Enclosure I to
LD-90-092

COMBUSTION ENGINEERING, INC.

WINDSOR NUCLEAR FUEL MANUFACTURING FACILITY

REQUEST FOR LICENSE AMENDMENT

DOCKET NO. 70-1100, LICENSE NO. SNM-1067

LIST OF AFFECTED PAGES

DECEMBER, 1990

REQUEST FOR LICENSE AMENDMENT

LIST OF AFFECTED PAGES

Combustion Engineering, Inc. requests that License SNM-1067 for its Windsor Nuclear Fuel Manufacturing Facility be amended with the pages provided in Enclosure II. Combustion Engineering has modified the design of its UNC-2901 shipping container to allow shipment in either a horizontal or vertical orientation with package contents of either UO_2 powder or pellets. The proposed changes affect shipping container handling in the fuel manufacturing facility to accommodate the modified containers.

The license application pages affected by this amendment request are as follows:

List of Affected Pages

Deleted Page			Added Page		
Page No.	Rev.	Date	Page No.	Rev.	Date
I.4-16	5	8/16/88	I.4-16	6	12/11/90
I.4-16A	0	8/16/88	I.4-16A	1	12/11/90
II.8-2	3	8/16/88	II.8-2	4	12/11/90
II.8-2A	3	8/16/88	II.8-2A	4	12/11/90
--	-	--	II.8-2B	0	12/11/90
--	-	--	II.8-2C	0	12/11/90
--	-	--	II.8-2D	0	12/11/90
--	-	--	II.8-2E	0	12/11/90
--	-	--	II.8-2F	0	12/11/90
II.8-31	4	8/16/88	II.8-31	5	12/11/90
--	-	--	II.8-44A	0	12/11/90
--	-	--	II.8-44B	0	12/11/90

Enclosure II to
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PROPOSED CHANGE PAGES

DECEMBER, 1990

4.3.17 UO_2 powder (clean or dirty residues) may be stored in CE-250-2 type containers which, in turn, shall be stored in the residue trailer located within the security fence of the Building 17/21 complex. The size of the array of loaded CE-250-2 containers shall not exceed 100 containers. The UO_2 powder shall be transferred to a shipping container for which there is a current NRC Certificate of Compliance for shipment off site.

4.3.18 Up to three vertical or two horizontal UNC-2901 shipping containers may be mounted to an individual pallet. Pallets of shipping containers may be stored within Building 21, the transport vehicle when it is within the security fence, and approved areas of Building 17. Approved areas of Building 17 include the Annex and the area adjacent to the rod loading room. A maximum of three pallets shall be allowed in specified laydown areas of the Annex and a maximum of four pallets shall be allowed in specified laydown areas of the area adjacent to the rod loading room. The specified laydown areas shall be at least one foot from any SNM process or storage equipment.

4.3.19 The size of any array of loaded shipping containers, with the exception of the 927A1 and 927C1 Fuel Bundle Shipping containers, shall be limited to a total transport index of 80. The loaded 927A1 and 927C1 Fuel Bundle Shipping Container arrays shall not be more than three high. Shipping container arrays of different types shall be separated from one another by at least 20 feet.

4.3.20 All storage containers of UO2, 5 gallons or less, located outside of hoods or in storage spaces shall be covered. Any storage containers accidentally internally moderated shall be handled as individual mass units and stored in the concrete block storage area.

4.3.21 Section Deleted.

4.3.22 The filled press feed hoppers can only be stored or placed in designated areas. Only one filled press feed hopper can be in transit on the pellet shop main floor and one can be in transit on the press feed mezzanine.

will be sampled.

Pellets are received in UNC-2901 shipping containers arranged in either of two configurations on shipping pallets. The first is by UNC-2901 shipping containers mounted two per pallet; each container is oriented such that its longitudinal axis is parallel to the pallet (horizontal mounting). The second method employs three UNC-2901 shipping containers per pallet with their longitudinal axes perpendicular to the pallet (vertical mounting). Loaded UNC-2901 shipping containers attached to the pallets may be stored within the transport vehicle inside the security fence, within Building 21, or within approved areas of Building 17 and Annex. The number of pallets of vertical or horizontal shipping containers permitted in the Annex is three and in the area outside the rod loading room the maximum number is four.

Vertical Shipping Containers

Each pallet of vertical UNC-2901 containers may contain up to three containers. The external covers of all containers on a pallet may be removed for inspection purposes but only one inner container can be accessed at a time. The cover to the inner compartment of the shipping container is unbolted and removed. The fuel pellet tray cradle is lifted upwards with a hoist, the compression device holding the pellet trays in the cradle is relaxed and the 5" x 10.25" x 2" high pellet trays are transferred to a slab limited transfer cart with the cradle suspended in the container opening. The pellet trays are transferred to the weighing station and after weighing, may be introduced into the manufacturing process, transferred to the receiving pellet storage shelves or the drying oven.

When the lifting cradle is emptied of all filled pellet trays, the cradle may be reloaded with empty pellet trays or trays of scrap material (in conformance with the requirements of the Certificate of Compliance). If the cradle is reloaded, the pellet tray compression device is retightened and the cradle is lowered back into the shipping container. Next, the inner compartment seal plate is lowered into place and bolted down and the cradle hoist is positioned above the next shipping container.

The UNC-2901 shipping container provides safe storage of fuel pellets, when loaded in conformance with the Certificate of Compliance, for array sizes well in excess of the capacity of the Annex or approved areas of Building 17. The individual transport index is 0.5 and a maximum of 4 pallets (or 12 shipping containers) is permitted in the approved areas of Building 17 or three pallets (or 9 shipping containers) in the Annex.

A vertical UNC-2901 shipping container may also be loaded with UO_2 powder (clean or dirty residues) under the Certificate of Compliance. If this option is used, the pellet tray cradle is removed from the container and replaced by a powder can cradle. The cradle then may be loaded with a maximum of two (2) powder cans, consistent with the Certificate of Compliance (Docket No. 71-6294).

Criticality Safety Analysis

The UNC-2901 is a safe container even if fully flooded with water, when loaded according to the Certificate of Compliance. The unloading process would appear to offer the potential for a diminishment of the degree of subcriticality. To examine the potential safety problem here, an explicit analysis of the environment of the cradle is employed. In this analysis it is assumed that the pellet trays are flooded as a result of an abnormal event. It is further assumed that the cradle of pellet trays is fully reflected by water to simulate the proximity of handling personnel.

The cradle of pellet trays as it emerges from the vertical UNC-2901 shipping container does not meet the slab criteria of Chapter 4. Figure 8.14 shows the KENO-IV model of the UNC-2901 cradle with an 8x2x1 array of bulk pellet trays. The cradle and hold-down plate are represented but the compression hardware is neglected. The inner width of the cradle in the plane of Figure 8.14 is 10 inches. In the transverse direction, the cradle has a zero thickness and the wood block at the bottom of the cradle is 10.25" in width. A 0.38 inch thick slab of rubber above the 3.5 inch wood block is replaced by equivalent wood in the KENO-IV model. Each pellet tray pair is represented explicitly as a single tray having outer dimensions of 10" x 10 1/4" x 2.05". The interior

double wall between each 5"x 10 1/4" pellet tray in the pair is neglected in the modelling. The corresponding internal dimensions of the trays are 9.844" wide by 10.094" long and 1.922" high. The width of 9.844" includes the two wall thicknesses that are represented as added free volume in the tray interior. The interior volume of the two trays is conserved in the computation of the water that the pellets are assumed to be immersed within for this conservative analysis.

The UO2 pellet volume is computed as the quotient of the pellet weight and an assumed effective pellet density of 10.25 g/cc. The free volume is the total volume of the eight double trays (25.04 liters) minus the volume of the UO2. The cradle is surrounded on all surfaces by a one foot thick water reflector.

A sixteen group cross section library was created using the NITAWL and XSDRNPM codes and the 123 group DLC-16 basic cross section library. The sixteen group energy structure is the same as in the Hansen and Roach 16 group library. The KENO-IV multiplication factors plus twice the KENO-IV standard deviation versus pellet tray loading are shown in Figure 8.15 over a range which extends below the minimum allowed shipping weight per tray, assuming the container was loaded with 16 trays each at the minimum loading.

An additional KENO-IV calculation was run for the case where there were 16 trays, each loaded with 6.2 Kg of pellets. In this analysis the cradle, hold-down plate, wood spacer block and 0.38 inch thick rubber slab are replaced by water. Thus, the 8x2x1 configuration of trays is reflected by a minimum of 12 inches of water on each side. This calculation yields a multiplication factor of 0.89576 $\pm$ 0.00508 or a Keff +2 sigma of 0.90592. It may be concluded from this analysis that the cradle structure reduces the adjusted multiplication factor by about 2% but, even in the absence of the structure, the 8x2x1 array of pellet trays is adequately subcritical so as to present no safety concern.

The above analyses demonstrates that the unloading of pellet trays from a vertical UNC-2901 shipping container poses no criticality problem even in the event that the primary criticality barrier, i.e., the pellet tray covers, are

penetrated by water from some abnormal event. Handling procedures require that the pellet trays be unloaded to a safe slab configuration and that all other SNM be at least one foot away from the cradle being unloaded. The latter spacing requirement is assured by limiting the unloading process to one container per pallet. If adjacent pallets are spaced closer than one foot, further restrictions may be imposed on the simultaneous unloading of containers on adjacent pallets to assure one foot spacing requirements are maintained.

The loading of the vertical UNC-2901 shipping container with two powder cans using the powder can cradle poses no criticality concerns when other Special Nuclear Material is at least one (1) foot away from the powder cans being placed in the cradle. This conclusion is based on the following information.

The UO_2 powder is typically placed in a sealed plastic bag prior to placement in the powder can. The powder can cover is typically secured with tape. For the purpose of this criticality assessment, it is assumed that as a result of an abnormal event, the powder cans are flooded with water and a homogeneous mixture of UO_2 and water results. Furthermore, it is assumed that the two cans in the powder can cradle are fully reflected on all sides.

Figure 1.D.11 of the UKAEA Handbook of Criticality Data (AHSB(S) Handbook 1) yields a value of 10.4 inches as the minimum critical diameter of an infinitely long fully reflected optimally moderated cylinder. By use of a buckling conversion from an infinite cylinder to a 22.1 inch high cylinder, it may be deduced that the safe cylinder diameter is 10.0 inches. Since this exceeds the diameter of the powder cans by 0.25 inch, it is concluded that the fully reflected cradle containing two (2) powder cans poses no criticality safety concern. (Note that this evaluation is for optimum moderation which corresponds to roughly 26 Kg UO_2 per powder can. At lower loadings, the system is less reactive because of over moderation.)

It is further noted that the orientation of the UNC-2901 (i.e., vertical versus horizontal) is of no consequence in the criticality evaluation.

Horizontal Shipping Containers

The horizontal UNC-2901 shipping containers may also be brought into Bldg. 17 and the Annex as discussed in Section 4.3.18 of Part I. Three pallets (six UNC-2901 containers) can be brought into the Bldg. 17 Fuel Pellet Shop Annex and four pallets (eight UNC-2901 containers) can be brought into the Bldg. 17 Rod Loading Area for storage and unloading. The sealed containers on the pallets can be stored next to each other but must be at least 1 foot from process equipment in the area. The pellets in the shipping container are received in 2 inch deep pellet trays with covers. The package of pellet trays is unloaded by partially withdrawing the skid containing the trays, undoing the hold-down straps, and then transferring the trays to a slab limited configuration. The pellet trays are transferred to the weighing station and after weighing, maybe introduced into the manufacturing process, transferred to the receiving pellet storage shelves or the drying oven.

Criticality Safety Analysis

In the above discussion of the criticality safety of the 8x2x1 pellet tray package employed in the vertical UNC-2901, it was noted that the Keff plus 2 sigma for the isolated and fully reflected 8x2x1 array of flooded fuel pellet trays loaded to 6.2 Kg UO2 per tray is 0.90592. Based on this analysis it may be concluded that under the same conditions, the 4x2x2 pellet tray is less reactive for two reasons. First, the surface area of the 4x2x2 array is 898 square inches versus 853 square inches for the 8x2x1 array. Consequently, the geometric buckling of the 4x2x2 array is larger and the leakage is greater. Second, the minimum loading per tray for the horizontal UNC-2901 is 6.7 Kg UO2 per tray versus 6.3 Kg UO2 per tray for the vertical UNC-2901 package for pellet diameter up to 0.40 inches. Since both pellet tray packages exhibit the same inverse dependence of reactivity versus pellet tray loading when the

trays are postulated to be flooded and the pellets are assumed to be uniformly distributed over the tray volume, the 4x2x2 array of pellet trays is less reactive. Thus, it may be concluded that both arrays of pellet trays are safe even if the pellet trays are fully flooded and optimally moderated providing they are at least one foot away from the other SNM bearing equipment and operations.

8.1.2 Virgin Power Storage Area

The virgin powder storage area is isolated from the remainder of the plant on all sides by concrete block walls, a double steel roof, and a metal fire door. If the door is in the open position, it is automatically closed upon activation of the fire alarm, or on failure of electrical power. The automatic closing feature of this door shall be verified quarterly and records of its performance shall be maintained. These engineered safety features are considered adequate to prevent the introduction of water in the event of a fire. This area will be kept free of combustibles, and located such that there are no potentially hazardous items such as boilers in the vicinity of the area.

Two ammonia crackers are housed in a concrete block building which is located some 25 feet northwest of Building #17. In view of its many redundant safety features, it is not viewed as potentially hazardous item.

Criticality Safety Analyses

The following assumptions were incorporated into the calculational model of the Virgin Power Storage Area:

1) All steel structural materials were neglected.

2) The fuel was assumed to be a homogeneous mixture of UO_2 containing 5.0 wt% H_2O.

3) All storage positions were filled and each individual can was assumed to contain 35.0 kg's of UO2 at 5.0 wt% U235.

4) No interspersed water moderation was considered.

8.5.10 Section Deleted

8.5.11 Buckets containing 35.0 Kg UO2

The UO2 power and UO2 pellets may be stored in 5 gallons or less enclosed buckets. Normally the powder and pellets will be dry. The only time the buckets will be open will be in hoods, which will limit the amount of water that can be introduced in the bucket from the fire sprinklers.

Criticality Safety Analysis

A very conservative analysis was done for the following array of buckets filled with UO2 powder. The conditions, assumptions, and results are as follows:

1) The steel cylindrical container has an effective inner diameter of 10.75" and an effective height of 14.25". A 2x2x2 array of containers was analyzed with the buckets in the array separated by 1 foot.

FIGURE 8.14

KENO-IV MODEL FOR UNC-2901 LIFTING CRADLE
BULK PELLET TRAY 8x2x1 CONFIGURATION
(VERTICAL SHIPPING ORIENTATION)

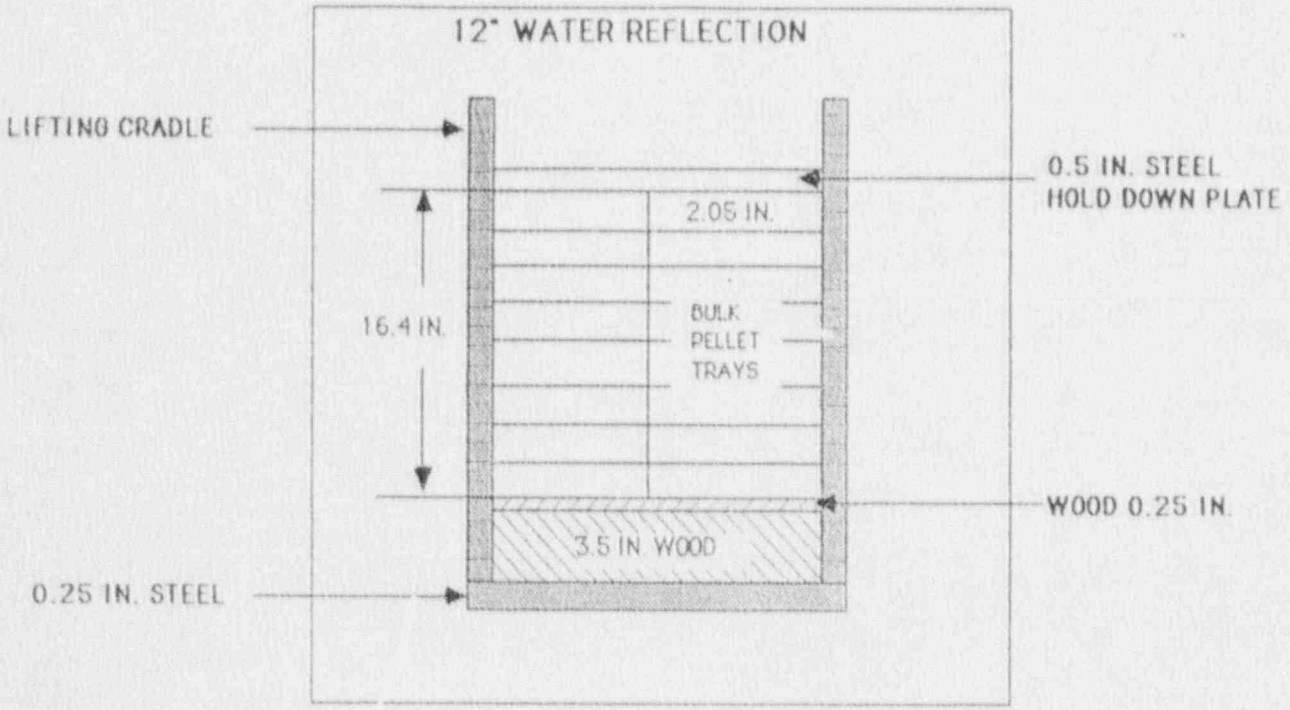

FIGURE 8.15

K-eff (including 2-sigma) versus PELLET WEIGHT/CRADLE