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Docket 70-36
Project S-8

Oct 17, 1961

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Criticality Evaluation Br.

**UNITED NUCLEAR CORP. - ENRICHED URANIUM SHIPMENT -
DOCKET 70-36**

The United Nuclear Corporation in their letter of September 29, 1961, requested amendment of their license to permit shipment of 90% enriched uranium. This was supplemented with information in their teletype of October 13, 1961. It is recommended that this application be approved for single drum shipments. The applicant should be informed that for multiple drum shipments, strength of the inner container would be expected to be equivalent to Schedule 40 pipe.

The inner container for this shipment is a tin can (4.875" dia. x 5.5 ht) with unspecified closure and strength. This is placed in a standard drum (ICC 37A-350, 15" dia. x 17.25" ht). Only one drum is involved in the shipment. It is proposed to ship 8.4 kg of 90% enriched uranium metal in the form of broken biscuits, the smallest piece weighing approximately 150 grams. The individual pieces are wrapped in polyethylene and packed securely with additional polyethylene dunnage in the small inner container. At a density of 18 grams/cc a 150 gram piece has the volume of a 1" diameter sphere. For a solid piece of fully enriched metal having an effective diameter of 1", Figure 13 of LANS P-15 shows that the minimum critical mass of water moderated metal lattice is 18 kg U-235. Since the U-235 content of this shipment will be only 7.5 kg, a minimum safety factor of 2.4 is in effect.

In the event of failure of the inner container a safe slab would result in the outer container. Certification of each carrier involved in the shipment of this material will be obtained to the effect that this container will not be commingled with other shipments of special nuclear material. It is concluded that satisfactory provisions have been taken to prevent a nuclear criticality accident.

Attachment:
Docket 70-36
& Shipping Container Specs.

DLR:FL:CEB DLR:FL:CEB

WKE:ster/vj CD:duke

10/16/61 10/16/61

8-80

SHIPPING CONTAINER SPECIFICATIONS

Each shipping container shall be (1) designed for the requisite mechanical integrity and resistance to leakage of water, consistent with the requirements upon which the individual shipping quantity is based. Where (2) moderation control is required or where maintenance of geometry (shape or size) is mandatory, the container shall have the following specifications:

- (1) Resistance to crushing and fracture shall be equivalent to that provided by Schedule 40 steel pipe.
- (2) The bottom shall be equivalent to a plate, at least equal in thickness to the wall of the pipe, welded or threaded to the bottom of the container.
- (3) The top closure shall be equivalent in strength and leak-tightness to the container itself. A properly designed flanged and gasketed cover would meet this requirement.

United Nuclear Corporation

8.4 kg 90% enriched U-235 1" dia min
broken biscuits wrapped & padded ^(a) polyethylene
 $8.4 \times 0.9 = 7.56 \text{ kg U-235}$

Container Std. ICC 37A-350 Drum

16" od x 17 1/4" h

4 7/8" od x 5 1/2" h inside tin can

4.875

H/U 4.2 when inner can is
full of water

Vol of container

$$3.14 \times \frac{4.875}{4} \times 5.5 \times 16.4 = 1680 \text{ cc}$$

Vol of U

$$\frac{8.4}{18} \times 1000 = \frac{467 \text{ cc}}$$

1213 cc H₂O

$$\frac{7.560}{235} = 32.1 \text{ moles U}$$

$$\frac{1213}{18} \times 2 = 135 \text{ moles H}$$

$$H/U = \frac{135}{32.1} = 4.2$$
