.85512	0.00135	0.85782	-0.01890	0.87672	TT53-705	0.85372	0.00136	0.85644	-0.01890	0.87534
TT55-800	0.82572	0.00114	0.82800	-0.01890	0.84690	TT53-800	0.82783	0.00127	0.83037	-0.01890	0.84927
	9X9 Square Lattice			Max	0.94152		9X9 Square Lattice			Max	0.93769
NS55-058	0.55306	0.00105	0.55516	-0.01890	0.57406	NS53-058	0.54273	0.00117	0.54507	-0.01890	0.56397
NS55-100	0.68336	0.00135	0.68606	-0.01890	0.70496	NS53-100	0.67178	0.00127	0.67432	-0.01890	0.69322
NS55-200	0.84337	0.00138	0.84613	-0.01890	0.86503	NS53-200	0.83608	0.00140	0.83888	-0.01890	0.85778
NS55-300	0.89649	0.00147	0.89943	-0.01890	0.91833	NS53-300	0.88886	0.00146	0.89178	-0.01890	0.91068
NS55-400	0.91097	0.00133	0.91363	-0.01890	0.93253	NS53-400	0.90145	0.00124	0.90393	-0.01890	0.92283
NS55-410	0.91052	0.00139	0.91330	-0.01890	0.93220	NS53-410	0.90492	0.00134	0.90760	-0.01890	0.92650
NS55-420	0.91206	0.00146	0.91498	-0.01890	**0.93388**	NS53-420	0.90376	0.00143	0.90662	-0.01890	0.92552
NS55-430	0.90917	0.00137	0.91191	-0.01890	0.93081	NS53-430	**0.90676**	0.00121	0.90918	-0.01890	**0.92808**
NS55-437	0.90993	0.00129	0.91251	-0.01890	0.93141	NS53-437	0.90598	0.00145	0.90888	-0.01890	0.92778
NS55-440	0.90950	0.00133	0.91216	-0.01890	0.93106	NS53-440	0.90513	0.00127	0.90767	-0.01890	0.92657
NS55-450	**0.91208**	0.00130	0.91468	-0.01890	0.93358	NS53-450	0.90605	0.00140	0.90885	-0.01890	0.92775
NS55-460	0.91120	0.00139	0.91398	-0.01890	0.93288	NS53-460	0.90551	0.00140	0.90831	-0.01890	0.92721
NS55-470	0.90951	0.00128	0.91207	-0.01890	0.93097	NS53-470	0.90197	0.00130	0.90457	-0.01890	0.92347
NS55-480	0.90983	0.00128	0.91239	-0.01890	0.93129	NS53-480	0.90286	0.00138	0.90562	-0.01890	0.92452
NS55-486	0.91010	0.00133	0.91276	-0.01890	0.93166	NS53-486	0.90274	0.00133	0.90540	-0.01890	0.92430
NS55-490	0.90953	0.00122	0.91197	-0.01890	0.93087	NS53-490	0.90624	0.00137	0.90898	-0.01890	0.92788
NS55-500	0.90431	0.00123	0.90677	-0.01890	0.92567	NS53-500	0.90315	0.00134	0.90583	-0.01890	0.92473
NS55-520	0.89984	0.00135	0.90254	-0.01890	0.92144	NS53-520	0.89996	0.00146	0.90288	-0.01890	0.92178
NS55-540	0.89459	0.00125	0.89709	-0.01890	0.91599	NS53-540	0.89416	0.00122	0.89660	-0.01890	0.91550
NS55-544	0.89315	0.00132	0.89579	-0.01890	0.91469	NS53-544	0.88983	0.00121	0.89225	-0.01890	0.91115
NS55-560	0.88391	0.00129	0.88649	-0.01890	0.90539	NS53-560	0.88740	0.00127	0.88994	-0.01890	0.90884
NS55-600	0.87385	0.00134	0.87653	-0.01890	0.89543	NS53-600	0.87346	0.00123	0.87592	-0.01890	0.89482
NS55-616	0.86895	0.00138	0.87171	-0.01890	0.89061	NS53-616	0.87114	0.00114	0.87342	-0.01890	0.89232
NS55-700	0.84198	0.00135	0.84468	-0.01890	0.86358	NS53-700	0.84080	0.00128	0.84336	-0.01890	0.86226
NS55-705	0.84039	0.00126	0.84291	-0.01890	0.86181	NS53-705	0.84034	0.00135	0.84304	-0.01890	0.86194
NS55-800	0.80795	0.00141	0.81077	-0.01890	0.82967	NS53-800	0.81079	0.00117	0.81313	-0.01890	0.83203

	9X9 Triangular Lattice			Max	0.93388		9X9 Triangular Lattice			Max	0.92808
NT55-058	0.55089	0.00115	0.55319	-0.01890	0.57209	NT53-058	0.54335	0.00109	0.54553	-0.01890	0.56443
NT55-100	0.68309	0.00134	0.68577	-0.01890	0.70467	NT53-100	0.67595	0.00132	0.67859	-0.01890	0.69749
NT55-200	0.84150	0.00132	0.84414	-0.01890	0.86304	NT53-200	0.83461	0.00149	0.83759	-0.01890	0.85649
NT55-300	0.89486	0.00146	0.89778	-0.01890	0.91668	NT53-300	0.89066	0.00145	0.89356	-0.01890	0.91246
NT55-400	0.91436	0.00135	0.91706	-0.01890	0.93596	NT53-400	0.90710	0.00131	0.90972	-0.01890	0.92862
NT55-410	0.91469	0.00137	0.91743	-0.01890	0.93633	NT53-410	0.90744	0.00130	0.91004	-0.01890	0.92894
NT55-420	0.91272	0.00140	0.91552	-0.01890	0.93442	NT53-420	0.90779	0.00139	0.91057	-0.01890	0.92947
NT55-430	0.91568	0.00137	0.91842	-0.01890	0.93732	NT53-430	0.90891	0.00139	0.91169	-0.01890	0.93059
NT55-437	0.91328	0.00131	0.91590	-0.01890	0.93480	NT53-437	**0.90957**	0.00141	0.91239	-0.01890	**0.93129**
NT55-440	0.91191	0.00136	0.91463	-0.01890	0.93353	NT53-440	0.90649	0.00122	0.90893	-0.01890	0.92783
NT55-450	0.90938	0.00133	0.91204	-0.01890	0.93094	NT53-450	0.90883	0.00126	0.91135	-0.01890	0.93025
NT55-460	0.91140	0.00134	0.91408	-0.01890	0.93298	NT53-460	0.90779	0.00130	0.91039	-0.01890	0.92929
NT55-470	**0.91613**	0.00144	0.91901	-0.01890	**0.93791**	NT53-470	0.90779	0.00132	0.91043	-0.01890	0.92933
NT55-480	0.91173	0.00136	0.91445	-0.01890	0.93335	NT53-480	0.90674	0.00122	0.90918	-0.01890	0.92808
NT55-486	0.90964	0.00137	0.91238	-0.01890	0.93128	NT53-486	0.90956	0.00125	0.91206	-0.01890	0.93096
NT55-490	0.91142	0.00144	0.91430	-0.01890	0.93320	NT53-490	0.90563	0.00141	0.90845	-0.01890	0.92735
NT55-500	0.90813	0.00140	0.91093	-0.01890	0.92983	NT53-500	0.90508	0.00141	0.90790	-0.01890	0.92680
NT55-520	0.90368	0.00129	0.90626	-0.01890	0.92516	NT53-520	0.90368	0.00139	0.90646	-0.01890	0.92536
NT55-540	0.89606	0.00129	0.89864	-0.01890	0.91754	NT53-540	0.89853	0.00127	0.90107	-0.01890	0.91997
NT55-544	0.89866	0.00134	0.90134	-0.01890	0.92024	NT53-544	0.89597	0.00128	0.89853	-0.01890	0.91743
NT55-560	0.88863	0.00124	0.89111	-0.01890	0.91001	NT53-560	0.89019	0.00144	0.89307	-0.01890	0.91197
NT55-600	0.88028	0.00128	0.88284	-0.01890	0.90174	NT53-600	0.87457	0.00132	0.87721	-0.01890	0.89611
NT55-616	0.87458	0.00121	0.87700	-0.01890	0.89590	NT53-616	0.87225	0.00130	0.87485	-0.01890	0.89375
NT55-700	0.84750	0.00129	0.85008	-0.01890	0.86898	NT53-700	0.84556	0.00113	0.84782	-0.01890	0.86672
NT55-705	0.84532	0.00119	0.84770	-0.01890	0.86660	NT53-705	0.84255	0.00122	0.84499	-0.01890	0.86389
NT55-800	0.81145	0.00133	0.81411	-0.01890	0.83301	NT53-800	0.81341	0.00113	0.81567	-0.01890	0.83457
	8X8 Square Lattice			Max	0.93791		8X8 Square Lattice			Max	0.93129
ES55-058	0.55345	0.00111	0.55567	-0.01890	0.57457	ES53-058	0.54381	0.00109	0.54599	-0.01890	0.56489
ES55-100	0.68369	0.00132	0.68633	-0.01890	0.70523	ES53-100	0.67741	0.00123	0.67987	-0.01890	0.69877
ES55-200	0.84220	0.00160	0.84540	-0.01890	0.86430	ES53-200	0.83518	0.00139	0.83796	-0.01890	0.85686
ES55-300	0.89099	0.00136	0.89371	-0.01890	0.91261	ES53-300	0.88706	0.00144	0.88994	-0.01890	0.90884
ES55-400	0.89977	0.00143	0.90263	-0.01890	0.92153	ES53-400	**0.90223**	0.00126	0.90475	-0.01890	**0.92365**
ES55-410	0.90354	0.00123	0.90600	-0.01890	0.92490	ES53-410	0.89620	0.00147	0.89914	-0.01890	0.91804
ES55-420	0.90405	0.00146	0.90697	-0.01890	0.92587	ES53-420	0.89884	0.00136	0.90156	-0.01890	0.92046
ES55-430	**0.90468**	0.00141	0.90750	-0.01890	**0.92640**	ES53-430	0.89861	0.00141	0.90143	-0.01890	0.92033

ES55-437	0.90462	0.00141	0.90744	-0.01890	0.92634	ES53-437	0.90128	0.00137	0.90402	-0.01890	0.92292
ES55-440	0.90234	0.00139	0.90512	-0.01890	0.92402	ES53-440	0.89881	0.00141	0.90163	-0.01890	0.92053
ES55-450	0.90232	0.00142	0.90516	-0.01890	0.92406	ES53-450	0.89963	0.00122	0.90207	-0.01890	0.92097
ES55-460	0.90180	0.00129	0.90438	-0.01890	0.92328	ES53-460	0.89897	0.00134	0.90165	-0.01890	0.92055
ES55-470	0.90183	0.00123	0.90429	-0.01890	0.92319	ES53-470	0.89722	0.00132	0.89986	-0.01890	0.91876
ES55-480	0.89946	0.00131	0.90208	-0.01890	0.92098	ES53-480	0.89409	0.00138	0.89685	-0.01890	0.91575
ES55-486	0.90036	0.00131	0.90298	-0.01890	0.92188	ES53-486	0.89715	0.00141	0.89997	-0.01890	0.91887
ES55-490	0.90260	0.00150	0.90560	-0.01890	0.92450	ES53-490	0.89606	0.00138	0.89882	-0.01890	0.91772
ES55-500	0.89770	0.00135	0.90040	-0.01890	0.91930	ES53-500	0.89228	0.00129	0.89486	-0.01890	0.91376
ES55-520	0.88985	0.00122	0.89229	-0.01890	0.91119	ES53-520	0.89186	0.00129	0.89444	-0.01890	0.91334
ES55-540	0.88415	0.00124	0.88663	-0.01890	0.90553	ES53-540	0.88481	0.00133	0.88747	-0.01890	0.90637
ES55-544	0.88113	0.00136	0.88385	-0.01890	0.90275	ES53-544	0.88145	0.00136	0.88417	-0.01890	0.90307
ES55-560	0.87296	0.00139	0.87574	-0.01890	0.89464	ES53-560	0.87976	0.00136	0.88248	-0.01890	0.90138
ES55-600	0.86390	0.00128	0.86646	-0.01890	0.88536	ES53-600	0.86222	0.00128	0.86478	-0.01890	0.88368
ES55-616	0.85966	0.00121	0.86208	-0.01890	0.88098	ES53-616	0.85542	0.00147	0.85836	-0.01890	0.87726
ES55-700	0.83164	0.00122	0.83408	-0.01890	0.85298	ES53-700	0.83006	0.00134	0.83274	-0.01890	0.85164
ES55-705	0.82878	0.00127	0.83132	-0.01890	0.85022	ES53-705	0.82958	0.00137	0.83232	-0.01890	0.85122
ES55-800	0.79782	0.00128	0.80038	-0.01890	0.81928	ES53-800	0.79728	0.00117	0.79962	-0.01890	0.81852
	8X8 Triangular Lattice			Max	0.92640		8X8 Triangular Lattice			Max	0.92365
ET55-058	0.55315	0.00120	0.55555	-0.01890	0.57445	ET53-058	0.54547	0.00118	0.54783	-0.01890	0.56673
ET55-100	0.68083	0.00141	0.68365	-0.01890	0.70255	ET53-100	0.67410	0.00124	0.67658	-0.01890	0.69548
ET55-200	0.84213	0.00131	0.84475	-0.01890	0.86365	ET53-200	0.83455	0.00151	0.83757	-0.01890	0.85647
ET55-300	0.89320	0.00138	0.89596	-0.01890	0.91486	ET53-300	0.88774	0.00144	0.89062	-0.01890	0.90952
ET55-400	0.90666	0.00146	0.90958	-0.01890	0.92848	ET53-400	0.90372	0.00138	0.90648	-0.01890	0.92538
ET55-410	0.90512	0.00126	0.90764	-0.01890	0.92654	ET53-410	0.90142	0.00151	0.90444	-0.01890	0.92334
ET55-420	0.90661	0.00145	0.90951	-0.01890	0.92841	ET53-420	0.90038	0.00121	0.90280	-0.01890	0.92170
ET55-430	0.90590	0.00135	0.90860	-0.01890	0.92750	ET53-430	0.90293	0.00137	0.90567	-0.01890	0.92457
ET55-437	0.90866	0.00143	0.91152	-0.01890	0.93042	ET53-437	0.89923	0.00140	0.90203	-0.01890	0.92093
ET55-440	0.90651	0.00139	0.90929	-0.01890	0.92819	ET53-440	**0.90455**	0.00135	0.90725	-0.01890	**0.92615**
ET55-450	**0.90883**	0.00143	0.91169	-0.01890	**0.93059**	ET53-450	0.90115	0.00128	0.90371	-0.01890	0.92261
ET55-460	0.90526	0.00144	0.90814	-0.01890	0.92704	ET53-460	0.89725	0.00129	0.89983	-0.01890	0.91873
ET55-470	0.90137	0.00123	0.90383	-0.01890	0.92273	ET53-470	0.90115	0.00127	0.90369	-0.01890	0.92259
ET55-480	0.90434	0.00132	0.90698	-0.01890	0.92588	ET53-480	0.89963	0.00139	0.90241	-0.01890	0.92131
ET55-486	0.90721	0.00118	0.90957	-0.01890	0.92847	ET53-486	0.90080	0.00135	0.90350	-0.01890	0.92240
ET55-490	0.90621	0.00132	0.90885	-0.01890	0.92775	ET53-490	0.89888	0.00125	0.90138	-0.01890	0.92028
ET55-500	0.90493	0.00134	0.90761	-0.01890	0.92651	ET53-500	0.89997	0.00128	0.90253	-0.01890	0.92143

ET55-520	0.89549	0.00131	0.89811	-0.01890	0.91701	ET53-520	0.89637	0.00135	0.89907	-0.01890	0.91797
ET55-540	0.88883	0.00137	0.89157	-0.01890	0.91047	ET53-540	0.88716	0.00138	0.88992	-0.01890	0.90882
ET55-544	0.88853	0.00126	0.89105	-0.01890	0.90995	ET53-544	0.88618	0.00126	0.88870	-0.01890	0.90760
ET55-560	0.88420	0.00123	0.88666	-0.01890	0.90556	ET53-560	0.88169	0.00121	0.88411	-0.01890	0.90301
ET55-600	0.86921	0.00130	0.87181	-0.01890	0.89071	ET53-600	0.86827	0.00127	0.87081	-0.01890	0.88971
ET55-616	0.86165	0.00143	0.86451	-0.01890	0.88341	ET53-616	0.86541	0.00137	0.86815	-0.01890	0.88705
ET55-700	0.83365	0.00129	0.83623	-0.01890	0.85513	ET53-700	0.83148	0.00138	0.83424	-0.01890	0.85314
ET55-705	0.83226	0.00130	0.83486	-0.01890	0.85376	ET53-705	0.83125	0.00121	0.83367	-0.01890	0.85257
ET55-800	0.80070	0.00127	0.80324	-0.01890	0.82214	ET53-800	0.79972	0.00121	0.80214	-0.01890	0.82104
				Max	0.93059					Max	0.92615
				Max VFO	0.94963					Max VFO	0.94348

Table 6.20 –Listing of GEMER Calculations for 46Kg Heterogeneous Cases

46 Kg Single Container Case with VFO

VFO-Name	VFO-KEFF	VFO-Sigma	K+2S	Bias	K+2S - B	VFO-Name	VFO-KEFF	VFO-Sigma	K+2S	Bias	K+2S - B
	0.200" Rods - Square Lattice						0.050" Rods - Square Lattice				
MSSL-058	0.48619	0.00111	0.48841	-0.01890	0.50731	MNSL-058	0.48231	0.00102	0.48435	-0.01890	0.50325
MSSL-100	0.60077	0.00126	0.60329	-0.01890	0.62219	MNSL-100	0.58753	0.00123	0.58999	-0.01890	0.60889
MSSL-200	0.75505	0.00141	0.75787	-0.01890	0.77677	MNSL-200	0.73674	0.00142	0.73958	-0.01890	0.75848
MSSL-300	0.82073	0.00136	0.82345	-0.01890	0.84235	MNSL-300	0.80462	0.00144	0.80750	-0.01890	0.82640
MSSL-400	0.84290	0.00145	0.84580	-0.01890	0.86470	MNSL-400	0.83281	0.00138	0.83557	-0.01890	0.85447
MSSL-410	0.84235	0.00134	0.84503	-0.01890	0.86393	MNSL-410	0.83423	0.00138	0.83699	-0.01890	0.85589
MSSL-420	0.84374	0.00143	0.84660	-0.01890	0.86550	MNSL-420	0.83788	0.00144	0.84076	-0.01890	0.85966
MSSL-430	0.84597	0.00139	0.84875	-0.01890	0.86765	MNSL-430	0.83672	0.00146	0.83964	-0.01890	0.85854
MSSL-437	0.84393	0.00149	0.84691	-0.01890	0.86581	MNSL-437	0.83735	0.00143	0.84021	-0.01890	0.85911
MSSL-440	0.84412	0.00142	0.84696	-0.01890	0.86586	MNSL-440	0.83673	0.00141	0.83955	-0.01890	0.85845
MSSL-450	**0.84629**	0.00145	0.84919	-0.01890	**0.86809**	MNSL-450	0.83798	0.00150	0.84098	-0.01890	0.85988
MSSL-460	0.84319	0.00148	0.84615	-0.01890	0.86505	MNSL-460	0.84235	0.00135	0.84505	-0.01890	0.86395
MSSL-470	0.84467	0.00145	0.84757	-0.01890	0.86647	MNSL-470	0.84190	0.00138	0.84466	-0.01890	0.86356
MSSL-480	0.84335	0.00136	0.84607	-0.01890	0.86497	MNSL-480	0.84210	0.00150	0.84510	-0.01890	0.86400
MSSL-486	0.84529	0.00139	0.84807	-0.01890	0.86697	MNSL-486	0.84403	0.00135	0.84673	-0.01890	0.86563
MSSL-490	0.84542	0.00139	0.84820	-0.01890	0.86710	MNSL-490	0.84444	0.00152	0.84748	-0.01890	0.86638
MSSL-500	0.84468	0.00147	0.84762	-0.01890	0.86652	MNSL-500	0.84320	0.00141	0.84602	-0.01890	0.86492
MSSL-520	0.84432	0.00146	0.84724	-0.01890	0.86614	MNSL-520	**0.84886**	0.00147	0.85180	-0.01890	**0.87070**
MSSL-540	0.84409	0.00135	0.84679	-0.01890	0.86569	MNSL-540	0.84611	0.00139	0.84889	-0.01890	0.86779
MSSL-544	0.84304	0.00133	0.84570	-0.01890	0.86460	MNSL-544	0.84510	0.00129	0.84768	-0.01890	0.86658
MSSL-560	0.84122	0.00156	0.84434	-0.01890	0.86324	MNSL-560	0.84461	0.00157	0.84775	-0.01890	0.86665
MSSL-600	0.83829	0.00132	0.84093	-0.01890	0.85983	MNSL-600	0.84725	0.00141	0.85007	-0.01890	0.86897
MSSL-616	0.83724	0.00135	0.83994	-0.01890	0.85884	MNSL-616	0.84444	0.00131	0.84706	-0.01890	0.86596
MSSL-700	0.81857	0.00138	0.82133	-0.01890	0.84023	MNSL-700	0.83314	0.00140	0.83594	-0.01890	0.85484
MSSL-705	0.81771	0.00116	0.82003	-0.01890	0.83893	MNSL-705	0.83321	0.00145	0.83611	-0.01890	0.85501
MSSL-800	0.79716	0.00127	0.79970	-0.01890	0.81860	MNSL-800	0.81838	0.00133	0.82104	-0.01890	0.83994
				Max	0.86809					Max	0.87070
	0.200" Rods - Triangular Lattice						0.050" Rods - Triangular Lattice				
MSTL-058	0.48770	0.00100	0.48970	-0.01890	0.50860	MNTL-058	0.47952	0.00115	0.48182	-0.01890	0.50072
MSTL-100	0.59841	0.00121	0.60083	-0.01890	0.61973	MNTL-100	0.58731	0.00132	0.58995	-0.01890	0.60885

MSTL-200	0.75817	0.00143	0.76103	-0.01890	0.77993
MSTL-300	0.81968	0.00152	0.82272	-0.01890	0.84162
MSTL-400	0.84382	0.00138	0.84658	-0.01890	0.86548
MSTL-410	0.84444	0.00148	0.84740	-0.01890	0.86630
MSTL-420	0.84529	0.00148	0.84825	-0.01890	0.86715
MSTL-430	0.84313	0.00148	0.84609	-0.01890	0.86499
MSTL-437	0.84447	0.00143	0.84733	-0.01890	0.86623
MSTL-440	0.84523	0.00129	0.84781	-0.01890	0.86671
MSTL-450	0.84515	0.00135	0.84785	-0.01890	0.86675
MSTL-460	0.84471	0.00150	0.84771	-0.01890	0.86661
MSTL-470	0.84416	0.00131	0.84678	-0.01890	0.86568
MSTL-480	0.84576	0.00131	0.84838	-0.01890	0.86728
MSTL-486	0.84832	0.00155	0.85142	-0.01890	0.87032
MSTL-490	0.84457	0.00138	0.84733	-0.01890	0.86623
MSTL-500	**0.84902**	0.00134	0.85170	-0.01890	**0.87060**
MSTL-520	0.84510	0.00149	0.84808	-0.01890	0.86698
MSTL-540	0.84382	0.00135	0.84652	-0.01890	0.86542
MSTL-544	0.84344	0.00143	0.84630	-0.01890	0.86520
MSTL-560	0.84415	0.00146	0.84707	-0.01890	0.86597
MSTL-600	0.84084	0.00133	0.84350	-0.01890	0.86240
MSTL-616	0.83578	0.00128	0.83834	-0.01890	0.85724
MSTL-700	0.81979	0.00136	0.82251	-0.01890	0.84141
MSTL-705	0.82340	0.00126	0.82592	-0.01890	0.84482
MSTL-800	0.80041	0.00128	0.80297	-0.01890	0.82187
	0.84902			Max	0.87060
				Max S&T"	*0.87060*

0.100" Rods - Square Lattice

MTSL-058	0.48437	0.00115	0.48667	-0.01890	0.50557
MTSL-100	0.59486	0.00123	0.59732	-0.01890	0.61622
MTSL-200	0.74634	0.00147	0.74928	-0.01890	0.76818
MTSL-300	0.81045	0.00143	0.81331	-0.01890	0.83221
MTSL-400	0.84111	0.00138	0.84387	-0.01890	0.86277
MTSL-410	0.84055	0.00133	0.84321	-0.01890	0.86211
MTSL-420	0.84461	0.00139	0.84739	-0.01890	0.86629
MTSL-430	0.84466	0.00127	0.84720	-0.01890	0.86610
MTSL-437	0.84537	0.00144	0.84825	-0.01890	0.86715

MNTL-200	0.73965	0.00140	0.74245	-0.01890	0.76135
MNTL-300	0.80406	0.00135	0.80676	-0.01890	0.82566
MNTL-400	0.83101	0.00150	0.83401	-0.01890	0.85291
MNTL-410	0.83656	0.00137	0.83930	-0.01890	0.85820
MNTL-420	0.83506	0.00153	0.83812	-0.01890	0.85702
MNTL-430	0.83766	0.00147	0.84060	-0.01890	0.85950
MNTL-437	0.83675	0.00136	0.83947	-0.01890	0.85837
MNTL-440	0.83803	0.00141	0.84085	-0.01890	0.85975
MNTL-450	0.84039	0.00138	0.84315	-0.01890	0.86205
MNTL-460	0.83914	0.00143	0.84200	-0.01890	0.86090
MNTL-470	0.84254	0.00150	0.84554	-0.01890	0.86444
MNTL-480	0.84460	0.00137	0.84734	-0.01890	0.86624
MNTL-486	0.84535	0.00138	0.84811	-0.01890	0.86701
MNTL-490	0.84268	0.00129	0.84526	-0.01890	0.86416
MNTL-500	0.84221	0.00133	0.84487	-0.01890	0.86377
MNTL-520	0.84386	0.00141	0.84668	-0.01890	0.86558
MNTL-540	0.84260	0.00141	0.84542	-0.01890	0.86432
MNTL-544	0.84529	0.00128	0.84785	-0.01890	0.86675
MNTL-560	0.84643	0.00140	0.84923	-0.01890	0.86813
MNTL-600	**0.84713**	0.00141	0.84995	-0.01890	**0.86885**
MNTL-616	0.84206	0.00138	0.84482	-0.01890	0.86372
MNTL-700	0.83241	0.00128	0.83497	-0.01890	0.85387
MNTL-705	0.83327	0.00140	0.83607	-0.01890	0.85497
MNTL-800	0.82066	0.00131	0.82328	-0.01890	0.84218
	0.84713			Max	0.86885
				Max S&T"	*0.87070*

0.025" Rods - Square Lattice

MESL-058	0.47690	0.00111	0.47912	-0.01890	0.49802
MESL-100	0.58435	0.00128	0.58691	-0.01890	0.60581
MESL-200	0.73050	0.00153	0.73356	-0.01890	0.75246
MESL-300	0.79411	0.00158	0.79727	-0.01890	0.81617
MESL-400	0.82429	0.00139	0.82707	-0.01890	0.84597
MESL-410	0.82417	0.00152	0.82721	-0.01890	0.84611
MESL-420	0.83070	0.00142	0.83354	-0.01890	0.85244
MESL-430	0.83316	0.00148	0.83612	-0.01890	0.85502
MESL-437	0.83162	0.00138	0.83438	-0.01890	0.85328

MTSL-440	0.84631	0.00130	0.84891	-0.01890	0.86781
MTSL-450	0.84523	0.00142	0.84807	-0.01890	0.86697
MTSL-460	0.84688	0.00133	0.84954	-0.01890	0.86844
MTSL-470	0.84710	0.00136	0.84982	-0.01890	0.86872
MTSL-480	0.84680	0.00147	0.84974	-0.01890	0.86864
MTSL-486	0.84858	0.00140	0.85138	-0.01890	0.87028
MTSL-490	0.84532	0.00126	0.84784	-0.01890	0.86674
MTSL-500	0.84727	0.00135	0.84997	-0.01890	0.86887
MTSL-520	0.85062	0.00140	0.85342	-0.01890	0.87232
MTSL-540	**0.85424**	0.00146	0.85716	-0.01890	**0.87606**
MTSL-544	0.85052	0.00141	0.85334	-0.01890	0.87224
MTSL-560	0.84946	0.00132	0.85210	-0.01890	0.87100
MTSL-600	0.85040	0.00139	0.85318	-0.01890	0.87208
MTSL-616	0.84872	0.00131	0.85134	-0.01890	0.87024
MTSL-700	0.83377	0.00144	0.83665	-0.01890	0.85555
MTSL-705	0.83436	0.00148	0.83732	-0.01890	0.85622
MTSL-800	0.81657	0.00138	0.81933	-0.01890	0.83823
				Max	0.87606

0.100" Rods - Triangular Lattice

MTTL-058	0.48163	0.00119	0.48401	-0.01890	0.50291
MTTL-100	0.59320	0.00136	0.59592	-0.01890	0.61482
MTTL-200	0.74350	0.00138	0.74626	-0.01890	0.76516
MTTL-300	0.81212	0.00137	0.81486	-0.01890	0.83376
MTTL-400	0.84174	0.00156	0.84486	-0.01890	0.86376
MTTL-410	0.83926	0.00139	0.84204	-0.01890	0.86094
MTTL-420	0.84373	0.00145	0.84663	-0.01890	0.86553
MTTL-430	0.84611	0.00139	0.84889	-0.01890	0.86779
MTTL-437	0.84414	0.00146	0.84706	-0.01890	0.86596
MTTL-440	0.84348	0.00153	0.84654	-0.01890	0.86544
MTTL-450	0.84514	0.00138	0.84790	-0.01890	0.86680
MTTL-460	0.84780	0.00135	0.85050	-0.01890	0.86940
MTTL-470	0.85112	0.00150	0.85412	-0.01890	0.87302
MTTL-480	0.84924	0.00144	0.85212	-0.01890	0.87102
MTTL-486	0.84843	0.00131	0.85105	-0.01890	0.86995
MTTL-490	0.84911	0.00142	0.85195	-0.01890	0.87085
MTTL-500	0.84786	0.00139	0.85064	-0.01890	0.86954

MESL-440	0.83442	0.00141	0.83724	-0.01890	0.85614
MESL-450	0.83420	0.00151	0.83722	-0.01890	0.85612
MESL-460	0.83519	0.00133	0.83785	-0.01890	0.85675
MESL-470	0.83568	0.00135	0.83838	-0.01890	0.85728
MESL-480	0.83594	0.00143	0.83880	-0.01890	0.85770
MESL-486	0.83832	0.00141	0.84114	-0.01890	0.86004
MESL-490	0.83623	0.00138	0.83899	-0.01890	0.85789
MESL-500	0.83853	0.00129	0.84111	-0.01890	0.86001
MESL-520	0.83892	0.00139	0.84170	-0.01890	0.86060
MESL-540	0.83576	0.00142	0.83860	-0.01890	0.85750
MESL-544	0.83794	0.00148	0.84090	-0.01890	0.85980
MESL-560	0.83988	0.00132	0.84252	-0.01890	0.86142
MESL-600	**0.84060**	0.00133	0.84326	-0.01890	**0.86216**
MESL-616	0.83660	0.00137	0.83934	-0.01890	0.85824
MESL-700	0.82816	0.00143	0.83102	-0.01890	0.84992
MESL-705	0.82778	0.00129	0.83036	-0.01890	0.84926
MESL-800	0.81671	0.00133	0.81937	-0.01890	0.83827
				Max	0.86216

0.025" Rods - Triangular Lattice

METL-058	0.48044	0.00109	0.48262	-0.01890	0.50152
METL-100	0.58314	0.00134	0.58582	-0.01890	0.60472
METL-200	0.73344	0.00132	0.73608	-0.01890	0.75498
METL-300	0.79617	0.00139	0.79895	-0.01890	0.81785
METL-400	0.82619	0.00140	0.82899	-0.01890	0.84789
METL-410	0.83031	0.00148	0.83327	-0.01890	0.85217
METL-420	0.83033	0.00150	0.83333	-0.01890	0.85223
METL-430	0.83249	0.00153	0.83555	-0.01890	0.85445
METL-437	0.83021	0.00137	0.83295	-0.01890	0.85185
METL-440	0.83166	0.00141	0.83448	-0.01890	0.85338
METL-450	0.83260	0.00137	0.83534	-0.01890	0.85424
METL-460	0.83529	0.00140	0.83809	-0.01890	0.85699
METL-470	0.83717	0.00151	0.84019	-0.01890	0.85909
METL-480	0.83559	0.00137	0.83833	-0.01890	0.85723
METL-486	0.83568	0.00145	0.83858	-0.01890	0.85748
METL-490	0.83489	0.00141	0.83771	-0.01890	0.85661
METL-500	0.83764	0.00134	0.84032	-0.01890	0.85922

MTTL-520	0.84861	0.00138	0.85137	-0.01890	0.87027	METL-520	0.83992	0.00143	0.84278	-0.01890	0.86168
MTTL-540	0.84927	0.00133	0.85193	-0.01890	0.87083	METL-540	0.83954	0.00139	0.84232	-0.01890	0.86122
MTTL-544	0.84917	0.00138	0.85193	-0.01890	0.87083	METL-544	0.84027	0.00142	0.84311	-0.01890	0.86201
MTTL-560	0.84723	0.00153	0.85029	-0.01890	0.86919	METL-560	**0.84035**	0.00141	0.84317	-0.01890	**0.86207**
MTTL-600	**0.85120**	0.00146	0.85412	-0.01890	**0.87302**	METL-600	0.83823	0.00146	0.84115	-0.01890	0.86005
MTTL-616	0.84365	0.00144	0.84653	-0.01890	0.86543	METL-616	0.83826	0.00131	0.84088	-0.01890	0.85978
MTTL-700	0.83327	0.00136	0.83599	-0.01890	0.85489	METL-700	0.82743	0.00145	0.83033	-0.01890	0.84923
MTTL-705	0.83370	0.00133	0.83636	-0.01890	0.85526	METL-705	0.82801	0.00147	0.83095	-0.01890	0.84985
MTTL-800	0.81712	0.00137	0.81986	-0.01890	0.83876	METL-800	0.81311	0.00138	0.81587	-0.01890	0.83477
				Max	0.87302					Max	0.86207
				Max S&T	0.87606					Max S&T	0.86216

46 Kg Undamaged Array Cases with VFO

VFO-Name	VFO-KEFF	VFO-Sigma	K+2S	Bias	K+2S - B	VFO-Name	VFO-KEFF	VFO-Sigma	K+2S	Bias	K+2S - B
	0.200" Rods - Square Lattice						0.050" Rods - Square Lattice				
AASL-058	0.54593	0.00120	0.54833	-0.01890	0.56723	ACSL-058	0.53983	0.00108	0.54199	-0.01890	0.56089
AASL-100	0.65994	0.00125	0.66244	-0.01890	0.68134	ACSL-100	0.64692	0.00125	0.64942	-0.01890	0.66832
AASL-200	0.80791	0.00133	0.81057	-0.01890	0.82947	ACSL-200	0.79021	0.00136	0.79293	-0.01890	0.81183
AASL-300	0.86836	0.00142	0.87120	-0.01890	0.89010	ACSL-300	0.85219	0.00149	0.85517	-0.01890	0.87407
AASL-400	0.88524	0.00140	0.88804	-0.01890	0.90694	ACSL-400	0.87856	0.00146	0.88148	-0.01890	0.90038
AASL-410	0.88709	0.00132	0.88973	-0.01890	0.90863	ACSL-410	0.87622	0.00124	0.87870	-0.01890	0.89760
AASL-420	0.88632	0.00140	0.88912	-0.01890	0.90802	ACSL-420	0.88162	0.00144	0.88450	-0.01890	0.90340
AASL-430	0.88711	0.00135	0.88981	-0.01890	0.90871	ACSL-430	0.88211	0.00126	0.88463	-0.01890	0.90353
AASL-437	0.88789	0.00136	0.89061	-0.01890	0.90951	ACSL-437	0.88395	0.00137	0.88669	-0.01890	0.90559
AASL-440	0.88599	0.00140	0.88879	-0.01890	0.90769	ACSL-440	0.88235	0.00129	0.88493	-0.01890	0.90383
AASL-450	0.88886	0.00134	0.89154	-0.01890	0.91044	ACSL-450	0.88119	0.00143	0.88405	-0.01890	0.90295
AASL-460	0.88685	0.00141	0.88967	-0.01890	0.90857	ACSL-460	0.88503	0.00137	0.88777	-0.01890	0.90667
AASL-470	0.88539	0.00135	0.88809	-0.01890	0.90699	ACSL-470	0.88300	0.00138	0.88576	-0.01890	0.90466
AASL-480	0.88736	0.00139	0.89014	-0.01890	0.90904	ACSL-480	0.88638	0.00145	0.88928	-0.01890	0.90818
AASL-486	**0.88897**	0.00142	0.89181	-0.01890	**0.91071**	ACSL-486	0.88367	0.00136	0.88639	-0.01890	0.90529
AASL-490	0.88791	0.00142	0.89075	-0.01890	0.90965	ACSL-490	0.88359	0.00136	0.88631	-0.01890	0.90521
AASL-500	0.88600	0.00135	0.88870	-0.01890	0.90760	ACSL-500	0.88610	0.00124	0.88858	-0.01890	0.90748
AASL-520	0.88485	0.00128	0.88741	-0.01890	0.90631	ACSL-520	0.88615	0.00124	0.88863	-0.01890	0.90753
AASL-540	0.87942	0.00131	0.88204	-0.01890	0.90094	ACSL-540	0.88595	0.00141	0.88877	-0.01890	0.90767
AASL-544	0.88304	0.00132	0.88568	-0.01890	0.90458	ACSL-544	0.88777	0.00144	0.89065	-0.01890	0.90955

AASL-560	0.88326	0.00135	0.88596	-0.01890	0.90486
AASL-600	0.87907	0.00127	0.88161	-0.01890	0.90051
AASL-616	0.87446	0.00124	0.87694	-0.01890	0.89584
AASL-700	0.85746	0.00135	0.86016	-0.01890	0.87906
AASL-705	0.85548	0.00125	0.85798	-0.01890	0.87688
AASL-800	0.83608	0.00142	0.83892	-0.01890	0.85782
				Max	0.91071
	0.200" Rods - Triangular Lattice				
AATL-058	0.54722	0.00108	0.54938	-0.01890	0.56828
AATL-100	0.66350	0.00118	0.66586	-0.01890	0.68476
AATL-200	0.80727	0.00139	0.81005	-0.01890	0.82895
AATL-300	0.86486	0.00137	0.86760	-0.01890	0.88650
AATL-400	0.88568	0.00137	0.88842	-0.01890	0.90732
AATL-410	0.88722	0.00130	0.88982	-0.01890	0.90872
AATL-420	0.88735	0.00150	0.89035	-0.01890	0.90925
AATL-430	0.88620	0.00138	0.88896	-0.01890	0.90786
AATL-437	**0.89076**	0.00145	0.89366	-0.01890	**0.91256**
AATL-440	0.88880	0.00139	0.89158	-0.01890	0.91048
AATL-450	0.88957	0.00130	0.89217	-0.01890	0.91107
AATL-460	0.88933	0.00133	0.89199	-0.01890	0.91089
AATL-470	0.88786	0.00135	0.89056	-0.01890	0.90946
AATL-480	0.88969	0.00142	0.89253	-0.01890	0.91143
AATL-486	0.88631	0.00136	0.88903	-0.01890	0.90793
AATL-490	0.88677	0.00146	0.88969	-0.01890	0.90859
AATL-500	0.88788	0.00139	0.89066	-0.01890	0.90956
AATL-520	0.88567	0.00133	0.88833	-0.01890	0.90723
AATL-540	0.88408	0.00148	0.88704	-0.01890	0.90594
AATL-544	0.88578	0.00133	0.88844	-0.01890	0.90734
AATL-560	0.88247	0.00137	0.88521	-0.01890	0.90411
AATL-600	0.88003	0.00151	0.88305	-0.01890	0.90195
AATL-616	0.87572	0.00138	0.87848	-0.01890	0.89738
AATL-700	0.85787	0.00122	0.86031	-0.01890	0.87921
AATL-705	0.85653	0.00135	0.85923	-0.01890	0.87813
AATL-800	0.83850	0.00117	0.84084	-0.01890	0.85974
				Max	0.91256
				Max S&T	0.91256

ACSL-560	**0.88834**	0.00138	0.89110	-0.01890	**0.91000**
ACSL-600	0.88641	0.00130	0.88901	-0.01890	0.90791
ACSL-616	0.88528	0.00141	0.88810	-0.01890	0.90700
ACSL-700	0.87351	0.00128	0.87607	-0.01890	0.89497
ACSL-705	0.87336	0.00138	0.87612	-0.01890	0.89502
ACSL-800	0.85578	0.00123	0.85824	-0.01890	0.87714
				Max	0.91000
	0.050" Rods - Triangular Lattice				
ACTL-058	0.53669	0.00119	0.53907	-0.01890	0.55797
ACTL-100	0.64866	0.00140	0.65146	-0.01890	0.67036
ACTL-200	0.79045	0.00134	0.79313	-0.01890	0.81203
ACTL-300	0.85219	0.00137	0.85493	-0.01890	0.87383
ACTL-400	0.87917	0.00148	0.88213	-0.01890	0.90103
ACTL-410	0.87789	0.00122	0.88033	-0.01890	0.89923
ACTL-420	0.87821	0.00142	0.88105	-0.01890	0.89995
ACTL-430	0.87912	0.00147	0.88206	-0.01890	0.90096
ACTL-437	0.88496	0.00135	0.88766	-0.01890	0.90656
ACTL-440	0.88078	0.00149	0.88376	-0.01890	0.90266
ACTL-450	0.88408	0.00133	0.88674	-0.01890	0.90564
ACTL-460	0.88684	0.00136	0.88956	-0.01890	0.90846
ACTL-470	0.88550	0.00144	0.88838	-0.01890	0.90728
ACTL-480	0.88689	0.00146	0.88981	-0.01890	0.90871
ACTL-486	0.88435	0.00126	0.88687	-0.01890	0.90577
ACTL-490	0.88347	0.00142	0.88631	-0.01890	0.90521
ACTL-500	0.88531	0.00142	0.88815	-0.01890	0.90705
ACTL-520	0.88653	0.00133	0.88919	-0.01890	0.90809
ACTL-540	0.88606	0.00127	0.88860	-0.01890	0.90750
ACTL-544	0.88548	0.00139	0.88826	-0.01890	0.90716
ACTL-560	0.88624	0.00140	0.88904	-0.01890	0.90794
ACTL-600	**0.88882**	0.00126	0.89134	-0.01890	**0.91024**
ACTL-616	0.88570	0.00131	0.88832	-0.01890	0.90722
ACTL-700	0.87278	0.00128	0.87534	-0.01890	0.89424
ACTL-705	0.87322	0.00136	0.87594	-0.01890	0.89484
ACTL-800	0.85659	0.00131	0.85921	-0.01890	0.87811
				Max	0.91024
				Max S&T	0.91024

0.100" Rods - Square Lattice

ABSL-058	0.54036	0.00127	0.54290	-0.01890	0.56180
ABSL-100	0.65354	0.00116	0.65586	-0.01890	0.67476
ABSL-200	0.79634	0.00130	0.79894	-0.01890	0.81784
ABSL-300	0.85897	0.00140	0.86177	-0.01890	0.88067
ABSL-400	0.88468	0.00133	0.88734	-0.01890	0.90624
ABSL-410	0.88495	0.00150	0.88795	-0.01890	0.90685
ABSL-420	0.88756	0.00138	0.89032	-0.01890	0.90922
ABSL-430	0.88636	0.00137	0.88910	-0.01890	0.90800
ABSL-437	0.88741	0.00144	0.89029	-0.01890	0.90919
ABSL-440	0.88751	0.00129	0.89009	-0.01890	0.90899
ABSL-450	0.88759	0.00154	0.89067	-0.01890	0.90957
ABSL-460	0.89134	0.00149	0.89432	-0.01890	0.91322
ABSL-470	0.88864	0.00127	0.89118	-0.01890	0.91008
ABSL-480	0.89296	0.00142	0.89580	-0.01890	0.91470
ABSL-486	0.88909	0.00131	0.89171	-0.01890	0.91061
ABSL-490	0.88933	0.00131	0.89195	-0.01890	0.91085
ABSL-500	0.89107	0.00127	0.89361	-0.01890	0.91251
ABSL-520	**0.89600**	0.00133	0.89866	-0.01890	**0.91756**
ABSL-540	0.89228	0.00133	0.89494	-0.01890	0.91384
ABSL-544	0.89281	0.00139	0.89559	-0.01890	0.91449
ABSL-560	0.89142	0.00132	0.89406	-0.01890	0.91296
ABSL-600	0.88925	0.00141	0.89207	-0.01890	0.91097
ABSL-616	0.88897	0.00136	0.89169	-0.01890	0.91059
ABSL-700	0.87214	0.00132	0.87478	-0.01890	0.89368
ABSL-705	0.87297	0.00123	0.87543	-0.01890	0.89433
ABSL-800	0.85544	0.00129	0.85802	-0.01890	0.87692
				Max	0.91756

0.025" Rods - Square Lattice

ADSL-058	0.53699	0.00112	0.53923	-0.01890	0.55813
ADSL-100	0.64626	0.00131	0.64888	-0.01890	0.66778
ADSL-200	0.78685	0.00148	0.78981	-0.01890	0.80871
ADSL-300	0.84212	0.00140	0.84492	-0.01890	0.86382
ADSL-400	0.87205	0.00145	0.87495	-0.01890	0.89385
ADSL-410	0.87301	0.00145	0.87591	-0.01890	0.89481
ADSL-420	0.87462	0.00132	0.87726	-0.01890	0.89616
ADSL-430	0.87263	0.00137	0.87537	-0.01890	0.89427
ADSL-437	0.87525	0.00133	0.87791	-0.01890	0.89681
ADSL-440	0.87536	0.00137	0.87810	-0.01890	0.89700
ADSL-450	0.87542	0.00140	0.87822	-0.01890	0.89712
ADSL-460	0.87698	0.00144	0.87986	-0.01890	0.89876
ADSL-470	0.87973	0.00126	0.88225	-0.01890	0.90115
ADSL-480	0.87690	0.00140	0.87970	-0.01890	0.89860
ADSL-486	0.87837	0.00140	0.88117	-0.01890	0.90007
ADSL-490	0.87836	0.00137	0.88110	-0.01890	0.90000
ADSL-500	0.87640	0.00134	0.87908	-0.01890	0.89798
ADSL-520	0.88081	0.00137	0.88355	-0.01890	0.90245
ADSL-540	0.87885	0.00135	0.88155	-0.01890	0.90045
ADSL-544	0.88052	0.00145	0.88342	-0.01890	0.90232
ADSL-560	**0.88223**	0.00135	0.88493	-0.01890	**0.90383**
ADSL-600	0.87829	0.00141	0.88111	-0.01890	0.90001
ADSL-616	0.88050	0.00141	0.88332	-0.01890	0.90222
ADSL-700	0.86499	0.00134	0.86767	-0.01890	0.88657
ADSL-705	0.86636	0.00129	0.86894	-0.01890	0.88784
ADSL-800	0.85027	0.00127	0.85281	-0.01890	0.87171
				Max	0.90383

0.100" Rods - Triangular Lattice

ABTL-058	0.54080	0.00106	0.54292	-0.01890	0.56182
ABTL-100	0.65154	0.00132	0.65418	-0.01890	0.67308
ABTL-200	0.79916	0.00150	0.80216	-0.01890	0.82106
ABTL-300	0.86231	0.00145	0.86521	-0.01890	0.88411
ABTL-400	0.88693	0.00142	0.88977	-0.01890	0.90867
ABTL-410	0.88416	0.00146	0.88708	-0.01890	0.90598
ABTL-420	0.88603	0.00133	0.88869	-0.01890	0.90759

0.025" Rods - Triangular Lattice

ADTL-058	0.53490	0.00120	0.53730	-0.01890	0.55620
ADTL-100	0.64439	0.00124	0.64687	-0.01890	0.66577
ADTL-200	0.78703	0.00140	0.78983	-0.01890	0.80873
ADTL-300	0.84284	0.00137	0.84558	-0.01890	0.86448
ADTL-400	0.87114	0.00133	0.87380	-0.01890	0.89270
ADTL-410	0.87076	0.00140	0.87356	-0.01890	0.89246
ADTL-420	0.87084	0.00141	0.87366	-0.01890	0.89256

ABTL-430	0.88804	0.00144	0.89092	-0.01890	0.90982	ADTL-430	0.87458	0.00127	0.87712	-0.01890	0.89602
ABTL-437	0.89131	0.00131	0.89393	-0.01890	0.91283	ADTL-437	0.87391	0.00145	0.87681	-0.01890	0.89571
ABTL-440	0.88908	0.00135	0.89178	-0.01890	0.91068	ADTL-440	0.87581	0.00142	0.87865	-0.01890	0.89755
ABTL-450	0.88723	0.00130	0.88983	-0.01890	0.90873	ADTL-450	0.87647	0.00139	0.87925	-0.01890	0.89815
ABTL-460	0.89073	0.00144	0.89361	-0.01890	0.91251	ADTL-460	0.87906	0.00122	0.88150	-0.01890	0.90040
ABTL-470	0.89110	0.00141	0.89392	-0.01890	0.91282	ADTL-470	0.88089	0.00139	0.88367	-0.01890	0.90257
ABTL-480	0.88989	0.00143	0.89275	-0.01890	0.91165	ADTL-480	0.87745	0.00134	0.88013	-0.01890	0.89903
ABTL-486	0.88989	0.00137	0.89263	-0.01890	0.91153	ADTL-486	0.88112	0.00144	0.88400	-0.01890	0.90290
ABTL-490	**0.89307**	0.00152	0.89611	-0.01890	**0.91501**	ADTL-490	0.87697	0.00132	0.87961	-0.01890	0.89851
ABTL-500	0.88913	0.00137	0.89187	-0.01890	0.91077	ADTL-500	0.87801	0.00148	0.88097	-0.01890	0.89987
ABTL-520	0.89038	0.00137	0.89312	-0.01890	0.91202	ADTL-520	0.88147	0.00138	0.88423	-0.01890	0.90313
ABTL-540	0.89299	0.00136	0.89571	-0.01890	0.91461	ADTL-540	0.88127	0.00147	0.88421	-0.01890	0.90311
ABTL-544	0.89054	0.00136	0.89326	-0.01890	0.91216	ADTL-544	**0.88161**	0.00152	0.88465	-0.01890	**0.90355**
ABTL-560	0.88812	0.00132	0.89076	-0.01890	0.90966	ADTL-560	0.87924	0.00136	0.88196	-0.01890	0.90086
ABTL-600	0.89083	0.00126	0.89335	-0.01890	0.91225	ADTL-600	0.87964	0.00137	0.88238	-0.01890	0.90128
ABTL-616	0.88224	0.00137	0.88498	-0.01890	0.90388	ADTL-616	0.88068	0.00150	0.88368	-0.01890	0.90258
ABTL-700	0.87672	0.00137	0.87946	-0.01890	0.89836	ADTL-700	0.86849	0.00138	0.87125	-0.01890	0.89015
ABTL-705	0.87357	0.00128	0.87613	-0.01890	0.89503	ADTL-705	0.86826	0.00143	0.87112	-0.01890	0.89002
ABTL-800	0.85460	0.00132	0.85724	-0.01890	0.87614	ADTL-800	0.85202	0.00143	0.85488	-0.01890	0.87378
				Max	0.91501					Max	0.90355
				Max S&T	0.91756					Max S&T	0.90383

46 Kg Damaged Array Cases with VFO

VFO-Name	VFO-KEFF	VFO-Sigma	K+2S	Bias	K+2S - B	VFO-Name	VFO-KEFF	VFO-Sigma	K+2S	Bias	K+2S - B
	0.200" Rods - Square Lattice						0.050" Rods - Square Lattice				
AS46-058	0.50171	0.00100	0.50371	-0.01890	0.52261	CS46-058	0.49184	0.00106	0.49396	-0.01890	0.51286
AS46-100	0.62810	0.00126	0.63062	-0.01890	0.64952	CS46-100	0.61395	0.00126	0.61647	-0.01890	0.63537
AS46-200	0.80113	0.00141	0.80395	-0.01890	0.82285	CS46-200	0.78329	0.00130	0.78589	-0.01890	0.80479
AS46-300	0.87626	0.00144	0.87914	-0.01890	0.89804	CS46-300	0.85964	0.00146	0.86256	-0.01890	0.88146
AS46-400	0.90300	0.00139	0.90578	-0.01890	0.92468	CS46-400	0.89626	0.00132	0.89890	-0.01890	0.91780
AS46-410	0.90190	0.00137	0.90464	-0.01890	0.92354	CS46-410	0.89734	0.00137	0.90008	-0.01890	0.91898
AS46-420	0.90563	0.00133	0.90829	-0.01890	0.92719	CS46-420	0.90139	0.00137	0.90413	-0.01890	0.92303
AS46-430	0.90621	0.00132	0.90885	-0.01890	0.92775	CS46-430	0.90192	0.00151	0.90494	-0.01890	0.92384
AS46-437	0.90726	0.00135	0.90996	-0.01890	0.92886	CS46-437	0.90185	0.00136	0.90457	-0.01890	0.92347
AS46-440	0.90861	0.00146	0.91153	-0.01890	0.93043	CS46-440	0.90358	0.00158	0.90674	-0.01890	0.92564

AS46-450	0.90806	0.00139	0.91084	-0.01890	0.92974	CS46-450	0.90615	0.00139	0.90893	-0.01890	0.92783
AS46-460	0.91216	0.00147	0.91510	-0.01890	0.93400	CS46-460	0.91003	0.00137	0.91277	-0.01890	0.93167
AS46-470	0.91223	0.00133	0.91489	-0.01890	0.93379	CS46-470	0.91053	0.00133	0.91319	-0.01890	0.93209
AS46-480	0.91407	0.00126	0.91659	-0.01890	0.93549	CS46-480	0.91116	0.00128	0.91372	-0.01890	0.93262
AS46-486	0.91351	0.00146	0.91643	-0.01890	0.93533	CS46-486	0.91188	0.00143	0.91474	-0.01890	0.93364
AS46-490	0.91354	0.00139	0.91632	-0.01890	0.93522	CS46-490	0.91540	0.00144	0.91828	-0.01890	0.93718
AS46-500	0.91610	0.00139	0.91888	-0.01890	0.93778	CS46-500	0.91274	0.00135	0.91544	-0.01890	0.93434
AS46-520	0.91215	0.00133	0.91481	-0.01890	0.93371	CS46-520	0.91540	0.00134	0.91808	-0.01890	0.93698
AS46-540	**0.91869**	0.00129	0.92127	-0.01890	**0.94017**	CS46-540	0.91646	0.00146	0.91938	-0.01890	0.93828
AS46-544	0.91716	0.00146	0.92008	-0.01890	0.93898	CS46-544	0.92135	0.00116	0.92367	-0.01890	0.94257
AS46-560	0.91545	0.00143	0.91831	-0.01890	0.93721	CS46-560	0.91886	0.00130	0.92146	-0.01890	0.94036
AS46-600	0.91627	0.00138	0.91903	-0.01890	0.93793	CS46-600	0.92084	0.00128	0.92340	-0.01890	0.94230
AS46-616	0.91354	0.00130	0.91614	-0.01890	0.93504	CS46-616	**0.92402**	0.00128	0.92658	-0.01890	**0.94548**
AS46-700	0.89348	0.00126	0.89600	-0.01890	0.91490	CS46-700	0.90783	0.00132	0.91047	-0.01890	0.92937
AS46-705	0.89050	0.00136	0.89322	-0.01890	0.91212	CS46-705	0.91150	0.00119	0.91388	-0.01890	0.93278
AS46-800	0.86881	0.00126	0.87133	-0.01890	0.89023	CS46-800	0.89121	0.00140	0.89401	-0.01890	0.91291
				Max	0.94017					Max	0.94548
	0.200" Rods - Triangular Lattice						0.050" Rods - Triangular Lattice				
AT46-058	0.50051	0.00110	0.50271	-0.01890	0.52161	CT46-058	0.49205	0.00111	0.49427	-0.01890	0.51317
AT46-100	0.62918	0.00125	0.63168	-0.01890	0.65058	CT46-100	0.61648	0.00124	0.61896	-0.01890	0.63786
AT46-200	0.79906	0.00153	0.80212	-0.01890	0.82102	CT46-200	0.78563	0.00153	0.78869	-0.01890	0.80759
AT46-300	0.87492	0.00130	0.87752	-0.01890	0.89642	CT46-300	0.85624	0.00137	0.85898	-0.01890	0.87788
AT46-400	0.90489	0.00142	0.90773	-0.01890	0.92663	CT46-400	0.89577	0.00138	0.89853	-0.01890	0.91743
AT46-410	0.90654	0.00131	0.90916	-0.01890	0.92806	CT46-410	0.89991	0.00150	0.90291	-0.01890	0.92181
AT46-420	0.90731	0.00134	0.90999	-0.01890	0.92889	CT46-420	0.90211	0.00138	0.90487	-0.01890	0.92377
AT46-430	0.90938	0.00136	0.91210	-0.01890	0.93100	CT46-430	0.90127	0.00145	0.90417	-0.01890	0.92307
AT46-437	0.91126	0.00146	0.91418	-0.01890	0.93308	CT46-437	0.90211	0.00150	0.90511	-0.01890	0.92401
AT46-440	0.91122	0.00136	0.91394	-0.01890	0.93284	CT46-440	0.90598	0.00147	0.90892	-0.01890	0.92782
AT46-450	0.90899	0.00134	0.91167	-0.01890	0.93057	CT46-450	0.90840	0.00135	0.91110	-0.01890	0.93000
AT46-460	0.91345	0.00129	0.91603	-0.01890	0.93493	CT46-460	0.90581	0.00142	0.90865	-0.01890	0.92755
AT46-470	0.91224	0.00140	0.91504	-0.01890	0.93394	CT46-470	0.91036	0.00147	0.91330	-0.01890	0.93220
AT46-480	0.91637	0.00134	0.91905	-0.01890	0.93795	CT46-480	0.91399	0.00135	0.91669	-0.01890	0.93559
AT46-486	0.91346	0.00124	0.91594	-0.01890	0.93484	CT46-486	0.91129	0.00131	0.91391	-0.01890	0.93281
AT46-490	0.91146	0.00141	0.91428	-0.01890	0.93318	CT46-490	0.91173	0.00127	0.91427	-0.01890	0.93317
AT46-500	**0.91880**	0.00130	0.92140	-0.01890	**0.94030**	CT46-500	0.91332	0.00126	0.91584	-0.01890	0.93474
AT46-520	0.91821	0.00124	0.92069	-0.01890	0.93959	CT46-520	0.91715	0.00140	0.91995	-0.01890	0.93885

AT46-540	0.91661	0.00125	0.91911	-0.01890	0.93801	CT46-540	0.91562	0.00136	0.91834	-0.01890	0.93724
AT46-544	0.91744	0.00135	0.92014	-0.01890	0.93904	CT46-544	0.91865	0.00134	0.92133	-0.01890	0.94023
AT46-560	0.91850	0.00142	0.92134	-0.01890	0.94024	CT46-560	0.92192	0.00131	0.92454	-0.01890	0.94344
AT46-600	0.91727	0.00133	0.91993	-0.01890	0.93883	CT46-600	0.92321	0.00127	0.92575	-0.01890	0.94465
AT46-616	0.91347	0.00135	0.91617	-0.01890	0.93507	CT46-616	**0.92449**	0.00131	0.92711	-0.01890	**0.94601**
AT46-700	0.89630	0.00133	0.89896	-0.01890	0.91786	CT46-700	0.90962	0.00129	0.91220	-0.01890	0.93110
AT46-705	0.89717	0.00130	0.89977	-0.01890	0.91867	CT46-705	0.91095	0.00133	0.91361	-0.01890	0.93251
AT46-800	0.87171	0.00120	0.87411	-0.01890	0.89301	CT46-800	0.89150	0.00125	0.89400	-0.01890	0.91290
				Max	0.94030					Max	0.94601
	0.100" Rods - Square Lattice			Max S&T	0.94030		0.025" Rods - Square Lattice			Max S&T	0.94601
BS46-058	0.49777	0.00120	0.50017	-0.01890	0.51907	DS46-058	0.49300	0.00103	0.49506	-0.01890	0.51396
BS46-100	0.61721	0.00122	0.61965	-0.01890	0.63855	DS46-100	0.61111	0.00125	0.61361	-0.01890	0.63251
BS46-200	0.79010	0.00150	0.79310	-0.01890	0.81200	DS46-200	0.77565	0.00144	0.77853	-0.01890	0.79743
BS46-300	0.86631	0.00150	0.86931	-0.01890	0.88821	DS46-300	0.85460	0.00141	0.85742	-0.01890	0.87632
BS46-400	0.90117	0.00143	0.90403	-0.01890	0.92293	DS46-400	0.89155	0.00135	0.89425	-0.01890	0.91315
BS46-410	0.90869	0.00132	0.91133	-0.01890	0.93023	DS46-410	0.89367	0.00129	0.89625	-0.01890	0.91515
BS46-420	0.90813	0.00139	0.91091	-0.01890	0.92981	DS46-420	0.89318	0.00156	0.89630	-0.01890	0.91520
BS46-430	0.90713	0.00129	0.90971	-0.01890	0.92861	DS46-430	0.89375	0.00140	0.89655	-0.01890	0.91545
BS46-437	0.91223	0.00137	0.91497	-0.01890	0.93387	DS46-437	0.89626	0.00142	0.89910	-0.01890	0.91800
BS46-440	0.91027	0.00147	0.91321	-0.01890	0.93211	DS46-440	0.89656	0.00154	0.89964	-0.01890	0.91854
BS46-450	0.91214	0.00151	0.91516	-0.01890	0.93406	DS46-450	0.89559	0.00127	0.89813	-0.01890	0.91703
BS46-460	0.91283	0.00146	0.91575	-0.01890	0.93465	DS46-460	0.90060	0.00142	0.90344	-0.01890	0.92234
BS46-470	0.91338	0.00130	0.91598	-0.01890	0.93488	DS46-470	0.90146	0.00124	0.90394	-0.01890	0.92284
BS46-480	0.91587	0.00145	0.91877	-0.01890	0.93767	DS46-480	0.90077	0.00135	0.90347	-0.01890	0.92237
BS46-486	0.91836	0.00142	0.92120	-0.01890	0.94010	DS46-486	0.90360	0.00130	0.90620	-0.01890	0.92510
BS46-490	0.91963	0.00126	0.92215	-0.01890	0.94105	DS46-490	0.90409	0.00124	0.90657	-0.01890	0.92547
BS46-500	0.91776	0.00133	0.92042	-0.01890	0.93932	DS46-500	0.90599	0.00148	0.90895	-0.01890	0.92785
BS46-520	0.92090	0.00139	0.92368	-0.01890	0.94258	DS46-520	0.90756	0.00132	0.91020	-0.01890	0.92910
BS46-540	0.92026	0.00127	0.92280	-0.01890	0.94170	DS46-540	0.90963	0.00127	0.91217	-0.01890	0.93107
BS46-544	0.92346	0.00125	0.92596	-0.01890	0.94486	DS46-544	0.91374	0.00135	0.91644	-0.01890	0.93534
BS46-560	0.92184	0.00133	0.92450	-0.01890	0.94340	DS46-560	0.91439	0.00135	0.91709	-0.01890	0.93599
BS46-600	**0.92574**	0.00128	0.92830	-0.01890	**0.94720**	DS46-600	0.91625	0.00130	0.91885	-0.01890	0.93775
BS46-616	0.92539	0.00131	0.92801	-0.01890	0.94691	DS46-616	**0.91810**	0.00124	0.92058	-0.01890	**0.93948**
BS46-700	0.90749	0.00139	0.91027	-0.01890	0.92917	DS46-700	0.90290	0.00137	0.90564	-0.01890	0.92454
BS46-705	0.90659	0.00123	0.90905	-0.01890	0.92795	DS46-705	0.90094	0.00134	0.90362	-0.01890	0.92252
BS46-800	0.89039	0.00112	0.89263	-0.01890	0.91153	DS46-800	0.88750	0.00142	0.89034	-0.01890	0.90924

				Max	0.94720
	0.100" Rods - Triangular Lattice				
BT46-058	0.49500	0.00114	0.49728	-0.01890	0.51618
BT46-100	0.62308	0.00132	0.62572	-0.01890	0.64462
BT46-200	0.79157	0.00134	0.79425	-0.01890	0.81315
BT46-300	0.86788	0.00148	0.87084	-0.01890	0.88974
BT46-400	0.90064	0.00148	0.90360	-0.01890	0.92250
BT46-410	0.90207	0.00134	0.90475	-0.01890	0.92365
BT46-420	0.90738	0.00135	0.91008	-0.01890	0.92898
BT46-430	0.90859	0.00131	0.91121	-0.01890	0.93011
BT46-437	0.91270	0.00143	0.91556	-0.01890	0.93446
BT46-440	0.91105	0.00142	0.91389	-0.01890	0.93279
BT46-450	0.91088	0.00143	0.91374	-0.01890	0.93264
BT46-460	0.91521	0.00150	0.91821	-0.01890	0.93711
BT46-470	0.92015	0.00138	0.92291	-0.01890	0.94181
BT46-480	0.92026	0.00133	0.92292	-0.01890	0.94182
BT46-486	0.91702	0.00131	0.91964	-0.01890	0.93854
BT46-490	0.91882	0.00148	0.92178	-0.01890	0.94068
BT46-500	0.91897	0.00129	0.92155	-0.01890	0.94045
BT46-520	0.92161	0.00136	0.92433	-0.01890	0.94323
BT46-540	0.92381	0.00128	0.92637	-0.01890	0.94527
BT46-544	0.92260	0.00127	0.92514	-0.01890	0.94404
BT46-560	0.92469	0.00125	0.92719	-0.01890	0.94609
BT46-600	**0.92768**	0.00050	0.92868	-0.01890	**0.94758**
BT46-616	0.92214	0.00144	0.92502	-0.01890	0.94392
BT46-700	0.91188	0.00130	0.91448	-0.01890	0.93338
BT46-705	0.91012	0.00129	0.91270	-0.01890	0.93160
BT46-800	0.89305	0.00128	0.89561	-0.01890	0.91451
				Max	0.94758
				Max S&T	0.94758

				Max	0.93948
	0.025" Rods - Triangular Lattice				
DT46-058	0.49178	0.00107	0.49392	-0.01890	0.51282
DT46-100	0.61219	0.00134	0.61487	-0.01890	0.63377
DT46-200	0.77807	0.00152	0.78111	-0.01890	0.80001
DT46-300	0.85316	0.00147	0.85610	-0.01890	0.87500
DT46-400	0.88709	0.00143	0.88995	-0.01890	0.90885
DT46-410	0.88856	0.00143	0.89142	-0.01890	0.91032
DT46-420	0.89277	0.00136	0.89549	-0.01890	0.91439
DT46-430	0.89611	0.00151	0.89913	-0.01890	0.91803
DT46-437	0.89684	0.00135	0.89954	-0.01890	0.91844
DT46-440	0.89645	0.00144	0.89933	-0.01890	0.91823
DT46-450	0.89857	0.00143	0.90143	-0.01890	0.92033
DT46-460	0.90215	0.00131	0.90477	-0.01890	0.92367
DT46-470	0.90164	0.00125	0.90414	-0.01890	0.92304
DT46-480	0.90467	0.00139	0.90745	-0.01890	0.92635
DT46-486	0.90125	0.00131	0.90387	-0.01890	0.92277
DT46-490	0.90848	0.00136	0.91120	-0.01890	0.93010
DT46-500	0.90760	0.00132	0.91024	-0.01890	0.92914
DT46-520	0.91021	0.00145	0.91311	-0.01890	0.93201
DT46-540	0.91299	0.00128	0.91555	-0.01890	0.93445
DT46-544	0.91077	0.00141	0.91359	-0.01890	0.93249
DT46-560	0.91136	0.00132	0.91400	-0.01890	0.93290
DT46-600	**0.91908**	0.00127	0.92162	-0.01890	**0.94052**
DT46-616	0.91589	0.00136	0.91861	-0.01890	0.93751
DT46-700	0.90530	0.00115	0.90760	-0.01890	0.92650
DT46-705	0.90373	0.00135	0.90643	-0.01890	0.92533
DT46-800	0.88578	0.00138	0.88854	-0.01890	0.90744
				Max	0.94052
				Max S&T	0.94052

6.11 REACTIVITY COMPARISON OF U-COMPOUNDS

A reactivity comparison between 5% enriched theoretical UO_2, U_3O_8, UNH, and $CaU_xO_y \bullet ZH_2O$ compounds with water was considered to demonstrate that a theoretical mixture of UO2 and water is conservative relative to other homogeneous uranium compounds.

For comparison purposes, an infinite system is modeled for the compound material specifications provided in Tables 6.21 and 6.22. The comparison results between UO2, U3O8, UNH, and $CaU_6O_{19} \bullet 11H_2O$ are provided in Figure 6.0 in Section 6.1, General Description. A total of five separate calcium-uranium oxide compounds were evaluated as shown in Table 6.22. Only the most reactive form is provided in Figure 6.0.

In summary, Table 6.23 provides the calculated infinite multiplication factor results for the select compound and water mixtures, through optimal moderation. This table demonstrates, for <u>infinite systems,</u> there is little difference between UO2 and other oxide forms U_3O_8 and $CaU_xO_y \bullet ZH_2O$; while the UNH is markedly lower due to nitrogen absorption. These results do demonstrate that for finite systems, provided the total material mass does not exceed the equivalent homogeneous payload for UO2, these other compound forms will be less reactive.

Table 6.21 Material Specifications – Infinite System Reactivity Comparisons for UO2, U3O8, and UNH Compounds, 5% Enriched

COM	WF-W	FR.ENR	DFACT	RHOMIX gm/cc	RHOC gm/cc	RHOU gm/cc	UFACT	H/5	H/U x10
uo2, rho_c = 10.96 g/cc; ufact - 0.88144									
UO2	.000	.05000	1.0000	10.9600	10.9600	9.6606	.88144	0	0
UO2	.025	.05000	1.0000	8.7750	8.5556	7.5413	.88144	15	8
UO2	.050	.05000	1.0000	7.3164	6.9506	6.1265	.88144	31	16
UO2	.075	.05000	1.0000	6.2736	5.8031	5.1151	.88144	48	24
UO2	.100	.05000	1.0000	5.4910	4.9419	4.3560	.88144	66	33
UO2	.125	.05000	1.0000	4.8820	4.2717	3.7653	.88144	85	43
UO2	.150	.05000	1.0000	4.3945	3.7354	3.2925	.88144	104	53
UO2	.200	.05000	1.0000	3.6631	2.9305	2.5830	.88144	148	75
UO2	.250	.05000	1.0000	3.1404	2.3553	2.0761	.88144	197	100
UO2	.300	.05000	1.0000	2.7482	1.9238	1.6957	.88144	254	128
UO2	.350	.05000	1.0000	2.4432	1.5881	1.3998	.88144	319	161
UO2	.400	.05000	1.0000	2.1990	1.3194	1.1630	.88144	395	200
UO2	.450	.05000	1.0000	1.9993	1.0996	0.9692	.88144	484	245
UO2	.500	.05000	1.0000	1.8328	0.9164	0.8077	.88144	592	300
uox = u3o8; rho_c - 8.39 g/cc; ufact = 0.84793									
UOX	.000	.05000	1.0000	8.3900	8.3900	7.1141	.84793	0	0
UOX	.050	.05000	1.0000	6.1263	5.8200	4.9350	.84793	32	16
UOX	.100	.05000	1.0000	4.8246	4.3422	3.6818	.84793	68	35
UOX	.150	.05000	1.0000	3.9791	3.3823	2.8679	.84793	109	55
UOX	.200	.05000	1.0000	3.3858	2.7086	2.2967	.84793	154	78
UOX	.250	.05000	1.0000	2.9464	2.2098	1.8738	.84793	205	104
UOX	.300	.05000	1.0000	2.6080	1.8256	1.5480	.84793	264	133
UOX	.350	.05000	1.0000	2.3393	1.5206	1.2893	.84793	331	168
UOX	.400	.05000	1.0000	2.1208	1.2725	1.0790	.84793	410	208
UOX	.450	.05000	1.0000	1.9397	1.0668	0.9046	.84793	504	255
UOX	.500	.05000	1.0000	1.7870	0.8935	0.7576	.84793	615	311
unh - $UO_2(NO_3)_2 \bullet 6H_2O$; rho_c = 2.807 g/cc; ufact - 0.4739									
UNH	.000	.05000	1.0000	2.8070	2.8070	1.3302	.47390	237	120
UNH	.050	.05000	1.0000	2.5744	2.4457	1.1590	.47390	295	149
UNH	.100	.05000	1.0000	2.3774	2.1397	1.0140	.47390	359	182

UNH	.150	.05000	1.0000	2.2084	1.8771	0.8896	.47390	431	218
UNH	.200	.05000	1.0000	2.0618	1.6495	0.7817	.47390	512	259
UNH	.250	.05000	1.0000	1.9335	1.4501	0.6872	.47390	604	306
UNH	.300	.05000	1.0000	1.8202	1.2742	0.6038	.47390	709	359
UNH	.350	.05000	1.0000	1.7195	1.1177	0.5297	.47390	830	420
UNH	.400	.05000	1.0000	1.6293	0.9776	0.4633	.47390	971	492
UNH	.450	.05000	1.0000	1.5481	0.8515	0.4035	.47390	1138	576
UNH	.500	.05000	1.0000	1.4747	0.7373	0.3494	.47390	1338	677

Table 6.22 Material Specifications – Infinite System Reactivity Comparisons for Calcium – Uranium Oxide Compounds[2], 5% Enriched

compound id	rho c (g/cc)	ufact	mol. wt.
ca1: cauo3	6.97	0.729807	325.9748
ca2: cauo4	7.45	0.695663	341.9742
ca6: cau3o10*4h2o	5.337	0.723955	985.8290
ca7: cau6o19*11h2o	5.25	0.724702	1969.626
ca8: cau6o19*10h2o	5.10	0.731392	1951.611

Table 6.23 K-Infinite System Reactivity Results

CALCULATIONAL RESULTS

FILENAME	K-INF	SIGMA	K+2S	BIAS	K+2S-B	# HIST	LOST	DATE
k-infinite reactivity comparisons for select u-compounds								
guo2-00	0.8336	0.0005	0.8345	-.0090	0.8435	380000	3	08/09/02
guo2-025	1.0918	0.0008	1.0933	-.0090	1.1023	380000	3	08/09/02
guo2-05	1.2126	0.0008	1.2142	-.0090	1.2232	380000	2	08/09/02
guo2-075	1.2893	0.0008	1.2908	-.0090	1.2998	380000	3	08/09/02
guo2-10	1.3428	0.0009	1.3446	-.0090	1.3536	380000	2	08/09/02
guo2-125	1.3819	0.0008	1.3834	-.0090	1.3924	380000	1	08/09/02
guo2-15	1.4070	0.0007	1.4083	-.0090	1.4173	380000	0	08/09/02
guo2-20	1.4398	0.0007	1.4412	-.0090	1.4502	380000	2	08/09/02
guo2-25	1.4516	0.0007	1.4529	-.0090	**1.4619**	380000	0	08/09/02
guo2-30	1.4507	0.0006	1.4519	-.0090	1.4609	380000	1	08/09/02
guo2-35	1.4377	0.0005	1.4388	-.0090	1.4478	380000	0	08/09/02
guo2-40	1.4188	0.0005	1.4199	-.0090	1.4289	380000	0	08/09/02
guo2-45	1.3898	0.0005	1.3909	-.0090	1.3999	380000	1	08/09/02
guo2-50	1.3518	0.0004	1.3527	-.0090	1.3617	380000	0	08/09/02
guox-00	0.8257	0.0005	0.8267	-.0090	0.8357	380000	4	08/14/02
guox-05	1.2124	0.0009	1.2141	-.0090	1.2231	380000	2	08/09/02
guox-10	1.3454	0.0008	1.3469	-.0090	1.3559	380000	3	08/09/02
guox-15	1.4096	0.0007	1.4111	-.0090	1.4201	380000	3	08/09/02
guox-20	1.4395	0.0006	1.4407	-.0090	1.4497	380000	0	08/09/02
guox-25	1.4512	0.0007	1.4526	-.0090	**1.4615**	380000	0	08/09/02
guox-30	1.4489	0.0006	1.4500	-.0090	1.4590	380000	0	08/09/02
guox-35	1.4358	0.0006	1.4370	-.0090	1.4460	380000	4	08/09/02
guox-40	1.4144	0.0006	1.4155	-.0090	1.4245	380000	2	08/09/02
guox-45	1.3836	0.0005	1.3846	-.0090	1.3936	380000	4	08/09/02
guox-50	1.3428	0.0005	1.3437	-.0090	1.3527	380000	2	08/09/02
gunh-00	1.3054	0.0006	1.3066	-.0125	**1.3191**	380000	1	08/09/02
gunh-05	1.3036	0.0005	1.3047	-.0125	1.3172	380000	2	08/09/02
gunh-10	1.2964	0.0006	1.2975	-.0125	1.3100	380000	0	08/09/02
gunh-15	1.2821	0.0005	1.2831	-.0125	1.2956	380000	0	08/09/02
gunh-20	1.2619	0.0005	1.2628	-.0125	1.2753	380000	0	08/09/02
gunh-25	1.2368	0.0004	1.2377	-.0125	1.2502	380000	2	08/09/02
gunh-30	1.2069	0.0004	1.2077	-.0125	1.2202	380000	2	08/09/02
gunh-35	1.1712	0.0004	1.1720	-.0125	1.1845	380000	2	08/09/02
gunh-40	1.1311	0.0003	1.1318	-.0125	1.1443	380000	0	08/09/02
gunh-45	1.0857	0.0003	1.0863	-.0125	1.0988	380000	2	08/09/02

[2] Source: Crystal Data Detemination Tables, U.S. Department of Commerce National Bureau of Standards, Third Edition, Vol. 5 & 6.

gunh-50	1.0345	0.0003	1.0351	-.0125	1.0476	380000	1	08/09/02
gca1-00	0.7658	0.0003	0.7665	-.0090	0.7755	380000	5	08/15/02
gca1-05	1.1883	0.0008	1.1898	-.0090	1.1988	380000	0	08/15/02
gca1-10	1.3276	0.0007	1.3289	-.0090	1.3379	380000	2	08/15/02
gca1-15	1.3891	0.0007	1.3906	-.0090	1.3996	380000	4	08/15/02
gca1-20	1.4161	0.0007	1.4175	-.0090	1.4265	380000	1	08/15/02
gca1-25	1.4250	0.0006	1.4263	-.0090	**1.4353**	380000	0	08/15/02
gca1-30	1.4169	0.0005	1.4180	-.0090	1.4270	380000	1	08/15/02
gca1-35	1.4006	0.0005	1.4017	-.0090	1.4107	380000	0	08/15/02
gca1-40	1.3717	0.0005	1.3727	-.0090	1.3817	380000	2	08/15/02
gca2-00	0.7635	0.0003	0.7642	-.0090	0.7732	380000	4	08/15/02
gca2-05	1.1925	0.0007	1.1940	-.0090	1.2030	380000	2	08/15/02
gca2-10	1.3309	0.0009	1.3326	-.0090	1.3416	380000	0	08/15/02
gca2-15	1.3912	0.0006	1.3925	-.0090	1.4015	380000	1	08/15/02
gca2-20	1.4166	0.0007	1.4180	-.0090	1.4270	380000	1	08/15/02
gca2-25	1.4239	0.0006	1.4251	-.0090	**1.4341**	380000	1	08/15/02
gca2-30	1.4139	0.0006	1.4151	-.0090	1.4241	380000	0	08/15/02
gca2-35	1.3932	0.0005	1.3943	-.0090	1.4033	380000	0	08/15/02
gca2-40	1.3633	0.0005	1.3642	-.0090	1.3732	380000	3	08/15/02
gca6-00	1.2802	0.0008	1.2819	-.0090	1.2909	380000	2	08/15/02
gca6-05	1.3706	0.0008	1.3723	-.0090	1.3813	380000	1	08/15/02
gca6-10	1.4158	0.0007	1.4172	-.0090	1.4262	380000	2	08/15/02
gca6-15	1.4345	0.0007	1.4359	-.0090	**1.4449**	380000	1	08/15/02
gca6-20	1.4411	0.0007	1.4425	-.0090	1.4515	380000	0	08/15/02
gca6-25	1.4344	0.0007	1.4357	-.0090	1.4447	380000	1	08/15/02
gca6-30	1.4205	0.0006	1.4216	-.0090	1.4306	380000	5	08/15/02
gca6-35	1.3973	0.0005	1.3983	-.0090	1.4073	380000	0	08/15/02
gca6-40	1.3657	0.0005	1.3668	-.0090	1.3758	380000	1	08/15/02
gca7-00	1.3445	0.0008	1.3460	-.0090	1.3550	380000	0	08/15/02
gca7-05	1.4015	0.0008	1.4030	-.0090	1.4120	380000	0	08/15/02
gca7-15	1.4450	0.0007	1.4464	-.0090	**1.4554**	380000	0	08/15/02
gca7-20	1.4440	0.0006	1.4451	-.0090	1.4541	380000	0	08/15/02
gca7-25	1.4358	0.0006	1.4370	-.0090	1.4460	380000	1	08/15/02
gca7-30	1.4184	0.0006	1.4196	-.0090	1.4286	380000	0	08/15/02
gca7-35	1.3946	0.0005	1.3957	-.0090	1.4047	380000	1	08/15/02
gca7-40	1.3623	0.0005	1.3633	-.0090	1.3723	380000	2	08/15/02
gca8-00	1.3270	0.0008	1.3286	-.0090	1.3376	380000	5	08/15/02
gca8-05	1.3945	0.0007	1.3959	-.0090	1.4049	380000	0	08/15/02
gca8-10	1.4295	0.0007	1.4309	-.0090	1.4399	380000	1	08/15/02
gca8-15	1.4443	0.0007	1.4456	-.0090	**1.4546**	380000	1	08/15/02
gca8-20	1.4175	0.0006	1.4187	-.0090	1.4277	380000	1	08/15/02
gca8-25	1.4380	0.0006	1.4392	-.0090	1.4482	380000	1	08/15/02
gca8-30	1.4213	0.0005	1.4224	-.0090	1.4314	380000	2	08/15/02
gca8-35	1.3973	0.0005	1.3984	-.0090	1.4074	380000	1	08/15/02
gca8-40	1.3661	0.0005	1.3670	-.0090	1.3760	380000	0	08/15/02

6.12 ANALYSIS AND VERIFICATION SIGNOFF

(See Next Page)

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eDRF No. 0000-0006-6390
Criticality Safety Analysis
New Powder Container (NPC)
(Revision 02)

Analysis By: ____________________ Date: ________
William C. Peters

Verified By: ____________________ Date: ________
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