SECTION 6
CRITICALITY EVALUATION

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6 Criticality Evaluation

The Century Versa-Pac Shipping Container is described in Section 1.2, *Package Description*. The package exists in two distinct but similar versions consisting of outer 55-gallon and 110-gallon drums.

The 55-gallon drum version of the Versa-Pac Shipping Container consists of a 16 gauge body, bottom and cover. The drum uses a 12 gauge bolted closure ring, standard carbon steel lugs, 5/8" diameter, ASTM A307 bolts and nuts, and a closed-cell EPDM gasket. The overall outer dimensions of the 55 gallon package are 23-1/16" OD x 34-3/4" in height to the top of the drum bolt ring. The drum cover is reinforced by an eighth-inch thick 22-3/8" OD x 18-3/8" ID plate, and four ½" bolts are provided to lend additional strength to the drum closure ring.

The 110-gallon version utilizes a 16 gauge body, bottom and cover. The drum uses a 12 gauge bolted closure ring, standard carbon steel lugs, 5/8" diameter ASTM A307 bolts and nuts, and a closed-cell EPDM gasket. The overall outer dimensions for the 110 gallon package are 30-7/16" OD x 42-3/4" in height to the top of the druim bolt ring. The drum cover is reinforced by an eighth-inch thick 29-3/4" OD x 27-1/4" ID plate and eight ½" bolts are provided to lend additional strength to the drum closure ring.

Both drums are further strengthened with vertical stiffeners fabricated from 1-1/4" carbon steel square tubing, two inner liners of rolled 16 gauge carbon steel insulated by ceramic fiber blanket encase the vertical tubing, and a ¼" carbon steel reinforcing plate on the bottom. Reinforcing angles and solid bars within the liners provides additional strength.

The package's interior is completely insulated with layered ceramic fiber blanket around the containment area with rigid polyurethane foam disks on the top and bottom. The ceramic fiber blanket and polyurethane foam provide shock and thermal protection to the containment area.

The containment and exterior structure including their respective closures provide two barriers to prevent the payload dispersion and water inleakage. An illustration of the packaging is provided in Figure 1-1.

The criticality analysis demonstrates that the payload material may be pre-packaged in hydrogenous or non-hydrogenous containers within the payload vessel. Hydrogenous pre-packaging materials consist of polyethylene, polypropylene, or PVC. PTFE or Teflon® pre-packaging material are also allowed. Metallic pre-packaging materials consisting of aluminum, stainless and carbon steel are further allowed provided their total weight is controlled to within the payload allotment of the package. In addition only materials listed in Table 1-4 are presently qualified for use within the Versa-Pac shipping container; all other materials must meet the 600°F minimum auto-ignition temperature describe in Section 1.2.2. The user is required to establish that the auto-ignition temperature is a minimum of 600°F using an established method, such as the method prescribed by ASTM D883 (Test Method for Reaction Threshold Temperature of

Liquid and Solid Materials).

A summary of the results for the most reactive HAC cofiguration for the criticality evaluation is provided in Table 6-1. The most reactive HAC configuration was determined to consist of an arrangement of in-homogeneous spheres placed within the containment area of the package to achieve maximum interaction from contiguous packages in a triangular array.

6.1 Description of Criticality Design

6.1.1 Design Features

The Century Versa-Pac Shipping Container does not use any neutron moderators or absorbers, however minimum thicknesses of continuous sheet and plate carbon steel (e.g., containment liner, inner/outer liner, drum lid, body and bottom, including top and bottom reinforcing plates) are modeled in the analysis. Descrete carbon steel consisting of the vertical stiffeners, flanges, angles, and bars are not modeled. Also not modeled are the flange ring interfaces with the flange which are model assuming a continuous thickness of the flange material.

Criticality control of the Century Versa-Pac Shipping Container relies on control of the payload vessel diameter, the vessel-to-vessel spacing provided by the drum, and number of packagings that may be shipped together. Additionally, each payload is subject to a mass limit of 350 gram U-235. The U-235 mass limit is an absolute value which is typically defined as a nominal measured value with a measurement uncertainty at a 95% confidence level.

Further, the payload does not rely on moderation-control. Moderation in the payload vessel is evaluated using optimum polyethylene. The moderator is evaluated by varying the corresponding volume fractions. Polyethylene is further evaluated at an increased density. A polyethylene density of 0.98 g/cc conservatively bounds the use of pre-packaging materials containing carbon (including graphite and paraffin) and hydrogen. Basically, the higher density polyethylene bounds other moderating materials with a Hydrogen density less than or equal to 0.141 g/cc.[1]

Thus, the physical packaging design features that are important to criticality safety are the payload vessel diameter, the drum outer diameter, and the payload vessel body, body welds, blind flange and seals. Administrative control of the payload mass and shipment array must also be implemented.

6.1.2 Summary Table of Criticality Evaluation

Table 6-1 provides a summary of the results of the criticality evaluation of the Century Versa-Pac Shipping Container for the most reactive configuration. The 350 gram U-235 fissile mass modeled as a lumped 12.0-cm radius sphere leads to the most reactive configuration. A detailed description of the analytical models and methodology is provided in Section 6.3. All results are less than the conservative administrative Upper Subcritical Limit of 0.95 minus the code bias and bias uncertainty[2].

As indicated in Section 6.3, a single model is conservatively constructed to

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[1] Refer to Table 6-3 for a comparison of the moderating materials considered in this analysis.

[2] The k_{eff} used in all cases represents the KENO k_{eff} plus two sigma (sigma was typically on the order of 0.002). Discussion on the code bias and bias uncertainty is provided in Section 6.5.

represent the Normal Condition of Transport (NCT) and Hypothetical Accident Condition (HAC) package configurations for both the 55-gallon and 110-gallon package versions. As further indicated in Section 2.12.3, the tested 110-gallon package version sustained little damage from both the NCT and HAC testing suggesting small differences in the final evaluated package array sizes. Section 2.0 also indicates that prototype testing of both package designs shows that more damage resulted to the 110-gallon package version due to the heavier weight and greater distance between vertical stiffeners. Therefore, the criticality analysis model is conservatively constructed based on the 55-gallon package dimensions, due to the potential for higher package and fissile mass densities, with the conservative application of actual damage sustained during testing of the 110-gallon package version. This model conservatively bounds the HAC testing and is very conservative with respect to the NCT configuration for both package versions.

6.1.3 Criticality Safety Index (CSI)

The Criticality Safety Index (CSI) is 1.0. Arrays of at least 272 packages are evaluated for the Normal and Hypothetical Accident Conditions. Thus, N is 272/5 ≈ 55 or 272/2 = 136, and the minimum CSI is 50/55 ≈ 0.91, which is rounded upto 1.0. The corresponding maximum number of packages to be transported non-exclusive use based on a CSI of 1.0 is 50.

6.2 Fissile Material Contents

All materials shall be in solid form with no freestanding liquids; density is not limited. These materials quantities may not exceed 350 grams U-235 in any non-pyrophoric form, enriched up to 100 Wt%. Materials that may be shipped in the Versa-Pac include uranium oxides (U_yO_x), uranium metal (U-metal), uranyl nitrate crystals (UNX), and other uranium compounds (e.g., Uranyl Fluorides and Uranyl Carbonates) enriched up to 100 Wt% U-235. The uranium compounds may also contain carbon or graphite (e.g., UC, U_2C_3, and UC_2). UNX may be in the form of uranyl nitrate hexahydrate, trihydrate or dihydrate, and may contain any amount of moisture; however, the UNX must be in solid form with no freestanding liquid. The payload may be in homogeneous (powder or crystalline) or non-homogeneous (pelleted or lumped) form. Table 1-5 identifies the limits for U-324 and U-236 as applied to the Versa-Pac Shipping Container. The A_2 values are used as stated in 10 CFR 71 and are applied to the package since the payload is limited to normal form material.

The package is evaluated assuming optimum moderation using a bounding high-density polyethylene plastic (Density = 0.98 g/cc) and supports packaging applications containing both carbon (graphite) and hydrogen based materials. Non-fissile chemical impurities do not increase the reactivity of the system; therefore, they may be present in any quantity. The payload may be enriched in U-235 to 100 Wt%.

The payload material may be pre-packaged in hydrogenous or non-hydrogenous containers within the payload vessel. Hydrogenous pre-packaging materials may include polyethylene, polypropylene, and PVC. PTFE or Teflon pre-packaging material are also allowed. Metallic pre-packaging materials such as aluminum, stainless and carbon steel are further allowed provided their total weight is controlled to within the payload allotment of the package. In addition only materials listed in Table 1-4 are presently qualified for use within the Versa-Pac shipping container; all other materials must meet the 600°F minimum auto-ignition temperature describe in Section 1.2.2. The user is required to establish that the auto-ignition temperature is a minimum of 600°F using an established method, such as the method prescribed by ASTM D883 (Test Method for Reaction Threshold Temperature of Liquid and Solid Materials).

No materials, excluding the minimum steel wall thickness of the package, are used as neutron absorbers or moderators.

6.3 General Considerations

6.3.1 Model Configuration

Figure 6-1 provides a representation of the unit model used in the criticality analysis. The modeled dimensions represent a damaged 55-gallon package. The packaging consists of a cylindrical carbon steel shell surrounded by insulation, an inner/outer steel liner, and an outer carbon steel shell. The steel payload vessel, flange, and blind flange are modeled as carbon steel with reduced minimum dimensions. The drum, inner and outer liners, and upper and lower drum plates are also modeled as carbon steel with reduced minimum dimensions. An enrichment of 100 Wt% U-235 is used to evaluate all cases.

The constructed model evaluated in the criticality analysis, as also discussed in Section 6.1.2, conservatively represents the HAC package configuration (damaged package configuration) for the 55-gallon package design. The model is constructed considering worst case damage to both the 55-gallon and 110-gallon package designs. Due to the smaller package envelope of the 55-galon package design the package is inherently more reactive when compared to the 110-gallon package design. The modeled reduction in package dimensions leads to significant more interaction between packages and results in a lower CSI. The reduced dimensions of the modeled 55-gallon package (damaged package configuration) design results in a more reactive package array when compared to undamaged 55-gallon and 110-gallon designs. Therefore, the conservatively modeled HAC package configuration for the 55-gallon package design bounds the NCT (undamaged package configurations) for both the 55-gallon and 110-gallon packages and further bounds the HAC (damaged package configuration) for the 110-gallon package design. Further evaluation of the HAC (damaged package configuration) modeled array size to the more restrictive NCT criteria (5N) the resulting CSI (1.0) conservatively bounds the NCT criteria (5N) and HAC criteria (2N) for evaluation of package arrays using the single model.

With construction of a NCT model (undamaged package design) based on the 55-gallon design, the evaluated array size would be increased due to additional spacing afforded between fissile material in adjacent packages. This would further lead to a reduced CSI. Thus, a smaller package design, considering worst case damage of the two designs, to the most restrictive CSI criteria can conservatively represent the Versa-Pac 55-gallon and 110-gallon packages.

6.3.1.1 Model Conservatisms

Table 6-2 summarizes the dimensional changes to the test packages indicated as Test Articles with Serial Numbers 10550, 10551, and 10553. The pre and post test measured results for each package is provided in Section 2.12.3, *Century Industries Performance Test Report for the Versa-Pac*. The worst case dimensional reductions from these tests, as summarized in Table 6-2, are + 1/8" increase in the inner containment diameter, - 5/16" reduction in the outer drum diameter, and -1/4" reducion in the outer drum height (including lid). Note that the measured dimensions provided in Section 2.12.3 do not include the outer drum lid. Also, the outer drum diameter reduction only occurs on one side of the drum mostly due to compression of the area between drum stiffeners at the impact location of the test plate.

The overall outer dimensions of the 55 gallon package are 23" OD x 34-1/2" in height. Neglicting the drum stiffeners and bolt ring reduces the outer diameter to 22-1/2". For the bounding HAC/NCT model, the 55-gallon drum is further modeled with a reduced outer diameter of 1.313" which significantly bounds the maximum reduced dimension resulting from the tests of 0.313" (5/16"). The reduced outer diameter further bounds and still provides margin for the 1/8" increase in the inner containment diameter. The 55-gallon drum is further modeled with a reduced outer height of 0.875" which bounds the maximum reduced dimension resulting from the tests of 0.250" (1/4"). The containment area is further modeled at both nominal and with increased dimensions of 1/8" for the diameter and 1/16" for the height[3]. The nominal dimensions being 15" inner diameter with a height of 27 1/16". The overall outer dimensions of the 55 gallon package model are then 21.1875" OD x 33.625" in height. The drum and payload vessel walls, upper and lower plates are modeled at their minimum thickness as indicated in Table 6-3.

The four vertical members (square tubing), reinforcing angles, and bottom plate ring constructed from carbon steel have been conservatively neglected resulting in modeling less than 50% of the package carbon steel. All insulation products are conservatively modeled as optimum interspersed water moderation.

Packages and arrays of packages were also modeled with full density water boundary reflection.

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[3] Additional performance testing of the 55-gallon package version as documented in Section 2.12.4, indicates that the payload diameter is decreased by $^{1}/_{16}$". This decrease in diameter will have a net increase, although insignificant, on the k_{eff} for the homogeneous criticality model as discussed in Section 6.6.2.1. The reduced diameter has no impact on the in-homogeneous model k_{eff} since the reduction does not limit placement of the fissile lump. Also, additional array configurations are evaluated in Section 6.6.2.2.8 for the in-homogeneous models that demonstrate that the array k_{eff} is reduced as the fissile lump is moved inward.

6.3.2 Material Properties

Table 6-3 provides the materials and key dimensions used to evaluate the Century Versa-Pac Shipping Container. The density for each material used in the models is provided in Table 6-4. The default atomic number densities from the SCALE library were used for all materials and mixtures.

6.3.3 Computer Codes and Cross Section Libraries

The SCALE 4.4a code with the 44-Group Standard Cross Section Library was used to evaluate k_{eff} of the Century Versa-Pac Shipping Container under all conditions of transport. The code sequence BOMANI, NITAWL, and KENO VI (CSAS6) was used in all analyses.

The verification cases CSAS6 and KENOVI, as provided with the code for verification purposes, were executed prior to commencement of calculations and then upon completion of the final calculations. Other than time and date differences no additional differences were noted in a comparison of the different verification runs.

6.3.4 Demonstration of Maximum Reactivity

6.3.4.1 Fuel Density and Distribution

The fissile payload consisting of a maximum of 350 grams U-235 was modeled in all cases as U-Metal at an enrichment of 100 Wt%. This bounds other uranium compounds including oxides, fluorides, and nitrates. Moderation by both carbon and hydrogen, as discussed in Section 6.3.4.3, further bounds the presence of uranium containing carbon or graphite.

A fissile payload consisting of 350 grams U-235 was initially modeled as a function of the drum fill percentage ranging from 5% to 100% of the drum fill volume. The payload was also modeled as both spherical and cylindrical lumped configurations. The diameters of the spheres and cylinders were further varied to determine the effect on the fissile mass density. Also, the cylindrical heights were further varied to determine the effect on fissile mass density and interaction. The sensivity of k_{eff} with the fissile mass was further investigated at 375 and 400 grams U-235.

Polyethylene was modeled filling the voids of the fissile material with reductions in its volume fraction to consider partial moderation. The inner payload cavity, insulated package regions and exterior regions of the package were further evaluated with moderation ranging from partial to full water densities.

6.3.4.2 Heterogeneous Effects

All of the analyses of the Century Versa-Pac Shipping Container were completed using a homogeneous source material at an enrichment of 100 Wt%. The heterogenic effect noted with enriched Uranium is caused by the presence of U-238, which is not present in the model configurations. Therefore, the modeled homogeneous souce material is representative of and bounding of the proposed payload.

The material was modeled as descrete lumps as both spheres and cylinders to study in-homogeneous distribution effects of the fissile mass. The height-to-diameter ratio of the modeled cylinder was also varied. Spheres are typically more reactive than cylinders while cylinders are more interactive. The modeled conditions of the package will dictate the more reactive geometry. For instance, the modeled package carbon steel will have a more significant effect on the cylindrical geometry due to the higher degree of interaction between neibhoring cylinders. Both geometrical configurations are specifically evaluated in the criticality analysis.

6.3.4.3 Internal Moderation

6.3.4.3.1 Poly-Moderation

The fissile uranium mass was modeled with polyethylene (CH_2) moderation to bound a full range of packaging materials. The polyethylene was initially modeled at a density of 0.92 g/cc which results in a hydrogen density of 0.132 g/cc. This bounds water moderation (density of about 0.998 g/cc) with a corresponding hydrogen density of 0.112 g/cc. To bound other compounds containing more carbon and hydrogen, the polyethylene compound density is increased to 0.98 g/cc which increases the hydrogen density to 0.141 g/cc. At this increased density, the polyethylene moderation would bound paraffin ($C_{25}H_{52}$) at a density of 0.90 g/cc. Paraffin has a hydrogen density of 0.134 g/cc. Optimum poly-moderation with an increased poly-density is therefore demonstrated for the package.

With evaluation of partial poly-moderation of the fissile contents a full range of moderation is considered for the package. Since water-moderation is bounded by poly-moderation, any amount of water- or poly-moderation may be present in the package, and pre-packaging materials having a hydrogen density less than or equal to that of high density polyethylene (0.141 g/cc) do not need to be controlled for criticality purposes. Materials with a hydrogen density greater than 0.141 g/cc are not allowed.

6.3.4.3.2 Carbon-Moderation

The fissile uranium mass was modeled with polyethylene (CH_2) moderation to bound a full range of packaging materials. The polyethylene was modeled at a density of 0.98 g/cc which results in an evaluated carbon density of 0.840 g/cc.

In all instances, the carbon-moderated cases are bounded by the poly-moderated cases. For the unlimited moderation case, there is no limit imposed on pre-packaging material or carbon-containing pre-packaging materials, as the carbon-moderation case is bounded by the increased density poly-moderation case.

6.3.4.4 Interspersed Moderation

A full range of interspersed moderator (water) densities from 0.0001 to 1.00 g/cc were evaluated to determine the optimum interspersed moderator density for the packaging. Interspersed water moderation was evaluated for the thermal blanket and foam regions of the package. Water moderation was also considered in the package area that contains the vertical carbon steel stiffeners (e.g., square tubing and support angles) and further above the payload within the containment boundary. Also, interspersed water moderation was considered between packages. Due to the higher k_{eff} results for the in-homogeneous modeled configurations, additional region dependent cases are analyzed individually for the payload, payload containment insulation, inner/outer liners, top/bottom insulation, and the package exterior.

The analysis results, as further presented, show that increasing the interspersed moderation from 0.0001 g/cc in all moderator regions causes an increase in the single package multiplication factor and further causes a reduction in the multiplication factor for arrays of packages.

6.3.4.5 Package Array Configurations

Several different shipment package array configurations were evaluated to determine the most reactive arrangement. The package was evaluated using both square-pitched close-packed arrays and triangular-pitched close-packed arrays. The triangular-pitched arrays provide slightly more interaction between packages and yield the higher system k_{eff}.

The homogeneously distributed fissile mass systems, as indicated in Section 6.3.4.1, only considered the triangular-pitch close-packaged array. Square-pitched close-packed array calculations were not performed with the homogeneously distributed fissile mass since the k_{eff} results for these calculations were low and the results were significantly lower than the lumped fissile mass sytems.

However, the lumped fissile mass systems, as indicated in Section 6.3.4.2, considered both square-pitched close-packed arrays and triangular-pitched close-packed arrays. These calculations further considered the fissile mass as both spheres and cylinders. Both spheres and cylinders were considered in the array calculations due to the lower than expected differences noted in the k_{eff} results.

6.4 Single Package Evaluation

6.4.1 Configuration

The single package evaluation considered both the distributed fissile mass and a lumped fissile mass. The package geometry was considered in the distributed fissile mass calculations for the single package. Variations in the fissile mass moderator density and interspersed moderation were also considered in these calculations. A single model was constructed as previously indicated based on the HAC test results which is further bounding of the NCT configuration.

A lumped fissile mass is further evaluated without considering the package geometry since the mass could be essentially fully reflected with flooding of the package. Only variations in the fissile mass poly-moderator density were considered in these calculations since the lumped fissile mass is modeled with full boundary water reflection.

The HAC model would in general have the higher k_{eff} results when compared to a similar NCT model due to the reduced exterior package dimensions resulting from the required performance testing. However, the lumped spherical fissile mass with full boundary reflection bounds both NCT and HAC models in all cases since it is independent of the package modeled geometry. Therefore, the single package safety can be assessed with the use of a single very conservative model.

6.4.2 Results

The single package results are summarized in Table 6-5. All results are less than the conservative administrative Upper Subcritical Limit of 0.95 minus any code bias and uncertainty. Table 6-5 provides a summary of the multiplication factors for all calculations for the single package configurations. Figures 6-2 through 6-5 graphically display the results of the calculations.

The fully poly-moderated and reflected lumped spherical fissile mass provides the most reactive arrangement, Figure 6-5. However, the single package with distributed fissile mass is most reactive when the drum is filled to about 20%, Figures 6-2 and 6-4. Increasing the interspersed water moderation (within the package) density to about 1.0 g/cc maximizes the k_{eff} result (Figure 6-4) while reducing the poly-moderator density decreases the k_{eff} result (Figure 6-3).

Due to their simplicity, single package input cases are not provided in Section 6.9. However input cases can be constructed using the provided array input cases with modification of the array boundaries.

6.5 Evaluation of Package Arrays Under Normal Conditions of Transport

6.5.1 Configuration

The Normal Transport condition postulates a group of 5N Century Versa-Pac Shipping Containers (5(50)=250), optimized as discussed in Section 6.3.4. Close full water reflection is applied at the array boundary. Table 6-1 summarizes the evaluated fuel loadings and conditions for the Hypothetical Accident Conditions. Tables 6-6 through 6-9 provide summaries of the multiplication factors for all calculations for the Hypothetical Accident Condition package configuration including sensitivity studies.

A single model was constructed as previously indicated based on the HAC test results which is further bounding of the NCT configuration. The HAC model would in general have higher k_{eff} results when compared to a similar NCT model due to the more extensive damage resulting from testing. Therefore, the package array safety can be assessed with the use of a single very conservative model.

The package array evaluation considered both the distributed fissile mass and a lumped fissile mass. The package geometry was considered in the distributed fissile mass calculations for the package array evaluation. Variations in the fissile mass moderator density and interspersed moderation were also considered in these calculations.

6.5.2 Results

As discussed in Section 6.5.1, the package array safety can be assessed with the use of a single very conservative (HAC) model.The results of these bounding HAC calculations are further detailed in Section 6.6.2.

6.6 Evaluation of Package Arrays Under Hypothetical Accident Conditions

6.6.1 Configuration

Regulation requires that a minimum of 2N damaged packages (2(125)=250), arranged in the most reactive array, be evaluated for Hypothetical Accident Conditions (HAC). However, since a single model is used for both NCT and HAC, the more limiting NCT 5N criterion is used in the determination of the appropriate CSI. Additionally, the evaluation includes optimum interspersed moderation, optimum fissile mass moderation, and close full reflection by water at the boundaries. Also, the fissile payload contents are arranged within the package in support of the most reactive array determination.

The package bottom offers the lowest amount of carbon steel interms of amount and thicknesses and further provides the shortest distance to the boundary of the package. Therefore, the most reactive package orientation occurs when the fissile mass is oriented at the base of the package with the bottom package further inverted and the top package stacked in its normal orientation. This places the lumped fissile mass within two contiguous packages in their closest proximity. The packages are then evaluated in both square and triangular configurations with the lumped fissile mass further oriented to achieve maximum interaction between contiguous drums. Large package arrays are then constructed with duplication of the inverted and normal package arrangement. Figures 6-16 and 6-17 illustrate the package arrangement with lumped fissile mass for the triangular and square configurations, respectively. By comparison of both Figures 6-16 and 6-17 it is evident that more packages can be placed within a triangular array. Figure 6-18 illustrates the original stacked package configuration, hereafter refered to as the MOD0 array, with inverted bottom package and normally positioned top package and further shows the duplicated stack in a 4-high package array.

Figures 6-19, 6-20, and 6-21 illustrate additional array configurations (X-Z view) used in the criticality analysis. The MOD1 array as shown in Figure 6-19 is similar to the MOD0 array however only a central cluster is modeled with the remaining lumped spherical masses moved to the opposite extents of the package. The MOD2 array as shown in Figure 6-20 is similary to the MOD1 array however all lumped spherical masses are moved to the opposite extents of the package thereby eliminating the central cluster. The MOD3 array is similar to MOD1 however the spherical masses are centered on the package bottom thereby eliminating the triangular cluster of spheres. A fourth configuration MOD4 is shown in Figure 6-22. MOD4 is similar to MOD0 and MOD1 however the central clustered is moved to the lower region of the package array.

The results of the drop tests reported in Section 2 were used as a basis for determining the structural damage to the package under HAC. The overall OD and height of the package are modeled at 21.1875" and 33.625", respectively, per the configuration, conservatisms and approximations discussed in Section 6.3. This reduction in package diameter conservatively encompasses the damage resulting from both the side and top impact tests (see Section 2).

The density for each material used in the models is provided in Table 6-4. The default atomic number densities from the SCALE library were used for all materials and mixtures. Specific package orientations are further discussed.

6.6.1.1 Homogeneous Model

Two homogeneous model configuarations are investigated. The first model is similar to the single package array model but imployes specular reflection in a triangular array to produce an infinite array of packages. For the second model, the 350 gram U-235 fissile mass is evenly distributed in the base of the package with two packages oriented with one inverted such that the fissile mass within the two stacked drums are in a closer proximity. A finite model is constructed of this double stacked arrangement with specular boundary reflection applied to generate an infinite 3D array of packages. The packages are modeled in both a square and triangular configuration. The effect of interspersed moderation and variations in the fissile mass moderation density are further investigated.

The calculation results are significantly lower than that for the in-homogeneous models as further discussed in Section 6.6.1.2. The results are further presented in Section 6.6.2.

6.6.1.2 In-Homogeneous Model

Similar to the homogeneous model discussed in Section 6.6.1.1, the 350 gram U-235 fissile mass is lumped in the base of the containment region of the package with two packages oriented with one inverted such that the fissile mass within the two stacked packages are in close proximity. A finite model is constructed of this double stacked arrangement with placement of additional packages (drums) in a similar arrangement with their lumped fissile mass further placed in a similar fashion. A finite array of packages are then configured with explicitly modeled full water boundary reflection. The packages are modeled in both a square and triangular configuration with the lumped fissile masses further oriented in their respective packages to optimize interaction between the lumped masses of adjacent packages. The effect of interspersed moderation and variations in the fissile mass poly-moderation density are further investigated.

Figures 6-16 and 6-17 display the modeled drum arrays in both the triangular and square lattice, respectively. Figure 6-18 further shows the X-Z view of the model which in this case shows the sphere placement. A cylinder, with an H/D of 1.0, would occupy the same region as the sphere allowing easy conversion of the model from either sphere to cylinder and visa-versa. The package model places the fissile lump in the bottom of the package since the package bottom recognizies the shortest distance to a neibhoring lump in an adjacent package. The bottom portion of the package also has the least amount of carbon steel as the bottom plate is ¼" and the top containment closure is ½". The bottom package is then inverted, with the lump further in the bottom, with a normally oriented package above also with the fissile lump positioned in the base of the package containment region.

The calculated results for the lumped spherical and cylindrical results are anticipated to be very close. Additional sensitivity studies will be performed for the most reactive lumped configuration within the Century Versa-Pac Shipping Containers. Further sensitivity calculations consider different cross section libraries, an increased fissile mass, further reductions in the minimum modeled carbon steel thicknesses, an increased poly-moderation density, and lumped spherical mass placement within the package.

The results are further discussed in Section 6.6.2.

6.6.2 Results

The maximum $k_{eff} + 2\sigma$ evaluated for an array of 272 packages for HAC is less than 0.94. This result is based on a fissile mass of 350 grams U-235 with poly-moderation at an increased density of 0.98 g/cc, which corresponds to a Hydrogen density of 0.141 g/cc. The arrangement models about 50% of the carbon steel of the package with those selected components modeled at their minimum values based on standard manufacturing tolerances.

The maximum result occurs with a finite arrangement of Century Versa-Pac Shipping Containers oriented in a triangular configuration with the fissile mass modeled as spheres and further oriented within the package to achieve optimum interaction. A fully poly-moderated sphere of 12.0-cm diameter produces the maximum k_{eff} result for the evaluated package array. The MOD0 and MOD1 configurations for the lumped spherical mass appear to interchangeably produce the higher k_{eff} results as dependent on the number of stacked packages. Sensitivity calculations as discussed in Section 6.6.1.2 are further provided.

Table 6-1 summarizes the evaluated fuel loadings and conditions for the most reactive Hypothetical Accident Condition model. However, Tables 6-6 through 6-9 provide summaries of the multiplication factors for all calculations for the Hypothetical Accident Condition package configuration.

6.6.2.1 Homogeneous Model

The infinite array calculations for the model discussed in Section 6.6.1.1 produced a maximum $k_{eff} + 2\sigma$ of 0.7175 with a 10% volume fill level for a homogeneously distributed 350 gram U-235 mass. Little difference is observed between packages modeled in a triangular and square lattice but the triangular lattice does yield the higher k_{eff} by a difference of 0.0016. Reductions in the poly-moderation density cause the k_{eff} to be reduced. Likewise, increasing the interspersed water moderation also causes the keff to be reduced. Table 6-6 provides a summary of the multiplication factors for all calculations for the homogneous model Hypothetical Accident Condition package configuration.

Figure 6-6 displays the results of the homogeneously distributed fissile mass calculations for the inverted bottom/top package model in both triangular and square configurations as a function of the package fill percentage. Packages with a 10% fill volume appear to produce the higher k_{eff} results for this modeled configuration. Although not shown the the figure, the normally oriented packages have lower k_{eff} results and appear to have a maximum value also corresponding to a 10% fill volume. The results of both modeled configurations appear to be consistent.

Figure 6-7 displays the calculation results for conditions with reduced poly-moderation. The array k_{eff} is reduced with reduced poly-moderation density. The array k_{eff} is also reduced with increased interspersed moderation.

The maximum $k_{eff} + 2\sigma$ for this modeled configuration is 0.7175 and results in an EALF of 3.46E-02 eV. Due to the low k_{eff} results further sensitivity studies are not performed for the homogeneous model.

A reduction in the modeled diameter of the package slightly increases k_{eff} for the homogeneously modeled system. Table 6-6 summarizes the result for the homogeneous case in which the package radius is reduced from 19.2088-cm to 19.05-cm. A reduction in the radius of 0.1588-cm (~$^{1}/_{16}$") results in an increase in k_{eff} for the homogeneous case of 0.0129, however the maximum k_{eff} for the homogeneous model of 0.7304 is significantly low such that additional reductions in the diameter will not challenge the USL. Thus, with a further reduction in the diameter of ~$^{1}/_{16}$" the k_{eff} for the homogeneously modeled system is not expected to exceed a k_{eff} of 0.75.[4]

Two input cases are provided in Section 6.9. Case Versa_HAC_INFH_10_A represents an infinite (INF) array of packages with their fissile mass content occupying the bottom 10 volume percent of the inner package (containment). The package is modeled in a hexagonal (H) lattice arrangement with full fissile mass poly-moderation (A). Case Versa_HAC_INFH2_10_A represents an infinite (INF) array of packages with their fissile mass content occupying the bottom 10 volume percent of the inner package (containment). The packages are stacked in an array with the bottom package being inverted to achieve maximum interaction with a top package in its normal orientation. The package is modeled in a hexagonal (H) lattice arrangement as the second evaluated model (2) with full fissile mass poly-moderation (A). The results of these cases are presented in Table 6-6. These input cases can be modified to produce other input cases as referenced in Table 6-6.

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[4] Section 2.12.4 indicates that the inner diameter of a VP-55 package was slightly reduced by $^{1}/_{16}$" after the 30-ft slap-down test.

6.6.2.2 In-Homogeneous Model

Both spheres and cylinders are evaluated in the lumped fissile mass model for the Century Versa-Pac Shipping Containers. Sphere and cylinder diameters ranging from 8-cm to 14-cm are modeled with cylinders further modeled by varying their height-to-diameter H/D ratios. Since the fissile mass is fixed at 350 grams U-235, cylinders modeled with a high H/D ratio will have a lower U-235 density when compared to cylinders with a lower H/D ratio. Thus, as the cylinder height is increased to further increase interaction between cylinders in adjacent packages the single unit reactivity is reduced with the reduction in the fissile mass density. The drums are arranged in both a triangular and square lattice. Calculations are initially performed with expansion of a 2x2x2 drum array to a final array size of 10x10x8. Drum arrays are initially modeled consisting of 8, 64, 144, 216, 384, 512, and 800 packages in the MOD0 sphere placement configuration.

The 12.0-cm diameter sphere consistently produces the higher k_{eff} results in both triangular and square arrays with the triangular arrays consistently producing the highest result. The results of the lumped spherical mass calculations indicate that the triangular configuration is more reactive than the square arrays with an optimum sphere diameter of 12.0-cm. The triangular array is more reactive with increased sphere diameters of 14.0-cm, however reducing the sphere diameter to 10.0-cm causes the square array to become slightly more reactive. The lumped cylindrical fissile mass calculations are further described below. The cylindrical mass calculations will only consider arrangement in a triangular configuration since these arrays produced the higher k_{eff} results in the spherical model calculations.

The 10.0-cm and 12.0-cm diameter cylinders consistently produce the higher k_{eff} results. The 10.0-cm diameter cylinder produces a maximum value at an H/D of 1.0 while the 12.0-cm diameter cylinder produces a maximum value at an H/D of 0.80 with the k_{eff} results differing by only 0.0005. The results of the lumped spherical mass calculations for the 12.0-cm diameter sphere produce higher k_{eff} results with a k_{eff} difference of about 0.02. Therefore, sensitivity studies as indicated in Section 6.6.1.2 will be performed with the lumped spherical mass model.

The results of these cases are summarized in Table 6-7. Table 6-8 summarizes the results of increased poly-moderation density studies. Table 6-9 provides the sensitivity studies for the lumped spherical mass models as indicated in the preceding paragraph.

A reduction in the modeled diameter of the package will have little or no effect on the more reactive in-homogeneous (lumped fissile mass) modeled system since the reduced diameter does not otherwise limit placement of the modeled spherical mass.[5]

Two input cases are provided in Section 6.9. Case Versa_HAC_FINS_12S_A7

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[5] Section 2.12.4 indicates that the inner diameter of a VP-55 package was slightly reduced by $^{1}/_{16}$" after the 30-ft slap-down test.

and Versa_HAC_FINH_12S_A7 represent finite (FIN) arrays of packages in square (S) and hexagonal lattices (H). The fissile mass is modeled as a 12-cm radius sphere in both cases (12S) with full fissile mass poly-moderation (A). The modeled array size is 800 packages (7) in an 10x10x8 array. Corresponding cases A1 through A6, as indicated in Table 6-7, can be reproduced with modification of the array parameters. Likewise, the cylindrical fissile mass models can be duplicated by changing the modeled sphere to a cylinder with further indication of the cylindrical height.

6.6.2.2.1 Expanded Array Analysis

The lumped 12.0-cm diameter spherical mass is used in an expanded array interaction analysis with sphere placement as shown in Figure 6-18 for the MOD0 configuration. Poly-moderation with a density of 0.92 g/cc is used in this analysis. The purpose of the analysis being to evaluate arrays of at least 400 packages starting with a single layer (Z=1) and continuing to a multiple stacked layer (Z=10). The object being to stack 400 packages in layers until the USL is exceeded and then reduce the number of packages in each layer and proceed with additional stacking. Stacked layers with a Z>10 were not modeled due to the decreased k_{eff} trend with the same package array size as the Z is increased from 8 to 10.

The calculation results are combined with the initial package array calculations as show in Figure 6-14. The initial results are indicated by “Trend 1” while the latter results are shown as “Trend 2”. The results of these calculations indicate that package arrays consisting of 400, each containing a lumped fissile mass, has a $k_{eff} + 2\sigma$ of 0.94.

The results of these cases are further summarized in Table 6-8. A single input case is provided in Section 6.9. Case Versa_HAC_FINH_12S_10x064, representing an 8x8x10 package array. The nomenclature is similar to that described for other array input cases, however the 10x064 designation represents a modeled array with 10 packages stacked in the Z direction with a single layer of 64 packages modeled in the X-Y direction (an 8x8 array). Other cases, as indicated in Table 6-8, can be reproduced with modification of the array parameters. Likewise, the cylindrical fissile mass models can be duplicated by changing the modeled sphere to a cylinder with further indication of the cylindrical height.

6.6.2.2.2 Increased Poly-Moderation Density

The calculations performed in Section 6.6.2.2.1 were duplicated with an increased poly-moderation density from 0.92 to 0.98 g/cc. The results, shown in Figures 6-14 and 6-15, indicate that an increase in the poly-moderation density causes a reduction in the drum array size from 400 to 300 while maintaining a $k_{eff} + 2\sigma$ of 0.94.

Increasing the evaluated poly-moderation density to 0.98 g/cc bounds other carbon-hydrogen based moderators (paraffin) with sufficient margin. The k_{eff} for cases with paraffin moderation are greater than cases with poly-moderation at a density of 0.92 g/cc however these same cases are all lower than cases with an increased poly-moderation density of 0.98 g/cc. Therefore, poly-moderation with a density of 0.98 g/cc is bounding for this analysis.[6]

Replacing the poly-moderation with graphite causes the array k_{eff}'s to decrease significantly. A single calculation for an 10x10x8 package array with the 12.0-cm diameter lumped 350 gram U-235 fissile mass moderated with graphite reported a k_{eff} of 0.1554. Therefore, the package array reactivity is dictated exclusively by the presence of hydrogen based moderation. This allows Uranium-Carbon/Graphite compounds such as UC, U_2C_3, and UC_2 in the context of "other uranium compounds" , as proposed in Section 6.2, since they are bound by the analysis of Uranium Metal. Also, the other uranium compounds, including UC, U_2C_3, and UC_2 may also be mixed with carbon or graphite, as both moderator materials are bound by the modeled hydrogen (high density polyethylene) moderation.

The results of these cases are summarized in Table 6-8. The single calculation with only graphite moderation is provided in Table 6-9. The input cases provided in Section 6.9 can be modified to duplicate the cases described in this section by changing the poly-moderation density from 0.92 to 0.98 and by further substitution of the poly-moderation input with graphite or paraffin at their respective material densities.

6.6.2.2.3 Interspersed Moderation

The initial array calculation model involving 800 drums with a 12.0-cm diameter sphere with an interspersed moderation volume fraction (VF) of 0.0001 were duplicated with the interspersed moderation values of 0.001, 0.01, 0.1, 0.5, and 1.0. The results, provided in Table 6-9, show that increasing the interspersed moderation consistently within all regions causes the array k_{eff} to be reduced. With full interspersed moderation the k_{eff} result approaches the value of a single fully reflected sphere.

Input cases can be duplicated by changing mixture 5 in the provided input cases to the desired value.

Additional interspersed moderation calculations as a function of each modeled package region are documented in Section 6.6.2.2.9.

6.6.2.2.4 Fissile Moderation Density

The initial array calculation model involving 800 drums with a fully poly-moderated (VF=1.0) 12.0-cm diameter sphere with an interspersed moderation volume fraction (VF) of 0.0001 were duplicated with reduced poly-moderation values (VF) of 0.90, 0.80, 0.70, 0.60, and 0.50. The results, provided in Table 6-9, show that decreasing the poly-moderation volume fraction causes the array k_{eff} to be reduced.

Input cases can be duplicated by changing the poly-moderation in mixture 1 in the provided input cases to the desired value.

[6] The Hydrogen density associated with high density polyethylene (HDPE) is 0.141 g/cc. Moderators with a Hydrogen density exceeding 0.141 g/cc are expected to produce higher k_{eff} results.

6.6.2.2.5 Carbon Steel Reduction

The drum arrays initially modeled consisting of 8, 64, 144, 216, 384, 512, and 800 packages, as presented in Section 6.6.2.2, were duplicated by changing the Material and Volume Fraction for Carbon Steel to Water with a Volume Fraction of 0.0001. The results, provided in Table 6-9, show that eliminating the minimum modeled carbon steel causes the array k_{eff} to be increased. By comparison, the analysis involving the minimum modeled carbon steel thicknesses supported an array size of 400 drums.

A reduction of the minimum fabricated carbon steel thicknesses to values below the manufacturing tolerances causes a significant impact on the results. The original analysis essentially considered approximately 50% of the carbon steel of the package. Eliminating the minimum carbon steel in the modeled configuration decreases the array size from 400 to about 216. Further reductions may be necessary when considering a cylindrical lumped fissile mass. Therefore, the minimum modeled carbon steel thicknesses are not only required for structural integrity but also needed to ensure that the USL is not exceeded.

Input cases can be duplicated by changing the volume fraction of mixture 3 in the provided input cases to 0.50.

6.6.2.2.6 Cross Section and Neutron Histories

The initial array calculation model involving 800 drums is executed again by changing the modeled cross sections from the 44-Group Standard Cross Section Library to the 238 group. The case is executed with 600 generations and 1000 neutrons per group (600,000 neutron histories). The results differ by 0.0001 with the 44-Group generating the larger value.

To determine the sensitivity to the magnitude of the neutron histories the case is again executed with the 238-group cross sections with 600 generations and the neutrons per group increased from 1000 to 2000 (1,200,000 neutron histories). Although the $k_{eff} + 2\sigma$ for the case increases by 0.0017 the result is within 2σ of the original result. For comparison, the case using the 44-group cross sections is executed with 600 generations and 2000 neutrons per group. The raw k_{eff} for this case increases by 0.0010 however with reduction in the uncertainty the final $k_{eff} + 2\sigma$ result remains the same.

The use of differenct cross sections and increasing the neutron histories did not change the final result. Therefore, the cases used in the original analysis are sufficient and properly converged. There is also no observed benefit with migration of a larger group cross section library as the 44-group produces consistent results. The results are further summarized in Table 6-9.

Input cases can be duplicated by changing the cross section input, neutron generations and neutrons per group to their desired values.

6.6.2.2.7 Increased Fissile Mass

The drum arrays initially modeled consisting of 8, 64, 144, 216, 384, 512, and 800 packages, as presented in Section 6.6.2.2, were each duplicated by increasing the fissile mass from 350 grams U-235 to 375 and 400 grams U-235. The results, provided in Table 6-9, show that increasing the fissile mass by 25 grams requires that the drum array size be reduced. The 350 gram U-235 model, as originally evaluated, could potentially support a 550 package array and remain below a $k_{eff} + 2\sigma$ of 0.94. The 375 and 400 gram U-235 models require that the array, using the original array models, be reduced to 350 and 275 packages to remain below a $k_{eff} + 2\sigma$ of 0.94, respectively.

Increasing the fissile mass above 350 grams U-235 requires additional sensitivity analysis as it is quite possible that a larger or smaller fissile lump could become more reactive than the 12.0-cm diameter sphere as modeled in the above cases. Therefore, a fissile mass content no greater than 350 grams U-235 is recommended for the Century Versa-Pac Shipping Containers.

Input cases can be duplicated from those provided in Section 6.9 by changing the fissile constituent volume fraction of mixture 1 to correspond to the increased fissile mass.

6.6.2.2.8 Lumped Spherical Mass Placement Sensitivity

The array configuration illustrated in Figure 6-18 (MOD0) was anticipated to produce the higher k_{eff} results for the lumped spherical mass calculations due to the modeled cluster configuration of fissile mass within the array. The results of the original MOD0 calculations indicate that the USL is less than 0.94 for package arrays of 300 within high density poly-moderation. To demonstrate that the MOD0 array is more, or less, reactive, four additional array configurations are chosen as further illustrated in Figures 6-19, 6-20, 6-21, 6-22 for array configurations defined as MOD1, MOD2, MOD3, and MOD4, respectively. For reference, the results of additional calculations for the MOD0 configuration for arrays of 300 packages are shown in Table 6-10.

The MOD1 array is identical to the MOD0 array for stacked package heights ranging from 1 to 3. The arrays are further similar inthat the MOD1 array has a central clustered sphere array however the remaining spheres are positioned in the opposite ends of the packages. The MOD1 configuration places more spheres in the vicinity of the array full water boundary reflection. The results of the MOD1 calculations with high density poly-moderation are shown in Table 6-10. The MOD0 and MOD1 results interchange as to the higher k_{eff} results however the majority of the results with the exception of two are not stastically different. When compared to the MOD0 array, the MOD1 array produced stastically different and higher k_{eff} results for package array heights of 4 and 6 on the order of 4σ. The maximum observed k_{eff} differences for these package array heights were 0.0071 and 0.0072, respectively. The modeled package arrays for the 4 and 6 high stacks were 308 and 312, respectively. Since the USL of 0.94 is also exceeded for these two calculations, the maximum modeled array size for the 4 and 6 high package stacks are reduced to 272 and 288 packages, respectively. For the reduced package array size (272) the k_{eff} is less than the USL of 0.94.

The MOD2 array is similar to the MOD1 array however the central cluster of spheres as modeled in the MOD1 array are further positioned in the opposite ends of the packages. The MOD2 array eliminates the central cluster of spheres with sphere migration more toward the array bondary reflection. These calculations demonstrate which is more important, the clustering of the spheres or the presence of full water boundary reflection. The results of the MOD2 calculations with high density poly-moderation are shown in Table 6-10. In all cases, the MOD2 results are significant lower that the MOD0 and MOD1 results. All results are within the USL of 0.94 for package arrays of 300.

The MOD3 array is similar to the MOD1 array however the spheres are centered about the package base as opposed to being clustered. The results of the MOD3 calculations with high density poly-moderation are shown in Table 6-10. In all cases, the MOD3 results are significant lower that the MOD1 results. Centralization of the main cluster within the package array appears to produce the most reactive case by comparison of the MOD1 and MOD3 case results.

The maximum k_{eff} interchanges in comparison of MOD1 and MOD0 results. The MOD1 array is more reactive for the package heights of 4, 6, 7 and 8 with MOD0 being more reactive with package heights of 5 and 9 through 12. However, only the results for package heights of 10 and 12 are stastically different. All results are within the USL of 0.94 for package arrays of 272.

A final sensitivity series of calculations are performed using a variation of the MOD1 configuration with the central cluster of spheres being moved to the bottom of the array. These calculations for the MOD4 array are only performed for the configurations with package heights of 4 and 6. The MOD4 configuration is shown in Figure 6-22. The results are shown in Table 6-10. For the modeled cases, the MOD1 configuration yields the higher k_{eff} results. The MOD4 results are not stastically different from the original MOD0 calculations for the same package stack heights. All results are within the USL of 0.94 for package arrays of 300 in the MOD4 configuration.

Table 6-11 summarizes the results of the sphere sensitivity studies with the maximum k_{eff} result high-lighted for each configuration. The calculations demonstrate that arrays of 272 packages is within the USL of 0.94.

6.6.2.2.9 Interspersed Moderation with Modeled Package Region

The input cases for the MOD1 array are modified to allow different moderator volume fractions to be specified for five different package regions, including the payload region (Mixture 5), payload insulation region (Mixture 6), inner/outer liners (Mixture 8), top/bottom insulation regions (Mixture 7), and the exterior region between packages (Mixture 9). The MOD1 calculations presented in Section 6.6.2.2.9 are duplicated with modified input cases with the volume fractions of each designated moderator region of 0.001, 0.01, 0.1, 0.5 and 1.0. The results of these calculations are presented in Table 6-12. The calculations indicated that the MOD1 configurations with moderator volume fractions of 0.0001, 0.001, and 0.01 produce the higher k_{eff} results. All results are with the USL of 0.94.

It is noted that, since the k_{eff} has been shown to increase with region varied moderator volume fractions that, the larger 300-400 package arrays of the MOD0 configuration (Section 6.6.2.2.4) could have potentially exceeded the USL had the moderating regions been modeled separately. Modeling the MOD0 configuration in a similar fashion is expected to produce similar results. However, necessary reductions in the modeled array size due to the more reactive MOD1 array would also result in lower k_{eff} results for the MOD0 array configuration. To confirm this, the arrays with package heights ranging from 1 through 5 are executed using the same modeled configuration as presented above with the MOD0 array configuration. The MOD0 configuration with package heights of 4 and 5 were less reactive than the MOD1 array for the same package height. For package heights ranging from 1 to 3 the array configurations for MOD0 and MOD1 are identical. The results are also presented in Table 6-12. The calculations indicated that the MOD0 configurations with moderator volume fractions of 0.0001, 0.001, and 0.01 also produce the higher k_{eff} results similar to the MOD1 configuration with the exception of the single package height model which has a maximum k_{eff} with full moderation within the payload (Region 5). All results are within the USL of 0.94.

It is further noted that the majority of results are statistically indeterminate such that a correlation of the modeled array (MOD0 and MOD1) to the modeled interspersed moderation with the k_{eff} result is difficult to produce. In many cases, the next highest k_{eff} result is within 0.0001 of the maximum result. A summary (essentially of Tables 6-11 and 6-12) of the maximum k_{eff} results is provided in Table 6-1.

An input case of the revised base model is provided in Section 6.9.

6.7 Fissile Material Packages for Air Transport

The Century Versa-Pac Shipping Container is not authorized for air transport.

6.8 Benchmark Evaluations

6.8.1 Benchmark Experiments and Applicability

Reference 6-1 documents 161 critical experiments modeled using the SCALE 4.4a code (KENO VI) with the 44 Group Standard Cross Section Library. Uranium compounds used in the experiments include uranyl nitrate, uranium fluoride, uranium dioxide, uranium-aluminum alloys, and uranium metal. Moderators included water, alcohol, nitric acid, hydrofluoric acid, beryllium, aluminum and silicon oxides, water, D_2O, iron, tungsten, plastics and graphite. Reflectors included aluminum, steel, concrete, water, D_2O, titanium, tungsten, lead, iron, and graphite. Enrichments ranged from 62.4 to 97.68 wt% U-235. The H/X ratio ranged from 0 to 1,837. ALCF (eV) ranged from 3.0E-02 to 9.14E+05. The fuel density ranged from 0.014 to 18.6 gU-235/cc.

The HEU experiments were selected and categorized into four distinct groups. These groupings consisted of:

Group 1: All experiments (161) used in this validation,

Group 2: Experiments (81) with ALCF $\leq 10^{-2}$ eV, data sets 1-82, and

Group 3: Experiments (56) with ALCF $> 10^{-2}$ eV and $\leq 10^{5}$ eV, data sets 83-138, and

Group 4: Experiments (24) with ALCF > 10^5 eV, data sets 139-162.

The cases evaluated for the Century Versa-Pac Shipping Container include uranium metal, water, graphite, steel, and plastic moderation/reflection. The Century Versa-Pac Shipping Container cases were evaluated at an enrichment of 100 wt% ^{235}U, and the H/X ratio ranged from 0 to 1,011. The ALCF for the Century Versa-Pac Shipping Container cases ranged from 3.00E-02 to 9.90E-02. The fuel density ranged from 0.00160 to 0.020 gU-235/cc. Although the evaluated higher enrichment falls very slightly outside the validated range, the benchmark results for Group 2 and Group 3 are directly applicable to the Century Versa-Pac Shipping Container cases.

6.8.2 Bias Determination

Details of the benchmark calculations are provided in Reference 6-1. In order to validate the SCALE 4.4a code for use with high-enriched uranium systems, it is necessary to determine if KENO predicts the multiplication factor in an accurate and precise manner throughout the range of fission energies of interest. To evaluate the accuracy of the code, the mean of each Group of experiments was compared to the mean of the experimental results. A t-test was performed for each Group to determine whether or not the average result of a KENO calculation (the mean calculated k_{eff} for each Group) is statistically the same as the experimental result (unity). Passing the t-test affirms that the KENO code predicts multiplication factors accurately for the Group being tested, without bias. Failure of the t-test indicates that the mean KENO k_{eff} is statistically different from the experimental mean, and that a bias exists in the data. Groups that failed the t-test were further evaluated for bias and uncertainty, and these parameters applied to provide an upper limit subcritical multiplication factor for the Group.

Each Group of KENO-calculated k_{eff}s are also graphed against key system parameters (Energy of the Average Lethargy Causing Fission (ALCF), Hydrogen-to-Fissile Atom Ratio (H/^{235}U), enrichment, and fissile material density (g ^{235}U/cc)) to identify trends within the data that may indicate inaccurate cross-sections or instabilities in the code. The normality of residuals is also tested using the Anderson-Darling method. The null hypothesis of a normality test is that there is no significant departure from normality. When the probability level, ρ is greater than 0.05, it fails to reject the null hypothesis and thus the assumption holds. Histogram, skewness and kurtosis plots are also provided for each group.

Jaech's[7] method for bias determination is applied, and the upper subcritical limit is calculated based upon NUREG/CR-6361.[8]

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[7] Jaech, J., *Statistical Methods in Nuclear Material Control,* Exxon Nuclear Company, Richland, WA (1973).

[8] *Criticality Benchmark Guide for Light-Water-Reactor Fuel in Transportation and Storage Packages*, NUREG/CR-6361 (ORNL/TM-13211), (March 1997).

6.8.3 Benchmark Results

For the groups of interest for the Century Versa-Pac Shipping Container, the bounding combined bias and bias uncertainty was reported as 0.0026 (Group 3). Thus, including a conservative 5% administrative margin, the applicable upper subcritical limit for the Century Versa-Pac Shipping Container is 0.9466 for the calculated $k_{eff} + 2\sigma$. For conservatism, a USL of 0.94 is further adopted.

6.9 List of Appendices

6.9.1 References

[6-1] Montgomery, Richard D. Validation of SCALE-PC for High Enriched Uranium (HEU) Systems, MTS423, Rev. 1, 5/30/09.

6.9.2 Selected SCALE 4.4a Input Cases

6.9.3 Reference [6-1]

Table 6-1 Summary of Results for the Most Reactive Case														
Case ID	**Package Array Size**	**Material**	**Modeled Configuration**	**Poly-Moderation Density (g/cc)**	**^{235}U Mass (kg)**	**Interspersed Moderation (water volume fraction)/ Package Region** Note 1	**Close Water Reflection**	**H/X** Note 2	**EALF (eV)**	**k_{eff}**	**σ**	**k_{eff} + 2σ**	**Applicable USL**
VERSAPAK_HAC_FINH_12S_1x324Pf MOD0/R5	324	U-Metal, 12.0-cm Dia. Sphere	MOD0 MOD1	0.98	0.350	1.0 Region 5	Yes	636	3.63E-02	0.8988	0.0011	0.9010	0.94
VERSAPAK_HAC_FINH_12S_2x338Pc MOD0/R5	338	U-Metal, 12.0-cm Dia. Sphere	MOD0 MOD1	0.98	0.350	0.01 Region 5	Yes	636	3.83E-02	0.9189	0.0012	0.9213	0.94
VERSAPAK_HAC_FINH_12S_3x300Pb MOD0/R5	300	U-Metal, 12.0-cm Dia. Sphere	MOD0 MOD1	0.98	0.350	0.001 Region 5	Yes	636	3.83E-02	0.9347	0.0012	0.9371	0.94
VERSAPAK_HAC_FINH_12S_3x300Pc MOD0/R8	300	U-Metal, 12.0-cm Dia. Sphere	MOD0 MOD1	0.98	0.350	0.01 Region 8	Yes	636	3.84E-02	0.9345	0.0013	0.9371	0.94
VERSAPAK_HAC_FINH_12S_4x272P	272	U-Metal, 12.0-cm Dia. Sphere	MOD1	0.98	0.350	0.0001 All	Yes	636	3.84E-02	0.9378	0.0010	0.9398	0.94
VERSAPAK_HAC_FINH_12S_4x272Pb MOD1/R5	272	U-Metal, 12.0-cm Dia. Sphere	MOD1	0.98	0.350	0.001 Region 5	Yes	636	3.84E-02	0.9374	0.0012	0.9398	0.94
VERSAPAK_HAC_FINH_12S_4x272Pb MOD1/R8	272	U-Metal, 12.0-cm Dia. Sphere	MOD1	0.98	0.350	0.001 Region 8	Yes	636	3.84E-02	0.9374	0.0012	0.9398	0.94
VERSAPAK_HAC_FINH_12S_5x280P MOD1/R6	280	U-Metal, 12.0-cm Dia. Sphere	MOD1	0.98	0.350	0.001 Region 6	Yes	636	3.83E-02	0.9376	0.0012	0.9400	0.94
VERSAPAK_HAC_FINH_12S_6X288Pb MOD1/R6	288	U-Metal, 12.0-cm Dia. Sphere	MOD1	0.98	0.350	0.001 Region 6	Yes	636	3.843-02	0.9373	0.0012	0.9397	0.94
VERSAPAK_HAC_FINH_12S_7X322Pb MOD1/R6	322	U-Metal, 12.0-cm Dia. Sphere	MOD1	0.98	0.350	0.001 Region 6	Yes	636	3.83E-02	0.9361	0.0012	0.9385	0.94
VERSAPAK_HAC_FINH_12S_8X312Pb MOD1/R7	312	U-Metal, 12.0-cm Dia. Sphere	MOD1	0.98	0.350	0.001 Region 7	Yes	636	3.83E-02	0.9277	0.0013	0.9303	0.94

Case ID	Package Array Size	Material	Modeled Configuration	Poly-Moderation Density (g/cc)	^{235}U Mass (kg)	Interspersed Moderation (water volume fraction)/ Package Region Note 1	Close Water Reflection	H/X Note 2	EALF (eV)	k_{eff}	σ	k_{eff} + 2σ	Applicable USL
VERSAPAK_HAC_FINH_12S_9X324Pb MOD1/R5	324	U-Metal, 12.0-cm Dia. Sphere	MOD1	0.98	0.350	0.001 Region 5	Yes	636	3.83E-02	0.9250	0.0012	0.9274	0.94
VERSAPAK_HAC_FINH_12S_10X300Pb MOD1/R9	300	U-Metal, 12.0-cm Dia. Sphere	MOD1	0.98	0.350	0.001 Region 9	Yes	636	3.83E-02	0.9145	0.0012	0.9169	0.94
VERSAPAK_HAC_FINH_12S_12X300Pb MOD1/R5	300	U-Metal, 12.0-cm Dia. Sphere	MOD1	0.98	0.350	0.001 Region 5	Yes	636	3.83E-02	0.9039	0.0012	0.9063	0.94
VERSAPAK_HAC_FINH_12S_12X300Pb MOD1/R9	300	U-Metal, 12.0-cm Dia. Sphere	MOD1	0.98	0.350	0.001 Region 9	Yes	636	3.83E-02	0.9035	0.0014	0.9063	0.94

Table 6-1 Summary of Results for the Most Reactive Case

Notes on Table 6-1:

1. Package region refers to the modeled regions of the package containing water moderation. “All” indicates that the package regions 5, 6, 7, 8, and 9 are modeled at the indicated volume fraction. Regions not indicated are modeled at a volume fraction of 0.0001, unless otherwise specified
2. X in this case refers to U-235; since the modeled enrichment is 100 Wt%.

Table 6-2 Century Versa-Pac Shipping Container – Test Package Dimensional Changes

Location	Description	Package 10550	Package 10551	Package 10552
A-C	Inner Container Inner Diameter	+ 1/8	NC	+ 1/16
A-C	Outer Container Outer Diameter	+ 1/16	NC	- 3/16
A	Drum Height	+ 1/8	+ 1/16	- 3/16
A	Wall – In/Out	+ 1/8	- 1/16	+ 1/8
A	Inside Height	NC	NC	NC
A	Top Rim – Inside Flange	+ 1/8	+ 1/8	- 3/8
B	Drum Height	+ 1/16	NC	- 1/4
B	Top Rim – Inside Flange	+ 1/16	NC	- 1/4
B	Wall – In/Out	- 1/8	NC	+ 1/8
B-D	Inner Container Inner Diameter	+ 1/16	NC	NC
B-D	Outer Container Outer Diameter	- 1/16	+ 1/8	- 5/16
C	Drum Height	NC	NC	NC
C	Wall – In/Out	+ 3/16	+ 1/16	- 11/16
C	Inside Height	NC	+ 5/16	- 1/8
C	Top Rim – Inside Flange	- 1/16	NC	- 1/4
D	Drum Height	NC	NC	NC
D	Top Rim – Inside Flange	NC	+ 1/16	- 1/16
D	Wall – In/Out	- 1/16	+ 1/16	- 7/16
D	Inner Container	+ 7/16	- 1/8	NC

NC – Denotes No Change (Dimensional) with tested orientation

Table 6-3 Century Versa-Pac Shipping Container Dimensions and Materials

Component	Actual Dimension		Modeled Dimension		Actual Material	Modeled Material/Notes
	(in)	(cm)	(in)	(cm)		
Radial Direction						
Payload vessel Inner diameter	15.0	38.1	15.0 – 15.125	38.1 – 38.4175	Payload – Containment Boundary	The fissile material is initially modeled in a defined volume with the remaining interstitial volume completely filled with poly-moderation. In this case, the sum of the volume fractions of both fissile material and poly-moderation are equal to unity. Subsequent calculations reduce the poly-moderation volume fraction to demonstrate that the system is not over moderated (or not more reactive with partial poly-moderation). In the latter case, the mixture is then comprised of fissile material, poly-moderation, and void. Void is technically modeled within the mixture under conditions in which the summed fissile material and poly-moderation volume fractions are less than unity. Both homogeneous and in-homogeneous (lumped) fissile masses are modeled.
Payload vessel Wall thickness	0.1345 (10 ga)	0.3416	0.1211	0.3076	Carbon steel	Carbon steel modeled with reduced manufacturing tolerance
Insulation thickness	3.0	7.62	2.5	6.35	Insulation	Optimum interspersed moderator
Inner liner wall thickness	0.0598 (16 ga)	0.1518	0.0533	0.1354	Carbon steel	Carbon steel modeled with reduced manufacturing tolerance
Outer insulation, vertical and horizonal tubing and angles	1.25	3.175	1.25 NCT 0.25 HAC	3.175 NCT 0.6356 HAC	Carbon Steel & Insulation	Optimum interspersed moderator. Carbon steel tubing and angles are neglected for conservatism.
Outer liner wall thickness	0.0598 (16 ga)	0.1518	0.0533	0.1354	Carbon steel	Carbon steel modeled with reduced manufacturing tolerance
Drum wall thickness	0.0598 (16 ga)	0.1518	0.0533	0.1354	Carbon steel	Carbon steel modeled with reduced manufacturing tolerance
Drum outer radius	11.531 [Note 1]	29.2887	11.250 NCT [Note 2] 10.593 HAC	28.575 NCT 26.908 HAC	N/A	The outer radius of the 55 gallon package is 23”. Neglecting the drum stiffeners and bolt ring reduces the outer diameter to 22-1/2”. For the bounding HAC/NCT model, the 55-gallon drum is further modeled with a reduced outer diameter of 1.313” which significantly bounds the maximum reduced dimension resulting from the tests of 0.313” (5/16”) as indicated in Section 2. The outer radius of the 55 gallon package HAC model is then 21.1875”.
Axial Direction From Bottom of Package						
Drum bottom thickness	0.0598 (16 ga)	0.1518	0.0533	0.1354	Carbon steel	Carbon steel modeled with reduced manufacturing tolerance
Bottom reinforcing plate	0.25	0.635	0.24	0.6096	Carbon steel	Carbon steel modeled with reduced manufacturing tolerance

Bottom insulation layer thickness	2.5	6.35	2.5	6.35	Insulation	Optimum interspersed moderator
Payload vessel Bottom wall thickness	0.1345 (10 ga)	0.3416	0.1211	0.3076	Carbon steel	Carbon steel modeled with reduced manufacturing tolerance
Payload vessel Inner height	27.0625	68.7387	27.0625 – 27.1875	68.7387 – 69.0562	Payload – Containment Boundary	Fissile material, same as payload vessel inner diameter.
Payload vessel Closure lid wall thickness	0.50	1.27	0.49	1.2446	Carbon steel	Carbon steel modeled with reduced manufacturing tolerance
Lid-to-plug gap	0.9065	2.3025	0.4265	1.0833	Gasket, Carbon steel bolts, Air	Clearance for gasket and inner fasteners. Modeled as optimum interspersed moderator
Inner plug liner	0.0598 (16 ga)	0.1518	0.0533	0.1354	Carbon steel	Carbon steel modeled with reduced manufacturing tolerance
Top insulation layer thickness	2.5	6.35	2.5	6.35	Insulation	Optimum interspersed moderator
Drum lid	0.0598 (16 ga)	0.1518	0.0533	0.1354	Carbon steel	Carbon steel modeled with reduced manufacturing tolerance
Drum outer height	34.5 Note 3	87.63	34.0 NCT Note 4 33.625 HAC	86.36 NCT 85.4075 HAC	N/A	The outer height of the 55 gallon package is 34-1/2". Neglecting the drum bottom chime reduces the outer height to 34". For the bounding HAC model, the 55-gallon drum is modeled with a reduced outer height of 0.875" which bounds the maximum reduced dimension resulting from the tests of 0.250" (1/4") as indicated in Section 2. The outer height of the 55 gallon package HAC model is then 33.625".

Notes on Table 6-3:

1. Dimension includes the drum ring stiffeners, lid, chime, and lock ring.
2. Dimension does not include the drum ring stiffeners, lid, chime, or lock ring.
3. Dimension includes the drum bottom chime.
4. Dimension does not include the drum bottom chime.

Table 6-4 Package and Material Regional Densities

Material	Maximum Material Density (g/cc) at 21°C	Material Hydrogen Density (g/cc)
UO_2	10.96	N/A
U-metal	19.05	N/A
UNX at 1,274 gU/L	2.705	N/A
H_2O	0.9982	0.1117
Carbon Steel (CS)	7.8212	N/A
Polyethylene (LDPE) – CH_2	0.92	0.1323
Polyethylene (HDPE) – CH_2	0.98	0.1409
Pariffin – $C_{25}H_{52}$	0.90	0.1338
Carbon (graphite)	2.300	N/A

Table 6-5 Summary of Single Package Results

Case ID	Drum Fill Percent	Poly-Moderation	^{235}U Mass (kg)	Interspersed Moderation (water volume fraction)	Close Water Reflection	k_{eff}	σ	$k_{eff} + 2\sigma$	EALF (eV)	Comments
Homogeneous Fissile Material as a Function of Drum Fill Percentage										
VERSAPAK_HAC_SIN_5_A	5	100	0.350	0.0001	Yes	0.1546	0.0006	0.1558	4.87E-02	
VERSAPAK_HAC_SIN_10_A	10	100	0.350	0.0001	Yes	0.3155	0.0007	0.3169	3.45E-02	
VERSAPAK_HAC_SIN_15_A	15	100	0.350	0.0001	Yes	0.3950	0.0006	0.3962	3.11E-02	
VERSAPAK_HAC_SIN_20_A [Note 1]	20	100	0.350	0.0001	Yes	0.4193	0.0006	0.4205	2.97E-02	
VERSAPAK_HAC_SIN_30_A	30	100	0.350	0.0001	Yes	0.3993	0.0007	0.4007	2.84E-02	
VERSAPAK_HAC_SIN_40_A	40	100	0.350	0.0001	Yes	0.3591	0.0005	0.3601	2.79E-02	
VERSAPAK_HAC_SIN_60_A	60	100	0.350	0.0001	Yes	0.2849	0.0003	0.2855	2.74E-02	
VERSAPAK_HAC_SIN_80_A	80	100	0.350	0.0001	Yes	0.2318	0.0002	0.2322	2.71E-02	
VERSAPAK_HAC_SIN_100_A	100	100	0.350	0.0001	Yes	0.1946	0.0002	0.1950	2.70E-02	
Homogeneous Fissile Material as a Function of Poly-Moderation Density										
VERSAPAK_HAC_SIN_20_A [Note 1]	20	100	0.350	0.0001	Yes	0.4193	0.0006	0.4205	2.97E-02	**k_{eff} decreases with reduced poly-moderation density**
VERSAPAK_HAC_SIN_20_B	20	90	0.350	0.0001	Yes	0.4003	0.0007	0.4017	3.02E-02	
VERSAPAK_HAC_SIN_20_C	20	80	0.350	0.0001	Yes	0.3741	0.0007	0.3755	3.09E-02	
VERSAPAK_HAC_SIN_20_D	20	70	0.350	0.0001	Yes	0.3385	0.0006	0.3397	3.19E-02	
VERSAPAK_HAC_SIN_20_E	20	60	0.350	0.0001	Yes	0.2936	0.0006	0.2948	3.33E-02	
VERSAPAK_HAC_SIN_20_F	20	50	0.350	0.0001	Yes	0.2397	0.0006	0.2409	3.54E-02	
Homogeneous Fissile Material as a Function of Interspersed-Moderator Density										
VERSAPAK_HAC_SIN_20_A [Note 1]	20	100	0.350	0.0001	Yes	0.4193	0.0006	0.4205	2.97E-02	**k_{eff} increases with increased interspersed moderation density**
VERSAPAK_HAC_SIN_20_Aa	20	100	0.350	0.001	Yes	0.4195	0.0006	0.4207	2.97E-02	
VERSAPAK_HAC_SIN_20_Ab	20	100	0.350	0.01	Yes	0.4215	0.0006	0.4227	2.96E-02	
VERSAPAK_HAC_SIN_20_Ac	20	100	0.350	0.1	Yes	0.4335	0.0006	0.4347	2.95E-02	
VERSAPAK_HAC_SIN_20_Ad	20	100	0.350	0.5	Yes	0.4708	0.0007	0.4722	2.91E-02	
VERSAPAK_HAC_SIN_20_Ae	20	100	0.350	1.0	Yes	0.4839	0.0006	0.4851	2.90E-02	**Maximum Homogeneous Result**

Case ID	Sphere Radius, cm	Poly-Moderation	^{235}U Mass (kg)	Interspersed Moderation (water volume fraction)	Close Water Reflection	k_{eff}	σ	k_{eff} + 2σ	EALF (eV)	Comments
Single Lumped Fissile Mass										
VERSAPAK_HAC_SIN_6S_A	6	100	0.350	0.0001	Yes	0.6471	0.0012	0.6495	1.45E-01	
VERSAPAK_HAC_SIN_8S_A	8	100	0.350	0.0001	Yes	0.7927	0.0012	0.7951	6.55E-02	
VERSAPAK_HAC_SIN_10S_A	10	100	0.350	0.0001	Yes	0.8683	0.0012	0.8707	4.47E-02	
VERSAPAK_HAC_SIN_12S_A Note 2	12	100	0.350	0.0001	Yes	0.8814	0.0012	0.8838	3.66E-02	**Maximum Lumped Result**
VERSAPAK_HAC_SIN_14S_A	14	100	0.350	0.0001	Yes	0.8429	0.0011	0.8451	3.27E-02	
Single Lumped Fissile Mass as a Function of Poly-Moderation Density										
VERSAPAK_HAC_SIN_12S_A Note 2	12	100	0.350	0.0001	Yes	0.8814	0.0012	0.8838	3.66E-02	**k_{eff} decreases with reduced poly-moderation density**
VERSAPAK_HAC_SIN_12S_B	12	90	0.350	0.0001	Yes	0.8431	0.0012	0.8455	3.77E-02	
VERSAPAK_HAC_SIN_12S_C	12	80	0.350	0.0001	Yes	0.7952	0.0011	0.7974	3.90E-02	
VERSAPAK_HAC_SIN_12S_D	12	70	0.350	0.0001	Yes	0.7411	0.0011	0.7433	4.07E-02	
VERSAPAK_HAC_SIN_12S_E	12	60	0.350	0.0001	Yes	0.6800	0.0012	0.6824	4.27E-02	

Notes on Table 6-5:

1. Duplicate entry for observance of trend.
2. Duplicate entry for observance of trend.

Table 6-6 Summary of Hypothetical Accident Condition Package Results for Homogeneous Models

Case ID	Drum Fill Percent	Poly-Moderation	^{235}U Mass (kg)	Interspersed Moderation (water volume fraction)	Close Water Reflection	k_{eff}	σ	$k_{eff} + 2σ$	EALF (eV)	Comments
Infinite Triangular Package Array - Homogeneous Fissile Material as a Function of Drum Fill Percentage – Bottom Filled Package Model										
VERSAPAK_HAC_INFH_5_A	5	100	0.350	0.0001	Yes	0.6807	0.0008	0.6823	4.77E-02	
VERSAPAK_HAC_INFH_10_A Note 1	10	100	0.350	0.0001	Yes	0.7158	0.0006	0.7170	3.46E-02	
VERSAPAK_HAC_INFH_15_A	15	100	0.350	0.0001	Yes	0.6673	0.0005	0.6683	3.14E-02	
VERSAPAK_HAC_INFH_20_A	20	100	0.350	0.0001	Yes	0.6104	0.0005	0.6114	3.00E-02	
Infinite Triangular Package Array - Homogeneous Fissile Material as a Function of Poly-Moderation Density – Bottom Filled Package Model										
VERSAPAK_HAC_INFH_10_A Note 1	10	100	0.350	0.0001	Yes	0.7158	0.0006	0.7170	3.46E-02	**k_{eff} decreases with reduced poly-moderation density**
VERSAPAK_HAC_INFH_10_B	10	90	0.350	0.0001	Yes	0.7149	0.0006	0.7161	3.58E-02	
VERSAPAK_HAC_INFH_10_C	10	80	0.350	0.0001	Yes	0.7082	0.0006	0.7094	3.76E-02	
Infinite Triangular Package Array - Homogeneous Fissile Material as a Function of Interspersed Moderator Density – Bottom Filled Package Model										
VERSAPAK_HAC_INFH_10_Aa	10	100	0.350	0.001	Yes	0.7083	0.0006	0.7095	3.45E-02	**k_{eff} decreases with increased interspersed moderator density**
VERSAPAK_HAC_INFH_10_Ba	10	90	0.350	0.001	Yes	0.7063	0.0006	0.7075	3.58E-02	
VERSAPAK_HAC_INFH_10_Ca	10	80	0.350	0.001	Yes	0.7002	0.0007	0.7016	3.75E-02	
VERSAPAK_HAC_INFH_10_Ab	10	100	0.350	0.01	Yes	0.6420	0.0006	0.6432	3.42E-02	
VERSAPAK_HAC_INFH_10_Bb	10	90	0.350	0.01	Yes	0.6347	0.0006	0.6359	3.54E-02	
VERSAPAK_HAC_INFH_10_Cb	10	80	0.350	0.01	Yes	0.6209	0.0007	0.6223	3.70E-02	
VERSAPAK_HAC_INFH_10_Ac	10	100	0.350	0.1	Yes	0.4959	0.0007	0.4973	3.30E-02	
VERSAPAK_HAC_INFH_10_Bc	10	90	0.350	0.1	Yes	0.4780	0.0007	0.4794	3.39E-02	
VERSAPAK_HAC_INFH_10_Cc	10	80	0.350	0.1	Yes	0.4551	0.0007	0.4565	3.49E-02	
Infinite Triangular Package Array - Homogeneous Fissile Material as a Function of Drum Fill Percentage – Bottom Filled Inverted Bottom Package Model										
VERSAPAK_HAC_INFH2_5_A	5	100	0.350	0.0001	Yes	0.6817	0.0007	0.6831	4.77E-02	**Bottom filled inverted model (H2) is more reactive than previous bottom filled (H) model**
VERSAPAK_HAC_INFH2_5_B	5	90	0.350	0.0001	Yes	0.6625	0.0006	0.6637	5.15E-02	
VERSAPAK_HAC_INFH2_5_C	5	80	0.350	0.0001	Yes	0.6374	0.0006	0.6386	5.70E-02	
VERSAPAK_HAC_INFH2_5_D	5	70	0.350	0.0001	Yes	0.608	0.0007	0.6094	6.50E-02	
VERSAPAK_HAC_INFH2_5_E	5	60	0.350	0.0001	Yes	0.5727	0.0006	0.5739	7.74E-02	
VERSAPAK_HAC_INFH2_5_F	5	50	0.350	0.0001	Yes	0.5317	0.0006	0.5329	9.90E-02	
VERSAPAK_HAC_INFH2_10_A	10	100	0.350	0.0001	Yes	0.7161	0.0007	0.7175	3.46E-02	

VERSAPAK_HAC_INFH2_10_B	10	90	0.350	0.0001	Yes	0.7141	0.0006	0.7153	3.58E-02	**k_{eff} decreases with reduced poly-moderation density**
VERSAPAK_HAC_INFH2_10_C	10	80	0.350	0.0001	Yes	0.7082	0.0006	0.7094	3.76E-02	
VERSAPAK_HAC_INFH2_10_D	10	70	0.350	0.0001	Yes	0.697	0.0007	0.6984	3.99E-02	
VERSAPAK_HAC_INFH2_10_E	10	60	0.350	0.0001	Yes	0.6769	0.0007	0.6783	4.34E-02	
VERSAPAK_HAC_INFH2_10_F	10	50	0.350	0.0001	Yes	0.6465	0.0007	0.6479	4.91E-02	
VERSAPAK_HAC_INFH2_15_A	15	100	0.350	0.0001	Yes	0.6664	0.0006	0.6676	3.15E-02	
VERSAPAK_HAC_INFH2_15_B	15	90	0.350	0.0001	Yes	0.6773	0.0005	0.6783	3.22E-02	
VERSAPAK_HAC_INFH2_15_C	15	80	0.350	0.0001	Yes	0.6829	0.0006	0.6841	3.32E-02	
VERSAPAK_HAC_INFH2_15_D	15	70	0.350	0.0001	Yes	0.6874	0.0006	0.6886	3.45E-02	
VERSAPAK_HAC_INFH2_15_E	15	60	0.350	0.0001	Yes	0.6824	0.0006	0.6836	3.65E-02	
VERSAPAK_HAC_INFH2_15_F	15	50	0.350	0.0001	Yes	0.6707	0.0006	0.6719	3.94E-02	
VERSAPAK_HAC_INFH2_20_A	20	100	0.350	0.0001	Yes	0.6089	0.0005	0.6099	3.00E-02	
Infinite Triangular Package Array - Homogeneous Fissile Material as a Function of Poly-Moderation Density – Bottom Filled Inverted Bottom Package Model										
VERSAPAK_HAC_INFH2_10_Aa	10	100	0.350	0.001	Yes	0.7090	0.0006	0.7102	3.45E-02	**k_{eff} decreases with reduced poly-moderation density and with increased interspersed moderator density**
VERSAPAK_HAC_INFH2_10_Ba	10	90	0.350	0.001	Yes	0.7060	0.0006	0.7072	3.58E-02	
VERSAPAK_HAC_INFH2_10_Ca	10	80	0.350	0.001	Yes	0.6990	0.0006	0.7002	3.75E-02	
VERSAPAK_HAC_INFH2_10_Ab	10	100	0.350	0.01	Yes	0.6431	0.0007	0.6445	3.42E-02	
VERSAPAK_HAC_INFH2_10_Bb	10	90	0.350	0.01	Yes	0.6325	0.0007	0.6339	3.54E-02	
VERSAPAK_HAC_INFH2_10_Cb	10	80	0.350	0.01	Yes	0.6197	0.0007	0.6211	3.70E-02	
VERSAPAK_HAC_INFH2_10_Ac	10	100	0.350	0.1	Yes	0.4956	0.0008	0.4972	3.30E-02	
VERSAPAK_HAC_INFH2_10_Bc	10	90	0.350	0.1	Yes	0.4762	0.0007	0.4776	3.39E-02	
VERSAPAK_HAC_INFH2_10_Cc	10	80	0.350	0.1	Yes	0.4530	0.0007	0.4544	3.50E-02	
Infinite Square Package Array - Homogeneous Fissile Material as a Function of Drum Fill Percentage – Bottom Filled Inverted Bottom Package Model										
VERSAPAK_HAC_INFS2_5_A	5	100	0.350	0.0001	Yes	0.6800	0.0007	0.6814	4.77E-02	**k_{eff} decreases for square array**
VERSAPAK_HAC_INFS2_10_A	10	100	0.350	0.0001	Yes	0.7145	0.0007	0.7159	3.46E-02	
VERSAPAK_HAC_INFS2_15_A	15	100	0.350	0.0001	Yes	0.6663	0.0005	0.6673	3.14E-02	
VERSAPAK_HAC_INFS2_20_A	20	100	0.350	0.0001	Yes	0.6082	0.0005	0.6092	3.01E-02	
VERSAPAK_HAC_INFS2_30_A	30	100	0.350	0.0001	Yes	0.5063	0.0004	0.5071	2.88E-02	
Infinite Triangular Package Array - Homogeneous Fissile Material as a Function of Drum Fill Percentage – Bottom Filled Inverted Bottom Package Model – Reduced Containment Cavity Radius										
VERSAPAK_HAC_INFH2_10M_A	10	100	0.350	0.0001	Yes	0.7292	0.0006	0.7304	3.46E-02	**Containment radius reduced from 19.2088 to 19.05-cm**

Notes on Table 6-6:

1. Duplicate entry for observance of trend.

Table 6-7 Summary of Hypothetical Accident Condition Package Results for Lumped Fissile Mass Models

Case ID	Radius (cm) of Sphere or Cylinder (H/D)	Modeled Package Array	Poly-Moderation	^{235}U Mass (kg)	Interspersed Moderation (water volume fraction)	Close Water Reflection	k_{eff}	σ	$k_{eff} + 2σ$	EALF (eV)	Comments
Triangular Package Arrays – Lumped Spherical Fissile Mass – Initial Array Sensitivity Study											
VERSAPAK_HAC_FINH_8S_A1	8	2x2x2=8	100	0.350	0.0001	Yes	0.5932	0.0013	0.5958	8.89E-02	
VERSAPAK_HAC_FINH_8S_A2	8	4x4x4=64	100	0.350	0.0001	Yes	0.6311	0.0013	0.6337	8.84E-02	
VERSAPAK_HAC_FINH_8S_A3	8	6x6x4=144	100	0.350	0.0001	Yes	0.6672	0.0014	0.6700	8.82E-02	
VERSAPAK_HAC_FINH_8S_A4	8	6x6x6=216	100	0.350	0.0001	Yes	0.6827	0.0014	0.6855	8.79E-02	
VERSAPAK_HAC_FINH_8S_A5	8	8x8x6=384	100	0.350	0.0001	Yes	0.7182	0.0014	0.7210	8.79E-02	
VERSAPAK_HAC_FINH_8S_A6	8	8x8x8=512	100	0.350	0.0001	Yes	0.7282	0.0013	0.7308	8.76E-02	
VERSAPAK_HAC_FINH_8S_A7	8	10x10x8=800	100	0.350	0.0001	Yes	0.7695	0.0014	0.7723	8.74E-02	
VERSAPAK_HAC_FINH_10S_A1	10	2x2x2=8	100	0.350	0.0001	Yes	0.7381	0.0014	0.7409	5.11E-02	
VERSAPAK_HAC_FINH_10S_A2	10	4x4x4=64	100	0.350	0.0001	Yes	0.7804	0.0012	0.7828	5.11E-02	
VERSAPAK_HAC_FINH_10S_A3	10	6x6x4=144	100	0.350	0.0001	Yes	0.8214	0.0012	0.8238	5.10E-02	
VERSAPAK_HAC_FINH_10S_A4	10	6x6x6=216	100	0.350	0.0001	Yes	0.8346	0.0011	0.8368	5.12E-02	
VERSAPAK_HAC_FINH_10S_A5	10	8x8x6=384	100	0.350	0.0001	Yes	0.8712	0.0015	0.8742	5.11E-02	
VERSAPAK_HAC_FINH_10S_A6	10	8x8x8=512	100	0.350	0.0001	Yes	0.8841	0.0014	0.8869	5.10E-02	
VERSAPAK_HAC_FINH_10S_A7	10	10x10x8=800	100	0.350	0.0001	Yes	0.9210	0.0013	0.9236	5.11E-02	
VERSAPAK_HAC_FINH_12S_A1	12	2x2x2=8	100	0.350	0.0001	Yes	0.7973	0.0011	0.7995	3.92E-02	
VERSAPAK_HAC_FINH_12S_A2	12	4x4x4=64	100	0.350	0.0001	Yes	0.8403	0.0012	0.8427	3.93E-02	
VERSAPAK_HAC_FINH_12S_A3	12	6x6x4=144	100	0.350	0.0001	Yes	0.8791	0.0012	0.8815	3.94E-02	
VERSAPAK_HAC_FINH_12S_A4	12	6x6x6=216	100	0.350	0.0001	Yes	0.8889	0.0013	0.8915	3.94E-02	
VERSAPAK_HAC_FINH_12S_A5	12	8x8x6=384	100	0.350	0.0001	Yes	0.9220	0.0011	0.9242	3.94E-02	
VERSAPAK_HAC_FINH_12S_A6	12	8x8x8=512	100	0.350	0.0001	Yes	0.9341	0.0012	0.9365	3.94E-02	
VERSAPAK_HAC_FINH_12S_A7	12	10x10x8=800	100	0.350	0.0001	Yes	0.9623	0.0013	0.9649	3.95E-02	
VERSAPAK_HAC_FINH_14S_A1	14	2x2x2=8	100	0.350	0.0001	Yes	0.7929	0.0010	0.7949	3.41E-02	
VERSAPAK_HAC_FINH_14S_A2	14	4x4x4=64	100	0.350	0.0001	Yes	0.8359	0.0010	0.8379	3.41E-02	
VERSAPAK_HAC_FINH_14S_A3	14	6x6x4=144	100	0.350	0.0001	Yes	0.8662	0.0011	0.8684	3.42E-02	
VERSAPAK_HAC_FINH_14S_A4	14	6x6x6=216	100	0.350	0.0001	Yes	0.8762	0.0010	0.8782	3.42E-02	
VERSAPAK_HAC_FINH_14S_A5	14	8x8x6=384	100	0.350	0.0001	Yes	0.9037	0.0011	0.9059	3.43E-02	

VERSAPAK_HAC_FINH_14S_A6	14	8x8x8=512	100	0.350	0.0001	Yes	0.9084	0.0010	0.9104	3.43E-02	
VERSAPAK_HAC_FINH_14S_A7	14	10x10x8=800	100	0.350	0.0001	Yes	0.9314	0.0010	0.9334	3.43E-02	
Square Package Arrays – Lumped Spherical Fissile Mass – Initial Array Sensitivity Study											
VERSAPAK_HAC_FINS_10S_A1	10	2x2x2=8	100	0.350	0.0001	Yes	0.7348	0.0012	0.7372	5.11E-02	
VERSAPAK_HAC_FINS_10S_A2	10	4x4x4=64	100	0.350	0.0001	Yes	0.7780	0.0012	0.7804	5.12E-02	
VERSAPAK_HAC_FINS_10S_A3	10	6x6x4=144	100	0.350	0.0001	Yes	0.8118	0.0012	0.8142	5.12E-02	
VERSAPAK_HAC_FINS_10S_A4	10	6x6x6=216	100	0.350	0.0001	Yes	0.8241	0.0012	0.8265	5.11E-02	
VERSAPAK_HAC_FINS_10S_A5	10	8x8x6=384	100	0.350	0.0001	Yes	0.8583	0.0014	0.8611	5.12E-02	
VERSAPAK_HAC_FINS_10S_A6	10	8x8x8=512	100	0.350	0.0001	Yes	0.8706	0.0014	0.8734	5.13E-02	
VERSAPAK_HAC_FINS_10S_A7	10	10x10x8=800	100	0.350	0.0001	Yes	0.9056	0.0014	0.9084	5.11E-02	
VERSAPAK_HAC_FINS_12S_A1	12	2x2x2=8	100	0.350	0.0001	Yes	0.7923	0.0012	0.7947	3.92E-02	
VERSAPAK_HAC_FINS_12S_A2	12	4x4x4=64	100	0.350	0.0001	Yes	0.8381	0.0014	0.8409	3.93E-02	
VERSAPAK_HAC_FINS_12S_A3	12	6x6x4=144	100	0.350	0.0001	Yes	0.8720	0.0011	0.8742	3.93E-02	
VERSAPAK_HAC_FINS_12S_A4	12	6x6x6=216	100	0.350	0.0001	Yes	0.8814	0.0012	0.8838	3.93E-02	
VERSAPAK_HAC_FINS_12S_A5	12	8x8x6=384	100	0.350	0.0001	Yes	0.9154	0.0012	0.9178	3.94E-02	
VERSAPAK_HAC_FINS_12S_A6	12	8x8x8=512	100	0.350	0.0001	Yes	0.9219	0.0012	0.9243	3.94E-02	
VERSAPAK_HAC_FINS_12S_A7	12	10x10x8=800	100	0.350	0.0001	Yes	0.9505	0.0012	0.9529	3.95E-02	
VERSAPAK_HAC_FINS_14S_A1	14	2x2x2=8	100	0.350	0.0001	Yes	0.7926	0.0010	0.7946	3.41E-02	
VERSAPAK_HAC_FINS_14S_A2	14	4x4x4=64	100	0.350	0.0001	Yes	0.8331	0.0011	0.8353	3.42E-02	
VERSAPAK_HAC_FINS_14S_A3	14	6x6x4=144	100	0.350	0.0001	Yes	0.8573	0.0010	0.8593	3.42E-02	
VERSAPAK_HAC_FINS_14S_A4	14	6x6x6=216	100	0.350	0.0001	Yes	0.8713	0.0010	0.8733	3.42E-02	
VERSAPAK_HAC_FINS_14S_A5	14	8x8x6=384	100	0.350	0.0001	Yes	0.8962	0.0010	0.8982	3.43E-02	
VERSAPAK_HAC_FINS_14S_A6	14	8x8x8=512	100	0.350	0.0001	Yes	0.9047	0.0010	0.9067	3.43E-02	
VERSAPAK_HAC_FINS_14S_A7	14	10x10x8=800	100	0.350	0.0001	Yes	0.9236	0.0010	0.9256	3.43E-02	
Triangular Package Arrays – Lumped Cylindrical Fissile Mass – Initial Array Sensitivity Study											
VERSAPAK_HAC_FINH_8C_A1	8 (1.0)	2x2x2=8	100	0.350	0.0001	Yes	0.6623	0.0012	0.6647	6.18E-02	
VERSAPAK_HAC_FINH_8C_A2	8 (1.0)	4x4x4=64	100	0.350	0.0001	Yes	0.7005	0.0012	0.7029	6.18E-02	
VERSAPAK_HAC_FINH_8C_A3	8 (1.0)	6x6x4=144	100	0.350	0.0001	Yes	0.7433	0.0014	0.7461	6.20E-02	
VERSAPAK_HAC_FINH_8C_A4	8 (1.0)	6x6x6=216	100	0.350	0.0001	Yes	0.7562	0.0013	0.7588	6.18E-02	
VERSAPAK_HAC_FINH_8C_A5	8 (1.0)	8x8x6=384	100	0.350	0.0001	Yes	0.7955	0.0013	0.7981	6.19E-02	
VERSAPAK_HAC_FINH_8C_A6	8 (1.0)	8x8x8=512	100	0.350	0.0001	Yes	0.8075	0.0013	0.8101	6.17E-02	
VERSAPAK_HAC_FINH_8C_A7	8 (1.0)	10x10x8=800	100	0.350	0.0001	Yes	0.8462	0.0013	0.8488	6.19E-02	
VERSAPAK_HAC_FINH_10C_A1	10 (1.0)	2x2x2=8	100	0.350	0.0001	Yes	0.7741	0.0011	0.7763	4.17E-02	
VERSAPAK_HAC_FINH_10C_A2	10 (1.0)	4x4x4=64	100	0.350	0.0001	Yes	0.8179	0.0013	0.8205	4.18E-02	
VERSAPAK_HAC_FINH_10C_A3	10 (1.0)	6x6x4=144	100	0.350	0.0001	Yes	0.8546	0.0013	0.8572	4.19E-02	
VERSAPAK_HAC_FINH_10C_A4	10 (1.0)	6x6x6=216	100	0.350	0.0001	Yes	0.8657	0.0012	0.8681	4.19E-02	

VERSAPAK_HAC_FINH_10C_A5	10 (1.0)	8x8x6=384	100	0.350	0.0001	Yes	0.9033	0.0012	0.9057	4.19E-02	
VERSAPAK_HAC_FINH_10C_A6	10 (1.0)	8x8x8=512	100	0.350	0.0001	Yes	0.9126	0.0013	0.9152	4.20E-02	
VERSAPAK_HAC_FINH_10C_A7	10 (1.0)	10x10x8=800	100	0.350	0.0001	Yes	0.9427	0.0014	0.9455	4.21E-02	
VERSAPAK_HAC_FINH_12C_A1	12 (1.0)	2x2x2=8	100	0.350	0.0001	Yes	0.7854	0.0010	0.7874	3.47E-02	
VERSAPAK_HAC_FINH_12C_A2	12 (1.0)	4x4x4=64	100	0.350	0.0001	Yes	0.8248	0.0011	0.8270	3.48E-02	
VERSAPAK_HAC_FINH_12C_A3	12 (1.0)	6x6x4=144	100	0.350	0.0001	Yes	0.8592	0.0010	0.8612	3.49E-02	
VERSAPAK_HAC_FINH_12C_A4	12 (1.0)	6x6x6=216	100	0.350	0.0001	Yes	0.8674	0.0011	0.8696	3.49E-02	
VERSAPAK_HAC_FINH_12C_A5	12 (1.0)	8x8x6=384	100	0.350	0.0001	Yes	0.8958	0.0010	0.8978	3.49E-02	
VERSAPAK_HAC_FINH_12C_A6	12 (1.0)	8x8x8=512	100	0.350	0.0001	Yes	0.9000	0.0010	0.9020	3.50E-02	
VERSAPAK_HAC_FINH_12C_A7	12 (1.0)	10x10x8=800	100	0.350	0.0001	Yes	0.9227	0.0010	0.9247	3.50E-02	
VERSAPAK_HAC_FINH_14C_A1	14 (1.0)	2x2x2=8	100	0.350	0.0001	Yes	0.7377	0.0009	0.7395	3.15E-02	
VERSAPAK_HAC_FINH_14C_A2	14 (1.0)	4x4x4=64	100	0.350	0.0001	Yes	0.7737	0.0011	0.7759	3.16E-02	
VERSAPAK_HAC_FINH_14C_A3	14 (1.0)	6x6x4=144	100	0.350	0.0001	Yes	0.7985	0.0009	0.8003	3.17E-02	
VERSAPAK_HAC_FINH_14C_A4	14 (1.0)	6x6x6=216	100	0.350	0.0001	Yes	0.8057	0.0008	0.8073	3.17E-02	
VERSAPAK_HAC_FINH_14C_A5	14 (1.0)	8x8x6=384	100	0.350	0.0001	Yes	0.8247	0.0009	0.8265	3.17E-02	
VERSAPAK_HAC_FINH_14C_A6	14 (1.0)	8x8x8=512	100	0.350	0.0001	Yes	0.8296	0.0008	0.8312	3.17E-02	
VERSAPAK_HAC_FINH_14C_A7	14 (1.0)	10x10x8=800	100	0.350	0.0001	Yes	0.8436	0.0009	0.8454	3.17E-02	
Triangular Package Arrays – Lumped Cylindrical Fissile Mass – Initial Array Sensitivity Study – 10.0” Cylinder Height-to-Diameter Sensitivity											
VERSAPAK_HAC_FINH_10C12_A1	10 (1.2)	2x2x2=8	100	0.350	0.0001	Yes	0.7777	0.0013	0.7803	3.88E-02	
VERSAPAK_HAC_FINH_10C12_A2	10 (1.2)	4x4x4=64	100	0.350	0.0001	Yes	0.8204	0.0012	0.8228	3.89E-02	
VERSAPAK_HAC_FINH_10C12_A3	10 (1.2)	6x6x4=144	100	0.350	0.0001	Yes	0.8587	0.0010	0.8607	3.91E-02	
VERSAPAK_HAC_FINH_10C12_A4	10 (1.2)	6x6x6=216	100	0.350	0.0001	Yes	0.8711	0.0010	0.8731	3.90E-02	
VERSAPAK_HAC_FINH_10C12_A5	10 (1.2)	8x8x6=384	100	0.350	0.0001	Yes	0.9041	0.0011	0.9063	3.91E-02	
VERSAPAK_HAC_FINH_10C12_A6	10 (1.2)	8x8x8=512	100	0.350	0.0001	Yes	0.9130	0.0011	0.9152	3.91E-02	
VERSAPAK_HAC_FINH_10C12_A7	10 (1.2)	10x10x8=800	100	0.350	0.0001	Yes	0.9428	0.0012	0.9452	3.92E-02	
VERSAPAK_HAC_FINH_10C11_A1	10 (1.1)	2x2x2=8	100	0.350	0.0001	Yes	0.8229	0.0012	0.8253	4.34E-02	
VERSAPAK_HAC_FINH_10C11_A2	10 (1.1)	4x4x4=64	100	0.350	0.0001	Yes	0.8202	0.0011	0.8224	4.03E-02	
VERSAPAK_HAC_FINH_10C11_A3	10 (1.1)	6x6x4=144	100	0.350	0.0001	Yes	0.8570	0.0014	0.8598	4.03E-02	
VERSAPAK_HAC_FINH_10C11_A4	10 (1.1)	6x6x6=216	100	0.350	0.0001	Yes	0.8723	0.0011	0.8745	4.03E-02	
VERSAPAK_HAC_FINH_10C11_A5	10 (1.1)	8x8x6=384	100	0.350	0.0001	Yes	0.9038	0.0012	0.9062	4.04E-02	
VERSAPAK_HAC_FINH_10C11_A6	10 (1.1)	8x8x8=512	100	0.350	0.0001	Yes	0.9131	0.0014	0.9159	4.04E-02	
VERSAPAK_HAC_FINH_10C11_A7	10 (1.1)	10x10x8=800	100	0.350	0.0001	Yes	0.9430	0.0012	0.9454	4.05E-02	
VERSAPAK_HAC_FINH_10C9_A1	10 (0.9)	2x2x2=8	100	0.350	0.0001	Yes	0.7676	0.0013	0.7702	4.37E-02	
VERSAPAK_HAC_FINH_10C9_A2	10 (0.9)	4x4x4=64	100	0.350	0.0001	Yes	0.8099	0.0012	0.8123	4.38E-02	
VERSAPAK_HAC_FINH_10C9_A3	10 (0.9)	6x6x4=144	100	0.350	0.0001	Yes	0.8485	0.0012	0.8509	4.39E-02	

VERSAPAK_HAC_FINH_10C9_A4	10 (0.9)	6x6x6=216	100	0.350	0.0001	Yes	0.8581	0.0012	0.8605	4.39E-02	
VERSAPAK_HAC_FINH_10C9_A5	10 (0.9)	8x8x6=384	100	0.350	0.0001	Yes	0.8954	0.0013	0.8980	4.40E-02	
VERSAPAK_HAC_FINH_10C9_A6	10 (0.9)	8x8x8=512	100	0.350	0.0001	Yes	0.9035	0.0013	0.9061	4.41E-02	
VERSAPAK_HAC_FINH_10C9_A7	10 (0.9)	10x10x8=800	100	0.350	0.0001	Yes	0.9373	0.0013	0.9399	4.41E-02	
Triangular Package Arrays – Lumped Cylindrical Fissile Mass – Initial Array Sensitivity Study – 12.0" Cylinder Height-to-Diameter Sensitivity											
VERSAPAK_HAC_FINH_12C11_A1	12 (1.1)	2x2x2=8	100	0.350	0.0001	Yes	0.7787	0.0010	0.7807	3.39E-02	
VERSAPAK_HAC_FINH_12C11_A2	12 (1.1)	4x4x4=64	100	0.350	0.0001	Yes	0.8178	0.0009	0.8196	3.40E-02	
VERSAPAK_HAC_FINH_12C11_A3	12 (1.1)	6x6x4=144	100	0.350	0.0001	Yes	0.8481	0.0010	0.8501	3.41E-02	
VERSAPAK_HAC_FINH_12C11_A4	12 (1.1)	6x6x6=216	100	0.350	0.0001	Yes	0.8568	0.0011	0.8590	3.41E-02	
VERSAPAK_HAC_FINH_12C11_A5	12 (1.1)	8x8x6=384	100	0.350	0.0001	Yes	0.8819	0.0010	0.8839	3.41E-02	
VERSAPAK_HAC_FINH_12C11_A6	12 (1.1)	8x8x8=512	100	0.350	0.0001	Yes	0.8904	0.0010	0.8924	3.42E-02	
VERSAPAK_HAC_FINH_12C11_A7	12 (1.1)	10x10x8=800	100	0.350	0.0001	Yes	0.9103	0.0010	0.9123	3.42E-02	
VERSAPAK_HAC_FINH_12C9_A1	12 (0.9)	2x2x2=8	100	0.350	0.0001	Yes	0.7917	0.0011	0.7939	3.57E-02	
VERSAPAK_HAC_FINH_12C9_A2	12 (0.9)	4x4x4=64	100	0.350	0.0001	Yes	0.8308	0.0010	0.8328	3.58E-02	
VERSAPAK_HAC_FINH_12C9_A3	12 (0.9)	6x6x4=144	100	0.350	0.0001	Yes	0.8661	0.0009	0.8679	3.59E-02	
VERSAPAK_HAC_FINH_12C9_A4	12 (0.9)	6x6x6=216	100	0.350	0.0001	Yes	0.8769	0.0010	0.8789	3.59E-02	
VERSAPAK_HAC_FINH_12C9_A5	12 (0.9)	8x8x6=384	100	0.350	0.0001	Yes	0.9043	0.0011	0.9065	3.60E-02	
VERSAPAK_HAC_FINH_12C9_A6	12 (0.9)	8x8x8=512	100	0.350	0.0001	Yes	0.9125	0.0009	0.9143	3.60E-02	
VERSAPAK_HAC_FINH_12C9_A7	12 (0.9)	10x10x8=800	100	0.350	0.0001	Yes	0.9391	0.0009	0.9409	3.60E-02	
VERSAPAK_HAC_FINH_12C8_A1	12 (0.8)	2x2x2=8	100	0.350	0.0001	Yes	0.7908	0.0011	0.7930	3.70E-02	
VERSAPAK_HAC_FINH_12C8_A2	12 (0.8)	4x4x4=64	100	0.350	0.0001	Yes	0.8317	0.0012	0.8341	3.71E-02	
VERSAPAK_HAC_FINH_12C8_A3	12 (0.8)	6x6x4=144	100	0.350	0.0001	Yes	0.8657	0.0011	0.8679	3.72E-02	
VERSAPAK_HAC_FINH_12C8_A4	12 (0.8)	6x6x6=216	100	0.350	0.0001	Yes	0.8794	0.0011	0.8816	3.72E-02	
VERSAPAK_HAC_FINH_12C8_A5	12 (0.8)	8x8x6=384	100	0.350	0.0001	Yes	0.9061	0.0010	0.9081	3.73E-02	
VERSAPAK_HAC_FINH_12C8_A6	12 (0.8)	8x8x8=512	100	0.350	0.0001	Yes	0.9158	0.0011	0.9180	3.73E-02	
VERSAPAK_HAC_FINH_12C8_A7	12 (0.8)	10x10x8=800	100	0.350	0.0001	Yes	0.9426	0.0012	0.9450	3.73E-02	
VERSAPAK_HAC_FINH_12C6_A1	12 (0.6)	2x2x2=8	100	0.350	0.0001	Yes	0.7631	0.0013	0.7657	4.13E-02	
VERSAPAK_HAC_FINH_12C6_A2	12 (0.6)	4x4x4=64	100	0.350	0.0001	Yes	0.8088	0.0011	0.8110	4.13E-02	
VERSAPAK_HAC_FINH_12C6_A3	12 (0.6)	6x6x4=144	100	0.350	0.0001	Yes	0.8469	0.0010	0.8489	4.14E-02	
VERSAPAK_HAC_FINH_12C6_A4	12 (0.6)	6x6x6=216	100	0.350	0.0001	Yes	0.8471	0.0013	0.8497	4.14E-02	
VERSAPAK_HAC_FINH_12C6_A5	12 (0.6)	8x8x6=384	100	0.350	0.0001	Yes	0.8913	0.0012	0.8937	4.16E-02	
VERSAPAK_HAC_FINH_12C6_A6	12 (0.6)	8x8x8=512	100	0.350	0.0001	Yes	0.9029	0.0015	0.9059	4.15E-02	
VERSAPAK_HAC_FINH_12C6_A7	12 (0.6)	10x10x8=800	100	0.350	0.0001	Yes	0.9336	0.0012	0.9360	4.16E-02	

Table 6-8 Summary of Hypothetical Accident Condition Package Results for Lumped Fissile Mass Models – Increased Array Size and Increased Poly-Moderation Sensitivity

Case ID	Radius (cm) of Sphere	Modeled Package Array	Poly-Moderation Density	^{235}U Mass (kg)	Interspersed Moderation (water volume fraction)	Close Water Reflection	k_{eff}	σ	$k_{eff} + 2\sigma$	EALF (eV)	Comments
Triangular Package Arrays – Lumped Spherical Fissile Mass – Normal Density Poly-Moderation Sensitivity Study											
VERSAPAK_HAC_FINH_12S_1X400	12	16x25x1=400	0.92	0.350	0.0001	Yes	0.8240	0.0011	0.8262	3.92E-02	
VERSAPAK_HAC_FINH_12S_1x416	12	16x26x1=416	0.92	0.350	0.0001	Yes	0.8273	0.0012	0.8297	3.92E-02	
VERSAPAK_HAC_FINH_12S_1x468	12	18x26x1=468	0.92	0.350	0.0001	Yes	0.8249	0.0012	0.8273	3.93E-02	
VERSAPAK_HAC_FINH_12S_2X324	12	20x18x2=720	0.92	0.350	0.0001	Yes	0.9077	0.0011	0.9099	3.95E-02	
VERSAPAK_HAC_FINH_12S_2x400	12	16x25x2=800	0.92	0.350	0.0001	Yes	0.9076	0.0010	0.9096	3.94E-02	
VERSAPAK_HAC_FINH_12S_2x416	12	16x26x2=832	0.92	0.350	0.0001	Yes	0.9074	0.0013	0.9100	3.94E-02	
VERSAPAK_HAC_FINH_12S_2x468	12	18x26x2=936	0.92	0.350	0.0001	Yes	0.9110	0.0012	0.9134	3.94E-02	
VERSAPAK_HAC_FINH_12S_3X120	12	10x12x3=360	0.92	0.350	0.0001	Yes	0.9202	0.0012	0.9226	3.94E-02	
VERSAPAK_HAC_FINH_12S_3X144	12	12x12x3=432	0.92	0.350	0.0001	Yes	0.9253	0.0011	0.9275	3.94E-02	
VERSAPAK_HAC_FINH_12S_3X224	12	14x16x3=672	0.92	0.350	0.0001	Yes	0.9371	0.0013	0.9397	3.95E-02	
VERSAPAK_HAC_FINH_12S_3X324	12	20x18x3=1080	0.92	0.350	0.0001	Yes	0.9500	0.0011	0.9522	3.95E-02	
VERSAPAK_HAC_FINH_12S_3x400	12	16x25x3=1200	0.92	0.350	0.0001	Yes	0.9491	0.0012	0.9515	3.95E-02	
VERSAPAK_HAC_FINH_12S_3x416	12	16x26x3=1248	0.92	0.350	0.0001	Yes	0.9504	0.0011	0.9526	3.94E-02	
VERSAPAK_HAC_FINH_12S_3x468	12	18x26x3=1404	0.92	0.350	0.0001	Yes	0.9548	0.0011	0.9570	3.94E-02	
VERSAPAK_HAC_FINS_12_A3	12	6x6x4=144	0.92	0.350	0.0001	Yes	0.8720	0.0011	0.8742	3.93E-02	
VERSAPAK_HAC_FINH_12S_4X120	12	10x12x4=480	0.92	0.350	0.0001	Yes	0.9359	0.0011	0.9381	3.95E-02	
VERSAPAK_HAC_FINH_12S_4x400	12	16x25x4=1600	0.92	0.350	0.0001	Yes	0.9779	0.0010	0.9799	3.95E-02	
VERSAPAK_HAC_FINH_12S_4x416	12	16x26x4=1664	0.92	0.350	0.0001	Yes	0.9754	0.0011	0.9776	3.95E-02	
VERSAPAK_HAC_FINH_12S_4x468	12	18x26x4=1872	0.92	0.350	0.0001	Yes	0.9825	0.0012	0.9849	3.95E-02	
VERSAPAK_HAC_FINH_12S_5X080	12	8x10x5=400	0.92	0.350	0.0001	Yes	0.9322	0.0012	0.9346	3.95E-02	
VERSAPAK_HAC_FINH_12S_5X120	12	10x12x5=600	0.92	0.350	0.0001	Yes	0.9554	0.0012	0.9578	3.94E-02	
VERSAPAK_HAC_FINS_12_A4	12	6x6x6=216	0.92	0.350	0.0001	Yes	0.8814	0.0012	0.8838	3.93E-02	
VERSAPAK_HAC_FINS_12_A5	12	8x8x6=384	0.92	0.350	0.0001	Yes	0.9154	0.0012	0.9178	3.94E-02	
VERSAPAK_HAC_FINH_12S_6X080	12	8x10x6=480	0.92	0.350	0.0001	Yes	0.9373	0.0012	0.9397	3.94E-02	
VERSAPAK_HAC_FINH_12S_7X064	12	8x8x7=448	0.92	0.350	0.0001	Yes	0.9319	0.0012	0.9343	3.94E-02	

VERSAPAK_HAC_FINH_12S_7X080	12	8x10x7=560	0.92	0.350	0.0001	Yes	0.9436	0.0012	0.9460	3.95E-02	
VERSAPAK_HAC_FINS_12_A6	12	8x8x8=512	0.92	0.350	0.0001	Yes	0.9219	0.0012	0.9243	3.94E-02	
VERSAPAK_HAC_FINH_12S_8X080	12	8x10x8=640	0.92	0.350	0.0001	Yes	0.9507	0.0012	0.9531	3.94E-02	
VERSAPAK_HAC_FINS_12_A7	12	10x10x8=800	0.92	0.350	0.0001	Yes	0.9505	0.0012	0.9529	3.95E-02	
VERSAPAK_HAC_FINH_12S_8X064	12	8x8x10=640	0.92	0.350	0.0001	Yes	0.9380	0.0011	0.9402	3.94E-02	
Triangular Package Arrays – Lumped Spherical Fissile Mass – Increased Density Poly-Moderation Sensitivity Study											
VERSAPAK_HAC_FINH_12S_1X400PM	12	16x25x1=400	0.98	0.350	0.0001	Yes	0.8572	0.0013	0.8598	3.82E-02	
VERSAPAK_HAC_FINH_12S_1x416PM	12	16x26x1=416	0.98	0.350	0.0001	Yes	0.8520	0.0012	0.8544	3.82E-02	
VERSAPAK_HAC_FINH_12S_1x468PM	12	18x26x1=468	0.98	0.350	0.0001	Yes	0.8542	0.0011	0.8564	3.83E-02	
VERSAPAK_HAC_FINH_12S_2X324PM	12	20x18x2=720	0.98	0.350	0.0001	Yes	0.9270	0.0012	0.9294	3.84E-02	
VERSAPAK_HAC_FINH_12S_2x400PM	12	16x25x2=800	0.98	0.350	0.0001	Yes	0.9313	0.0011	0.9335	3.84E-02	
VERSAPAK_HAC_FINH_12S_2x416PM	12	16x26x2=832	0.98	0.350	0.0001	Yes	0.9301	0.0012	0.9325	3.84E-02	
VERSAPAK_HAC_FINH_12S_2x468PM	12	18x26x2=936	0.98	0.350	0.0001	Yes	0.9317	0.0011	0.9339	3.84E-02	
VERSAPAK_HAC_FINH_12S_3X120PM	12	10x12x3=360	0.98	0.350	0.0001	Yes	0.9413	0.0010	0.9433	3.84E-02	
VERSAPAK_HAC_FINH_12S_3X144PM	12	12x12x3=432	0.98	0.350	0.0001	Yes	0.9460	0.0011	0.9482	3.84E-02	
VERSAPAK_HAC_FINH_12S_3X224PM	12	14x16x3=672	0.98	0.350	0.0001	Yes	0.9574	0.0012	0.9598	3.84E-02	
VERSAPAK_HAC_FINH_12S_3X324PM	12	20x18x3=1080	0.98	0.350	0.0001	Yes	0.9694	0.0011	0.9716	3.84E-02	
VERSAPAK_HAC_FINH_12S_3x400PM	12	16x25x3=1200	0.98	0.350	0.0001	Yes	0.9703	0.0011	0.9725	3.84E-02	**Increasing the poly-moderation density from 0.92 to 0.98 g/cc results in an average increase in the $k_{eff} + 2\sigma$ of 0.0221. This results in an array reduction from 400 to 300 packages to remain within the established USL of 0.94.**
VERSAPAK_HAC_FINH_12S_3x416PM	12	16x26x3=1248	0.98	0.350	0.0001	Yes	0.9672	0.0011	0.9694	3.84E-02	
VERSAPAK_HAC_FINH_12S_3x468PM	12	18x26x3=1404	0.98	0.350	0.0001	Yes	0.9728	0.0010	0.9748	3.85E-02	
VERSAPAK_HAC_FINS_12_A3PM	12	6x6x4=144	0.98	0.350	0.0001	Yes	0.9026	0.0013	0.9052	3.83E-02	
VERSAPAK_HAC_FINH_12S_4X120PM	12	10x12x4=480	0.98	0.350	0.0001	Yes	0.9532	0.0012	0.9556	3.84E-02	
VERSAPAK_HAC_FINH_12S_4x400PM	12	16x25x4=1600	0.98	0.350	0.0001	Yes	0.9937	0.0011	0.9959	3.85E-02	
VERSAPAK_HAC_FINH_12S_4x416PM	12	16x26x4=1664	0.98	0.350	0.0001	Yes	0.9957	0.0012	0.9981	3.85E-02	
VERSAPAK_HAC_FINH_12S_4x468PM	12	18x26x4=1872	0.98	0.350	0.0001	Yes	0.9984	0.0011	1.0006	3.85E-02	
VERSAPAK_HAC_FINH_12S_5X080PM	12	8x10x5=400	0.98	0.350	0.0001	Yes	0.9523	0.0012	0.9547	3.84E-02	
VERSAPAK_HAC_FINH_12S_5X120PM	12	10x12x5=600	0.98	0.350	0.0001	Yes	0.9722	0.0012	0.9746	3.84E-02	
VERSAPAK_HAC_FINS_12_A4PM	12	6x6x6=216	0.98	0.350	0.0001	Yes	0.9101	0.0012	0.9125	3.83E-02	
VERSAPAK_HAC_FINS_12_A5PM	12	8x8x6=384	0.98	0.350	0.0001	Yes	0.9434	0.0011	0.9456	3.84E-02	
VERSAPAK_HAC_FINH_12S_6X080PM	12	8x10x6=480	0.98	0.350	0.0001	Yes	0.9571	0.0012	0.9595	3.84E-02	
VERSAPAK_HAC_FINH_12S_7X064PM	12	8x8x7=448	0.98	0.350	0.0001	Yes	0.9514	0.0012	0.9538	3.84E-02	
VERSAPAK_HAC_FINH_12S_7X080PM	12	8x10x7=560	0.98	0.350	0.0001	Yes	0.9648	0.0012	0.9672	3.84E-02	
VERSAPAK_HAC_FINS_12_A6PM	12	8x8x8=512	0.98	0.350	0.0001	Yes	0.9540	0.0011	0.9562	3.84E-02	
VERSAPAK_HAC_FINH_12S_8X080PM	12	8x10x8=640	0.98	0.350	0.0001	Yes	0.9672	0.0011	0.9694	3.84E-02	
VERSAPAK_HAC_FINS_12_A7PM	12	10x10x8=800	0.98	0.350	0.0001	Yes	0.9815	0.0015	0.9845	3.84E-02	
VERSAPAK_HAC_FINH_12S_8X064PM	12	8x8x10=640	0.98	0.350	0.0001	Yes	0.9579	0.0012	0.9603	3.84E-02	

Triangular Package Arrays – Lumped Spherical Fissile Mass – Paraffin Moderation Sensitivity Study											
VERSAPAK_HAC_FINH_12S_1X400PF	12	16x25x1=400	0.90	0.350	0.0001	Yes	0.8266	0.0012	0.8290	3.91E-02	
VERSAPAK_HAC_FINH_12S_1X416PF	12	16x26x1=416	0.90	0.350	0.0001	Yes	0.8272	0.0011	0.8294	3.91E-02	
VERSAPAK_HAC_FINH_12S_1X468PF	12	18x26x1=468	0.90	0.350	0.0001	Yes	0.8281	0.0011	0.8303	3.90E-02	
VERSAPAK_HAC_FINH_12S_2X324PF	12	20x18x2=720	0.90	0.350	0.0001	Yes	0.9075	0.0013	0.9101	3.93E-02	
VERSAPAK_HAC_FINH_12S_2X400PF	12	16x25x2=800	0.90	0.350	0.0001	Yes	0.9099	0.0010	0.9119	3.93E-02	
VERSAPAK_HAC_FINH_12S_2X416 PF	12	16x26x2=832	0.90	0.350	0.0001	Yes	0.9107	0.0011	0.9129	3.92E-02	
VERSAPAK_HAC_FINH_12S_2X468 PF	12	18x26x2=936	0.90	0.350	0.0001	Yes	0.9118	0.0011	0.9140	3.93E-02	
VERSAPAK_HAC_FINH_12S_3X120 PF	12	10x12x3=360	0.90	0.350	0.0001	Yes	0.9202	0.0012	0.9226	3.93E-02	
VERSAPAK_HAC_FINH_12S_3X144 PF	12	12x12x3=432	0.90	0.350	0.0001	Yes	0.9256	0.0011	0.9278	3.93E-02	
VERSAPAK_HAC_FINH_12S_3X224 PF	12	14x16x3=672	0.90	0.350	0.0001	Yes	0.9410	0.0012	0.9434	3.92E-02	
VERSAPAK_HAC_FINH_12S_3X324 PF	12	20x18x3=1080	0.90	0.350	0.0001	Yes	0.9502	0.0011	0.9524	3.93E-02	**All poly-moderation cases with density of 0.98 g/cc are higher than the paraffin cases with an average increase in the k_{eff} + 2σ of 0.0194.**
VERSAPAK_HAC_FINH_12S_3X400 PF	12	16x25x3=1200	0.90	0.350	0.0001	Yes	0.9531	0.0010	0.9551	3.93E-02	
VERSAPAK_HAC_FINH_12S_3X416 PF	12	16x26x3=1248	0.90	0.350	0.0001	Yes	0.9519	0.0012	0.9543	3.93E-02	
VERSAPAK_HAC_FINH_12S_3X468 PF	12	18x26x3=1404	0.90	0.350	0.0001	Yes	0.9530	0.0010	0.9550	3.93E-02	
VERSAPAK_HAC_FINH_12S_4X120 PF	12	10x12x4=480	0.90	0.350	0.0001	Yes	0.9382	0.0010	0.9402	3.93E-02	
VERSAPAK_HAC_FINH_12S_4X400 PF	12	16x25x4=1600	0.90	0.350	0.0001	Yes	0.9770	0.0013	0.9796	3.93E-02	
VERSAPAK_HAC_FINH_12S_4X416 PF	12	16x26x4=1664	0.90	0.350	0.0001	Yes	0.9790	0.0013	0.9816	3.93E-02	
VERSAPAK_HAC_FINH_12S_4X468 PF	12	18x26x4=1872	0.90	0.350	0.0001	Yes	0.9842	0.0010	0.9862	3.93E-02	
VERSAPAK_HAC_FINH_12S_5X080 PF	12	8x10x5=400	0.90	0.350	0.0001	Yes	0.9315	0.0010	0.9335	3.93E-02	
VERSAPAK_HAC_FINH_12S_5X120 PF	12	10x12x5=600	0.90	0.350	0.0001	Yes	0.9541	0.0011	0.9563	3.93E-02	
VERSAPAK_HAC_FINH_12S_6X080 PF	12	6x6x6=216	0.90	0.350	0.0001	Yes	0.9384	0.0012	0.9408	3.93E-02	
VERSAPAK_HAC_FINH_12S_7X064 PF	12	8x10x6=480	0.90	0.350	0.0001	Yes	0.9313	0.0013	0.9339	3.92E-02	
VERSAPAK_HAC_FINH_12S_7X080 PF	12	8x10x7=560	0.90	0.350	0.0001	Yes	0.9458	0.0011	0.9480	3.93E-02	
VERSAPAK_HAC_FINH_12S_8X080 PF	12	8x10x8=640	0.90	0.350	0.0001	Yes	0.9488	0.0011	0.9510	3.93E-02	
VERSAPAK_HAC_FINH_12S_10X064 PF	12	8x8x10=640	0.90	0.350	0.0001	Yes	0.9389	0.0013	0.9415	3.92E-02	

Table 6-9 Summary of Hypothetical Accident Condition Package Results for Lumped Fissile Mass Models – Cross Section, Fissile Mass, Interspersed Moderation, Fissile Moderator Density, Package Carbon Steel Sensitivity, and Graphite Moderation

Case ID	Radius (cm) of Sphere	Modeled Package Array	Poly-Moderation	^{235}U Mass (kg)	Interspersed Moderation (water volume fraction)	Close Water Reflection	k_{eff}	σ	$k_{eff} + 2σ$	EALF (eV)	Comments
Triangular Package Arrays – Lumped Spherical Fissile Mass – Normal Density Poly-Moderation - Cross Section Sensitivity Study											
VERSAPAK_HAC_FINH_12S_A7	12	10x10x8=800	100	0.350	0.0001	Yes	0.9623	0.0013	0.9649	3.95E-02	**44 Group**
VERSAPAK_HAC_FINH_12S_A7X	12	10x10x8=800	100	0.350	0.0001	Yes	0.9624	0.0012	0.9648	4.12E-02	**238 Group**
VERSAPAK_HAC_FINH_12S_A7X1	12	10x10x8=800	100	0.350	0.0001	Yes	0.9650	0.0008	0.9666	4.11E-02	**238 Group Increased Histories**
VERSAPAK_HAC_FINH_12S_A7XN	12	10x10x8=800	100	0.350	0.0001	Yes	0.9633	0.0008	0.9649	3.95E-02	**44 Group Increased Histories**
Triangular Package Arrays – Lumped Spherical Fissile Mass – Normal Density Poly-Moderation – Increased Fissile Mass Sensitivity Study											
VERSAPAK_HAC_FINH_12S_A1_375	12	2x2x2=8	100	0.375	0.0001	Yes	0.8135	0.0012	0.8159	4.01E-02	**Increasing the fissile mass above 350 gcarbon steel content requires array size reduction**
VERSAPAK_HAC_FINH_12S_A2_375	12	4x4x4=64	100	0.375	0.0001	Yes	0.8585	0.0011	0.8607	4.02E-02	
VERSAPAK_HAC_FINH_12S_A3_375	12	6x6x4=144	100	0.375	0.0001	Yes	0.8957	0.0011	0.8979	4.03E-02	
VERSAPAK_HAC_FINH_12S_A4_375	12	6x6x6=216	100	0.375	0.0001	Yes	0.9094	0.0014	0.9122	4.03E-02	
VERSAPAK_HAC_FINH_12S_A5_375	12	8x8x6=384	100	0.375	0.0001	Yes	0.9416	0.0012	0.9440	4.04E-02	
VERSAPAK_HAC_FINH_12S_A6_375	12	8x8x8=512	100	0.375	0.0001	Yes	0.9502	0.0011	0.9524	4.04E-02	
VERSAPAK_HAC_FINH_12S_A7_375	12	10x10x8=800	100	0.375	0.0001	Yes	0.9818	0.0010	0.9838	4.04E-02	
VERSAPAK_HAC_FINH_12S_A1_400	12	2x2x2=8	100	0.400	0.0001	Yes	0.8276	0.0012	0.8300	4.11E-02	
VERSAPAK_HAC_FINH_12S_A2_400	12	4x4x4=64	100	0.400	0.0001	Yes	0.8741	0.0013	0.8767	4.12E-02	
VERSAPAK_HAC_FINH_12S_A3_400	12	6x6x4=144	100	0.400	0.0001	Yes	0.9118	0.0012	0.9142	4.13E-02	
VERSAPAK_HAC_FINH_12S_A4_400	12	6x6x6=216	100	0.400	0.0001	Yes	0.9258	0.0012	0.9282	4.12E-02	
VERSAPAK_HAC_FINH_12S_A5_400	12	8x8x6=384	100	0.400	0.0001	Yes	0.9594	0.0012	0.9618	4.14E-02	
VERSAPAK_HAC_FINH_12S_A6_400	12	8x8x8=512	100	0.400	0.0001	Yes	0.9704	0.0013	0.9730	4.14E-02	
VERSAPAK_HAC_FINH_12S_A7_400	12	10x10x8=800	100	0.400	0.0001	Yes	1.0043	0.0011	1.0065	4.13E-02	
Triangular Package Arrays – Lumped Spherical Fissile Mass – Normal Density Poly-Moderation – Interspersed Moderation Sensitivity Study											
VERSAPAK_HAC_FINH_12S_A7	12	10x10x8=800	100	0.350	0.0001	Yes	0.9623	0.0013	0.9649	3.95E-02	**Increased interspersed moderation**
VERSAPAK_HAC_FINH_12S_A7a	12	10x10x8=800	100	0.350	0.001	Yes	0.9621	0.0011	0.9643	3.94E-02	
VERSAPAK_HAC_FINH_12S_A7b	12	10x10x8=800	100	0.350	0.01	Yes	0.9405	0.0012	0.9429	3.93E-02	

VERSAPAK_HAC_FINH_12S_A7c	12	10x10x8=800	100	0.350	0.1	Yes	0.8527	0.0012	0.8551	3.83E-02	**reduces k_{eff}**
VERSAPAK_HAC_FINH_12S_A7d	12	10x10x8=800	100	0.350	0.5	Yes	0.8517	0.0013	0.8543	3.72E-02	
VERSAPAK_HAC_FINH_12S_A7e	12	10x10x8=800	100	0.350	1.0	Yes	0.8793	0.0016	0.8825	3.67E-02	
Triangular Package Arrays – Lumped Spherical Fissile Mass – Normal Density Poly-Moderation – Reduced Poly-Moderation Sensitivity Study											
VERSAPAK_HAC_FINH_12S_A7	12	10x10x8=800	100	0.350	0.0001	Yes	0.9623	0.0013	0.9649	3.95E-02	**Reduced poly-moderation reduces k_{eff}**
VERSAPAK_HAC_FINH_12S_A7B	12	10x10x8=800	90	0.350	0.0001	Yes	0.9315	0.0012	0.9339	4.14E-02	
VERSAPAK_HAC_FINH_12S_A7C	12	10x10x8=800	80	0.350	0.0001	Yes	0.8906	0.0013	0.8932	4.40E-02	
VERSAPAK_HAC_FINH_12S_A7D	12	10x10x8=800	70	0.350	0.0001	Yes	0.8358	0.0012	0.8382	4.76E-02	
VERSAPAK_HAC_FINH_12S_A7E	12	10x10x8=800	60	0.350	0.0001	Yes	0.7677	0.0014	0.7705	5.30E-02	
VERSAPAK_HAC_FINH_12S_A7F	12	10x10x8=800	50	0.350	0.0001	Yes	0.6809	0.0012	0.6833	6.15E-02	
Triangular Package Arrays – Lumped Spherical Fissile Mass – Normal Density Poly-Moderation – No Carbon Steel Sensitivity Study											
VERSAPAK_HAC_FINH_12S_A1NS	12	2x2x2=8	100	0.350	0.0001	Yes	0.8046	0.0010	0.8066	3.81E-02	**Not crediting the minimum carbon steel content requires array size reduction**
VERSAPAK_HAC_FINH_12S_A2NS	12	4x4x4=64	100	0.350	0.0001	Yes	0.8666	0.0011	0.8688	3.76E-02	
VERSAPAK_HAC_FINH_12S_A3NS	12	6x6x4=144	100	0.350	0.0001	Yes	0.9097	0.0012	0.9121	3.73E-02	
VERSAPAK_HAC_FINH_12S_A4NS	12	6x6x6=216	100	0.350	0.0001	Yes	0.9276	0.0012	0.9300	3.72E-02	
VERSAPAK_HAC_FINH_12S_A5NS	12	8x8x6=384	100	0.350	0.0001	Yes	0.9677	0.0013	0.9703	3.69E-02	
VERSAPAK_HAC_FINH_12S_A6NS	12	8x8x8=512	100	0.350	0.0001	Yes	0.9793	0.0011	0.9815	3.69E-02	
VERSAPAK_HAC_FINH_12S_A7NS	12	10x10x8=800	100	0.350	0.0001	Yes	1.0168	0.0010	1.0188	3.69E-02	
Triangular Package Arrays – Lumped Spherical Fissile Mass – Graphite Moderation Sensitivity Study											
VERSAPAK_HAC_FINH_12S_A7G	12	10x10x8=800	100	0.350	0.0001	Yes	0.1544	0.0005	0.1554	3.43E+00	

Table 6-10 Summary of Sphere Sensitivity Placement Calculations for MOD0, MOD1, MOD2, MOD3, and MOD4 Arrays

(note values exceeding the USL of 0.94 are high-lighted yellow)

CASE ID	ARRAY HEIGHT	# PACKAGES	k_{eff}	σ	$k_{eff} + 2\sigma$	EALF (eV)
MOD0 - INITIAL ARRAY STUDY						
VERSAPAK_HAC_FINH_12S_1X306P	1	306	0.8514	0.0012	0.8538	3.82E-02
VERSAPAK_HAC_FINH_12S_1x315P	1	315	0.8541	0.0013	0.8567	3.82E-02
VERSAPAK_HAC_FINH_12S_1x324P	1	324	0.8536	0.0012	0.8560	3.82E-02
VERSAPAK_HAC_FINH_12S_2X312P	2	312	0.9162	0.0011	0.9184	3.83E-02
VERSAPAK_HAC_FINH_12S_2X326P	2	326	0.9172	0.0013	0.9198	3.84E-02
VERSAPAK_HAC_FINH_12S_2X338P	2	338	0.9184	0.0010	0.9204	3.84E-02
VERSAPAK_HAC_FINH_12S_3X300P	3	300	0.9333	0.0011	0.9355	3.84E-02
VERSAPAK_HAC_FINH_12S_4X272P	4	272	0.9298	0.0012	0.9322	3.84E-02
VERSAPAK_HAC_FINH_12S_4X308P	4	308	0.9360	0.0011	0.9382	3.84E-02
VERSAPAK_HAC_FINH_12S_5X260P	5	260	0.9299	0.0012	0.9323	3.83E-02
VERSAPAK_HAC_FINH_12S_5X280P	5	280	0.9364	0.0011	0.9386	3.83E-02
VERSAPAK_HAC_FINH_12S_5x300P	5	300	0.9361	0.0012	0.9385	3.84E-02
VERSAPAK_HAC_FINH_12S_6X312P	6	312	0.9341	0.0011	0.9363	3.83E-02
VERSAPAK_HAC_FINH_12S_6X336P	6	336	0.9376	0.0012	0.9400	3.83E-02
VERSAPAK_HAC_FINH_12S_7X322P	7	322	0.9303	0.0011	0.9325	3.83E-02
VERSAPAK_HAC_FINH_12S_7X343P	7	343	0.9360	0.0011	0.9382	3.83E-02
VERSAPAK_HAC_FINH_12S_8X312P	8	312	0.9212	0.0010	0.9232	3.84E-02
VERSAPAK_HAC_FINH_12S_8X336P	8	336	0.9280	0.0011	0.9302	3.83E-02
VERSAPAK_HAC_FINH_12S_8X368P	8	368	0.9313	0.0011	0.9335	3.83E-02
VERSAPAK_HAC_FINH_12S_8X392P	8	392	0.9370	0.0012	0.9394	3.83E-02
VERSAPAK_HAC_FINH_12S_9X324P	9	324	0.9224	0.0012	0.9248	3.83E-02
VERSAPAK_HAC_FINH_12S_10X300P	10	300	0.9121	0.0013	0.9147	3.83E-02
VERSAPAK_HAC_FINH_12S_10X330P	10	330	0.9153	0.0014	0.9181	3.83E-02

VERSAPAK_HAC_FINH_12S_10X360P	10	360	0.9220	0.0010	0.9240	3.83E-02
VERSAPAK_HAC_FINH_12S_12X300P	12	300	0.9028	0.0013	0.9054	3.83E-02
MOD1						
VERSAPAK_HAC_FINH_12S_4x272P	4	272	0.9378	0.0010	0.9398	3.84E-02
VERSAPAK_HAC_FINH_12S_4x288P	4	288	0.9390	0.0013	0.9416	3.84E-02
VERSAPAK_HAC_FINH_12S_4x308P	4	308	0.9431	0.0011	0.9453	3.84E-02
VERSAPAK_HAC_FINH_12S_5x280P	5	280	0.9358	0.0011	0.9380	3.84E-02
VERSAPAK_HAC_FINH_12S_6x288P	6	288	0.9345	0.0012	0.9369	3.84E-02
VERSAPAK_HAC_FINH_12S_6x312P	6	312	0.9409	0.0013	0.9435	3.84E-02
VERSAPAK_HAC_FINH_12S_7x322P	7	322	0.9330	0.0015	0.9360	3.83E-02
VERSAPAK_HAC_FINH_12S_8x312P	8	312	0.9246	0.0012	0.9270	3.83E-02
VERSAPAK_HAC_FINH_12S_9x324P	9	324	0.9214	0.0012	0.9238	3.83E-02
VERSAPAK_HAC_FINH_12S_10x300P	10	300	0.9114	0.0011	0.9136	3.83E-02
VERSAPAK_HAC_FINH_12S_12x300P	12	300	0.9032	0.0011	0.9054	3.83E-02
MOD2						
VERSAPAK_HAC_FINH_12S_4x272P	4	272	0.9076	0.0013	0.9102	3.83E-02
VERSAPAK_HAC_FINH_12S_4x288P	4	288	0.9088	0.0011	0.9110	3.83E-02
VERSAPAK_HAC_FINH_12S_4x308P	4	308	0.9118	0.0013	0.9144	3.83E-02
VERSAPAK_HAC_FINH_12S_5x280P	5	280	0.9115	0.0012	0.9139	3.83E-02
VERSAPAK_HAC_FINH_12S_6x288P	6	288	0.9063	0.0010	0.9083	3.83E-02
VERSAPAK_HAC_FINH_12S_6x312P	6	312	0.9152	0.0012	0.9176	3.83E-02
VERSAPAK_HAC_FINH_12S_7x322P	7	322	0.9121	0.0010	0.9141	3.83E-02
VERSAPAK_HAC_FINH_12S_8x312P	8	312	0.9070	0.0011	0.9092	3.83E-02
VERSAPAK_HAC_FINH_12S_9x324P	9	324	0.9054	0.0012	0.9078	3.83E-02
VERSAPAK_HAC_FINH_12S_10x300P	10	300	0.8972	0.0011	0.8994	3.83E-02
VERSAPAK_HAC_FINH_12S_12x300P	12	300	0.8900	0.0012	0.8924	3.83E-02
MOD3						
VERSAPAK_HAC_FINH_12S_4x272P	4	272	0.9353	0.0012	0.9377	3.84E-02
VERSAPAK_HAC_FINH_12S_4x288P	4	288	0.9372	0.0012	0.9396	3.84E-02
VERSAPAK_HAC_FINH_12S_4x308P	4	308	0.9377	0.0010	0.9397	3.84E-02
VERSAPAK_HAC_FINH_12S_5x280P	5	280	0.9347	0.0011	0.9369	3.84E-02

VERSAPAK_HAC_FINH_12S_6x288P	6	288	0.9318	0.0012	0.9342	3.84E-02
VERSAPAK_HAC_FINH_12S_6x312P	6	312	0.9358	0.0012	0.9382	3.84E-02
VERSAPAK_HAC_FINH_12S_7x322P	7	322	0.9302	0.0012	0.9326	3.84E-02
VERSAPAK_HAC_FINH_12S_8x312P	8	312	0.9234	0.0012	0.9258	3.83E-02
VERSAPAK_HAC_FINH_12S_9x324P	9	324	0.9214	0.0010	0.9234	3.83E-02
VERSAPAK_HAC_FINH_12S_10x300P	10	300	0.9092	0.0012	0.9116	3.83E-02
VERSAPAK_HAC_FINH_12S_12x300P	12	300	0.8985	0.0013	0.9011	3.83E-02
MOD4						
VERSAPAK_HAC_FINH_12S_4x272P	4	272	0.9323	0.0012	0.9347	3.84E-02
VERSAPAK_HAC_FINH_12S_4x288P	4	288	0.9367	0.0011	0.9389	3.84E-02
VERSAPAK_HAC_FINH_12S_4x308P	4	308	0.9370	0.0011	0.9392	3.84E-02
VERSAPAK_HAC_FINH_12S_6x288P	6	288	0.9258	0.0013	0.9284	3.84E-02
VERSAPAK_HAC_FINH_12S_6x312P	6	312	0.9314	0.0013	0.9340	3.84E-02

Table 6-11 Summary of Sphere Sensitivity Placement Calculations for MOD0, MOD1, MOD2, MOD3, and MOD4 Arrays

(note: yellow high-lighted cells represent the bounding case, interspersed moderator VF=0.0001, poly-moderation density=0.98 g/cc)

CASE ID	ARRAY HEIGHT	# PACKAGES	$k_{eff} + 2\sigma$				
			MOD0	MOD1	MOD2	MOD3	MOD4
VERSAPAK_HAC_FINH_12S_1x324P	1	324	0.8560	0.8560	n/a	n/a	n/a
VERSAPAK_HAC_FINH_12S_2X338P	2	338	0.9204	0.9204	n/a	n/a	n/a
VERSAPAK_HAC_FINH_12S_3X300P	3	300	0.9355	0.9355	n/a	n/a	n/a
VERSAPAK_HAC_FINH_12S_4x272P	4	272	0.9322	0.9398	0.9102	0.9377	0.9347
VERSAPAK_HAC_FINH_12S_4x288P	4	288	n/a	0.9416	0.9110	0.9396	0.9389
VERSAPAK_HAC_FINH_12S_4X308P	4	308	0.9382	0.9453	0.9144	0.9397	0.9392
VERSAPAK_HAC_FINH_12S_5X260P	5	260	0.9323	n/a	n/a	n/a	n/a
VERSAPAK_HAC_FINH_12S_5X280P	5	280	0.9386	0.9380	0.9139	0.9369	n/a
VERSAPAK_HAC_FINH_12S_5x300P	5	300	0.9385	n/a	n/a	n/a	n/a
VERSAPAK_HAC_FINH_12S_6x288P	6	288	n/a	0.9369	0.9083	0.9342	0.9284
VERSAPAK_HAC_FINH_12S_6X312P	6	312	0.9363	0.9435	0.9176	0.9382	0.9340
VERSAPAK_HAC_FINH_12S_6X336P	6	336	0.9400	n/a	n/a	n/a	n/a
VERSAPAK_HAC_FINH_12S_7X322P	7	322	0.9325	0.9360	0.9141	0.9326	n/a
VERSAPAK_HAC_FINH_12S_7X343P	7	343	0.9382	n/a	n/a	n/a	n/a
VERSAPAK_HAC_FINH_12S_8X312P	8	312	0.9232	0.9270	0.9092	0.9258	n/a
VERSAPAK_HAC_FINH_12S_8X336P	8	336	0.9302	n/a	n/a	n/a	n/a
VERSAPAK_HAC_FINH_12S_8X368P	8	368	0.9335	n/a	n/a	n/a	n/a
VERSAPAK_HAC_FINH_12S_8X392P	8	392	0.9394	n/a	n/a	n/a	n/a
VERSAPAK_HAC_FINH_12S_9X324P	9	324	0.9248	0.9238	0.9078	0.9234	n/a
VERSAPAK_HAC_FINH_12S_10X300P	10	300	0.9147	0.9136	0.8994	0.9116	n/a
VERSAPAK_HAC_FINH_12S_10X330P	10	330	0.9181	n/a	n/a	n/a	n/a
VERSAPAK_HAC_FINH_12S_10X360P	10	360	0.9240	n/a	n/a	n/a	n/a
VERSAPAK_HAC_FINH_12S_12X300P	12	300	0.9054	0.9054	0.8924	0.9011	n/a

Table 6-12 Summary of Region Dependent Interspersed Moderation Calculations for MOD0 and MOD1 Array Configurations

(note: yellow high-lighted cells represent the bounding case)

CASE ID	Region/Mixture Moderator Volume Fraction	k_{eff}	σ	k_{eff} + 2σ	EALF (eV)
MOD1 – Region/Mixture 5 – Payload Region					
VERSAPAK_HAC_FINH_12S_1x324P	0.0001	0.8536	0.0012	0.8560	3.82E-02
VERSAPAK_HAC_FINH_12S_1X324Pb	0.001	0.8531	0.0012	0.8555	3.82E-02
VERSAPAK_HAC_FINH_12S_1X324Pc	0.01	0.8532	0.0012	0.8556	3.81E-02
VERSAPAK_HAC_FINH_12S_1X324Pd	0.1	0.8565	0.0013	0.8591	3.77E-02
VERSAPAK_HAC_FINH_12S_1X324Pe	0.5	0.8780	0.0012	0.8804	3.67E-02
VERSAPAK_HAC_FINH_12S_1X324Pf	1	0.8988	0.0011	0.9010	3.63E-02
VERSAPAK_HAC_FINH_12S_2X338P	0.0001	0.9184	0.0010	0.9204	3.84E-02
VERSAPAK_HAC_FINH_12S_2X338Pb	0.001	0.9174	0.0012	0.9198	3.84E-02
VERSAPAK_HAC_FINH_12S_2X338Pc	0.01	0.9189	0.0012	0.9213	3.83E-02
VERSAPAK_HAC_FINH_12S_2X338Pd	0.1	0.9101	0.0011	0.9123	3.77E-02
VERSAPAK_HAC_FINH_12S_2X338Pe	0.5	0.9067	0.0012	0.9091	3.67E-02
VERSAPAK_HAC_FINH_12S_2X338Pf	1	0.9153	0.0011	0.9175	3.62E-02
VERSAPAK_HAC_FINH_12S_3X300P	0.0001	0.9333	0.0011	0.9355	3.84E-02
VERSAPAK_HAC_FINH_12S_3X300Pb	0.001	0.9347	0.0012	0.9371	3.83E-02
VERSAPAK_HAC_FINH_12S_3X300Pc	0.01	0.9329	0.0011	0.9351	3.83E-02
VERSAPAK_HAC_FINH_12S_3X300Pd	0.1	0.9163	0.0012	0.9187	3.77E-02
VERSAPAK_HAC_FINH_12S_3X300Pe	0.5	0.9035	0.0011	0.9057	3.66E-02
VERSAPAK_HAC_FINH_12S_3X300Pf	1	0.9136	0.0011	0.9158	3.62E-02
VERSAPAK_HAC_FINH_12S_4x272P	0.0001	0.9378	0.0010	0.9398	3.84E-02
VERSAPAK_HAC_FINH_12S_4x272Pb	0.001	0.9374	0.0012	0.9398	3.84E-02
VERSAPAK_HAC_FINH_12S_4x272Pc	0.01	0.9374	0.0010	0.9394	3.83E-02
VERSAPAK_HAC_FINH_12S_4x272Pd	0.1	0.9167	0.0011	0.9189	3.77E-02
VERSAPAK_HAC_FINH_12S_4x272Pe	0.5	0.9071	0.0013	0.9097	3.66E-02

VERSAPAK_HAC_FINH_12S_4x272Pf	1.0	0.9142	0.0012	0.9166	3.62E-02
VERSAPAK_HAC_FINH_12S_5x280P	0.0001	0.9358	0.0011	0.9380	3.84E-02
VERSAPAK_HAC_FINH_12S_5X280Pb	0.001	0.9358	0.0011	0.9380	3.83E-02
VERSAPAK_HAC_FINH_12S_5X280Pc	0.01	0.9345	0.0013	0.9371	3.83E-02
VERSAPAK_HAC_FINH_12S_5X280Pd	0.1	0.9144	0.0012	0.9168	3.76E-02
VERSAPAK_HAC_FINH_12S_5X280Pe	0.5	0.8629	0.0012	0.8653	3.80E-02
VERSAPAK_HAC_FINH_12S_5X280Pf	1.0	0.9163	0.0011	0.9185	3.62E-02
VERSAPAK_HAC_FINH_12S_6x288P	0.0001	0.9345	0.0012	0.9369	3.84E-02
VERSAPAK_HAC_FINH_12S_6X288Pb	0.001	0.9348	0.0013	0.9374	3.84E-02
VERSAPAK_HAC_FINH_12S_6X288Pc	0.01	0.9326	0.0013	0.9352	3.83E-02
VERSAPAK_HAC_FINH_12S_6X288Pd	0.1	0.9117	0.0012	0.9141	3.76E-02
VERSAPAK_HAC_FINH_12S_6X288Pe	0.5	0.9050	0.0013	0.9076	3.66E-02
VERSAPAK_HAC_FINH_12S_6X288Pf	1.0	0.9132	0.0012	0.9156	3.63E-02
VERSAPAK_HAC_FINH_12S_7x322P	0.0001	0.9330	0.0015	0.9360	3.83E-02
VERSAPAK_HAC_FINH_12S_7X322Pb	0.001	0.9327	0.0011	0.9349	3.84E-02
VERSAPAK_HAC_FINH_12S_7X322Pc	0.01	0.9306	0.0011	0.9328	3.83E-02
VERSAPAK_HAC_FINH_12S_7X322Pd	0.1	0.9124	0.0012	0.9148	3.76E-02
VERSAPAK_HAC_FINH_12S_7X322Pe	0.5	0.9045	0.0013	0.9071	3.66E-02
VERSAPAK_HAC_FINH_12S_7X322Pf	1.0	0.9133	0.0013	0.9159	3.62E-02
VERSAPAK_HAC_FINH_12S_8x312P	0.0001	0.9246	0.0012	0.9270	3.83E-02
VERSAPAK_HAC_FINH_12S_8X312Pb	0.001	0.9246	0.0013	0.9272	3.83E-02
VERSAPAK_HAC_FINH_12S_8X312Pc	0.01	0.9263	0.0011	0.9285	3.82E-02
VERSAPAK_HAC_FINH_12S_8X312Pd	0.1	0.9049	0.0011	0.9071	3.76E-02
VERSAPAK_HAC_FINH_12S_8X312Pe	0.5	0.9034	0.0013	0.9060	3.66E-02
VERSAPAK_HAC_FINH_12S_8X312Pf	1.0	0.9162	0.0011	0.9184	3.62E-02
VERSAPAK_HAC_FINH_12S_9x324P	0.0001	0.9214	0.0012	0.9238	3.83E-02
VERSAPAK_HAC_FINH_12S_9X324Pb	0.001	0.9250	0.0012	0.9274	3.83E-02
VERSAPAK_HAC_FINH_12S_9X324Pc	0.01	0.9232	0.0012	0.9256	3.83E-02
VERSAPAK_HAC_FINH_12S_9X324Pd	0.1	0.9055	0.0015	0.9085	3.77E-02
VERSAPAK_HAC_FINH_12S_9X324Pe	0.5	0.9060	0.0011	0.9082	3.66E-02
VERSAPAK_HAC_FINH_12S_9X324Pf	1.0	0.9026	0.0012	0.9050	3.63E-02
VERSAPAK_HAC_FINH_12S_10x300P	0.0001	0.9114	0.0011	0.9136	3.83E-02
VERSAPAK_HAC_FINH_12S_10X300Pb	0.001	0.9142	0.0013	0.9168	3.83E-02

VERSAPAK_HAC_FINH_12S_10X300Pc	0.01	0.9119	0.0012	0.9143	3.83E-02
VERSAPAK_HAC_FINH_12S_10X300Pd	0.1	0.8974	0.0013	0.9000	3.76E-02
VERSAPAK_HAC_FINH_12S_10X300Pe	0.5	0.8985	0.0013	0.9011	3.67E-02
VERSAPAK_HAC_FINH_12S_10X300Pf	1.0	0.9112	0.0010	0.9132	3.62E-02
VERSAPAK_HAC_FINH_12S_12x300P	0.0001	0.9032	0.0011	0.9054	3.83E-02
VERSAPAK_HAC_FINH_12S_12X300Pb	0.001	0.9039	0.0012	0.9063	3.83E-02
VERSAPAK_HAC_FINH_12S_12X300Pc	0.01	0.8994	0.0011	0.9016	3.82E-02
VERSAPAK_HAC_FINH_12S_12X300Pd	0.1	0.8962	0.0013	0.8988	3.76E-02
VERSAPAK_HAC_FINH_12S_12X300Pe	0.5	0.8995	0.0013	0.9021	3.67E-02
VERSAPAK_HAC_FINH_12S_12X300Pf	1.0	0.9084	0.0013	0.9110	3.63E-02
MOD0 – Region/Mixture 5 – Payload Region					
VERSAPAK_HAC_FINH_12S_4X272P	0.0001	0.9298	0.0012	0.9322	3.84E-02
VERSAPAK_HAC_FINH_12S_4X272Pb	0.001	0.9342	0.0012	0.9366	3.83E-02
VERSAPAK_HAC_FINH_12S_4X272Pc	0.01	0.9302	0.0013	0.9328	3.83E-02
VERSAPAK_HAC_FINH_12S_4X272Pd	0.1	0.9110	0.0011	0.9132	3.76E-02
VERSAPAK_HAC_FINH_12S_4X272Pe	0.5	0.9037	0.0011	0.9059	3.66E-02
VERSAPAK_HAC_FINH_12S_4X272Pf	1.0	0.9158	0.0013	0.9184	3.63E-02
VERSAPAK_HAC_FINH_12S_5X280P	0.0001	0.9364	0.0011	0.9386	3.83E-02
VERSAPAK_HAC_FINH_12S_5X280Pb	0.001	0.9349	0.0011	0.9371	3.84E-02
VERSAPAK_HAC_FINH_12S_5X280Pc	0.01	0.9320	0.0013	0.9346	3.83E-02
VERSAPAK_HAC_FINH_12S_5X280Pd	0.1	0.9118	0.0012	0.9142	3.77E-02
VERSAPAK_HAC_FINH_12S_5X280Pe	0.5	0.8996	0.0013	0.9022	3.66E-02
VERSAPAK_HAC_FINH_12S_5X280Pf	1.0	0.9159	0.0013	0.9185	3.63E-02
MOD1 – Region/Mixture 6 – Payload Radial Insulation Region					
VERSAPAK_HAC_FINH_12S_1x324P	0.0001	0.8536	0.0012	0.8560	3.82E-02
VERSAPAK_HAC_FINH_12S_1X324Pb	0.001	0.8529	0.0013	0.8555	3.82E-02
VERSAPAK_HAC_FINH_12S_1X324Pc	0.01	0.8530	0.0013	0.8556	3.81E-02
VERSAPAK_HAC_FINH_12S_1X324Pd	0.1	0.8398	0.0010	0.8418	3.80E-02
VERSAPAK_HAC_FINH_12S_1X324Pe	0.5	0.8153	0.0012	0.8177	3.77E-02
VERSAPAK_HAC_FINH_12S_1X324Pf	1	0.8081	0.0013	0.8107	3.77E-02
VERSAPAK_HAC_FINH_12S_2X338P	0.0001	0.9184	0.0010	0.9204	3.84E-02
VERSAPAK_HAC_FINH_12S_2X338Pb	0.001	0.9174	0.0011	0.9196	3.84E-02
VERSAPAK_HAC_FINH_12S_2X338Pc	0.01	0.9176	0.0012	0.9200	3.84E-02

VERSAPAK_HAC_FINH_12S_2X338Pd	0.1	0.8919	0.0011	0.8941	3.81E-02
VERSAPAK_HAC_FINH_12S_2X338Pe	0.5	0.8495	0.0013	0.8521	3.77E-02
VERSAPAK_HAC_FINH_12S_2X338Pf	1	0.8296	0.0012	0.8320	3.77E-02
VERSAPAK_HAC_FINH_12S_3X300P	0.0001	0.9333	0.0011	0.9355	3.84E-02
VERSAPAK_HAC_FINH_12S_3X300Pb	0.001	0.9341	0.0010	0.9361	3.83E-02
VERSAPAK_HAC_FINH_12S_3X300Pc	0.01	0.9288	0.0010	0.9308	3.83E-02
VERSAPAK_HAC_FINH_12S_3X300Pd	0.1	0.8983	0.0012	0.9007	3.81E-02
VERSAPAK_HAC_FINH_12S_3X300Pe	0.5	0.8476	0.0012	0.8500	3.77E-02
VERSAPAK_HAC_FINH_12S_3X300Pf	1	0.8290	0.0012	0.8314	3.77E-02
VERSAPAK_HAC_FINH_12S_4x272P	0.0001	0.9378	0.0010	0.9398	3.84E-02
VERSAPAK_HAC_FINH_12S_4x272Pb	0.001	0.9370	0.0011	0.9392	3.84E-02
VERSAPAK_HAC_FINH_12S_4x272Pc	0.01	0.9316	0.0013	0.9342	3.84E-02
VERSAPAK_HAC_FINH_12S_4x272Pd	0.1	0.9017	0.0011	0.9039	3.81E-02
VERSAPAK_HAC_FINH_12S_4x272Pe	0.5	0.8468	0.0016	0.8500	3.77E-02
VERSAPAK_HAC_FINH_12S_4x272Pf	1.0	0.8315	0.0012	0.8339	3.77E-02
VERSAPAK_HAC_FINH_12S_5x280P	0.0001	0.9358	0.0011	0.9380	3.84E-02
VERSAPAK_HAC_FINH_12S_5x280Pb	0.001	0.9376	0.0012	0.9400	3.83E-02
VERSAPAK_HAC_FINH_12S_5X280Pc	0.01	0.9330	0.0015	0.9360	3.84E-02
VERSAPAK_HAC_FINH_12S_5X280Pd	0.1	0.9007	0.0012	0.9031	3.80E-02
VERSAPAK_HAC_FINH_12S_5X280Pe	0.5	0.8465	0.0012	0.8489	3.77E-02
VERSAPAK_HAC_FINH_12S_5X280Pf	1.0	0.8318	0.0012	0.8342	3.77E-02
VERSAPAK_HAC_FINH_12S_6x288P	0.0001	0.9345	0.0012	0.9369	3.84E-02
VERSAPAK_HAC_FINH_12S_6X288Pb	0.001	0.9373	0.0012	0.9397	3.83E-02
VERSAPAK_HAC_FINH_12S_6X288Pc	0.01	0.9310	0.0014	0.9338	3.83E-02
VERSAPAK_HAC_FINH_12S_6X288Pd	0.1	0.8973	0.0013	0.8999	3.81E-02
VERSAPAK_HAC_FINH_12S_6X288Pe	0.5	0.8473	0.0010	0.8493	3.77E-02
VERSAPAK_HAC_FINH_12S_6X288Pf	1.0	0.8295	0.0011	0.8317	3.76E-02
VERSAPAK_HAC_FINH_12S_7x322P	0.0001	0.9330	0.0015	0.9360	3.83E-02
VERSAPAK_HAC_FINH_12S_7X322Pb	0.001	0.9361	0.0012	0.9385	3.83E-02
VERSAPAK_HAC_FINH_12S_7X322Pc	0.01	0.9312	0.0012	0.9336	3.83E-02
VERSAPAK_HAC_FINH_12S_7X322Pd	0.1	0.8965	0.0012	0.8989	3.80E-02
VERSAPAK_HAC_FINH_12S_7X322Pe	0.5	0.8437	0.0011	0.8459	3.77E-02
VERSAPAK_HAC_FINH_12S_7X322Pf	1.0	0.8287	0.0014	0.8315	3.77E-02

VERSAPAK_HAC_FINH_12S_8x312P	0.0001	0.9246	0.0012	0.9270	3.83E-02
VERSAPAK_HAC_FINH_12S_8X312Pb	0.001	0.9265	0.0012	0.9289	3.83E-02
VERSAPAK_HAC_FINH_12S_8X312Pc	0.01	0.9223	0.0012	0.9247	3.83E-02
VERSAPAK_HAC_FINH_12S_8X312Pd	0.1	0.8970	0.0013	0.8996	3.80E-02
VERSAPAK_HAC_FINH_12S_8X312Pe	0.5	0.8429	0.0012	0.8453	3.77E-02
VERSAPAK_HAC_FINH_12S_8X312Pf	1.0	0.8288	0.0011	0.8310	3.77E-02
VERSAPAK_HAC_FINH_12S_9x324P	0.0001	0.9214	0.0012	0.9238	3.83E-02
VERSAPAK_HAC_FINH_12S_9X324Pb	0.001	0.9235	0.0011	0.9257	3.83E-02
VERSAPAK_HAC_FINH_12S_9X324Pc	0.01	0.9202	0.0013	0.9228	3.83E-02
VERSAPAK_HAC_FINH_12S_9X324Pd	0.1	0.8940	0.0012	0.8964	3.80E-02
VERSAPAK_HAC_FINH_12S_9X324Pe	0.5	0.8468	0.0011	0.8490	3.77E-02
VERSAPAK_HAC_FINH_12S_9X324Pf	1.0	0.8293	0.0012	0.8317	3.77E-02
VERSAPAK_HAC_FINH_12S_10x300P	0.0001	0.9114	0.0011	0.9136	3.83E-02
VERSAPAK_HAC_FINH_12S_10X300Pb	0.001	0.9119	0.0012	0.9143	3.83E-02
VERSAPAK_HAC_FINH_12S_10X300Pc	0.01	0.9115	0.0012	0.9139	3.83E-02
VERSAPAK_HAC_FINH_12S_10X300Pd	0.1	0.8867	0.0013	0.8893	3.80E-02
VERSAPAK_HAC_FINH_12S_10X300Pe	0.5	0.8464	0.0013	0.8490	3.76E-02
VERSAPAK_HAC_FINH_12S_10X300Pf	1.0	0.8279	0.0012	0.8303	3.77E-02
VERSAPAK_HAC_FINH_12S_12x300P	0.0001	0.9032	0.0011	0.9054	3.83E-02
VERSAPAK_HAC_FINH_12S_12X300Pb	0.001	0.9020	0.0010	0.9040	3.83E-02
VERSAPAK_HAC_FINH_12S_12X300Pc	0.01	0.9030	0.0012	0.9054	3.83E-02
VERSAPAK_HAC_FINH_12S_12X300Pd	0.1	0.8809	0.0012	0.8833	3.81E-02
VERSAPAK_HAC_FINH_12S_12X300Pe	0.5	0.8419	0.0012	0.8443	3.77E-02
VERSAPAK_HAC_FINH_12S_12X300Pf	1.0	0.8305	0.0012	0.8329	3.77E-02
MOD0 – Region/Mixture 6 – Payload Radial Insulation Region					
VERSAPAK_HAC_FINH_12S_4X272P	0.0001	0.9298	0.0012	0.9322	3.84E-02
VERSAPAK_HAC_FINH_12S_4X272Pb	0.001	0.9304	0.0012	0.9328	3.84E-02
VERSAPAK_HAC_FINH_12S_4X272Pc	0.01	0.9281	0.0012	0.9305	3.83E-02
VERSAPAK_HAC_FINH_12S_4X272Pd	0.1	0.8973	0.0011	0.8995	3.80E-02
VERSAPAK_HAC_FINH_12S_4X272Pe	0.5	0.8468	0.0012	0.8492	3.77E-02
VERSAPAK_HAC_FINH_12S_4X272Pf	1.0	0.8306	0.0011	0.8328	3.77E-02
VERSAPAK_HAC_FINH_12S_5X280P	0.0001	0.9364	0.0011	0.9386	3.83E-02
VERSAPAK_HAC_FINH_12S_5X280Pb	0.001	0.9332	0.0012	0.9356	3.84E-02

VERSAPAK_HAC_FINH_12S_5X280Pc	0.01	0.931	0.001	0.9330	3.83E-02
VERSAPAK_HAC_FINH_12S_5X280Pd	0.1	0.8991	0.0015	0.9021	3.81E-02
VERSAPAK_HAC_FINH_12S_5X280Pe	0.5	0.8465	0.0013	0.8491	3.77E-02
VERSAPAK_HAC_FINH_12S_5X280Pf	1.0	0.8295	0.0011	0.8317	3.77E-02
MOD1 – Region/Mixture 7 – Top/Bottom Insulation Region					
VERSAPAK_HAC_FINH_12S_1x324P	0.0001	0.8536	0.0012	0.8560	3.82E-02
VERSAPAK_HAC_FINH_12S_1X324Pb	0.001	0.8525	0.0015	0.8555	3.82E-02
VERSAPAK_HAC_FINH_12S_1X324Pc	0.01	0.8569	0.0011	0.8591	3.82E-02
VERSAPAK_HAC_FINH_12S_1X324Pd	0.1	0.8537	0.0012	0.8561	3.82E-02
VERSAPAK_HAC_FINH_12S_1X324Pe	0.5	0.8540	0.0012	0.8564	3.81E-02
VERSAPAK_HAC_FINH_12S_1X324Pf	1	0.8536	0.0011	0.8558	3.80E-02
VERSAPAK_HAC_FINH_12S_2X338P	0.0001	0.9184	0.0010	0.9204	3.84E-02
VERSAPAK_HAC_FINH_12S_2X338Pb	0.001	0.9158	0.0011	0.9180	3.83E-02
VERSAPAK_HAC_FINH_12S_2X338Pc	0.01	0.9156	0.0012	0.9180	3.84E-02
VERSAPAK_HAC_FINH_12S_2X338Pd	0.1	0.9046	0.0012	0.9070	3.82E-02
VERSAPAK_HAC_FINH_12S_2X338Pe	0.5	0.8719	0.0012	0.8743	3.80E-02
VERSAPAK_HAC_FINH_12S_2X338Pf	1	0.8579	0.0013	0.8605	3.80E-02
VERSAPAK_HAC_FINH_12S_3X300P	0.0001	0.9333	0.0011	0.9355	3.84E-02
VERSAPAK_HAC_FINH_12S_3X300Pb	0.001	0.9328	0.0012	0.9352	3.84E-02
VERSAPAK_HAC_FINH_12S_3X300Pc	0.01	0.9347	0.0011	0.9369	3.84E-02
VERSAPAK_HAC_FINH_12S_3X300Pd	0.1	0.9132	0.0011	0.9154	3.82E-02
VERSAPAK_HAC_FINH_12S_3X300Pe	0.5	0.8695	0.0011	0.8717	3.79E-02
VERSAPAK_HAC_FINH_12S_3X300Pf	1	0.8544	0.0011	0.8566	3.80E-02
VERSAPAK_HAC_FINH_12S_4x272P	0.0001	0.9378	0.0010	0.9398	3.84E-02
VERSAPAK_HAC_FINH_12S_4x272Pb	0.001	0.9371	0.0012	0.9395	3.84E-02
VERSAPAK_HAC_FINH_12S_4x272Pc	0.01	0.9371	0.0012	0.9395	3.83E-02
VERSAPAK_HAC_FINH_12S_4x272Pd	0.1	0.9172	0.0012	0.9196	3.82E-02
VERSAPAK_HAC_FINH_12S_4x272Pe	0.5	0.8670	0.0012	0.8694	3.80E-02
VERSAPAK_HAC_FINH_12S_4x272Pf	1.0	0.8522	0.0012	0.8546	3.80E-02
VERSAPAK_HAC_FINH_12S_5x280P	0.0001	0.9358	0.0011	0.9380	3.84E-02
VERSAPAK_HAC_FINH_12S_5X280Pb	0.001	0.9351	0.0012	0.9375	3.84E-02
VERSAPAK_HAC_FINH_12S_5X280Pc	0.01	0.9359	0.0012	0.9383	3.83E-02
VERSAPAK_HAC_FINH_12S_5X280Pd	0.1	0.9158	0.0011	0.9180	3.82E-02

VERSAPAK_HAC_FINH_12S_5X280Pe	0.5	0.8629	0.0012	0.8653	3.80E-02
VERSAPAK_HAC_FINH_12S_5X280Pf	1.0	0.8489	0.0012	0.8513	3.80E-02
VERSAPAK_HAC_FINH_12S_6x288P	0.0001	0.9345	0.0012	0.9369	3.84E-02
VERSAPAK_HAC_FINH_12S_6X288Pb	0.001	0.9351	0.0014	0.9379	3.83E-02
VERSAPAK_HAC_FINH_12S_6X288Pc	0.01	0.9335	0.0012	0.9359	3.83E-02
VERSAPAK_HAC_FINH_12S_6X288Pd	0.1	0.9122	0.0011	0.9144	3.82E-02
VERSAPAK_HAC_FINH_12S_6X288Pe	0.5	0.8641	0.0012	0.8665	3.80E-02
VERSAPAK_HAC_FINH_12S_6X288Pf	1.0	0.8492	0.0012	0.8516	3.80E-02
VERSAPAK_HAC_FINH_12S_7x322P	0.0001	0.9330	0.0015	0.9360	3.83E-02
VERSAPAK_HAC_FINH_12S_7X322Pb	0.001	0.9345	0.0012	0.9369	3.84E-02
VERSAPAK_HAC_FINH_12S_7X322Pc	0.01	0.9328	0.0011	0.9350	3.83E-02
VERSAPAK_HAC_FINH_12S_7X322Pd	0.1	0.9093	0.0014	0.9121	3.82E-02
VERSAPAK_HAC_FINH_12S_7X322Pe	0.5	0.8639	0.0012	0.8663	3.79E-02
VERSAPAK_HAC_FINH_12S_7X322Pf	1.0	0.8465	0.0013	0.8491	3.80E-02
VERSAPAK_HAC_FINH_12S_8x312P	0.0001	0.9246	0.0012	0.9270	3.83E-02
VERSAPAK_HAC_FINH_12S_8X312Pb	0.001	0.9277	0.0013	0.9303	3.83E-02
VERSAPAK_HAC_FINH_12S_8X312Pc	0.01	0.9239	0.0013	0.9265	3.83E-02
VERSAPAK_HAC_FINH_12S_8X312Pd	0.1	0.9037	0.0013	0.9063	3.82E-02
VERSAPAK_HAC_FINH_12S_8X312Pe	0.5	0.8589	0.0011	0.8611	3.80E-02
VERSAPAK_HAC_FINH_12S_8X312Pf	1.0	0.8443	0.0012	0.8467	3.80E-02
VERSAPAK_HAC_FINH_12S_9x324P	0.0001	0.9214	0.0012	0.9238	3.83E-02
VERSAPAK_HAC_FINH_12S_9X324Pb	0.001	0.9229	0.0011	0.9251	3.84E-02
VERSAPAK_HAC_FINH_12S_9X324Pc	0.01	0.9227	0.0012	0.9251	3.83E-02
VERSAPAK_HAC_FINH_12S_9X324Pd	0.1	0.9022	0.0011	0.9044	3.82E-02
VERSAPAK_HAC_FINH_12S_9X324Pe	0.5	0.8501	0.0012	0.8525	3.79E-02
VERSAPAK_HAC_FINH_12S_9X324Pf	1.0	0.8441	0.0011	0.8463	3.80E-02
VERSAPAK_HAC_FINH_12S_10x300P	0.0001	0.9114	0.0011	0.9136	3.83E-02
VERSAPAK_HAC_FINH_12S_10X300Pb	0.001	0.9118	0.0012	0.9142	3.83E-02
VERSAPAK_HAC_FINH_12S_10X300Pc	0.01	0.9110	0.0014	0.9138	3.83E-02
VERSAPAK_HAC_FINH_12S_10X300Pd	0.1	0.8953	0.0014	0.8981	3.81E-02
VERSAPAK_HAC_FINH_12S_10X300Pe	0.5	0.8527	0.0011	0.8549	3.80E-02
VERSAPAK_HAC_FINH_12S_10X300Pf	1.0	0.8415	0.0013	0.8441	3.80E-02
VERSAPAK_HAC_FINH_12S_12x300P	0.0001	0.9032	0.0011	0.9054	3.83E-02

VERSAPAK_HAC_FINH_12S_12X300Pb	0.001	0.9014	0.0011	0.9036	3.83E-02
VERSAPAK_HAC_FINH_12S_12X300Pc	0.01	0.9026	0.0012	0.9050	3.82E-02
VERSAPAK_HAC_FINH_12S_12X300Pd	0.1	0.8862	0.0011	0.8884	3.81E-02
VERSAPAK_HAC_FINH_12S_12X300Pe	0.5	0.8533	0.0013	0.8559	3.80E-02
VERSAPAK_HAC_FINH_12S_12X300Pf	1.0	0.8392	0.0012	0.8416	3.80E-02
MOD0 – Region/Mixture 7 – Top/Bottom Insulation Region					
VERSAPAK_HAC_FINH_12S_4X272P	0.0001	0.9298	0.0012	0.9322	3.84E-02
VERSAPAK_HAC_FINH_12S_4X272Pb	0.001	0.9258	0.0012	0.9282	3.83E-02
VERSAPAK_HAC_FINH_12S_4X272Pc	0.01	0.9290	0.0012	0.9314	3.83E-02
VERSAPAK_HAC_FINH_12S_4X272Pd	0.1	0.9110	0.0013	0.9136	3.82E-02
VERSAPAK_HAC_FINH_12S_4X272Pe	0.5	0.8688	0.0011	0.8710	3.80E-02
VERSAPAK_HAC_FINH_12S_4X272Pf	1.0	0.8507	0.0013	0.8533	3.80E-02
VERSAPAK_HAC_FINH_12S_5X280P	0.0001	0.9364	0.0011	0.9386	3.83E-02
VERSAPAK_HAC_FINH_12S_5X280Pb	0.001	0.9330	0.0012	0.9354	3.83E-02
VERSAPAK_HAC_FINH_12S_5X280Pc	0.01	0.9314	0.0010	0.9334	3.83E-02
VERSAPAK_HAC_FINH_12S_5X280Pd	0.1	0.9112	0.0010	0.9132	3.82E-02
VERSAPAK_HAC_FINH_12S_5X280Pe	0.5	0.8626	0.0014	0.8654	3.80E-02
VERSAPAK_HAC_FINH_12S_5X280Pf	1.0	0.8512	0.0012	0.8536	3.80E-02
MOD1 – Region/Mixture 8 – Payload Radial Inner/Outer Liner Insulation Region					
VERSAPAK_HAC_FINH_12S_1x324P	0.0001	0.8536	0.0012	0.8560	3.82E-02
VERSAPAK_HAC_FINH_12S_1X324Pb	0.001	0.8539	0.0011	0.8561	3.82E-02
VERSAPAK_HAC_FINH_12S_1X324Pc	0.01	0.8530	0.0012	0.8554	3.82E-02
VERSAPAK_HAC_FINH_12S_1X324Pd	0.1	0.8523	0.0013	0.8549	3.82E-02
VERSAPAK_HAC_FINH_12S_1X324Pe	0.5	0.8459	0.0012	0.8483	3.81E-02
VERSAPAK_HAC_FINH_12S_1X324Pf	1	0.8357	0.0011	0.8379	3.80E-02
VERSAPAK_HAC_FINH_12S_2X338P	0.0001	0.9184	0.0010	0.9204	3.84E-02
VERSAPAK_HAC_FINH_12S_2X338Pb	0.001	0.9172	0.0011	0.9194	3.84E-02
VERSAPAK_HAC_FINH_12S_2X338Pc	0.01	0.9184	0.0011	0.9206	3.84E-02
VERSAPAK_HAC_FINH_12S_2X338Pd	0.1	0.9140	0.0012	0.9164	3.83E-02
VERSAPAK_HAC_FINH_12S_2X338Pe	0.5	0.8962	0.0011	0.8984	3.82E-02
VERSAPAK_HAC_FINH_12S_2X338Pf	1	0.8802	0.0013	0.8828	3.81E-02
VERSAPAK_HAC_FINH_12S_3X300P	0.0001	0.9333	0.0011	0.9355	3.84E-02
VERSAPAK_HAC_FINH_12S_3X300Pb	0.001	0.9342	0.0012	0.9366	3.84E-02

VERSAPAK_HAC_FINH_12S_3X300Pc	0.01	0.9345	0.0013	0.9371	3.84E-02
VERSAPAK_HAC_FINH_12S_3X300Pd	0.1	0.9286	0.0011	0.9308	3.83E-02
VERSAPAK_HAC_FINH_12S_3X300Pe	0.5	0.9046	0.0012	0.9070	3.82E-02
VERSAPAK_HAC_FINH_12S_3X300Pf	1	0.8842	0.0011	0.8864	3.80E-02
VERSAPAK_HAC_FINH_12S_1x324P	0.0001	0.8536	0.0012	0.8560	3.82E-02
VERSAPAK_HAC_FINH_12S_4x272P	0.0001	0.9378	0.0010	0.9398	3.84E-02
VERSAPAK_HAC_FINH_12S_4x272Pb	0.001	0.9374	0.0012	0.9398	3.84E-02
VERSAPAK_HAC_FINH_12S_4x272Pc	0.01	0.9373	0.0011	0.9395	3.83E-02
VERSAPAK_HAC_FINH_12S_4x272Pd	0.1	0.9315	0.0013	0.9341	3.83E-02
VERSAPAK_HAC_FINH_12S_4x272Pe	0.5	0.9075	0.0013	0.9101	3.82E-02
VERSAPAK_HAC_FINH_12S_4x272Pf	1.0	0.8833	0.0012	0.8857	3.81E-02
VERSAPAK_HAC_FINH_12S_5x280P	0.0001	0.9358	0.0011	0.9380	3.84E-02
VERSAPAK_HAC_FINH_12S_5X280Pb	0.001	0.9363	0.0012	0.9387	3.84E-02
VERSAPAK_HAC_FINH_12S_5X280Pc	0.01	0.9364	0.0012	0.9388	3.84E-02
VERSAPAK_HAC_FINH_12S_5X280Pd	0.1	0.9306	0.0011	0.9328	3.84E-02
VERSAPAK_HAC_FINH_12S_5X280Pe	0.5	0.9061	0.0013	0.9087	3.82E-02
VERSAPAK_HAC_FINH_12S_5X280Pf	1.0	0.8835	0.0011	0.8857	3.80E-02
VERSAPAK_HAC_FINH_12S_6x288P	0.0001	0.9345	0.0012	0.9369	3.84E-02
VERSAPAK_HAC_FINH_12S_6X288Pb	0.001	0.9347	0.0011	0.9369	3.83E-02
VERSAPAK_HAC_FINH_12S_6X288Pc	0.01	0.9338	0.0013	0.9364	3.83E-02
VERSAPAK_HAC_FINH_12S_6X288Pd	0.1	0.9285	0.0011	0.9307	3.83E-02
VERSAPAK_HAC_FINH_12S_6X288Pe	0.5	0.9061	0.0011	0.9083	3.81E-02
VERSAPAK_HAC_FINH_12S_6X288Pf	1.0	0.8836	0.0013	0.8862	3.80E-02
VERSAPAK_HAC_FINH_12S_7x322P	0.0001	0.9330	0.0015	0.9360	3.83E-02
VERSAPAK_HAC_FINH_12S_7X322Pb	0.001	0.9329	0.0013	0.9355	3.84E-02
VERSAPAK_HAC_FINH_12S_7X322Pc	0.01	0.9326	0.0012	0.9350	3.84E-02
VERSAPAK_HAC_FINH_12S_7X322Pd	0.1	0.9275	0.0011	0.9297	3.83E-02
VERSAPAK_HAC_FINH_12S_7X322Pe	0.5	0.9025	0.0012	0.9049	3.81E-02
VERSAPAK_HAC_FINH_12S_7X322Pf	1.0	0.8804	0.0011	0.8826	3.80E-02
VERSAPAK_HAC_FINH_12S_8x312P	0.0001	0.9246	0.0012	0.9270	3.83E-02
VERSAPAK_HAC_FINH_12S_8X312Pb	0.001	0.9266	0.0012	0.9290	3.83E-02
VERSAPAK_HAC_FINH_12S_8X312Pc	0.01	0.9249	0.0012	0.9273	3.83E-02
VERSAPAK_HAC_FINH_12S_8X312Pd	0.1	0.9213	0.0012	0.9237	3.83E-02

VERSAPAK_HAC_FINH_12S_8X312Pe	0.5	0.9004	0.0013	0.9030	3.82E-02
VERSAPAK_HAC_FINH_12S_8X312Pf	1.0	0.8777	0.0012	0.8801	3.80E-02
VERSAPAK_HAC_FINH_12S_9x324P	0.0001	0.9214	0.0012	0.9238	3.83E-02
VERSAPAK_HAC_FINH_12S_9X324Pb	0.001	0.9238	0.0012	0.9262	3.83E-02
VERSAPAK_HAC_FINH_12S_9X324Pc	0.01	0.9252	0.0012	0.9276	3.83E-02
VERSAPAK_HAC_FINH_12S_9X324Pd	0.1	0.9208	0.0012	0.9232	3.83E-02
VERSAPAK_HAC_FINH_12S_9X324Pe	0.5	0.8991	0.0011	0.9013	3.81E-02
VERSAPAK_HAC_FINH_12S_9X324Pf	1.0	0.8777	0.0012	0.8801	3.80E-02
VERSAPAK_HAC_FINH_12S_10x300P	0.0001	0.9114	0.0011	0.9136	3.83E-02
VERSAPAK_HAC_FINH_12S_10X300Pb	0.001	0.9130	0.0013	0.9156	3.83E-02
VERSAPAK_HAC_FINH_12S_10X300Pc	0.01	0.9126	0.0012	0.9150	3.83E-02
VERSAPAK_HAC_FINH_12S_10X300Pd	0.1	0.9101	0.0011	0.9123	3.83E-02
VERSAPAK_HAC_FINH_12S_10X300Pe	0.5	0.8905	0.0016	0.8937	3.82E-02
VERSAPAK_HAC_FINH_12S_10X300Pf	1.0	0.8726	0.0012	0.8750	3.80E-02
VERSAPAK_HAC_FINH_12S_12x300P	0.0001	0.9032	0.0011	0.9054	3.83E-02
VERSAPAK_HAC_FINH_12S_12X300Pb	0.001	0.9012	0.0013	0.9038	3.83E-02
VERSAPAK_HAC_FINH_12S_12X300Pc	0.01	0.9018	0.0013	0.9044	3.83E-02
VERSAPAK_HAC_FINH_12S_12X300Pd	0.1	0.9001	0.0012	0.9025	3.83E-02
VERSAPAK_HAC_FINH_12S_12X300Pe	0.5	0.8817	0.0012	0.8841	3.82E-02
VERSAPAK_HAC_FINH_12S_12X300Pf	1.0	0.8647	0.0013	0.8673	3.80E-02
MOD0 – Region/Mixture 8 – Payload Radial Inner/Outer Liner Insulation Region					
VERSAPAK_HAC_FINH_12S_4X272P	0.0001	0.9298	0.0012	0.9322	3.84E-02
VERSAPAK_HAC_FINH_12S_4X272Pb	0.001	0.9341	0.0012	0.9365	3.83E-02
VERSAPAK_HAC_FINH_12S_4X272Pc	0.01	0.9301	0.0011	0.9323	3.83E-02
VERSAPAK_HAC_FINH_12S_4X272Pd	0.1	0.9237	0.0011	0.9259	3.83E-02
VERSAPAK_HAC_FINH_12S_4X272Pe	0.5	0.9009	0.0012	0.9033	3.81E-02
VERSAPAK_HAC_FINH_12S_4X272Pf	1.0	0.881	0.0013	0.8836	3.80E-02
VERSAPAK_HAC_FINH_12S_5X280P	0.0001	0.9364	0.0011	0.9386	3.83E-02
VERSAPAK_HAC_FINH_12S_5X280Pb	0.001	0.9339	0.0011	0.9361	3.84E-02
VERSAPAK_HAC_FINH_12S_5X280Pc	0.01	0.9336	0.0011	0.9358	3.83E-02
VERSAPAK_HAC_FINH_12S_5X280Pd	0.1	0.9267	0.0011	0.9289	3.83E-02
VERSAPAK_HAC_FINH_12S_5X280Pe	0.5	0.9049	0.0015	0.9079	3.82E-02
VERSAPAK_HAC_FINH_12S_5X280Pf	1.0	0.8814	0.0012	0.8838	3.80E-02

MOD1 – Region/Mixture 9 – Exterior Package Region					
VERSAPAK_HAC_FINH_12S_1x324P	0.0001	0.8536	0.0012	0.8560	3.82E-02
VERSAPAK_HAC_FINH_12S_1X324Pb	0.001	0.8538	0.0011	0.8560	3.82E-02
VERSAPAK_HAC_FINH_12S_1X324Pc	0.01	0.8535	0.0012	0.8559	3.81E-02
VERSAPAK_HAC_FINH_12S_1X324Pd	0.1	0.8510	0.0012	0.8534	3.81E-02
VERSAPAK_HAC_FINH_12S_1X324Pe	0.5	0.8319	0.0014	0.8347	3.81E-02
VERSAPAK_HAC_FINH_12S_1X324Pf	1	0.8248	0.0011	0.8270	3.80E-02
VERSAPAK_HAC_FINH_12S_2X338P	0.0001	0.9184	0.0010	0.9204	3.84E-02
VERSAPAK_HAC_FINH_12S_2X338Pb	0.001	0.9184	0.0012	0.9208	3.83E-02
VERSAPAK_HAC_FINH_12S_2X338Pc	0.01	0.9171	0.0011	0.9193	3.83E-02
VERSAPAK_HAC_FINH_12S_2X338Pd	0.1	0.9104	0.0012	0.9128	3.83E-02
VERSAPAK_HAC_FINH_12S_2X338Pe	0.5	0.8790	0.0011	0.8812	3.80E-02
VERSAPAK_HAC_FINH_12S_2X338Pf	1	0.8559	0.0011	0.8581	3.80E-02
VERSAPAK_HAC_FINH_12S_3X300P	0.0001	0.9333	0.0011	0.9355	3.84E-02
VERSAPAK_HAC_FINH_12S_3X300Pb	0.001	0.9324	0.0011	0.9346	3.84E-02
VERSAPAK_HAC_FINH_12S_3X300Pc	0.01	0.9323	0.0011	0.9345	3.84E-02
VERSAPAK_HAC_FINH_12S_3X300Pd	0.1	0.9216	0.0011	0.9238	3.83E-02
VERSAPAK_HAC_FINH_12S_3X300Pe	0.5	0.8826	0.0011	0.8848	3.80E-02
VERSAPAK_HAC_FINH_12S_3X300Pf	1	0.8577	0.0010	0.8597	3.80E-02
VERSAPAK_HAC_FINH_12S_4x272P	0.0001	0.9378	0.0010	0.9398	3.84E-02
VERSAPAK_HAC_FINH_12S_4X272Pb	0.001	0.9367	0.0011	0.9389	3.84E-02
VERSAPAK_HAC_FINH_12S_4x272Pc	0.01	0.9353	0.0011	0.9375	3.84E-02
VERSAPAK_HAC_FINH_12S_4x272Pd	0.1	0.9247	0.0011	0.9269	3.83E-02
VERSAPAK_HAC_FINH_12S_4x272Pe	0.5	0.8839	0.0011	0.8861	3.81E-02
VERSAPAK_HAC_FINH_12S_4x272Pf	1.0	0.8602	0.0013	0.8628	3.80E-02
VERSAPAK_HAC_FINH_12S_5x280P	0.0001	0.9358	0.0011	0.9380	3.84E-02
VERSAPAK_HAC_FINH_12S_5X280Pb	0.001	0.9352	0.0012	0.9376	3.83E-02
VERSAPAK_HAC_FINH_12S_5X280Pc	0.01	0.9354	0.0013	0.9380	3.84E-02
VERSAPAK_HAC_FINH_12S_5X280Pd	0.1	0.9235	0.0010	0.9255	3.83E-02
VERSAPAK_HAC_FINH_12S_5X280Pe	0.5	0.8831	0.0011	0.8853	3.80E-02
VERSAPAK_HAC_FINH_12S_5X280Pf	1.0	0.8580	0.0012	0.8604	3.80E-02
VERSAPAK_HAC_FINH_12S_6x288P	0.0001	0.9345	0.0012	0.9369	3.84E-02
VERSAPAK_HAC_FINH_12S_6X288Pb	0.001	0.9353	0.0011	0.9375	3.83E-02

VERSAPAK_HAC_FINH_12S_6X288Pc	0.01	0.9337	0.0011	0.9359	3.84E-02
VERSAPAK_HAC_FINH_12S_6X288Pd	0.1	0.9211	0.0012	0.9235	3.83E-02
VERSAPAK_HAC_FINH_12S_6X288Pe	0.5	0.8802	0.0012	0.8826	3.80E-02
VERSAPAK_HAC_FINH_12S_6X288Pf	1.0	0.8567	0.0011	0.8589	3.80E-02
VERSAPAK_HAC_FINH_12S_7x322P	0.0001	0.9330	0.0015	0.9360	3.83E-02
VERSAPAK_HAC_FINH_12S_7X322Pb	0.001	0.9345	0.0013	0.9371	3.83E-02
VERSAPAK_HAC_FINH_12S_7X322Pc	0.01	0.9340	0.0011	0.9362	3.83E-02
VERSAPAK_HAC_FINH_12S_7X322Pd	0.1	0.9197	0.0011	0.9219	3.82E-02
VERSAPAK_HAC_FINH_12S_7X322Pe	0.5	0.8786	0.0011	0.8808	3.81E-02
VERSAPAK_HAC_FINH_12S_7X322Pf	1.0	0.8574	0.0013	0.8600	3.80E-02
VERSAPAK_HAC_FINH_12S_8x312P	0.0001	0.9246	0.0012	0.9270	3.83E-02
VERSAPAK_HAC_FINH_12S_8X312Pb	0.001	0.9259	0.0012	0.9283	3.84E-02
VERSAPAK_HAC_FINH_12S_8X312Pc	0.01	0.9210	0.0012	0.9234	3.83E-02
VERSAPAK_HAC_FINH_12S_8X312Pd	0.1	0.9159	0.0012	0.9183	3.82E-02
VERSAPAK_HAC_FINH_12S_8X312Pe	0.5	0.8798	0.0011	0.8820	3.80E-02
VERSAPAK_HAC_FINH_12S_8X312Pf	1.0	0.8548	0.0012	0.8572	3.80E-02
VERSAPAK_HAC_FINH_12S_9x324P	0.0001	0.9214	0.0012	0.9238	3.83E-02
VERSAPAK_HAC_FINH_12S_9X324Pb	0.001	0.9227	0.0013	0.9253	3.84E-02
VERSAPAK_HAC_FINH_12S_9X324Pc	0.01	0.9221	0.0012	0.9245	3.83E-02
VERSAPAK_HAC_FINH_12S_9X324Pd	0.1	0.9158	0.0013	0.9184	3.83E-02
VERSAPAK_HAC_FINH_12S_9X324Pe	0.5	0.8771	0.0012	0.8795	3.81E-02
VERSAPAK_HAC_FINH_12S_9X324Pf	1.0	0.8557	0.0011	0.8579	3.80E-02
VERSAPAK_HAC_FINH_12S_10x300P	0.0001	0.9114	0.0011	0.9136	3.83E-02
VERSAPAK_HAC_FINH_12S_10X300Pb	0.001	0.9145	0.0012	0.9169	3.83E-02
VERSAPAK_HAC_FINH_12S_10X300Pc	0.01	0.9086	0.0011	0.9108	3.83E-02
VERSAPAK_HAC_FINH_12S_10X300Pd	0.1	0.9032	0.0013	0.9058	3.83E-02
VERSAPAK_HAC_FINH_12S_10X300Pe	0.5	0.8712	0.0011	0.8734	3.80E-02
VERSAPAK_HAC_FINH_12S_10X300Pf	1.0	0.8559	0.0012	0.8583	3.80E-02
VERSAPAK_HAC_FINH_12S_12x300P	0.0001	0.9032	0.0011	0.9054	3.83E-02
VERSAPAK_HAC_FINH_12S_12X300Pb	0.001	0.9035	0.0014	0.9063	3.83E-02
VERSAPAK_HAC_FINH_12S_12X300Pc	0.01	0.8998	0.0011	0.9020	3.83E-02
VERSAPAK_HAC_FINH_12S_12X300Pd	0.1	0.8950	0.0012	0.8974	3.82E-02
VERSAPAK_HAC_FINH_12S_12X300Pe	0.5	0.8669	0.0012	0.8693	3.81E-02

VERSAPAK_HAC_FINH_12S_12X300Pf	1.0	0.8498	0.0012	0.8522	3.80E-02
MOD0 – Region/Mixture 9 – Exterior Package Region					
VERSAPAK_HAC_FINH_12S_4X272P	0.0001	0.9298	0.0012	0.9322	3.84E-02
VERSAPAK_HAC_FINH_12S_4X272Pb	0.001	0.9290	0.0011	0.9312	3.84E-02
VERSAPAK_HAC_FINH_12S_4X272Pc	0.01	0.9293	0.0012	0.9317	3.83E-02
VERSAPAK_HAC_FINH_12S_4X272Pd	0.1	0.9195	0.0013	0.9221	3.83E-02
VERSAPAK_HAC_FINH_12S_4X272Pe	0.5	0.8808	0.0012	0.8832	3.80E-02
VERSAPAK_HAC_FINH_12S_4X272Pf	1.0	0.8575	0.0012	0.8599	3.80E-02
VERSAPAK_HAC_FINH_12S_5X280P	0.0001	0.9364	0.0011	0.9386	3.83E-02
VERSAPAK_HAC_FINH_12S_5X280Pb	0.001	0.9359	0.0012	0.9383	3.84E-02
VERSAPAK_HAC_FINH_12S_5X280Pc	0.01	0.9363	0.0014	0.9391	3.83E-02
VERSAPAK_HAC_FINH_12S_5X280Pd	0.1	0.9216	0.0012	0.9240	3.82E-02
VERSAPAK_HAC_FINH_12S_5X280Pe	0.5	0.8774	0.0012	0.8798	3.80E-02
VERSAPAK_HAC_FINH_12S_5X280Pf	1.0	0.8594	0.0012	0.8618	3.80E-02

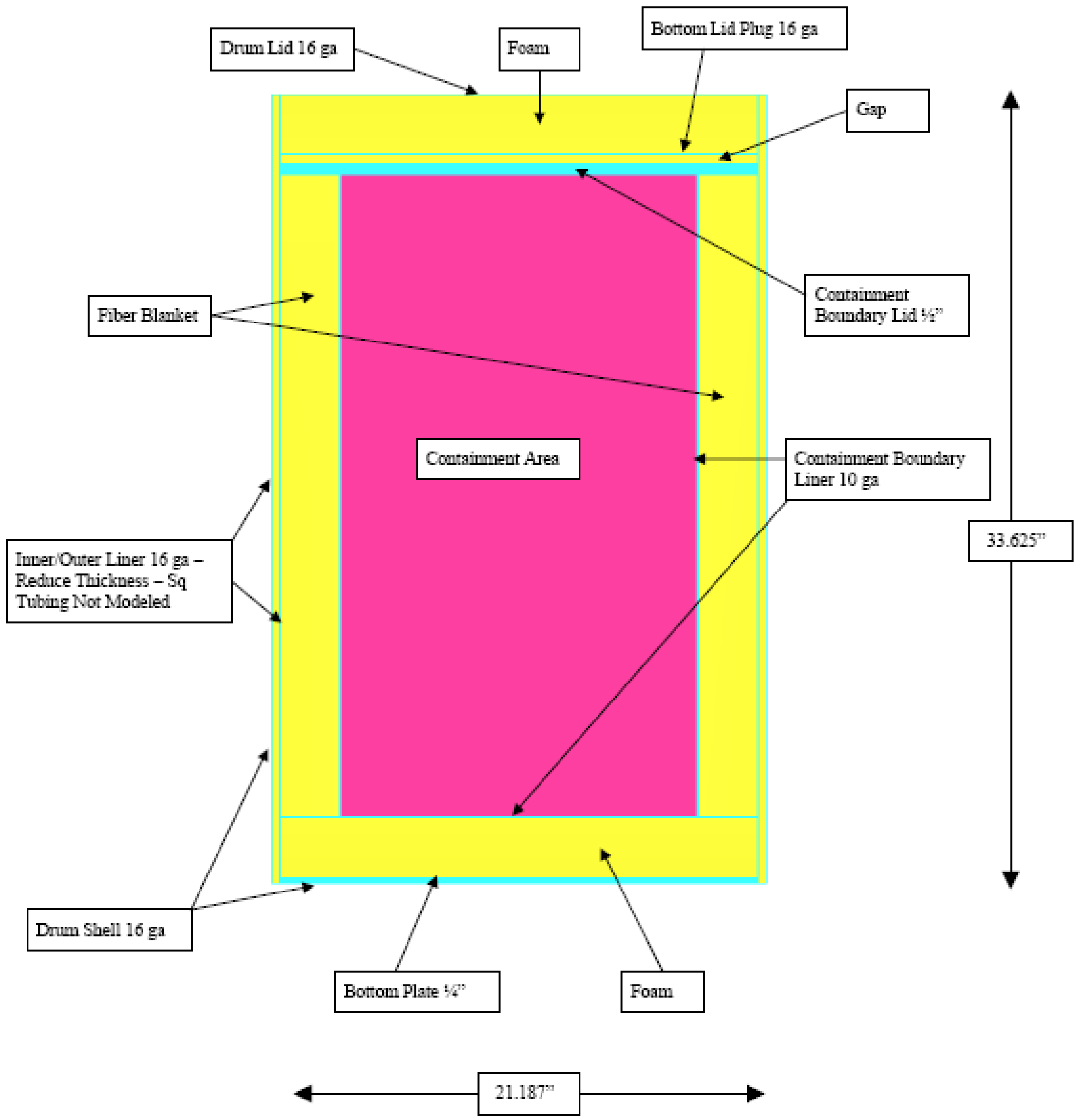

Figure 6-1 Illustration of the KENO Model of the Century Versa-Pac Shipping Container for the Normal Condition of Transport and Hypothetical Accident Condition.

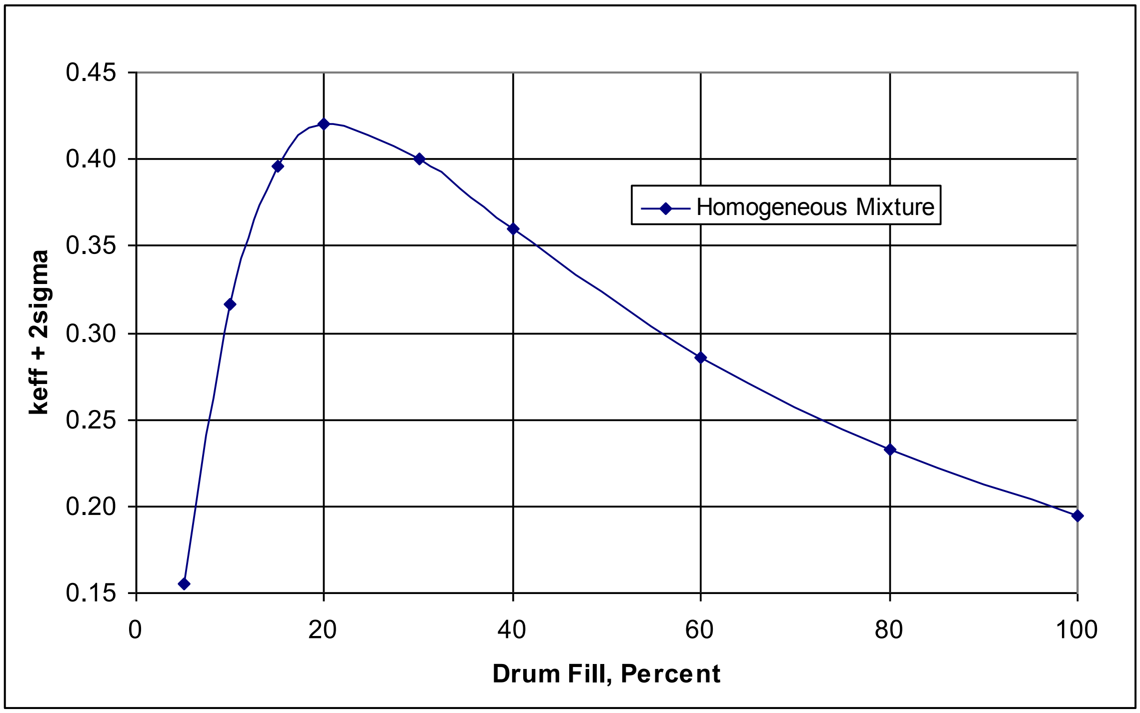

Figure 6-2 KENO VI results for single model calculation as a function of drum fill percentage for the Normal Condition of Transport and Hypothetical Condition.

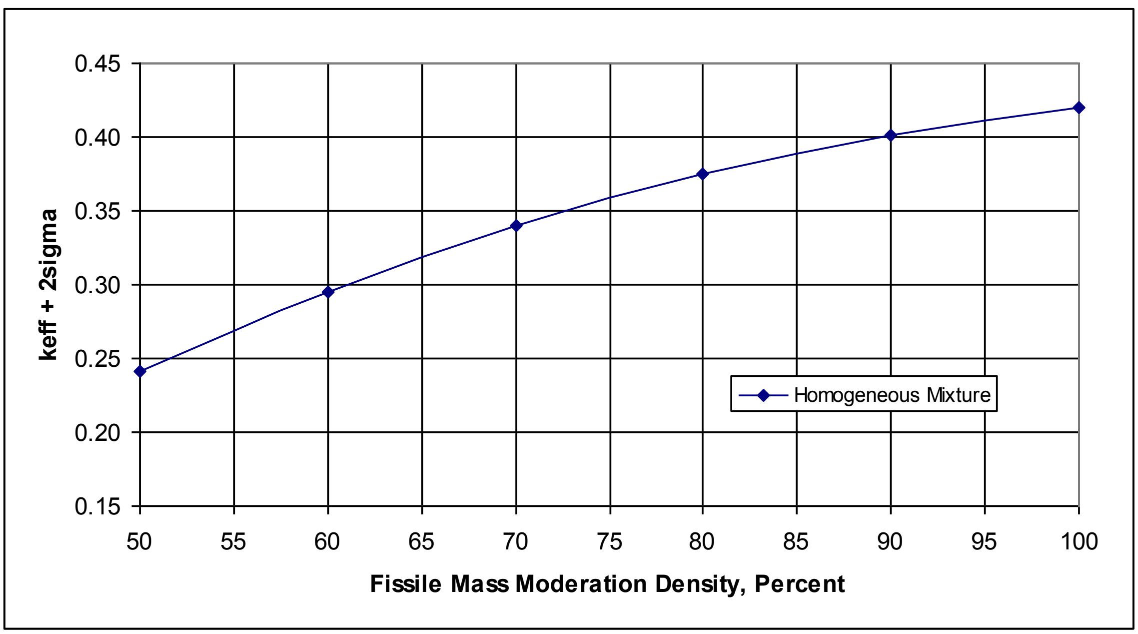

Figure 6-3 KENO VI results for single model calculation as a function of poly-moderator density (20% filled drum) for the Normal Condition of Transport and Hypothetical Condition.

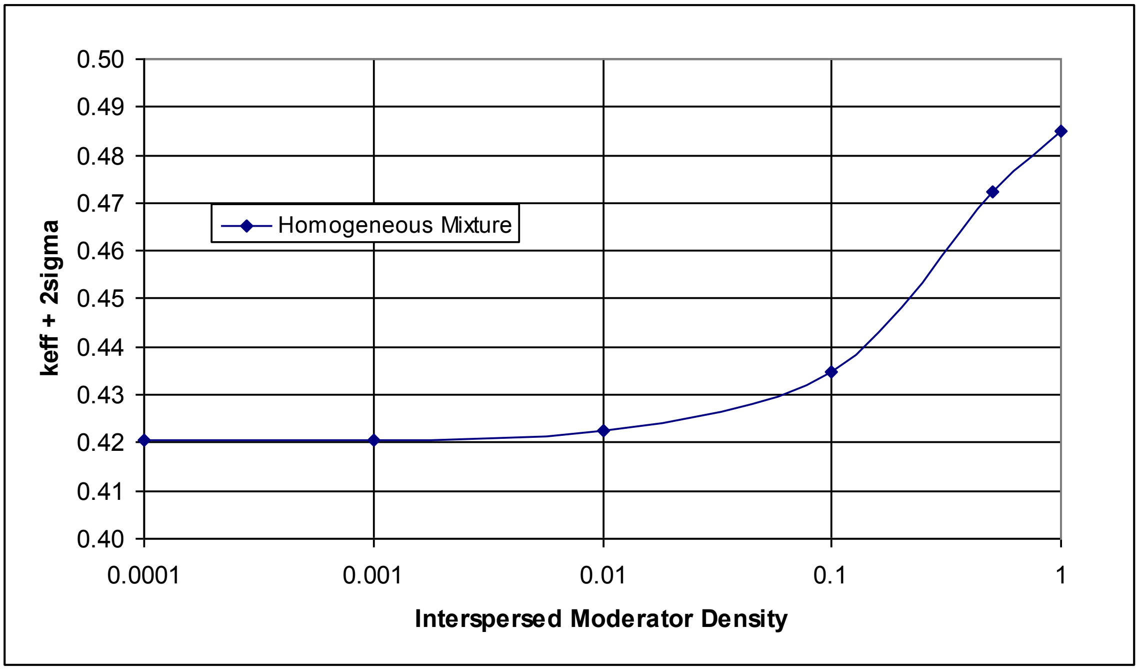

Figure 6-4 KENO VI results for single model calculation as a function of interspersed moderator (20% filled drum) for the Normal Condition of Transport and Hypothetical Condition.

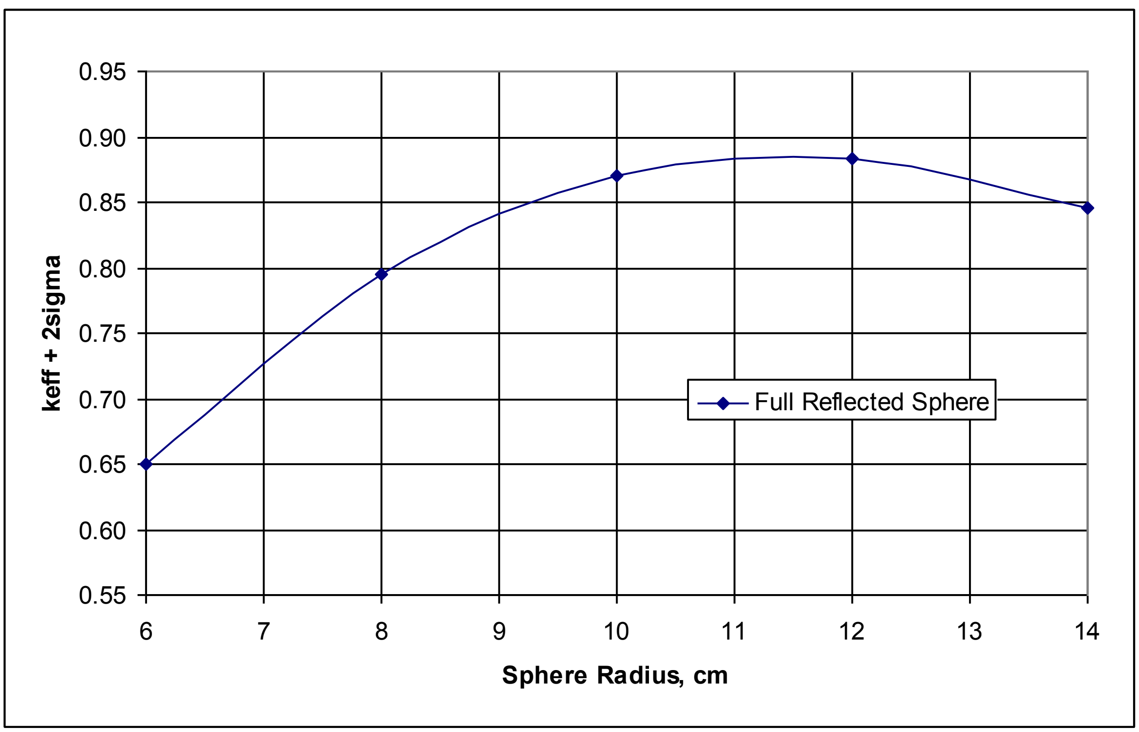

Figure 6-5 KENO VI results for fully reflected spheres representing the Normal Condition of Transport and Hypothetical Condition for a single package.

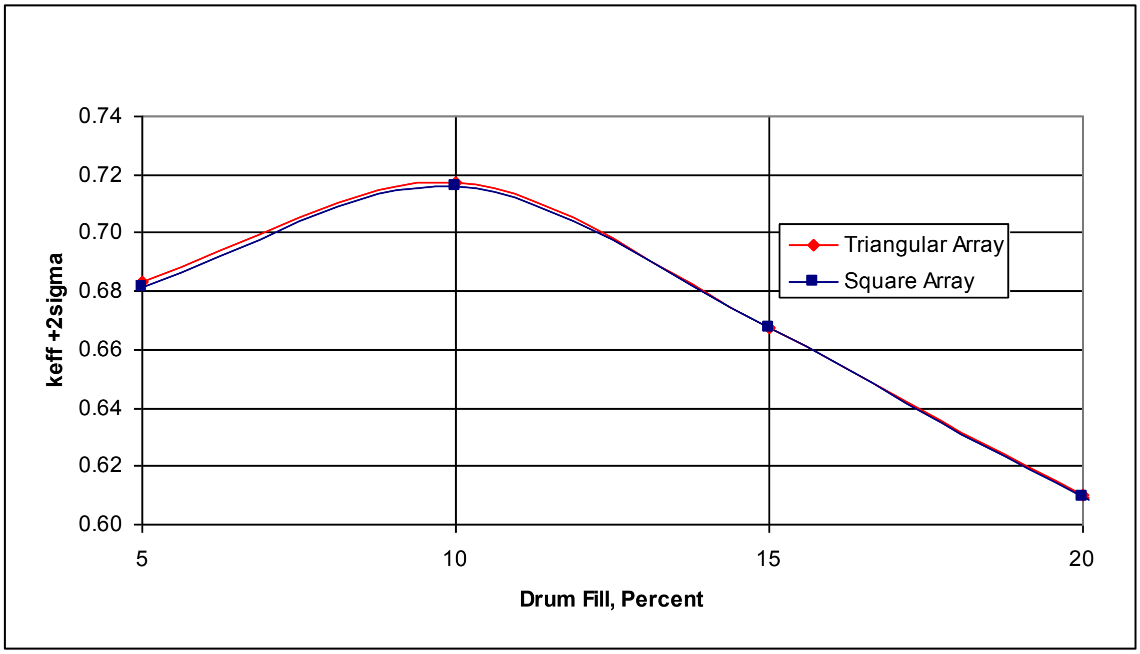

Figure 6-6 KENO VI results for infinite array model calculation as a function of drum fill percentage for the Normal Condition of Transport and Hypothetical Condition.

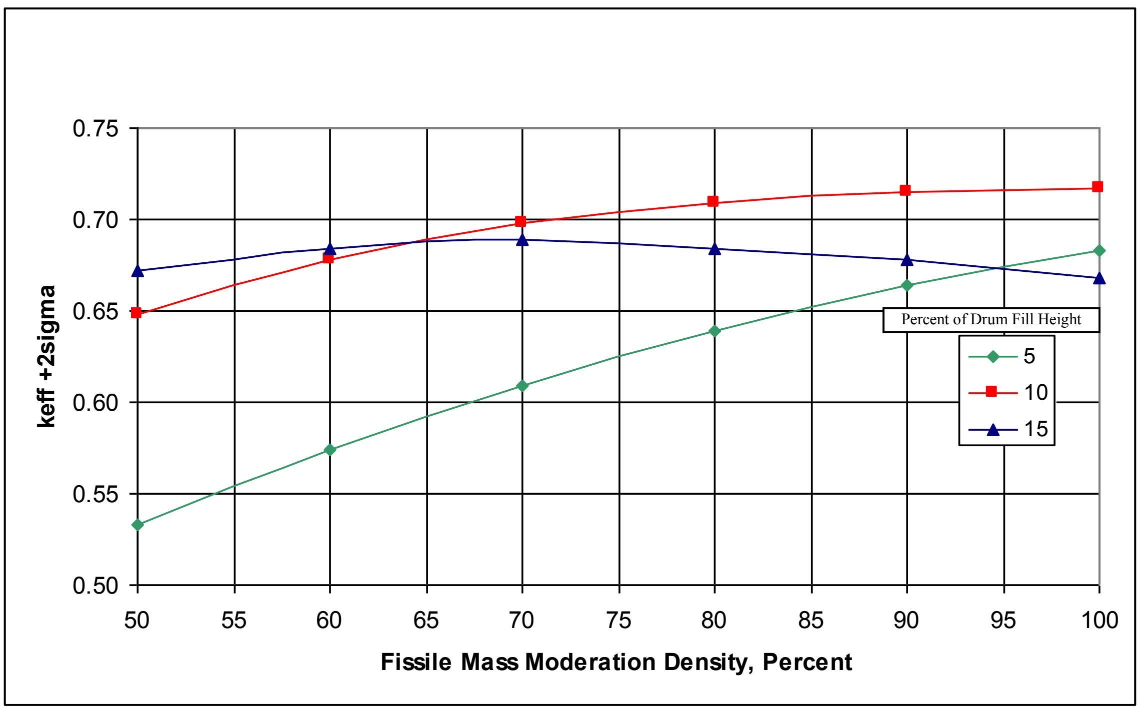

Figure 6-7 KENO VI results for infinite array model calculation as a function of the fissile mass poly-moderator density (as a function of drum fill height, 5%, 10%, and 20% filled drums) for the Normal Condition of Transport and Hypothetical Condition.

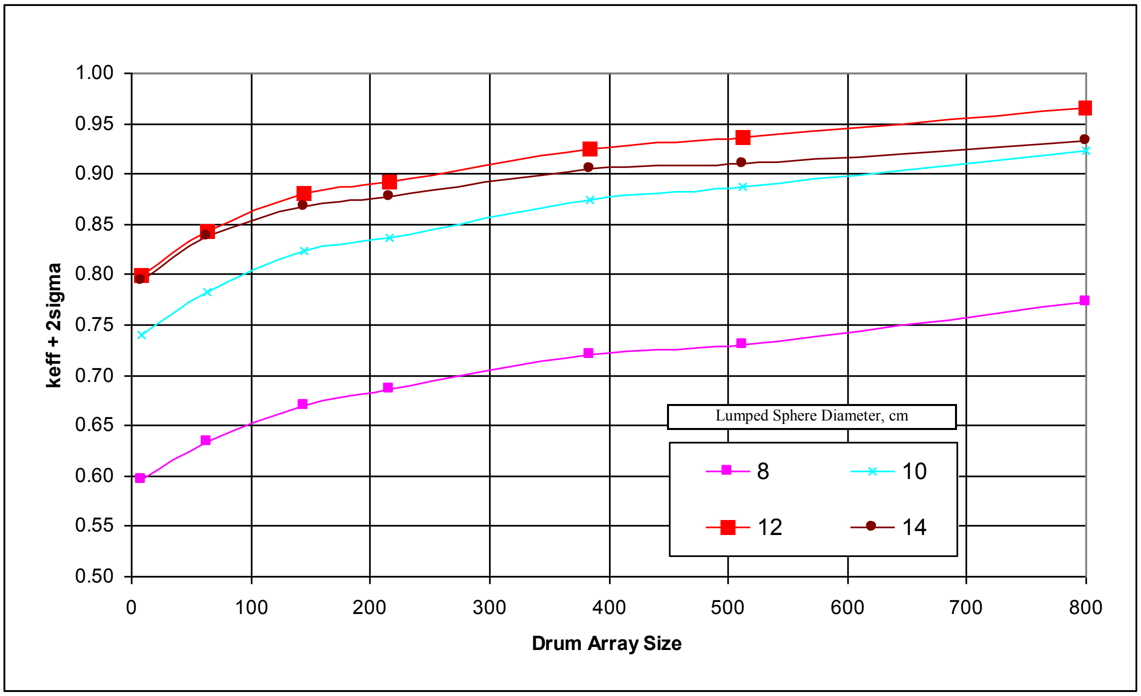

Figure 6-8 KENO VI results for triangular package array model calculation with lumped spheres as a function of package array size for the Normal Condition of Transport and Hypothetical Condition.

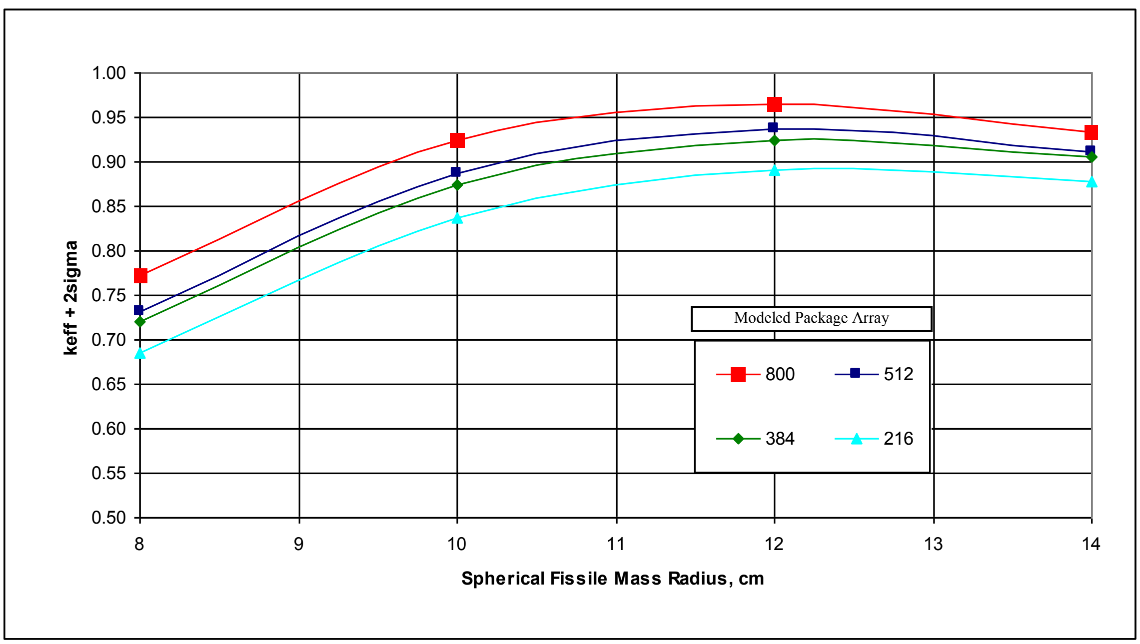

Figure 6-9 KENO VI results for triangular package array model calculation with lumped spheres as a function of sphere diameter for the Normal Condition of Transport and Hypothetical Condition.

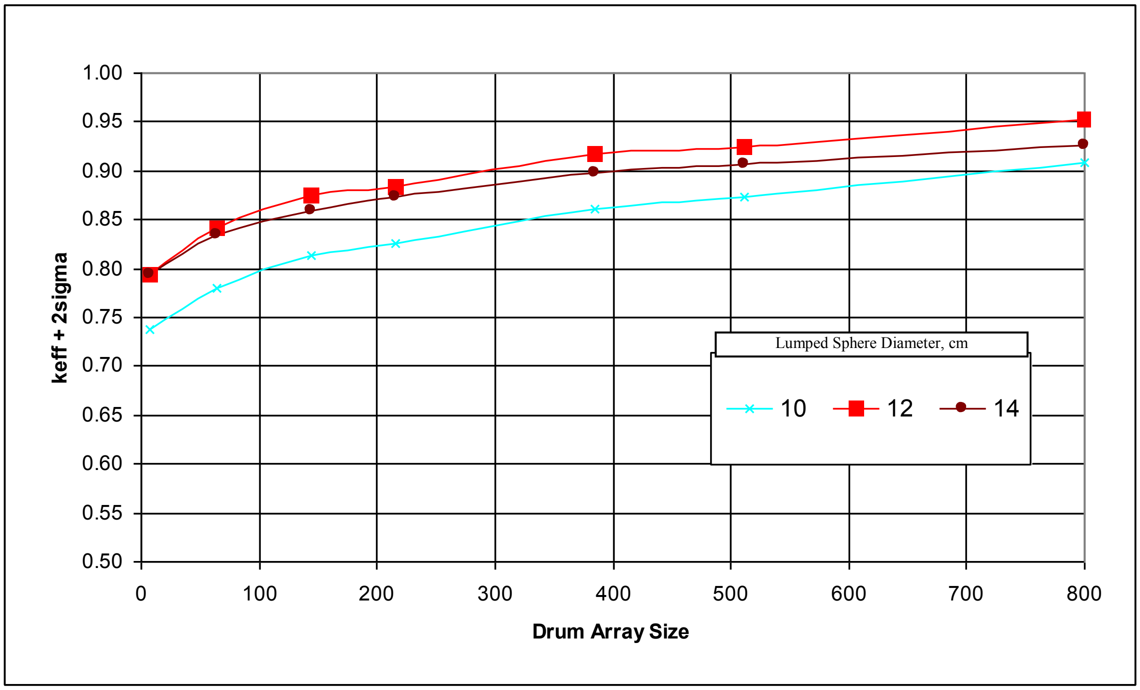

Figure 6-10 KENO VI results for square package array model calculation with lumped spheres as a function of package array size for the Normal Condition of Transport and Hypothetical Condition.

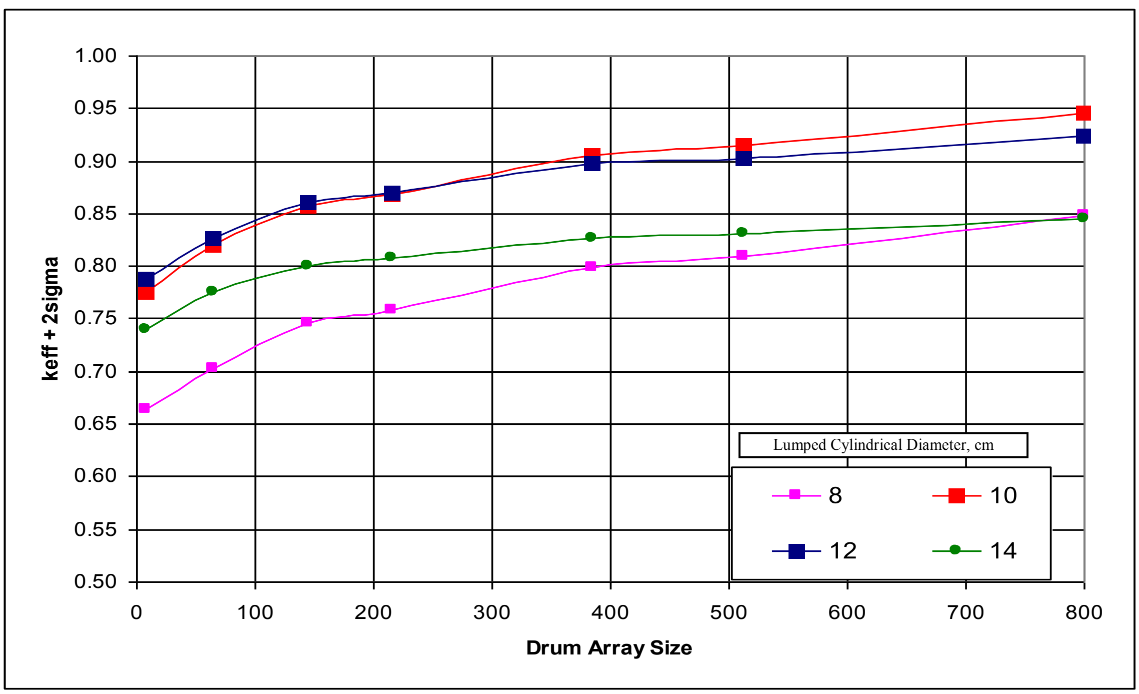

Figure 6-11 KENO VI results for triangular package array model calculation with lumped cylinders as a function of package array size for the Normal Condition of Transport and Hypothetical Condition.

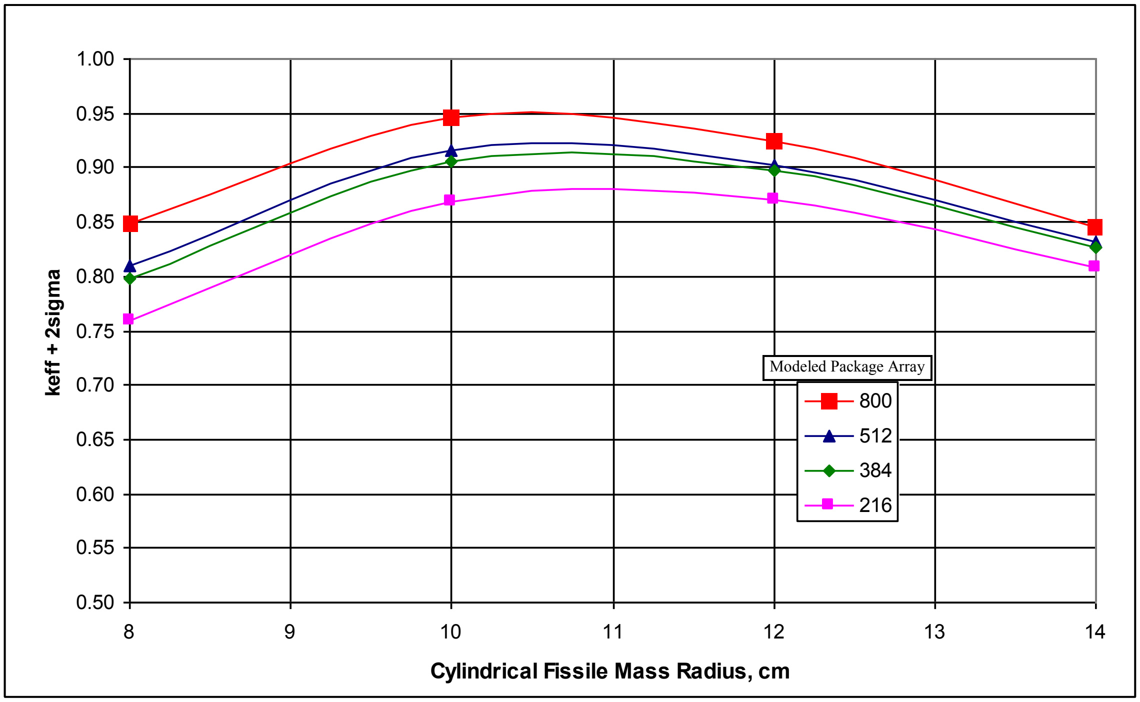

Figure 6-12 KENO VI results for triangular package array model calculation with lumped cylinders as a function of cylinder diameter for the Normal Condition of Transport and Hypothetical Condition.

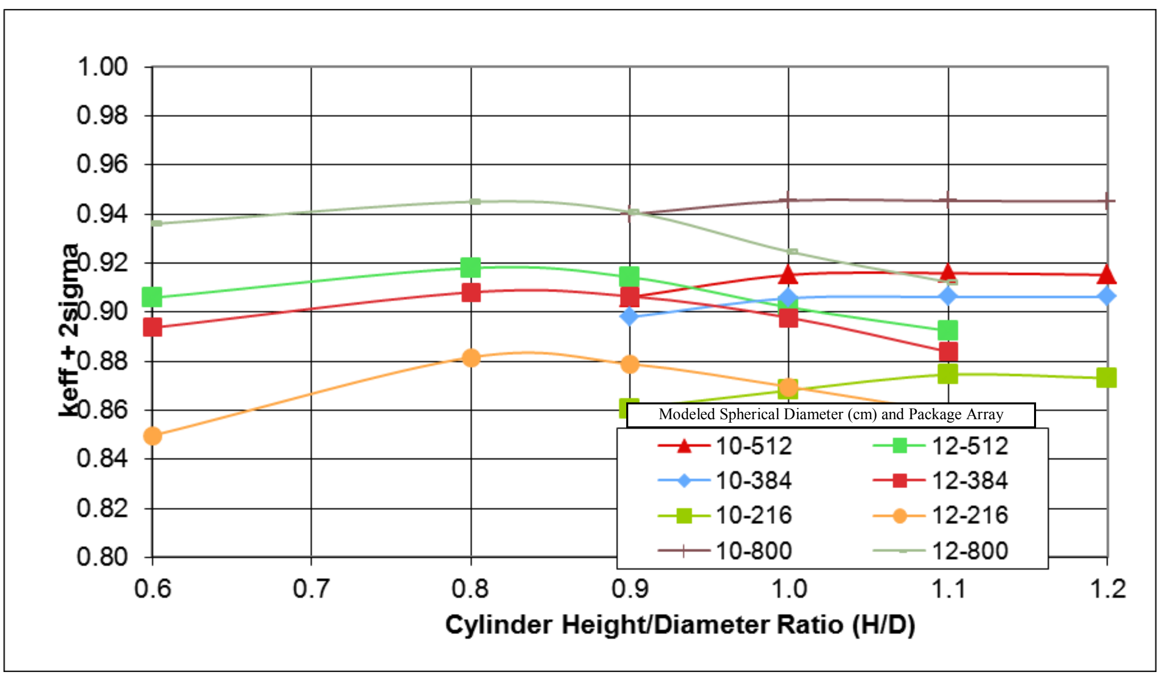

Figure 6-13 KENO VI results for triangular package array model calculation with lumped cylinders as a function of cylinder height-to-diameter ratio for the Normal Condition of Transport and Hypothetical Condition.

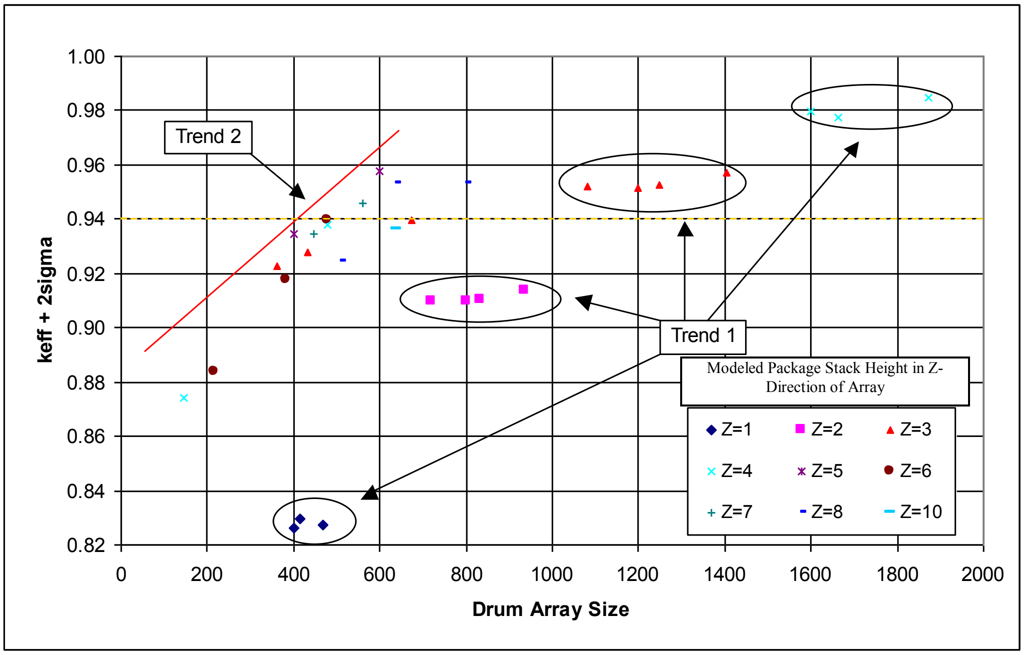

Figure 6-14 KENO VI results for triangular package array model calculation with poly-moderated (0.92 g/cc) lumped spheres as a function of package array size for the Normal Condition of Transport and Hypothetical Condition.

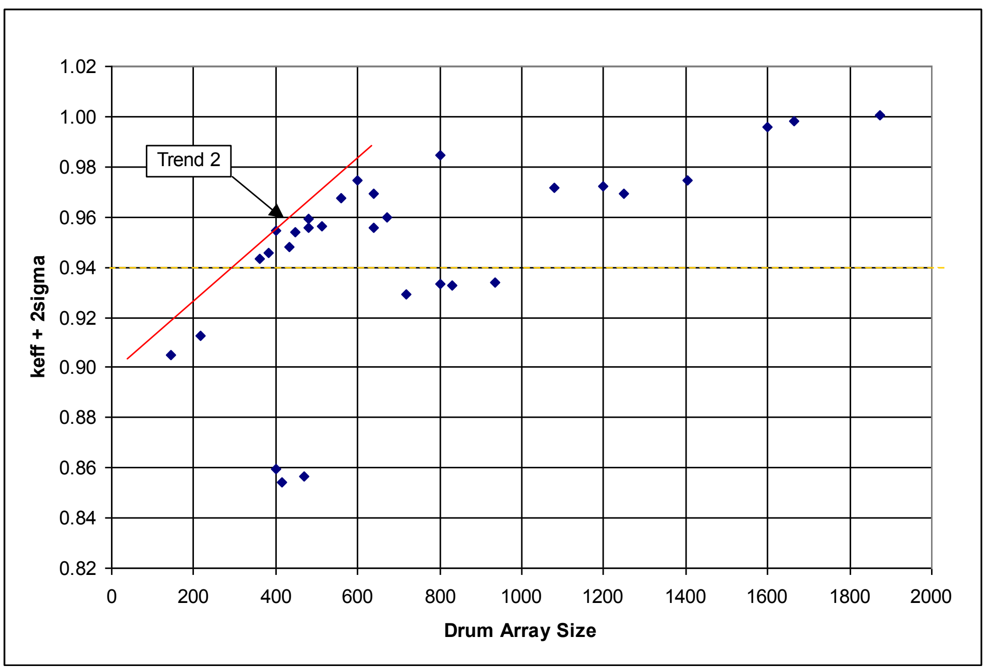

Figure 6-15 KENO VI results for triangular package array model calculation with poly-moderated (0.98 g/cc) lumped spheres as a function of package array size for the Normal Condition of Transport and Hypothetical Condition.

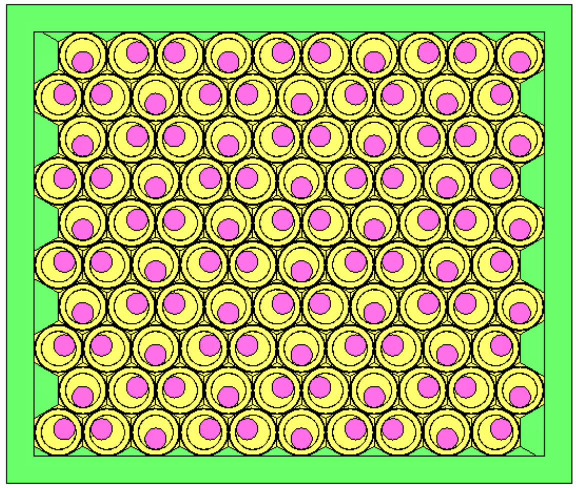

Figure 6-16 Illustration of KENO VI triangular package array model with orientation of lumped fissile mass for the Normal Condition of Transport and Hypothetical Condition.

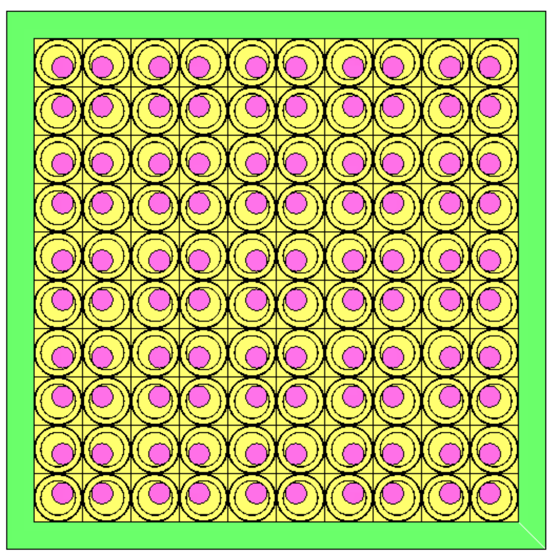

Figure 6-17 Illustration of KENO VI square package array model with orientation of lumped fissile mass for the Normal Condition of Transport and Hypothetical Condition.

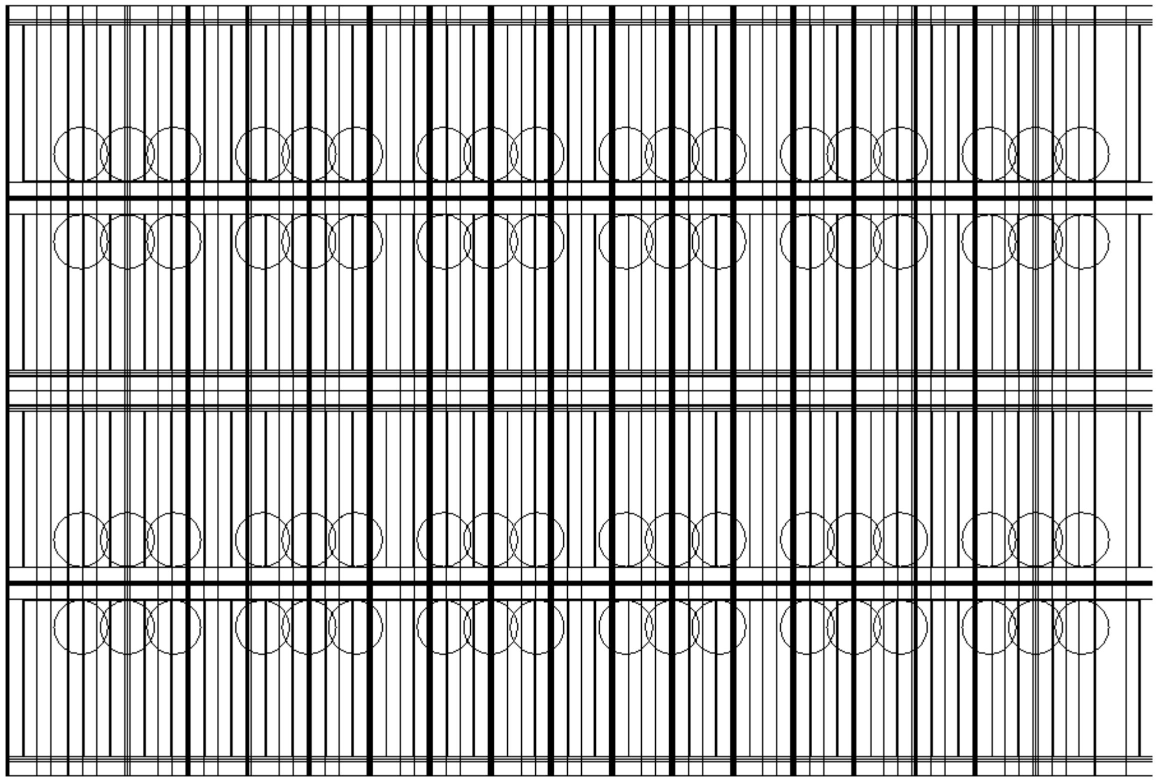

Figure 6-18 Illustration of KENO VI stacked X-Z view of the inverted bottom package and normally orientated top package in a triangular package array model with orientation of lumped fissile mass for the NCT and HAC (Initial MOD0 Configuration).

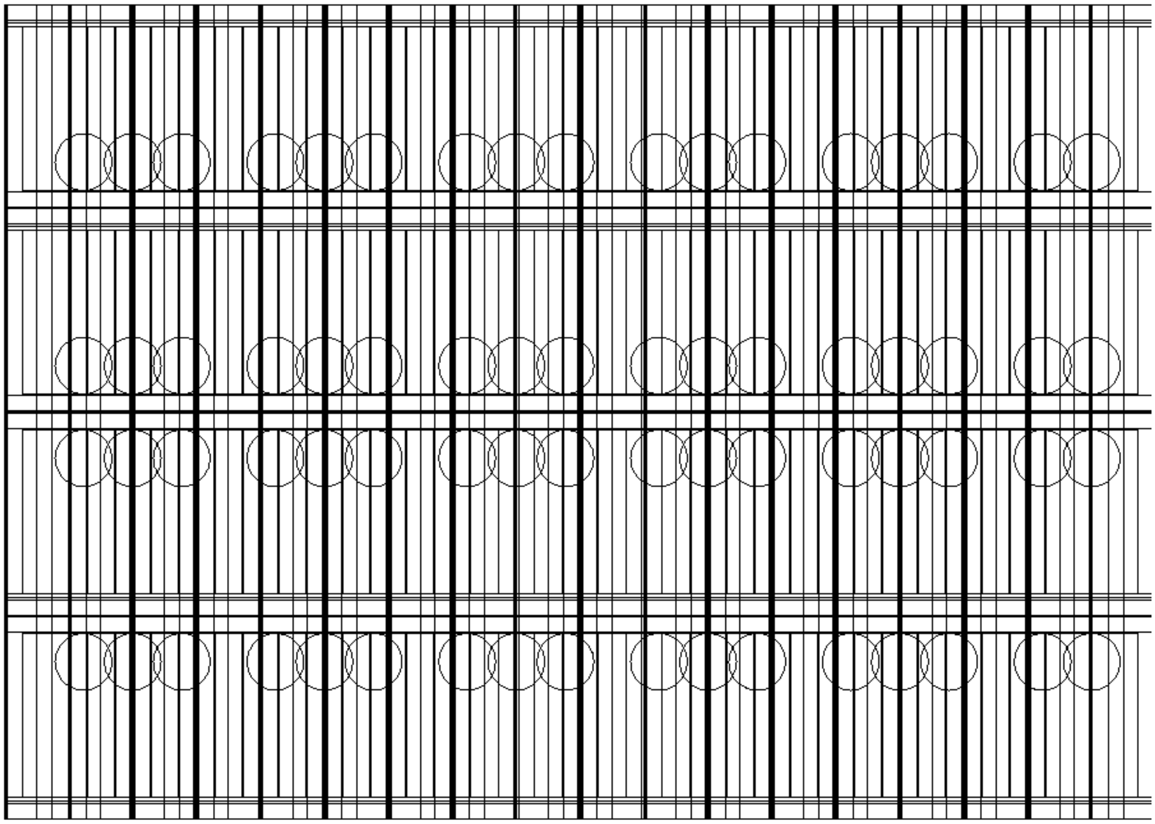

Figure 6-19 Illustration of KENO VI stacked X-Z view for the triangular package array model with orientation of lumped fissile mass for the NCT and HAC (MOD1 Configuration).

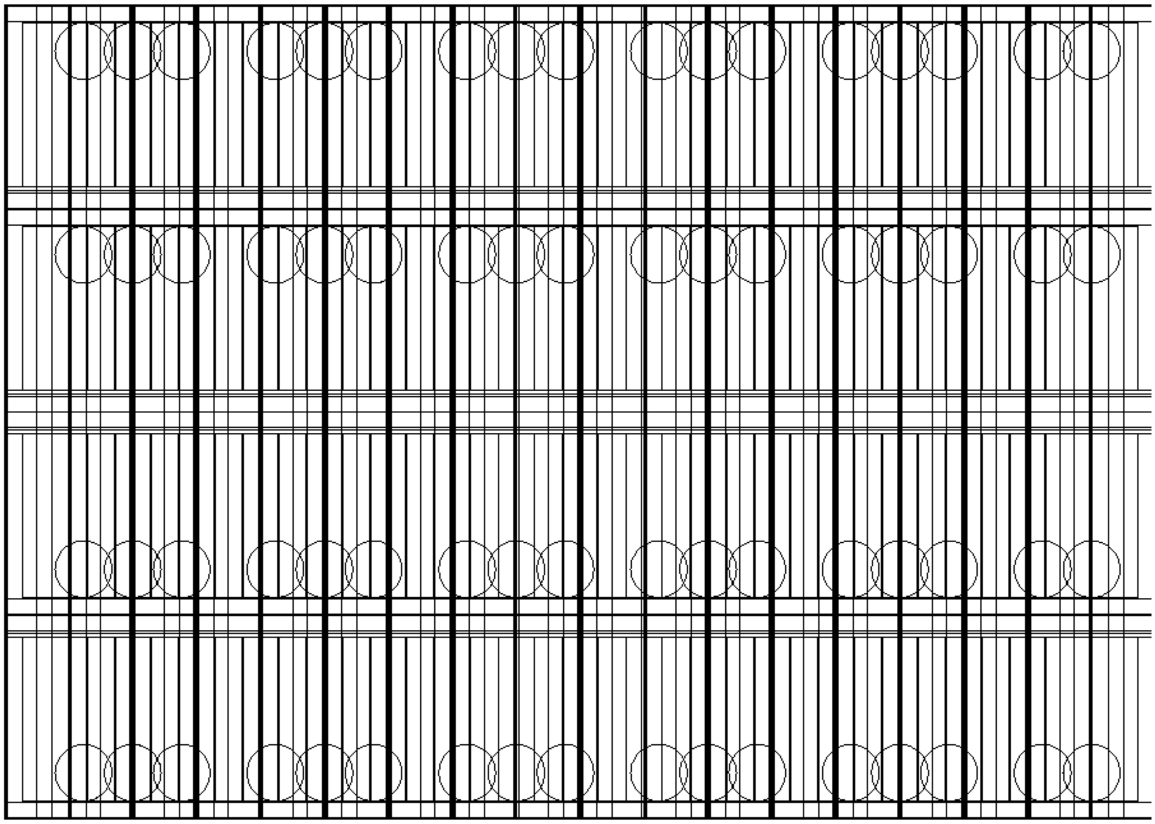

Figure 6-20 Illustration of KENO VI stacked X-Z view for the triangular package array model with orientation of lumped fissile mass for the NCT and HAC (MOD2 Configuration).

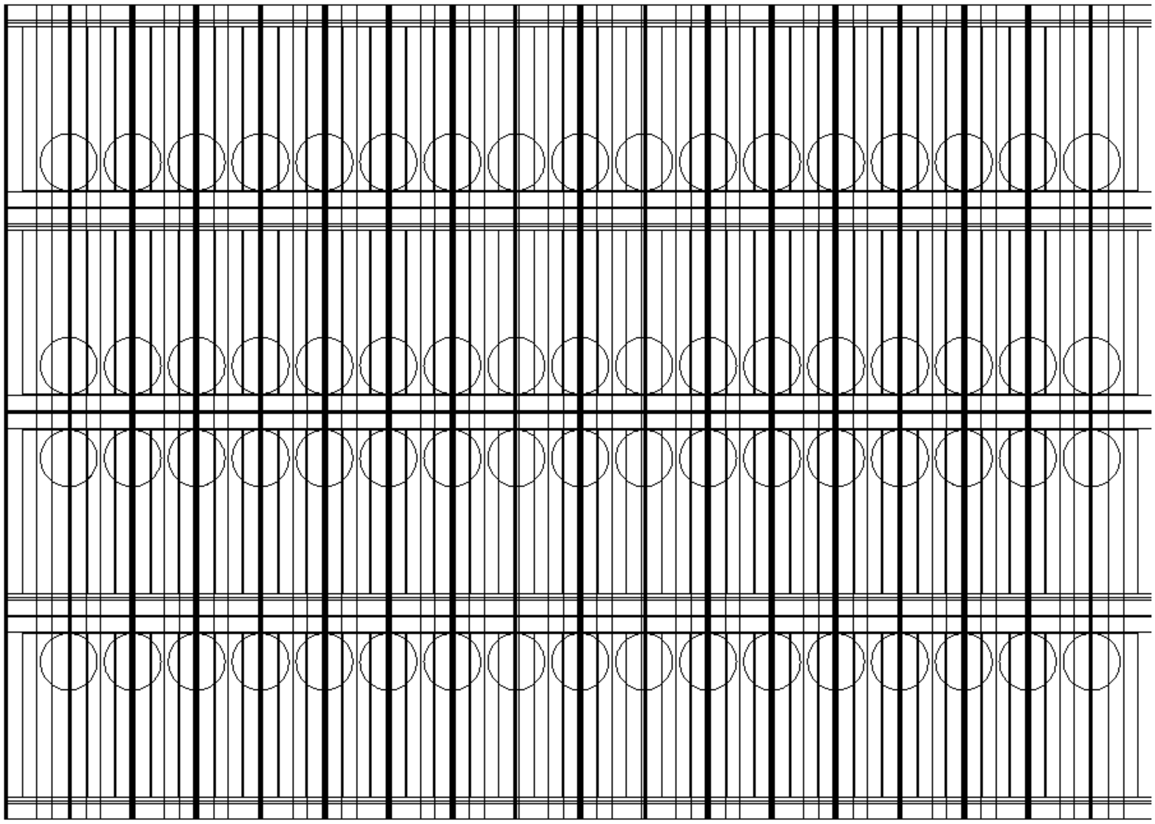

Figure 6-21 Illustration of KENO VI stacked X-Z view for the triangular package array model with orientation of lumped fissile mass for the NCT and HAC (MOD3 Configuration – note centered spheres as opposed to overlapping view as observed in Figure 6-19).

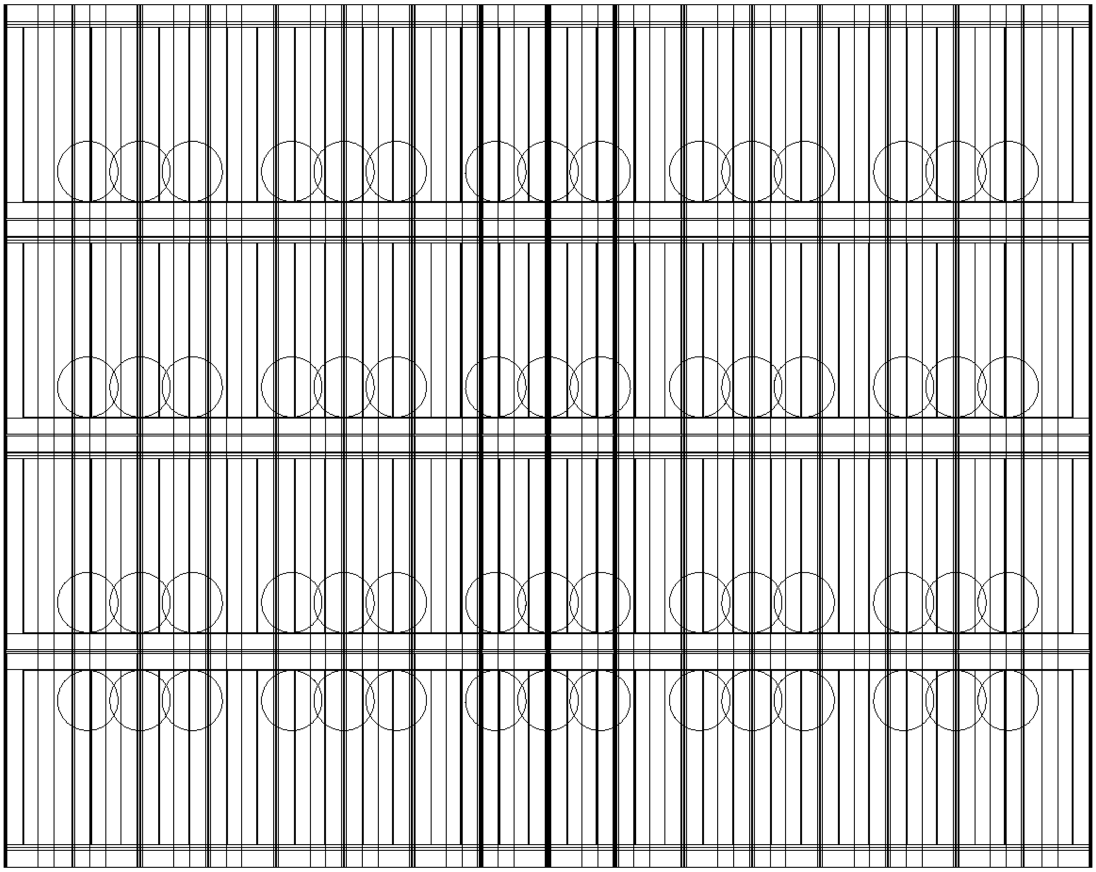

Figure 6-22 Illustration of KENO VI stacked X-Z view for the triangular package array model with orientation of lumped fissile mass for the NCT and HAC (MOD4 Configuration).

6.9.2 Section 6.9.2 – Selected SCALE 4.4a Input Cases

Input Case: VERSA_HAC_INFH_10_A
HAC Case Infinite Homogeneous Hexagonal 10% Fill

```
=CSAS26     PARM='SIZE=00100000'
CENTURY INDUSTRIES VERSA-PAK
44GR     INFHOM
'URANIUM METAL
U          1 0.00114760 294.0 92235 100.0 END
POLYETHYLENE    1 0.99885 294.0  END
'GRAPHITE   1 0.100 294.0  END
'INTERSPERSED MODERATOR
H2O          2 1.0  294.0  END
'PACKAGE STEEL
CARBONSTEEL  3 1.0  294.0  END
'REFLECTOR
H2O          4 1.0   294.0  END
'INSULATION
H2O          5 0.0001 294.0 END
END COMP
READ PARM  NUB=YES GEN=600 NPG=1000 NSK=5
END PARM
READ GEOMETRY

UNIT  10
CYLINDER  1  19.2088  -27.6225  -34.5281
MEDIA  1  1  1
CYLINDER  2  19.2088  34.5281  -34.5281
MEDIA  5  1  2  -1
CYLINDER  3  19.5163  34.5281  -34.8357
MEDIA  3  1  3  -2  -1
CYLINDER  4  25.8663  34.5281  -34.8357
MEDIA  5  1  4  -3  -2  -1
CYLINDER  5  25.8663  35.7727  -34.8357
MEDIA  3  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.8560  -34.8357
MEDIA  5  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  36.9914  -34.8357
MEDIA  3  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  25.8663  43.3414  -41.1857
MEDIA  5  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.0017  43.3414  -41.7953
MEDIA  3  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.6374  43.3414  -41.7963
MEDIA  5  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.7727  43.3414  -41.7953
MEDIA  3  1  11  -10  -9  -8  -7  -6  -5  -4  -3  -
2  -1
CYLINDER  12  26.9081  43.4768  -41.9307
MEDIA  3  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
HEXPRISM  13  26.9081  43.4768  -41.9307
MEDIA  5  1  13 -12 -11 -10  -9  -8  -7  -6  -5  -4
-3  -2  -1
BOUNDARY  13

GLOBAL
UNIT  100
CUBOID  10  26.9081 -26.9081  93.2124  0.00
85.4075  0.00
ARRAY  1  10  PLACE 2 1 1  2*0.0 41.9307
BOUNDARY  10
END GEOMETRY
READ ARRAY
GBL=1 ARA=1 TYP=TRIANGULAR NUX=3  NUY=3  NUZ=1
 FILL  10 10 10
      10 10 10
     10 10 10  END FILL
END ARRAY
READ BOUNDS
ALL=SPEC
END BOUNDS
END DATA
END
```

Input Case: VERSA_HAC_INFH2_10_A
HAC Case Infinite Homogeneous Model 2 Hexagonal Inverted 10% Fill

```
=CSAS26     PARM='SIZE=00100000'
CENTURY INDUSTRIES VERSA-PAK
44GR     INFHOM
'URANIUM METAL
U          1 0.00114760 294.0 92235 100.0 END
POLYETHYLENE    1 0.99885 294.0  END
'GRAPHITE   1 0.100 294.0  END
'INTERSPERSED MODERATOR
H2O          2 1.0  294.0  END
'PACKAGE STEEL
CARBONSTEEL  3 1.0  294.0  END
'REFLECTOR
H2O          4 1.0   294.0  END
'INSULATION
H2O          5 0.0001 294.0 END
END COMP
READ PARM  NUB=YES GEN=600 NPG=1000 NSK=5
END PARM
READ GEOMETRY

UNIT  10
CYLINDER  1  19.2088  -27.6225  -34.5281
MEDIA  1  1  1
CYLINDER  2  19.2088  34.5281  -34.5281
MEDIA  5  1  2  -1
CYLINDER  3  19.5163  34.5281  -34.8357
MEDIA  3  1  3  -2  -1
CYLINDER  4  25.8663  34.5281  -34.8357
MEDIA  5  1  4  -3  -2  -1
CYLINDER  5  25.8663  35.7727  -34.8357
MEDIA  3  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.8560  -34.8357
MEDIA  5  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  36.9914  -34.8357
MEDIA  3  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  25.8663  43.3414  -41.1857
MEDIA  5  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.0017  43.3414  -41.7953
MEDIA  3  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.6374  43.3414  -41.7963
MEDIA  5  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.7727  43.3414  -41.7953
MEDIA  3  1  11  -10  -9  -8  -7  -6  -5  -4  -3  -
2  -1
CYLINDER  12  26.9081  43.4768  -41.9307
MEDIA  3  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
HEXPRISM  13  26.9081  43.4768  -41.9307
MEDIA  5  1  13 -12 -11 -10  -9  -8  -7  -6  -5  -4
-3  -2  -1
BOUNDARY  13

UNIT  20
CYLINDER  1  19.2088  34.5281   27.6225
MEDIA  1  1  1
CYLINDER  2  19.2088  34.5281  -34.5281
MEDIA  5  1  2  -1
CYLINDER  3  19.5163  34.8357  -34.5281
MEDIA  3  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -34.5281
MEDIA  5  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -35.7727
```

```
MEDIA  3  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.8560
MEDIA  5  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  34.8357  -36.9914
MEDIA  3  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  25.8663  41.1857  -43.3414
MEDIA  5  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.0017  41.7953  -43.3414
MEDIA  3  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.6374 41.7963  -43.3414
MEDIA  5  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.7727 41.7953  -43.3414
MEDIA  3  1  11  -10  -9  -8  -7  -6  -5  -4  -3  -
2  -1
CYLINDER  12  26.9081 41.9307  -43.4768
MEDIA  3  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
HEXPRISM  13  26.9081 41.9307  -43.4768
MEDIA  5  1  13 -12 -11 -10  -9  -8  -7  -6  -5  -4
-3  -2  -1
BOUNDARY  13

GLOBAL
UNIT  100
CUBOID  10  26.9081 -26.9081  93.2124  0.00
170.8150  0.00
ARRAY  1  10  PLACE 2 1 1  2*0.0 43.4768
BOUNDARY  10
END GEOMETRY
READ ARRAY
GBL=1 ARA=1 TYP=TRIANGULAR NUX=3  NUY=3  NUZ=2
 FILL  20 20 20
      20 20 20
     20 20 20
       10 10 10
      10 10 10
     10 10 10  END FILL
END ARRAY
READ BOUNDS
ALL=SPEC
END BOUNDS
END DATA
END
```

Input Case: VERSA_HAC_FINS_12S_A7 (MOD0 Array Configuration)
HAC Case Finite In-Homogeneous Square Lattice 12-cm Spheres 800 Packages

```
=CSAS26     PARM='SIZE=00100000'
CENTURY INDUSTRIES VERSA-PAK
44GR     INFHOM
'URANIUM METAL
U         1 0.00253829 294.0 92235 100.0 END
POLYETHYLENE    1 0.99746 294.0  END
'GRAPHITE   1 0.100 294.0  END
'INTERSPERSED MODERATOR
H2O          2 1.0  294.0  END
'PACKAGE STEEL
CARBONSTEEL  3 1.0  294.0  END
'REFLECTOR
H2O          4 1.0   294.0  END
'INSULATION
H2O          5 0.0001 294.0 END
END COMP
READ PARM  NUB=YES GEN=600 NPG=1000 NSK=5
END PARM
READ GEOMETRY

UNIT  10
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=5.097 Y=5.097  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
CUBOID  12  4P26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  11
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=5.097 Y=5.097  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
CUBOID  12  4P26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  20
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-5.097 Y=5.097  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
CUBOID  12  4P26.9081  43.4768  -41.9307
```

```
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  21
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-5.097 Y=5.097  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
CUBOID  12  4P26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  30
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=5.097 Y=-5.097  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
CUBOID  12  4P26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  31
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=5.097 Y=-5.097  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
```

```
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
CUBOID  12  4P26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  40
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-5.097 Y=-5.097  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
CUBOID  12  4P26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  41
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-5.097 Y=-5.097  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
CUBOID  12  4P26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  100
SPHERE  1  12.00
```

```
MEDIA  1  1  1
BOUNDARY  1

UNIT  200
CUBOID  10  107.6324  0.00  107.6324  0.00  170.815
0.00
ARRAY  1  10  PLACE 1 1 1 26.9081  26.9081  43.4768
BOUNDARY  10
GLOBAL
UNIT  300
CUBOID  10  538.16  0.00  538.16  0.00  683.260
0.00
ARRAY  2  10  PLACE 1 1 1  3*0.00
CUBOID  20  568.64  -30.48  568.64  -30.48  713.74
-30.48
MEDIA  4  10  20  -10
BOUNDARY  20
END GEOMETRY
READ ARRAY
ARA=1 NUX=2 NUY=2 NUZ=2
      FILL 11 21 31 41 10 20 30 40  END FILL
ARA=2 NUX=5 NUY=5 NUZ=4
      FILL  F200  END FILL
END ARRAY
READ BOUNDS
ALL=VACUUM
END BOUNDS
END DATA
END
```

Input Case: VERSA_HAC_FINH_12S_A7 (MOD0 Array Configuration)
HAC Case Finite In-Homogeneous Hexagonal Lattice 12-cm Spheres 800 Packages

```
=CSAS26     PARM='SIZE=00100000'
CENTURY INDUSTRIES VERSA-PAK
44GR     INFHOM
'URANIUM METAL
U         1 0.00253829 294.0 92235 100.0 END
POLYETHYLENE    1 0.99746 294.0  END
'SUB FOR HIGH DENSITY POLY
'POLYETHYLENE    1  DEN=0.98  0.99746 294.0  END
'SUB FOR GRAPHITE
'GRAPHITE   1 0.99746 294.0  END
'INTERSPERSED MODERATOR
H2O          2 1.0  294.0  END
'PACKAGE STEEL
CARBONSTEEL  3 1.0  294.0  END
'REFLECTOR
H2O          4 1.0   294.0  END
'INSULATION
H2O          5 0.0001 294.0 END
END COMP
READ PARM  NUB=YES GEN=600 NPG=1000 NSK=5
END PARM
READ GEOMETRY

UNIT  10
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=6.24  Y=3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  11
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE  100  ORIGIN X=6.24  Y=3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  20
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  21
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
```

```
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  30
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=0.00  Y=-7.208  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  31
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=0.00  Y=-7.208  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  40
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=-3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  41
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=-3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT 50
HEXPRISM  10  26.9081  43.4768 -41.9307
MEDIA  4  1  10
BOUNDARY  10

UNIT 51
HEXPRISM  10  26.9081  41.9307 -43.4768
MEDIA  4  1  10
BOUNDARY  10

UNIT  100
SPHERE  1  12.00
MEDIA  1  1  1
BOUNDARY  1
```

```
GLOBAL
UNIT  1000
CUBOID  10  565.1  0.00  473.3  0.00  683.260  0.00
ARRAY  1  10  PLACE 6 2 1  26.9081  26.9081
43.4768
CUBOID  20  595.55  -30.48  503.75  -30.48  713.74
-30.48
MEDIA  4  10  20  -10
BOUNDARY  20
END GEOMETRY
READ ARRAY
GBL=1 ARA=1 TYP=TRIANGULAR NUX=16 NUY=12 NUZ=8
      FILL 51 51 51 51 51 51 51 51 51 51 51 51 51
51 51 51
          51 51 51 51 51 11 21 31 11 21 31 11 21 31
11 51
         51 51 51 51 51 31 11 21 31 11 21 31 11 21
31 51
        51 51 51 51 11 21 31 11 21 31 11 21 31 11
51 51
       51 51 51 51 31 11 21 31 11 21 31 11 21 31 51
51
      51 51 51 11 21 31 11 21 31 11 21 31 11 51 51
51
     51 51 51 31 11 21 31 11 21 31 11 21 31 51 51
51
    51 51 11 21 31 11 21 31 11 21 31 11 51 51 51 51
   51 51 31 11 21 31 11 21 31 11 21 31 51 51 51 51
  51 11 21 31 11 21 31 11 21 31 11 51 51 51 51 51
 51 31 11 21 31 11 21 31 11 21 31 51 51 51 51 51
51 51 51 51 51 51 51 51 51 51 51 51 51 51 51 51
           50 50 50 50 50 50 50 50 50 50 50 50 50
50 50 50
          50 50 50 50 50 10 20 30 10 20 30 10 20 30
10 50
         50 50 50 50 50 30 10 20 30 10 20 30 10 20
30 50
        50 50 50 50 10 20 30 10 20 30 10 20 30 10
50 50
       50 50 50 50 30 10 20 30 10 20 30 10 20 30 50
50
      50 50 50 10 20 30 10 20 30 10 20 30 10 50 50
50
     50 50 50 30 10 20 30 10 20 30 10 20 30 50 50
50
    50 50 10 20 30 10 20 30 10 20 30 10 50 50 50 50
   50 50 30 10 20 30 10 20 30 10 20 30 50 50 50 50
  50 10 20 30 10 20 30 10 20 30 10 50 50 50 50 50
 50 30 10 20 30 10 20 30 10 20 30 50 50 50 50 50
50 50 50 50 50 50 50 50 50 50 50 50 50 50 50 50
3Q384 END FILL
END ARRAY
READ BOUNDS
ALL=VACUUM
END BOUNDS
END DATA
END
```

Input Case: VERSA_HAC_FINH_12S_10X064 (MOD0 Array Configuration)
HAC Case Finite In-Homogeneous Hexagonal Lattice 12-cm Spheres 8X8X10 Packages

```
=CSAS26     PARM='SIZE=00100000'
CENTURY INDUSTRIES VERSA-PAK
44GR     INFHOM
'URANIUM METAL
U          1 0.00253829 294.0 92235 100.0 END
POLYETHYLENE    1 0.99746 294.0  END
'GRAPHITE   1 0.100 294.0  END
'INTERSPERSED MODERATOR
H2O          2 1.0  294.0  END
'PACKAGE STEEL
CARBONSTEEL  3 1.0  294.0  END
'REFLECTOR
H2O          4 1.0   294.0  END
'INSULATION
H2O          5 0.0001 294.0 END
END COMP
READ PARM  NUB=YES GEN=600 NPG=1000 NSK=5
END PARM
READ GEOMETRY

UNIT  10
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=6.24  Y=3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  11
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE  100  ORIGIN X=6.24  Y=3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  20
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
```

```
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  21
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  30
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=0.00  Y=-7.208  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  31
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=0.00  Y=-7.208  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  40
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=-3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  41
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=-3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
```

```
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT 50
HEXPRISM  10  26.9081  43.4768 -41.9307
MEDIA  4  1  10
BOUNDARY  10

UNIT 51
HEXPRISM  10  26.9081  41.9307 -43.4768
MEDIA  4  1  10
BOUNDARY  10

UNIT  100
SPHERE  1  12.00
MEDIA  1  1  1
BOUNDARY  1

GLOBAL
UNIT  1000
CUBOID  10  457.5  0.00  380.1  0.00  854.075  0.00
ARRAY  1  10  PLACE 5 2 1  26.9081  26.9081
43.4768
CUBOID  20  487.91  -30.48  410.53  -30.48  884.555
-30.48
MEDIA  4  10  20  -10
BOUNDARY  20
END GEOMETRY
READ ARRAY
GBL=1 ARA=1 TYP=TRIANGULAR NUX=13  NUY=10  NUZ=10
    FILL 51 51 51 51 51 51 51 51 51 51 51 51 51
        51 51 51 51 11 21 31 11 21 31 11 21 51
       51 51 51 51 31 11 21 31 11 21 31 11 51
      51 51 51 11 21 31 11 21 31 11 21 51 51
     51 51 51 31 11 21 31 11 21 31 11 51 51
    51 51 11 21 31 11 21 31 11 21 51 51 51
   51 51 31 11 21 31 11 21 31 11 51 51 51
  51 11 21 31 11 21 31 11 21 51 51 51 51
 51 31 11 21 31 11 21 31 11 51 51 51 51
51 51 51 51 51 51 51 51 51 51 51 51 51
         50 50 50 50 50 50 50 50 50 50 50 50 50
        50 50 50 50 10 20 30 10 20 30 10 20 50
       50 50 50 50 30 10 20 30 10 20 30 10 50
      50 50 50 10 20 30 10 20 30 10 20 50 50
     50 50 50 30 10 20 30 10 20 30 10 50 50
    50 50 10 20 30 10 20 30 10 20 50 50 50
   50 50 30 10 20 30 10 20 30 10 50 50 50
  50 10 20 30 10 20 30 10 20 50 50 50 50
 50 30 10 20 30 10 20 30 10 50 50 50 50
50 50 50 50 50 50 50 50 50 50 50 50 50
4Q260  END FILL
END ARRAY
READ BOUNDS
ALL=VACUUM
END BOUNDS
END DATA
END
```

Input Case: VERSA_HAC_FINH_12S_1X324 (MOD0 Array Configuration)
HAC Case Finite In-Homogeneous Hexagonal Lattice 12-cm Spheres 18X18X1 Packages

```
=CSAS26     PARM='SIZE=00900000'
CENTURY INDUSTRIES VERSA-PAK
44GR     INFHOM
'URANIUM METAL
U          1 0.00253829 294.0 92235 100.0 END
POLYETHYLENE    1  DEN=0.98  0.99746 294.0  END
'PARAFFIN       1  0.99746 294.0  END
'GRAPHITE   1 0.100 294.0  END
'INTERSPERSED MODERATOR
H2O          2 1.0  294.0  END
'PACKAGE STEEL
CARBONSTEEL  3 1.0  294.0  END
'REFLECTOR
H2O          4 1.0   294.0  END
'INSULATION
H2O          5 0.0001 294.0 END
END COMP
READ PARM  NUB=YES GEN=600 NPG=1000 NSK=5
END PARM
READ GEOMETRY

UNIT  10
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=6.24  Y=3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  11
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE  100  ORIGIN X=6.24  Y=3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  20
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=3.60  Z=-22.528
```

```
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  21
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  30
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=0.00  Y=-7.208  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  31
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=0.00  Y=-7.208  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  40
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=-3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  41
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=-3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
```

```
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT 50
HEXPRISM  10  26.9081  43.4768 -41.9307
MEDIA  4  1  10
BOUNDARY  10

UNIT 51
HEXPRISM  10  26.9081  41.9307 -43.4768
MEDIA  4  1  10
BOUNDARY  10

UNIT  100
SPHERE  1  12.00
MEDIA  1  1  1
BOUNDARY  1

GLOBAL
UNIT  1000
CUBOID  10  995.5997  0.00  846.1215  0.00  85.4075
0.00
ARRAY  1  10  PLACE 10 2 1  26.9081  26.9081
43.4768
CUBOID  20  1026.0797  -30.48  876.6015 -30.48
115.8875  -30.48
MEDIA  4  10  20  -10
BOUNDARY  20
END GEOMETRY
READ ARRAY
GBL=1 ARA=1 TYP=TRIANGULAR NUX=28  NUY=20  NUZ=1
FILL
                   51 51 51 51 51 51 51 51 51 51 51
51 51 51 51 51 51 51 51
51 51 51 51 51 51 51 51 51
                  51 51 51 51 51 51 51 51 51 11 21
31 11 21 31 11 21 31 11
21 31 11 21 31 11 21 31 51
                 51 51 51 51 51 51 51 51 51 31 11
21 31 11 21 31 11 21 31
11 21 31 11 21 31 11 21 51
                51 51 51 51 51 51 51 51 11 21 31 11
21 31 11 21 31 11 21
31 11 21 31 11 21 31 51 51
               51 51 51 51 51 51 51 51 31 11 21 31
11 21 31 11 21 31 11
21 31 11 21 31 11 21 51 51
              51 51 51 51 51 51 51 11 21 31 11 21
31 11 21 31 11 21 31
11 21 31 11 21 31 51 51 51
             51 51 51 51 51 51 51 31 11 21 31 11 21
31 11 21 31 11 21
31 11 21 31 11 21 51 51 51
            51 51 51 51 51 51 11 21 31 11 21 31 11
21 31 11 21 31 11
21 31 11 21 31 51 51 51 51
           51 51 51 51 51 51 31 11 21 31 11 21 31
11 21 31 11 21 31
11 21 31 11 21 51 51 51 51
          51 51 51 51 51 11 21 31 11 21 31 11 21 31
11 21 31 11 21
31 11 21 31 51 51 51 51 51
         51 51 51 51 51 31 11 21 31 11 21 31 11 21
31 11 21 31 11
21 31 11 21 51 51 51 51 51
        51 51 51 51 11 21 31 11 21 31 11 21 31 11
21 31 11 21 31
11 21 31 51 51 51 51 51 51
       51 51 51 51 31 11 21 31 11 21 31 11 21 31 11
21 31 11 21
31 11 21 51 51 51 51 51 51
      51 51 51 11 21 31 11 21 31 11 21 31 11 21 31
11 21 31 11
21 31 51 51 51 51 51 51 51
     51 51 51 31 11 21 31 11 21 31 11 21 31 11 21
31 11 21 31
11 21 51 51 51 51 51 51 51
    51 51 11 21 31 11 21 31 11 21 31 11 21 31 11 21
31 11 21
31 51 51 51 51 51 51 51 51
   51 51 31 11 21 31 11 21 31 11 21 31 11 21 31 11
21 31 11
21 51 51 51 51 51 51 51 51
  51 11 21 31 11 21 31 11 21 31 11 21 31 11 21 31
11 21 31
51 51 51 51 51 51 51 51 51
 51 31 11 21 31 11 21 31 11 21 31 11 21 31 11 21 31
11 21
51 51 51 51 51 51 51 51 51
51 51 51 51 51 51 51 51 51 51 51 51 51 51 51 51
51 51
51 51 51 51 51 51 51 51 51  END FILL
END ARRAY
READ BOUNDS
ALL=VACUUM
END BOUNDS
END DATA
END
```

Input Case: VERSA_HAC_FINH_12S_2X338 (MOD0 Array Configuration)
HAC Case Finite In-Homogeneous Hexagonal Lattice 12-cm Spheres 13X13X2 Packages

```
=CSAS26     PARM='SIZE=00900000'
CENTURY INDUSTRIES VERSA-PAK
44GR     INFHOM
'URANIUM METAL
U          1 0.00253829 294.0 92235 100.0 END
POLYETHYLENE    1  DEN=0.98  0.99746 294.0  END
'PARAFFIN       1  0.99746 294.0  END
'GRAPHITE   1 0.100 294.0  END
'INTERSPERSED MODERATOR
H2O          2 1.0  294.0  END
'PACKAGE STEEL
CARBONSTEEL  3 1.0  294.0  END
'REFLECTOR
H2O          4 1.0   294.0  END
'INSULATION
H2O          5 0.0001 294.0 END
END COMP
READ PARM  NUB=YES GEN=600 NPG=1000 NSK=5
END PARM
READ GEOMETRY

UNIT  10
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=6.24  Y=3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
```

```
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  11
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE  100  ORIGIN X=6.24  Y=3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  20
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  21
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  30
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=0.00  Y=-7.208  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  31
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=0.00  Y=-7.208  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
```

```
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  40
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=-3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  41
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=-3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT 50
HEXPRISM  10  26.9081  43.4768 -41.9307
MEDIA  4  1  10
BOUNDARY  10

UNIT 51
HEXPRISM  10  26.9081  41.9307 -43.4768
MEDIA  4  1  10
BOUNDARY  10

UNIT  100
SPHERE  1  12.00
MEDIA  1  1  1
BOUNDARY  1

GLOBAL
UNIT  1000
CUBOID  10  726.5187  0.00  613.5706  0.00
170.8150  0.00
ARRAY  1  10  PLACE 8 2 1  26.9081  26.9081
43.4768
CUBOID  20  756.9987  -30.48  643.5706 -30.48
201.2950  -30.48
MEDIA  4  10  20  -10
BOUNDARY  20
END GEOMETRY
READ ARRAY
GBL=1 ARA=1 TYP=TRIANGULAR NUX=21  NUY=15  NUZ=2
FILL
               51 51 51 51 51 51 51 51 51 51 51 51
51 51 51 51 51 51 51 51 51
              51 51 51 51 51 51 51 11 21 31 11 21
31 11 21 31 11 21 31 11 51
             51 51 51 51 51 51 51 31 11 21 31 11 21
31 11 21 31 11 21 31 51
            51 51 51 51 51 51 11 21 31 11 21 31 11
21 31 11 21 31 11 51 51
           51 51 51 51 51 51 31 11 21 31 11 21 31
11 21 31 11 21 31 51 51
          51 51 51 51 51 11 21 31 11 21 31 11 21 31
11 21 31 11 51 51 51
         51 51 51 51 51 31 11 21 31 11 21 31 11 21
31 11 21 31 51 51 51
        51 51 51 51 11 21 31 11 21 31 11 21 31 11
21 31 11 51 51 51 51
       51 51 51 51 31 11 21 31 11 21 31 11 21 31 11
21 31 51 51 51 51
      51 51 51 11 21 31 11 21 31 11 21 31 11 21 31
11 51 51 11 51 51
     51 51 51 31 11 21 31 11 21 31 11 21 31 11 21
31 51 21 31 11 51
    51 51 11 21 31 11 21 31 11 21 31 11 21 31 11 51
51 51 51 51 51
   51 51 31 11 21 31 11 21 31 11 21 31 11 21 31 51
51 51 51 51 51
  51 11 21 31 11 21 31 11 21 31 11 21 31 11 51 51
51 51 51 51 51
 51 51 51 51 51 51 51 51 51 51 51 51 51 51 51 51 51
51 51 51 51
               50 50 50 50 50 50 50 50 50 50 50 50
50 50 50 50 50 50 50 50 50
              50 50 50 50 50 50 50 10 20 30 10 20
30 10 20 30 10 20 30 10 50
             50 50 50 50 50 50 50 30 10 20 30 10 20
30 10 20 30 10 20 30 50
            50 50 50 50 50 50 10 20 30 10 20 30 10
20 30 10 20 30 10 50 50
           50 50 50 50 50 50 30 10 20 30 10 20 30
10 20 30 10 20 30 50 50
          50 50 50 50 50 10 20 30 10 20 30 10 20 30
10 20 30 10 50 50 50
         50 50 50 50 50 30 10 20 30 10 20 30 10 20
30 10 20 30 50 50 50
        50 50 50 50 10 20 30 10 20 30 10 20 30 10
20 30 10 50 50 50 50
       50 50 50 50 30 10 20 30 10 20 30 10 20 30 10
20 30 50 50 50 50
      50 50 50 10 20 30 10 20 30 10 20 30 10 20 30
10 50 50 50 50 50
     50 50 50 30 10 20 30 10 20 30 10 20 30 10 20
30 50 50 50 50 50
    50 50 10 20 30 10 20 30 10 20 30 10 20 30 10 50
50 50 50 50 50
   50 50 30 10 20 30 10 20 30 10 20 30 10 20 30 50
50 50 50 50 50
  50 10 20 30 10 20 30 10 20 30 10 20 30 10 50 50
50 50 50 50 50
```

```
 50 50 50 50 50 50 50 50 50 50 50 50 50 50 50 50 50
50 50 50 50
END FILL
END ARRAY
READ BOUNDS
ALL=VACUUM
END BOUNDS
END DATA
END
```

Input Case: VERSA_HAC_FINH_12S_3X300 (MOD0 Array Configuration)
HAC Case Finite In-Homogeneous Hexagonal Lattice 12-cm Spheres 10X10X3 Packages

```
=CSAS26     PARM='SIZE=00900000'
CENTURY INDUSTRIES VERSA-PAK
44GR     INFHOM
'URANIUM METAL
U         1 0.00253829 294.0 92235 100.0 END
POLYETHYLENE    1  DEN=0.98  0.99746 294.0  END
'PARAFFIN       1  0.99746 294.0  END
'GRAPHITE   1 0.100 294.0  END
'INTERSPERSED MODERATOR
H2O         2 1.0  294.0  END
'PACKAGE STEEL
CARBONSTEEL  3 1.0  294.0  END
'REFLECTOR
H2O         4 1.0   294.0  END
'INSULATION
H2O         5 0.0001 294.0 END
END COMP
READ PARM  NUB=YES GEN=600 NPG=1000 NSK=5
END PARM
READ GEOMETRY

UNIT  10
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=6.24  Y=3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  11
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE  100  ORIGIN X=6.24  Y=3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  20
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  21
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  30
```

```
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=0.00  Y=-7.208  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  31
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=0.00  Y=-7.208  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  40
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=-3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  41
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=-3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT 50
HEXPRISM  10  26.9081  43.4768 -41.9307
MEDIA  4  1  10
BOUNDARY  10

UNIT 51
HEXPRISM  10  26.9081  41.9307 -43.4768
MEDIA  4  1  10
BOUNDARY  10

UNIT  100
SPHERE  1  12.00
MEDIA  1  1  1
BOUNDARY  1

GLOBAL
UNIT  1000
CUBOID  10  565.0701  0.00  473.2720  0.00
256.2225  0.00
ARRAY  1  10  PLACE 6 2 1  26.9081  26.9081
43.4768
CUBOID  20  595.5501  -30.48  503.7520 -30.48
286.7025  -30.48
MEDIA  4  10  20  -10
BOUNDARY  20
END GEOMETRY
READ ARRAY
GBL=1 ARA=1 TYP=TRIANGULAR NUX=16  NUY=12  NUZ=3
FILL
        51 51 51 51 51 51 51 51 51 51 51 51 51
51 51 51
       51 51 51 51 51 11 21 31 11 21 31 11 21
31 11 51
      51 51 51 51 51 31 11 21 31 11 21 31 11 21
31 51
     51 51 51 51 11 21 31 11 21 31 11 21 31 11
51 51
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        51 51 51 51 31 11 21 31 11 21 31 11 21 31
51 51
       51 51 51 11 21 31 11 21 31 11 21 31 11 51 51
51
      51 51 51 31 11 21 31 11 21 31 11 21 31 51 51
51
     51 51 11 21 31 11 21 31 11 21 31 11 51 51 51
51
    51 51 31 11 21 31 11 21 31 11 21 31 51 51 51 51
   51 11 21 31 11 21 31 11 21 31 11 51 51 51 51 51
  51 31 11 21 31 11 21 31 11 21 31 51 51 51 51 51
 51 51 51 51 51 51 51 51 51 51 51 51 51 51 51 51
            50 50 50 50 50 50 50 50 50 50 50 50 50
50 50 50
           50 50 50 50 50 10 20 30 10 20 30 10 20
30 10 50
          50 50 50 50 50 30 10 20 30 10 20 30 10 20
30 50
         50 50 50 50 10 20 30 10 20 30 10 20 30 10
50 50
        50 50 50 50 30 10 20 30 10 20 30 10 20 30
50 50
       50 50 50 10 20 30 10 20 30 10 20 30 10 50 50
50
      50 50 50 30 10 20 30 10 20 30 10 20 30 50 50
50
     50 50 10 20 30 10 20 30 10 20 30 10 50 50 50
50
    50 50 30 10 20 30 10 20 30 10 20 30 50 50 50 50
   50 10 20 30 10 20 30 10 20 30 10 50 50 50 50 50
  50 30 10 20 30 10 20 30 10 20 30 50 50 50 50 50
 50 50 50 50 50 50 50 50 50 50 50 50 50 50 50 50
1Q192
END FILL
END ARRAY
READ BOUNDS
ALL=VACUUM
END BOUNDS
END DATA
END
```

Input Case: VERSA_HAC_FINH_12S_4X272 (MOD1 Array Configuration)
HAC Case Finite In-Homogeneous Hexagonal Lattice 12-cm Spheres 8/7X9X4 Packages

```
=CSAS26     PARM='SIZE=00900000'
CENTURY INDUSTRIES VERSA-PAK
44GR     INFHOM
'URANIUM METAL
U         1 0.00253829 294.0 92235 100.0 END
POLYETHYLENE    1  DEN=0.98  0.99746 294.0  END
'PARAFFIN       1  0.99746 294.0  END
'GRAPHITE   1 0.100 294.0  END
'INTERSPERSED MODERATOR
H2O         2 1.0  294.0  END
'PACKAGE STEEL
CARBONSTEEL  3 1.0  294.0  END
'REFLECTOR
H2O         4 1.0   294.0  END
'INSULATION
H2O         5 0.0001 294.0 END
END COMP
READ PARM  NUB=YES GEN=600 NPG=1000 NSK=5
END PARM
READ GEOMETRY

UNIT  10
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=6.24  Y=3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  11
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE  100  ORIGIN X=6.24  Y=3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  20
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12
```

```
UNIT  21
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  30
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=0.00  Y=-7.208  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  31
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=0.00  Y=-7.208  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  40
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=-3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  41
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=-3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  50
HEXPRISM  10  26.9081  43.4768 -41.9307
MEDIA  4  1  10
BOUNDARY  10

UNIT  51
```

```
HEXPRISM  10  26.9081  41.9307 -43.4768
MEDIA  4  1  10
BOUNDARY  10

UNIT  100
SPHERE  1  12.00
MEDIA  1  1  1
BOUNDARY  1

GLOBAL
UNIT  1000
CUBOID  10  511.2639  0.00  426.6658  0.00
341.6300  0.00
ARRAY  1  10  PLACE 6 2 1  26.9081  26.9081
43.4768
CUBOID  20  541.7339  -30.48  457.1458 -30.48
372.1100  -30.48
MEDIA  4  10  20  -10
BOUNDARY  20
END GEOMETRY
READ ARRAY
GBL=1 ARA=1 TYP=TRIANGULAR NUX=15  NUY=11  NUZ=4
FILL
           51 51 51 51 51 51 51 51 51 51 51 51 51
51 51
          51 51 51 51 51 11 21 31 11 21 31 11 21 51
51
         51 51 51 51 51 31 11 21 31 11 21 31 51 51
51
        51 51 51 51 11 21 31 11 21 31 11 21 51 51
51
       51 51 51 51 31 11 21 31 11 21 31 51 51 51 51
      51 51 51 11 21 31 11 21 31 11 21 51 51 51 51
     51 51 51 31 11 21 31 11 21 31 51 51 51 51 51
    51 51 11 21 31 11 21 31 11 21 51 51 51 51 51
   51 51 31 11 21 31 11 21 31 51 51 51 51 51 51
  51 11 21 31 11 21 31 11 21 51 51 51 51 51 51
 51 51 51 51 51 51 51 51 51 51 51 51 51 51 51
1Q165
           50 50 50 50 50 50 50 50 50 50 50 50 50
50 50
          50 50 50 50 50 10 20 30 10 20 30 10 20 50
50
         50 50 50 50 50 30 10 20 30 10 20 30 50 50
50
        50 50 50 50 10 20 30 10 20 30 10 20 50 50
50
       50 50 50 50 30 10 20 30 10 20 30 50 50 50 50
      50 50 50 10 20 30 10 20 30 10 20 50 50 50 50
     50 50 50 30 10 20 30 10 20 30 50 50 50 50 50
    50 50 10 20 30 10 20 30 10 20 50 50 50 50 50
   50 50 30 10 20 30 10 20 30 50 50 50 50 50 50
  50 10 20 30 10 20 30 10 20 50 50 50 50 50 50
 50 50 50 50 50 50 50 50 50 50 50 50 50 50 50
1Q165
END FILL
END ARRAY
READ BOUNDS
ALL=VACUUM
END BOUNDS
END DATA
END
```

Input Case: VERSA_HAC_FINH_12S_5X280 (MOD1 Array Configuration)
HAC Case Finite In-Homogeneous Hexagonal Lattice 12-cm Spheres 7X8X5 Packages

```
=CSAS26     PARM='SIZE=00900000'
CENTURY INDUSTRIES VERSA-PAK
44GR     INFHOM
'URANIUM METAL
U         1 0.00253829 294.0 92235 100.0 END
POLYETHYLENE    1  DEN=0.98  0.99746 294.0  END
'PARAFFIN       1  0.99746 294.0  END
'GRAPHITE   1 0.100 294.0  END
'INTERSPERSED MODERATOR
H2O          2 1.0  294.0  END
'PACKAGE STEEL
CARBONSTEEL  3 1.0  294.0  END
'REFLECTOR
H2O          4 1.0   294.0  END
'INSULATION
H2O          5 0.0001 294.0 END
END COMP
READ PARM  NUB=YES GEN=600 NPG=1000 NSK=5
END PARM
READ GEOMETRY

UNIT  10
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=6.24  Y=3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  11
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE  100  ORIGIN X=6.24  Y=3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  20
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
```

```
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  21
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  30
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=0.00  Y=-7.208  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  31
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=0.00  Y=-7.208  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  40
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=-3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  41
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=-3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
```

```
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT 50
HEXPRISM  10  26.9081  43.4768 -41.9307
MEDIA  4  1  10
BOUNDARY  10

UNIT 51
HEXPRISM  10  26.9081  41.9307 -43.4768
MEDIA  4  1  10
BOUNDARY  10

UNIT  100
SPHERE  1  12.00
MEDIA  1  1  1
BOUNDARY  1

GLOBAL
UNIT  1000
CUBOID  10  457.4377  0.00  380.0596  0.00
427.0375  0.00
ARRAY  1  10  PLACE 5 2 1  26.9081  26.9081
43.4768
CUBOID  20  487.9177  -30.48  410.5396 -30.48
457.5175  -30.48
MEDIA  4  10  20  -10
BOUNDARY  20
END GEOMETRY
READ ARRAY
GBL=1 ARA=1 TYP=TRIANGULAR NUX=13  NUY=10  NUZ=5
FILL
          51 51 51 51 51 51 51 51 51 51 51 51 51
         51 51 51 51 11 21 31 11 21 31 11 51 51
        51 51 51 51 31 11 21 31 11 21 31 51 51
       51 51 51 11 21 31 11 21 31 11 51 51 51
      51 51 51 31 11 21 31 11 21 31 51 51 51
     51 51 11 21 31 11 21 31 11 51 51 51 51
    51 51 31 11 21 31 11 21 31 51 51 51 51
   51 11 21 31 11 21 31 11 51 51 51 51 51
  51 31 11 21 31 11 21 31 51 51 51 51 51
 51 51 51 51 51 51 51 51 51 51 51 51 51
2Q130
          50 50 50 50 50 50 50 50 50 50 50 50 50
         50 50 50 50 10 20 30 10 20 30 10 50 50
        50 50 50 50 30 10 20 30 10 20 30 50 50
       50 50 50 10 20 30 10 20 30 10 50 50 50
      50 50 50 30 10 20 30 10 20 30 50 50 50
     50 50 10 20 30 10 20 30 10 50 50 50 50
    50 50 30 10 20 30 10 20 30 50 50 50 50
   50 10 20 30 10 20 30 10 50 50 50 50 50
  50 30 10 20 30 10 20 30 50 50 50 50 50
 50 50 50 50 50 50 50 50 50 50 50 50 50
1Q130
END FILL
END ARRAY
READ BOUNDS
ALL=VACUUM
END BOUNDS
END DATA
END
```

Input Case: VERSA_HAC_FINH_12S_6X288 (MOD1 Array Configuration)

HAC Case Finite In-Homogeneous Hexagonal Lattice 12-cm Spheres 6X8X6 Packages

```
=CSAS26     PARM='SIZE=00900000'
CENTURY INDUSTRIES VERSA-PAK
44GR     INFHOM
'URANIUM METAL
U         1 0.00253829 294.0 92235 100.0 END
POLYETHYLENE    1  DEN=0.98  0.99746 294.0  END
PARAFFIN        1  0.99746 294.0  END
'GRAPHITE   1 0.100 294.0  END
'INTERSPERSED MODERATOR
H2O          2 1.0  294.0  END
'PACKAGE STEEL
CARBONSTEEL  3 1.0  294.0  END
'REFLECTOR
H2O          4 1.0   294.0  END
'INSULATION
H2O          5 0.0001 294.0 END
END COMP
READ PARM  NUB=YES GEN=600 NPG=1000 NSK=5
END PARM
READ GEOMETRY

UNIT  10
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=6.24  Y=3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  11
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE  100  ORIGIN X=6.24  Y=3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
```

```
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  20
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  21
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  30
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=0.00  Y=-7.208  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  31
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=0.00  Y=-7.208  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  40
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=-3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  41
```

```
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=-3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT 50
HEXPRISM  10  26.9081  43.4768 -41.9307
MEDIA  4  1  10
BOUNDARY  10

UNIT 51
HEXPRISM  10  26.9081  41.9307 -43.4768
MEDIA  4  1  10
BOUNDARY  10

UNIT  100
SPHERE  1  12.00
MEDIA  1  1  1
BOUNDARY  1

GLOBAL
UNIT  1000
CUBOID  10  457.4377  0.00  380.0596  0.00
512.4450  0.00
ARRAY  1  10  PLACE 5 2 1  26.9081  26.9081
43.4768
CUBOID  20  487.9177  -30.48  410.5396 -30.48
542.9250  -30.48
MEDIA  4  10  20  -10
BOUNDARY  20
END GEOMETRY
READ ARRAY
GBL=1 ARA=1 TYP=TRIANGULAR NUX=13  NUY=10  NUZ=6
FILL
          51 51 51 51 51 51 51 51 51 51 51 51 51
         51 51 51 51 11 21 31 11 21 31 51 51 51
        51 51 51 51 31 11 21 31 11 21 51 51 51
       51 51 51 11 21 31 11 21 31 51 51 51 51
      51 51 51 31 11 21 31 11 21 51 51 51 51
     51 51 11 21 31 11 21 31 51 51 51 51 51
    51 51 31 11 21 31 11 21 51 51 51 51 51
   51 11 21 31 11 21 31 51 51 51 51 51 51
  51 31 11 21 31 11 21 51 51 51 51 51 51
 51 51 51 51 51 51 51 51 51 51 51 51 51
2Q130
          50 50 50 50 50 50 50 50 50 50 50 50 50
         50 50 50 50 10 20 30 10 20 30 50 50 50
        50 50 50 50 30 10 20 30 10 20 50 50 50
       50 50 50 10 20 30 10 20 30 50 50 50 50
      50 50 50 30 10 20 30 10 20 50 50 50 50
     50 50 10 20 30 10 20 30 50 50 50 50 50
    50 50 30 10 20 30 10 20 50 50 50 50 50
   50 10 20 30 10 20 30 50 50 50 50 50 50
  50 30 10 20 30 10 20 50 50 50 50 50 50
 50 50 50 50 50 50 50 50 50 50 50 50 50
2Q130
END FILL
END ARRAY
READ BOUNDS
ALL=VACUUM
END BOUNDS
END DATA
END
```

Input Case: VERSA_HAC_FINH_12S_7X322 (MOD1 Array Configuration)
HAC Case Finite In-Homogeneous Hexagonal Lattice 12-cm Spheres 7/6X7X7 Packages

```
=CSAS26     PARM='SIZE=00900000'
CENTURY INDUSTRIES VERSA-PAK
44GR     INFHOM
'URANIUM METAL
U         1 0.00253829 294.0 92235 100.0 END
POLYETHYLENE    1  DEN=0.98  0.99746 294.0  END
PARAFFIN        1  0.99746 294.0  END
'GRAPHITE   1 0.100 294.0  END
'INTERSPERSED MODERATOR
H2O          2 1.0  294.0  END
'PACKAGE STEEL
CARBONSTEEL  3 1.0  294.0  END
'REFLECTOR
H2O          4 1.0   294.0  END
'INSULATION
H2O          5 0.0001 294.0 END
END COMP
READ PARM  NUB=YES GEN=600 NPG=1000 NSK=5
END PARM
READ GEOMETRY

UNIT  10
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=6.24  Y=3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  11
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE  100  ORIGIN X=6.24  Y=3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
```

```
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  20
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  21
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  30
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=0.00  Y=-7.208  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  31
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=0.00  Y=-7.208  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  40
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=-3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
```

```
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  41
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=-3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT 50
HEXPRISM  10  26.9081  43.4768 -41.9307
MEDIA  4  1  10
BOUNDARY  10

UNIT 51
HEXPRISM  10  26.9081  41.9307 -43.4768
MEDIA  4  1  10
BOUNDARY  10

UNIT  100
SPHERE  1  12.00
MEDIA  1  1  1
BOUNDARY  1

GLOBAL
UNIT  1000
CUBOID  10  403.6215  0.00  333.4534  0.00
597.8525  0.00
ARRAY  1  10  PLACE 5 2 1  26.9081  26.9081
43.4768
CUBOID  20  434.1015  -30.48  363.9334 -30.48
628.3325  -30.48
MEDIA  4  10  20  -10
BOUNDARY  20
END GEOMETRY
READ ARRAY
GBL=1 ARA=1 TYP=TRIANGULAR NUX=12  NUY=9  NUZ=7
FILL
         51 51 51 51 51 51 51 51 51 51 51 51
        51 51 51 51 11 21 31 11 21 31 11 51
       51 51 51 51 31 11 21 31 11 21 51 51
      51 51 51 11 21 31 11 21 31 11 51 51
     51 51 51 31 11 21 31 11 21 51 51 51
    51 51 11 21 31 11 21 31 11 51 51 51
   51 51 31 11 21 31 11 21 51 51 51 51
  51 11 21 31 11 21 31 11 51 51 51 51
 51 51 51 51 51 51 51 51 51 51 51 51
3Q108
         50 50 50 50 50 50 50 50 50 50 50 50
        50 50 50 50 10 20 30 10 20 30 10 50
       50 50 50 50 30 10 20 30 10 20 50 50
      50 50 50 10 20 30 10 20 30 10 50 50
     50 50 50 30 10 20 30 10 20 50 50 50
    50 50 10 20 30 10 20 30 10 50 50 50
   50 50 30 10 20 30 10 20 50 50 50 50
  50 10 20 30 10 20 30 10 50 50 50 50
 50 50 50 50 50 50 50 50 50 50 50 50
2Q108
END FILL
END ARRAY
READ BOUNDS
ALL=VACUUM
END BOUNDS
END DATA
END
```

Input Case: VERSA_HAC_FINH_12S_8X312 (MOD1 Array Configuration)
HAC Case Finite In-Homogeneous Hexagonal Lattice 12-cm Spheres 6/5X7X8 Packages

```
=CSAS26     PARM='SIZE=00900000'
CENTURY INDUSTRIES VERSA-PAK
44GR     INFHOM
'URANIUM METAL
U         1 0.00253829 294.0 92235 100.0 END
POLYETHYLENE    1  DEN=0.98  0.99746 294.0  END
'PARAFFIN       1  0.99746 294.0  END
'GRAPHITE   1 0.100 294.0  END
'INTERSPERSED MODERATOR
H2O          2 1.0  294.0  END
'PACKAGE STEEL
CARBONSTEEL  3 1.0  294.0  END
'REFLECTOR
H2O          4 1.0   294.0  END
'INSULATION
H2O          5 0.0001 294.0 END
END COMP
READ PARM  NUB=YES GEN=600 NPG=1000 NSK=5
END PARM
READ GEOMETRY

UNIT  10
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=6.24  Y=3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  11
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
```

```
HOLE  100  ORIGIN X=6.24  Y=3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  20
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  21
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  30
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=0.00  Y=-7.208  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  31
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=0.00  Y=-7.208  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  40
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=-3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
```

```
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  41
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=-3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT 50
HEXPRISM  10  26.9081  43.4768 -41.9307
MEDIA  4  1  10
BOUNDARY  10

UNIT 51
HEXPRISM  10  26.9081  41.9307 -43.4768
MEDIA  4  1  10
BOUNDARY  10

UNIT  100
SPHERE  1  12.00
MEDIA  1  1  1
BOUNDARY  1

GLOBAL
UNIT  1000
CUBOID  10  403.6215  0.00  333.4534  0.00
683.2600  0.00
ARRAY  1  10  PLACE 5 2 1  26.9081  26.9081
43.4768
CUBOID  20  434.1015  -30.48  363.9334 -30.48
713.7400  -30.48
MEDIA  4  10  20  -10
BOUNDARY  20
END GEOMETRY
READ ARRAY
GBL=1 ARA=1 TYP=TRIANGULAR NUX=12  NUY=9  NUZ=8
FILL
         51 51 51 51 51 51 51 51 51 51 51 51
        51 51 51 51 11 21 31 11 21 31 51 51
       51 51 51 51 31 11 21 31 11 51 51 51
      51 51 51 11 21 31 11 21 31 51 51 51
     51 51 51 31 11 21 31 11 51 51 51 51
    51 51 11 21 31 11 21 31 51 51 51 51
   51 51 31 11 21 31 11 51 51 51 51 51
  51 11 21 31 11 21 31 51 51 51 51 51
 51 51 51 51 51 51 51 51 51 51 51 51
3Q108
         50 50 50 50 50 50 50 50 50 50 50 50
        50 50 50 50 10 20 30 10 20 30 50 50
       50 50 50 50 30 10 20 30 10 50 50 50
      50 50 50 10 20 30 10 20 30 50 50 50
     50 50 50 30 10 20 30 10 50 50 50 50
    50 50 10 20 30 10 20 30 50 50 50 50
   50 50 30 10 20 30 10 50 50 50 50 50
  50 10 20 30 10 20 30 50 50 50 50 50
 50 50 50 50 50 50 50 50 50 50 50 50
3Q108
END FILL
END ARRAY
READ BOUNDS
ALL=VACUUM
END BOUNDS
END DATA
END
```

Input Case: VERSA_HAC_FINH_12S_9X324 (MOD1 Array Configuration)
HAC Case Finite In-Homogeneous Hexagonal Lattice 12-cm Spheres 6X7X9 Packages

```
=CSAS26     PARM='SIZE=00900000'
CENTURY INDUSTRIES VERSA-PAK
44GR     INFHOM
'URANIUM METAL
U         1 0.00253829 294.0 92235 100.0 END
POLYETHYLENE    1  DEN=0.98  0.99746 294.0  END
'PARAFFIN        1  0.99746 294.0  END
'GRAPHITE   1 0.100 294.0  END
'INTERSPERSED MODERATOR
H2O         2 1.0  294.0  END
'PACKAGE STEEL
CARBONSTEEL  3 1.0  294.0  END
'REFLECTOR
H2O         4 1.0   294.0  END
'INSULATION
H2O         5 0.0001 294.0 END
END COMP
READ PARM  NUB=YES GEN=600 NPG=1000 NSK=5
END PARM
READ GEOMETRY

UNIT  10
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=6.24  Y=3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
```

```
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  11
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE  100  ORIGIN X=6.24  Y=3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  20
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  21
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  30
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=0.00  Y=-7.208  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  31
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=0.00  Y=-7.208  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12
```

```
UNIT  40
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=-3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  41
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=-3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT 50
HEXPRISM  10  26.9081  43.4768 -41.9307
MEDIA  4  1  10
BOUNDARY  10

UNIT 51
HEXPRISM  10  26.9081  41.9307 -43.4768
MEDIA  4  1  10
BOUNDARY  10

UNIT  100
SPHERE  1  12.00
MEDIA  1  1  1
BOUNDARY  1

GLOBAL
UNIT  1000
CUBOID  10  349.8053  0.00  286.8472  0.00
768.6675  0.00
ARRAY  1  10  PLACE 4 2 1  26.9081  26.9081
43.4768
CUBOID  20  380.2853  -30.48  317.8472 -30.48
799.1475  -30.48
MEDIA  4  10  20  -10
BOUNDARY  20
END GEOMETRY
READ ARRAY
GBL=1 ARA=1 TYP=TRIANGULAR NUX=10  NUY=8  NUZ=9
FILL
        51 51 51 51 51 51 51 51 51 51
       51 51 51 11 21 31 11 21 31 51
      51 51 51 31 11 21 31 11 21 51
     51 51 11 21 31 11 21 31 51 51
    51 51 31 11 21 31 11 21 51 51
   51 11 21 31 11 21 31 51 51 51
  51 31 11 21 31 11 21 51 51 51
 51 51 51 51 51 51 51 51 51 51
4Q80
        50 50 50 50 50 50 50 50 50 50
       50 50 50 10 20 30 10 20 30 50
      50 50 50 30 10 20 30 10 20 50
     50 50 10 20 30 10 20 30 50 50
    50 50 30 10 20 30 10 20 50 50
   50 10 20 30 10 20 30 50 50 50
  50 30 10 20 30 10 20 50 50 50
 50 50 50 50 50 50 50 50 50 50
3Q80
END FILL
END ARRAY
READ BOUNDS
ALL=VACUUM
END BOUNDS
END DATA
END
```

Input Case: VERSA_HAC_FINH_12S_10X300 (MOD1 Array Configuration)
HAC Case Finite In-Homogeneous Hexagonal Lattice 12-cm Spheres 5X5X10 Packages

```
=CSAS26     PARM='SIZE=00900000'
CENTURY INDUSTRIES VERSA-PAK
44GR     INFHOM
'URANIUM METAL
U         1 0.00253829 294.0 92235 100.0 END
POLYETHYLENE    1  DEN=0.98  0.99746 294.0  END
PARAFFIN        1  0.99746 294.0  END
'GRAPHITE   1 0.100 294.0  END
'INTERSPERSED MODERATOR
H2O          2 1.0  294.0  END
'PACKAGE STEEL
CARBONSTEEL  3 1.0  294.0  END
'REFLECTOR
H2O          4 1.0   294.0  END
'INSULATION
H2O          5 0.0001 294.0 END
END COMP
READ PARM  NUB=YES GEN=600 NPG=1000 NSK=5
END PARM
READ GEOMETRY

UNIT  10
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=6.24  Y=3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
```

```
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  11
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE  100  ORIGIN X=6.24  Y=3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  20
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  21
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  30
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=0.00  Y=-7.208  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  31
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=0.00  Y=-7.208  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
```

```
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  40
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=-3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  41
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=-3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT 50
HEXPRISM  10  26.9081  43.4768 -41.9307
MEDIA  4  1  10
BOUNDARY  10

UNIT 51
HEXPRISM  10  26.9081  41.9307 -43.4768
MEDIA  4  1  10
BOUNDARY  10

UNIT  100
SPHERE  1  12.00
MEDIA  1  1  1
BOUNDARY  1

GLOBAL
UNIT  1000
CUBOID  10  349.8053  0.00  286.8472  0.00
854.0750  0.00
ARRAY  1  10  PLACE 4 2 1  26.9081  26.9081
43.4768
CUBOID  20  380.2853  -30.48  317.8472 -30.48
884.5550  -30.48
MEDIA  4  10  20  -10
BOUNDARY  20
END GEOMETRY
READ ARRAY
GBL=1 ARA=1 TYP=TRIANGULAR NUX=10  NUY=8  NUZ=10
FILL
        51 51 51 51 51 51 51 51 51 51
       51 51 51 11 21 31 11 21 51 51
      51 51 51 31 11 21 31 11 51 51
     51 51 11 21 31 11 21 51 51 51
    51 51 31 11 21 31 11 51 51 51
   51 11 21 31 11 21 51 51 51 51
  51 31 11 21 31 11 51 51 51 51
 51 51 51 51 51 51 51 51 51 51
4Q80
        50 50 50 50 50 50 50 50 50 50
       50 50 50 10 20 30 10 20 50 50
      50 50 50 30 10 20 30 10 50 50
     50 50 10 20 30 10 20 50 50 50
    50 50 30 10 20 30 10 50 50 50
   50 10 20 30 10 20 50 50 50 50
  50 30 10 20 30 10 50 50 50 50
 50 50 50 50 50 50 50 50 50 50
4Q80
END FILL
END ARRAY
READ BOUNDS
ALL=VACUUM
END BOUNDS
END DATA
END
```

Input Case: VERSA_HAC_FINH_12S_12X300 (MOD1 Array Configuration)
HAC Case Finite In-Homogeneous Hexagonal Lattice 12-cm Spheres 5X4X12 Packages

```
=CSAS26     PARM='SIZE=00900000'
CENTURY INDUSTRIES VERSA-PAK
44GR     INFHOM
'URANIUM METAL
U         1 0.00253829 294.0 92235 100.0 END
POLYETHYLENE    1  DEN=0.98  0.99746 294.0  END
'PARAFFIN       1  0.99746 294.0  END
'GRAPHITE   1 0.100 294.0  END
'INTERSPERSED MODERATOR
H2O          2 1.0  294.0  END
'PACKAGE STEEL
CARBONSTEEL  3 1.0  294.0  END
'REFLECTOR
H2O          4 1.0   294.0  END
'INSULATION
H2O          5 0.0001 294.0 END
END COMP
READ PARM  NUB=YES GEN=600 NPG=1000 NSK=5
END PARM
READ GEOMETRY

UNIT  10
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=6.24  Y=3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
```

```
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  11
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE  100  ORIGIN X=6.24  Y=3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  20
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  21
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  30
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=0.00  Y=-7.208  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  31
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=0.00  Y=-7.208  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
```

```
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  40
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=-3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  41
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=-3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  5  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  5  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  5  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  5  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  5  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT 50
HEXPRISM  10  26.9081  43.4768 -41.9307
MEDIA  4  1  10
BOUNDARY  10

UNIT 51
HEXPRISM  10  26.9081  41.9307 -43.4768
MEDIA  4  1  10
BOUNDARY  10

UNIT  100
SPHERE  1  12.00
MEDIA  1  1  1
BOUNDARY  1

GLOBAL
UNIT  1000
CUBOID  10  295.9891  0.00  240.2410  0.00
1024.8900  0.00
ARRAY  1  10  PLACE 4 2 1  26.9081  26.9081
43.4768
CUBOID  20  326.4691  -30.48  270.7210 -30.48
1055.3700  -30.48
MEDIA  4  10  20  -10
BOUNDARY  20
END GEOMETRY
READ ARRAY
GBL=1 ARA=1 TYP=TRIANGULAR NUX=9  NUY=7  NUZ=12
FILL
       51 51 51 51 51 51 51 51 51
      51 51 51 11 21 31 11 21 51
     51 51 51 31 11 21 31 11 51
    51 51 11 21 31 11 21 51 51
   51 51 31 11 21 31 11 51 51
  51 11 21 31 11 21 51 51 51
 51 51 51 51 51 51 51 51 51
5Q63
       50 50 50 50 50 50 50 50 50
      50 50 50 10 20 30 10 20 50
     50 50 50 30 10 20 30 10 50
    50 50 10 20 30 10 20 50 50
   50 50 30 10 20 30 10 50 50
  50 10 20 30 10 20 50 50 50
 50 50 50 50 50 50 50 50 50
5Q63
END FILL
END ARRAY
READ BOUNDS
ALL=VACUUM
END BOUNDS
END DATA
END
```

MULTIREGION Input Case: VERSA_HAC_FINH_12S_4X272_MR (MOD1 Array Configuration)
HAC Case Finite In-Homogeneous Hexagonal Lattice 12-cm Spheres 8/7X9X4 Packages

```
=CSAS26     PARM='SIZE=1000000'
CENTURY INDUSTRIES VERSA-PAK
44GR     INFHOM
'URANIUM METAL
U         1 0.00253829 294.0 92235 100.0 END
'PARAFFIN  1  0.99746  294.0  END
POLYETHYLENE    1  DEN=0.98  0.99746 294.0  END
'GRAPHITE   1 0.100 294.0  END
'INTERSPERSED MODERATOR
H2O          2 1.0  294.0  END
'PACKAGE STEEL
CARBONSTEEL  3 1.0  294.0  END
'REFLECTOR
H2O          4 1.0   294.0  END
'PAYLOAD CAVITY
H2O          5 0.0001 294.0 END
'RADIAL CAVITY
H2O          6 0.0001 294.0 END
'TOP BOTTOM CAVITY
H2O          7 0.0001 294.0 END
'RADIAL INNER OUTER CAVITY
H2O          8 0.0001 294.0 END
```

```
'PACKAGE EXTERIOR
H2O          9 0.0001 294.0 END
END COMP
READ PARM  NUB=YES GEN=600 NPG=1000 NSK=5
END PARM
READ GEOMETRY

UNIT  10
CYLINDER  1  19.2088 34.5281 -34.5281
'PAYLOAD
MEDIA  5  1  1
HOLE   100  ORIGIN  X=6.24  Y=3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
'PAYLOAD RADIAL INSULATION
MEDIA  6  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
'TOP INSULATION
MEDIA  7  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
'TOP/BOTTOM INSULATION
MEDIA  7  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
'INNER/OUTER RADIAL LINER INSULATION
MEDIA  8  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
'EXTERIOR MODERATION
MEDIA  9  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  11
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE  100  ORIGIN X=6.24  Y=3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  6  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  7  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  7  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  8  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  9  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  20
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=3.60  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  6  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  7  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  7  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  8  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  9  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  21
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=-6.24  Y=3.60  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  6  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  7  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  7  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  8  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  9  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  30
CYLINDER  1  19.2088 34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=0.00  Y=-7.208  Z=-22.528
CYLINDER  2  19.5163  34.5281  -34.8357
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.5281  -34.8357
MEDIA  6  1  3  -2  -1
CYLINDER  4  25.8663  35.7727  -34.8357
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  36.8560  -34.8357
MEDIA  7  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  36.9914  -34.8357
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  43.3414  -41.1857
MEDIA  7  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  43.3414  -41.7953
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374  43.3414  -41.7963
MEDIA  8  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727  43.3414  -41.7953
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081  43.4768  -41.9307
```

```
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081  43.4768  -41.9307
MEDIA  9  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT  31
CYLINDER  1  19.2088  34.5281 -34.5281
MEDIA  5  1  1
HOLE   100  ORIGIN  X=0.00  Y=-7.208  Z=22.528
CYLINDER  2  19.5163  34.8357  -34.5281
MEDIA  3  1  2  -1
CYLINDER  3  25.8663  34.8357  -34.5281
MEDIA  6  1  3  -2  -1
CYLINDER  4  25.8663  34.8357  -35.7727
MEDIA  3  1  4  -3  -2  -1
CYLINDER  5  25.8663  34.8357  -36.8560
MEDIA  7  1  5  -4  -3  -2  -1
CYLINDER  6  25.8663  34.8357  -36.9914
MEDIA  3  1  6  -5  -4  -3  -2  -1
CYLINDER  7  25.8663  41.1857  -43.3414
MEDIA  7  1  7  -6  -5  -4  -3  -2  -1
CYLINDER  8  26.0017  41.7953  -43.3414
MEDIA  3  1  8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  9  26.6374 41.7963  -43.3414
MEDIA  8  1  9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  10  26.7727 41.7953  -43.3414
MEDIA  3  1  10  -9  -8  -7  -6  -5  -4  -3  -2  -1
CYLINDER  11  26.9081 41.9307  -43.4768
MEDIA  3  1  11 -10  -9  -8  -7  -6  -5  -4  -3  -2
-1
HEXPRISM  12  26.9081 41.9307  -43.4768
MEDIA  9  1  12 -11 -10  -9  -8  -7  -6  -5  -4  -3
-2  -1
BOUNDARY  12

UNIT 50
HEXPRISM  10  26.9081  43.4768 -41.9307
MEDIA  4  1  10
BOUNDARY  10

UNIT 51
HEXPRISM  10  26.9081  41.9307 -43.4768
MEDIA  4  1  10
BOUNDARY  10

UNIT  100
SPHERE  1  12.00
MEDIA  1  1  1
BOUNDARY  1

GLOBAL
```

```
UNIT  1000
CUBOID  10  511.2639  0.00  426.6658  0.00
341.6300  0.00
ARRAY  1  10  PLACE 6 2 1  26.9081  26.9081
43.4768
CUBOID  20  541.7339  -30.48  457.1458 -30.48
372.1100  -30.48
MEDIA  4  10  20  -10
BOUNDARY  20
END GEOMETRY
READ ARRAY
GBL=1 ARA=1 TYP=TRIANGULAR NUX=15  NUY=11  NUZ=4
FILL
           51 51 51 51 51 51 51 51 51 51 51 51 51
51 51
          51 51 51 51 51 11 21 31 11 21 31 11 21 51
51
         51 51 51 51 51 31 11 21 31 11 21 31 51 51
51
        51 51 51 51 11 21 31 11 21 31 11 21 51 51
51
       51 51 51 51 31 11 21 31 11 21 31 51 51 51 51
      51 51 51 11 21 31 11 21 31 11 21 51 51 51 51
     51 51 51 31 11 21 31 11 21 31 51 51 51 51 51
    51 51 11 21 31 11 21 31 11 21 51 51 51 51 51
   51 51 31 11 21 31 11 21 31 51 51 51 51 51 51
  51 11 21 31 11 21 31 11 21 51 51 51 51 51 51
 51 51 51 51 51 51 51 51 51 51 51 51 51 51 51
1Q165
           50 50 50 50 50 50 50 50 50 50 50 50 50
50 50
          50 50 50 50 50 10 20 30 10 20 30 10 20 50
50
         50 50 50 50 50 30 10 20 30 10 20 30 50 50
50
        50 50 50 50 10 20 30 10 20 30 10 20 50 50
50
       50 50 50 50 30 10 20 30 10 20 30 50 50 50 50
      50 50 50 10 20 30 10 20 30 10 20 50 50 50 50
     50 50 50 30 10 20 30 10 20 30 50 50 50 50 50
    50 50 10 20 30 10 20 30 10 20 50 50 50 50 50
   50 50 30 10 20 30 10 20 30 50 50 50 50 50 50
  50 10 20 30 10 20 30 10 20 50 50 50 50 50 50
 50 50 50 50 50 50 50 50 50 50 50 50 50 50 50
1Q165
END FILL
END ARRAY
READ BOUNDS
ALL=VACUUM
END BOUNDS
END DATA
END
```

6.9.3 Section 6.9.3 – Reference [6-1] Richard Montgomery – Validation of Scale PC for HEU Systems

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