NORTHEAST UTILITIES

THE CONNECTICUT LIGHT AND POWER COMPANY
WESTERN MASSACHUSETTS ELECTRIC COMPANY
HOLYOKE WATER POWER COMPANY
NORTHEAST UTILITIES SERVICE COMPANY
NORTHEAST NUCLEAR ENERGY COMPANY

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December 28, 1984

Docket No. 50-423
B11393

Director of Nuclear Reactor Regulation
Mr. B. J. Youngblood, Chief
Licensing Branch No. 1
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Reference: (1) B. J. Youngblood to W. G. Counsil, dated August 23, 1984.

Dear Mr. Youngblood:

Millstone Nuclear Power Station, Unit No. 3
Additional Information Related to the
Design of Component Supports

In Reference (1), the NRC Staff requested additional information from Northeast Nuclear Energy Company (NNECO) regarding the design of component supports. As a result, a meeting was held at the Millstone Unit No. 3 site on September 13 and 14, 1984, among representatives of the NRC-MEB, NNECO, Stone & Webster Engineering Corporation (SWEC), and Westinghouse Electric Corporation (WNES), to discuss SER Open Item 4 concerning load combinations and SER Open Item 5 concerning the design of component supports. Attached is a discussion providing further information which, as agreed to by the Staff in the September meetings, responds to the Staff's concerns.

We trust you find this submittal adequate to close out the subject items. If you have any questions regarding the information provided herein, please contact our Licensing representative directly.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY
et. al.

BY NORTHEAST NUCLEAR ENERGY COMPANY
Their Agent

W. G. Counsil
W. G. Counsil
Senior Vice President

C. F. Sears
By: C. F. Sears
Vice President

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E PDR

STATE OF CONNECTICUT)
) ss. Berlin
COUNTY OF HARTFORD)

Then personally appeared before me C. F. Sears, who being duly sworn, did state that he is Vice President of Northeast Nuclear Energy Company, an Applicant herein, that he is authorized to execute and file the foregoing information in the name and on behalf of the Applicants herein and that the statements contained in said information are true and correct to the best of his knowledge and belief.

Lorraine J. D'Amico
Notary Public

My Commission Expires March 31, 1988

DESIGN OF COMPONENT SUPPORTS

The discussion regarding the design of component supports is divided into the following sections:

I. BOP Piping Supports

II. BOP Component Supports (excluding piping)

III. Comparison of ASME-NF with Millstone 3 Criteria

IV. Treatment of LOCA Loads

DESIGN OF COMPONENT SUPPORTS

I. BOP PIPING SUPPORTS

The Staff questioned the jurisdictional boundary used for component standard supports (i.e., catalog items). The effective code for the design of piping and supports is ASME III 1971 Edition through the Summer 1973 Addenda. Since the ASME code references ANSI B31.1 as the applicable code for pipe supports, the Millstone Unit No. 3 jurisdictional boundary for component standard supports is ANSI B31.1 not AISC. Component standard supports are procured with specific provisions that the vendor shall comply to all applicable requirements of ANSI B31.1 Code 1973 including the Summer 1973 Addenda.

The Staff questioned the use of 1.2Sy for the tensile stress allowable in the faulted condition. In earlier submittals to the Staff, NNECO had demonstrated that the Upset condition tended to govern design and presented results of a sample of support designs to verify that fact. The Staff requested further information regarding the sample which is provided below.

The evaluation of supports in the sample included the secondary type loads (SSE anchor movement and thermal) in the Faulted condition and compared to a member stress allowable value of .95Sy. To arrive at the new stress level, a conservative ratio method was first applied in an attempt to avoid a complete support reanalysis. Utilizing this method, the results indicated that the .95Sy stress level was not exceeded; although in a few cases, the supports required reanalysis for the new loads in order to meet the .95Sy stress limit. The distribution of margin to allowable stress is provided in Attachment 1. It should be noted that materials of high yield strength are not utilized for structural members in Millstone Unit No. 3 supports and that more rigorous analyses could have been performed to demonstrate significantly greater margin than that provided in Attachment 1.

A review of the distribution indicates the average ratio of calculated stress to allowable stress is 0.304 with a standard deviation of 0.229. Utilizing these results, including the worst case sampling error allowance, it is estimated that 99.5% of the remaining supports have a ratio of 0.95 or less. Since each support review resulted in a specific margin to allowable stress, the sample size is considered to be sufficient per MIL-STD-414. MIL-STD-105D is not appropriate since it is utilized for attribute sampling plans where a sat/unsat condition is evaluated. In this instance of variables sampling, MIL-STD-414 applies.

The Staff was concerned that the constraint of free end displacement loads was not included in the Faulted load combination. NNECO indicated that the relative anchor displacements are typically small and that the sampling study included these loads. The Staff requested a profile of anchor point motion. Attachment 2 provides the profiles of both OBE and SSE anchor point motion for several Category I structures.

The Staff was concerned that no specific deformation limits are imposed on piping supports, and if allowed to deform substantially, could affect the operability of the supported piping. This is not a concern since the piping supports are modeled in the piping analysis as springs with a representative stiffness. As such, the analysis considers appropriate support deflections and imposes them on the piping. Therefore, deflections are inherently factored into the pipe stress analysis and accounted for in the ASME code stress evaluation.

Regarding components attached to the piping, the loads transmitted to the component through the piping include the effects of the deflection of the piping supports. These loads are subsequently considered in the qualification of the component.

It is also worth noting that the piping analyst reviews the support designs to ensure that the stiffness of the support is representative. Support stiffness is not a concern since Millstone Unit No. 3 typically utilizes short, robust supports which are not susceptible to any appreciable deflection.

In an earlier submittal dated June 19, 1984, NNECO indicated that the weld stress allowable was 21.0 ksi for the Normal and Upset conditions and 25.9 ksi for the Faulted condition. In order to avoid unnecessary rework on pipe supports during the stress reconciliation process and to make the weld stress criteria more consistent with the AISC code, the following weld stress allowable values have been adopted in lieu of the previous values:

Condition	Weld Stress Allowable (psi)
Normal	21,000
Upset	28,000
Faulted	28,000

The increased allowable in the Upset and Faulted Conditions is consistent with the AISC code which allows a 1/3 increase in allowable stress for consideration of seismic loading combinations.

II. BOP COMPONENT SUPPORTS (Excluding Piping Supports)

The Staff requested further clarification of the exceptions from ASME III/NF for the reactor vessel leveling devices and the hydraulic snubbers on the steam generators and reactor coolant pumps. With the exception of the snubber body itself, the snubber hardware (extension piece, load pins, clevis, bolting, etc.) meets the requirements of ASME III/NF. At the time the purchase order was released for the snubber bodies, Subsection NF was not yet incorporated into the ASME code. Therefore, the requirements were specified as follows (Note: all reference to ASME is the 1971 Edition through Summer 1973 Addenda):

Materials were produced to ASTM or AISI standard specifications. Certified Material Test Reports (CMTRs) and impact testing were required. Ultrasonic testing per NB-2530 and NB-2540 was required.

Design analysis was subsequently performed utilizing the rules and material allowable stress of NF-3000. Additionally, both static and dynamic full load prototype testing was performed for qualification purposes.

Fabrication was in accordance with the weld procedures and procedure qualification of NB-4000 with the applicable requirements of ASME IX.

Examination requirements, other than base material examinations as explained above, imposed radiographic examinations on all welds where possible by ASME VIII UW-51. Where radiography was not possible, magnetic particle examination per ASTM/E-138 was performed. All personnel qualification was per NB-5500.

The vendor (Paul Monroe Hydraulics) manufactured the snubbers in accordance with their Quality Assurance Program which meets 10CFR50 Appendix B requirements. Essentially, the only exceptions to ASME III/NF for the snubber bodies are the use of an Appendix B quality program and ASTM/AISI materials versus an ASME quality program and ASME material.

The leveling devices on the reactor vessel are similar to the snubbers such that an ASME program and ASME material were not specified. Also, since they are a non-engineered item which function as an adjustable compression shim, the design portion described above is not applicable.

The Staff was concerned that loads due to LOCA effects and the constraint of free end displacement (thermal and SSE anchor motion) be included in the Faulted load combination. These loads are included in the design of component supports (refer to FSAR Table 3.9B-9B).

The Staff was concerned that no specific deflection limits are imposed on component supports. As discussed, similarly in Section I for piping supports, deflection is an intrinsic parameter in the analysis of a component and component support system. The piping analysis utilizes a representative stiffness for the component and associated support. The analysis yields nozzle reactions which are imposed on the component. The component is evaluated for these loads against the vendor allowable loads. For active components, the allowable nozzle loads are based on a combination of stress limit and critical deflection limits (e.g., pump shaft deflection, impeller to casing clearance); the allowable nozzle loads for passive components are

typically based on elastic stress limits. Therefore, the deflection of component supports, although not specifically limited, is inherently considered in the qualification of a supported component.

III. COMPARISON OF ASME III/NF WITH MILLSTONE UNIT NO. 3 CRITERIA

The Staff requested additional information regarding the weld criteria utilized for supports. It was noted that a detailed comparison of AWS D1.1 criteria with Millstone criteria was provided in the June 19, 1984, submittal.

The Staff requested additional information concerning weld joint design. The weld designs are based either on the prequalified weld joints specified by AWS D1.1 or weld joints qualified in accordance with ASME IX requirements. Except for certain tube steel joints shown in Attachment 3, the weld joints specified in the Millstone 3 criteria are essentially the same as those specified in AWS D1.1. Some minor deviations from D1.1 in tolerance on groove angle, root opening and land are allowed. The tube to plate and parallel tube to tube weld details provided in Attachment 3, although similar to the prequalified partial penetration tubular groove weld of D1.1, are qualified to ASME IX requirements. They have also been qualified in accordance with AWS D1.1 requirements and sectioned for measurement to verify that the design effective throat is achieved. Therefore, these weld joint designs are considered acceptable.

The Staff was especially interested in the design of flare bevel welds. The flare bevel weld design for the tube steel to tube steel matched connection (refer to Attachment 3) is based on an effective throat of t - 1/16 and is qualified by test. The Millstone Unit No. 3 weld design guide provides specific requirements for wall thickness on both the main and branch members and limitations on joint angle to ensure that the design assumption is valid. The AWS D1.1 code specifies an effective throat of t for matched tube steel connections of equal wall thickness (refer to Fig. 10.13.3B of 1983 AWS D1.1). The Millstone analytical criteria assumes a smaller effective throat and therefore results in a more conservative design.

The Staff questioned whether field fabricated sections are utilized in support design. For tubular sections, A500 Grade B tube steel material is specified with the exception of trunnion attachments to stainless steel piping which have been fabricated from stainless steel plate. However, this exception is considered an unrelated application and is only noted here for informational purposes.

The Staff was interested in reviewing the weld inspection criteria. The Millstone 3 criteria require a 100% visual inspection of non-integral welds for all Category I supports. The acceptance criteria for visual inspection was reviewed by the Staff in the September 14, 1984, meeting and was found acceptable.

The Staff was concerned that punching shear be considered in the design of unmatched tube steel connections suggesting a design approach similar to that provided in Chapter 10 of AWS D1.1. A review of support designs indicates that the typical unmatched tube steel joint is very close in size (e.g., 3-inch on 4-inch, 6-inch on 8-inch) and such should not be cause for concern with respect to punching shear. Unmatched connections of larger ratio (2-inch on 10-inch) are typically found only for tubing and small bore supports attached to large bore supports. The tubing and small bore supports have relatively small design loads which are not considered to be significant with respect to punching shear on the main member.

The Staff was concerned that oversized bolt holes were utilized in anchor bolt applications with base plates. The Millstone criteria allows an 1/8-inch oversized bolt hole for baseplates attached to concrete structures. ASME III NF-4721 allows a 1/16" oversized bolt hole up to and including a 1" nominal diameter bolt and 1/8" oversized bolt hole for bolts larger than 1" nominal diameter.

The NF requirements stated above are considered applicable for bolted steel shear type connections due to the relatively high shear stress developed in the bolt. The Millstone requirements for bolted steel construction are in accordance with the AISC code with specifies the similar bolt hole diameters

as ASME III/NF. However, for concrete anchor bolts, the NF criteria is not considered applicable for the following reasons.

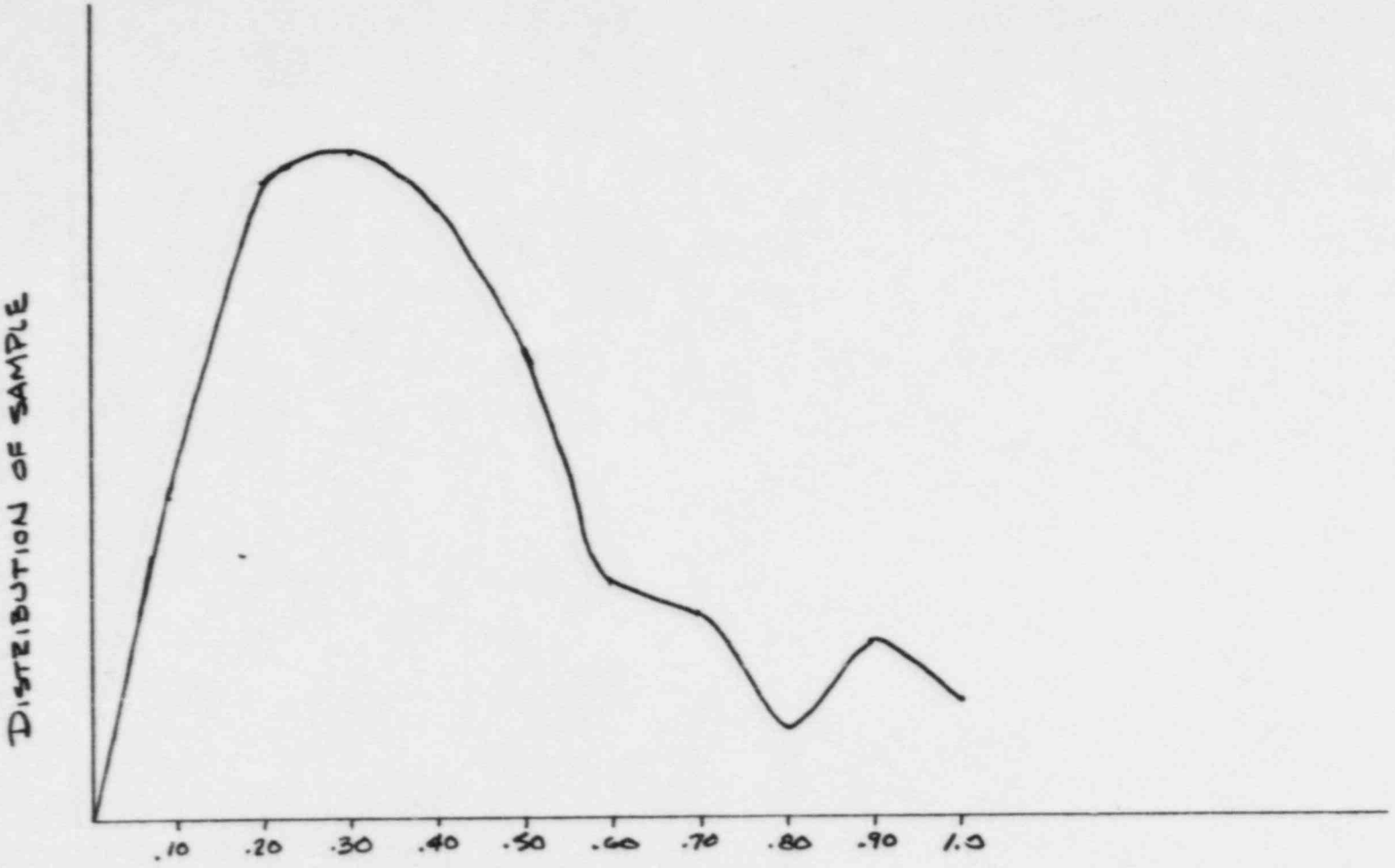
From a constructability standpoint, considering variations in the perpendicularity of concrete bolt holes in a multi-bolt, relatively thick baseplate, it is essential that the 1/8" oversized holes be utilized. The 1/8-inch oversized holes are justified since the ductility of the bolted connection is provided by the grout and/or concrete in the following manner. As the baseplate is loaded, the bolt with the smallest gap is loaded first, the ductility in the connection is provided through local concrete crushing which allows the gaps in the remaining bolt holes to be closed such that all bolts become effective in shear. Since the concrete capacities are much more limiting than the bolt material properties, the local concrete crushing will occur when the shear stress in the bolt is relatively low. Therefore, the use of high strength bolts versus low strength bolts is academic since the concrete limits the design of the connection and the shear stress in the bolt is always maintained at a low level.

IV. TREATMENT OF LOCA LOADS

The Staff was concerned that LOCA loads be included in both component supports and piping supports for the Faulted load combination. The LOCA issue was discussed at length with the Staff in the September 13 and 14, 1984, meetings. The LOCA loads are included in the design of these supports. Refer to Attachment 4 for the appropriate FSAR changes.

Presently, the LOCA loads are based on the WCAP-8082 primary loop pipe breaks. The request for exemption from GDC 4 submitted September 12, 1984, specified that, if approved, branch line LOCA loads would be utilized in lieu of primary loop LOCA loads to evaluate primary loop piping, branch line piping, and branch line supports. NNECO is awaiting a response on this issue and will retain the present design basis until such time the issue is resolved.

ATTACHMENT 1



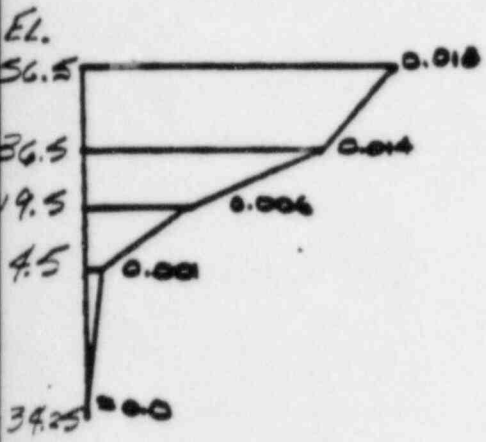
PIPE SUPPORT SURVEY FOR MEB Q210.36

ATTACHMENT 2

BUILDING DISPLACEMENT PROFILES

ENGINEERED SAFETY FEATURES BLDG

DISPLACEMENT PROFILES (INCHES)



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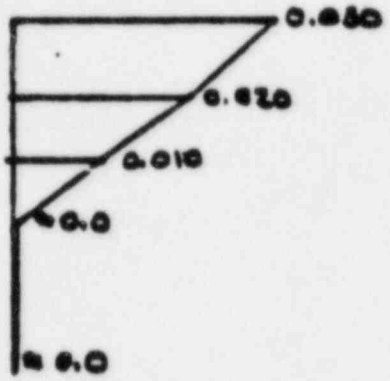
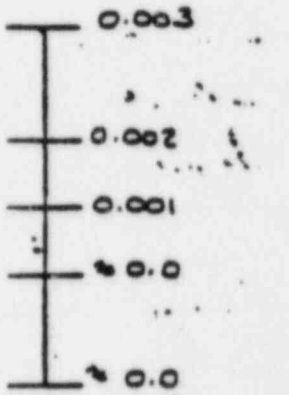
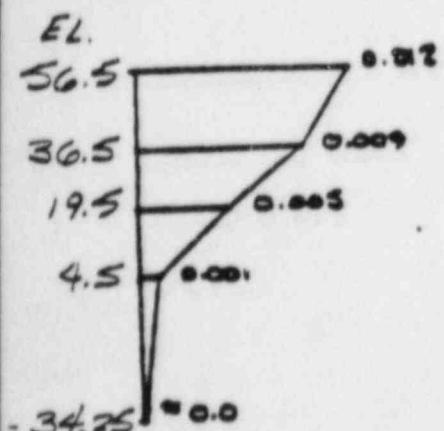


E-W



VERT

SSE



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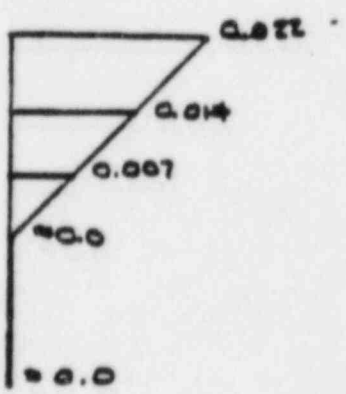

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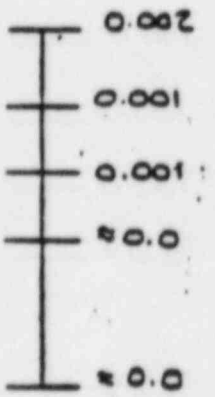
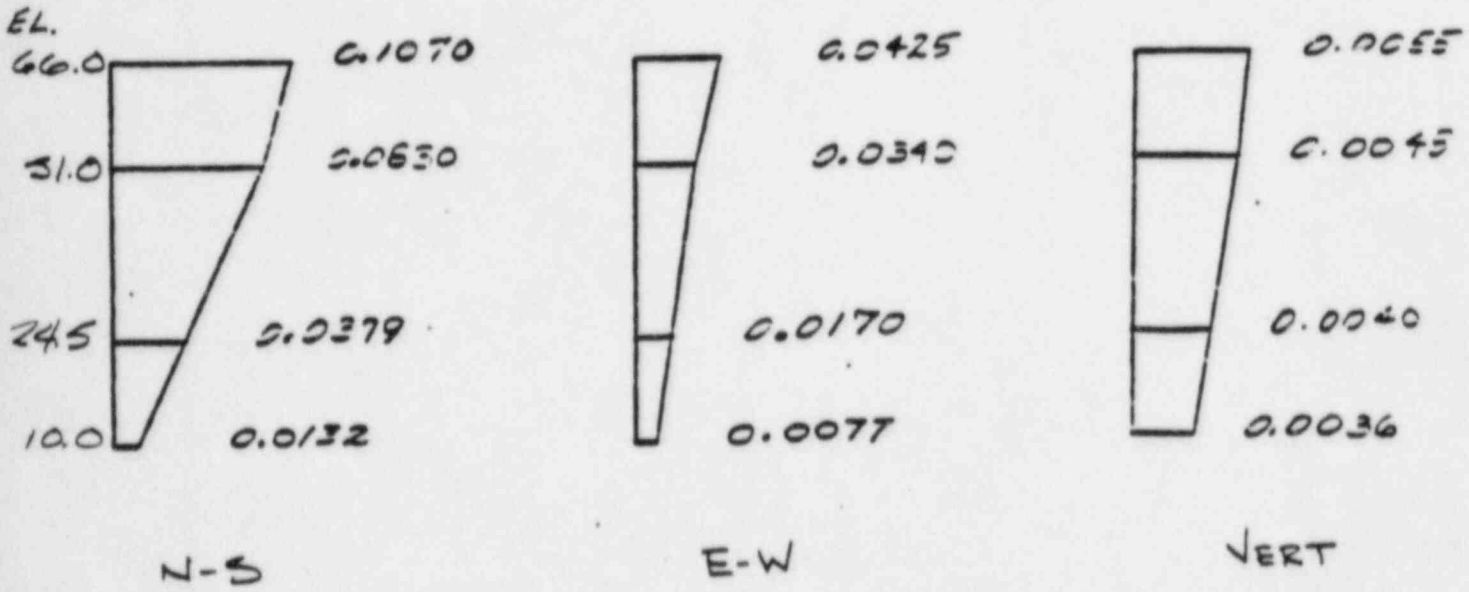


VERT

½ SSE

EMERGENCY GENERATOR ENCLOSURE

DISPLACEMENT PROFILES (INCHES)



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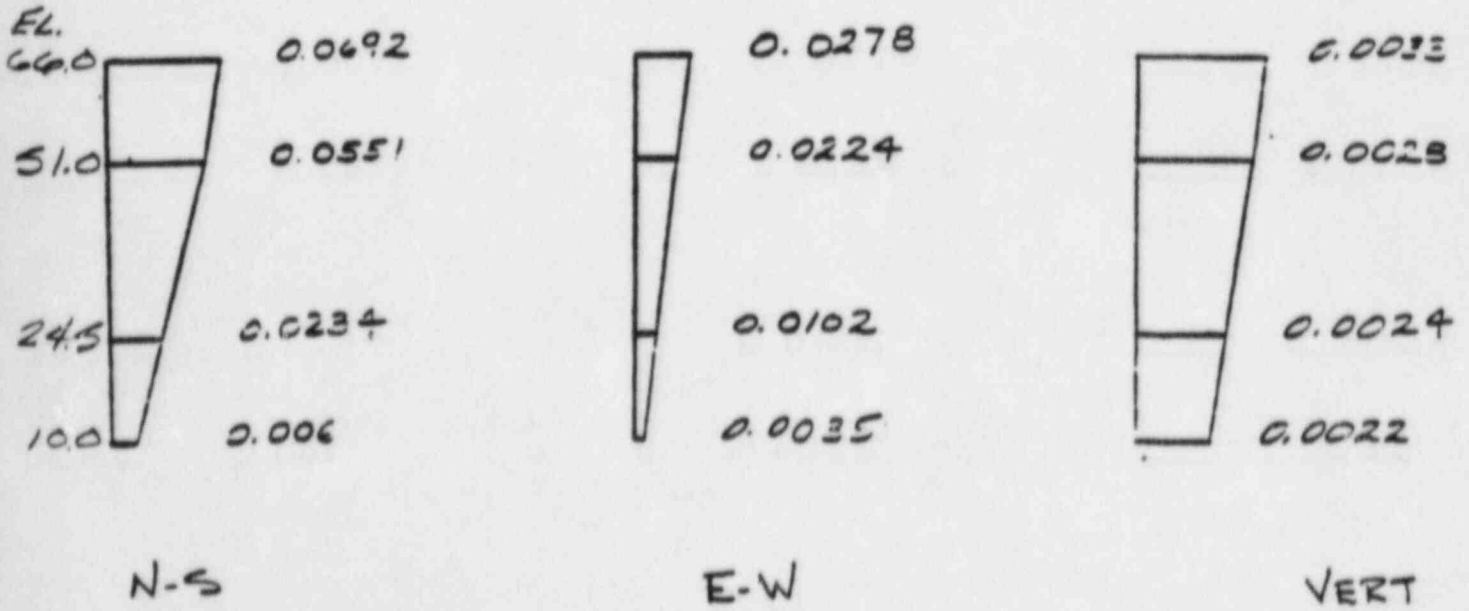
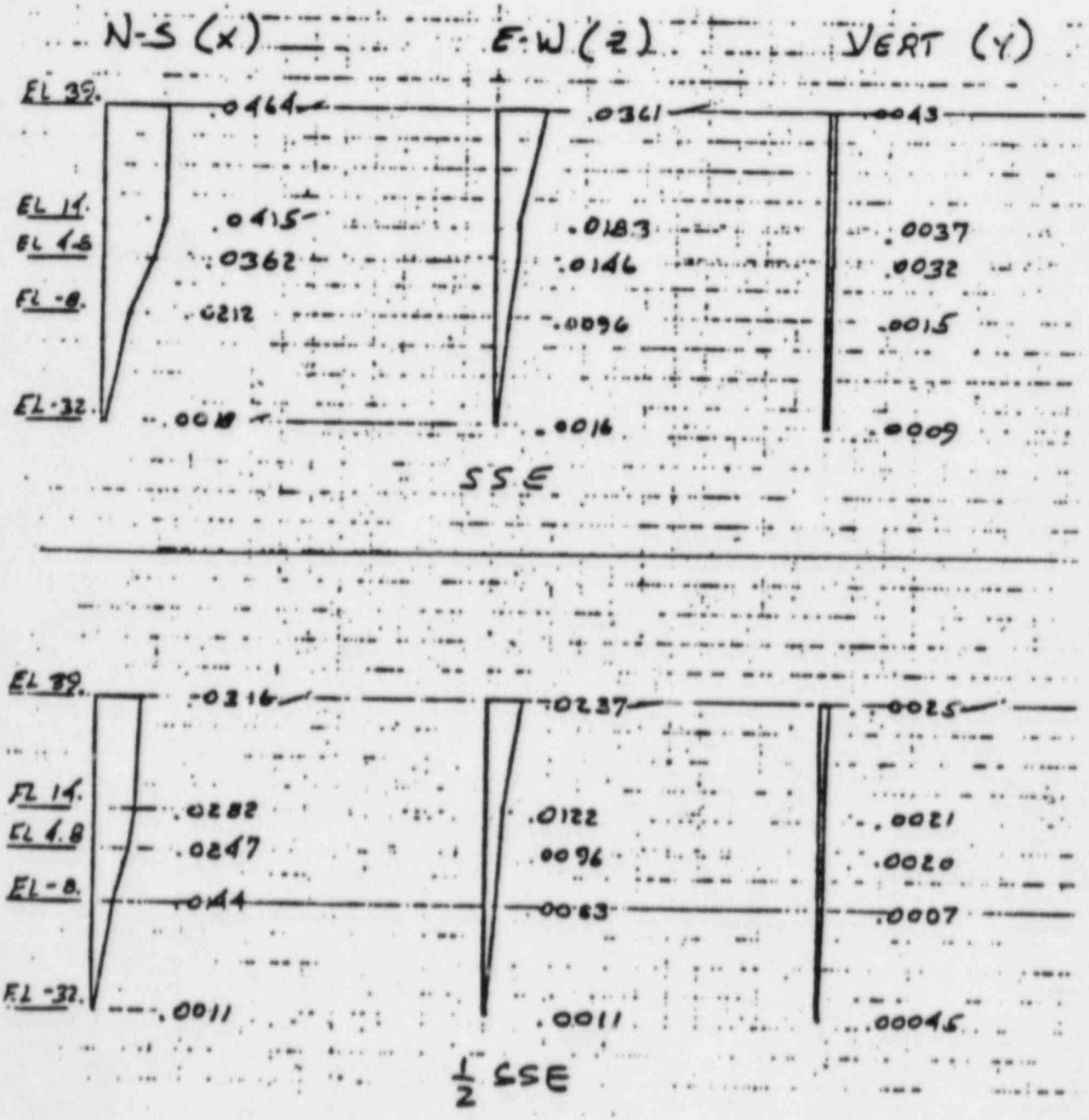


1/2 SSE

SERVICE WATER PUMP HOUSE

DISPLACEMENT PROFILES (INCHES)



MAIN STEAM VALVE BLDG

DISPLACEMENT PROFILES (INCHES)

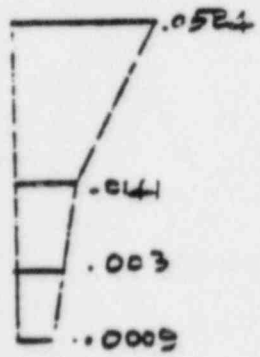
ELEVATION

85.33'

40.0'

23.5'

9.0'



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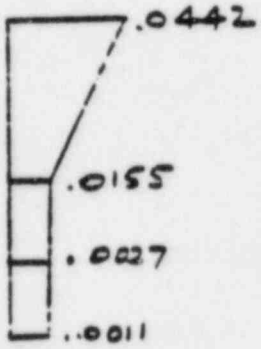
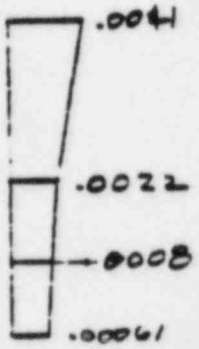


E-W



VERT

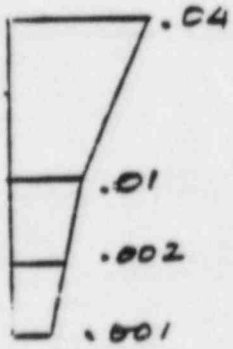
SSE

85.33'

40.0'

23.5'

9.0'



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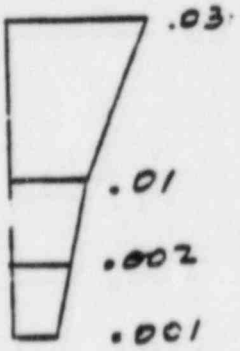

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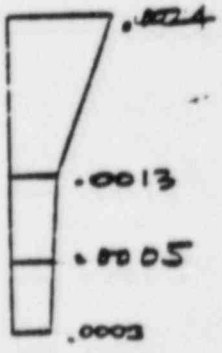
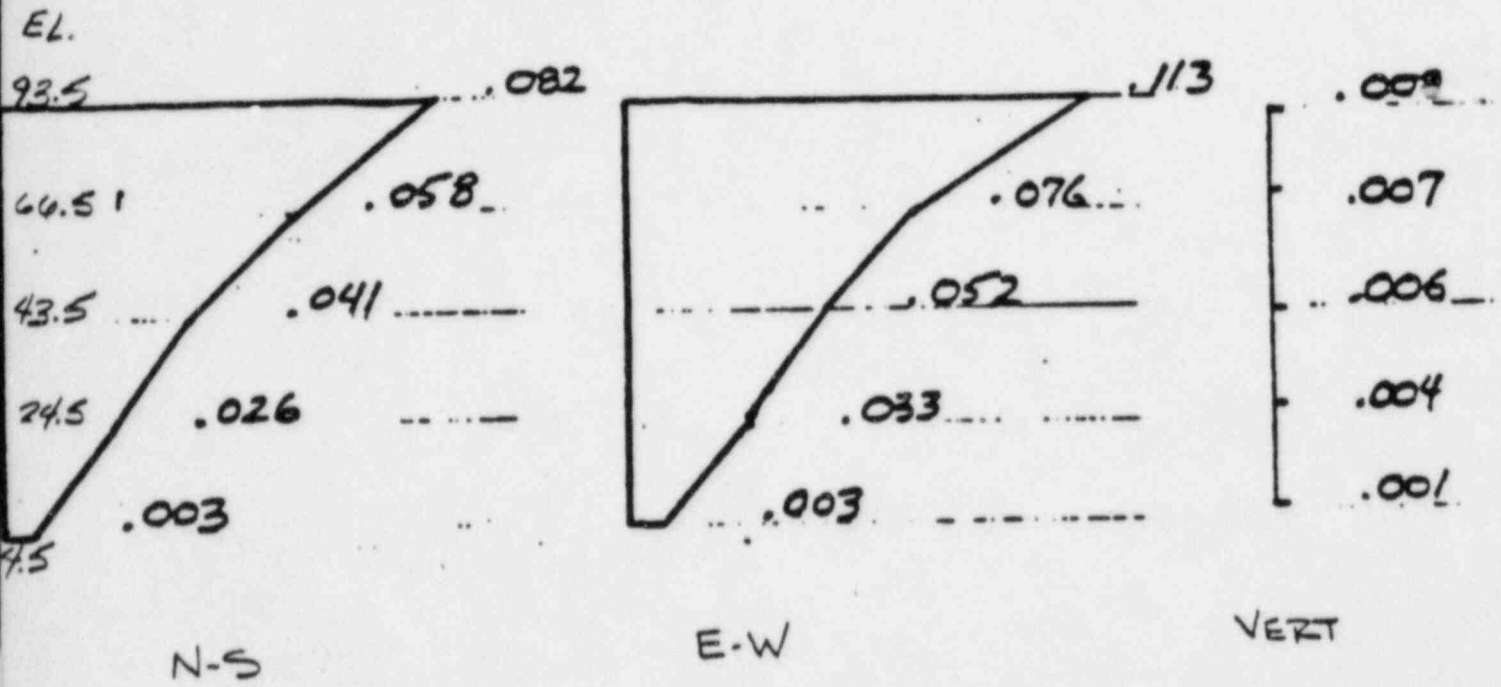


VERT

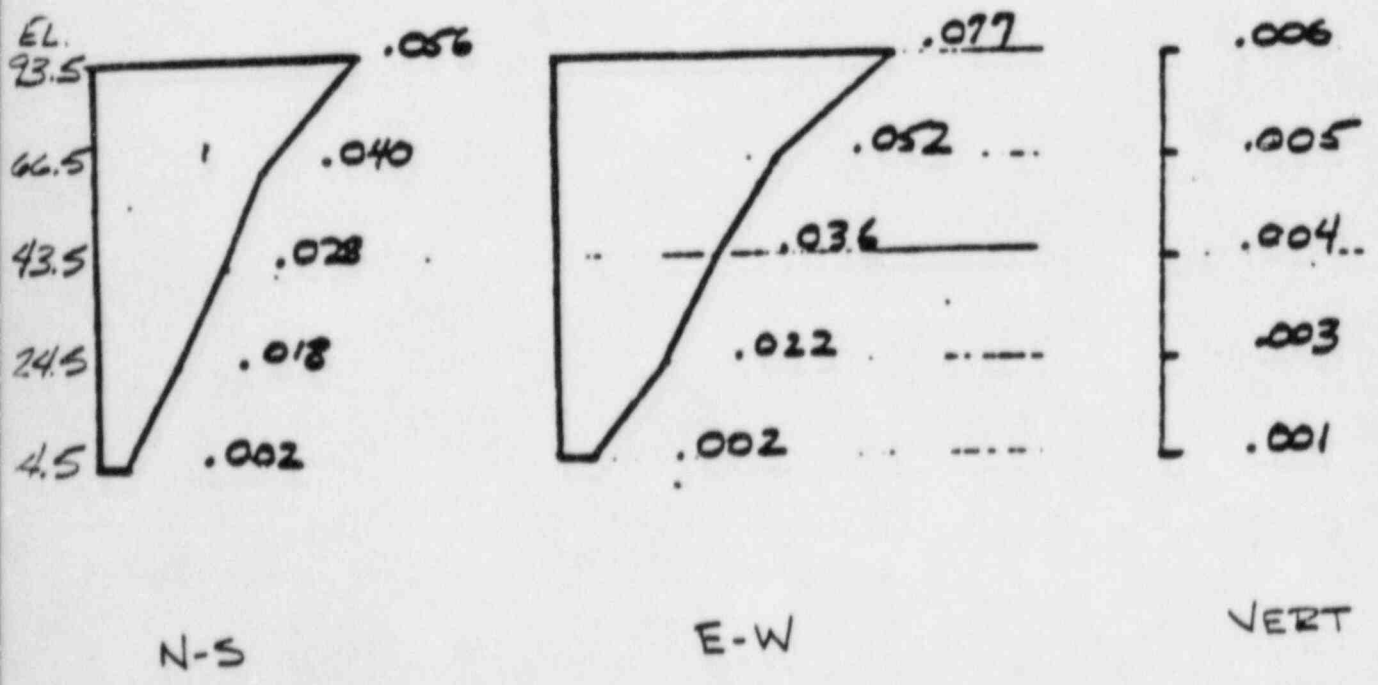
½ SSE

AUXILIARY BUILDING

DISPLACEMENT PROFILES (INCHES)



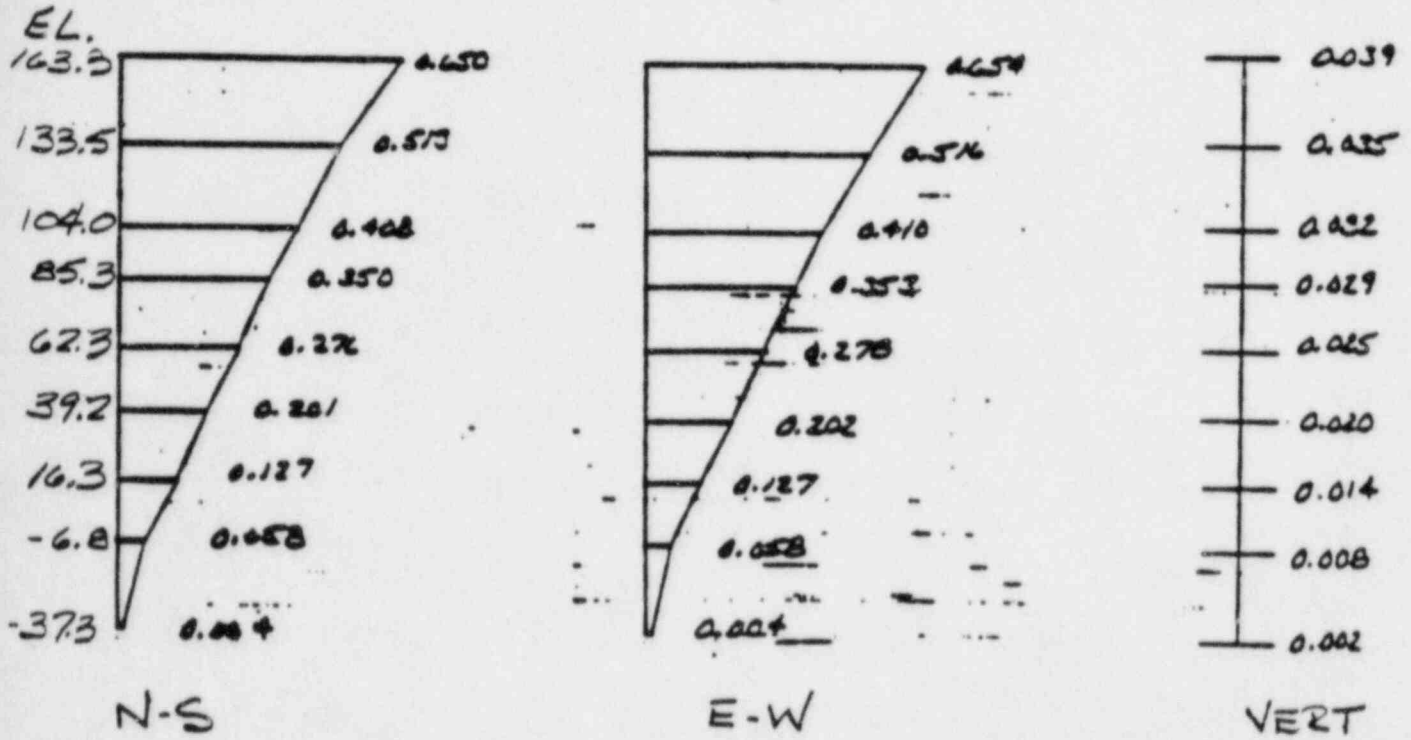
SSE



½ SSE

CONTAINMENT EXTERIOR STRUCTURE

DISPLACEMENT PROFILES (INCHES)



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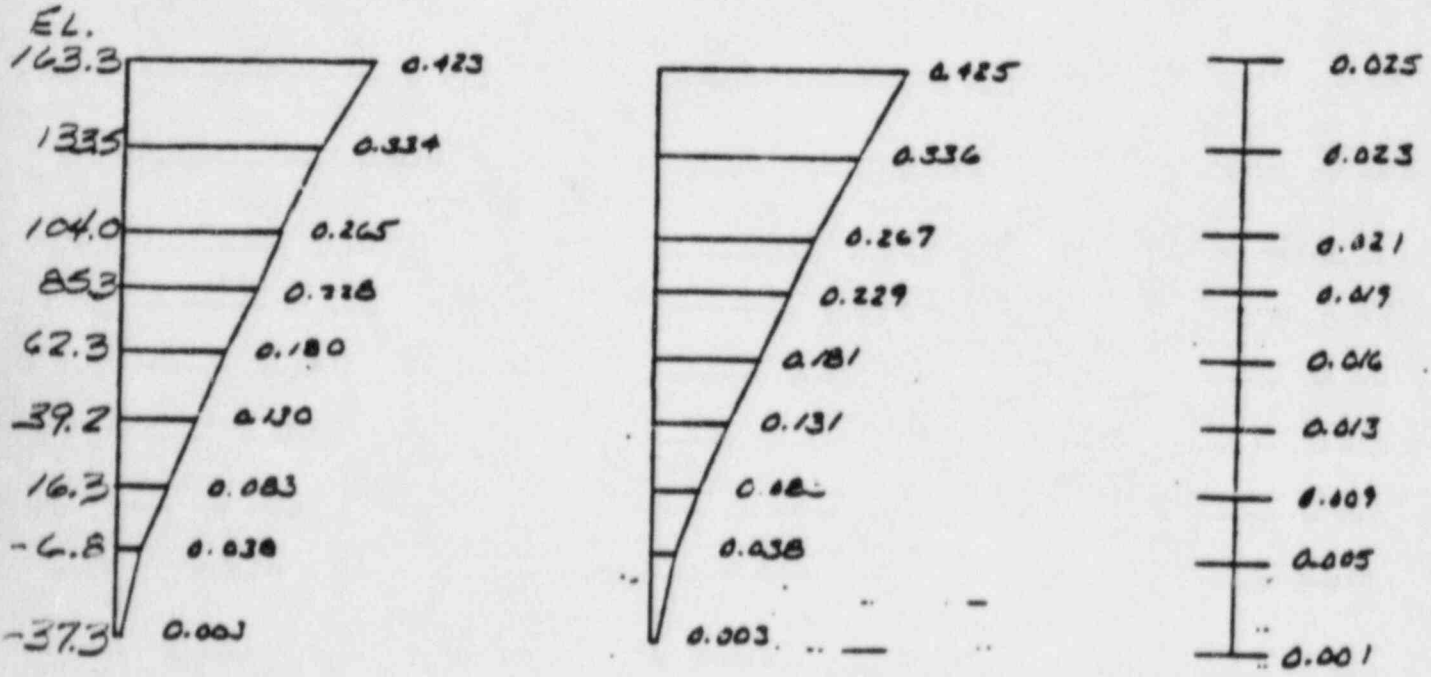
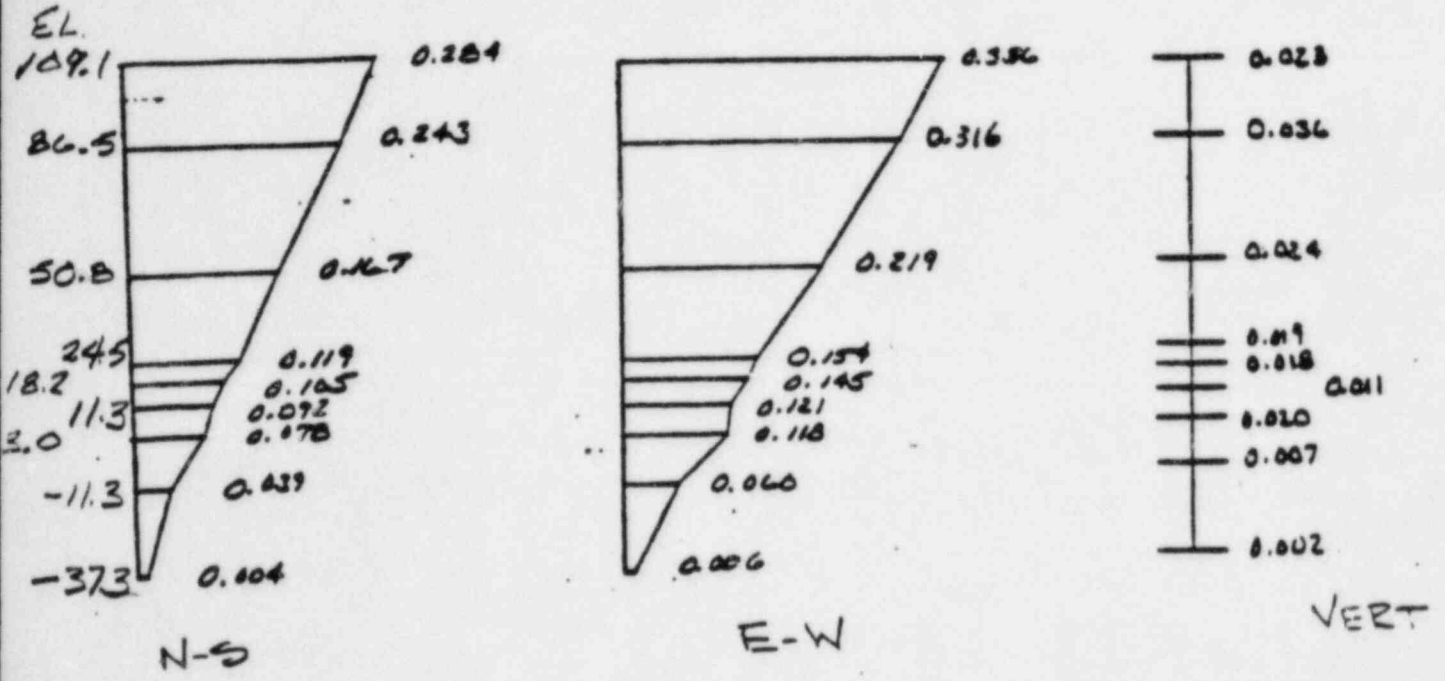


1/2 SSE

CONTAINMENT INTERIOR STRUCTURE

DISPLACEMENT PROFILES (INCHES)



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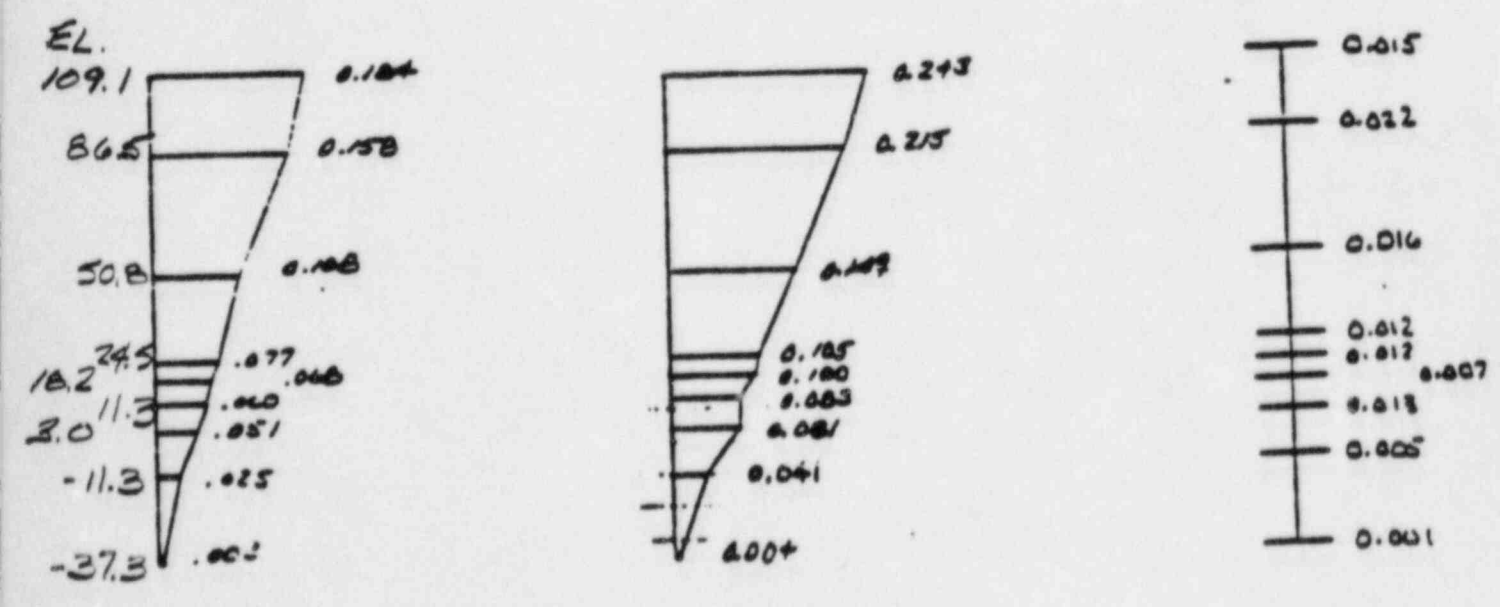
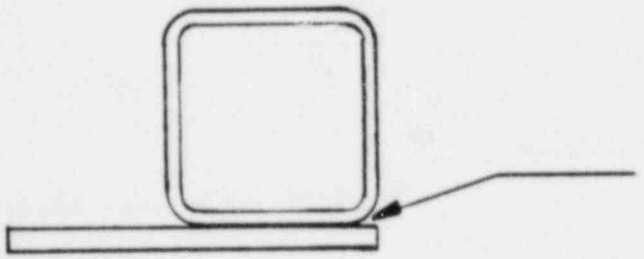
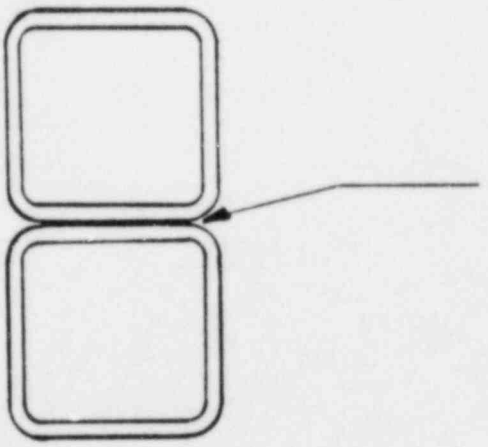


1/2 SSE

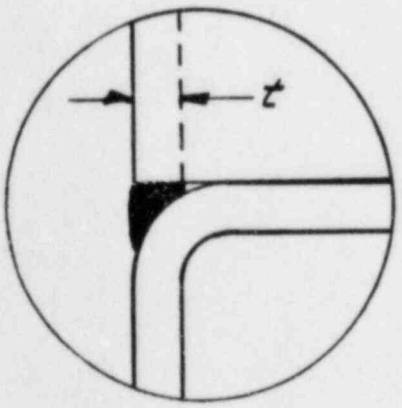
ATTACHMENT 3



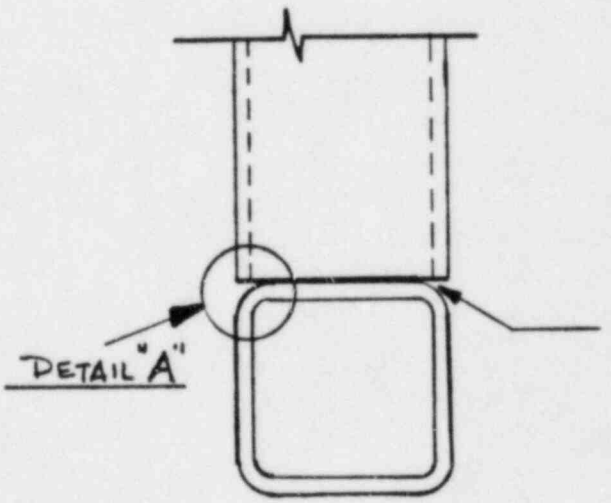
TUBE STEEL TO PLATE OR STRUCTURAL STEEL



PARALLEL TUBE STEEL TO TUBE STEEL



DETAIL "A"



TUBE STEEL TO TUBE STEEL MATCHED CONNECTION

ATTACHMENT 4

FSAR CHANGES FOR LOCA LOAD

MILLSTONE NUCLEAR POWER STATION, UNIT NO. 3 FSAR

TABLE 3.9B-10 (Cont.)

LOAD COMBINATIONS FOR ASME III CLASS 1 PIPING**

Plant Operating Condition	NB 3600 Equations	Load (Moment Combination)***	Allowable Stress
Normal/Upset	9	P + D + E + H + V	1.5 Sm
	10	P + T + R + H + E + A + V + L	3.0 Sm
	11	P + T + R + H + E + A + V + L	N/R
	12	T + R	3.0 Sm
	13	P + D + E + H + V + L	3.0 Sm
	14	P + T + R + H + E + A + V + L	N/R
Emergency	9	P + D + H + Y	2.25 Sm
Faulted	9	P + D + H + Y' + E' + A1	3.0 Sm

NOTES:

**This includes the main coolant loop and branch piping (larger than 1") within the reactor coolant pressure boundary (CHS, RHS, SIL, SIH, etc).

***See Table 3.9B-12 for Definition of Loadings

TABLE 3.9B-11 (Cont)

NUSCo. MILLSTONE 3
LOAD COMBINATIONS FOR ASME III CLASS 2 AND 3 PIPING
EXCEPT QUENCH, RECIRCULATION AND SI

Plant Operating Condition	NC 3600 Equations	Load (Moment) Combinations**	Allowable Stress
Normal/Upset	8	P + D	S_h
	9	P + D + E + H + V + W	1.2 S_h
	10	T + R + A	S_A
	10A	S	3 S_c
	11	P + D + T + R + A	$S_h + S_A$
Emergency	9	P + D + H + Y + W	1.8 S_h
Faulted	9	P + D + E' + H + Y' + A1 + W	2.4 S_h
Rupture Postulation	9 + 10	P + D + T + R + A + E + H + V + W	0.8 (S_A + 1.2 S_h)

NOTE:

** See Table 3.9B-12 for definition of loading.

TABLE 3.9B-11 (Cont)

LOADING COMBINATION FOR QUENCH SPRAY,
RECIRCULATION SPRAY AND SAFETY INJECTION

Plant Operating Condition	NC 3600 Equations	Load (Moment) Combinations**	Allowable Stress
Normal/Upset	8	P + D	S_h
	9	P + D + E + H + V + W	1.2 S_h
	10*	T + R + A	S_A
	10a	S	3 S_C
	11*	P + D + T + R + A	$S_h + S_A$
Emergency	9	P + D + H + Y + W	1.8 S_h
Faulted	9	P + D + E' + H + Y' + A1 + W	1.8 S_h
	10*	T + R' + A' + X	S_A
	11*	P + D + T + R' + A' + X	$S_h + S_A$

NOTES:

(1) Class 1 portions of the Safety Injection are analyzed in accordance with Table III.

* Either the requirements of Eq. (10) or Eq. (11) must be satisfied.

** See Table 3.9B-12 for definition of loading.

TABLE Q210.36-2

LOAD CONDITIONS FOR LINEAR TYPE PIPING SUPPORTS FOR CONTAINMENT SPRAY SYSTEMS(1)(2)

Plant Operating Condition	Load Conditions(3)	Allowable(4) Tensile Stress
Normal/Upset	D + T + R	0.6 S_y
	D + T + R + E + A + H + W + V	0.8 S_y
Emergency	D + H + T + R + W + Y	0.8 S_y
Faulted(5)	D + E' + H + A1 + W + Y'	0.8 S_y
	T + R' + A'	0.8 S_y

NOTES:

Refer to notes on Table Q210.36-1.

TABLE Q210.36-1

LOAD CONDITIONS FOR LINEAR TYPE PIPING SUPPORTS
(Except for Containment Spray Systems)[1][2]

Plant Operating Condition	Load Conditions[3]	Allowable[4] Tensile Stress
Normal/Upset	D + T + R	0.6 S_y
	D + E + H + T + R + A + W + V	0.8 S_y
Emergency	D + H + T + R + W + Y	0.8 S_y
Faulted[5]	D + E' + H + A1 + W + Y'	1.2 S_y or 0.7 S_u[6]

NOTES:

1. See Table Q210.36-2 for allowable tensile stress values for containment spray system pipe supports.

2. Containment spray system is comprised of the following:

   - recirculation (containment) spray piping
   - quench spray piping
   - portions of SIL/SIH piping

3. See Table Q210.36-3 for identification of loadings.

4. Buckling check is performed using the provisons of AISC Code, 7th Edition. (See Table Q210.36-4 for list of AISC Code equations used.)

5. For ANSI B31.1 piping, faulted conditions noted above do not apply; and under normal/upset condition, unless otherwise specified in applicable support summaries, loads due to seismic conditions are not considered. When seismic load becomes applicable, the allowable of 0.8 S_y is used as stated above.

6. The faulted allowables are based upon the guidance provided in Appendix XVII of ASME III, 1974 Edition.

TABLE 5.4-18

EQUIPMENT SUPPORTS, LOADING COMBINATIONS, AND DESIGN ALLOWABLE STRESSES

Equipment	Loading Category	Loading Combinations	Stress Limits	Codes
Steam Generator and Reactor Coolant Pump Supports, and Pressurizer Supports	Design Normal Upset Emergency	Dead Weight +Steady state thermal +1/2 SSE	App. XVII-2000	ASME Boiler and Pressure Vessel Code, Section III, 1974 Edition Nuclear Power Plant Components Subsection NF, 1974 Edition
RPVSS (Neutron Shield Tank)	Design Normal Upset Emergency	Dead Weight +Steady state thermal +1/2 SSE	App. XVII-2000 for linear type supports Subsection NF-3220 for plate and shell type supports	ASME Boiler and Pressure Vessel Code, Section III, 1974 Edition Nuclear Power Plant Components Subsection NF, 1974 Edition
Steam Generator and Reactor Coolant Pump Supports, Pressurizer Supports, and Reactor Pressure Vessel Structural Supports	Faulted	Dead Weight +SSE +Pipe rupture + FAULTED THERMAL	App. F-1323.1 for plate and shell type supports App. F-1370 for linear type supports App. A-9000 for plastic analysis of linear type supports	ASME Boiler and Pressure Vessel Code, Section III, 1974 Edition Nuclear Power Plant Components Subsection NF, 1974 Edition

TABLE Q210.36-3

LOADING APPLICABLE TO PIPE SUPPORT DESIGNS
(See Tables Q210.36-1 and Q210.36-2)

D - Sustained mechanical loads, including deadweight of piping, components, contents, and insulation

T - Loads due to thermal expansion of the system in response to average fluid temperature

R - Loads induced in the piping due to the thermal growth of equipment and/or structures to which the piping is connected as a result of plant normal or upset plant conditions.

R' - Loads induced in the piping due to the thermal and pressure growth of equipment and/or structures to which the piping is connected as a result of plant faulted conditions.

E - Inertia effects of the OBE.

E' - Inertia effects of the SSE.

A - Loads induced in the piping due to response of the connected equipment and/or civil structures to the OBE (commonly referred to as OBE anchor movements).

A' - Loads induced in the piping due to response of the connected equipment and/or civil structures to the SSE (commonly referred to as SSE movements).

H - Loads resulting from occasional loads other than seismic as defined by the design specification for the appropriate operating condition. Examples of these loads would be: water hammer, steam hammer, opening and closing of safety relief valves, etc.

Y - Effects of components striking pipe (pipe whip) or effects of blowdown of an adjacent system (jet impingement loads), as defined for the emergency plant condition.

W - Loads imposed by wind or snow or ice. (Wind load is not considered to occur concurrently with earthquake loads.)

A1 - Loads induced in the piping due to the effects of LOCA (primary loop pipe break)

Y' - Effects of components striking pipe (pipe whip) or effects of blowdown of an adjacent system (jet impingement loads), as defined for the ~~emergency~~ faulted plant condition.

TABLE 3.9B-12

LOADINGS APPLICABLE TO PIPING SYSTEMS

D - Sustained mechanical loads, including deadweight of piping, components, contents, and insulation

P - Internal pressure loads

T - Loads due to thermal expansion of the system in response to average fluid temperature

R - Loads induced in the piping due to the thermal growth of equipment and/or structures to which the piping is connected as a result of plant normal or upset plant conditions.

R' - Loads induced in the piping due to thermal growth of equipment and/or structures to which the piping is connected as a result of plant faulted plant conditions.

E - Inertia effects of the OBE

E' - Inertia effects of the SSE

A - Loads induced in the piping due to response of the connected equipment and/or civil structures to the OBE (commonly referred to as OBE anchor movements).

A' - Loads induced in the piping due to response of the connected equipment and/or civil structures to the SSE (commonly referred to as SSE movements)

S - Loads induced due to building settlement effects

H - Loads resulting from occasional loads other than seismic. Examples of these loads would be: water hammer, steam hammer, opening and closing of safety relief valves, etc.

L - Local stress effects in piping and/or piping components due to sudden changes in fluid temperature. These loads are commonly referred to as thermal transient effects.

Y - Effects of pipe striking pipe (pipe whip) or effects of blowdown of an adjacent system (jet impingement loads), as defined for the emergency plant condition

Y' - Effects of pipe striking pipe (pipe whip) or effects of blowdown of an adjacent system (jet impingement loads), as defined for the faulted plant condition

V - Loads induced by operation of the system other than those loads described above (transient vibration) These loads are due to unanticipated transients and are evaluated during the preoperational testing phase.