GPU NUCLEAR

B/A No. 128108

W/O No. 95-552A-52108

SEISMIC QUALIFICATION

No. SQ - T1 - Ic-T-0001

REVISION 0

COMPONENT: IC-T-0001

SUBCOMPONENT(S): _____

_____

_____

Sheet 1 of 12

EVALUATED BY: R. D. Augustino DATE 8-31-93

EVALUATED BY: H Rander DATE ~~8-31-93~~ 10-14-93 SUR.

05-5-97 08:25:52

SQUG DATA FILE INDEX

COMPONENT TAG NUMBER IC-T-0001

DESCRIPTION INTERMEDIATE CLOSED COOLING SURGE TANK

▸ DOCUMENTS	NUMBERS/STATUS	
SEWS		✓
GMS-2 (TECHNICAL FUNCTIONS DATA SURVEY)		✓
PHYSICAL DRAWING/ASSEMBLY DRAWING	D-68-87-3 (41780)	✓
VENDOR CATALOG/DATA/INSTRUCTION MANUAL		
INSTALLATION SPECIFICATION		
SEISMIC ANALYSIS/TEST REPORTS/CALCS		
CONCRETE OR PAD DRAWINGS, SPECS, BLOCK WALLS		
EMBEDDED STEEL DRAWINGS		
ANCHORAGE DRAWING/DETAILS/AIDS	421119	✓

FIELD CHANGE DOCS/MNCR'S

OTHER IE-154-02-005, 423065, 641-024, C-68-33 (41780)

* anchor calcs not available

RL 4/22/93
signature

▸ GENERIC ISSUES

_____ POTENTIAL OUTLIER

_____ BASE PLATE PLUG WELDS

_____ OTHERS

▸ DISPOSITION

_____ NEED MORE DATA

✓ KNOWN OUTLIER

_____ SEISMIC DATA ACCEPTABLE, CONFIMATION WALKDOWN ONLY

ANCHORAGE CALCULATIONS: ___ EXIST ___ PERFORM IN FIELD

COMMENTS NOT IN SQUG DATA BASE. COLLECT CALCS FOR TANK

_____ READY FOR SQUG WALKDOWN

Seismic Capacity Engineer (SCE)

3543-92-178

Use reverse side for COMMENTS.

05-15-97 08:25:52

Status Y N U

SCREENING EVALUATION WORK SHEET (SEWS) Sheet 1 of 2

Equip. ID No. IC-T-0001 Equip. Class 21 - Tanks and Heat Exchangers

Equipment Description ICCW SURGE TANK

Location: Bldg. FHB Floor El. 348 Room, Row/Col E OF TANK NS-T-1

Manufacturer, Model, Etc. (optional) ____

PHOTO LOG 8-31-93, FRAMES 27, 28, 29, 30, 31

SHELL CAPACITY VS DEMAND

Buckling capacity of shell of large, flat-bottom, vertical tank is equal to or greater than demand: Y N U (N/A)

ANCHOR BOLTS AND EMBEDMENT

Capacity of anchor bolts and their embedments is equal to or greater than demand: (Y) N U N/A

See Attachment B

CONNECTION BETWEEN ANCHOR BOLTS AND SHELL

Capacity of connections between the anchor bolts and the tank shell is equal to or greater than the demand: (Y) N U N/A

See Attachments A & B

FLEXIBILITY OF ATTACHED PIPING

Attached piping has adequate flexibility to accommodate motion of large, flat-bottom, vertical tank: Y N U (N/A)

TANK FOUNDATION

Ring-type foundation is not used to support large, flat-bottom, vertical tank: Y N U (N/A)

IS EQUIPMENT SEISMICALLY ADEQUATE? (Y) N U

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SCREENING EVALUATION WORK SHEET (SEWS) Sheet 2 of 2

Equip. ID No. IC-T-0001 Equip. Class 21 - Tanks and Heat Exchangers

Equipment Description ICCW SURGE TANK

COMMENTS

Evaluated by: G. D. Augustine Date: 8-31-93

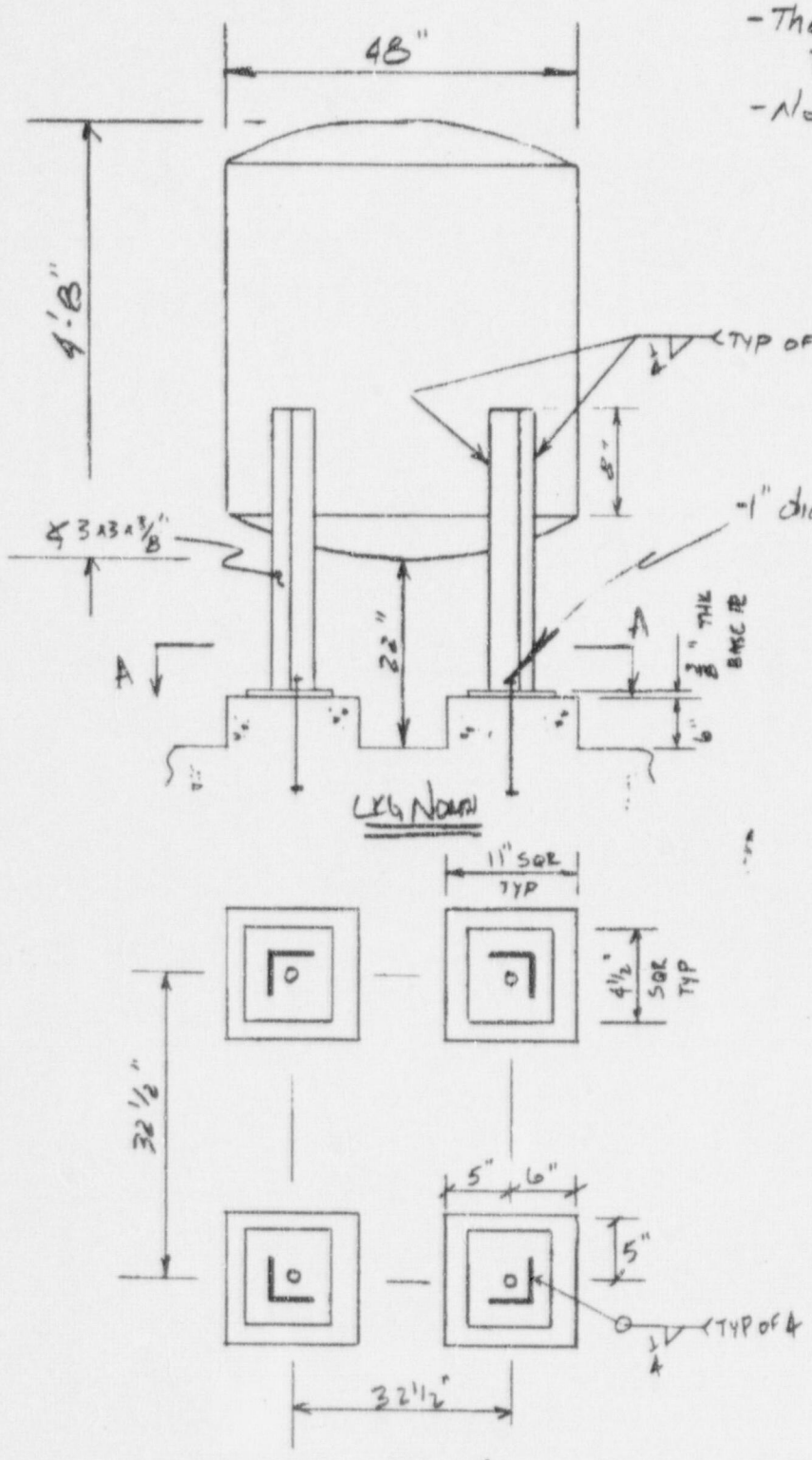
J. K. Ander 8-31-93

05-15-97 08:25:52

GPU Nuclear — **Calculation Sheet** — ATTACHMENT A

Subject		Calc No.	Rev. No.	Sheet No.
IC-T-1		WALKDOWN NOTES		A1 of 1
Originator	**Date**	**Reviewed by**		**Date**
S. D. Augustine	8-31-93	[illegible]		8-31-93

- There are no interaction hazards
- No leg bracing



SEC A-A

GPU Nuclear Calculation Sheet ATTACHMENT B

Subject		Calc No.	Rev. No.	Sheet No.
IC-T-1		IC-T-1	0	B1 of 5
Originator	**Date**	**Reviewed by**		**Date**
B.D. Augustine	8-31-93	[illegible]		8-31-93

PURPOSE Verification of equipment anchorage

METHODOLOGY The methoddogy detailed in the GIP will be utilized.

REFERENCES

1) ES-022 Rev 5, Seismic Design Criteria
2) Generic Implementation Procedure (GIP) for Seismic Verification of Nuclar Plant Equipment. Rev 2.
3) EQE Report No. 42105-R-001
4) Richmond Engineering Company Dwg # D-68-87-3 Rev 5
5) Gilbert drawing # E-421-119 Rev 5
6) Gilbert drawing # S-423-065 Rev. 1
7) AISC Manual of Steel Construction 8th Edition
8) ATTACHMENT B TO NS-T-1-SENS.
9) STRUCTURAL ANALYSIS BY HAROLD I. LAURSEN, 2nd EDITION, McGRAW HILL BOOK COMPANY, 1978.

CALCULATIONS

Per Ref. 4 the tank weight full of water = 3,830# and its C.G. is located (15" + 119/16" - 1½" + 15½") = 40 9/16" above the top of the pad. From Attachment A, pad height = 6". Therefore tank C.G. is 46 9/16" above the floor.

The tank is located on Elev. 348' of the Fuel Handling Building. From Ref 3 find the following acceleration values:

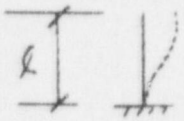
Peak N-S = 0.45g	ZPA N-S = 0.15g	Figure 3-88
Peak E-W = 0.68g	ZPA E-W = 0.18g	Figure 3-89
Peak Vert = 0.37g	ZPA VERT = 0.12g	Figure 3-90

GPU Nuclear — **Calculation Sheet**

Subject		Calc No.	Rev. No.	Sheet No.
IC-T-1		IC-T-1	0	B2 of 5
Originator	**Date**	**Reviewed by**		**Date**
G.D. Augustine	8-31-93	J.L. Randa		10-14-93

- The (4) 3x3x3/8" angle legs are adequately welded to the tank shell by (2) 8" long 1/4" fillets per leg. As such, model the legs as guided cantilevers and check bending stress.

VERIFIER NOTE: CHECKED BY ALTERNATE METHOD ON SHEETS B4 & B5



$l = 26\frac{9}{16}$" (Ref 4) $\quad S = .833 in^3$ (Ref 7)

$$M_{BASE} = \frac{Pl}{2(4\,legs)} = \underbrace{\frac{(3830)(0.45_g)(26\frac{9}{16})}{2(4)}}_{N\text{-}S} + \underbrace{\frac{3830(0.68_g)(26\frac{9}{16})}{2(4)}}_{E\text{-}W} = 14.4^{K\text{-}"}$$

$$\sigma = \frac{M}{S} = \frac{14.4}{.833} = 17.3^{ksi} \leq 21.6^{ksi} \quad \text{Legs OK}$$

- Check CIP bolts:

From Ref 5 the anchor bolts are identified as type "FB-13" with 3" projection. From Ref 6 find the bolt is 1" diameter, 21" long, and has nut and 5" sq. plate on the bottom.

From REF 8 find the following bolt allowables:

$F_t = 20,367^{\#}$ $\quad F_v = 4,068^{\#}$

$$\text{Bolt Tension} = \left[\left(\frac{(3830^{\#})(0.45_g)(46\frac{9}{16}")}{(2\ bolts)(32\frac{1}{2}")}\right)^{N\text{-}S} + \left(\frac{(3830^{\#})(0.68_g)(46\frac{9}{16}")}{(2\ bolts)(32\frac{1}{2}")}\right)^{2}_{E\text{-}W} + \left(\frac{3830(0.12_g)}{4\ bolts}\right)^{2}_{VERT}\right]^{\frac{1}{2}}$$

$$- \frac{3830}{4\ bolts} = 1283^{\#}/BOLT$$

GPU Nuclear

Calculation Sheet

Subject		Calc No.	Rev. No.	Sheet No.
IC-T-1		IC-T-1	0	B3 of 5
Originator: G.D. Augustine	Date: 8-31-93	Reviewed by: LL Rander		Date: 10-14-93

$$\text{Shear} = \frac{3830^{\#}(0.45^2+0.68^2)^{1/2}}{4 \text{ bolts}} = 781^{\#}/\text{bolt}$$

$$\text{Interaction} = \frac{1283}{20367} + \frac{781}{4048} = 0.26 \leq 1.0 \} \text{ Anchor Bolts OK}$$

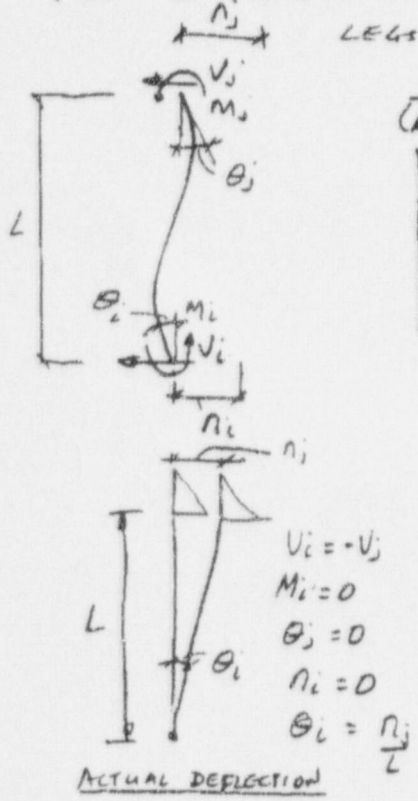
- All other items and welds are OK by engineering judgement.

Conclusion: The tank and its anchorage are seismically adequate.

GPU Nuclear — **Calculation Sheet**

Subject		Calc No.	Rev. No.	Sheet No.
VERIFIGA'S CHECK. IC-T-1		IC-T-1 SEIS	0	B4 of 5
Originator	**Date**	**Reviewed by**		**Date**
A Rander	10-14-93	N/A		

SINCE THE HEIGHT AND DIAMETER OF THE TANK IS APPROXIMATELY EQUAL AND LATERAL ACCELERATION IS SMALLER THAN 1.0, THE TANK BY ITSELF WILL NOT OVERTURN. THE THE NET MOMENT ABOVE THE LEGS IS ZERO. THEN THE FOLLOWING CONDITION APPLIES.



ACTUAL DEFLECTION

MATRIX FORMULATION FOR THIS BEAM IS (REF. 9, Pg 364)

$$\begin{bmatrix} M_i \\ V_i \\ M_j \\ V_j \end{bmatrix} = \frac{2EI}{L^3} \begin{bmatrix} 2L^2 & 3L & L^2 & -3L \\ 3L & 6 & 3L & -6 \\ L^2 & 3L & 2L^2 & -3L \\ -3L & -6 & -3L & 6 \end{bmatrix} \begin{Bmatrix} \Phi_i \\ n_i \\ \Phi_j \\ n_j \end{Bmatrix}$$

SETTING IN THE BOUNDRY CONDITIONS

$V_i = -V_j$
$M_i = 0$
$\theta_j = 0$
$n_i = 0$
$\theta_i = \frac{n_j}{L}$

$$\begin{bmatrix} V_i \\ M_i \end{bmatrix} = \frac{2EI}{L^3} \begin{bmatrix} 3L & -6 \\ L^2 & -3L \end{bmatrix} \begin{bmatrix} \frac{n_j}{L} \\ n_j \end{bmatrix}$$

$$V_i = \frac{2EI}{L^3}\left[3n_j - 6n_j\right] = -\frac{6EI\,n_j}{L^3}$$

$$n_j = \frac{-\theta_i L^3}{6EI}$$

$$M_j = \frac{2EI}{L^3}\left[-\frac{L^2 V_i L^3}{6EIL} + \frac{3L V_i L^3}{6EI}\right]$$

$$M_j = \frac{2EI}{L^3}\left[\frac{2 V_i L^4}{6EI}\right]$$

$$= \frac{2}{3} V_i L$$

V_i = (WEIGHT OF TANK) / 4 × SEISMIC ACCELERATION FACTOR

$V_{i_x} = \frac{3830 \times .45}{4} = 431$ lbs, $M_{i_x} = \frac{2}{3} \times 431 \times 26.5625 = 7632$ in-lb

$V_{i_z} = \frac{3830 \times .68}{4} = 651$ lbs, $M_{i_z} = \frac{2}{3} \times 651 \times 26.5625 = 11530$ in-lb

GPU Nuclear

Calculation Sheet

Subject		Calc No.	Rev. No.	Sheet No.
VERIFIER'S CHECK IC-T-1		IC-T-1 SEIS	0	85 of 5
Originator	**Date**	**Reviewed by**		**Date**
[signature]	10-14-93	N/A		

COMPRESSION IN EACH LEG $= (431 + 651)\frac{26.5625}{32.5} + \frac{3830 \times 1.37}{4}$

$= 2196$ lbs

CHECK $L 3 \times 3 \times 3/8$ $A = 2.11\ in^2$, $S = 0.888\ in^3$, $r = .587$

$f_a = \frac{2.196}{2.11} = 1.04$ ksi, $f_b = \frac{7.63 + 11.53}{0.888} = 21.6$ ksi

$\frac{kl}{r} = \frac{2 \times 26.5625}{0.587} = 91$, $F_a = 14.09$ ksi

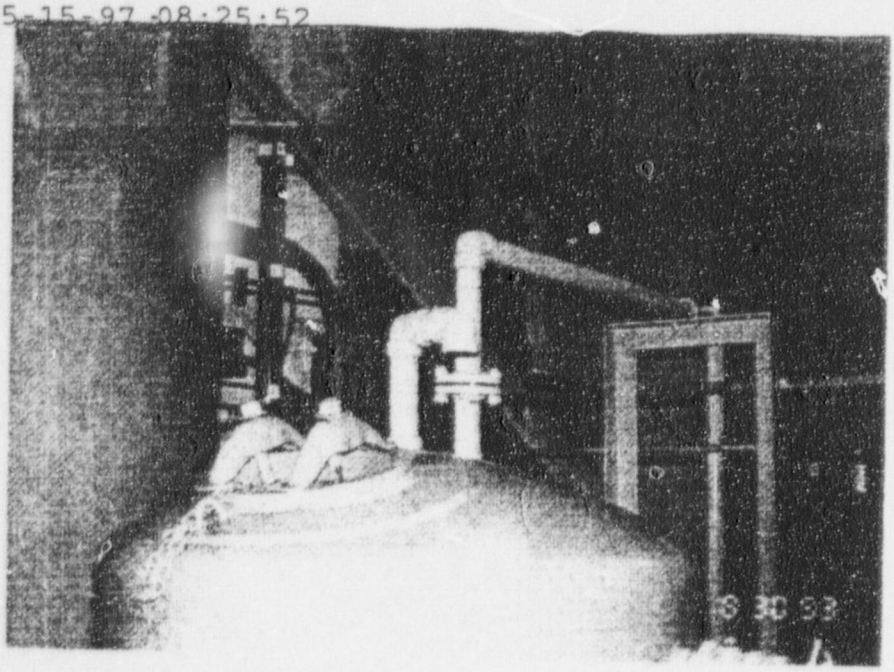
FOR SEISMIC, $\frac{f_a}{F_a} = \frac{1.04}{14.09} = 0.07 < 0.15$

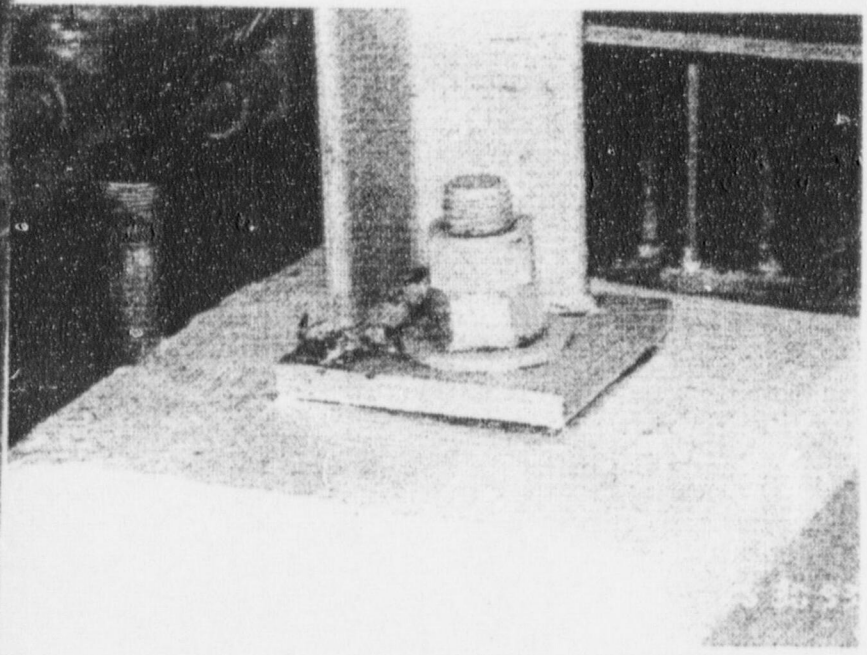
INTERACTION $= \frac{0.07}{1.6} + \frac{21.6}{.6 \times 36 \times 1.6} = 0.67 < 1.0$

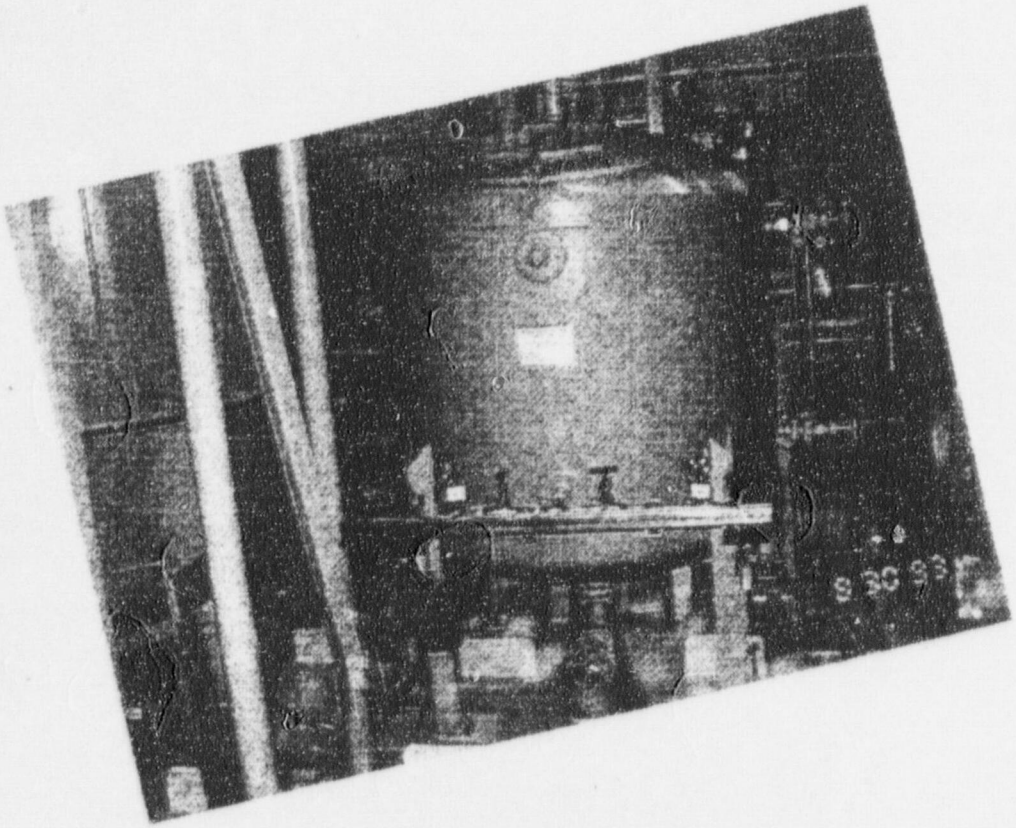
O.K.

CONCLUSION THE TANK LEGS ARE STRUCTURALLY ADEQUATE.

TC-T-0001



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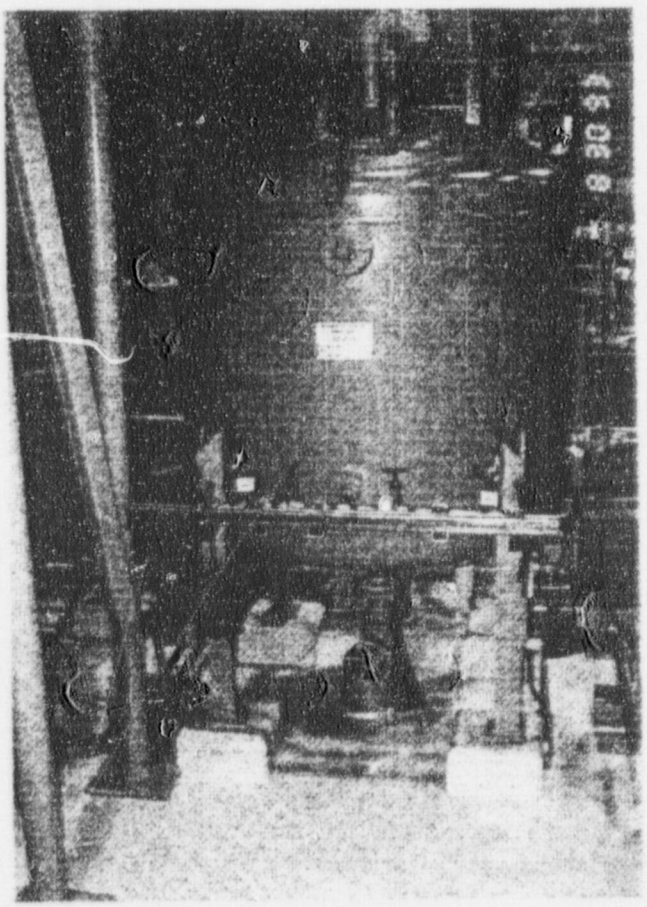
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