DOCKET NO. 70-133

File Cy.

# CLEVITE RESEARCH CENTER

DIVISION OF CLEVITE CORPORATION

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CLEVELAND 8, OHIO

CLEVITE CORPORATION

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February 2, 1959



U. S. Atomic Energy Commission
Materials Section, Licensing Branch
Division of Licensing and Regulation
Washington 25, D. C.

Attention: Mr. C. P. McCallum, Jr.

Subject: Request for Amendment to SNM 183 dated December 19, 1958.

Reference: Document No. 70-133

Gentlemen:

We are pleased to furnish the additional information requested in your letter of January 22 pertaining to the subject request for amendment. The basis for the requested increase in the possession limit to 55.8 kgs. of U-235 is summarized below:

1. Our contract with Westinghouse for 196 U/Al fuel elements will require approximately 48.5 kgs. of U-235 including process scrap. For efficient operation it will be necessary for us to have all of this material on hand for at least a limited period of time during the fabrication of these elements and prior to the time delivery of the finished elements begins.

2. While we are proceeding with the fabrication of the fuel elements for Westinghouse we will have in our vault the completed fuel elements for the Swedish material test reactor and associated residual scrap. (These were fabricated under our original license.) These elements and scrap contain a total of 7.3 kgs. of U-235.

Since we do not have a definite shipping date for the Swedish fuel elements due to delays in the construction of the reactor, and since scrap disposition will be taking place while the Westinghouse contract is in progress, it is possible that there will be a period of time when all of this material is on hand.

The quantity of 55.8 kgs. of U-235 does not pose any problem from the standpoint of storage or handling. Our vault has been enlarged since our original license was granted to permit us to handle substantial quantities of contract SS material. The enclosed drawing shows the current size of our vault. The actual capacity of the vault is dependent upon the form of the material in storage. For example, as an accountability

station, we have handled and stored at one time, contract material in excess of 400 kgs. of U-235. This material was distributed in the form of completed MTR fuel elements and related in-process alloy, U/Al strips 3 inches wide and 6 feet long containing approximately 25 wt. % U-235 and unalloyed highly enriched uranium in sizes ranging from 1 inch square plates to single ingots containing up to 10 kgs. of U-235. The storage and processing procedures covering the simultaneous handling of these materials were reviewed by the Health and Safety Division of the Chicago Operations office, under whose jurisdiction we operate. Effective accountability procedures were established and the required segration of the various material allotments was satisfactorily maintained.

As stated in our General Criticality Procedure, CR-17, specific process procedures are prepared for each particular job. This is mandatory since our operations encompass a wide variety of fabrication procedures. To assist in providing you with some insight to our operations and to establish some background for the procedures proposed in SP-CR-17D, the enclosed Criticality Guides are submitted. These guides are essentially bare outlines prepared from the detailed procedures for the particular jobs. Since all SS material is issued from the vault daily and returned to the vault for weight checks between operations, the vault custodian uses the guide to control the amount of material in the container for each specific operation. The material handler, who is the floor supervisor, checks the batch make-up in a given container as it is prepared by the vault custodian. We have found that the specific control procedures illustrated by the enclosed guides satisfy the requirements of production and accountability as well as safety. Since the procedures for each job are quite specific, new procedures must be defined whenever a different job is undertaken. This is the reason for the new procedure contained in our amendment request.

The following examples illustrate how published nuclear safety information was used to determine the safety of the procedures proposed in SP-CR-17D.

Under Section A, the proposed alloy make-up of 2.05 kgs. of U-235 is conservative, based on TID 7016, Nuclear Safety Guide which indicates a safe mass limit of 11 kgs. of U-235 for U/Al alloy being compounded during melting. In our melting practice broken buttons containing 300 to 400 gms. of U-235 are added to the molten aluminum. The handling of pieces of uranium in these sizes in a 2.05 kg. lot would present no hazard based on LA-1958 (deleted) where Graves and Paxton report that the minimum critical mass for an optimum array of 1 inch cubes (approximately 290 gms. each) when completed flooded would be approximately 20 kgs. Once an alloy has been compounded in a homogeneous form, the permissible mass for this alloy in massive sections would be approximately 450 kgs. containing approximately 66 kgs. of U-235. This was determined from Figure 5, TID 7016, for this particular aluminum alloy which has a

U-235 volume fraction of 0.027. Therefore, the handling of 4 ingots of this alloy with a total U-235 content of 1.87 kgs. constitutes no hazard.

The hot and cold rolling operations are performed in the same manner as stated in our existing license procedure with the exception that the resulting strip contains 0.47 kgs. of U-235 vs. 0.385 kgs. The rolling operations and the handling of the fillers, as stated in Sections E & F, in lots containing 1805 gms. of U-235 constitute no hazard when based on the procedures for handling the U/Al alloy strip discussed by McLendon and Morfitt in classified reports YA2-101 and YA2-98. U/Al strip with a comparable U-235 content was handled safely on a previous job as is illustrated in the attached Criticality Guides.

In subsequent operations, under Section G, the mass limit is reduced since the fuel fillers are reduced to thinner dimensions and the possibility for improved moderation if flooded increases. The limit of 6 elements per batch was established from information that 13 MTR assemblies were the minimum number required to go critical. This analogy should also hold true for the 3-tube Westinghouse fuel element assembly which has the same U-235 content as the MTR element and consequently should not have any greater reactivity.

In Section H, the conditions were chosen to prevent the accumulation of more than 300 gms. of U-235 in any decladding tank with an assembly present in the tank. This is less than the always-safe batch size of 350 gms. of U-235. The actual build-up in a process solution is limited to 100 gms. of U-235 to provide additional safety. Experience with decladding MTR fuel plates indicates that the caustic becomes exhausted due to the high aluminum build-up and must be changed for processing efficiency before the 100 gram limit is reached.

The packing proposed in Section K for the scrap materials is based upon the recommendations in Table I-2.3 of the proposed Nuclear Safety Handbook prepared by the ORO Committee on Criticality. Copies of this table were distributed to AEC contractor personnel at a conference on the processing and handling of enriched scrap materials held in the New York Operations office on September 23-24, 1958. The shipping procedure for the completed fuel elements as stated in Section K has not as yet been defined. Specific calculations for the array to be shipped will be submitted at a later date.

We trust that the above information will enable you to complete the evaluation of our requested amendment. In the event there are further questions concerning any of the processing procedures, we would appreciate an authorization to procure the material while these are being discussed. Our schedule requires that the initial melting operations for the Westinghouse

fuel elements begin by February 15. We will appreciate anything you can do to expedite the requested amendment.

Very truly yours,

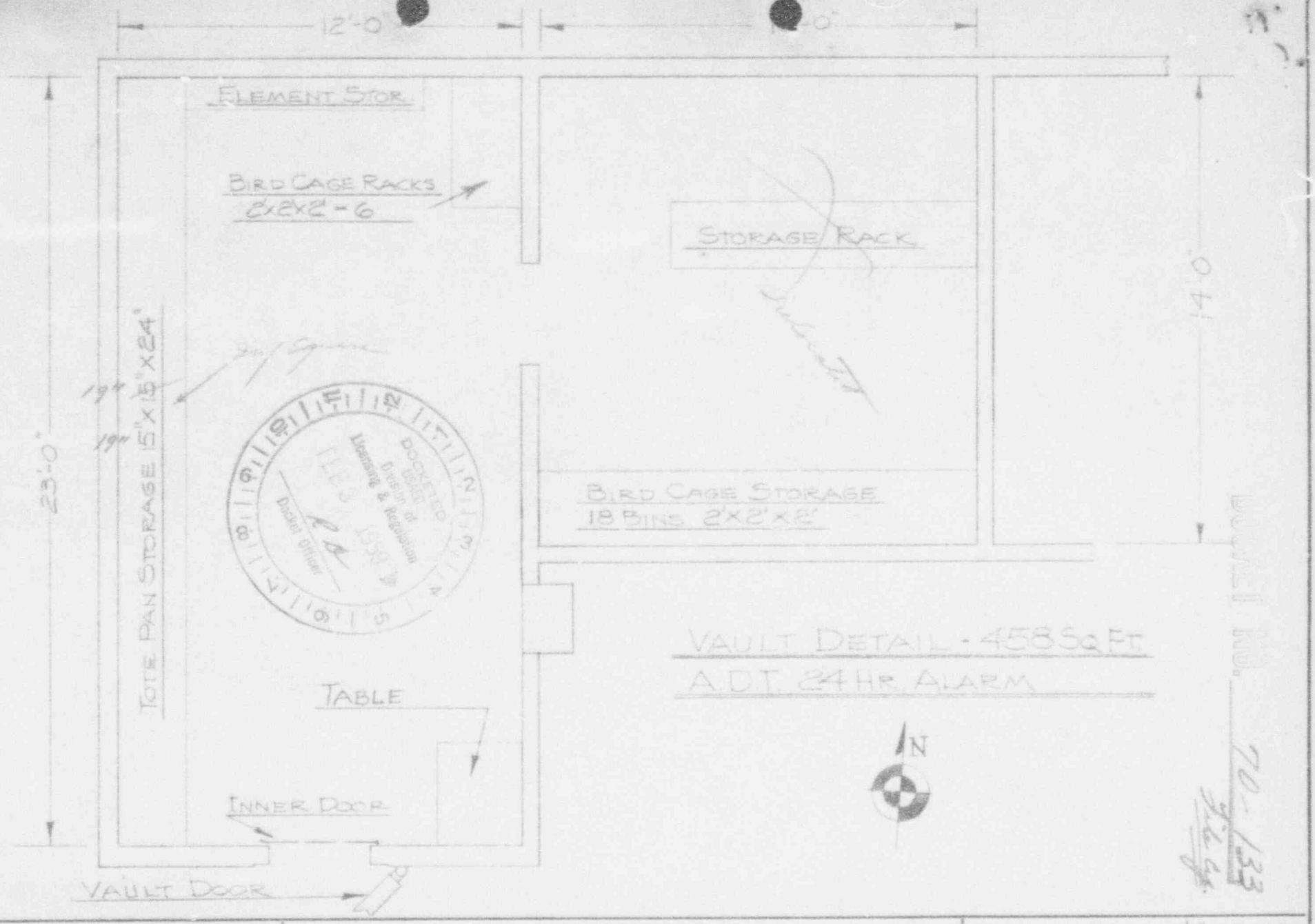
D. J. Berger

D. J. Berger
Executive Assistant
Mechanical Research Division

DJB/sj

Encls: Drawing of Vault
Criticality Guides 4/9/58

DO NOT SCALE THIS DRAWING

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|---|---|---|
| REVISION 4-4-58 OF DRAW'G A560 | UNLESS OTHERWISE INDICATED DIMENSIONS: FRACTIONAL = ± 1/64, .XX = ± .015, .XXX = ± .005; ANGLES: ± 1/2°; SURFACE: MAX. 63 | DATE 4-4-58 SCALE 1" = 1'-0" |
| | | DR. BY R. REEVES CH. BY |
| CLEVITE RESEARCH CENTER DIVISION OF CLEVITE CORPORATION CLEVELAND, OHIO, U. S. A. | NAME STORAGE VAULT DETAIL | APP. FOR PROD. BY |
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# CRITICALITY GUIDE

## Process Operations

The following table summarizes the maximum weight of enriched uranium-aluminum alloy which can be handled in a single batch. No more than one batch of the indicated amounts is to be placed in one tote pan and only one tote pan is permitted in one work area.

NOTE: Only the Material Handler is permitted to move material between work stations and/or the vault.

| | CONTRACT | | |
|---|---|---|---|
| OPERATION | Phillips MTR | Westinghouse Bettis | ACF Swedish |
| MELTING | 15 kg. total alloy<br>2.8 kg. U | 15 kg. total alloy<br>4.3 kg. U | 12 kg. total alloy<br>1.54 kg. U |
| HOT ROLLING | 4 ingots<br>12.2 kg. alloy<br>2.2 kg. U | 2 ingots<br>15 kg. alloy<br>4.3 kg. U | 4 ingots<br>12 kg. alloy<br>1.54 kg. U |
| COLD ROLLING | 4 strips<br>12.2 kg. alloy<br>2.2 kg. U | 6 strips - 7" wide<br>10 kg. alloy<br>2.8 kg. U | 4 strips<br>12 kg. alloy<br>1.54 kg. U |
| SHEARING | 4 strips<br>12.2 kg. alloy<br>2.2 kg. U | 6 strips - 7" wide<br>10 kg. alloy<br>2.8 kg. U | 4 strips<br>12 kg. alloy<br>1.54 kg. U |
| PUNCHING | " | - | " |
| WEIGHING & INSPECTION | 120 fillers<br>1.3 kg. U | 12 strips -3.5" wide<br>2.32 Kg. U | 192 fillers<br>1.54 Kg. U |
| ROLL-BONDING | 120 fillers<br>1.3 kg U | - | 108 fillers<br>6 lots of 18<br>850 g. U |
| ASSEMBLY | 6 lots of 19 plates | | " |
| BRAZING | " | | " |
| WELDING | " | | " |
| MACHINING | " | | " |



4/9/58

D. J. Berger

# CRITICALITY GUIDE

## Storage

The following table summarizes the maximum weight and storage spacing requirements for enriched uranium-aluminum alloys in process under the designated contracts.

| Completed Assemblies | Phillips MTR | Westinghouse Bettis | ACF Swedish |
|---|---|---|---|
| STORAGE | One Array-linear 6 fuel elements on 4" centers. Arrays on 15" centers. | 12 strips per array on steel shelves. Arrays on 15" centers. | One array-linear 6 fuel elements on 4" centers. Arrays on 15" centers. |
| SHIPPING | 6 elements per box, 6 boxes stacked or shipped together. | 20 strips per metal box. Boxes spaced 12" apart. | 6 elements per box 6 boxes stacked or shipped together. |
| REMELT SCRAP per tote pan on 15" center. Alloy thicker than 0.140" strip or ingot. | 15 Kg. alloy<br>2.8 kg. U | 15 kg. alloy<br>4.3 kg. U | 12 kg. alloy<br>1.53 kg. U |
| Strip less than 0.140". Fillers or fuel plates | 120 fillers or plates*<br>1.3 kg. U | 4 kg. alloy*<br>1.2 kg. U | 125 fillers or plates*<br>1 kg. U |
| NONREMELT SCRAP-dry, in 1 gal. containers in tote pans on 15" centers. | 3 kg. alloy<br>500 g. U | 2 kg. alloy<br>600 g. U | 4 kg. alloy<br>500 g. U |
| LIQUID WASTES in carboys on 24" centers. | 600 g. alloy<br>100 g. U | 350 g. alloy<br>100 g. U | 800 g. alloy<br>100 g. U |

*Storage only.
On remelting, one pan at one time may be brought to the melting area as required.

D J. Berger

4/9/58

# CRITICALITY GUIDE

Fabrication of Enriched Uranium Fuel Plates

Argonne National Laboratories P. O. #31-109-38-851

The maximum amount of total uranium which is permitted in the tote pans or at a given work station is listed below for various fabrication operations:

| Operation | Highly Enriched Uranium | Remarks |
|---|---|---|
| Melting | 11 kg | One tote pan may contain 10.2 kg. of U-235 if the material is in large pieces, i. e. approx. 300-400 g. and no dimension smaller than 1/2 inch and less than 100 g. of small chips. |
| Remelt | 11 kg. | Remelt ladder material brought to melt area in maximum lots of 2.8 kg of U-235 per tote pan including less than 100 g. of small chips. |
| Hot Rolling | 11 kg.<br>1 ingot | Spilled salt and metal and oxide recovered from floor and equipment. Maximum of 350 g. U-235 per 1-gallon container. |
| Quenching | 1 strip in tank | Note: Maximum uranium buildup in quench tank 100 g. U-235. |
| Warm Rolling | 11 kgs.<br>2 strips | Two strips in oil bath at least 8-inch separation. Maximum uranium buildup in oil bath 100 g. U-235. |
| Degreasing | 1 strip in degreasing tank | Special degreasing tank having an effective diameter of less than 5 inches. Buildup in tank not to exceed 100 g. U-235. |
| Punching | 1 strip max. 5.5 kg. | Note: Plates & punching scrap go in separate tote pans.<br>Plates - 4 kg. U - 3.85 kg. U-235/pan maximum<br>Ladders - 3 kg. U-2.8 kg. U-235/pan maximum |
| Inspection | 4 kg. lot | |
| Chamfering | 4 kg. lot | Maximum buildup of 100 g. U-235 in chips. Store in 1-gallon container under oil. |
| Shipping | 4 kg. lot | One kg. lot per birdcage. |
| Pickling | 3 kg. lot | Special container with less than 5-inch effective diameter. Buildup not to exceed 100 g. U-235 in solution.<br>Note: Only ladders to be pickled in 3 kg. lots.<br>No fines or small chips to be pickled. |

4/9/58

D. J. Berger

# CRITICALITY GUIDE

Storage Enriched Uranium

Argonne Contract P. O. #31-109-38-851

| Item | Quantity | Remarks |
|---|---|---|
| Incoming Material | 4 kg. lots | One 4-kg. lot per birdcage stored in 24" x 24" x 24" rack. |
| Ingot & Strip Material | 11 kg. lots | Store in tote pans on at least 24" centers with 12" space between pans. |
| Remelt Shearing & Punching scrap | 3 kg. lot | Store in tote pan in standard rack 19" center to center spacing. |
| Salt & Metal & Oxide | 350 g. U-235 Dry | Store in 1-gallon containers. One container per tote pan in standard rack 19" center to center spacing. |
| Chips, Fines & Residues | 100 g. U-235 under oil | Store under oil in vented 1-gallon containers. One container per tote pan in standard racks 19" center to center spacing.<br><br>Larger quantities will be prescribed for birdcage storage. |
| Liquids | 100 g. U-235 per carboy | Store side by side in rows, 24" space between rows. |

D. J. Berger

4/9/58