TVA

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John A. Scalice
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FEB 2 4 1997

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Gentlemen:

In the Matter of	)	Docket No. 50-390
Tennessee Valley Authority	)	

WATTS BAR NUCLEAR PLANT (WBN) UNIT 1 - RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION REGARDING REQUEST FOR LICENSE AMENDMENT TO TECHNICAL SPECIFICATIONS - SPENT FUEL POOL STORAGE CAPACITY INCREASE (TAC NO. M96930)

The purpose of this letter is to provide TVA's response to the request for additional information dated January 23, 1997, concerning the structural engineering information. The enclosure provides the response to NRC's questions.

If you should have any questions, please contact P. L. Pace at (423) 365-1824.

Sincerely,

J. A. Scalice

Enclosure
cc: See page 2

A001

FEB 2 4 1997

cc (Enclosure):

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ENCLOSURE

WATTS BAR NUCLEAR PLANT (WBN) UNIT 1
REQUEST FOR ADDITIONAL INFORMATION
SPENT FUEL POOL STORAGE CAPACITY

QUESTION 1

With respect to the dynamic fluid-structure interaction analyses using the computer code, DYNARACK, in Reference 1, provide the following:

a. Explain how the simple stick model used in the dynamic analyses can represent accurately and realistically the actual highly complicated nonlinear hydrodynamic fluid-rack structure interactions and behavior of the fuel assemblies and the box-type rack structures. Discuss whether or not a finite element (FE) model with 3D plate, beam and fluid elements together with appropriate constitutive relationships would be a more realistic, accurate approach to analyze the fluid-structure interactions in contrast to the stick model.

b. Provide the results of any existing experimental study that verifies the correct or adequate simulation of the fluid coupling utilized in the numerical analyses for the fuel assemblies, racks and walls. If there is no such experimental study available, provide justification that the current level of the DYNARACK code verification is adequate for engineering application and should be accepted without further experimental verification work.

RESPONSE 1

a. The finite element method of analysis is ill suited to solve problems with the extent of geometric non-linearity that exist in free standing rack structures. For example, the ANSYS finite element code exhibits numerical stability difficulties when applied to free standing rack problems. The component element method of analysis (Reference 4), on the other hand, has demonstrated robust and unconditionally convergent capabilities in free standing fuel rack problems.

As shown in Reference 2, the dynamic response of honeycomb connected submerged racks to seismic excitation is largely characterized by rigid body modes (twisting, lift-off of pedestals, sliding, etc.), occurring in a complex juxtaposition. As a result, on many dockets (such as Diablo Canyon, Docket Nos. 50-275 and 50-323, ca. 1985), the Commission has accepted a six degree of freedom (DOF) model for the rack structure. However, to capture the relatively modest elastic action within the rack module, a 12 DOF model (for each rack) has been utilized in recent Holtec license submittals. The "beam" idealization of rack structure, however, does not inhibit the analyst's ability to model the fluid structure interaction in a most comprehensive manner. For example, the fuel assembly-to-cell wall fluid coupling is based on the actual fuel assembly geometry surrounded by the box cell (Reference 3). The rack-to-rack fluid coupling likewise is simulated using the equations which define the hydrodynamic coupling between large proximate plates. The Component Element Method of Analysis (Reference 4) enables the analyst to simplify certain aspects of the structural model (such as the internal stress fields in the rack structure) and emphasize other aspects (such as inter-surface impacts and Coulomb friction), while making no compromise with respect to the rigorousness in modeling the fluid coupling effects. In other words, the fluid-structure interaction terms take full account of the shape and geometry of the structures and their interstitial spaces.

b. Holtec International carried out a detailed experimentation program to correlate the fluid-coupling effect in proximate racks in 1988. Nearly 100 discrete experiments were carried out. That benchmarking work is documented in Reference 5 and has been presented to the NRC in extensive discussions on fluid coupling for previous dockets (J. A. FitzPatrick, D. C. Cook).

QUESTION 2

A comprehensive analysis of the results were not provided in the submittal (Reference 1) for staff review. Provide a summary of the analysis results (i.e., stresses, displacements, hydrodynamic pressure distribution, locations of the maximum responses, etc.) in a tabular form for the single- and multi-rack analyses.

RESPONSE 2

The tables shown below provide the requested information. Figures 2.1 and 2.2 give representative gap and pedestal loads as a function of time.

TABLE 2.1

Summary of Limiting Results from Single Rack Analysis

Item	OBE*	SSE	15 x 15 SSE*
Max. Vertical Pedestal Load, lbf	198,000	158,000	402,000
Max. Displacement at Rack Top Corner, in	0.457	0.704	.525
Max. Displacement at Baseplate, in	0.015	0.045	.024
Max. Fuel-to-Cell Impact Load, lbf	894	873	729
Max. Impact Load at Rack Top Corner, lbf	0.0	0.0	0.0
Max. Impact Load at Baseplate, lbf	0.0	0.0	0.0
Max. Stress Factor - Above Baseplate	0.119	0.111	.193
Max. Stress Factor - Support Pedestal	0.464	0.569	.257

*Evaluation used heavier (consolidated) fuel for conservatism.

ENCLOSURE

WATTS BAR NUCLEAR PLANT (WBN) UNIT 1
REQUEST FOR ADDITIONAL INFORMATION
SPENT FUEL POOL STORAGE CAPACITY

TABLE 2.2

Summary of Limiting Results from Whole Pool Multi-Rack Analysis		
Item	OBE	SSE
Max. Vertical Pedestal Load, lbf	86,300	120,000
Max. Horizontal Pedestal Load, lbf	34,140	63,770
Max. Rack Displacement at top	0.648	1.394
Max. Fuel-to-Cell Impact Load, lbf	1,407	2,161
Max. Rack-to-Rack Impact Load, lbf	0	3,982*
Max. Rack-to-Wall Impact Load, lbf	0	0
Max. Stress Factor - Above Baseplate	0.977	0.552
Max. Stress Factor - Support Pedestal	0.684	0.591

*Rack impact is limited to the casting at the top of the rack and does not result in fuel damage.

The table below lists the peak pressures between the fuel racks and the surrounding pool walls.

TABLE 2.3

Maximum Hydrodynamic Pressures	
Pool Wall	Pressure, psi
North	2.28
South	2.42
East	2.89
West	1.24

QUESTION 3

Explain how the dampings were considered in the DYNARACK and ANSYS numerical simulations. Were they constant for all frequencies or frequency dependent?

RESPONSE 3

Structural damping is the sole damping structural characteristic component used in the fuel rack analysis (the impact locations have impact dampers which are activated only when the impact occurs). That is, for the characteristic frequency chosen, and with the specified damping percent, the structural damping matrix is set at

$$C = \beta\ k$$

where k is the appropriate structural stiffener matrix and

$\beta = \dfrac{\delta}{\pi\ f}$; where δ is the fraction of critical damping ($\delta = 0.02$ for WBN) and the frequency, f, is conservatively set at 7 Hz, which bounds the frequency response of the rack.

The structural damping is constant over the entire time of the event. Since DYNARACK employs a direct solution of the nonlinear equations of motion, there is no modal analysis performed, and therefore frequency dependent damping cannot be specified.

The ANSYS analysis of the pool structure uses results from DYNARACK (floor load inputs from the rack pedestals) and computes additional seismic loads caused by the self-weight of the pool structure. Since the response spectra method is used to obtain the response due to the pool structure mass, damping is reflected only in the level of the input spectra employed for the pool structure. For WBN, the pool structure is subject to the appropriate spectra with 5 percent damping.

QUESTION 4

With respect to the accidental rack-drop analysis in Reference 1, provide the following:

a) analytical approaches or methodologies used,
b) loading conditions,
c) failure (tear and rupture) criteria
d) material properties used including concrete bearing strength and the friction between the pedestal and liner, and
e) complete summary of the analytical results in a tabular form.

RESPONSE 4

In considering a rack drop in Section 2.3 (Existing Rack Modules and Proposed Reracking Operations) of Reference 1, it was noted that there will be no spent fuel stored in the pool when the Region 1 PaR flux trap rack modules are installed. During the future installation of the Region 2 burnup credit racks, spent fuel will be stored in the pool. However, it is not necessary to consider a drop of the Region 2 15 x 15 cask pit rack because the cask loading area can be isolated from the spent fuel pool by installing the cask pit gate. This leaves the much smaller Region 2 "baby" racks (2570 to 4290 lbs) which are to be installed in accordance with the criteria of

NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants," and additional defense-in-depth measures of safety. Despite these favorable weight and handling factors, a postulated rack drop was considered in order to evaluate the potential for pool leakage and fuel uncovering. Several prior analyses performed recently by TVA's contractor, Holtec International, concluded that the WBN spent fuel pool case was bounded and that the cooling and shielding of spent fuel in the pool would remain unaffected. The postulated rack drop is incapable of causing a gross structural failure because primary impact of the relatively light weight "baby" rack module is with the ¼-inch pool liner and 25 foot thick reinforced concrete slab which is located over a rock subgrade.

For example, one of the bounding analyses similar to the one referenced for Three Mile Island Unit 1 was performed by Holtec in 1996 for a 14,000 lb. rack dropped from pool water level (40 foot height) on a 1/8 inch thick austenitic liner supported by the 64 inch underlying structure of the pool's elevated slab. It was concluded that localized damage to the liner would occur, but there would be no primary damage to the overall pool structure and no likelihood of massive water loss. Pertinent information relative to that rack drop evaluation follows.

To accurately predict the consequences of the drop scenario, an elasto-plastic finite element model was developed representing the rack with its pedestals, the liner, and the underlying reinforced concrete structure. The LS-DYNA3D computer code (Version 932, Livermore Software Technology Corporation, May 1, 1995) was used to solve the numerical problems. This computer code has a very sophisticated finite element and material description library and can account for various time dependent contact conditions, which normally arise between the structural components during the impact analysis. The code is frequently used in the automotive and aerospace industries and has been implemented in Holtec International's quality assurance system for the evaluation of impact events in nuclear power plants.

The steady state loading on the liner is principally compressive arising from the pressure head of water and the dead load of the spent fuel racks transmitted through the pedestals. Bending and shear stresses also develop under abnormal conditions such as a seismic event. During the contact time between the impactor and the target, energy distribution phenomena take place, a large transfer of energy occurs, and the contact interfaces represent a number of highly non-linear time-dependent connectivity conditions which are enforced and checked during every time-step of the analysis. After full contact is completed, phenomena related to the shock wave propagation through the structural components of the impactor and target are tracked. The numerical analysis is considered complete when the velocity of the impact is nullified or the damage criteria of the target becomes a certain fact. Of course, a significant reduction in the impactor kinetic energy and an increase in the target deformation energy are observed.

WATTS BAR NUCLEAR PLANT (WBN) UNIT 1
REQUEST FOR ADDITIONAL INFORMATION
SPENT FUEL POOL STORAGE CAPACITY

Correctness of material description is a very important aspect of the impact analysis and elasto-plastic material behavior can be accurately defined as a bilinear material through four constants: the elastic modulus, the yield stress, the rupture stress, and the rupture strain. The values of the constants are greatly affected when the deformation is applied as a spike function characteristic of the postulated drop event. Material subjected to an instantaneous deformation will increase its elastic stress limit but show reduced plastic strain before rupture. In the absence of specific material data representing the real situation, the elasto-plastic bilinear description was used.

Because the superior stratum of the concrete slab is laterally confined and simultaneously compressed from the interior of the pool by water pressure, it exhibits a tri-axial compressive stress behavior, which reduces the tendency for internal cracking. The stress-strain curve of various types of concrete subjected to tri-axial compression tests is depicted in Figure 4.1. For conservative reasons, in the absence of laboratory tests confirming a real stress-strain relationship of the pool slab concrete, the values representing the unconfined full capacity of concrete are used.

The stainless steel elasto-plastic properties were extracted from the ASME "Boiler and Pressure Vessel Code," Section II, Part S. The values include the temperature effects corresponding to a minimum 150°F operating temperature. Figure 4.2 shows the variation of the 304 type stainless steel stress-strain curve with temperature.
Table 4.1 contains data pertinent to the definition of the material used and Table 4.2 contains information pertinent to the impactor and target definition.

For the bounding analysis discussed above, the 14,000 lb. rack was determined to reach a velocity of 307 inches per second before impact. See Table 4.3. The 1/8 inch thick liner was determined to be breached in a localized region, i.e., limited liner cracking, but no primary damage to the pool structure on a global scale was indicated. A small leakage of pool water into the leak chase system in the pool slab would occur, but there was no likelihood of massive water loss from the spent fuel pool. Similarly for WBN, no damage to the pool structure would be expected. If the 1/4 inch liner for WBN is breached, the leakage would be contained by the leak chase system, and there would be no likelihood of massive water loss.

TABLE NO. 4.1 MATERIAL DEFINITION

Material Name	Type	Density	Elastic Modulus	Stress		Strain	
				First Yield	Failure	Elastic	Failure
		(pcf)	(psi)	(psi)	(psi)		
Stainless Steel	SA-240-304	490	2.760E+06	2.500E+04	6.600E+04	9.056E-03	3.800E-01
Stainless Steel	SA-479-304	490	2.760E+06	4.490E+05	9.435E+04	1.627E-02	3.800E-01
Stainless Steel	SA-564-630	490	2.760E+06	1.063E+05	1.400E+05	3.851E-02	3.800E-01
Concrete	4000	150	3.605E+06	4.000E+03	4.000E+03	1.110E-03	3.000E-03
Concrete(*)	4000	150	3.605E+06	4.000E+03	19.000E+03	1.110E-03	5.000E-02

Note: (*) represents the confined tri-axial compressive strength.

TABLE NO. 4.2 STRUCTURAL AND MATERIAL DEFINITION OF IMPACTOR AND TARGET

Impactor Description				Target Description			
Element	Structural Type	Material		Element	Structural Type	Material	
		Behavior	Type			Behavior	Type
Typical Rack	Deformable						
• Walls	Plate F.E	EP	SA-240-304	• Liner	Plate F.E	EP	SA-240-304
• Pedestal Outer Cylinder	Solid F.E	EP	SA-479-304	• Concrete	Solid F.E	EP	4000
• Pedestal Inner Cylinder	Solid F.E	EP	SA-564-630				

Note: E-elastc, EP-elasto-plastic, B-britle.

TABLE NO. 4.3 IMPACTOR WEIGHT AND IMPACT VELOCITY CALCULATIONS

Impactor Definition					Drop	Drag	Velocity Calculations			
Name	Weight	Dimensions			Height	Surface	λ	K_v	θ	V_{impact}
		A	B	C	H	A_c				
	(lbs)	(inc)	(inc)	(inc)	(inc)	(inc^2)				(inc/sec)
Rack	14000	51	102	165	480	5202.00	1.215E-01	1.002E+05	2.849E+00	307

ENCLOSURE

WATTS BAR NUCLEAR PLANT (WBN) UNIT 1
REQUEST FOR ADDITIONAL INFORMATION
SPENT FUEL POOL STORAGE CAPACITY

QUESTION 5

It appears that Figures 6.4.3 through 6.4.5 of Reference 1 do not contain correct units for the acceleration of the time histories. Please review them and submit a revised set of time histories.

RESPONSE 5

The units should be in/sec^2 instead of g. Otherwise, the figures are correct.

QUESTION 6

Tennessee Valley Authority (TVA) is planning to install the storage racks that were manufactured by Programmed and Remote System Corporation (PaR) and used at the TVA's Sequoyah Nuclear Power Plant (SQN) for about 13 years. Discuss the quality assurance and inspection programs to confirm the structural integrity of the racks (i.e., material strength and property changes, corrosions and material creep/hardening due to thermal loadings and radiations, etc.). Submit a summary report of the structural degradations that deviate from the licensed structural conditions of the SQN if there are any.

RESPONSE 6

The SQN fuel racks planned for installation at WBN employ two constituent materials, stainless steel and Boral. The Boral is encapsulated in hermetically sealed cavities. The stability of austenitic stainless steels in low temperature and low stress environment (typical of spent fuel pools) is an established technical fact. Boral, which consists of boron carbide and aluminum, likewise has performed in high neutron and gamma flux environments for decades without degradation. The neutron fluence level in fuel racks is a minor fraction of what exists in reactors where unsheathed Boral has been used for over 40 years without experiencing any material degradation. Boral develops an impregnable ceramic layer (Al_2O_3) upon exposure to water, which protects it from environmental attack. Because of the sealed construction of Boral in these racks, even the passivation process has not occurred, making the Boral panels essentially virgin material at this time.

Holtec International has reviewed the documentation package provided by the rack manufacturer. Holtec's review indicated that these racks were fabricated to the highest standards of quality and subjected to a well articulated quality assurance oversight. Holtec supervised the removal of the PaR racks from the SQN pool in 1994-1995. At that time, Holtec performed a visual inspection on the racks and concluded that no corrosion, erosion, or any other form of age-induced degradation had occurred. The proven history of the ruggedness of the constituent materials in these racks, and a demonstrable evidence of hardware quality through inspection of the hardware and examination of the manufacturing data, lead TVA and Holtec to conclude that the racks emulate new equipment in every respect.

QUESTION 7

Discuss the quality assurance and inspection programs to preclude installation of any irregular or distorted rack structure, and to confirm the actual fuel rack gap configurations with respect to the gaps assumed in the DYNARACK analyses after installation of the racks.

RESPONSE 7

Several steps are planned to be taken to preclude installation of any irregular or distorted rack structure. A visual examination will be conducted and documented for the rack modules during placement in the WBN spent fuel pool together with dimensional verifications as required to resolve any indications of handling or shipping damage. A comparison will be made with the results of inspections conducted immediately after the racks were removed from the SQN pool and substantive differences will be resolved.

Levelness of the racks will be obtained by adjustment of the threaded pedestal spindles. After the racks are placed in their final installed position, a visual check will be made to ensure that the pedestal legs are in contact with their respective bearing pads.

Rack-to-rack and rack-to-wall gaps will then be measured to confirm compliance with configurations assumed in the DYNARACK analyses. Deviations between the as-designed and as-built configurations will be reviewed and approved. The racks will be picked up and moved as necessary until acceptable gaps are obtained. The pedestal feet will again be adjusted as necessary until the rack is level. Rack position measurements and adjustments will be made again, if necessary, to ensure all gaps are within tolerance.

The final check for irregularities and distortions will be a 100 percent post-installation drag test conducted with a dummy fuel assembly and a calibrated load cell. Cells exceeding a 50 pound load test criterion will be reworked with a specially designed expander tool and retested to confirm cell envelope acceptability before release as an approved spent fuel assembly storage location.

QUESTION 8

Provide the locations of the leak chase systems with respect to the locations of the racks and pedestals.

RESPONSE 8

Figure 8.1 shows the layout of the racks and the leak chase system. The leak chase system in the floor of the spent fuel pool consists of leak channels around the periphery of the floor (see Figure 8.2, Section A-A), one east-west leak channel and eight north-south leak channels (see Figure 8.2, Sections B-B and C-C). The leak channel locations were considered when the rack layout was developed. However, it was not possible to avoid the leak channels entirely. Therefore, the bearing pads have been designed to ensure that the load from the rack pedestal is bridged across the leak channels and the concrete allowable stresses are not exceeded. Also, the rack layout does not cause a support pedestal to be located over the existing pits in the floor which were used for the existing rack supports (see Figure 8.3, Detail A).

QUESTION 9

Describe how the liner plates are attached to the channels embedded in the concrete slab.

RESPONSE 9

Figure 9.1 provides an excerpt from the TVA construction drawing which shows the detail of the connection of the liner plates at the leak channel.

It should be noted that during the January 14, 1997 meeting with NRC, TVA incorrectly stated that plug welds were not used on the spent fuel pool liner. Plug welds were not used on the floor liner plates. However, plug welds were used on the wall liner plates. Figures 9.2 through 9.5 provide excerpts of the TVA construction drawings and show representative construction details of the liner plates. The liner plates on the floor of the spent fuel pool are not positively attached to the concrete. The plates were placed on the concrete base slab and were attached to the adjacent plates with full penetration welds at the edges of the plates. The plates for the walls were also installed after placement of the concrete with the same type leak channels and welded plate edges. The wall plate was also plug welded to horizontal embedded plates. These embedded plates are shown in Figure 9.4 and the plug weld detail is shown in Figure 9.5.

QUESTION 10

Describe the method of leak detection in the fuel pool structure. How are leaks monitored? Is there any existing leakage?

ENCLOSURE

WATTS BAR NUCLEAR PLANT (WBN) UNIT 1
REQUEST FOR ADDITIONAL INFORMATION
SPENT FUEL POOL STORAGE CAPACITY

RESPONSE 10

As currently licensed, leakage detection for the spent fuel pool is described as follows in the Final Safety Analysis Report (FSAR), Section 9.1.3.3.5:

> "Leakage detection is provided for the spent fuel pool (SFP) by leakage channels located on the back side of each welded joint of the floor and walls of the SFP steel liner. Leakage into these channels will drain to the perimeter leakage channels located at the bottom of the SFP. The leakage will then flow into the SFP drain pipe to a normally open manual gate valve. Visual detection of the leakage from the SFP may be witnessed as the leakage exits the manual valve and drips into a funnel. The leakage is then routed to the tritiated drain collector tank (TDCT) of the waste disposal system. In the event of excessive leakage, the manual gate valve may be closed to prevent further leakage. Similar type design of leakage channels and visual display of leakage are also provided for the fuel transfer canal and the cask loading area. Non qualified instrumentation are provided in the SFP and the TDCT with main control room low and local high level alarms, respectively."

The manual valves were monitored during power ascension testing, and no leakage was detected.

QUESTION 11

Indicate whether or not TVA is planning to place an overhead platform on the racks permanently or as a temporary storage during the installation of the racks.

RESPONSE 11

An overhead platform on the racks permanently or as a temporary storage during installation of the racks is not anticipated or planned.

QUESTION 12

Describe the plan and procedure for the post OBE inspection of fuel racks gap configurations.

RESPONSE 12

FSAR Section 3.7.4.4.2 contains provisions to determine the actual response spectra resulting from a seismic event. The spectra will then be compared to the design spectra and the plant will be verified to be adequate for restart or continued operation. This verification would ensure that the plant can be maintained in a safe shutdown condition, the integrity of the reactor coolant system has not been violated and safety of the spent fuel pool is not compromised. The fuel rack gaps would be one aspect of the spent fuel pool integrity investigation.

REFERENCES

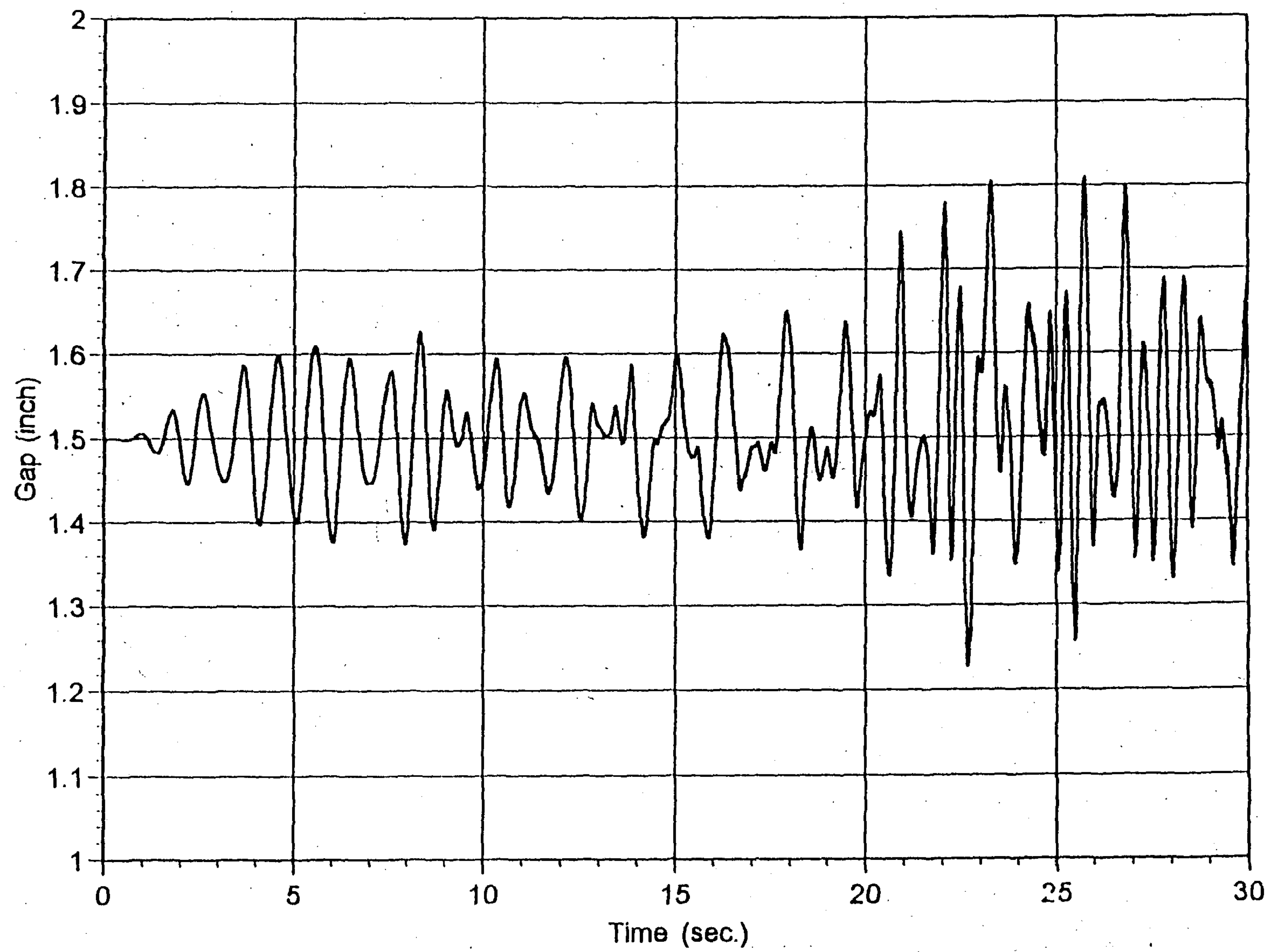
1. "Watts Bar Nuclear Plant Unit 1 - Request for License Amendment to Technical Specification - Spent Fuel Pool Storage Capacity Increase." Letter dated October 23, 1996, from TVA to U.S. NRC.

2. Soler, A.I., and Singh K.P., "Seismic Responses of Free Standing Fuel Rack Constructions to 3-D Motions," Nuclear Engineering and Design, Vol. 80, pp. 315-329 (1984).

3. Singh, K.P. and Soler A.I., "Dynamic Coupling in a Closely Spaced Two-Body System Vibrating in Liquid Medium: The Case of Fuel Racks," 3rd International Conference on Nuclear Power Safety, Keswick, England, May 1982.

4. Levy, S. and Wilkinson, J.P.D., "The Component Element Method in Dynamics with Application to Earthquake and Vehicle Engineering," McGraw Hill, 1976.

5. Paul, B., "Fluid Coupling in Fuel Racks: Correlation of Theory and Experiment," (Proprietary), NUSCO/Holtec Report HI-88243.



TOP GAP BETWEEN RACKS 12 AND 13 VS. TIME FOR WATTS BAR, RUN 1

Figure 2.1

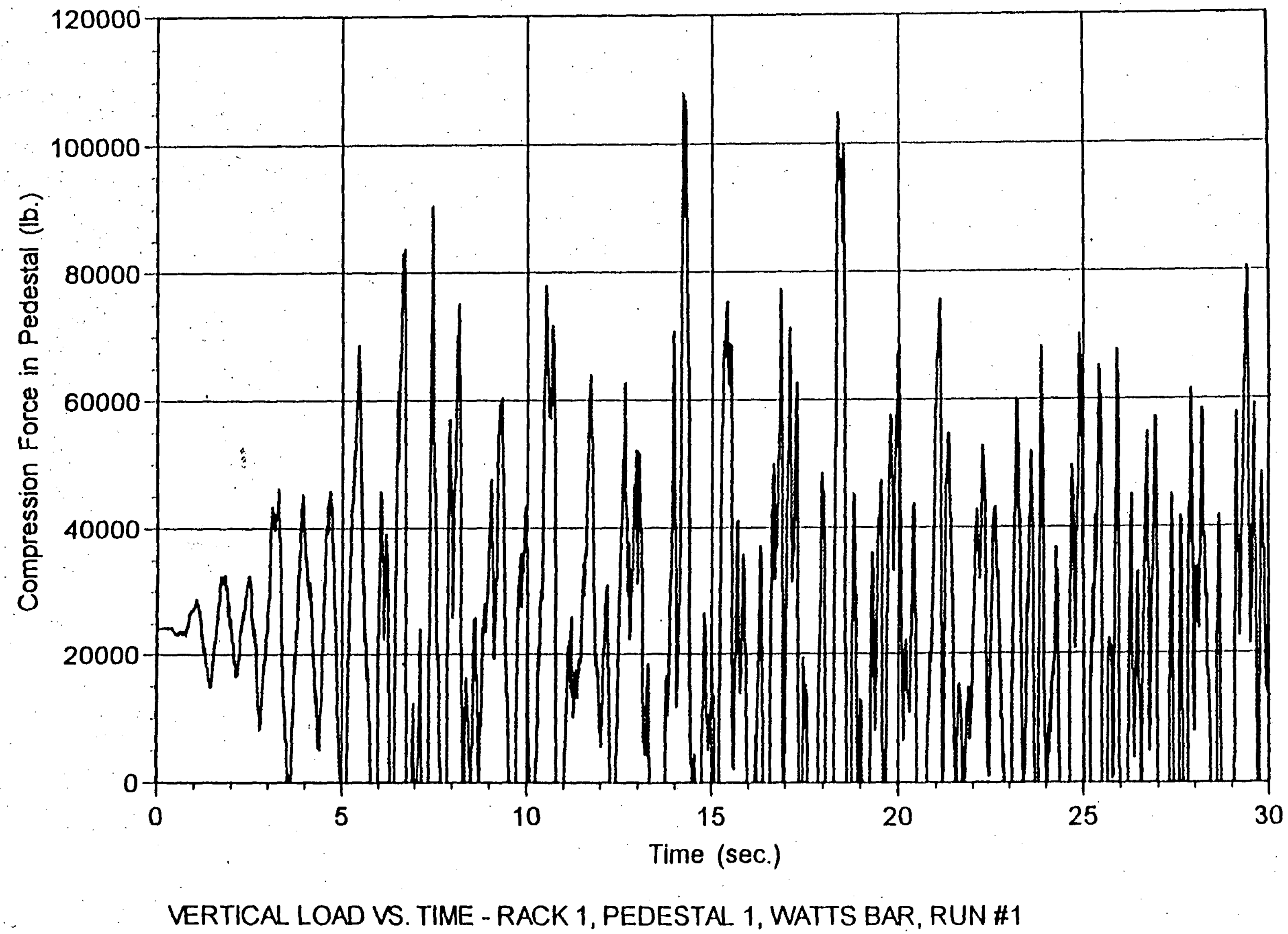

120000
100000
80000
60000
40000
20000
0
Compression Force in Pedestal (lb.)
0
5
10
15
20
25
30
Time (sec.)
VERTICAL LOAD VS. TIME - RACK 1, PEDESTAL 1, WATTS BAR, RUN #1

Figure 2.2

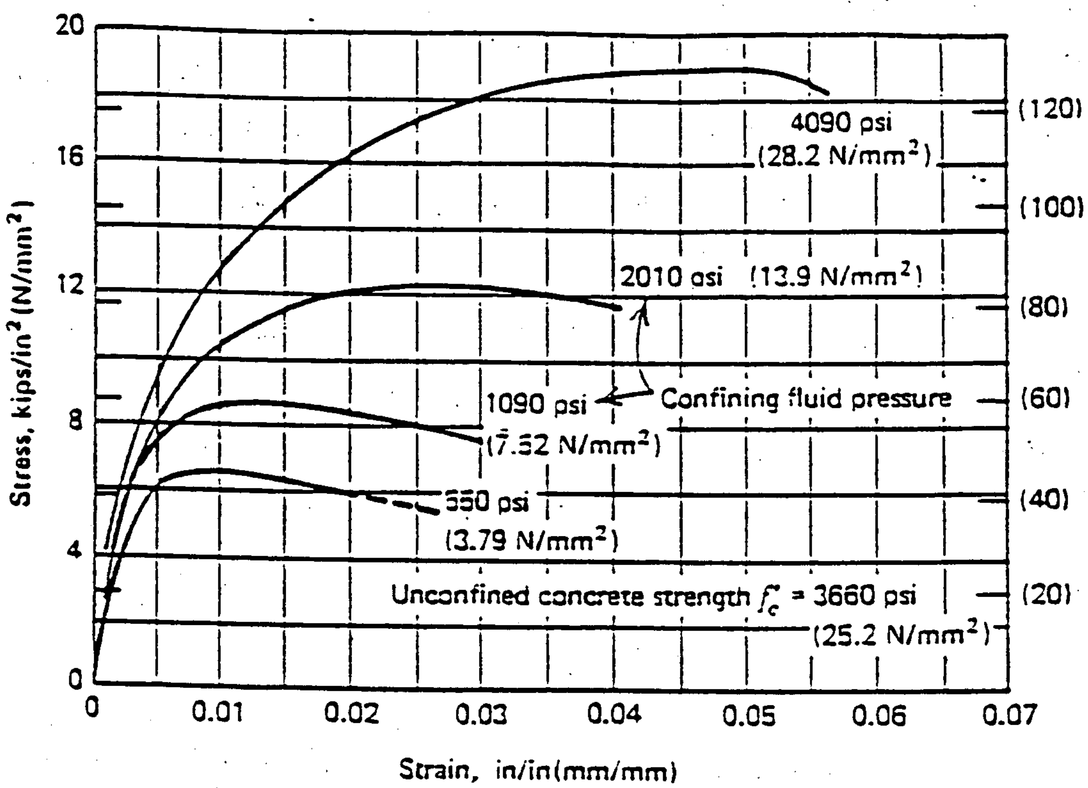


Figure 4.1
Concrete Stress-Strain Curves

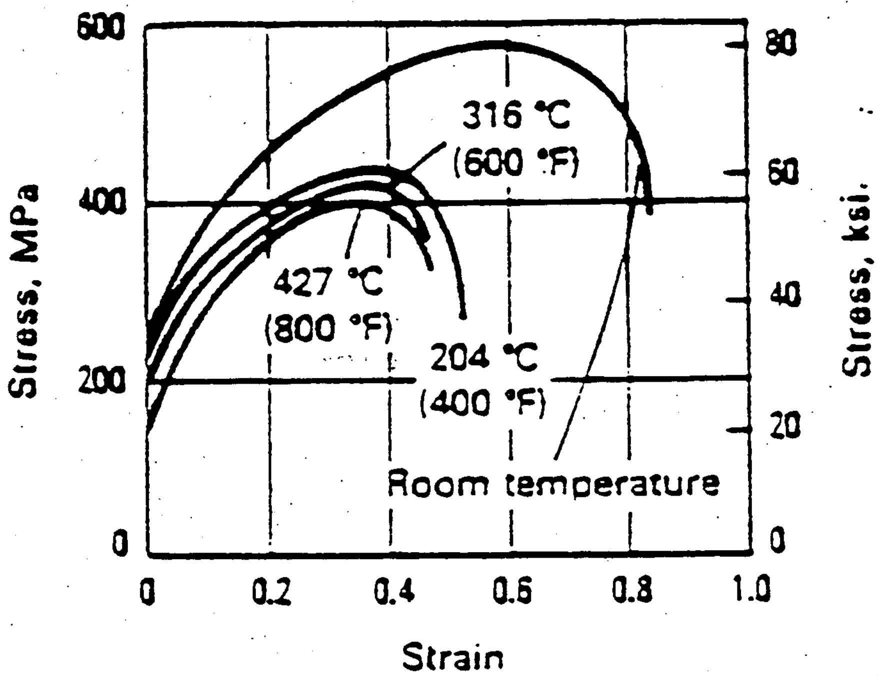


Figure 4.2
Stainless Steel Stress-Strain Curves

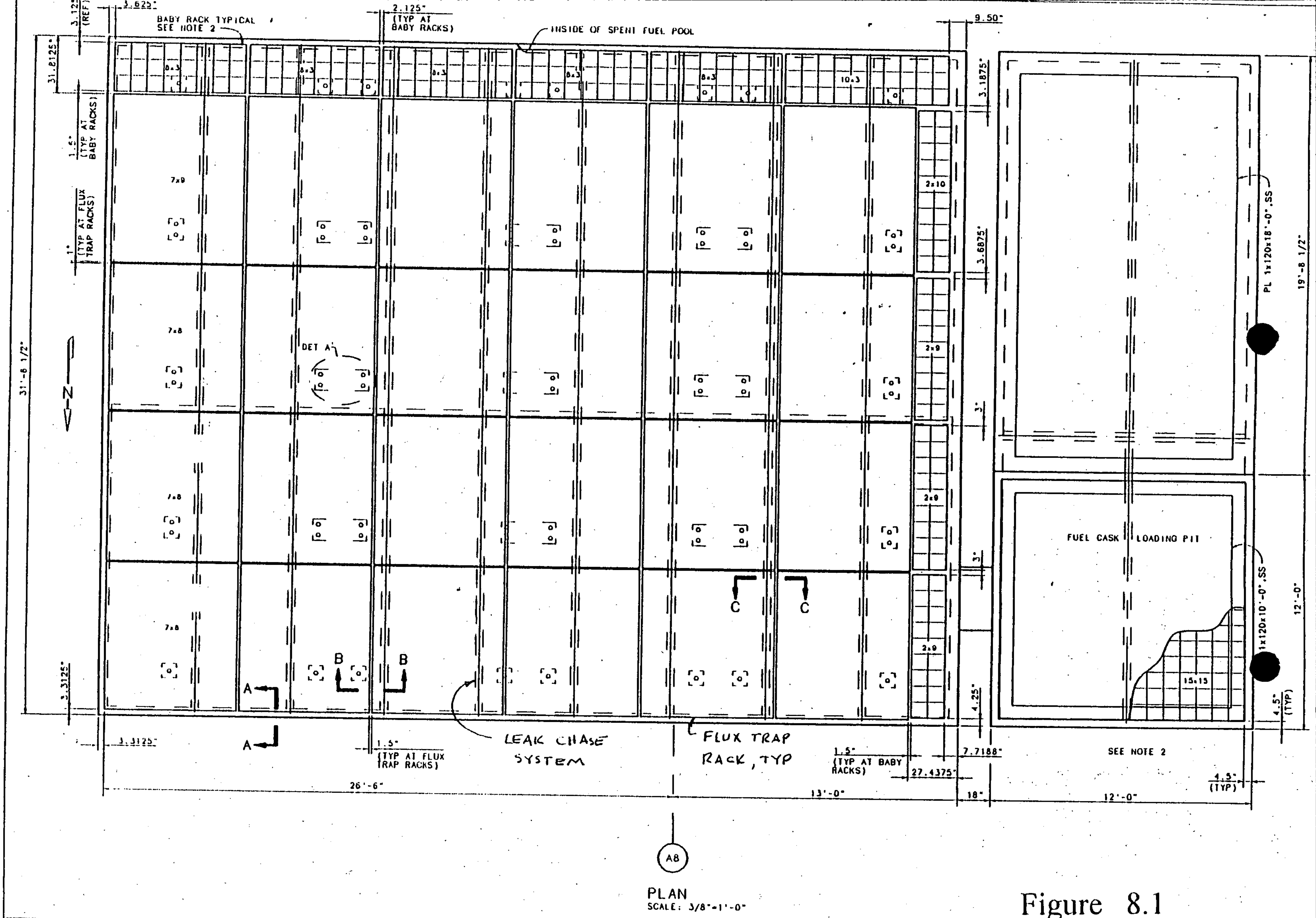
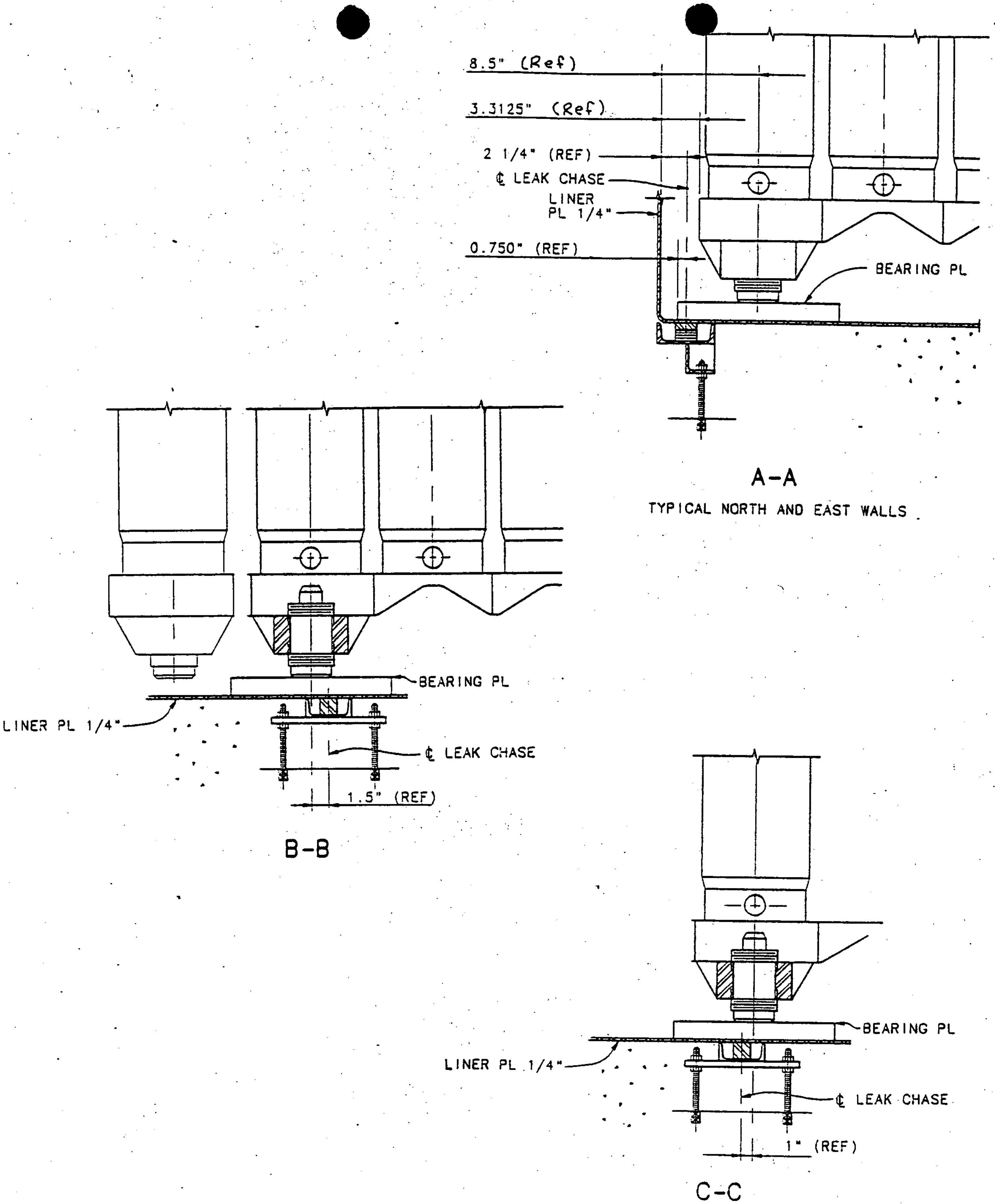
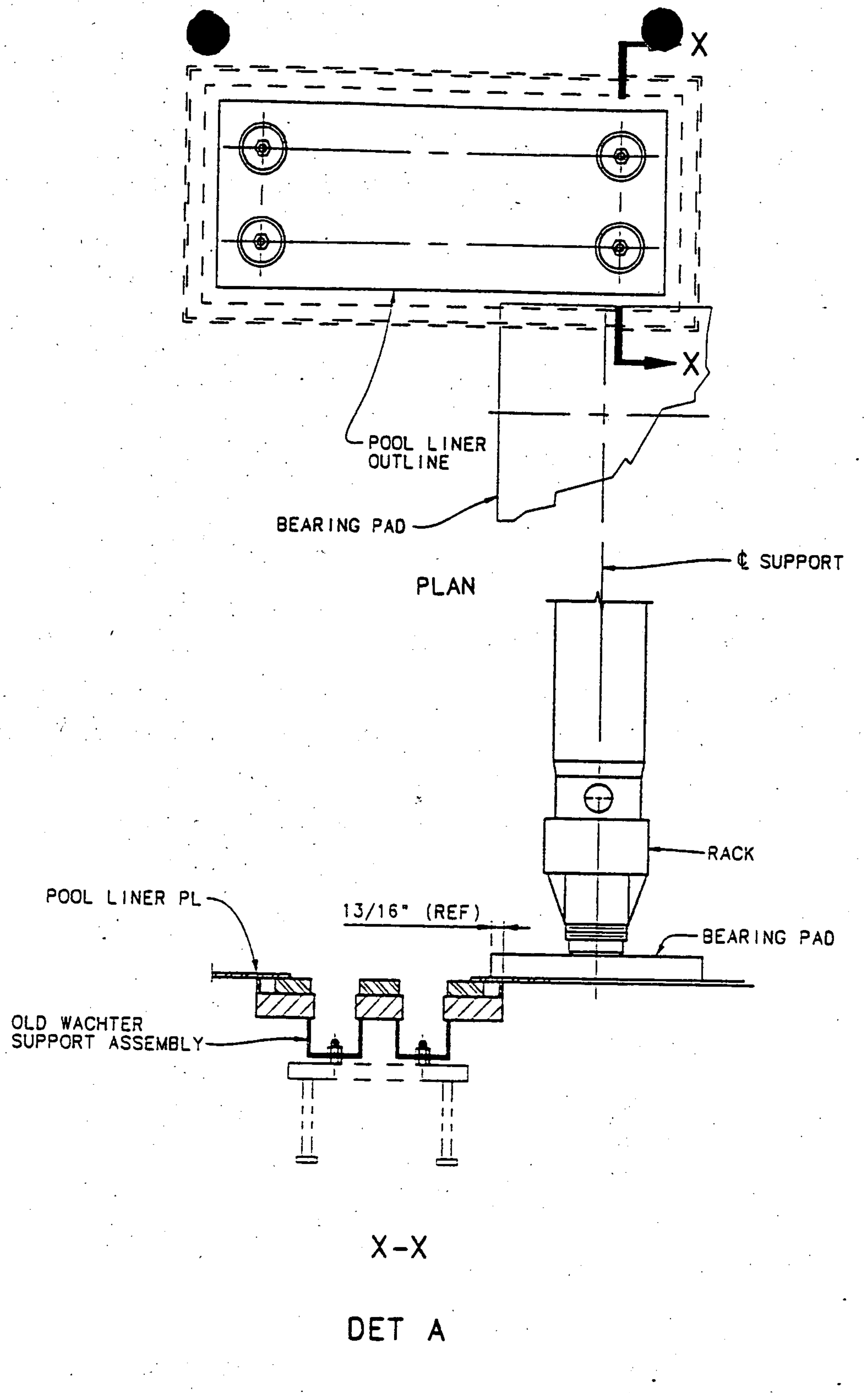

BABY RACK TYPICAL SEE NOTE 2
2.125" (TYP AT BABY RACKS)
INSIDE OF SPENT FUEL POOL
9.50"
3.625"
31.8125"
3.1875"
1.5" (TYP AT BABY RACKS)
1" (TYP AT FLUX TRAP RACKS)
31'-8 1/2"
N
7x9
7x8
DET A
2x10
2x9
3.6875"
3"
4.25"
PL 1x120x18'-0",SS
19'-8 1/2"
FUEL CASK LOADING PIT
15x15
12'-0"
4.5" (TYP)
3.3125"
A
B
C
LEAK CHASE SYSTEM
FLUX TRAP RACK, TYP
1.5" (TYP AT FLUX TRAP RACKS)
1.5" (TYP AT BABY RACKS)
7.7188"
27.4375"
SEE NOTE 2
26'-6"
13'-0"
18"
A8
PLAN
SCALE: 3/8"=1'-0"

Figure 8.1



8.5" (Ref)
3.3125" (Ref)
2 1/4" (REF)
℄ LEAK CHASE
LINER PL 1/4"
0.750" (REF)
BEARING PL
A-A
TYPICAL NORTH AND EAST WALLS
BEARING PL
LINER PL 1/4"
℄ LEAK CHASE
1.5" (REF)
B-B
BEARING PL
LINER PL 1/4"
℄ LEAK CHASE
1" (REF)
C-C

Figure 8.2



(Interference at old Wachter Support)

Figure 8.3

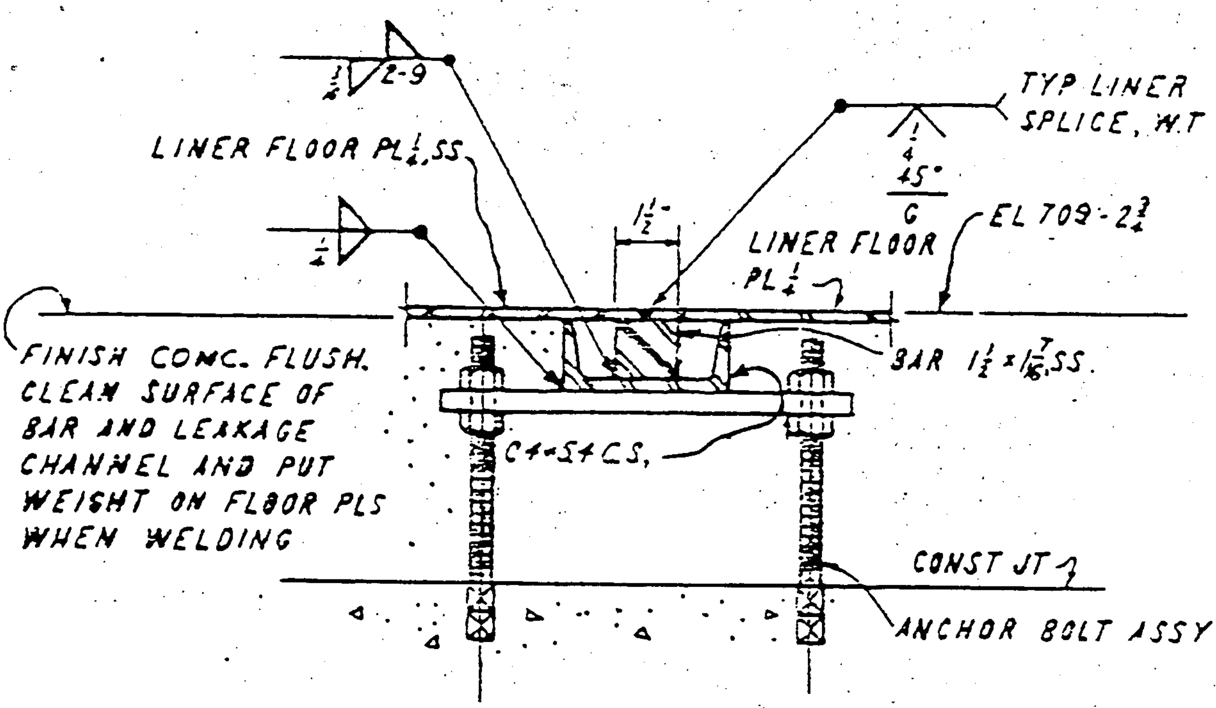
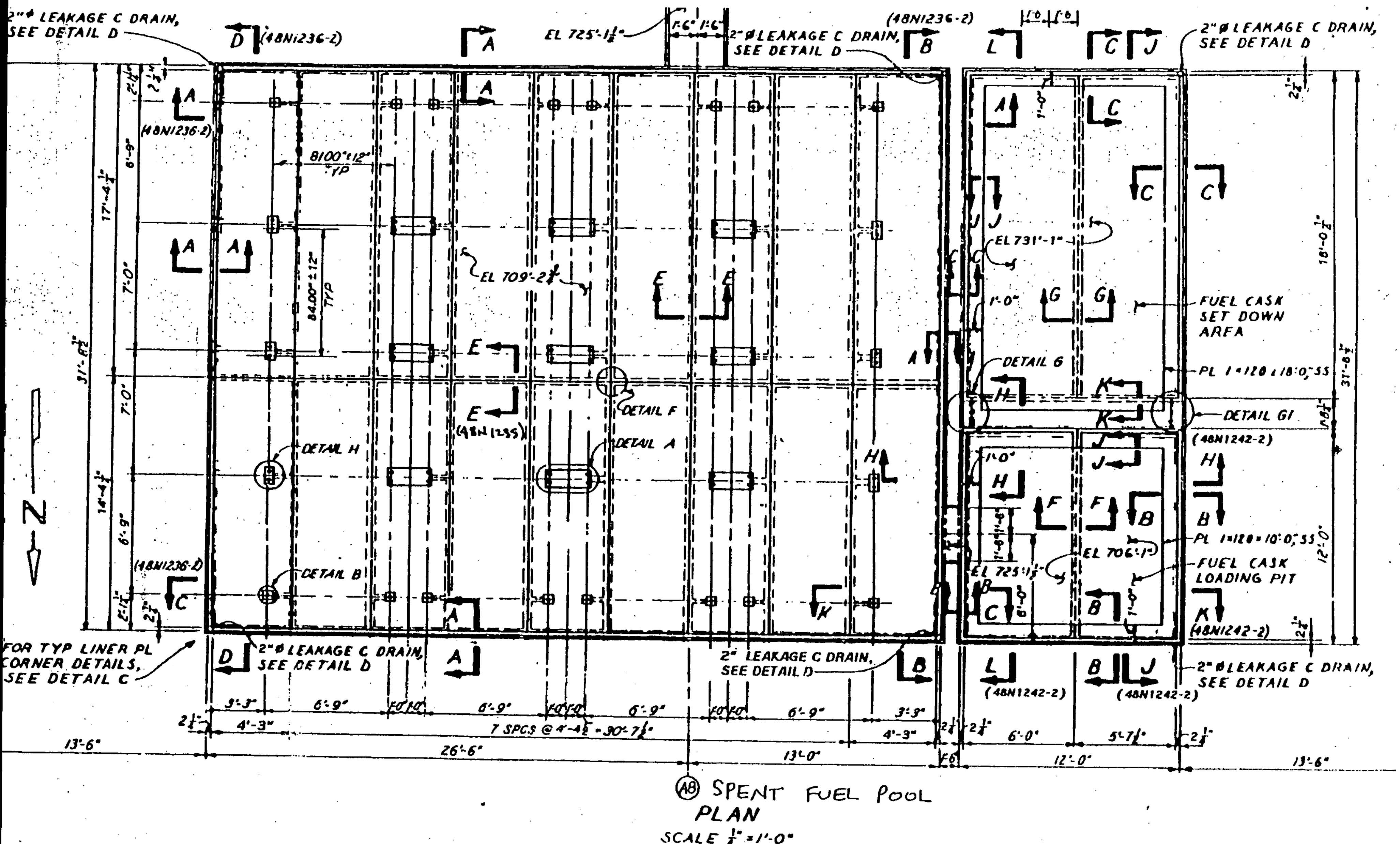


Figure 9.1

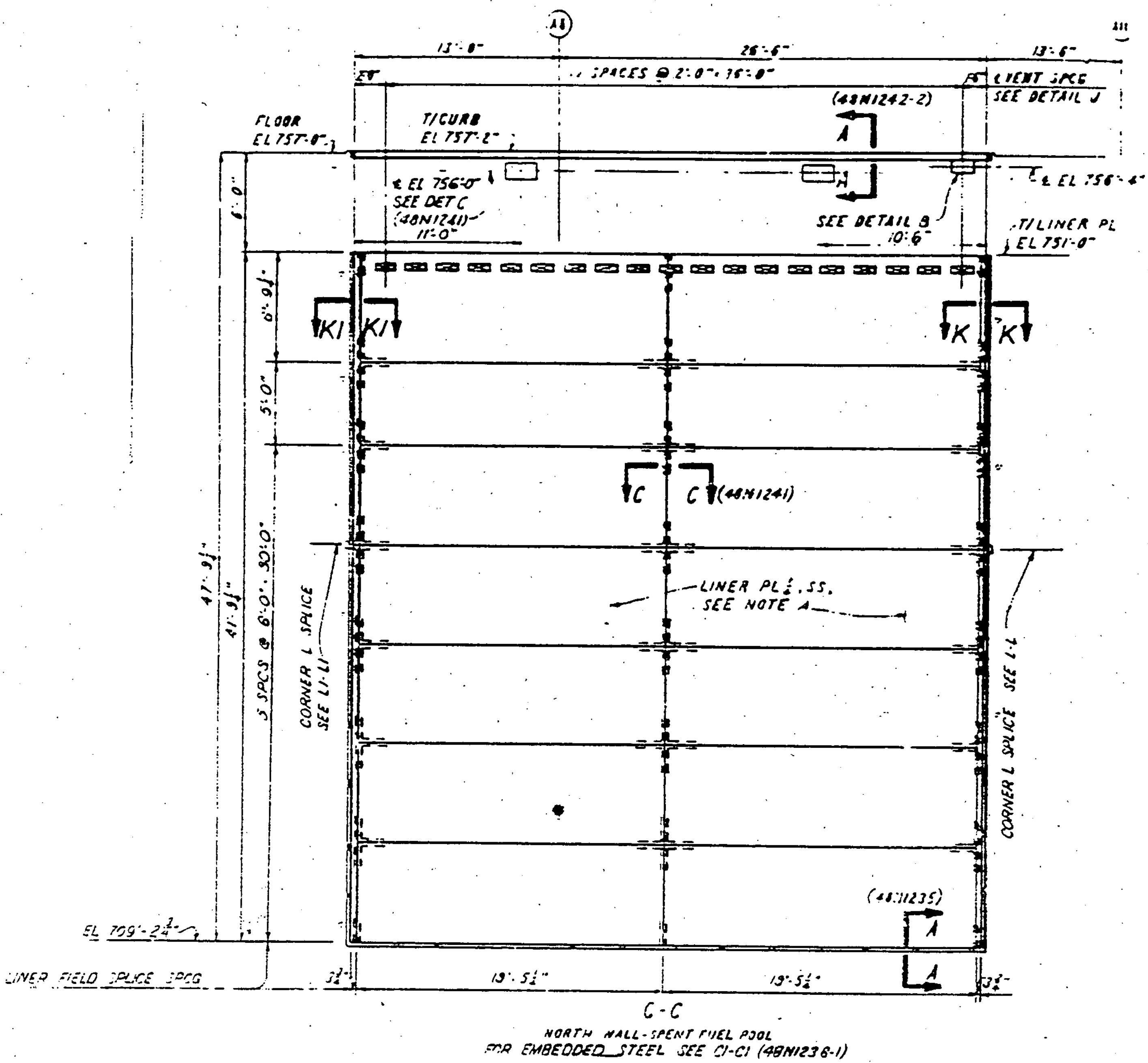
Spent Fuel Pool Liner Weld Detail
at Leakage Channel

(Taken from TVA Drawing 48N1235)



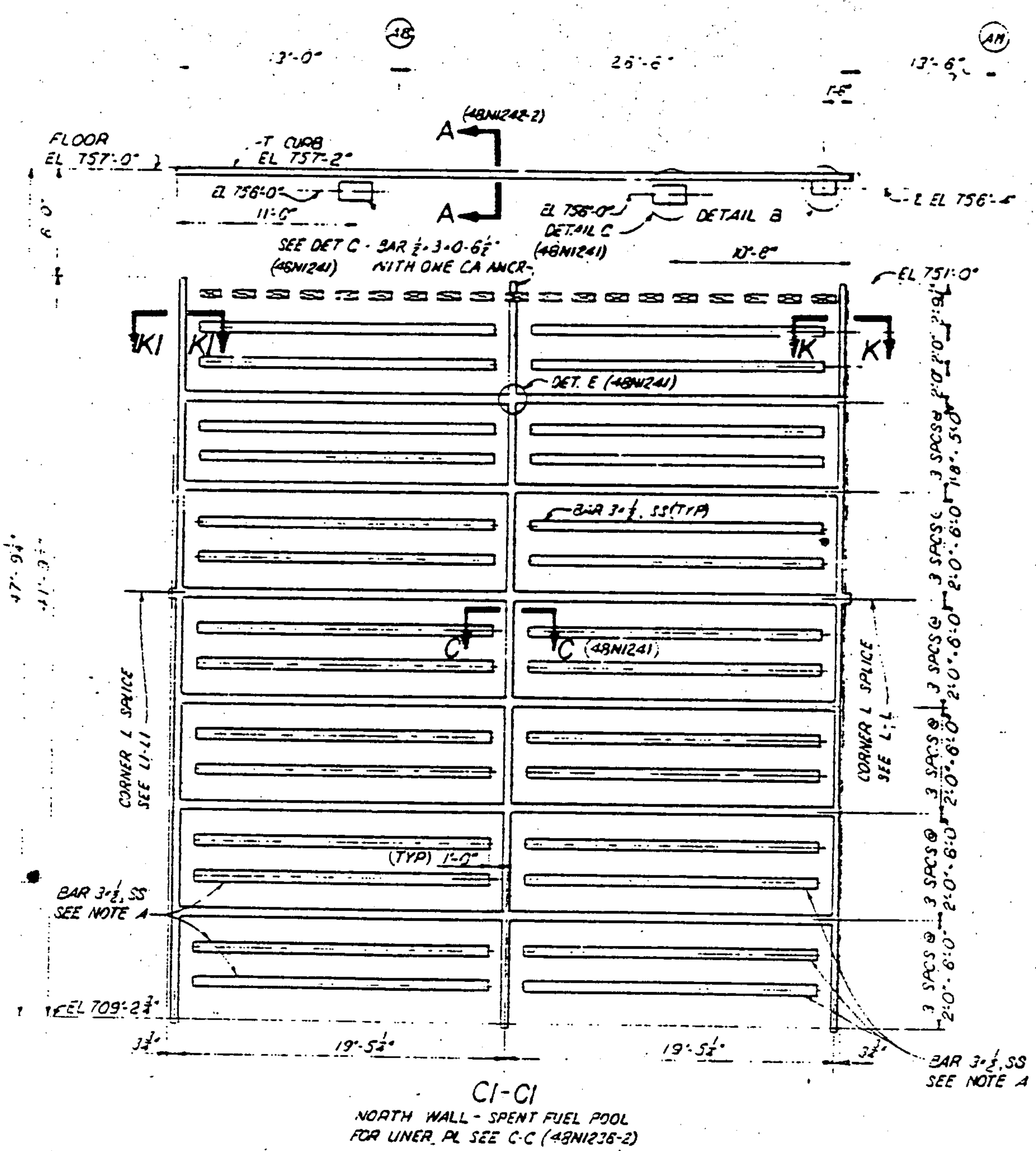
(Taken from 48N1234)

Figure 9.2



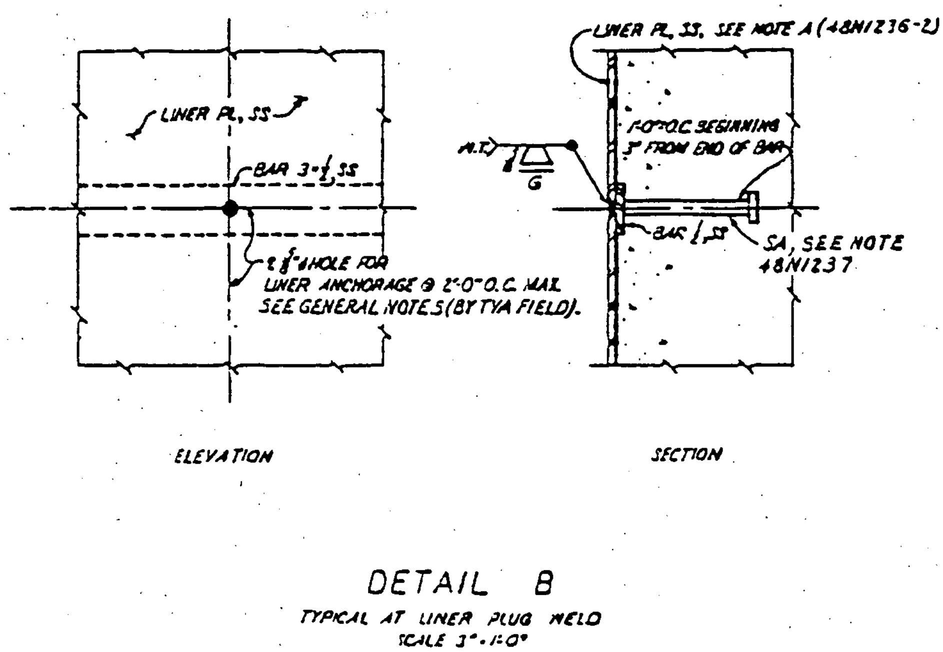
(Taken from 48N1236-2 to show wall plates)

Figure 9.3



(Taken from 48N1236-1 to show leak chase and embedded plates for wall plates)

Figure 9.4



(Taken from 48N1242-1 to show plug weld detail)

Figure 9.5