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DESIGN CALCULATION

PROPRIETARY

PRIVATE FUEL STORAGE SKYSHINE II

ISFSI DOSE RATE CALCULATION

(4000 Casks)

CONTROLLED
#2

APPROVED BY: William McCrosky DATE: 4/10/97

PREPARED BY

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1.0 PURPOSE

The purpose of these calculations is to determine the gamma and neutron dose rates as a function of distance from the boundary (security fence) of the Private Fuel Storage ISFSI. The calculations are based on a cask array containing 4000 casks that are loaded with 40 GWd/MTU - 10 year cooled PWR fuel. These calculations are based upon the preliminary ISFSI layout provided by Stone & Webster Engineering Corp. (Ref. 1).

Since a PWR basket loaded with design basis fuel produces higher dose rates on the storage cask surface than a BWR basket containing design basis BWR fuel (Ref. 2), the PWR case will be bounding. Also, the assumed 10 year cooling time is extremely conservative, since the fully loaded PFS ISFSI is expected to have an average spent fuel cooling time that is well over 20 years. The minimum cooling time required to ship 40 GWd/MTU PWR fuel to the PFS ISFSI is 7 years (Ref. 3), just three years under the assumed average cooling time. The potential effects of higher burnup fuel on ISFSI dose rates is also discussed in this document.

The gamma and neutron dose rates are calculated at a large number of distances from the ISFSI security fence. Studied distances range from zero to ~2000 feet (600 m) from the fence. Dose rates due to radiation leaving the cask side surfaces (direct + scattered) and dose rates due to radiation leaving the cask top surfaces (scattered only) are determined separately. The PFS ISFSI may employ a berm to reduce dose rates around the ISFSI. Dose rates are calculated for an ISFSI with and without a berm present.

This ISFSI dose rate calculation is very similar to the one presented in SNC Document # PFS01.10.02.02 (Ref. 4). The only difference between the two calculations is that this calculation uses the SKYSHINE II particle scattering code, whereas the Ref. 4 calculations were based on the MCNP monte-carlo shielding code. These calculations were performed to obtain a second set of dose rate predictions and to compare the results of the two codes.

Regulations require that the dose rate be under 25 mrem/year at the site boundary (which is 600 m from the security fence) assuming a 2000 hour/year occupancy factor. A dose rate under 2 mrem/hour at the security fence is also desired. A dose rate calculation for the "nearest neighbor" (10,000 feet from the security fence) is also required. It is desired that both codes (SKYSHINE II and MCNP) predict dose rates under the regulatory (or desired) limits at these three locations.

2.0 RESULTS/CONCLUSIONS

The dose rate contributions from four components, gammas leaving the cask sides, neutrons leaving the cask sides, gammas leaving the cask tops, and neutrons leaving the cask tops, are listed separately in Table 1 for the 4000 cask ISFSI. The dose rate contributions are shown for a large number of distances (from the ISFSI security fence).

Based on the Table 1 results, the total gamma and neutron dose rates (as a function of distance) can be determined. These results are shown in Table 2. The Table 2 results correspond to an ISFSI with no berm present. The dose rate results for an ISFSI with a berm present are shown in Table 3. For the no-berm case, the components shown in Table 1 are simply summed to yield the total dose rate. For the berm case, the same is true except that the cask side gamma and neutron dose rate components are simply not included in the total dose rate results. The berm will totally block the direct radiation leaving the cask sides from reaching the detector locations outside the berm.

TABLE 1

DOSE RATE COMPONENTS (VS. DISTANCE)
FOR THE PFS ISFSI
(mrem/hr)

Distance to Detector (feet)	Gamma Dose Rate From Cask Sides	Neutron Dose Rate From Cask Sides	Gamma Dose Rate From Cask Tops	Neutron Dose Rate From Cask Tops
0	2.660E-01	1.373E-03	1.846E-01	2.955E-03
50	1.860E-01	9.349E-04	1.344E-01	2.172E-03
100	1.564E-01	7.768E-04	1.070E-01	1.750E-03
200	1.079E-01	5.235E-04	6.777E-02	1.137E-03
328 (100 m)	6.496E-02	3.060E-04	3.790E-02	6.563E-04
500	3.173E-02	1.433E-04	1.771E-02	3.199E-04
1000	4.992E-03	2.120E-05	2.953E-03	5.897E-05
1500	1.112E-03	4.795E-06	9.380E-04	2.006E-05
1968.5 (600 m)	4.489E-04	1.953E-06	7.460E-04	1.617E-05

TABLE 2

TOTAL DOSE RATES VS. DISTANCE
FOR THE PFS ISFSI - WITHOUT BERM
(mrem/hr)

Distance to Detector (feet)	Total Gamma Dose Rate	Total Neutron Dose Rate	Total Dose Rate
0	4.506E-01	4.328E-03	4.549E-01
50	3.204E-01	3.107E-03	3.235E-01
100	2.634E-01	2.527E-03	2.659E-01
200	1.757E-01	1.661E-03	1.773E-01
328 (100 m)	1.029E-01	9.623E-04	1.038E-01
500	4.944E-02	4.632E-04	4.990E-02
1000	7.945E-03	8.017E-05	8.025E-03
1500	2.050E-03	2.486E-05	2.075E-03
1968.5 (600 m)	1.195E-03	1.812E-05	1.213E-03

TABLE 3

TOTAL DOSE RATES VS. DISTANCE
FOR THE PFS ISFSI - WITH BERM
(mrem/hr)

Distance to Detector (feet)	Total Gamma Dose Rate	Total Neutron Dose Rate	Total Dose Rate
0	1.846E-01	2.955E-03	1.876E-01
50	1.344E-01	2.172E-03	1.366E-01
100	1.070E-01	1.750E-03	1.088E-01
200	6.777E-02	1.137E-03	6.891E-02
328 (100 m)	3.790E-02	6.563E-04	3.856E-02
500	1.771E-02	3.199E-04	1.803E-02
1000	2.953E-03	5.897E-05	3.012E-03
1500	9.380E-04	2.006E-05	9.581E-04
1968.5 (600 m)	7.460E-04	1.617E-05	7.622E-04

The total dose rate at the controlled area boundary must be under 25 mrem/year, based on a 2000 hour/year occupancy factor. This corresponds to a limiting total dose rate of 0.0125 mrem/hour. The results show that the total dose rate at the proposed PFS boundary 600 m from the security fence is below the above limit by a very wide margin (more than an order of magnitude). This is true whether a berm is present or not. The results shown in Tables 2 and 3 also suggest that the controlled area boundary could be as close as 1000 feet from the security fence, with or without a berm present. The presence of a berm does not dramatically reduce the required distance because the scattered radiation from the cask top surfaces ("skyshine") contributes significantly to the overall dose rate and because the dose rate is a very strong function of distance.

As discussed in Section 4, the ISFSI dose rate is determined, through a straightforward arithmetic calculation, from the single cask dose rate vs. distance results shown in Table 4 of Section 3. The dose rate results shown in Table 4 were calculated using the SKYSHINE II code. SKYSHINE II single cask dose rate results are only available out to 2000 ft. from the cask (see Section 4). For casks that are more than 2000 ft. from the detector, the 2000 ft. dose rate values are conservatively used. In the case where the detector is ~2000 ft. from the security fence, many of the casks in the ISFSI are more than 3000 ft. from the detector. The dose rate results presented in Table 4 of Ref. 4, and the 1000 and 2000 ft. dose rate results presented in Table 4 of this document show that the dose rates fall off by more than an order of magnitude for each additional 1000 feet of distance. Thus, assuming a distance of 2000 ft. for all casks that are further than 2000 ft. will yield a large amount of conservatism in the ISFSI dose rate calculation.

Comparing the SKYSHINE II single cask dose rate vs. distance data shown in Table 4 of this document with the corresponding MCNP values shown in Table 4 of Ref. 4 shows the following. For the cask side gamma dose rate contributions, the codes agree fairly well with each other. They remain within a factor of two of each other throughout the distance range, with different codes predicting higher dose rates at different distances within the range. At the 2000 ft. distance, SKYSHINE II predicts a cask side gamma dose rate that is 33% higher than that predicted by MCNP. The codes also agree relatively well with respect to the cask top gamma dose rate contributions. The results show that MCNP predicts dose rates that are about 50% to a factor of two higher than those predicted by SKYSHINE II for most distances. The results show, however, that for the critical 2000 ft. distance, SKYSHINE II over-predicts MCNP by 17%.

For neutron dose rates, however, there is a substantial disagreement between the two codes. For cask side neutron dose rate contributions, MCNP predicts dose rates that are about a factor of 20 higher than those predicted by SKYSHINE II over the entire distance range. For the cask top neutron dose rate contribution, the disagreement is even stronger for the lower distances. For the cask top neutron dose rate, MCNP over-predicts SKYSHINE II by a factor of 500 for closer distances (~50 ft.) and over-predicts SKYSHINE II by a factor of 20 at the 2000 ft. distance.

The above differences show up in the final ISFSI dose rate results for the two codes. Table 1 of this document shows that neutron dose rates do not significantly contribute to the overall ISFSI dose rate. Table 1 of Ref. 4, however, shows that the cask top neutron dose rate contribution is the single largest contributor to the ISFSI dose rate. Given the relative agreement on gamma dose rates, and MCNP's much higher neutron dose rate predictions, one would expect MCNP to yield higher overall ISFSI dose rates. Comparing Tables 2 and 3 of this document to Tables 2 and 3 of Ref. 4 shows that this is the case over most of the distance range, with MCNP predicting ISFSI total dose rates that are about a factor of four higher than those predicted by SKYSHINE II. However, the SKYSHINE II dose rates fall off much less between 1000 and 2000 ft. than do the MCNP results. In fact, at 2000 ft., the codes roughly agree with one another with SKYSHINE II over-predicting MCNP by 3%.

The SKYSHINE II results "catch up" with the MCNP results between 1000 and 2000 ft. because, in the SKYSHINE II ISFSI dose calculations, the 2000 ft. dose rate values are assumed for all casks that are over 2000 ft. from the detector. As the detector moves from 1000 ft. (from the security fence) to 2000 ft., a significant number of casks in the ISFSI become significantly more than 2000 ft. from the detector. Thus, the conservative 2000 ft. assumption starts to significantly impact the SKYSHINE II dose rate calculation. At a 2000 ft. detector distance, this conservative effect is enough to cancel the effect of MCNP's higher neutron dose rate predictions. In Section 2 of Ref. 4, a dose rate based on assuming the 2000 ft. results for all casks beyond 2000 ft. was calculated (based on MCNP results). The calculated total ISFSI dose rate, using this assumption, for a detector distance of 2000 ft was 5.0×10^{-3} mrem/hr. This is about a factor of four higher than the 2000 ft. dose rate calculated by SKYSHINE II (as shown in Table 2). This is exactly consistent with the level of MCNP over-prediction that occurs over the rest of the distance range.

As stated in Section 1, the dose rate results are based upon 40 GWd/MTU PWR fuel with a cooling time of 10 years. Since gamma dose rates fall of rapidly with time, and because the average cooling time for fuel in the PFS ISFSI is well over 20 years, the design basis case described above will clearly give conservative gamma dose rate predictions for the ISFSI. This is less clear, however, for neutrons, because 1) neutron dose rates decay slowly with time; 2) neutron source strengths (and therefore dose rates) are a very strong function of burnup, and; 3) fuel burnup levels as high as 60 GWd/MTU may be stored in the PFS ISFSI.

According to the OCRWM Spent Fuel Computer Database (Ref. 5), the neutron source strength for 60 GWd/MTU - 15 year cooled PWR fuel is higher than the 40 GWd/MTU - 10 year cooled fuel neutron source strength used in this analysis by a factor of ~2.3. This is the minimum required cooling time for shipping 60 GWd/MTU fuel in the TranStor™ shipping cask (Ref. 3). The gamma source strengths for the 60 GWd/MTU - 15 year case are bounded by the gamma source strengths for the 40 GWd/MTU case. If the ISFSI neutron dose rates (which make up a small fraction of the total) are multiplied by 2.3, and the gamma dose rates are left unchanged, the calculated 600 m dose rates are still well under the regulatory limit of 0.0125 mrem/hr. The dose rates would remain under the regulatory limit even if the bounding approach of assuming all casks are 2000 ft. from the detector is used. Therefore, storage of any amount of fuel with burnup levels up to 60 GWd/MTU in the PFS ISFSI will not cause regulatory dose rate limits to be exceeded at the proposed 600 m site boundary.

In support of calculating the dose rate at the location of the nearest neighbor to the ISFSI, a dose rate calculation for a distance of 10,000 feet is also desired. However, SKYSHINE II single cask dose rate vs. distance results are not available for distances greater than 2000 feet. However, an upper bound estimate of the dose rate at 10,000 ft. can be made using the approach described below.

The maximum occupancy factor of 8766 hours/year is assumed for the nearest neighbor location. At this occupancy factor, the dose rate at ~2000 feet (600 m) is about 11 mrem/year, even if the ultra-conservative bounding approach (all casks at 2000 feet) is used. The results shown in Tables 1-4 of this document and Ref. 4 also clearly show that the dose rates decrease by at least a factor of 5 for every additional 1000 feet of distance from the ISFSI (for distances over 1000 feet). Therefore, an upper bound estimate for the 10,000 foot dose rate would be only 3.0×10^{-5} mrem/year (11 mrem/year divided by 5.0 to the eighth power). This extrapolation out to 10,000 feet does involve a significant amount of uncertainty. It can, however, be stated with an extremely high confidence level that the dose rate at the 10,000 foot distance is much less than 0.1 mrem/year.

3.0 DESIGN INPUT AND ASSUMPTIONS

The only significant design input data to this calculation is the single cask dose rate vs. distance data for the four dose rate components described in Sections 1 and 2. Dose rate vs. distance data for a single TranStor™ storage cask loaded with 40 GWd/MTU - 5 year cooled PWR fuel is given in Refs. 6 and 7. These dose rates were calculated by adjusting dose rate vs. distance data previously calculated for the VSC-24 storage cask using the SKYSHINE II code (Ref. 8). The dose rates calculated (for each distance) for the VSC-24 cask were multiplied by the ratio of surface dose rates (TranStor™ over VSC-24) to yield dose rate vs. distance data for the TranStor™ storage cask. The dose rate ratios were based upon VSC-24 storage cask surface dose rates from Ref. 9 and TranStor™ storage cask surface dose rates from Ref. 2. The dose rates for each of the four contributions were multiplied by the dose rate ratio for the corresponding cask surface and radiation type. The single TranStor™ cask dose rate vs. distance data (from Refs. 6 and 7) is shown below in Table 4.

TABLE 4

DOSE RATE VS. DISTANCE
FROM A SINGLE TRANSTOR™ STORAGE CASK
CONTAINING 40 GWd/MTU - 5 YEAR COOLED PWR FUEL
(mrem/hr)

Distance From Cask Side	Cask Side Gamma Dose Rate	Cask Side Neutron Dose Rate	Cask Top Gamma Dose Rate	Cask Top Neutron Dose Rate
50	1.26 E-01	4.47 E-04	2.88 E-03	2.84 E-05
200	8.63 E-03	2.70 E-05	3.81 E-04	3.53 E-06
1000	1.94 E-04	4.93 E-07	9.49 E-06	1.07 E-07
2000	8.47 E-06	2.22 E-08	3.73 E-07	4.87 E-09

The data presented in Refs. 6 and 7 is for 5 year cooled fuel. For this calculation, dose rate vs. distance must be calculated for 10 year old fuel. Table 7 of Ref. 7 gives the fuel region gamma source strengths, by energy line, as a function of cooling time for 40 GWd/MTU PWR fuel. Gamma source strengths are shown for 5 and 10 year old fuel. Table 8 of Ref. 7 gives the ratio (by gamma energy line) of the gamma source strength for each cooling time over the gamma source strength for 5 year old fuel. The Table 8 (of Ref. 7) results show that for all of the gamma energy lines between 0.8 and 2.75 MeV, the gamma source strengths for 10 year old fuel are less than half the gamma source strengths for 5 year old fuel. As stated in the 1996 NRC Cask Review Plan (Ref. 10), only gamma energies between 0.8 and 2.5 MeV contribute significantly to cask external dose rates. Also, the assembly non-fuel region gamma sources (the bottom nozzle, gas plenum, and top nozzle region gamma sources) are entirely due to the presence of Co-60, which has a ~ 5 year half-life.

For the above reasons, the surface gamma dose rates for a TranStor™ cask loaded with 10 year old fuel will be less than half the surface gamma dose rates for a TranStor™ cask loaded with 5 year old fuel (for all cask surfaces). Therefore, the single cask gamma dose rates (vs. distance) presented in Refs. 6 and 7 are divided by two to yield the gamma dose rates vs. distance for 40 GWd/MTU - 10 year old fuel.

Data from the OCRWM Spent Fuel Computer Database (Ref. 5) shows that the total neutron source strength for 40 GWd/MTU - 10 year cooled PWR fuel is 0.83 times the total neutron source strength for 40 GWd/MTU - 5 year cooled PWR fuel. Since the neutron source spectrum and the axial neutron source profile within the assembly fuel region do not significantly vary with fuel cooling time, the neutron dose rates on the cask surfaces for 10 year old fuel will also be about 0.83 times the neutron dose rates for 5 year old fuel. Thus, the single cask neutron dose rate vs. distance data shown in Refs. 6 and 7 is multiplied by 0.83 to yield the single cask neutron dose rate vs. distance data for 10 year old fuel that shall be used in these analyses.

The single cask dose rate vs. distance data for 10 year old fuel, which is the primary design input for these calculations, is shown in Table 5. As stated above, the gamma dose rate data presented in Table 5 is simply that presented in Table 4 times 0.5. The neutron dose rate data presented in Table 5 is that presented in Table 4 times 0.83.

TABLE 5

DOSE RATE VS. DISTANCE
FROM A SINGLE TRANSTOR™ STORAGE CASK
CONTAINING 40 GWd/MTU - 10 YEAR COOLED PWR FUEL
(mrem/hr)

Distance From Cask Side	Cask Side Gamma Dose Rate	Cask Side Neutron Dose Rate	Cask Top Gamma Dose Rate	Cask Top Neutron Dose Rate
50	6.30 E-02	3.71 E-04	1.44 E-03	2.36 E-05
200	4.32 E-03	2.24 E-05	1.91 E-04	2.93 E-06
1000	9.70 E-05	4.09 E-07	4.75 E-06	8.88 E-08
2000	4.24 E-06	1.84 E-08	1.87 E-07	4.04 E-09

Given the design input data provided in Table 5, the ISFSI dose rate calculation is a straightforward arithmetic calculation. No other input data is used, other than the proposed ISFSI layout (discussed later in this section and shown in Figure 2). There are some assumptions made, however, in the calculation. These assumptions are given below.

Due to the close proximity of the casks, the cask side dose rate contributions from all casks except those on the edge of the ISFSI are assumed to be completely blocked by other casks. Thus, for a detector at some distance from a given side of the ISFSI, only the casks in the "front row" of the ISFSI will contribute to the cask side dose rate component. This is a valid assumption. The casks are spaced 15 feet apart, and the casks are 11.33 feet wide, so there is only 3.67 feet between casks. A very small fraction of the cask side flux can escape through this narrow space.

In the ISFSI dose calculation, the detectors are placed at given distances away from the center of the ISFSI side. For a regular square pitched cask array, radiation from inner casks would have to leave the surfaces of the inner casks at a very shallow angle in order to pass between the front row casks and move in the direction of the detector. This is illustrated in Figure 1. In reality, the angular distribution of the radiation leaving the cask side surfaces is far from isotropic, with almost all of the radiation leaving in a direction almost normal to the cask surface. Thus, an extremely small amount of radiation would actually follow such a path.

It is also true that, for a regular square pitched cask array, radiation leaving the surface of a cask in the row right behind the "front" (outer) row can pass between the adjacent front row casks and leave the ISFSI. This radiation is leaving the cask surface in the normal direction, but the radiation escapes the ISFSI in a direction that is roughly 30 degrees off the normal vector (which points straight towards the detector). This is also illustrated in Figure 1.

This escaping radiation is not of significant concern due to its direction of travel. If a detector were placed on the site boundary line at a point not directly over the center of the ISFSI side wall, but at an angle 30 degrees off the normal vector, the distance from the detector to the casks would increase by about 15%. Given the exponential drop-off rate in dose rate (vs. distance) at large distances, the overall dose rate at such a location would be lower than that measured at a detector placed above center of the ISFSI side.

As an example, the dose rate falls by roughly an order of magnitude between 2000 and 3000 feet. If the 2000 ft. detector were placed 30 degrees off the normal angle, the distance would increase to ~2300 feet. Based on the dose rate's fall off with distance, this would correspond to at least a factor of two reduction in the total dose rate.

Due to the small space between the front row casks, only a fraction of the cask side dose rate from the "second" cask row will escape the ISFSI (see Figure 1). Therefore, the cask side dose rate contributions would not increase by a factor of two due to this leaking radiation. Furthermore, the cask side dose rates are only a fraction of the overall dose rate. Thus, this cask side radiation leaking between casks would not nearly make up for the factor of two reduction in dose rate due to the increased distance to the detector. For these reasons, a detector placed directly over the ISFSI side will measure higher dose rates than a detector that is placed at an angle relative to the side wall in order to pick up the radiation leaking from the second cask row.

For a detector directly over the center of the ISFSI side, radiation from the second cask row is not significant, as discussed earlier. It is true that, for a detector 2000 feet from the center of the ISFSI side, the angle between the casks at the ISFSI corner (on the ends of the front cask row) and the detector is about 30 degrees. Thus, the casks that are near the ends of the second cask row may contribute somewhat to the dose rate at the detector. However, since this is the section of the second cask row that is furthest from the detector, and since most of the radiation leaving the second cask row (even the radiation traveling at a 30 degree angle) is blocked by the first cask row, the cask side dose rate contributions from the ends of the second cask row will be very small. As discussed on the following page, the analyses make several conservative assumptions that will more than compensate for the fact that this small potential contribution from the second cask row is neglected.

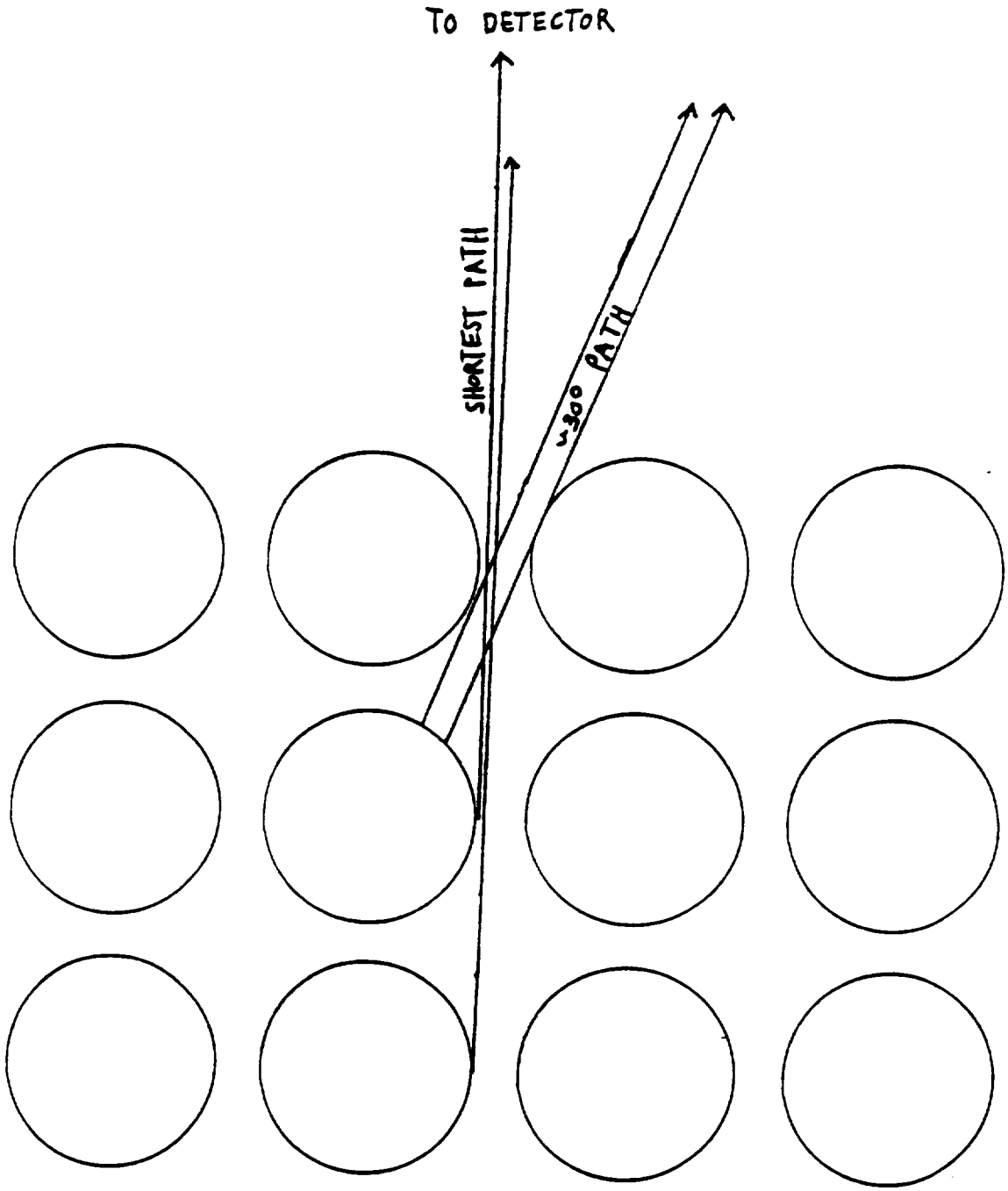

FIGURE 1: POTENTIAL RADIATION LEAKAGE PATHS IN A REGULAR CASK ARRAY

As discussed in Section 4, the cask top dose rate contributions for the 4000 casks in the ISFSI are based upon conservative lower bound distance values which will cause a significant over-estimation of the total cask top dose rate contributions. Also, the SKYSHINE II single cask dose rate vs. distance data for the cask side gamma dose rate contribution is based upon conservatively high cask side surface gamma dose rates (from Ref. 2). Comparisons of calculated (Ref. 9) cask side gamma dose rates to measured cask side gamma dose rates for the VSC-24 storage cask (Ref. 11) show that cask side gamma dose rates are over-predicted by over 50%. It is also true that the cask side gamma dose rates are over-estimated by at least a factor of two due to the extremely low cooling time assumption of 10 years (average cooling times will be over 20 years for the PFS ISFSI). The cask side neutron dose rate contributions are negligible compared to the cask side gamma contributions. The effects of the conservative data and assumptions discussed above far outweigh the small cask side contributions that may come from the ends of the second cask row.

Finally, it can be stated, without analysis, that the largest possible effect of leakage from the second cask row is to double the cask side dose rate contribution. The Section 2 results also show that, at 600 m, the dose rates are under the regulatory 25 mrem/year limit by a very wide margin. The security fence limit of 2 mrem/hour is also met by a wide margin and the dose rate at the nearest neighbor location is vanishingly small. Thus, even if the cask side dose rate contributions were doubled, the total dose rates would still be nowhere near any of the limits. However, in reality, for the reasons given in the preceding paragraphs, the dose rate calculations will actually over-predict the ISFSI dose rates even though cask side radiation from the second row is neglected.

The preceding discussion showed how cask side dose rate contributions from all casks other than the front row of casks are insignificant for a regular cask array. However, the PFS ISFSI is not a regular cask array. The proposed PFS ISFSI layout is shown in Figure 2. There are 4000 casks laid out in a 50 x 80 rectangular array. The casks are placed in columns that run in the North-South direction. In these columns, the average cask spacing is 16 feet. The cask to cask spacing is only 15 feet, but there is some additional space between the individual storage slabs (see Figure 2) which brings the average cask spacing to roughly 16 feet. There is a 150 foot space that divides each of these columns into two sections containing 40 casks (per column) each. In the East-West direction, the columns described above are arranged in groups of two. The two columns in each group are spaced 15 feet apart and there is a 30 foot space between the column groups. Also, at the center of the ISFSI, there is another 150 foot space. There are 12 column groups on one side of the large space, and 13 column groups on the other side of the large space. Thus, there are a total of 80 casks on the East and West edges of the ISFSI, and a total of 50 casks on the North and South edges of the ISFSI.

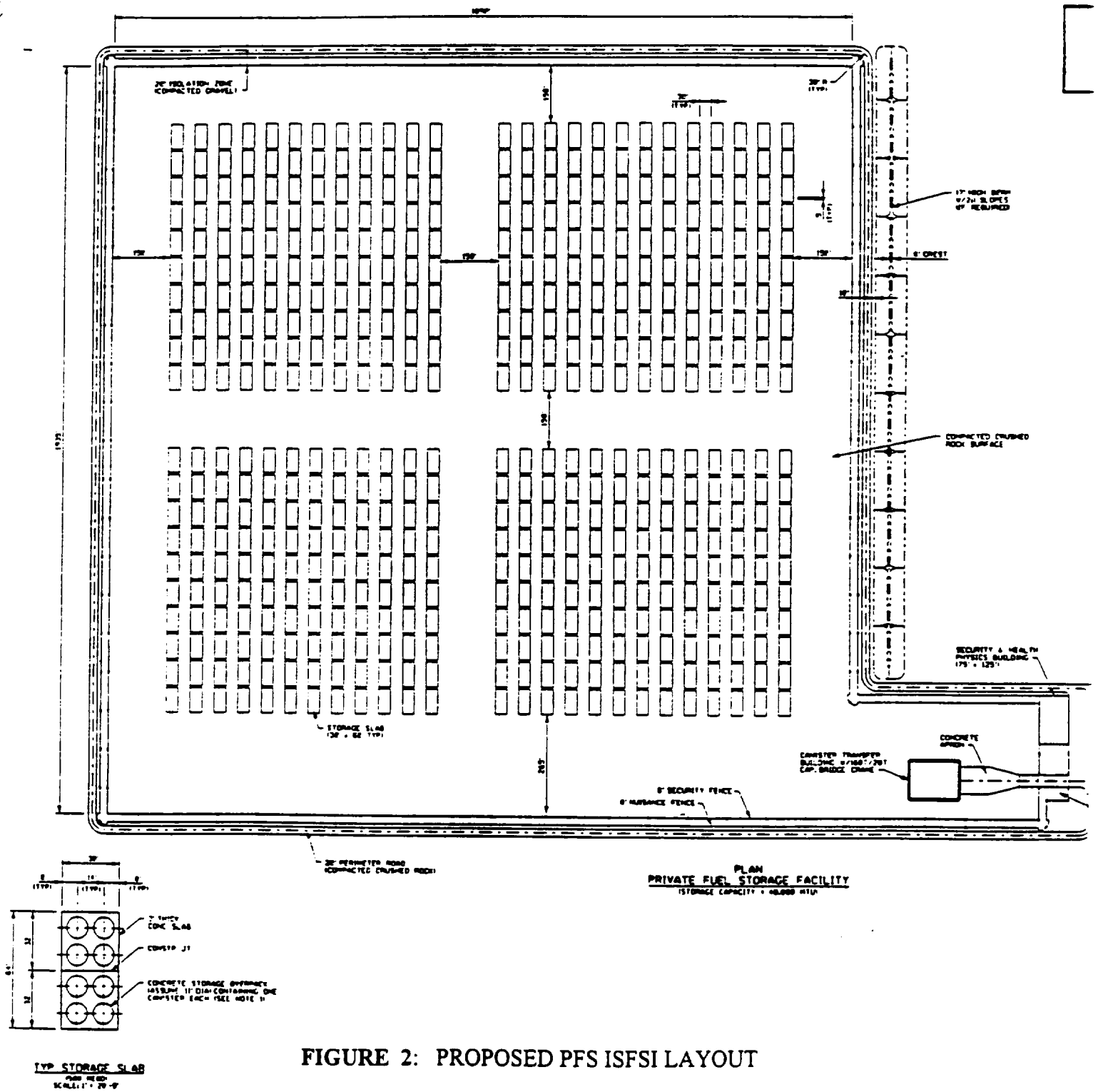

FIGURE 2: PROPOSED PFS ISFSI LAYOUT

The ISFSI layout described above has significant spaces between casks and dose rate contributions from inner casks may be significant. The effects of large spaces between casks are conservatively treated by artificially "filling" these spaces with additional casks. Additional casks are placed in any gaps that occur in the front cask row (i.e. the cask row on the ISFSI edge facing the detector). The resulting front cask row has no spaces between the casks larger than the 3 or 4 feet that would be present in a regular cask array.

An additional cask will produce more radiation than that which would leak (from inner casks) through a cask sized hole in the front row, so this assumption is conservative. This assertion is based on the fact that the projected cask surface area that can be viewed through a cask sized hole is no greater than the surface area of the cask that would be placed in the front row to "plug" the hole. Also, the projected surface area viewed through the cask sized hole will primarily consist of cask surface areas that are viewed at a very shallow angle (i.e. far from the normal direction). Given that most radiation leaves the cask surface in a direction more normal to the surface, the projected area of the inner casks will release less radiation in the direction of the "viewer" than would the equivalent projected area of an extra cask placed in the front row to "plug" the hole. The conservatism of this hole plugging assumption will also more than make up for any cask side dose rate contributions from the second cask row.

The cask side dose rate calculations are based on this artificial front cask row which has more casks than are actually present in the front row. This procedure does not apply to the cask top dose rate contribution calculations, since cask blockage issues do not effect the cask top contributions (which are already based upon all 4000 casks). The ISFSI dose rate calculations are based on detectors placed over the ISFSI side that has the highest number of casks in the front row, after additional "hole plugging" casks have been artificially added.

Dose rates at distances between the distances shown in Tables 4 and 5 (for which actual SKYSHINE II dose rate results are available) are determined using logarithmic interpolation. This means that the logarithms of the dose rates between data points are determined using linear interpolation between the logarithms of the dose rates at the data points. The anti-log of the results are taken to produce the intermediate distance dose rates.

A copy of Figure 6-2 of Ref. 6, which shows a semi-log plot of dose rate vs. distance data for 5 year old fuel, is shown in Figure 3. The logarithmic interpolation approach would correspond to drawing straight lines (on the semi-log paper) between the data points, as is shown in Figure 3. It can be seen by examining the data points shown in Figure 3 that the actual curves would have negative curvature in the semi-log plot. Therefore, the actual curves would lie below the straight lines that are drawn between the data points in Figure 3. This illustrates the conservatism if the logarithmic interpolation method.

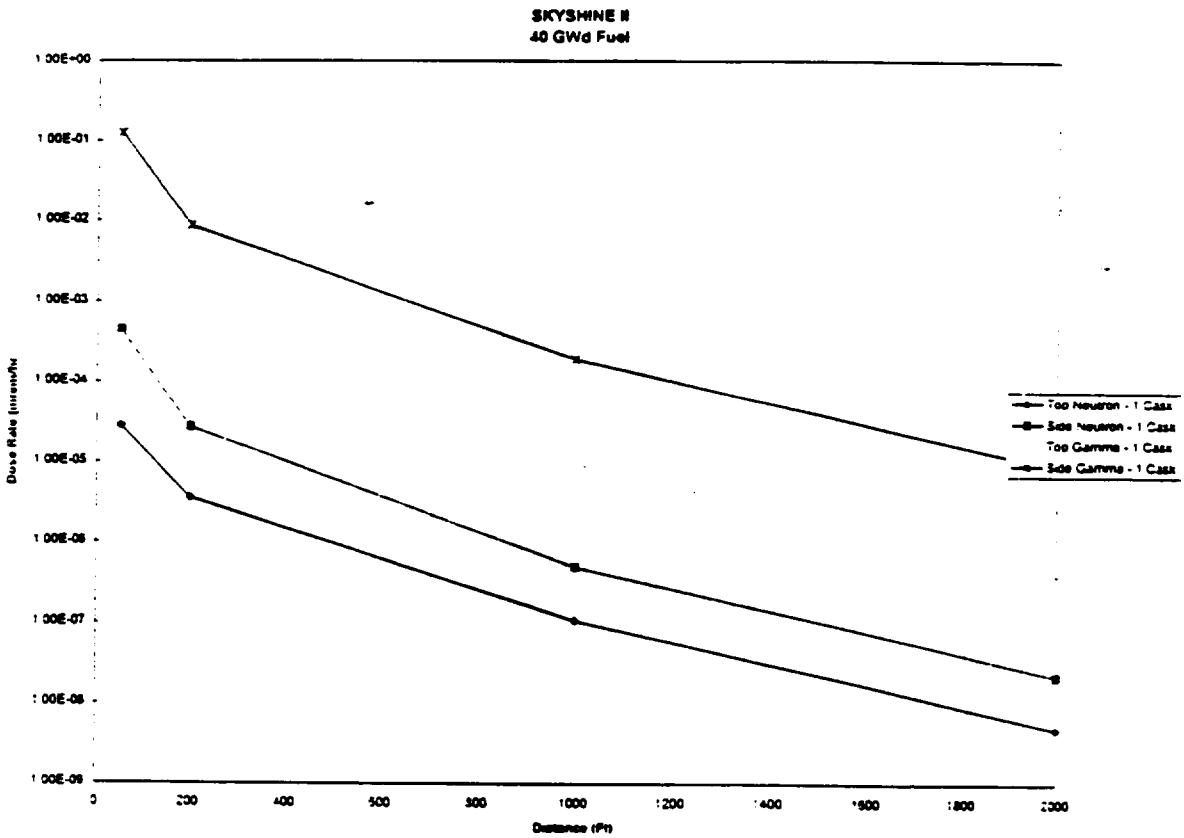

FIGURE 3: PLOT OF SINGLE CASK DOSE RATE VS. DISTANCE DATA

The dose rate vs. distance functions for 10 year old fuel are simply the dose rates vs. distance for 5 year fuel times a constant (as discussed earlier in this section). Therefore, the dose rate vs. distance curves for 10 year old fuel will have the same shape as those shown in Figure 3. Thus, logarithmic interpolation will be conservative for 10 year old fuel, as well as for 5 year old fuel.

Dose rates (vs. distance) are calculated for an ISFSI with and without a berm. Since the berm is higher than the tops of the casks, the berm is assumed to completely block all radiation that leaves the cask side surfaces. Thus, the cask side dose rate contributions are completely eliminated for the berm case calculations.

4.0 METHODOLOGY

These ISFSI dose rate calculations are based upon single cask dose rate vs. distance calculations that were performed using the SKYSHINE II computer code. With this code, energy dependent, average surface fluxes for the cask side and top surfaces are entered into the code, which then calculates dose rate contributions, vs. distance, for radiation leaving the cask side and top, respectively.

SKYSHINE II calculations were performed to determine dose rate vs. distance data for the VSC-24 storage cask (Ref. 8). Dose rates, vs. distance, were determined separately for gammas leaving the cask side, neutrons leaving the cask side, gammas leaving the cask top, and neutrons leaving the cask top. The average gamma and neutron fluxes for the cask side and top surfaces were taken from the VSC-24 storage cask design basis shielding analyses (Ref. 9). These average surface fluxes are the primary input to the SKYSHINE II code.

The dose rate vs. distance data presented in Refs. 6 and 7 for a single TranStor™ cask loaded with 40 GWd/MTU - 5 year cooled PWR fuel is determined from the VSC-24 SKYSHINE II data (from Ref. 8) using the cask surface dose rate ratio methodology discussed in Section 3. As also discussed in Section 3, this is then converted into 10 year cooled fuel data. The results of these conversions are presented in Table 5 in Section 3 of this document. This dose rate vs. distance data (for each of the four contributing components) is the primary design input for the ISFSI dose rate calculations.

The SKYSHINE II dose rate calculations presented in Refs. 8 and 6 only consider distances out to 2000 feet. Using extrapolation from the available SKYSHINE II results for larger distances would involve a significant amount of uncertainty. Therefore, to be conservative, the 2000 ft. dose rate results are assumed in the ISFSI dose rate calculations for all casks that are more than 2000 ft. from the detector (as discussed in Sections 2 and 3).

Unlike the MCNP monte-carlo code, SKYSHINE II is a deterministic code. Therefore, there is no statistical error level associated with the dose rate results. Thus, no error levels are shown with the results in Tables 4 and 5 (unlike Table 4 of the Ref. 4 MCNP calculations).

The ISFSI dose rate calculation is a straightforward arithmetic exercise, based on the design input data shown in Table 5 and the assumptions listed in Section 3. Detector locations at various distances from the ISFSI security fence are considered. In each case, the detectors are lined up directly over the center of the ISFSI side, to yield maximum dose rates (as discussed in Section 3).

There are two basic steps that are performed to determine the dose rate contributions from each cask in the ISFSI. The first step is to determine the distance between each cask and each detector location (i.e. each distance from the security fence). The second step is to determine the dose rate contributions for each cask, based on the determined distance, from the data shown in Table 5 through use of logarithmic interpolation. After determining the dose rate contributions from each cask in the ISFSI, the contributions are summed to yield the total ISFSI dose rate contributions shown in Table 1. Different approaches are used to determine the cask distances for the cask side and cask top dose rate contribution calculations, as is discussed below.

As discussed in Section 3, only the first cask row contributes to the cask side dose rate contributions shown in Table 1. The distance to each cask in the front row is accurately calculated as a function of detector distance (from the security fence). These distance calculations include both vector components of the overall distance to the cask, including the distance from the detector to the center of the front cask row, and the distance from the center of the front cask row to each individual cask in the row.

Once the distance (from the detector) to each cask in the front row is determined, the cask side gamma and neutron dose rate contributions from each cask can be calculated, using logarithmic interpolation between the Table 5 data points. The cask side gamma and neutron dose rate contributions calculated for each cask are then summed to yield the total gamma and neutron cask side dose rate contributions for the entire ISFSI. The total cask side dose rate contributions are calculated as a function of the detector distance (from the security fence).

As discussed in Section 3, gaps in the cask rows at the ISFSI edge are treated by filling the gaps with extra casks so that no gaps are present in the row (i.e. there are no gaps bigger than ~4 feet between the casks). This "full" cask row will yield a total cask side dose rate contribution that bounds the effects of any streaming through gaps in the row.

On the East and West sides of the ISFSI, there are two solid rows of 40 casks (with an average cask spacing of 16 feet) that are separated by a large 150 foot gap. At a typical cask spacing, about 10 casks could fit inside this 150 foot gap. Thus, cask side dose rate contribution calculations for detectors above the East or West ISFSI sides would be based upon a solid (uninterrupted) front row containing 90 casks (80 actual casks plus 10 artificial casks).

On the North and South sides of the ISFSI, the front cask rows have only 50 casks, but there are more spaces between the casks. On one side of the 150 foot central alley, there are 13 cask pads, each of which is 30 feet wide and has two casks (in the front row). There is a 30 foot space between each cask pad. On the other side of the central alley, there are 12 cask pads, with a 30 foot space between each pad. This is illustrated in Figure 2. Thus, there are a total of 25 cask pads (containing a total of 50 casks), and there is a total of 23 thirty foot gaps between the pads. Each of these 30 foot gaps are artificially filled with two casks (on the ISFSI edge). Also, the 150 foot wide central alley is filled with an additional 10 artificial casks. This creates a solid front cask row containing a total of 106 (50 + 23x2 + 10) casks that have an average spacing of 15 feet. Thus, 56 artificial casks are added to the 50 actual casks in the front row.

Since the effective number of front row casks is higher for the North and South ISFSI sides than it is for the East and West ISFSI sides (106 vs. 90), the cask side dose rate calculations are based upon detectors over the North side of the ISFSI. Therefore, the cask side dose rate contributions are calculated based on a solid (uninterrupted) front cask row containing 106 casks spaced 15 feet apart. As shown in Figure 2, the security fence is farther from the ISFSI South side than it is from the ISFSI North Side, so the distances between the detectors and the cask rows are based upon the North security fence.

Due to symmetry, only half of the front cask row needs to actually be treated by the cask side dose rate contribution calculations. Thus, calculations are based upon a half row, containing 53 casks, that extends in one direction from the ISFSI centerline. The resulting dose rates are multiplied by two (at the end of the calculation) to yield the final total dose rate contributions.

Unlike the cask side dose rate contributions, all 4000 casks in the ISFSI contribute to the overall cask top (scattered) dose rate contributions. Calculating an accurate distance (to the detector) for each of the 4000 casks in the array would be very cumbersome and time consuming. Therefore, for the cask top dose rate contribution calculations, conservative simplifying assumptions were made. These assumptions are discussed below.

Instead of being considered individually, the casks are considered in large sub-groups. Each sub-group consists of two full cask rows. Cask rows run in the East-West direction, where the detector locations are above the North side of the ISFSI (see Figure 2). The distance for all casks in each pair of rows is conservatively set to equal the distance between the detector and the closest cask in the pair of cask rows. Thus, one of the vector components (of the overall distance) discussed on the previous page, i.e. the distance between the row center and each individual cask, is neglected in the distance calculation. Also, the distance to the front row is conservatively used for all casks in the back row.

This approach is conservative because is under-estimates the distance for the casks near the ends of the cask rows. For a 2000 foot detector distance, the distance to the casks at the ends of the front row is under-estimated by about 7%. The degree of under-estimation is less for the other cask rows, with a 3% under-estimation for the farthest cask row in the ISFSI. Two rows at a time are considered because the difference in distance between two cask rows (front row to back row) is much smaller than the difference in distance between the centers of the rows and the ends of the rows. In other words, assuming the front row distance for the back row is a much smaller effect than the under-estimation already present for casks at the ends of the rows.

Given the strong exponential dependence of dose rate on distance, this small degree of under-estimation in the distance can lead to large levels of over-estimation (i.e. conservatism) in the calculated dose rates. Also, the degree (percentage) of the distance under-estimation becomes much larger for the smaller detector distances. At the detector 100 meters from the security fence, the distance to the casks on the ends of the front row is under-estimated by more than a factor of two. Thus, this approach leads to very conservative dose rate estimates for the lower detector distances. This conservatism adds to the other sources of conservatism discussed in Section 3.

The casks in the columns (running North to South) are, on average, 16 feet apart. The distance from the detector to each cask group is determined as follows. The casks are divided into 40 sub-groups, with 100 casks in each sub-group. There are 80 cask rows (running East to West) in the array, so there are 40 sub-groups with two rows in each sub-group. Each sub-group is 32 feet deep (on average).

The distance between each detector and the first cask group is equal to the distance between the security fence and the detector plus the 150 foot distance between the security fence and the cask pads for the first cask row (see Figure 2). An additional 2.3 feet exists between the cask side and the cask pad edge (assuming the casks are spaced evenly on the 64 foot long pads shown in Figure 2). Thus, 152.3 feet is added to the distance from the security fence to yield the distance to the first cask row. For each subsequent cask group, 32 feet is added to the distance calculated for the preceding cask group. There is one exception to this, due to the presence of the 150 foot central alley. An additional 150 feet is placed between cask group #20 and cask group #21 (i.e. 182 feet is added to the distance of the preceding row, as opposed to 32 feet). The above process is repeated until a distance is determined for all 40 cask groups.

Once the distances for each cask group are determined, the dose rate contributions for each cask group are then determined. First, the dose rate contributions for a single cask in each group, based on the lower bound group distance determined above, is calculated. The two dose rate contributions (cask top gamma and cask top neutron) are separately determined. Once the distance has been determined, these two dose rate contributions can easily be determined from the dose rate vs. distance data shown in Table 5 using the logarithmic interpolation technique discussed in Section 3.

The cask top dose rate contributions for each cask group is equal to the single cask dose rate contributions (determined based on the cask group distance) times the number of casks in the group (i.e. 100). After the cask top dose rate contributions for each sub-group are determined, the contributions are summed over the 40 sub-groups to yield the ISFSI total cask top dose rate contributions.

The ISFSI dose rate values shown in Table 2 assume no berm is present around the ISFSI. Dose rates for an ISFSI surrounded by a berm are also calculated. For these calculations, the exact same approach as before is used. The only difference is that the cask side dose rate contributions are simply eliminated. No cask side radiation is assumed to reach the detector, since the berm is taller than the casks and the detectors are assumed to be near ground level. Thus, the total gamma and neutron dose rates shown for the berm case in Table 3 are simply equal to the cask top gamma and neutron dose rates shown in Table 1.

5.0 CALCULATIONS

The ISFSI dose rate calculations were performed using two EXCEL spreadsheets. The first spreadsheet is used to calculate the total cask side dose rate contributions from the front cask row in the ISFSI. The single cask side dose rate vs. distance data (from Table 4), along with the corresponding distances, was entered (by hand) into the spreadsheet as a data table. This input data table is shown in the upper section of the spreadsheet. Based on this input data, the spreadsheet calculates the total ISFSI cask side dose rate contributions (gamma and neutron) as a function of the distance between the security fence and the detector. The spreadsheet user enters the distance between the detector and the security fence in a box at the top of the spreadsheet. The spreadsheet will then output results based on the entered distance. To obtain results for different detector distances, the user enters new distances at the top of the spreadsheet. Thus, the spreadsheet is rerun for each studied distance shown in Tables 1-3.

As discussed in Section 4, the spreadsheet considers a front cask row containing 106 casks spaced 15 feet apart. Due to symmetry, only half of this row is actually modeled. The first step performed by the spreadsheet is to determine the distance between the detector and each of the 53 modeled casks.

There are two components to the vector between the detector and each cask. The first component is the distance from the detector to the center of the front cask row. This distance is equal to the distance between the detector and the security fence (entered by the user for each case), plus the distance between the security fence and the front edges of the first row of modular storage pads (150 ft.), plus the distance between the pad edge and the surfaces of the casks (~2.3 ft.). Thus, the distance between the first cask row and the security fence is 152.3 ft..

The second component is the distance between the center of the row and each individual cask in the row. The casks are spaced 15 feet apart. Also, since there is an even number of casks in the row (106), the row centerline passes halfway between two casks. Thus, in the half row that is modeled, the distance (from the row center) for the first cask is 7.5 feet. This distance then increases by 15 feet for every subsequent cask in the row. The distance calculations performed by the spreadsheet are summarized in the three equations shown on the next page:

The distance between the detector and the center of the first cask row is given by the equation:

$$D_R = D_F + 152.3$$

where D_R is the distance to the center of the cask row and D_F is the distance between the detector and the security fence (entered by the user). All distances are in feet.

The distance between the center of the cask row and each individual cask is given by the equation:

$$D_N = (15.0 \times N) - 7.5$$

where D_N is the calculated distance to the Nth cask in the row, and N is the cask number, with a value of 1 corresponding to the cask that is closest to the ISFSI centerline, and a value of 53 corresponding to the cask at the end of the first cask row (i.e. the cask at the ISFSI corner).

These two distances (i.e. vector components) are summed to yield the total distance between the detector and each cask in the front row using the following equation:

$$D_C = \sqrt{D_R^2 + D_N^2}$$

The cask number (1-53) is listed in the left column of the spreadsheet. The calculated distance (D_C) for each cask is shown in the next column of the spreadsheet.

After the distance to the detector is determined for each cask in the front row, the dose rate is determined for each cask. For each calculated distance in the second column, the spreadsheet determines which pair of distances shown in Table 4 the calculated distance lies between. These two distance values from Table 4, and the dose rate values shown in Table 4 for those distances, are used to determine the dose rate contributions at the calculated distance.

The spreadsheet uses a nested series of "IF" statements to search, or iterate, over the data points presented in Table 4. The spreadsheet starts at the lowest distance from Table 4 (50 ft.) and asks if it is greater than the calculated distance for the cask in question. If it is not, the spreadsheet moves to the next higher distance. As soon as the test is met, and a distance higher than the calculated distance is encountered, the spreadsheet defines the Table 4 distance value it just tested as the "upper bound" distance value (d_U). It then defines the previous Table 4 distance value it considered as the "lower bound" distance value (d_L). The lower and upper bound distance values (d_L and d_U) are shown in the fourth and fifth columns of the spreadsheet, respectively.

The spreadsheet then defines the corresponding dose rate values from Table 4 (which were entered into the spreadsheet by the user) as the bounding dose rate values. Upper and lower bound dose rate values (D_U and D_L) are determined for both the gamma and neutron dose rate contribution components. With upper and lower bound distance and dose rate values, the intermediate dose rate values (for the calculated distances) can be determined using the logarithmic interpolation approach. This approach is summarized in the equation below:

$$D_C = \exp [\ln (D_L) - ((d_C-d_L)/(d_U-d_L)) \times (\ln (D_L) - \ln (D_U))]$$

where "exp [x]" implies $e^{[x]}$, D_C is the calculated dose rate, d_L is the lower bound distance, d_C is the calculated distance (at which the dose rate, D_C, needs to be determined), d_U is the upper bound distance, D_L is the dose rate at the lower bound distance (from Table 4), and D_U is the dose rate at the upper bound distance (from Table 4).

The lower and upper bound gamma dose rate values (D_L and D_U) are shown in the seventh and eighth columns of the spreadsheet, respectively. The gamma dose rate value for the calculated distance (D_C) is shown in the ninth column. For the neutron dose rates, the lower and upper bound dose rate values (D_L and D_U) are shown in columns #11 and #12, and the neutron dose rate at the calculated distance (D_C) is shown in column #13.

The spreadsheet then sums over the 53 casks to yield the total cask side dose rate contributions. Then the spreadsheet multiplies the gamma dose rate contribution by 0.5 and multiplies the neutron dose rate contribution by 0.83. This is done in order to adjust the results (which are based on 5 year cooled fuel input data from Table 4) to correspond to 10 year cooled fuel. The same result would be achieved if the data shown in Table 5 were simply entered into the spreadsheet, as opposed to the Table 4 data. Finally, the total contribution results are multiplied by 2 in order to correspond to a full (as opposed to half) front cask row.

The final result is the total ISFSI cask side gamma and neutron dose rate contributions, expressed as a function of the distance between the detector and the security fence (this variable being entered into the spreadsheet by the user). These final results are shown at the bottom of the spreadsheet page. A separate spreadsheet calculation is performed for each studied distance shown in Tables 1-3. The spreadsheet results are shown in Table 1.

As discussed in Section 4, a different calculational methodology is used to calculate the cask top dose rate contributions from all 4000 casks in the array. Therefore, a second EXCEL spreadsheet is used to perform the cask top dose rate contribution calculations. The cask array is sub-divided into 40 sub-groups, each containing two full rows of casks, 50 casks each, for a total of 100 casks. In this spreadsheet, the single cask top dose rate contributions, vs. distance, from Table 4 are entered manually into the spreadsheet. The user also enters the number of casks in each cask sub-group (i.e. 100). Also, each time the spreadsheet is run, the user enters the distance between the security fence and the detector.

Based on the input data, this spreadsheet gives the total ISFSI cask top dose rate contributions (gamma and neutron) for a given detector distance (between the detector and the security fence) entered by the user. Thus, the spreadsheet is run once for each distance value shown in Tables 1-3.

Once the distance from the security fence is entered, the spreadsheet calculates the distance from the detector to each of the 40 cask groups. Each cask group contains two full cask rows. As discussed in Section 4, the distance assumed for each cask group is the distance to the center of the nearer of the two rows. The spreadsheet uses the following formulas to determine the distance for each cask group. The distance to the first cask group (in feet) is given by the following formula:

$$D_1 = D_F + 152.3$$

where D_1 is the distance between the detector and the first cask group and D_F is the distance between the detector and the security fence (entered by the user).

The distance for the subsequent cask groups is determined by the following iterative formula:

$$D_N = D_{N-1} + 32.0$$

where D_N is the distance to the Nth cask group and D_{N-1} is the distance to the (previously determined) preceding cask group. There is one exception to this. For the 21st cask row, the distance is equal to the distance to the 20th cask row plus 182 feet, as opposed to plus 32 feet.

After the distances are determined for each cask group, the cask top dose rate contributions are determined for each cask in that group. The dose rate contributions corresponding to each calculated distance value are determined using the same approach used by the first spreadsheet to determine cask side dose rates for the front row casks. Using an iterative process with conditional "IF" statements, the spreadsheet determines the two distance values in Table 4 (and the corresponding cask top dose rate contribution values) that bound the calculated distance value. Based on the upper and lower bound distance values, and their corresponding dose rate values, the dose rate value for the calculated distance is determined using the logarithmic interpolation method. The formula used to calculate the dose rate contributions for a given calculated distance is (once again) shown below:

$$D_C = \exp\left[\ln(D_L) - ((d_C - d_L)/(d_U - d_L)) \times (\ln(D_L) - \ln(D_U)) \right]$$

where "exp [x]" implies $e^{[x]}$, D_C is the calculated dose rate, d_L is the lower bound distance, d_C is the calculated distance (at which the dose rate, D_C, needs to be determined), d_U is the upper bound distance, D_L is the dose rate at the lower bound distance (from Table 4), and D_U is the dose rate at the upper bound distance (from Table 4).

After determining the gamma and neutron cask top dose rate contributions for each cask in each of the 40 cask groups using the above formula, the spreadsheet sums the 40 calculated dose rate contribution values. The resulting sum is multiplied by 100, the number of casks in each cask group, to yield total ISFSI cask top dose rate contribution values. Then the gamma dose rate results are multiplied by 0.5 and the neutron dose rate results are multiplied by 0.83 to yield final dose rate values that correspond to 10 year cooled fuel. These final dose rate results are shown in Table 1.

The layout of the second spreadsheet is exactly the same as that of the first, with the same parameter values in the same locations. The only difference is that instead of having the front row cask number in the left column, the second spreadsheet has the cask group number in the left column. Although the formula for calculating the distances is different between the two spreadsheets, the calculated distance is still shown in the second column in both spreadsheets. After the distance values are determined, the calculations performed in the other columns are similar for both spreadsheets.

Copies of the spreadsheets used to determine the total ISFSI dose rate contribution values are included in Attachment A to this document. For each of the two spreadsheet types (cask side and cask top), a spreadsheet is presented for each studied distance value shown in Tables 1-3. Thus, since dose rates are calculated for 9 distances, there are a total of 18 spreadsheets shown in Attachment A. The distance between the security fence and the detector is shown near the top of each spreadsheet. The first nine spreadsheets presented are the cask side dose rate spreadsheets.

6.0 REFERENCES

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ATTACHMENT A

DOSE RATE CALCULATION SPREADSHEETS

Distance= 0

Single Cask Results

Distance	Side Gam	Side Neut
100	5.16E-02	1.75E-04
200	8.63E-03	2.70E-05
328	4.70E-03	1.42E-05
500	2.08E-03	6.02E-06
1000	1.94E-04	4.93E-07
2000	8.47E-06	2.22E-08
3000	8.47E-06	2.22E-08
4000	8.47E-06	2.22E-08

Distance to Cask Groups		Distance Interval		Cask Group Dose Rate Calculation (Single Cask)					
Cask #	Distance	D min	D max	G/S Min	G/S Max	S Gamma	N/S Min	N/S Max	Side Neut
1	152.5	100	200	5.160E-02	8.630E-03	2.019E-02	1.750E-04	2.700E-05	6.562E-05
2	154.0	100	200	5.160E-02	8.630E-03	1.966E-02	1.750E-04	2.700E-05	6.384E-05
3	156.8	100	200	5.160E-02	8.630E-03	1.867E-02	1.750E-04	2.700E-05	6.048E-05
4	161.1	100	200	5.160E-02	8.630E-03	1.730E-02	1.750E-04	2.700E-05	5.587E-05
5	166.6	100	200	5.160E-02	8.630E-03	1.569E-02	1.750E-04	2.700E-05	5.042E-05
6	173.2	100	200	5.160E-02	8.630E-03	1.393E-02	1.750E-04	2.700E-05	4.455E-05
7	180.8	100	200	5.160E-02	8.630E-03	1.216E-02	1.750E-04	2.700E-05	3.863E-05
8	189.3	100	200	5.160E-02	8.630E-03	1.044E-02	1.750E-04	2.700E-05	3.295E-05
9	198.6	100	200	5.160E-02	8.630E-03	8.845E-03	1.750E-04	2.700E-05	2.770E-05
10	208.6	200	328	8.630E-03	4.700E-03	8.286E-03	2.700E-05	1.420E-05	2.586E-05
11	219.1	200	328	8.630E-03	4.700E-03	7.882E-03	2.700E-05	1.420E-05	2.453E-05
12	230.1	200	328	8.630E-03	4.700E-03	7.480E-03	2.700E-05	1.420E-05	2.321E-05
13	241.6	200	328	8.630E-03	4.700E-03	7.085E-03	2.700E-05	1.420E-05	2.192E-05
14	253.4	200	328	8.630E-03	4.700E-03	6.698E-03	2.700E-05	1.420E-05	2.065E-05
15	265.5	200	328	8.630E-03	4.700E-03	6.323E-03	2.700E-05	1.420E-05	1.943E-05
16	277.9	200	328	8.630E-03	4.700E-03	5.961E-03	2.700E-05	1.420E-05	1.826E-05
17	290.6	200	328	8.630E-03	4.700E-03	5.613E-03	2.700E-05	1.420E-05	1.713E-05
18	303.5	200	328	8.630E-03	4.700E-03	5.280E-03	2.700E-05	1.420E-05	1.606E-05
19	316.5	200	328	8.630E-03	4.700E-03	4.963E-03	2.700E-05	1.420E-05	1.504E-05
20	329.8	328	500	4.700E-03	2.080E-03	4.661E-03	1.420E-05	6.020E-06	1.407E-05
21	343.1	328	500	4.700E-03	2.080E-03	4.374E-03	1.420E-05	6.020E-06	1.317E-05
22	356.7	328	500	4.700E-03	2.080E-03	4.103E-03	1.420E-05	6.020E-06	1.231E-05
23	370.3	328	500	4.700E-03	2.080E-03	3.847E-03	1.420E-05	6.020E-06	1.150E-05
24	384.0	328	500	4.700E-03	2.080E-03	3.604E-03	1.420E-05	6.020E-06	1.074E-05
25	397.8	328	500	4.700E-03	2.080E-03	3.376E-03	1.420E-05	6.020E-06	1.002E-05
26	411.7	328	500	4.700E-03	2.080E-03	3.161E-03	1.420E-05	6.020E-06	9.352E-06
37	568.3	500	1000	2.080E-03	1.940E-04	1.504E-03	6.020E-06	4.930E-07	4.277E-06
28	439.7	328	500	4.700E-03	2.080E-03	2.768E-03	1.420E-05	6.020E-06	8.132E-06
29	453.8	328	500	4.700E-03	2.080E-03	2.589E-03	1.420E-05	6.020E-06	7.580E-06
30	468.0	328	500	4.700E-03	2.080E-03	2.421E-03	1.420E-05	6.020E-06	7.063E-06
31	482.2	328	500	4.700E-03	2.080E-03	2.263E-03	1.420E-05	6.020E-06	6.580E-06
32	496.4	328	500	4.700E-03	2.080E-03	2.115E-03	1.420E-05	6.020E-06	6.128E-06
33	510.7	500	1000	2.080E-03	1.940E-04	1.977E-03	6.020E-06	4.930E-07	5.705E-06
34	525.1	500	1000	2.080E-03	1.940E-04	1.847E-03	6.020E-06	4.930E-07	5.310E-06
35	539.4	500	1000	2.080E-03	1.940E-04	1.725E-03	6.020E-06	4.930E-07	4.942E-06
36	553.9	500	1000	2.080E-03	1.940E-04	1.611E-03	6.020E-06	4.930E-07	4.598E-06
37	568.3	500	1000	2.080E-03	1.940E-04	1.504E-03	6.020E-06	4.930E-07	4.277E-06
38	582.8	500	1000	2.080E-03	1.940E-04	1.405E-03	6.020E-06	4.930E-07	3.979E-06
39	597.2	500	1000	2.080E-03	1.940E-04	1.311E-03	6.020E-06	4.930E-07	3.700E-06
40	611.8	500	1000	2.080E-03	1.940E-04	1.224E-03	6.020E-06	4.930E-07	3.441E-06
41	626.3	500	1000	2.080E-03	1.940E-04	1.142E-03	6.020E-06	4.930E-07	3.200E-06
42	640.9	500	1000	2.080E-03	1.940E-04	1.066E-03	6.020E-06	4.930E-07	2.975E-06
43	655.4	500	1000	2.080E-03	1.940E-04	9.949E-04	6.020E-06	4.930E-07	2.765E-06
44	670.0	500	1000	2.080E-03	1.940E-04	9.283E-04	6.020E-06	4.930E-07	2.571E-06
45	684.7	500	1000	2.080E-03	1.940E-04	8.661E-04	6.020E-06	4.930E-07	2.389E-06
46	699.3	500	1000	2.080E-03	1.940E-04	8.080E-04	6.020E-06	4.930E-07	2.220E-06
47	713.9	500	1000	2.080E-03	1.940E-04	7.538E-04	6.020E-06	4.930E-07	2.064E-06
48	728.6	500	1000	2.080E-03	1.940E-04	7.031E-04	6.020E-06	4.930E-07	1.918E-06
49	743.3	500	1000	2.080E-03	1.940E-04	6.558E-04	6.020E-06	4.930E-07	1.782E-06
50	758.0	500	1000	2.080E-03	1.940E-04	6.117E-04	6.020E-06	4.930E-07	1.655E-06
51	772.7	500	1000	2.080E-03	1.940E-04	5.705E-04	6.020E-06	4.930E-07	1.538E-06
52	787.4	500	1000	2.080E-03	1.940E-04	5.320E-04	6.020E-06	4.930E-07	1.429E-06
53	802.1	500	1000	2.080E-03	1.940E-04	4.961E-04	6.020E-06	4.930E-07	1.327E-06

ISFSI Dose Calculation (from all 4000 casks)

Side Gamma =	2.660E-01
Side Neutron =	1.373E-03
Total Dose Rate =	2.673E-01

Distance= 50

Single Cask Results

Distance	Side Gam	Side Neut
100	5.16E-02	1.75E-04
200	8.63E-03	2.70E-05
328	4.70E-03	1.42E-05
500	2.08E-03	6.02E-06
1000	1.94E-04	4.93E-07
2000	8.47E-06	2.22E-08
3000	8.47E-06	2.22E-08
4000	8.47E-06	2.22E-08

Distance to Cask Groups — Distance Interval — Cask Group Dose Rate Calculation (Single Cask)

Cask #	Distance	D min	D max	G/S Min	G/S Max	S Gamma	N/S Min	N/S Max	Side Neut
1	202.4	200	328	8.630E-03	4.700E-03	8.531E-03	2.700E-05	1.420E-05	2.667E-05
2	203.5	200	328	8.630E-03	4.700E-03	8.486E-03	2.700E-05	1.420E-05	2.652E-05
3	205.7	200	328	8.630E-03	4.700E-03	8.398E-03	2.700E-05	1.420E-05	2.623E-05
4	209.0	200	328	8.630E-03	4.700E-03	8.269E-03	2.700E-05	1.420E-05	2.581E-05
5	213.3	200	328	8.630E-03	4.700E-03	8.103E-03	2.700E-05	1.420E-05	2.526E-05
6	218.5	200	328	8.630E-03	4.700E-03	7.905E-03	2.700E-05	1.420E-05	2.461E-05
7	224.6	200	328	8.630E-03	4.700E-03	7.680E-03	2.700E-05	1.420E-05	2.387E-05
8	231.5	200	328	8.630E-03	4.700E-03	7.432E-03	2.700E-05	1.420E-05	2.305E-05
9	239.1	200	328	8.630E-03	4.700E-03	7.167E-03	2.700E-05	1.420E-05	2.218E-05
10	247.5	200	328	8.630E-03	4.700E-03	6.889E-03	2.700E-05	1.420E-05	2.128E-05
11	256.4	200	328	8.630E-03	4.700E-03	6.603E-03	2.700E-05	1.420E-05	2.034E-05
12	265.9	200	328	8.630E-03	4.700E-03	6.313E-03	2.700E-05	1.420E-05	1.940E-05
13	275.8	200	328	8.630E-03	4.700E-03	6.021E-03	2.700E-05	1.420E-05	1.845E-05
14	286.2	200	328	8.630E-03	4.700E-03	5.731E-03	2.700E-05	1.420E-05	1.751E-05
15	297.0	200	328	8.630E-03	4.700E-03	5.444E-03	2.700E-05	1.420E-05	1.659E-05
16	308.2	200	328	8.630E-03	4.700E-03	5.163E-03	2.700E-05	1.420E-05	1.568E-05
17	319.7	200	328	8.630E-03	4.700E-03	4.890E-03	2.700E-05	1.420E-05	1.481E-05
18	331.4	328	500	4.700E-03	2.080E-03	4.625E-03	1.420E-05	6.020E-06	1.396E-05
19	343.4	328	500	4.700E-03	2.080E-03	4.369E-03	1.420E-05	6.020E-06	1.315E-05
20	355.6	328	500	4.700E-03	2.080E-03	4.123E-03	1.420E-05	6.020E-06	1.237E-05
21	368.1	328	500	4.700E-03	2.080E-03	3.887E-03	1.420E-05	6.020E-06	1.163E-05
22	380.7	328	500	4.700E-03	2.080E-03	3.661E-03	1.420E-05	6.020E-06	1.092E-05
23	393.5	328	500	4.700E-03	2.080E-03	3.446E-03	1.420E-05	6.020E-06	1.024E-05
24	406.4	328	500	4.700E-03	2.080E-03	3.241E-03	1.420E-05	6.020E-06	9.602E-06
25	419.5	328	500	4.700E-03	2.080E-03	3.046E-03	1.420E-05	6.020E-06	8.995E-06
26	432.7	328	500	4.700E-03	2.080E-03	2.861E-03	1.420E-05	6.020E-06	8.422E-06
37	583.7	500	1000	2.080E-03	1.940E-04	1.398E-03	6.020E-06	4.930E-07	3.960E-06
28	459.4	328	500	4.700E-03	2.080E-03	2.521E-03	1.420E-05	6.020E-06	7.370E-06
29	472.9	328	500	4.700E-03	2.080E-03	2.365E-03	1.420E-05	6.020E-06	6.890E-06
30	486.6	328	500	4.700E-03	2.080E-03	2.217E-03	1.420E-05	6.020E-06	6.438E-06
31	500.2	500	1000	2.080E-03	1.940E-04	2.078E-03	6.020E-06	4.930E-07	6.013E-06
32	514.0	500	1000	2.080E-03	1.940E-04	1.946E-03	6.020E-06	4.930E-07	5.613E-06
33	527.8	500	1000	2.080E-03	1.940E-04	1.823E-03	6.020E-06	4.930E-07	5.238E-06
34	541.7	500	1000	2.080E-03	1.940E-04	1.707E-03	6.020E-06	4.930E-07	4.886E-06
35	555.6	500	1000	2.080E-03	1.940E-04	1.597E-03	6.020E-06	4.930E-07	4.557E-06
36	569.6	500	1000	2.080E-03	1.940E-04	1.495E-03	6.020E-06	4.930E-07	4.249E-06
37	583.7	500	1000	2.080E-03	1.940E-04	1.398E-03	6.020E-06	4.930E-07	3.960E-06
38	597.8	500	1000	2.080E-03	1.940E-04	1.308E-03	6.020E-06	4.930E-07	3.691E-06
39	611.9	500	1000	2.080E-03	1.940E-04	1.223E-03	6.020E-06	4.930E-07	3.438E-06
40	626.1	500	1000	2.080E-03	1.940E-04	1.144E-03	6.020E-06	4.930E-07	3.203E-06
41	640.3	500	1000	2.080E-03	1.940E-04	1.069E-03	6.020E-06	4.930E-07	2.983E-06
42	654.5	500	1000	2.080E-03	1.940E-04	9.991E-04	6.020E-06	4.930E-07	2.778E-06
43	668.8	500	1000	2.080E-03	1.940E-04	9.337E-04	6.020E-06	4.930E-07	2.586E-06
44	683.1	500	1000	2.080E-03	1.940E-04	8.724E-04	6.020E-06	4.930E-07	2.407E-06
45	697.5	500	1000	2.080E-03	1.940E-04	8.150E-04	6.020E-06	4.930E-07	2.241E-06
46	711.9	500	1000	2.080E-03	1.940E-04	7.613E-04	6.020E-06	4.930E-07	2.085E-06
47	726.2	500	1000	2.080E-03	1.940E-04	7.110E-04	6.020E-06	4.930E-07	1.940E-06
48	740.7	500	1000	2.080E-03	1.940E-04	6.640E-04	6.020E-06	4.930E-07	1.805E-06
49	755.1	500	1000	2.080E-03	1.940E-04	6.200E-04	6.020E-06	4.930E-07	1.679E-06
50	769.6	500	1000	2.080E-03	1.940E-04	5.789E-04	6.020E-06	4.930E-07	1.562E-06
51	784.0	500	1000	2.080E-03	1.940E-04	5.405E-04	6.020E-06	4.930E-07	1.453E-06
52	798.5	500	1000	2.080E-03	1.940E-04	5.045E-04	6.020E-06	4.930E-07	1.351E-06
53	813.1	500	1000	2.080E-03	1.940E-04	4.710E-04	6.020E-06	4.930E-07	1.256E-06

ISFSI Dose Calculation (from all 4000 casks)

Side Gamma =	1.860E-01
Side Neutron =	9.349E-04
Total Dose Rate =	1.870E-01

Distance= 100

Single Cask Results

Distance	Side Gam	Side Neut
100	5.16E-02	1.75E-04
200	8.63E-03	2.70E-05
328	4.70E-03	1.42E-05
500	2.08E-03	6.02E-06
1000	1.94E-04	4.93E-07
2000	8.47E-06	2.22E-08
3000	8.47E-06	2.22E-08
4000	8.47E-06	2.22E-08

Distance to Cask Groups		Distance Interval		Cask Group Dose Rate Calculation (Single Cask)					
Cask #	Distance	D min	D max	G/S Min	G/S Max	S Gamma	N/S Min	N/S Max	Side Neut
1	252.4	200	328	8.630E-03	4.700E-03	6.729E-03	2.700E-05	1.420E-05	2.075E-05
2	253.3	200	328	8.630E-03	4.700E-03	6.701E-03	2.700E-05	1.420E-05	2.066E-05
3	255.1	200	328	8.630E-03	4.700E-03	6.645E-03	2.700E-05	1.420E-05	2.048E-05
4	257.7	200	328	8.630E-03	4.700E-03	6.562E-03	2.700E-05	1.420E-05	2.021E-05
5	261.2	200	328	8.630E-03	4.700E-03	6.455E-03	2.700E-05	1.420E-05	1.986E-05
6	265.4	200	328	8.630E-03	4.700E-03	6.325E-03	2.700E-05	1.420E-05	1.944E-05
7	270.5	200	328	8.630E-03	4.700E-03	6.176E-03	2.700E-05	1.420E-05	1.895E-05
8	276.2	200	328	8.630E-03	4.700E-03	6.009E-03	2.700E-05	1.420E-05	1.841E-05
9	282.7	200	328	8.630E-03	4.700E-03	5.828E-03	2.700E-05	1.420E-05	1.783E-05
10	289.8	200	328	8.630E-03	4.700E-03	5.636E-03	2.700E-05	1.420E-05	1.721E-05
11	297.4	200	328	8.630E-03	4.700E-03	5.434E-03	2.700E-05	1.420E-05	1.656E-05
12	305.6	200	328	8.630E-03	4.700E-03	5.227E-03	2.700E-05	1.420E-05	1.589E-05
13	314.3	200	328	8.630E-03	4.700E-03	5.015E-03	2.700E-05	1.420E-05	1.521E-05
14	323.5	200	328	8.630E-03	4.700E-03	4.801E-03	2.700E-05	1.420E-05	1.452E-05
15	333.1	328	500	4.700E-03	2.080E-03	4.588E-03	1.420E-05	6.020E-06	1.384E-05
16	343.1	328	500	4.700E-03	2.080E-03	4.376E-03	1.420E-05	6.020E-06	1.317E-05
17	353.4	328	500	4.700E-03	2.080E-03	4.166E-03	1.420E-05	6.020E-06	1.251E-05
18	364.1	328	500	4.700E-03	2.080E-03	3.961E-03	1.420E-05	6.020E-06	1.188E-05
19	375.0	328	500	4.700E-03	2.080E-03	3.761E-03	1.420E-05	6.020E-06	1.123E-05
20	386.3	328	500	4.700E-03	2.080E-03	3.566E-03	1.420E-05	6.020E-06	1.062E-05
21	397.8	328	500	4.700E-03	2.080E-03	3.377E-03	1.420E-05	6.020E-06	1.003E-05
22	409.5	328	500	4.700E-03	2.080E-03	3.195E-03	1.420E-05	6.020E-06	9.457E-06
23	421.4	328	500	4.700E-03	2.080E-03	3.019E-03	1.420E-05	6.020E-06	8.911E-06
24	433.5	328	500	4.700E-03	2.080E-03	2.851E-03	1.420E-05	6.020E-06	8.389E-06
25	445.8	328	500	4.700E-03	2.080E-03	2.690E-03	1.420E-05	6.020E-06	7.890E-06
26	458.2	328	500	4.700E-03	2.080E-03	2.536E-03	1.420E-05	6.020E-06	7.415E-06
37	602.8	500	1000	2.080E-03	1.940E-04	1.277E-03	6.020E-06	4.930E-07	3.598E-06
28	483.5	328	500	4.700E-03	2.080E-03	2.249E-03	1.420E-05	6.020E-06	6.535E-06
29	496.4	328	500	4.700E-03	2.080E-03	2.116E-03	1.420E-05	6.020E-06	6.129E-06
30	509.4	500	1000	2.080E-03	1.940E-04	1.990E-03	6.020E-06	4.930E-07	5.744E-06
31	522.5	500	1000	2.080E-03	1.940E-04	1.870E-03	6.020E-06	4.930E-07	5.380E-06
32	535.6	500	1000	2.080E-03	1.940E-04	1.756E-03	6.020E-06	4.930E-07	5.037E-06
33	548.9	500	1000	2.080E-03	1.940E-04	1.649E-03	6.020E-06	4.930E-07	4.713E-06
34	562.3	500	1000	2.080E-03	1.940E-04	1.548E-03	6.020E-06	4.930E-07	4.408E-06
35	575.7	500	1000	2.080E-03	1.940E-04	1.452E-03	6.020E-06	4.930E-07	4.121E-06
36	589.2	500	1000	2.080E-03	1.940E-04	1.362E-03	6.020E-06	4.930E-07	3.851E-06
37	602.8	500	1000	2.080E-03	1.940E-04	1.277E-03	6.020E-06	4.930E-07	3.598E-06
38	616.5	500	1000	2.080E-03	1.940E-04	1.197E-03	6.020E-06	4.930E-07	3.360E-06
39	630.2	500	1000	2.080E-03	1.940E-04	1.121E-03	6.020E-06	4.930E-07	3.138E-06
40	644.0	500	1000	2.080E-03	1.940E-04	1.050E-03	6.020E-06	4.930E-07	2.929E-06
41	657.8	500	1000	2.080E-03	1.940E-04	9.838E-04	6.020E-06	4.930E-07	2.733E-06
42	671.7	500	1000	2.080E-03	1.940E-04	9.211E-04	6.020E-06	4.930E-07	2.549E-06
43	685.6	500	1000	2.080E-03	1.940E-04	8.622E-04	6.020E-06	4.930E-07	2.378E-06
44	699.6	500	1000	2.080E-03	1.940E-04	8.069E-04	6.020E-06	4.930E-07	2.217E-06
45	713.6	500	1000	2.080E-03	1.940E-04	7.550E-04	6.020E-06	4.930E-07	2.067E-06
46	727.6	500	1000	2.080E-03	1.940E-04	7.063E-04	6.020E-06	4.930E-07	1.927E-06
47	741.7	500	1000	2.080E-03	1.940E-04	6.607E-04	6.020E-06	4.930E-07	1.796E-06
48	755.9	500	1000	2.080E-03	1.940E-04	6.178E-04	6.020E-06	4.930E-07	1.673E-06
49	770.0	500	1000	2.080E-03	1.940E-04	5.777E-04	6.020E-06	4.930E-07	1.559E-06
50	784.2	500	1000	2.080E-03	1.940E-04	5.401E-04	6.020E-06	4.930E-07	1.452E-06
51	798.4	500	1000	2.080E-03	1.940E-04	5.049E-04	6.020E-06	4.930E-07	1.352E-06
52	812.7	500	1000	2.080E-03	1.940E-04	4.719E-04	6.020E-06	4.930E-07	1.259E-06
53	826.9	500	1000	2.080E-03	1.940E-04	4.410E-04	6.020E-06	4.930E-07	1.172E-06

ISFSI Dose Calculation (from all 4000 casks)

Side Gamma =	1.564E-01
Side Neutron =	7.768E-04
Total Dose Rate =	1.572E-01

Distance= 200

Single Cask Results

Distance	Side Gam	Side Neut
100	5.16E-02	1.75E-04
200	8.63E-03	2.70E-05
328	4.70E-03	1.42E-05
500	2.08E-03	6.02E-06
1000	1.94E-04	4.93E-07
2000	8.47E-06	2.22E-08
3000	8.47E-06	2.22E-08
4000	8.47E-06	2.22E-08

Distance to Cask Groups — Distance Interval — Cask Group Dose Rate Calculation (Single Cask)

Cask #	Distance	D min	D max	G/S Min	G/S Max	S Gamma	N/S Min	N/S Max	Side Neut
1	352.4	328	500	4.700E-03	2.080E-03	4.187E-03	1.420E-05	6.020E-06	1.257E-05
2	353.0	328	500	4.700E-03	2.080E-03	4.174E-03	1.420E-05	6.020E-06	1.253E-05
3	354.3	328	500	4.700E-03	2.080E-03	4.149E-03	1.420E-05	6.020E-06	1.245E-05
4	356.2	328	500	4.700E-03	2.080E-03	4.112E-03	1.420E-05	6.020E-06	1.234E-05
5	358.7	328	500	4.700E-03	2.080E-03	4.063E-03	1.420E-05	6.020E-06	1.218E-05
6	361.8	328	500	4.700E-03	2.080E-03	4.004E-03	1.420E-05	6.020E-06	1.199E-05
7	365.5	328	500	4.700E-03	2.080E-03	3.934E-03	1.420E-05	6.020E-06	1.177E-05
8	369.8	328	500	4.700E-03	2.080E-03	3.855E-03	1.420E-05	6.020E-06	1.153E-05
9	374.7	328	500	4.700E-03	2.080E-03	3.767E-03	1.420E-05	6.020E-06	1.125E-05
10	380.0	328	500	4.700E-03	2.080E-03	3.673E-03	1.420E-05	6.020E-06	1.095E-05
11	385.9	328	500	4.700E-03	2.080E-03	3.572E-03	1.420E-05	6.020E-06	1.064E-05
12	392.3	328	500	4.700E-03	2.080E-03	3.466E-03	1.420E-05	6.020E-06	1.030E-05
13	399.1	328	500	4.700E-03	2.080E-03	3.356E-03	1.420E-05	6.020E-06	9.960E-06
14	406.4	328	500	4.700E-03	2.080E-03	3.242E-03	1.420E-05	6.020E-06	9.605E-06
15	414.0	328	500	4.700E-03	2.080E-03	3.126E-03	1.420E-05	6.020E-06	9.244E-06
16	422.1	328	500	4.700E-03	2.080E-03	3.009E-03	1.420E-05	6.020E-06	8.879E-06
17	430.5	328	500	4.700E-03	2.080E-03	2.891E-03	1.420E-05	6.020E-06	8.513E-06
18	439.3	328	500	4.700E-03	2.080E-03	2.773E-03	1.420E-05	6.020E-06	8.148E-06
19	448.5	328	500	4.700E-03	2.080E-03	2.655E-03	1.420E-05	6.020E-06	7.785E-06
20	457.9	328	500	4.700E-03	2.080E-03	2.539E-03	1.420E-05	6.020E-06	7.427E-06
21	467.6	328	500	4.700E-03	2.080E-03	2.425E-03	1.420E-05	6.020E-06	7.075E-06
22	477.6	328	500	4.700E-03	2.080E-03	2.313E-03	1.420E-05	6.020E-06	6.731E-06
23	487.9	328	500	4.700E-03	2.080E-03	2.203E-03	1.420E-05	6.020E-06	6.395E-06
24	498.4	328	500	4.700E-03	2.080E-03	2.098E-03	1.420E-05	6.020E-06	6.069E-06
25	509.1	500	1000	2.080E-03	1.940E-04	1.992E-03	6.020E-06	4.930E-07	5.752E-06
26	520.0	500	1000	2.080E-03	1.940E-04	1.892E-03	6.020E-06	4.930E-07	5.446E-06
37	651.1	500	1000	2.080E-03	1.940E-04	1.016E-03	6.020E-06	4.930E-07	2.827E-06
28	542.5	500	1000	2.080E-03	1.940E-04	1.700E-03	6.020E-06	4.930E-07	4.867E-06
29	554.0	500	1000	2.080E-03	1.940E-04	1.610E-03	6.020E-06	4.930E-07	4.595E-06
30	565.6	500	1000	2.080E-03	1.940E-04	1.524E-03	6.020E-06	4.930E-07	4.335E-06
31	577.4	500	1000	2.080E-03	1.940E-04	1.441E-03	6.020E-06	4.930E-07	4.086E-06
32	589.4	500	1000	2.080E-03	1.940E-04	1.361E-03	6.020E-06	4.930E-07	3.849E-06
33	601.5	500	1000	2.080E-03	1.940E-04	1.285E-03	6.020E-06	4.930E-07	3.623E-06
34	613.7	500	1000	2.080E-03	1.940E-04	1.213E-03	6.020E-06	4.930E-07	3.408E-06
35	626.0	500	1000	2.080E-03	1.940E-04	1.144E-03	6.020E-06	4.930E-07	3.204E-06
36	638.5	500	1000	2.080E-03	1.940E-04	1.078E-03	6.020E-06	4.930E-07	3.010E-06
37	651.1	500	1000	2.080E-03	1.940E-04	1.016E-03	6.020E-06	4.930E-07	2.827E-06
38	663.7	500	1000	2.080E-03	1.940E-04	9.566E-04	6.020E-06	4.930E-07	2.653E-06
39	676.5	500	1000	2.080E-03	1.940E-04	9.004E-04	6.020E-06	4.930E-07	2.489E-06
40	689.3	500	1000	2.080E-03	1.940E-04	8.471E-04	6.020E-06	4.930E-07	2.334E-06
41	702.3	500	1000	2.080E-03	1.940E-04	7.967E-04	6.020E-06	4.930E-07	2.188E-06
42	715.3	500	1000	2.080E-03	1.940E-04	7.490E-04	6.020E-06	4.930E-07	2.050E-06
43	728.4	500	1000	2.080E-03	1.940E-04	7.039E-04	6.020E-06	4.930E-07	1.920E-06
44	741.5	500	1000	2.080E-03	1.940E-04	6.613E-04	6.020E-06	4.930E-07	1.797E-06
45	754.8	500	1000	2.080E-03	1.940E-04	6.210E-04	6.020E-06	4.930E-07	1.682E-06
46	768.1	500	1000	2.080E-03	1.940E-04	5.831E-04	6.020E-06	4.930E-07	1.574E-06
47	781.4	500	1000	2.080E-03	1.940E-04	5.472E-04	6.020E-06	4.930E-07	1.472E-06
48	794.8	500	1000	2.080E-03	1.940E-04	5.135E-04	6.020E-06	4.930E-07	1.376E-06
49	808.3	500	1000	2.080E-03	1.940E-04	4.817E-04	6.020E-06	4.930E-07	1.287E-06
50	821.8	500	1000	2.080E-03	1.940E-04	4.518E-04	6.020E-06	4.930E-07	1.202E-06
51	835.4	500	1000	2.080E-03	1.940E-04	4.236E-04	6.020E-06	4.930E-07	1.123E-06
52	849.0	500	1000	2.080E-03	1.940E-04	3.971E-04	6.020E-06	4.930E-07	1.049E-06
53	862.7	500	1000	2.080E-03	1.940E-04	3.721E-04	6.020E-06	4.930E-07	9.800E-07

ISFSI Dose Calculation (from all 4000 casks)

Side Gamma =	1.079E-01
Side Neutron =	5.235E-04
Total Dose Rate =	1.084E-01

Distance= 328

Single Cask Results

Distance	Side Gam	Side Neut
100	5.16E-02	1.75E-04
200	8.63E-03	2.70E-05
328	4.70E-03	1.42E-05
500	2.08E-03	6.02E-06
1000	1.94E-04	4.93E-07
2000	8.47E-06	2.22E-08
3000	8.47E-06	2.22E-08
4000	8.47E-06	2.22E-08

Distance to Cask Groups — Distance Interval — Cask Group Dose Rate Calculation (Single Cask)

Cask #	Distance	D min	D max	G/S Min	G/S Max	S Gamma	N/S Min	N/S Max	Side Neut
1	480.4	328	500	4.700E-03	2.080E-03	2.283E-03	1.420E-05	6.020E-06	6.640E-06
2	480.8	328	500	4.700E-03	2.080E-03	2.278E-03	1.420E-05	6.020E-06	6.624E-06
3	481.8	328	500	4.700E-03	2.080E-03	2.268E-03	1.420E-05	6.020E-06	6.593E-06
4	483.2	328	500	4.700E-03	2.080E-03	2.253E-03	1.420E-05	6.020E-06	6.548E-06
5	485.0	328	500	4.700E-03	2.080E-03	2.233E-03	1.420E-05	6.020E-06	6.487E-06
6	487.3	328	500	4.700E-03	2.080E-03	2.209E-03	1.420E-05	6.020E-06	6.413E-06
7	490.1	328	500	4.700E-03	2.080E-03	2.180E-03	1.420E-05	6.020E-06	6.325E-06
8	493.3	328	500	4.700E-03	2.080E-03	2.147E-03	1.420E-05	6.020E-06	6.225E-06
9	496.9	328	500	4.700E-03	2.080E-03	2.110E-03	1.420E-05	6.020E-06	6.113E-06
10	501.0	500	1000	2.080E-03	1.940E-04	2.070E-03	6.020E-06	4.930E-07	5.990E-06
11	505.5	500	1000	2.080E-03	1.940E-04	2.027E-03	6.020E-06	4.930E-07	5.858E-06
12	510.3	500	1000	2.080E-03	1.940E-04	1.980E-03	6.020E-06	4.930E-07	5.716E-06
13	515.6	500	1000	2.080E-03	1.940E-04	1.932E-03	6.020E-06	4.930E-07	5.568E-06
14	521.2	500	1000	2.080E-03	1.940E-04	1.881E-03	6.020E-06	4.930E-07	5.413E-06
15	527.3	500	1000	2.080E-03	1.940E-04	1.828E-03	6.020E-06	4.930E-07	5.252E-06
16	533.6	500	1000	2.080E-03	1.940E-04	1.773E-03	6.020E-06	4.930E-07	5.088E-06
17	540.3	500	1000	2.080E-03	1.940E-04	1.718E-03	6.020E-06	4.930E-07	4.920E-06
18	547.4	500	1000	2.080E-03	1.940E-04	1.661E-03	6.020E-06	4.930E-07	4.750E-06
19	554.7	500	1000	2.080E-03	1.940E-04	1.605E-03	6.020E-06	4.930E-07	4.578E-06
20	562.4	500	1000	2.080E-03	1.940E-04	1.547E-03	6.020E-06	4.930E-07	4.406E-06
21	570.3	500	1000	2.080E-03	1.940E-04	1.490E-03	6.020E-06	4.930E-07	4.234E-06
22	578.5	500	1000	2.080E-03	1.940E-04	1.433E-03	6.020E-06	4.930E-07	4.064E-06
23	587.0	500	1000	2.080E-03	1.940E-04	1.376E-03	6.020E-06	4.930E-07	3.895E-06
24	595.8	500	1000	2.080E-03	1.940E-04	1.320E-03	6.020E-06	4.930E-07	3.728E-06
25	604.8	500	1000	2.080E-03	1.940E-04	1.265E-03	6.020E-06	4.930E-07	3.564E-06
26	614.0	500	1000	2.080E-03	1.940E-04	1.211E-03	6.020E-06	4.930E-07	3.403E-06
37	728.3	500	1000	2.080E-03	1.940E-04	7.041E-04	6.020E-06	4.930E-07	1.920E-06
28	633.1	500	1000	2.080E-03	1.940E-04	1.106E-03	6.020E-06	4.930E-07	3.092E-06
29	643.0	500	1000	2.080E-03	1.940E-04	1.055E-03	6.020E-06	4.930E-07	2.943E-06
30	653.1	500	1000	2.080E-03	1.940E-04	1.006E-03	6.020E-06	4.930E-07	2.798E-06
31	663.3	500	1000	2.080E-03	1.940E-04	9.584E-04	6.020E-06	4.930E-07	2.658E-06
32	673.8	500	1000	2.080E-03	1.940E-04	9.121E-04	6.020E-06	4.930E-07	2.523E-06
33	684.4	500	1000	2.080E-03	1.940E-04	8.673E-04	6.020E-06	4.930E-07	2.393E-06
34	695.1	500	1000	2.080E-03	1.940E-04	8.242E-04	6.020E-06	4.930E-07	2.267E-06
35	706.0	500	1000	2.080E-03	1.940E-04	7.825E-04	6.020E-06	4.930E-07	2.147E-06
36	717.1	500	1000	2.080E-03	1.940E-04	7.425E-04	6.020E-06	4.930E-07	2.031E-06
37	728.3	500	1000	2.080E-03	1.940E-04	7.041E-04	6.020E-06	4.930E-07	1.920E-06
38	739.7	500	1000	2.080E-03	1.940E-04	6.672E-04	6.020E-06	4.930E-07	1.814E-06
39	751.1	500	1000	2.080E-03	1.940E-04	6.318E-04	6.020E-06	4.930E-07	1.713E-06
40	762.7	500	1000	2.080E-03	1.940E-04	5.980E-04	6.020E-06	4.930E-07	1.616E-06
41	774.4	500	1000	2.080E-03	1.940E-04	5.657E-04	6.020E-06	4.930E-07	1.524E-06
42	786.3	500	1000	2.080E-03	1.940E-04	5.348E-04	6.020E-06	4.930E-07	1.437E-06
43	798.2	500	1000	2.080E-03	1.940E-04	5.054E-04	6.020E-06	4.930E-07	1.354E-06
44	810.2	500	1000	2.080E-03	1.940E-04	4.774E-04	6.020E-06	4.930E-07	1.275E-06
45	822.3	500	1000	2.080E-03	1.940E-04	4.507E-04	6.020E-06	4.930E-07	1.199E-06
46	834.6	500	1000	2.080E-03	1.940E-04	4.253E-04	6.020E-06	4.930E-07	1.128E-06
47	846.9	500	1000	2.080E-03	1.940E-04	4.012E-04	6.020E-06	4.930E-07	1.061E-06
48	859.3	500	1000	2.080E-03	1.940E-04	3.783E-04	6.020E-06	4.930E-07	9.971E-07
49	871.7	500	1000	2.080E-03	1.940E-04	3.565E-04	6.020E-06	4.930E-07	9.367E-07
50	884.3	500	1000	2.080E-03	1.940E-04	3.359E-04	6.020E-06	4.930E-07	8.797E-07
51	896.9	500	1000	2.080E-03	1.940E-04	3.163E-04	6.020E-06	4.930E-07	8.258E-07
52	909.6	500	1000	2.080E-03	1.940E-04	2.978E-04	6.020E-06	4.930E-07	7.749E-07
53	922.4	500	1000	2.080E-03	1.940E-04	2.803E-04	6.020E-06	4.930E-07	7.269E-07

ISFSI Dose Calculation (from all 4000 casks)

Side Gamma =	6.496E-02
Side Neutron =	3.080E-04
Total Dose Rate =	6.527E-02

Distance= 500

Single Cask Results

Distance	Side Gam	Side Neut
100	5.16E-02	1.75E-04
200	8.63E-03	2.70E-05
328	4.70E-03	1.42E-05
500	2.08E-03	6.02E-06
1000	1.94E-04	4.93E-07
2000	8.47E-06	2.22E-08
3000	8.47E-06	2.22E-08
4000	8.47E-06	2.22E-08

Distance to Cask Groups		Distance Interval		Cask Group Dose Rate Calculation (Single Cask)					
Cask #	Distance	D min	D max	G/S Min	G/S Max	S Gamma	N/S Min	N/S Max	Side Neut
1	652.3	500	1000	2.080E-03	1.940E-04	1.010E-03	6.020E-06	4.930E-07	2.809E-06
2	652.7	500	1000	2.080E-03	1.940E-04	1.008E-03	6.020E-06	4.930E-07	2.804E-06
3	653.4	500	1000	2.080E-03	1.940E-04	1.005E-03	6.020E-06	4.930E-07	2.794E-06
4	654.4	500	1000	2.080E-03	1.940E-04	9.998E-04	6.020E-06	4.930E-07	2.780E-06
5	655.8	500	1000	2.080E-03	1.940E-04	9.933E-04	6.020E-06	4.930E-07	2.761E-06
6	657.5	500	1000	2.080E-03	1.940E-04	9.852E-04	6.020E-06	4.930E-07	2.737E-06
7	659.5	500	1000	2.080E-03	1.940E-04	9.757E-04	6.020E-06	4.930E-07	2.709E-06
8	661.9	500	1000	2.080E-03	1.940E-04	9.647E-04	6.020E-06	4.930E-07	2.677E-06
9	664.6	500	1000	2.080E-03	1.940E-04	9.524E-04	6.020E-06	4.930E-07	2.641E-06
10	667.7	500	1000	2.080E-03	1.940E-04	9.387E-04	6.020E-06	4.930E-07	2.601E-06
11	671.0	500	1000	2.080E-03	1.940E-04	9.239E-04	6.020E-06	4.930E-07	2.558E-06
12	674.7	500	1000	2.080E-03	1.940E-04	9.079E-04	6.020E-06	4.930E-07	2.511E-06
13	678.7	500	1000	2.080E-03	1.940E-04	8.909E-04	6.020E-06	4.930E-07	2.461E-06
14	683.0	500	1000	2.080E-03	1.940E-04	8.729E-04	6.020E-06	4.930E-07	2.409E-06
15	687.6	500	1000	2.080E-03	1.940E-04	8.541E-04	6.020E-06	4.930E-07	2.354E-06
16	692.5	500	1000	2.080E-03	1.940E-04	8.345E-04	6.020E-06	4.930E-07	2.297E-06
17	697.7	500	1000	2.080E-03	1.940E-04	8.142E-04	6.020E-06	4.930E-07	2.238E-06
18	703.1	500	1000	2.080E-03	1.940E-04	7.934E-04	6.020E-06	4.930E-07	2.178E-06
19	708.9	500	1000	2.080E-03	1.940E-04	7.721E-04	6.020E-06	4.930E-07	2.116E-06
20	714.9	500	1000	2.080E-03	1.940E-04	7.504E-04	6.020E-06	4.930E-07	2.054E-06
21	721.1	500	1000	2.080E-03	1.940E-04	7.284E-04	6.020E-06	4.930E-07	1.990E-06
22	727.7	500	1000	2.080E-03	1.940E-04	7.062E-04	6.020E-06	4.930E-07	1.926E-06
23	734.4	500	1000	2.080E-03	1.940E-04	6.839E-04	6.020E-06	4.930E-07	1.862E-06
24	741.5	500	1000	2.080E-03	1.940E-04	6.615E-04	6.020E-06	4.930E-07	1.798E-06
25	748.7	500	1000	2.080E-03	1.940E-04	6.392E-04	6.020E-06	4.930E-07	1.734E-06
26	756.2	500	1000	2.080E-03	1.940E-04	6.169E-04	6.020E-06	4.930E-07	1.670E-06
37	851.6	500	1000	2.080E-03	1.940E-04	3.922E-04	6.020E-06	4.930E-07	1.036E-06
28	771.8	500	1000	2.080E-03	1.940E-04	5.729E-04	6.020E-06	4.930E-07	1.545E-06
29	779.9	500	1000	2.080E-03	1.940E-04	5.512E-04	6.020E-06	4.930E-07	1.483E-06
30	788.2	500	1000	2.080E-03	1.940E-04	5.299E-04	6.020E-06	4.930E-07	1.423E-06
31	796.7	500	1000	2.080E-03	1.940E-04	5.089E-04	6.020E-06	4.930E-07	1.363E-06
32	805.5	500	1000	2.080E-03	1.940E-04	4.883E-04	6.020E-06	4.930E-07	1.305E-06
33	814.3	500	1000	2.080E-03	1.940E-04	4.681E-04	6.020E-06	4.930E-07	1.248E-06
34	823.4	500	1000	2.080E-03	1.940E-04	4.484E-04	6.020E-06	4.930E-07	1.193E-06
35	832.6	500	1000	2.080E-03	1.940E-04	4.292E-04	6.020E-06	4.930E-07	1.139E-06
36	842.1	500	1000	2.080E-03	1.940E-04	4.104E-04	6.020E-06	4.930E-07	1.087E-06
37	851.6	500	1000	2.080E-03	1.940E-04	3.922E-04	6.020E-06	4.930E-07	1.036E-06
38	861.3	500	1000	2.080E-03	1.940E-04	3.746E-04	6.020E-06	4.930E-07	9.868E-07
39	871.2	500	1000	2.080E-03	1.940E-04	3.574E-04	6.020E-06	4.930E-07	9.392E-07
40	881.2	500	1000	2.080E-03	1.940E-04	3.408E-04	6.020E-06	4.930E-07	8.933E-07
41	891.4	500	1000	2.080E-03	1.940E-04	3.248E-04	6.020E-06	4.930E-07	8.491E-07
42	901.7	500	1000	2.080E-03	1.940E-04	3.093E-04	6.020E-06	4.930E-07	8.064E-07
43	912.1	500	1000	2.080E-03	1.940E-04	2.944E-04	6.020E-06	4.930E-07	7.655E-07
44	922.6	500	1000	2.080E-03	1.940E-04	2.800E-04	6.020E-06	4.930E-07	7.261E-07
45	933.3	500	1000	2.080E-03	1.940E-04	2.662E-04	6.020E-06	4.930E-07	6.884E-07
46	944.1	500	1000	2.080E-03	1.940E-04	2.529E-04	6.020E-06	4.930E-07	6.522E-07
47	955.0	500	1000	2.080E-03	1.940E-04	2.402E-04	6.020E-06	4.930E-07	6.176E-07
48	966.0	500	1000	2.080E-03	1.940E-04	2.280E-04	6.020E-06	4.930E-07	5.845E-07
49	977.1	500	1000	2.080E-03	1.940E-04	2.163E-04	6.020E-06	4.930E-07	5.528E-07
50	988.3	500	1000	2.080E-03	1.940E-04	2.050E-04	6.020E-06	4.930E-07	5.226E-07
51	999.7	500	1000	2.080E-03	1.940E-04	1.943E-04	6.020E-06	4.930E-07	4.939E-07
52	1011.1	1000	2000	1.940E-04	8.470E-06	1.674E-04	4.930E-07	2.220E-08	4.764E-07
53	1022.6	1000	2000	1.940E-04	8.470E-06	1.808E-04	4.930E-07	2.220E-08	4.597E-07

ISFSI Dose Calculation (from all 4000 casks)

Side Gamma =	3.173E-02
Side Neutron =	1.433E-04
Total Dose Rate =	3.187E-02

Distance= 1000

Single Cask Results

Distance	Side Gam	Side Neut
100	5.16E-02	1.75E-04
200	8.63E-03	2.70E-05
328	4.70E-03	1.42E-05
500	2.08E-03	6.02E-06
1000	1.94E-04	4.93E-07
2000	8.47E-06	2.22E-08
3000	8.47E-06	2.22E-08
4000	8.47E-06	2.22E-08

Distance to Cask Groups		Distance Interval		Cask Group Dose Rate Calculation (Single Cask)					
Cask #	Distance	D min	D max	G/S Min	G/S Max	S Gamma	N/S Min	N/S Max	Side Neut
1	1152.3	1000	2000	1.940E-04	8.470E-06	1.204E-04	4.930E-07	2.220E-08	3.074E-07
2	1152.5	1000	2000	1.940E-04	8.470E-06	1.203E-04	4.930E-07	2.220E-08	3.072E-07
3	1152.9	1000	2000	1.940E-04	8.470E-06	1.202E-04	4.930E-07	2.220E-08	3.069E-07
4	1153.5	1000	2000	1.940E-04	8.470E-06	1.200E-04	4.930E-07	2.220E-08	3.063E-07
5	1154.3	1000	2000	1.940E-04	8.470E-06	1.197E-04	4.930E-07	2.220E-08	3.056E-07
6	1155.2	1000	2000	1.940E-04	8.470E-06	1.193E-04	4.930E-07	2.220E-08	3.047E-07
7	1156.4	1000	2000	1.940E-04	8.470E-06	1.189E-04	4.930E-07	2.220E-08	3.036E-07
8	1157.8	1000	2000	1.940E-04	8.470E-06	1.184E-04	4.930E-07	2.220E-08	3.023E-07
9	1159.3	1000	2000	1.940E-04	8.470E-06	1.178E-04	4.930E-07	2.220E-08	3.008E-07
10	1161.1	1000	2000	1.940E-04	8.470E-06	1.172E-04	4.930E-07	2.220E-08	2.992E-07
11	1163.0	1000	2000	1.940E-04	8.470E-06	1.164E-04	4.930E-07	2.220E-08	2.974E-07
12	1165.1	1000	2000	1.940E-04	8.470E-06	1.157E-04	4.930E-07	2.220E-08	2.955E-07
13	1167.5	1000	2000	1.940E-04	8.470E-06	1.148E-04	4.930E-07	2.220E-08	2.933E-07
14	1170.0	1000	2000	1.940E-04	8.470E-06	1.139E-04	4.930E-07	2.220E-08	2.911E-07
15	1172.6	1000	2000	1.940E-04	8.470E-06	1.130E-04	4.930E-07	2.220E-08	2.887E-07
16	1175.5	1000	2000	1.940E-04	8.470E-06	1.120E-04	4.930E-07	2.220E-08	2.861E-07
17	1178.6	1000	2000	1.940E-04	8.470E-06	1.109E-04	4.930E-07	2.220E-08	2.834E-07
18	1181.8	1000	2000	1.940E-04	8.470E-06	1.098E-04	4.930E-07	2.220E-08	2.806E-07
19	1185.2	1000	2000	1.940E-04	8.470E-06	1.086E-04	4.930E-07	2.220E-08	2.776E-07
20	1188.8	1000	2000	1.940E-04	8.470E-06	1.074E-04	4.930E-07	2.220E-08	2.745E-07
21	1192.6	1000	2000	1.940E-04	8.470E-06	1.061E-04	4.930E-07	2.220E-08	2.713E-07
22	1196.6	1000	2000	1.940E-04	8.470E-06	1.048E-04	4.930E-07	2.220E-08	2.680E-07
23	1200.7	1000	2000	1.940E-04	8.470E-06	1.035E-04	4.930E-07	2.220E-08	2.646E-07
24	1205.0	1000	2000	1.940E-04	8.470E-06	1.021E-04	4.930E-07	2.220E-08	2.611E-07
25	1209.5	1000	2000	1.940E-04	8.470E-06	1.007E-04	4.930E-07	2.220E-08	2.575E-07
26	1214.1	1000	2000	1.940E-04	8.470E-06	9.922E-05	4.930E-07	2.220E-08	2.538E-07
37	1275.8	1000	2000	1.940E-04	8.470E-06	8.181E-05	4.930E-07	2.220E-08	2.097E-07
28	1223.9	1000	2000	1.940E-04	8.470E-06	9.623E-05	4.930E-07	2.220E-08	2.462E-07
29	1229.0	1000	2000	1.940E-04	8.470E-06	9.469E-05	4.930E-07	2.220E-08	2.423E-07
30	1234.3	1000	2000	1.940E-04	8.470E-06	9.314E-05	4.930E-07	2.220E-08	2.384E-07
31	1239.8	1000	2000	1.940E-04	8.470E-06	9.156E-05	4.930E-07	2.220E-08	2.344E-07
32	1245.4	1000	2000	1.940E-04	8.470E-06	8.996E-05	4.930E-07	2.220E-08	2.304E-07
33	1251.2	1000	2000	1.940E-04	8.470E-06	8.835E-05	4.930E-07	2.220E-08	2.263E-07
34	1257.1	1000	2000	1.940E-04	8.470E-06	8.673E-05	4.930E-07	2.220E-08	2.222E-07
35	1263.2	1000	2000	1.940E-04	8.470E-06	8.510E-05	4.930E-07	2.220E-08	2.180E-07
36	1269.4	1000	2000	1.940E-04	8.470E-06	8.346E-05	4.930E-07	2.220E-08	2.139E-07
37	1275.8	1000	2000	1.940E-04	8.470E-06	8.181E-05	4.930E-07	2.220E-08	2.097E-07
38	1282.3	1000	2000	1.940E-04	8.470E-06	8.016E-05	4.930E-07	2.220E-08	2.055E-07
39	1288.9	1000	2000	1.940E-04	8.470E-06	7.851E-05	4.930E-07	2.220E-08	2.013E-07
40	1295.7	1000	2000	1.940E-04	8.470E-06	7.685E-05	4.930E-07	2.220E-08	1.971E-07
41	1302.6	1000	2000	1.940E-04	8.470E-06	7.520E-05	4.930E-07	2.220E-08	1.929E-07
42	1309.7	1000	2000	1.940E-04	8.470E-06	7.356E-05	4.930E-07	2.220E-08	1.887E-07
43	1316.9	1000	2000	1.940E-04	8.470E-06	7.192E-05	4.930E-07	2.220E-08	1.846E-07
44	1324.2	1000	2000	1.940E-04	8.470E-06	7.029E-05	4.930E-07	2.220E-08	1.804E-07
45	1331.7	1000	2000	1.940E-04	8.470E-06	6.867E-05	4.930E-07	2.220E-08	1.763E-07
46	1339.3	1000	2000	1.940E-04	8.470E-06	6.706E-05	4.930E-07	2.220E-08	1.722E-07
47	1347.0	1000	2000	1.940E-04	8.470E-06	6.546E-05	4.930E-07	2.220E-08	1.681E-07
48	1354.8	1000	2000	1.940E-04	8.470E-06	6.387E-05	4.930E-07	2.220E-08	1.641E-07
49	1362.7	1000	2000	1.940E-04	8.470E-06	6.230E-05	4.930E-07	2.220E-08	1.601E-07
50	1370.8	1000	2000	1.940E-04	8.470E-06	6.075E-05	4.930E-07	2.220E-08	1.562E-07
51	1379.0	1000	2000	1.940E-04	8.470E-06	5.921E-05	4.930E-07	2.220E-08	1.522E-07
52	1387.3	1000	2000	1.940E-04	8.470E-06	5.769E-05	4.930E-07	2.220E-08	1.484E-07
53	1395.7	1000	2000	1.940E-04	8.470E-06	5.619E-05	4.930E-07	2.220E-08	1.446E-07

ISFSI Dose Calculation (from all 4000 casks)

Side Gamma =	4.992E-03
Side Neutron =	2.120E-05
Total Dose Rate =	5.013E-03

Distance= 1500

Single Cask Results

Distance	Side Gam	Side Neut
100	5.16E-02	1.75E-04
200	8.63E-03	2.70E-05
328	4.70E-03	1.42E-05
500	2.08E-03	6.02E-06
1000	1.94E-04	4.93E-07
2000	8.47E-06	2.22E-08
3000	8.47E-06	2.22E-08
4000	8.47E-06	2.22E-08

Distance to Cask Groups — Distance Interval — Cask Group Dose Rate Calculation (Single Cask)

Cask #	Distance	D min	D max	G/S Min	G/S Max	S Gamma	N/S Min	N/S Max	Side Neut
1	1652.3	1000	2000	1.940E-04	8.470E-06	2.516E-05	4.930E-07	2.220E-08	6.524E-06
2	1652.5	1000	2000	1.940E-04	8.470E-06	2.515E-05	4.930E-07	2.220E-08	6.521E-06
3	1652.7	1000	2000	1.940E-04	8.470E-06	2.513E-05	4.930E-07	2.220E-08	6.516E-06
4	1653.1	1000	2000	1.940E-04	8.470E-06	2.510E-05	4.930E-07	2.220E-08	6.507E-06
5	1653.7	1000	2000	1.940E-04	8.470E-06	2.505E-05	4.930E-07	2.220E-08	6.496E-06
6	1654.4	1000	2000	1.940E-04	8.470E-06	2.500E-05	4.930E-07	2.220E-08	6.483E-06
7	1655.2	1000	2000	1.940E-04	8.470E-06	2.494E-05	4.930E-07	2.220E-08	6.468E-06
8	1656.1	1000	2000	1.940E-04	8.470E-06	2.486E-05	4.930E-07	2.220E-08	6.447E-06
9	1657.2	1000	2000	1.940E-04	8.470E-06	2.478E-05	4.930E-07	2.220E-08	6.426E-06
10	1658.4	1000	2000	1.940E-04	8.470E-06	2.468E-05	4.930E-07	2.220E-08	6.401E-06
11	1659.8	1000	2000	1.940E-04	8.470E-06	2.458E-05	4.930E-07	2.220E-08	6.374E-06
12	1661.3	1000	2000	1.940E-04	8.470E-06	2.446E-05	4.930E-07	2.220E-08	6.345E-06
13	1662.9	1000	2000	1.940E-04	8.470E-06	2.434E-05	4.930E-07	2.220E-08	6.313E-06
14	1664.7	1000	2000	1.940E-04	8.470E-06	2.421E-05	4.930E-07	2.220E-08	6.279E-06
15	1666.6	1000	2000	1.940E-04	8.470E-06	2.406E-05	4.930E-07	2.220E-08	6.242E-06
16	1668.6	1000	2000	1.940E-04	8.470E-06	2.391E-05	4.930E-07	2.220E-08	6.203E-06
17	1670.7	1000	2000	1.940E-04	8.470E-06	2.375E-05	4.930E-07	2.220E-08	6.162E-06
18	1673.0	1000	2000	1.940E-04	8.470E-06	2.358E-05	4.930E-07	2.220E-08	6.118E-06
19	1675.4	1000	2000	1.940E-04	8.470E-06	2.340E-05	4.930E-07	2.220E-08	6.073E-06
20	1678.0	1000	2000	1.940E-04	8.470E-06	2.322E-05	4.930E-07	2.220E-08	6.025E-06
21	1680.7	1000	2000	1.940E-04	8.470E-06	2.302E-05	4.930E-07	2.220E-08	5.975E-06
22	1683.5	1000	2000	1.940E-04	8.470E-06	2.282E-05	4.930E-07	2.220E-08	5.923E-06
23	1686.4	1000	2000	1.940E-04	8.470E-06	2.261E-05	4.930E-07	2.220E-08	5.869E-06
24	1689.5	1000	2000	1.940E-04	8.470E-06	2.240E-05	4.930E-07	2.220E-08	5.814E-06
25	1692.7	1000	2000	1.940E-04	8.470E-06	2.217E-05	4.930E-07	2.220E-08	5.757E-06
26	1696.0	1000	2000	1.940E-04	8.470E-06	2.194E-05	4.930E-07	2.220E-08	5.698E-06
37	1740.6	1000	2000	1.940E-04	8.470E-06	1.906E-05	4.930E-07	2.220E-08	4.961E-06
28	1703.0	1000	2000	1.940E-04	8.470E-06	2.147E-05	4.930E-07	2.220E-08	5.575E-06
29	1706.7	1000	2000	1.940E-04	8.470E-06	2.122E-05	4.930E-07	2.220E-08	5.511E-06
30	1710.5	1000	2000	1.940E-04	8.470E-06	2.097E-05	4.930E-07	2.220E-08	5.447E-06
31	1714.5	1000	2000	1.940E-04	8.470E-06	2.071E-05	4.930E-07	2.220E-08	5.380E-06
32	1718.5	1000	2000	1.940E-04	8.470E-06	2.045E-05	4.930E-07	2.220E-08	5.313E-06
33	1722.7	1000	2000	1.940E-04	8.470E-06	2.018E-05	4.930E-07	2.220E-08	5.245E-06
34	1727.0	1000	2000	1.940E-04	8.470E-06	1.991E-05	4.930E-07	2.220E-08	5.175E-06
35	1731.4	1000	2000	1.940E-04	8.470E-06	1.964E-05	4.930E-07	2.220E-08	5.105E-06
36	1736.0	1000	2000	1.940E-04	8.470E-06	1.936E-05	4.930E-07	2.220E-08	5.033E-06
37	1740.6	1000	2000	1.940E-04	8.470E-06	1.908E-05	4.930E-07	2.220E-08	4.961E-06
38	1745.4	1000	2000	1.940E-04	8.470E-06	1.880E-05	4.930E-07	2.220E-08	4.888E-06
39	1750.3	1000	2000	1.940E-04	8.470E-06	1.851E-05	4.930E-07	2.220E-08	4.815E-06
40	1755.3	1000	2000	1.940E-04	8.470E-06	1.822E-05	4.930E-07	2.220E-08	4.740E-06
41	1760.4	1000	2000	1.940E-04	8.470E-06	1.793E-05	4.930E-07	2.220E-08	4.666E-06
42	1765.7	1000	2000	1.940E-04	8.470E-06	1.764E-05	4.930E-07	2.220E-08	4.591E-06
43	1771.0	1000	2000	1.940E-04	8.470E-06	1.735E-05	4.930E-07	2.220E-08	4.515E-06
44	1776.5	1000	2000	1.940E-04	8.470E-06	1.706E-05	4.930E-07	2.220E-08	4.439E-06
45	1782.0	1000	2000	1.940E-04	8.470E-06	1.676E-05	4.930E-07	2.220E-08	4.364E-06
46	1787.7	1000	2000	1.940E-04	8.470E-06	1.647E-05	4.930E-07	2.220E-08	4.287E-06
47	1793.5	1000	2000	1.940E-04	8.470E-06	1.617E-05	4.930E-07	2.220E-08	4.211E-06
48	1799.4	1000	2000	1.940E-04	8.470E-06	1.588E-05	4.930E-07	2.220E-08	4.135E-06
49	1805.4	1000	2000	1.940E-04	8.470E-06	1.558E-05	4.930E-07	2.220E-08	4.059E-06
50	1811.5	1000	2000	1.940E-04	8.470E-06	1.529E-05	4.930E-07	2.220E-08	3.983E-06
51	1817.7	1000	2000	1.940E-04	8.470E-06	1.499E-05	4.930E-07	2.220E-08	3.907E-06
52	1824.0	1000	2000	1.940E-04	8.470E-06	1.470E-05	4.930E-07	2.220E-08	3.832E-06
53	1830.4	1000	2000	1.940E-04	8.470E-06	1.441E-05	4.930E-07	2.220E-08	3.756E-06

ISFSI Dose Calculation (from all 4000 casks)

Side Gamma =	1.112E-03
Side Neutron =	4.795E-06
Total Dose Rate =	1.117E-03

Distance= 1968.5

Single Cask Results

Distance	Side Gam	Side Neut
100	5.16E-02	1.75E-04
200	8.63E-03	2.70E-05
328	4.70E-03	1.42E-05
500	2.08E-03	6.02E-06
1000	1.94E-04	4.93E-07
2000	8.47E-06	2.22E-08
3000	8.47E-06	2.22E-08
4000	8.47E-06	2.22E-08

Distance to Cask Groups		Distance Interval		Cask Group Dose Rate Calculation (Single Cask)					
Cask #	Distance	D min	D max	G/S Min	G/S Max	S Gamma	N/S Min	N/S Max	Side Neut
1	2120.8	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
2	2120.9	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
3	2121.1	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
4	2121.4	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
5	2121.9	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
6	2122.4	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
7	2123.0	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
8	2123.8	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
9	2124.6	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
10	2125.6	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
11	2126.6	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
12	2127.8	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
13	2129.1	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
14	2130.4	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
15	2131.9	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
16	2133.5	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
17	2135.2	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
18	2137.0	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
19	2138.9	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
20	2140.9	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
21	2143.0	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
22	2145.2	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
23	2147.5	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
24	2149.9	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
25	2152.4	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
26	2155.0	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
37	2190.3	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
28	2160.5	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
29	2163.5	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
30	2166.5	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
31	2169.6	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
32	2172.8	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
33	2176.1	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
34	2179.5	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
35	2183.0	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
36	2186.6	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
37	2190.3	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
38	2194.1	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
39	2198.0	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
40	2202.0	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
41	2206.1	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
42	2210.3	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
43	2214.5	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
44	2218.9	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
45	2223.4	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
46	2227.9	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
47	2232.6	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
48	2237.3	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
49	2242.1	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
50	2247.0	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
51	2252.0	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
52	2257.1	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08
53	2262.3	2000	3000	8.470E-06	8.470E-06	8.470E-06	2.220E-08	2.220E-08	2.220E-08

ISFSI Dose Calculation (from all 4000 casks)

Side Gamma =	4.489E-04
Side Neutron =	1.953E-06
Total Dose Rate =	4.509E-04

Distance= 0

Single Cask Results

Distance	Top Gam	Top Neut
100	1.47E-03	1.42E-05
200	3.81E-04	3.53E-06
328	2.11E-04	2.02E-06
500	9.54E-05	9.52E-07
1000	9.49E-06	1.07E-07
2000	3.73E-07	4.87E-09
3000	3.73E-07	4.87E-09
4000	3.73E-07	4.87E-09

Distance to Cask Groups		Distance Interval		Cask Group Dose Rate Calculation (Single Cask)					
Group #	Distance	D min	D max	G/T Min	G/T Max	T Gamma	N/T Min	N/T Max	Top Neut
Group 1	152.3	100	200	1.470E-03	3.810E-04	7.255E-04	1.420E-05	3.530E-06	6.857E-06
Group 2	184.3	100	200	1.470E-03	3.810E-04	4.710E-04	1.420E-05	3.530E-06	4.392E-06
Group 3	216.3	200	328	3.810E-04	2.110E-04	3.534E-04	3.530E-06	2.020E-06	3.288E-06
Group 4	248.3	200	328	3.810E-04	2.110E-04	3.048E-04	3.530E-06	2.020E-06	2.860E-06
Group 5	280.3	200	328	3.810E-04	2.110E-04	2.630E-04	3.530E-06	2.020E-06	2.487E-06
Group 6	312.3	200	328	3.810E-04	2.110E-04	2.269E-04	3.530E-06	2.020E-06	2.163E-06
Group 7	344.3	328	500	2.110E-04	9.540E-05	1.957E-04	2.020E-06	9.520E-07	1.881E-06
Group 8	376.3	328	500	2.110E-04	9.540E-05	1.688E-04	2.020E-06	9.520E-07	1.635E-06
Group 9	408.3	328	500	2.110E-04	9.540E-05	1.457E-04	2.020E-06	9.520E-07	1.422E-06
Group 10	440.3	328	500	2.110E-04	9.540E-05	1.257E-04	2.020E-06	9.520E-07	1.236E-06
Group 11	472.3	328	500	2.110E-04	9.540E-05	1.084E-04	2.020E-06	9.520E-07	1.075E-06
Group 12	504.3	500	1000	9.540E-05	9.490E-06	9.353E-05	9.520E-07	1.070E-07	9.343E-07
Group 13	536.3	500	1000	9.540E-05	9.490E-06	8.068E-05	9.520E-07	1.070E-07	8.123E-07
Group 14	568.3	500	1000	9.540E-05	9.490E-06	6.960E-05	9.520E-07	1.070E-07	7.063E-07
Group 15	600.3	500	1000	9.540E-05	9.490E-06	6.005E-05	9.520E-07	1.070E-07	6.141E-07
Group 16	632.3	500	1000	9.540E-05	9.490E-06	5.180E-05	9.520E-07	1.070E-07	5.339E-07
Group 17	664.3	500	1000	9.540E-05	9.490E-06	4.469E-05	9.520E-07	1.070E-07	4.642E-07
Group 18	696.3	500	1000	9.540E-05	9.490E-06	3.855E-05	9.520E-07	1.070E-07	4.036E-07
Group 19	728.3	500	1000	9.540E-05	9.490E-06	3.326E-05	9.520E-07	1.070E-07	3.509E-07
Group 20	760.3	500	1000	9.540E-05	9.490E-06	2.869E-05	9.520E-07	1.070E-07	3.051E-07
Group 21	942.3	500	1000	9.540E-05	9.490E-06	1.239E-05	9.520E-07	1.070E-07	1.377E-07
Group 22	974.3	500	1000	9.540E-05	9.490E-06	1.069E-05	9.520E-07	1.070E-07	1.197E-07
Group 23	1006.3	1000	2000	9.490E-06	3.730E-07	9.298E-06	1.070E-07	4.870E-09	1.049E-07
Group 24	1038.3	1000	2000	9.490E-06	3.730E-07	8.384E-06	1.070E-07	4.870E-09	9.506E-08
Group 25	1070.3	1000	2000	9.490E-06	3.730E-07	7.559E-06	1.070E-07	4.870E-09	8.611E-08
Group 26	1102.3	1000	2000	9.490E-06	3.730E-07	6.815E-06	1.070E-07	4.870E-09	7.800E-08
Group 27	1134.3	1000	2000	9.490E-06	3.730E-07	6.145E-06	1.070E-07	4.870E-09	7.066E-08
Group 28	1166.3	1000	2000	9.490E-06	3.730E-07	5.540E-06	1.070E-07	4.870E-09	6.401E-08
Group 29	1198.3	1000	2000	9.490E-06	3.730E-07	4.995E-06	1.070E-07	4.870E-09	5.798E-08
Group 30	1230.3	1000	2000	9.490E-06	3.730E-07	4.504E-06	1.070E-07	4.870E-09	5.252E-08
Group 31	1262.3	1000	2000	9.490E-06	3.730E-07	4.061E-06	1.070E-07	4.870E-09	4.758E-08
Group 32	1294.3	1000	2000	9.490E-06	3.730E-07	3.661E-06	1.070E-07	4.870E-09	4.310E-08
Group 33	1326.3	1000	2000	9.490E-06	3.730E-07	3.301E-06	1.070E-07	4.870E-09	3.904E-08
Group 34	1358.3	1000	2000	9.490E-06	3.730E-07	2.976E-06	1.070E-07	4.870E-09	3.537E-08
Group 35	1390.3	1000	2000	9.490E-06	3.730E-07	2.683E-06	1.070E-07	4.870E-09	3.204E-08
Group 36	1422.3	1000	2000	9.490E-06	3.730E-07	2.419E-06	1.070E-07	4.870E-09	2.902E-08
Group 37	1454.3	1000	2000	9.490E-06	3.730E-07	2.181E-06	1.070E-07	4.870E-09	2.629E-08
Group 38	1486.3	1000	2000	9.490E-06	3.730E-07	1.967E-06	1.070E-07	4.870E-09	2.381E-08
Group 39	1518.3	1000	2000	9.490E-06	3.730E-07	1.773E-06	1.070E-07	4.870E-09	2.157E-08
Group 40	1550.3	1000	2000	9.490E-06	3.730E-07	1.599E-06	1.070E-07	4.870E-09	1.954E-08

Number of Casks per Group = 100

ISFSI Dose Calculation (from all 4000 casks)

Top Gamma =	1.846E-01
Top Neutron =	2.955E-03
Total Dose Rate =	1.876E-01

Distance= 50

Single Cask Results

Distance	Top Gam	Top Neut
100	1.47E-03	1.42E-05
200	3.81E-04	3.53E-06
328	2.11E-04	2.02E-06
500	9.54E-05	9.52E-07
1000	9.49E-06	1.07E-07
2000	3.73E-07	4.87E-09
3000	3.73E-07	4.87E-09
4000	3.73E-07	4.87E-09

Distance to Cask Groups		Distance Interval		Cask Group Dose Rate Calculation (Single Cask)					
Group #	Distance	D min	D max	G/T Min	G/T Max	T Gamma	N/T Min	N/T Max	Top Neut
Group 1	202.3	200	328	3.810E-04	2.110E-04	3.770E-04	3.530E-06	2.020E-06	3.495E-06
Group 2	234.3	200	328	3.810E-04	2.110E-04	3.252E-04	3.530E-06	2.020E-06	3.040E-06
Group 3	266.3	200	328	3.810E-04	2.110E-04	2.805E-04	3.530E-06	2.020E-06	2.644E-06
Group 4	298.3	200	328	3.810E-04	2.110E-04	2.420E-04	3.530E-06	2.020E-06	2.299E-06
Group 5	330.3	328	500	2.110E-04	9.540E-05	2.088E-04	2.020E-06	9.520E-07	2.000E-06
Group 6	362.3	328	500	2.110E-04	9.540E-05	1.801E-04	2.020E-06	9.520E-07	1.739E-06
Group 7	394.3	328	500	2.110E-04	9.540E-05	1.554E-04	2.020E-06	9.520E-07	1.512E-06
Group 8	426.3	328	500	2.110E-04	9.540E-05	1.340E-04	2.020E-06	9.520E-07	1.314E-06
Group 9	458.3	328	500	2.110E-04	9.540E-05	1.156E-04	2.020E-06	9.520E-07	1.142E-06
Group 10	490.3	328	500	2.110E-04	9.540E-05	9.977E-05	2.020E-06	9.520E-07	9.933E-07
Group 11	522.3	500	1000	9.540E-05	9.490E-06	8.607E-05	9.520E-07	1.070E-07	8.636E-07
Group 12	554.3	500	1000	9.540E-05	9.490E-06	7.425E-05	9.520E-07	1.070E-07	7.508E-07
Group 13	586.3	500	1000	9.540E-05	9.490E-06	6.406E-05	9.520E-07	1.070E-07	6.528E-07
Group 14	618.3	500	1000	9.540E-05	9.490E-06	5.526E-05	9.520E-07	1.070E-07	5.676E-07
Group 15	650.3	500	1000	9.540E-05	9.490E-06	4.767E-05	9.520E-07	1.070E-07	4.935E-07
Group 16	682.3	500	1000	9.540E-05	9.490E-06	4.113E-05	9.520E-07	1.070E-07	4.291E-07
Group 17	714.3	500	1000	9.540E-05	9.490E-06	3.548E-05	9.520E-07	1.070E-07	3.731E-07
Group 18	746.3	500	1000	9.540E-05	9.490E-06	3.061E-05	9.520E-07	1.070E-07	3.244E-07
Group 19	778.3	500	1000	9.540E-05	9.490E-06	2.640E-05	9.520E-07	1.070E-07	2.820E-07
Group 20	810.3	500	1000	9.540E-05	9.490E-06	2.278E-05	9.520E-07	1.070E-07	2.452E-07
Group 21	992.3	500	1000	9.540E-05	9.490E-06	9.833E-06	9.520E-07	1.070E-07	1.107E-07
Group 22	1024.3	1000	2000	9.490E-06	3.730E-07	8.772E-06	1.070E-07	4.870E-09	9.926E-08
Group 23	1056.3	1000	2000	9.490E-06	3.730E-07	7.909E-06	1.070E-07	4.870E-09	8.992E-08
Group 24	1088.3	1000	2000	9.490E-06	3.730E-07	7.131E-06	1.070E-07	4.870E-09	8.145E-08
Group 25	1120.3	1000	2000	9.490E-06	3.730E-07	6.430E-06	1.070E-07	4.870E-09	7.378E-08
Group 26	1152.3	1000	2000	9.490E-06	3.730E-07	5.797E-06	1.070E-07	4.870E-09	6.684E-08
Group 27	1184.3	1000	2000	9.490E-06	3.730E-07	5.227E-06	1.070E-07	4.870E-09	6.055E-08
Group 28	1216.3	1000	2000	9.490E-06	3.730E-07	4.712E-06	1.070E-07	4.870E-09	5.485E-08
Group 29	1248.3	1000	2000	9.490E-06	3.730E-07	4.249E-06	1.070E-07	4.870E-09	4.968E-08
Group 30	1280.3	1000	2000	9.490E-06	3.730E-07	3.831E-06	1.070E-07	4.870E-09	4.501E-08
Group 31	1312.3	1000	2000	9.490E-06	3.730E-07	3.454E-06	1.070E-07	4.870E-09	4.077E-08
Group 32	1344.3	1000	2000	9.490E-06	3.730E-07	3.114E-06	1.070E-07	4.870E-09	3.693E-08
Group 33	1376.3	1000	2000	9.490E-06	3.730E-07	2.808E-06	1.070E-07	4.870E-09	3.345E-08
Group 34	1408.3	1000	2000	9.490E-06	3.730E-07	2.531E-06	1.070E-07	4.870E-09	3.030E-08
Group 35	1440.3	1000	2000	9.490E-06	3.730E-07	2.282E-06	1.070E-07	4.870E-09	2.745E-08
Group 36	1472.3	1000	2000	9.490E-06	3.730E-07	2.058E-06	1.070E-07	4.870E-09	2.487E-08
Group 37	1504.3	1000	2000	9.490E-06	3.730E-07	1.855E-06	1.070E-07	4.870E-09	2.253E-08
Group 38	1536.3	1000	2000	9.490E-06	3.730E-07	1.673E-06	1.070E-07	4.870E-09	2.041E-08
Group 39	1568.3	1000	2000	9.490E-06	3.730E-07	1.508E-06	1.070E-07	4.870E-09	1.848E-08
Group 40	1600.3	1000	2000	9.490E-06	3.730E-07	1.360E-06	1.070E-07	4.870E-09	1.674E-08

Number of Casks per Group = 100

ISFSI Dose Calculation (from all 4000 casks)

Top Gamma =	1.344E-01
Top Neutron =	2.172E-03
Total Dose Rate =	1.366E-01

Distance= 100

Single Cask Results

Distance	Top Gam	Top Neut
100	1.47E-03	1.42E-05
200	3.81E-04	3.53E-06
328	2.11E-04	2.02E-06
500	9.54E-05	9.52E-07
1000	9.49E-06	1.07E-07
2000	3.73E-07	4.87E-09
3000	3.73E-07	4.87E-09
4000	3.73E-07	4.87E-09

Distance to Cask Groups		Distance Interval		Cask Group Dose Rate Calculation (Single Cask)					
Group #	Distance	D min	D max	G/T Min	G/T Max	T Gamma	N/T Min	N/T Max	Top Neut
Group 1	252.3	200	328	3.810E-04	2.110E-04	2.993E-04	3.530E-06	2.020E-06	2.810E-06
Group 2	284.3	200	328	3.810E-04	2.110E-04	2.582E-04	3.530E-06	2.020E-06	2.444E-06
Group 3	316.3	200	328	3.810E-04	2.110E-04	2.227E-04	3.530E-06	2.020E-06	2.126E-06
Group 4	348.3	328	500	2.110E-04	9.540E-05	1.921E-04	2.020E-06	9.520E-07	1.848E-06
Group 5	380.3	328	500	2.110E-04	9.540E-05	1.658E-04	2.020E-06	9.520E-07	1.607E-06
Group 6	412.3	328	500	2.110E-04	9.540E-05	1.430E-04	2.020E-06	9.520E-07	1.397E-06
Group 7	444.3	328	500	2.110E-04	9.540E-05	1.234E-04	2.020E-06	9.520E-07	1.215E-06
Group 8	476.3	328	500	2.110E-04	9.540E-05	1.064E-04	2.020E-06	9.520E-07	1.056E-06
Group 9	508.3	500	1000	9.540E-05	9.490E-06	9.181E-05	9.520E-07	1.070E-07	9.181E-07
Group 10	540.3	500	1000	9.540E-05	9.490E-06	7.921E-05	9.520E-07	1.070E-07	7.982E-07
Group 11	572.3	500	1000	9.540E-05	9.490E-06	6.833E-05	9.520E-07	1.070E-07	6.940E-07
Group 12	604.3	500	1000	9.540E-05	9.490E-06	5.895E-05	9.520E-07	1.070E-07	6.034E-07
Group 13	636.3	500	1000	9.540E-05	9.490E-06	5.085E-05	9.520E-07	1.070E-07	5.247E-07
Group 14	668.3	500	1000	9.540E-05	9.490E-06	4.387E-05	9.520E-07	1.070E-07	4.562E-07
Group 15	700.3	500	1000	9.540E-05	9.490E-06	3.785E-05	9.520E-07	1.070E-07	3.966E-07
Group 16	732.3	500	1000	9.540E-05	9.490E-06	3.265E-05	9.520E-07	1.070E-07	3.448E-07
Group 17	764.3	500	1000	9.540E-05	9.490E-06	2.817E-05	9.520E-07	1.070E-07	2.998E-07
Group 18	796.3	500	1000	9.540E-05	9.490E-06	2.430E-05	9.520E-07	1.070E-07	2.607E-07
Group 19	828.3	500	1000	9.540E-05	9.490E-06	2.096E-05	9.520E-07	1.070E-07	2.267E-07
Group 20	860.3	500	1000	9.540E-05	9.490E-06	1.808E-05	9.520E-07	1.070E-07	1.971E-07
Group 21	1042.3	1000	2000	9.490E-06	3.730E-07	8.276E-06	1.070E-07	4.870E-09	9.389E-08
Group 22	1074.3	1000	2000	9.490E-06	3.730E-07	7.462E-06	1.070E-07	4.870E-09	8.505E-08
Group 23	1106.3	1000	2000	9.490E-06	3.730E-07	6.728E-06	1.070E-07	4.870E-09	7.705E-08
Group 24	1138.3	1000	2000	9.490E-06	3.730E-07	6.066E-06	1.070E-07	4.870E-09	6.979E-08
Group 25	1170.3	1000	2000	9.490E-06	3.730E-07	5.469E-06	1.070E-07	4.870E-09	6.322E-08
Group 26	1202.3	1000	2000	9.490E-06	3.730E-07	4.931E-06	1.070E-07	4.870E-09	5.727E-08
Group 27	1234.3	1000	2000	9.490E-06	3.730E-07	4.446E-06	1.070E-07	4.870E-09	5.188E-08
Group 28	1266.3	1000	2000	9.490E-06	3.730E-07	4.008E-06	1.070E-07	4.870E-09	4.699E-08
Group 29	1298.3	1000	2000	9.490E-06	3.730E-07	3.614E-06	1.070E-07	4.870E-09	4.257E-08
Group 30	1330.3	1000	2000	9.490E-06	3.730E-07	3.258E-06	1.070E-07	4.870E-09	3.856E-08
Group 31	1362.3	1000	2000	9.490E-06	3.730E-07	2.938E-06	1.070E-07	4.870E-09	3.493E-08
Group 32	1394.3	1000	2000	9.490E-06	3.730E-07	2.649E-06	1.070E-07	4.870E-09	3.164E-08
Group 33	1426.3	1000	2000	9.490E-06	3.730E-07	2.388E-06	1.070E-07	4.870E-09	2.866E-08
Group 34	1458.3	1000	2000	9.490E-06	3.730E-07	2.153E-06	1.070E-07	4.870E-09	2.597E-08
Group 35	1490.3	1000	2000	9.490E-06	3.730E-07	1.941E-06	1.070E-07	4.870E-09	2.352E-08
Group 36	1522.3	1000	2000	9.490E-06	3.730E-07	1.750E-06	1.070E-07	4.870E-09	2.131E-08
Group 37	1554.3	1000	2000	9.490E-06	3.730E-07	1.578E-06	1.070E-07	4.870E-09	1.930E-08
Group 38	1586.3	1000	2000	9.490E-06	3.730E-07	1.423E-06	1.070E-07	4.870E-09	1.748E-08
Group 39	1618.3	1000	2000	9.490E-06	3.730E-07	1.283E-06	1.070E-07	4.870E-09	1.584E-08
Group 40	1650.3	1000	2000	9.490E-06	3.730E-07	1.157E-06	1.070E-07	4.870E-09	1.435E-08

Number of Casks per Group = 100

ISFSI Dose Calculation (from all 4000 casks)

Top Gamma =	1.070E-01
Top Neutron =	1.750E-03
Total Dose Rate =	1.087E-01

Distance= 200

Single Cask Results

Distance	Top Gam	Top Neut
100	1.47E-03	1.42E-05
200	3.81E-04	3.53E-06
328	2.11E-04	2.02E-06
500	9.54E-05	9.52E-07
1000	9.49E-06	1.07E-07
2000	3.73E-07	4.87E-09
3000	3.73E-07	4.87E-09
4000	3.73E-07	4.87E-09

Distance to Cask Groups		Distance Interval		Cask Group Dose Rate Calculation (Single Cask)					
Group #	Distance	D min	D max	G/T Min	G/T Max	T Gamma	N/T Min	N/T Max	Top Neut
Group 1	352.3	328	500	2.110E-04	9.540E-05	1.886E-04	2.020E-06	9.520E-07	1.816E-06
Group 2	384.3	328	500	2.110E-04	9.540E-05	1.627E-04	2.020E-06	9.520E-07	1.579E-06
Group 3	416.3	328	500	2.110E-04	9.540E-05	1.404E-04	2.020E-06	9.520E-07	1.373E-06
Group 4	448.3	328	500	2.110E-04	9.540E-05	1.211E-04	2.020E-06	9.520E-07	1.194E-06
Group 5	480.3	328	500	2.110E-04	9.540E-05	1.045E-04	2.020E-06	9.520E-07	1.038E-06
Group 6	512.3	500	1000	9.540E-05	9.490E-06	9.013E-05	9.520E-07	1.070E-07	9.022E-07
Group 7	544.3	500	1000	9.540E-05	9.490E-06	7.776E-05	9.520E-07	1.070E-07	7.844E-07
Group 8	576.3	500	1000	9.540E-05	9.490E-06	6.708E-05	9.520E-07	1.070E-07	6.820E-07
Group 9	608.3	500	1000	9.540E-05	9.490E-06	5.787E-05	9.520E-07	1.070E-07	5.930E-07
Group 10	640.3	500	1000	9.540E-05	9.490E-06	4.992E-05	9.520E-07	1.070E-07	5.156E-07
Group 11	672.3	500	1000	9.540E-05	9.490E-06	4.307E-05	9.520E-07	1.070E-07	4.483E-07
Group 12	704.3	500	1000	9.540E-05	9.490E-06	3.715E-05	9.520E-07	1.070E-07	3.897E-07
Group 13	736.3	500	1000	9.540E-05	9.490E-06	3.205E-05	9.520E-07	1.070E-07	3.389E-07
Group 14	768.3	500	1000	9.540E-05	9.490E-06	2.765E-05	9.520E-07	1.070E-07	2.946E-07
Group 15	800.3	500	1000	9.540E-05	9.490E-06	2.385E-05	9.520E-07	1.070E-07	2.562E-07
Group 16	832.3	500	1000	9.540E-05	9.490E-06	2.058E-05	9.520E-07	1.070E-07	2.227E-07
Group 17	864.3	500	1000	9.540E-05	9.490E-06	1.775E-05	9.520E-07	1.070E-07	1.936E-07
Group 18	896.3	500	1000	9.540E-05	9.490E-06	1.532E-05	9.520E-07	1.070E-07	1.684E-07
Group 19	928.3	500	1000	9.540E-05	9.490E-06	1.321E-05	9.520E-07	1.070E-07	1.464E-07
Group 20	960.3	500	1000	9.540E-05	9.490E-06	1.140E-05	9.520E-07	1.070E-07	1.273E-07
Group 21	1142.3	1000	2000	9.490E-06	3.730E-07	5.988E-06	1.070E-07	4.870E-09	6.893E-08
Group 22	1174.3	1000	2000	9.490E-06	3.730E-07	5.399E-06	1.070E-07	4.870E-09	6.245E-08
Group 23	1206.3	1000	2000	9.490E-06	3.730E-07	4.867E-06	1.070E-07	4.870E-09	5.657E-08
Group 24	1238.3	1000	2000	9.490E-06	3.730E-07	4.389E-06	1.070E-07	4.870E-09	5.124E-08
Group 25	1270.3	1000	2000	9.490E-06	3.730E-07	3.957E-06	1.070E-07	4.870E-09	4.642E-08
Group 26	1302.3	1000	2000	9.490E-06	3.730E-07	3.568E-06	1.070E-07	4.870E-09	4.205E-08
Group 27	1334.3	1000	2000	9.490E-06	3.730E-07	3.217E-06	1.070E-07	4.870E-09	3.809E-08
Group 28	1366.3	1000	2000	9.490E-06	3.730E-07	2.900E-06	1.070E-07	4.870E-09	3.450E-08
Group 29	1398.3	1000	2000	9.490E-06	3.730E-07	2.615E-06	1.070E-07	4.870E-09	3.126E-08
Group 30	1430.3	1000	2000	9.490E-06	3.730E-07	2.358E-06	1.070E-07	4.870E-09	2.831E-08
Group 31	1462.3	1000	2000	9.490E-06	3.730E-07	2.126E-06	1.070E-07	4.870E-09	2.565E-08
Group 32	1494.3	1000	2000	9.490E-06	3.730E-07	1.916E-06	1.070E-07	4.870E-09	2.323E-08
Group 33	1526.3	1000	2000	9.490E-06	3.730E-07	1.728E-06	1.070E-07	4.870E-09	2.105E-08
Group 34	1558.3	1000	2000	9.490E-06	3.730E-07	1.558E-06	1.070E-07	4.870E-09	1.906E-08
Group 35	1590.3	1000	2000	9.490E-06	3.730E-07	1.405E-06	1.070E-07	4.870E-09	1.727E-08
Group 36	1622.3	1000	2000	9.490E-06	3.730E-07	1.266E-06	1.070E-07	4.870E-09	1.564E-08
Group 37	1654.3	1000	2000	9.490E-06	3.730E-07	1.142E-06	1.070E-07	4.870E-09	1.417E-08
Group 38	1686.3	1000	2000	9.490E-06	3.730E-07	1.030E-06	1.070E-07	4.870E-09	1.284E-08
Group 39	1718.3	1000	2000	9.490E-06	3.730E-07	9.282E-07	1.070E-07	4.870E-09	1.163E-08
Group 40	1750.3	1000	2000	9.490E-06	3.730E-07	8.369E-07	1.070E-07	4.870E-09	1.053E-08

Number of Casks per Group = 100

ISFSI Dose Calculation (from all 4000 casks)

Top Gamma =	6.777E-02
Top Neutron =	1.137E-03
Total Dose Rate =	6.890E-02

Distance= 328

Single Cask Results

Distance	Top Gam	Top Neut
100	1.47E-03	1.42E-05
200	3.81E-04	3.53E-06
328	2.11E-04	2.02E-06
500	9.54E-05	9.52E-07
1000	9.49E-06	1.07E-07
2000	3.73E-07	4.87E-09
3000	3.73E-07	4.87E-09
4000	3.73E-07	4.87E-09

Distance to Cask Groups		Distance Interval		Cask Group Dose Rate Calculation (Single Cask)					
Group #	Distance	D min	D max	G/T Min	G/T Max	T Gamma	N/T Min	N/T Max	Top Neut
Group 1	480.3	328	500	2.110E-04	9.540E-05	1.045E-04	2.020E-06	9.520E-07	1.038E-06
Group 2	512.3	500	1000	9.540E-05	9.490E-06	9.013E-05	9.520E-07	1.070E-07	9.022E-07
Group 3	544.3	500	1000	9.540E-05	9.490E-06	7.776E-05	9.520E-07	1.070E-07	7.844E-07
Group 4	576.3	500	1000	9.540E-05	9.490E-06	6.708E-05	9.520E-07	1.070E-07	6.820E-07
Group 5	608.3	500	1000	9.540E-05	9.490E-06	5.787E-05	9.520E-07	1.070E-07	5.930E-07
Group 6	640.3	500	1000	9.540E-05	9.490E-06	4.992E-05	9.520E-07	1.070E-07	5.156E-07
Group 7	672.3	500	1000	9.540E-05	9.490E-06	4.307E-05	9.520E-07	1.070E-07	4.483E-07
Group 8	704.3	500	1000	9.540E-05	9.490E-06	3.715E-05	9.520E-07	1.070E-07	3.897E-07
Group 9	736.3	500	1000	9.540E-05	9.490E-06	3.205E-05	9.520E-07	1.070E-07	3.389E-07
Group 10	768.3	500	1000	9.540E-05	9.490E-06	2.765E-05	9.520E-07	1.070E-07	2.946E-07
Group 11	800.3	500	1000	9.540E-05	9.490E-06	2.385E-05	9.520E-07	1.070E-07	2.562E-07
Group 12	832.3	500	1000	9.540E-05	9.490E-06	2.058E-05	9.520E-07	1.070E-07	2.227E-07
Group 13	864.3	500	1000	9.540E-05	9.490E-06	1.775E-05	9.520E-07	1.070E-07	1.936E-07
Group 14	896.3	500	1000	9.540E-05	9.490E-06	1.532E-05	9.520E-07	1.070E-07	1.684E-07
Group 15	928.3	500	1000	9.540E-05	9.490E-06	1.321E-05	9.520E-07	1.070E-07	1.464E-07
Group 16	960.3	500	1000	9.540E-05	9.490E-06	1.140E-05	9.520E-07	1.070E-07	1.273E-07
Group 17	992.3	500	1000	9.540E-05	9.490E-06	9.833E-06	9.520E-07	1.070E-07	1.107E-07
Group 18	1024.3	1000	2000	9.490E-06	3.730E-07	8.772E-06	1.070E-07	4.870E-09	9.926E-08
Group 19	1056.3	1000	2000	9.490E-06	3.730E-07	7.909E-06	1.070E-07	4.870E-09	8.992E-08
Group 20	1088.3	1000	2000	9.490E-06	3.730E-07	7.131E-06	1.070E-07	4.870E-09	8.145E-08
Group 21	1270.3	1000	2000	9.490E-06	3.730E-07	3.957E-06	1.070E-07	4.870E-09	4.642E-08
Group 22	1302.3	1000	2000	9.490E-06	3.730E-07	3.568E-06	1.070E-07	4.870E-09	4.205E-08
Group 23	1334.3	1000	2000	9.490E-06	3.730E-07	3.217E-06	1.070E-07	4.870E-09	3.809E-08
Group 24	1366.3	1000	2000	9.490E-06	3.730E-07	2.900E-06	1.070E-07	4.870E-09	3.450E-08
Group 25	1398.3	1000	2000	9.490E-06	3.730E-07	2.615E-06	1.070E-07	4.870E-09	3.126E-08
Group 26	1430.3	1000	2000	9.490E-06	3.730E-07	2.358E-06	1.070E-07	4.870E-09	2.831E-08
Group 27	1462.3	1000	2000	9.490E-06	3.730E-07	2.126E-06	1.070E-07	4.870E-09	2.565E-08
Group 28	1494.3	1000	2000	9.490E-06	3.730E-07	1.916E-06	1.070E-07	4.870E-09	2.323E-08
Group 29	1526.3	1000	2000	9.490E-06	3.730E-07	1.728E-06	1.070E-07	4.870E-09	2.105E-08
Group 30	1558.3	1000	2000	9.490E-06	3.730E-07	1.558E-06	1.070E-07	4.870E-09	1.906E-08
Group 31	1590.3	1000	2000	9.490E-06	3.730E-07	1.405E-06	1.070E-07	4.870E-09	1.727E-08
Group 32	1622.3	1000	2000	9.490E-06	3.730E-07	1.266E-06	1.070E-07	4.870E-09	1.564E-08
Group 33	1654.3	1000	2000	9.490E-06	3.730E-07	1.142E-06	1.070E-07	4.870E-09	1.417E-08
Group 34	1686.3	1000	2000	9.490E-06	3.730E-07	1.030E-06	1.070E-07	4.870E-09	1.284E-08
Group 35	1718.3	1000	2000	9.490E-06	3.730E-07	9.282E-07	1.070E-07	4.870E-09	1.163E-08
Group 36	1750.3	1000	2000	9.490E-06	3.730E-07	8.369E-07	1.070E-07	4.870E-09	1.053E-08
Group 37	1782.3	1000	2000	9.490E-06	3.730E-07	7.546E-07	1.070E-07	4.870E-09	9.542E-09
Group 38	1814.3	1000	2000	9.490E-06	3.730E-07	6.803E-07	1.070E-07	4.870E-09	8.644E-09
Group 39	1846.3	1000	2000	9.490E-06	3.730E-07	6.134E-07	1.070E-07	4.870E-09	7.830E-09
Group 40	1878.3	1000	2000	9.490E-06	3.730E-07	5.531E-07	1.070E-07	4.870E-09	7.093E-09

Number of Casks per Group = 100

ISFSI Dose Calculation (from all 4000 casks)

Top Gamma =	3.790E-02
Top Neutron =	6.563E-04
Total Dose Rate =	3.856E-02

Distance= 500

Single Cask Results

Distance	Top Gam	Top Neut
100	1.47E-03	1.42E-05
200	3.81E-04	3.53E-06
328	2.11E-04	2.02E-06
500	9.54E-05	9.52E-07
1000	9.49E-06	1.07E-07
2000	3.73E-07	4.87E-09
3000	3.73E-07	4.87E-09
4000	3.73E-07	4.87E-09

Distance to Cask Groups		Distance Interval		Cask Group Dose Rate Calculation (Single Cask)					
Group #	Distance	D min	D max	G/T Min	G/T Max	T Gamma	N/T Min	N/T Max	Top Neut
Group 1	652.3	500	1000	9.540E-05	9.490E-06	4.723E-05	9.520E-07	1.070E-07	4.892E-07
Group 2	684.3	500	1000	9.540E-05	9.490E-06	4.075E-05	9.520E-07	1.070E-07	4.253E-07
Group 3	716.3	500	1000	9.540E-05	9.490E-06	3.515E-05	9.520E-07	1.070E-07	3.698E-07
Group 4	748.3	500	1000	9.540E-05	9.490E-06	3.033E-05	9.520E-07	1.070E-07	3.215E-07
Group 5	780.3	500	1000	9.540E-05	9.490E-06	2.616E-05	9.520E-07	1.070E-07	2.796E-07
Group 6	812.3	500	1000	9.540E-05	9.490E-06	2.257E-05	9.520E-07	1.070E-07	2.431E-07
Group 7	844.3	500	1000	9.540E-05	9.490E-06	1.947E-05	9.520E-07	1.070E-07	2.113E-07
Group 8	876.3	500	1000	9.540E-05	9.490E-06	1.680E-05	9.520E-07	1.070E-07	1.838E-07
Group 9	908.3	500	1000	9.540E-05	9.490E-06	1.449E-05	9.520E-07	1.070E-07	1.598E-07
Group 10	940.3	500	1000	9.540E-05	9.490E-06	1.250E-05	9.520E-07	1.070E-07	1.389E-07
Group 11	972.3	500	1000	9.540E-05	9.490E-06	1.078E-05	9.520E-07	1.070E-07	1.208E-07
Group 12	1004.3	1000	2000	9.490E-06	3.730E-07	9.359E-06	1.070E-07	4.870E-09	1.056E-07
Group 13	1036.3	1000	2000	9.490E-06	3.730E-07	8.438E-06	1.070E-07	4.870E-09	9.565E-08
Group 14	1068.3	1000	2000	9.490E-06	3.730E-07	7.608E-06	1.070E-07	4.870E-09	8.664E-08
Group 15	1100.3	1000	2000	9.490E-06	3.730E-07	6.859E-06	1.070E-07	4.870E-09	7.849E-08
Group 16	1132.3	1000	2000	9.490E-06	3.730E-07	6.185E-06	1.070E-07	4.870E-09	7.110E-08
Group 17	1164.3	1000	2000	9.490E-06	3.730E-07	5.576E-06	1.070E-07	4.870E-09	6.440E-08
Group 18	1196.3	1000	2000	9.490E-06	3.730E-07	5.028E-06	1.070E-07	4.870E-09	5.834E-08
Group 19	1228.3	1000	2000	9.490E-06	3.730E-07	4.533E-06	1.070E-07	4.870E-09	5.285E-08
Group 20	1260.3	1000	2000	9.490E-06	3.730E-07	4.087E-06	1.070E-07	4.870E-09	4.787E-08
Group 21	1442.3	1000	2000	9.490E-06	3.730E-07	2.268E-06	1.070E-07	4.870E-09	2.728E-08
Group 22	1474.3	1000	2000	9.490E-06	3.730E-07	2.045E-06	1.070E-07	4.870E-09	2.471E-08
Group 23	1506.3	1000	2000	9.490E-06	3.730E-07	1.843E-06	1.070E-07	4.870E-09	2.239E-08
Group 24	1538.3	1000	2000	9.490E-06	3.730E-07	1.662E-06	1.070E-07	4.870E-09	2.028E-08
Group 25	1570.3	1000	2000	9.490E-06	3.730E-07	1.499E-06	1.070E-07	4.870E-09	1.837E-08
Group 26	1602.3	1000	2000	9.490E-06	3.730E-07	1.351E-06	1.070E-07	4.870E-09	1.664E-08
Group 27	1634.3	1000	2000	9.490E-06	3.730E-07	1.218E-06	1.070E-07	4.870E-09	1.507E-08
Group 28	1666.3	1000	2000	9.490E-06	3.730E-07	1.098E-06	1.070E-07	4.870E-09	1.366E-08
Group 29	1698.3	1000	2000	9.490E-06	3.730E-07	9.903E-07	1.070E-07	4.870E-09	1.237E-08
Group 30	1730.3	1000	2000	9.490E-06	3.730E-07	8.929E-07	1.070E-07	4.870E-09	1.121E-08
Group 31	1762.3	1000	2000	9.490E-06	3.730E-07	8.050E-07	1.070E-07	4.870E-09	1.015E-08
Group 32	1794.3	1000	2000	9.490E-06	3.730E-07	7.258E-07	1.070E-07	4.870E-09	9.195E-09
Group 33	1826.3	1000	2000	9.490E-06	3.730E-07	6.544E-07	1.070E-07	4.870E-09	8.329E-09
Group 34	1858.3	1000	2000	9.490E-06	3.730E-07	5.900E-07	1.070E-07	4.870E-09	7.545E-09
Group 35	1890.3	1000	2000	9.490E-06	3.730E-07	5.320E-07	1.070E-07	4.870E-09	6.835E-09
Group 36	1922.3	1000	2000	9.490E-06	3.730E-07	4.796E-07	1.070E-07	4.870E-09	6.191E-09
Group 37	1954.3	1000	2000	9.490E-06	3.730E-07	4.325E-07	1.070E-07	4.870E-09	5.609E-09
Group 38	1986.3	1000	2000	9.490E-06	3.730E-07	3.899E-07	1.070E-07	4.870E-09	5.081E-09
Group 39	2018.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 40	2050.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09

Number of Casks per Group = 100

ISFSI Dose Calculation (from all 4000 casks)

Top Gamma =	1.771E-02
Top Neutron =	3.199E-04
Total Dose Rate =	1.803E-02

Distance= 1000

Single Cask Results

Distance	Top Gam	Top Neut
100	1.47E-03	1.42E-05
200	3.81E-04	3.53E-06
328	2.11E-04	2.02E-06
500	9.54E-05	9.52E-07
1000	9.49E-06	1.07E-07
2000	3.73E-07	4.87E-09
3000	3.73E-07	4.87E-09
4000	3.73E-07	4.87E-09

Distance to Cask Groups		Distance Interval		Cask Group Dose Rate Calculation (Single Cask)					
Group #	Distance	D min	D max	G/T Min	G/T Max	T Gamma	N/T Min	N/T Max	Top Neut
Group 1	1152.3	1000	2000	9.490E-06	3.730E-07	5.797E-06	1.070E-07	4.870E-09	6.684E-08
Group 2	1184.3	1000	2000	9.490E-06	3.730E-07	5.227E-06	1.070E-07	4.870E-09	6.055E-08
Group 3	1216.3	1000	2000	9.490E-06	3.730E-07	4.712E-06	1.070E-07	4.870E-09	5.485E-08
Group 4	1248.3	1000	2000	9.490E-06	3.730E-07	4.249E-06	1.070E-07	4.870E-09	4.968E-08
Group 5	1280.3	1000	2000	9.490E-06	3.730E-07	3.831E-06	1.070E-07	4.870E-09	4.501E-08
Group 6	1312.3	1000	2000	9.490E-06	3.730E-07	3.454E-06	1.070E-07	4.870E-09	4.077E-08
Group 7	1344.3	1000	2000	9.490E-06	3.730E-07	3.114E-06	1.070E-07	4.870E-09	3.693E-08
Group 8	1376.3	1000	2000	9.490E-06	3.730E-07	2.808E-06	1.070E-07	4.870E-09	3.345E-08
Group 9	1408.3	1000	2000	9.490E-06	3.730E-07	2.531E-06	1.070E-07	4.870E-09	3.030E-08
Group 10	1440.3	1000	2000	9.490E-06	3.730E-07	2.282E-06	1.070E-07	4.870E-09	2.745E-08
Group 11	1472.3	1000	2000	9.490E-06	3.730E-07	2.058E-06	1.070E-07	4.870E-09	2.487E-08
Group 12	1504.3	1000	2000	9.490E-06	3.730E-07	1.855E-06	1.070E-07	4.870E-09	2.253E-08
Group 13	1536.3	1000	2000	9.490E-06	3.730E-07	1.673E-06	1.070E-07	4.870E-09	2.041E-08
Group 14	1568.3	1000	2000	9.490E-06	3.730E-07	1.508E-06	1.070E-07	4.870E-09	1.848E-08
Group 15	1600.3	1000	2000	9.490E-06	3.730E-07	1.360E-06	1.070E-07	4.870E-09	1.674E-08
Group 16	1632.3	1000	2000	9.490E-06	3.730E-07	1.226E-06	1.070E-07	4.870E-09	1.517E-08
Group 17	1664.3	1000	2000	9.490E-06	3.730E-07	1.105E-06	1.070E-07	4.870E-09	1.374E-08
Group 18	1696.3	1000	2000	9.490E-06	3.730E-07	9.967E-07	1.070E-07	4.870E-09	1.245E-08
Group 19	1728.3	1000	2000	9.490E-06	3.730E-07	8.987E-07	1.070E-07	4.870E-09	1.127E-08
Group 20	1760.3	1000	2000	9.490E-06	3.730E-07	8.103E-07	1.070E-07	4.870E-09	1.021E-08
Group 21	1942.3	1000	2000	9.490E-06	3.730E-07	4.496E-07	1.070E-07	4.870E-09	5.820E-09
Group 22	1974.3	1000	2000	9.490E-06	3.730E-07	4.054E-07	1.070E-07	4.870E-09	5.272E-09
Group 23	2006.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 24	2038.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 25	2070.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 26	2102.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 27	2134.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 28	2166.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 29	2198.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 30	2230.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 31	2262.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 32	2294.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 33	2326.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 34	2358.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 35	2390.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 36	2422.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 37	2454.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 38	2486.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 39	2518.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 40	2550.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09

Number of Casks per Group = 100

ISFSI Dose Calculation (from all 4000 casks)

Top Gamma =	2.953E-03
Top Neutron =	5.897E-05
Total Dose Rate =	3.012E-03

Distance= 1500

Single Cask Results

Distance	Top Gam	Top Neut
100	1.47E-03	1.42E-05
200	3.81E-04	3.53E-06
328	2.11E-04	2.02E-06
500	9.54E-05	9.52E-07
1000	9.49E-06	1.07E-07
2000	3.73E-07	4.87E-09
3000	3.73E-07	4.87E-09
4000	3.73E-07	4.87E-09

Distance to Cask Groups		Distance Interval		Cask Group Dose Rate Calculation (Single Cask)					
Group #	Distance	D min	D max	G/T Min	G/T Max	T Gamma	N/T Min	N/T Max	Top Neut
Group 1	1652.3	1000	2000	9.490E-06	3.730E-07	1.149E-06	1.070E-07	4.870E-09	1.426E-08
Group 2	1684.3	1000	2000	9.490E-06	3.730E-07	1.036E-06	1.070E-07	4.870E-09	1.292E-08
Group 3	1716.3	1000	2000	9.490E-06	3.730E-07	9.343E-07	1.070E-07	4.870E-09	1.170E-08
Group 4	1748.3	1000	2000	9.490E-06	3.730E-07	8.423E-07	1.070E-07	4.870E-09	1.060E-08
Group 5	1780.3	1000	2000	9.490E-06	3.730E-07	7.595E-07	1.070E-07	4.870E-09	9.601E-09
Group 6	1812.3	1000	2000	9.490E-06	3.730E-07	6.847E-07	1.070E-07	4.870E-09	8.698E-09
Group 7	1844.3	1000	2000	9.490E-06	3.730E-07	6.174E-07	1.070E-07	4.870E-09	7.879E-09
Group 8	1876.3	1000	2000	9.490E-06	3.730E-07	5.566E-07	1.070E-07	4.870E-09	7.137E-09
Group 9	1908.3	1000	2000	9.490E-06	3.730E-07	5.019E-07	1.070E-07	4.870E-09	6.465E-09
Group 10	1940.3	1000	2000	9.490E-06	3.730E-07	4.525E-07	1.070E-07	4.870E-09	5.856E-09
Group 11	1972.3	1000	2000	9.490E-06	3.730E-07	4.080E-07	1.070E-07	4.870E-09	5.305E-09
Group 12	2004.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 13	2036.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 14	2068.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 15	2100.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 16	2132.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 17	2164.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 18	2196.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 19	2228.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 20	2260.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 21	2442.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 22	2474.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 23	2506.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 24	2538.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 25	2570.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 26	2602.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 27	2634.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 28	2666.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 29	2698.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 30	2730.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 31	2762.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 32	2794.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 33	2826.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 34	2858.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 35	2890.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 36	2922.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 37	2954.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 38	2986.3	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 39	3018.3	3000	4000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 40	3050.3	3000	4000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09

Number of Casks per Group = 100

ISFSI Dose Calculation (from all 4000 casks)

Top Gamma =	9.380E-04
Top Neutron =	2.006E-05
Total Dose Rate =	9.580E-04

Distance= 1968.5

Single Cask Results

Distance	Top Gam	Top Neut
100	1.47E-03	1.42E-05
200	3.81E-04	3.53E-06
328	2.11E-04	2.02E-06
500	9.54E-05	9.52E-07
1000	9.49E-06	1.07E-07
2000	3.73E-07	4.87E-09
3000	3.73E-07	4.87E-09
4000	3.73E-07	4.87E-09

Distance to Cask Groups		Distance Interval		Cask Group Dose Rate Calculation (Single Cask)					
Group #	Distance	D min	D max	G/T Min	G/T Max	T Gamma	N/T Min	N/T Max	Top Neut
Group 1	2120.8	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 2	2152.8	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 3	2184.8	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 4	2216.8	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 5	2248.8	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 6	2280.8	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 7	2312.8	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 8	2344.8	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 9	2376.8	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 10	2408.8	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 11	2440.8	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 12	2472.8	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 13	2504.8	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 14	2536.8	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 15	2568.8	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 16	2600.8	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 17	2632.8	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 18	2664.8	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 19	2696.8	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 20	2728.8	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 21	2910.8	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 22	2942.8	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 23	2974.8	2000	3000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 24	3006.8	3000	4000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 25	3038.8	3000	4000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 26	3070.8	3000	4000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 27	3102.8	3000	4000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 28	3134.8	3000	4000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 29	3166.8	3000	4000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 30	3198.8	3000	4000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 31	3230.8	3000	4000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 32	3262.8	3000	4000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 33	3294.8	3000	4000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 34	3326.8	3000	4000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 35	3358.8	3000	4000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 36	3390.8	3000	4000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 37	3422.8	3000	4000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 38	3454.8	3000	4000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 39	3486.8	3000	4000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09
Group 40	3518.8	3000	4000	3.730E-07	3.730E-07	3.730E-07	4.870E-09	4.870E-09	4.870E-09

Number of Casks per Group = 100

ISFSI Dose Calculation (from all 4000 casks)

Top Gamma =	7.460E-04
Top Neutron =	1.617E-05
Total Dose Rate =	7.622E-04