RETURN TO ~~396-SS~~

70-1257
PDR

ADVANCED NUCLEAR FUELS CORPORATION

2101 HORN RAPIDS ROAD, PO BOX 130, RICHLAND, WA 99352-0130
(509) 375-8100 TELEX: 15-2878

SAFETY, SECURITY, AND LICENSING

November 20, 1989
CWM:89:124

U.S. Nuclear Regulatory Commission
Attention: Mr. L. C. Rouse, Chief
Fuel Cycle Safety Branch
Division of Industrial and medical Nuclear Safety
Washington, DC 20555

License No. SNM-1227
Docket No. 70-1257

Dear Mr. Rouse:

Advanced Nuclear Fuels Corporation (ANF) hereby request amendment to License No. SNM-1227 to authorize storage of uranium oxide in temporary, weather-tight storage facilities such as trailers or freight containers. A similar authorization existed in a previous application (June 1980) but was deleted during license renewal (July 1987). It would now appear that we need such an authorization reinstituted.

ANF produces uranium oxide for shipment to plants in the Federal Republic of Germany (FRG). For example, sintered pellets are loaded into pellet boxes which are sealed and, in turn, loaded into certificated packages for shipment. Prior to shipment, the loaded pellet boxes can be stored (sealed and externally free of contamination) in the Packaged Radioactive Materials Storage Building, or they may be loaded into certificated packages for shipment and subsequently stored in the yard.

The available warehouse space and certificated package inventory are exceeded on rare occasion. One option on those occasions is to bring in a temporary "warehouse" for storage. These are structurally sound, weather-tight facilities such as trailers as are used as temporary offices at construction sites, or enclosed freight containers used for containment and protection during transport.

The temporary "warehouse(s)" would be near or adjacent to the UO_2 Facility such that they would be fully monitored by the existing criticality alarm system. They will not have a filtered exhaust so that all containers must be determined to be sealed and externally free of significant contamination prior to storage. They will be weather-tight such that neither rain nor snow will be a problem. Standard ANF radiological safety procedures will also prevail including a Radiation Work Permit (RWP) covering the temporary storage facilities. Storage will be subject to the same criticality safety analysis and criticality safety specification requirements as all other ANF facilities.

1/1

DF03
26139

Initially, it is planned to store pellet boxes on pallets in a planar array on the floor of the warehouse. An example of a criticality safety analysis for the storage of pellet boxes in a temporary warehouse is presented in Attachment I.

These storage facilities will stand within the restricted area (fenced area) which is already committed to industrial activity with little or no ground preparation necessary. There will be no liquid or gaseous effluent stream. The environmental impact is judged to be nil.

Revised pages to Parts I and II of the license application are enclosed.

A check for $150 for the initial licensing fee is enclosed.

Very truly yours,

CW Malody

C. W. Malody, Manager
Regulatory Compliance

jrs

Enclosures

TABLE 1-1.1 Specific Locations of Authorized Activities

Location	SNM	Authorized Activity
SF Building	Pu and PuO_2-UO_2 contaminated waste	Storage and repackaging.
	UO_2 (up to 19.99 wt% U-235)	Storage, blending, pressing, sintering, fuel rod loading and downloading, fuel rod welding, fuel element assembly; process tests; associated quality control activities.
	Uranium Compounds (up to 5 wt% U-235)	Waste storage, sorting, incineration, packaging, and associated quality control activities.
UO_2 Building (including Powder Storage)	Uranium Compounds (up to 5 wt% U-235)	All operational steps of fuel manufacturing from UF_6-UO_2 conversion to packaging finished fuel elements, scrap recycling and reprocessing; process tests; associated quality control activities.
	UO_2 (5 to 19.99 wt% U-235)	All operational steps of fuel manufacturing involving UO_2; including associated quality control activities.
ELO Building	Uranium Compound (up to 19.99 wt% U-235)	All operational steps of fuel manufacturing involving uranium compounds; including process tests.
FCTF Building	UO_2 (up to 5 wt% U-235)	Hydraulic flow tests involving single fuel elements.

TABLE 1-1.1 Specific Locations of Authorized Activities (Cont.d)

Location	SNM	Authorized Activity
Packaged Radioactive Materials Storage Building	Uranium Compounds (up to 5 wt% U-235)	Storage of closed and externally free-of-significant-contamination containers of product, scrap, and waste materials.
Temporary Storage Facilities	Uranium Oxide (up to 5 wt% U-235)	Storage of a planar array of closed containers of oxide pellets which are externally free of significant contamination.
Materials Warehouse	UO_2 (up to 5 wt% U-235)	Storage of closed and externally free of significant contamination containers of product, scrap and waste materials.
Laundry Facility	Uranium Compounds (up to 5 wt% U-235)	Cleaning of contaminated protective clothing and equipment.
UF_6 Cylinder Storage Areas	UF_6 (up to 5 wt% U-235)	Outside storage of UF_6 cylinders (full and empty).
Packaged Fuel Storage Areas	UO_2 (up to 19.99 wt% U-235)	Outside storage of fuel packed for shipment; the transport containers are closed, sealed and properly labeled for shipment.
Packaged Waste Storage Areas	Uranium Compounds (up to 19.99 wt% U-235)	Outside storage of contaminated materials which are packaged, sealed, labeled and externally free of contamination.
Process Chemical Waste Storage Lagoon System	Uranium Compounds (up to 5 wt% U-235)	Transfer, mixing, sampling, storage and solar evaporation of contaminated liquid wastes.

TABLE 1-1.1 Specific Locations of Authorized Activities

Location	SNM	Authorized Activity
Retention Tanks	Uranium Compounds (up to 5 wt% U-235)	Interim storage of potentially contaminated liquid wastes.
High Uranium Solids Pond	Uranium Compounds (up to 5 wt% U-235)	Transfer of uranium bearing solids, leaching for uranium recovery.
Solids Trench	Uranium Compounds (up to 5 wt% U-235)	Transfer and storage of contaminated solids awaiting leaching or burial.
Lagoon Uranium Recovery	Uranium Compounds (up to 5 wt% U-235)	Recovery of uranium from waste solutions.
Ammonia Recovery Facility	Uranium Compounds (up to 5 wt% U-235)	Removal and recovery of ammonia from uranium contaminated liquid wastes.

differentials and airflows in the metal structure. All interior surfaces are taped and sealed, and suitably painted. The floor was made of 3000 psi concrete and designed for 250 psf.

Contaminated clothing is dry-cleaned in a freon solvent system, surveyed for contamination, and returned to use. Where clothing is essentially free of contamination but remains badly soiled, it may then be water-washed and the effluent directed to retention tanks which are sampled prior to being emptied to the site lagoon system. After cleaning, the clothing is again surveyed and returned to use.

10.1.5 Fuels Storage Warehouse

The location of the Fuels Storage Warehouse is shown on Figure II-10.1. The building is a pre-engineered metal building 60'x40'x16' eave height. The exterior walls are 26-gauge sheet metal, and the roof is 24-gauge sheet metal. The interior of the walls and roof are fully sealed with closure strips and insulated. The floor slab was made of 3000 psi concrete and designed for 250 psf.

The warehouse is used for the storage of packaged special nuclear material in various compounds and forms.

10.1.6 Radioactive Material Warehouse

The location of the Radioactive Material Warehouse is shown on Figure II-10.1. The building is a pre-engineered metal building 50'x140'x16' eave height. The exterior walls are 26-gauge sheet metal, and the roof is 24-gauge sheet metal. The interior of the walls and roof are fully sealed with closure strips and insulated. The floor slab was made of 3000 psi concrete and designed for 250 psf.

The warehouse is used for the storage of packaged special nuclear material in various compounds and forms.

10.1.6a Ancillary Radioactive Material Storage

On occasion, additional storage for uranium oxide product material is required. During those occasions, pre-engineered enclosures such as enclosed sea containers or trailers are positioned near the south end of the UO_2 plant in grid 6D (see Figure II-10.1). These temporary warehouses are weather-tight, and are positioned such that criticality alarm coverage is obtained by existing units.

purifying it through use of a solvent extraction system. The clean UNH from this operation is then reacted with aqueous ammonia to form ammonium diuranate. The precipitate is then centrifuged, dried, and calcined to UO_2, all within the Scrap Recovery Facility.

As in the case of the UNH Facility discussed above, criticality safety is assured in the scrap recovery area through control of equipment and tank locations and geometry. Batching of the dissolver is strictly controlled, and product UO_2 is handled only in safe batches. Both the hooding and process equipment are exhausted through HEPA filters, and protective clothing and eye protection are required for operating personnel safety.

15.8.4 Gadolinia Scrap Recovery

A separate facility is provided in the ELO Building for recovery of gadolinia scrap from the NAF operation. This facility, equipped with a dissolver, filtration equipment, and solvent extraction system, produces gadolinia-free uranyl nitrate. The uranyl nitrate may be converted to UO_2 in the scrap recovery area or in either conversion line.

Criticality safety in the Gadolinia Recovery Facility is provided by control of the geometry of the solvent extraction equipment and the dissolver, as well as through control of feed and product solution uranium concentration (mass). A HEPA-filtered exhaust hood is provided around the dissolver, and protective clothing and eye protection are required for personnel operating in the area. Survey equipment is provided at the exit of this area to monitor hands, clothing, and feet on egress.

15.9 Temporary Storage

Advanced Nuclear Fuels produces, among other products, sintered uranium oxide pellets for shipment off-site. There are occasions when pellet production exceeds normal storage capacity and temporary storage facilities are required. In those cases, the pellets are stored in a planar array of closed containers which are free of significant external contamination.

A Criticality Safety Analysis has been performed on such a temporary storage facility. It was determined that criticality safety is assured by controls on the geometry of the containers, the net weight of the contained uranium oxide, the H/U within the container, and the restriction that the containers be arranged only in a single-tier planar array. Storage requirements are posted at the storage site.

ATTACHMENT I

CRITICALITY SAFETY ANALYSIS

STORAGE OF PELLET SUITCASES IN SINGLE-TIER PLANAR ARRAYS

INTRODUCTION

This Criticality Safety Analysis (CSA) addresses storage of "suitcases" in generic single-tier planar arrays. Pellets are loaded into suitcases at ANF-Richland for shipment to ANFGmbH-Lingen in a certified package such as the CE-250-2. ANF has many years of experience in the safe use of this suitcase. The plan is to store suitcases in a single-tier array on the floor of a facility with adequate protection from the weather.

FISSILE MATERIAL DESCRIPTION

LWR fuel pellets of pure UO_2 with a density up to 95-96% TD are typically shipped in the suitcase. Most pellets have a diameter in the range 0.3-0.4 inch. Unless stated otherwise, the calculation models were based on a 0.35 inch diameter and a 10.96 gm UO_2/cc density (100% TD). All models assumed a 5.0% enrichment. Up to 60 kg uranium with an H/U up to 2.26 may be in each suitcase. Pellets are placed end-to-end in the corrugations of plastic trays and then the trays are stacked and placed into the suitcase as described below.

SUITCASE DESCRIPTION

The subject suitcase is shown on Drawing ANF-304306, Rev. 2. A photocopy of part of this drawing is attached for reference. The maximum dimensions of the tray stack are about 7.75" wide by 4.87" tall by 24.88" long for a maximum volume of 15.39 liters. The tray stack is centered on a steel base that is about 9.37" wide by 26.5" long. A lid of 0.06" thick stainless steel is then placed over the stack and secured to the steel base which is composed of a 0.12" thick steel plate on a frame of square tubing. The 0.06" thick lid and the 0.12" thick base plate were modeled but other steel parts such as handles and tubing were conservatively neglected. Since the base is longer and wider than the tray stack, a gap exists between tray stacks when the bases are placed edge-to-edge. This gap will be referred to as "the volume between suitcases."

CALCULATION METHODOLOGY

All codes and cross section libraries used are part of the SCALE system:

- Sixteen-group cross sections prepared by BONAMI/NITAWL were used.
- The pellet tray stack was modeled as a homogeneous mixture using cell-weighted cross sections from XSDRNPM.
- KENO-Va was used to calculate k-eff.
- Biased water and concrete reflector regions were used for most models.

LIMITS AND CONTROLS

The limits and controls used to assure criticality safety are listed below.

Enrichment: 5.0% maximum

Uranium Mass: 60 kgU (68.1 kg UO_2) maximum per suitcase

Moderation: 2.26 maximum H/U in suitcase

Geometry:

- The suitcase shall conform to Drawing ANF-304306, Rev. 2.
- Suitcases may be stored in a single tier array of any size and in any arrangement (i.e., no minimum horizontal spacing between units is specified).
- Arrays of shipping containers and other fixed fissile units shall be at least 10 feet edge-to-edge from the suitcase array unless covered by a specific analysis. Temporary storage areas shall be approved and posted by the criticality safety component of Safety, Security, and Licensing before storing fissile materials.

SAFETY EVALUATION

Calculations were performed to verify that criticality safety is assured at normal and credible abnormal conditions.

NORMAL CONDITIONS

"Normal" conditions were modeled as follows:

- Each suitcase contained 60 kgU with an H/U atom ratio of 2.26.
- The pellet density was 100% TD, and the pellet diameter was either 0.35" or 0.50". Therefore, the UO_2 volume is 6.21 liter, and the water volume

is 9.18 liter (15.39 liter total). To yield a 2.26 H/U, the volume between pellets is 55.96 vol% water and 44.04 vol% void (0.559 gm water/cc).

- An infinite planar array of edge-to-edge suitcases was modeled with 30 cm of water above the array, and 30 cm of concrete below. The volume between suitcases was void.

- The k-eff with 0.35" and 0.50" pellets is 0.7896 ± 0.0050 and 0.7883 ± 0.0046, respectively.

The full reflection conditions modeled, the large size of the array modeled, and the low reactivity of the system provide adequate margin for potential interactions with in-transit materials and for accident conditions where fissile materials are stored closer than specified.

ABNORMAL MODERATION CONDITIONS

Sensitivity study calculations were made to determine the effect of accidentally exceeding the specified H/U limit. The space between pellets (flooded with water) was adjusted to produce water-to-fuel volume ratios (Vw/VF) in the range 1.0 to 4.0. The volume between suitcases was either flooded or void but the volume between pellets within the suitcase was always flooded. These cases represent full flooding and then drainage of the water between suitcases while retaining full reflection; a very conservative model. The calculation results are in Table 1.

The data in Table 1 indicate a considerably enhanced reactivity with concrete reflection but the array remains adequately subcritical with any amount of water within and between suitcases. The reactivity with 0.35" pellets is greater than or equal to that with 0.50" pellets.

Suitcases are typically elevated above a floor such as concrete by wooden or steel pallets. This would tend to reduce the concrete effect at flooded conditions.

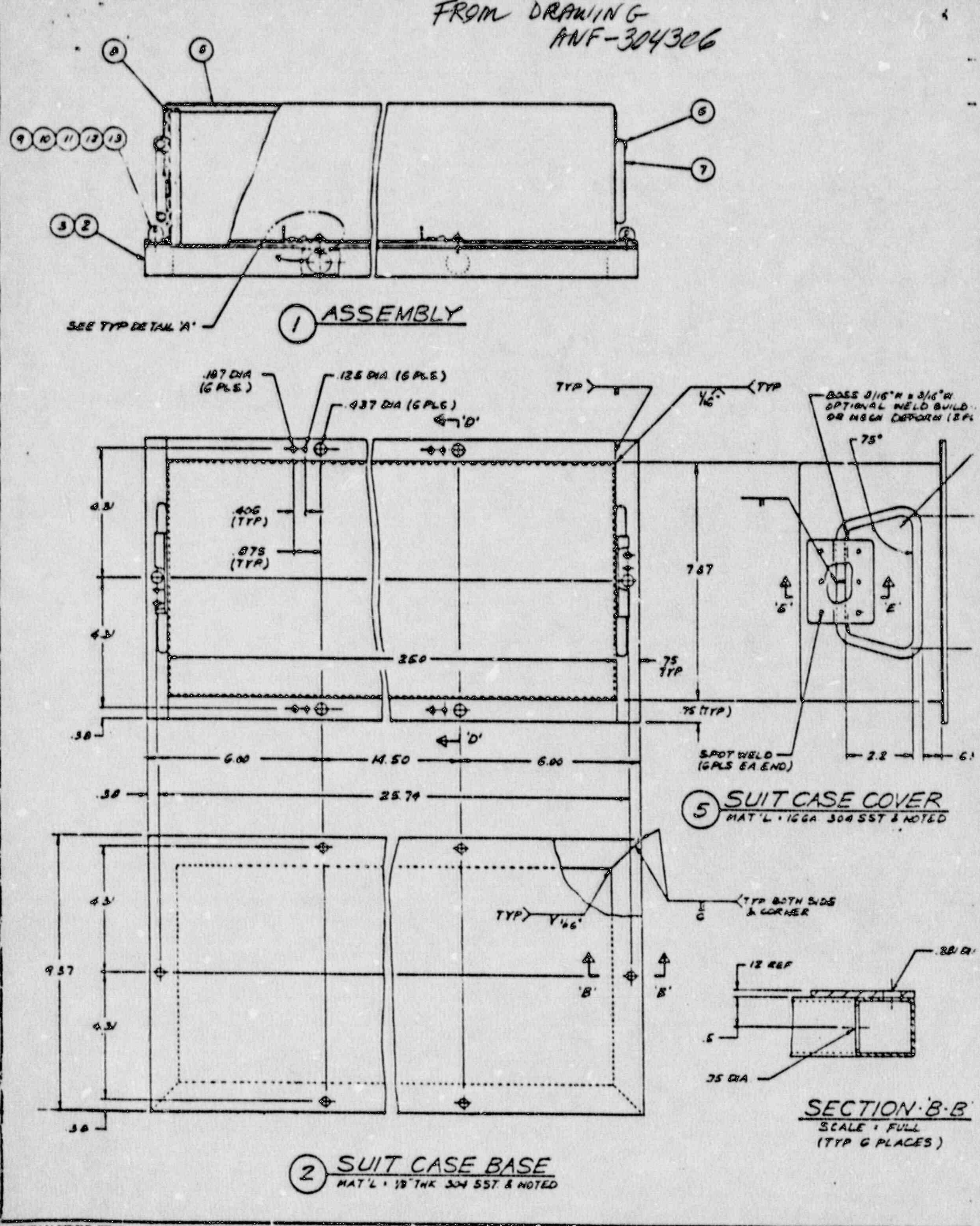
CONDITIONS WITH STACKED SUITCASES

An 11x11 subarray of suitcases (single layer) was modeled with a suitcase stacked on the central unit and with specular reflection at the edges of the sub-array. The result is an infinite array of the 11x11 subarray. Conditions other than stacking were normal. The k-eff is 0.7988 ± 0.0039 with water/concrete reflection. For an infinite array of suitcases stacked two high, the k-eff is 0.9721 ± 0.0049 but this represents many simultaneous accidents.

TABLE 1
KENO-Va RESULTS FOR INFINITE PLANAR ARRAY
OF EDGE-TO-EDGE SUITCASES
FULLY FLOODED CONDITIONS WITHIN SUITCASES
CLOSE-FITTED FULL WATER REFLECTION ABOVE ARRAY

Vw/Vf	kg UO_2	H/U	k-eff
0.35" pellet, water below array, water between suitcases			
2.0	56.2	5.46	0.8979 ± 0.0049
2.5	48.2	6.83	0.9037 ± 0.0049
0.35" pellet, concrete below array, water between suitcases			
1.5	67.5	4.10	0.9417 ± 0.0041
2.0	56.2	5.46	0.9521 ± 0.0042
2.5	48.2	6.82	0.9507 ± 0.0043
3.0	42.2	8.20	0.9308 ± 0.0042
0.35" pellet, concrete below array, void between suitcases			
2.0	56.2	5.46	0.9562 ± 0.0051
2.5	48.2	6.83	0.9566 ± 0.0041
0.50" pellet, concrete below array, water between suitcases			
2.0	56.2	5.46	0.9417 ± 0.0046

L. D. Gerrald



FROM DRAWING ANF-304306
SEE TYP DETAIL 'A'
1 ASSEMBLY
.187 DIA (6 PLS.)
.125 DIA (6 PLS.)
.437 DIA (6 PLS)
.406 (TYP)
.875 (TYP)
TYP
1/16 TYP
BOSS 3/16" H x 3/16" W OPTIONAL WELD BUILD OR MECH DEFORM
75°
7.87
'E'
'E'
2.50
.75 TYP
.75 (TYP)
SPOT WELD (6 PLS EA END)
'D'
'D'
2.2
6.00
14.50
6.00
.38
25.74
5 SUIT CASE COVER
MAT'L: 16GA 304 SST & NOTED
TYP BOTH SIDES & CORNER
TYP 1/16
9.57
'B'
'B'
.12 REF
.881 DIA
.5
.75 DIA
SECTION B-B
SCALE: FULL
(TYP 6 PLACES)
2 SUIT CASE BASE
MAT'L: 1/8" THK 304 SST & NOTED