ENCLOSURE 2

MSIV LEAKAGE ALTERNATE TREATMENT METHOD

SEISMIC EVALUATION

SUSQUEHANNA STEAM ELECTRIC STATION
UNIT 1 AND 2

MSIV LEAKAGE ALTERNATE TREATMENT METHOD
SEISMIC EVALUATION

OCTOBER 19, 1994

INTRODUCTION

The evaluation in this report was performed to document the seismic design adequacy of the "Main Steam Isolation Valve (MSIV) Leakage Alternate Treatment Method". This method is being evaluated for replacing the design function of the MSIV-Leakage Control System (LCS). The MSIV-LCS licensed based design function is to serve to redirect MSIV leakage back into secondary containment, where it can be processed as a filtered release and reduce the potential contribution to off-site and control room dose.

Historically, the MSIV-LCS has been susceptible to numerous failures and costly repairs. In order to improve the performance of the power plant, both from a nuclear safety viewpoint and elimination of a high cost and high maintenance system, the "MSIV Leakage Alternate Treatment Method" has been established, which will serve to provide a more effective means to process the MSIV leakage.

The primary components to be relied upon, for pressure boundary integrity, in resolution of the BWR MSIV leakage issue are: (1) the main turbine condensers, (2) the main steam lines to the turbine stop and bypass valves, and (3) the main steam turbine bypass and drain line piping to the condensers.

Earthquake experience has demonstrated that the welded steel piping and anchored condensers in similar systems are seismically rugged. The earthquake experience is derived from an extensive database on the seismic performance of over 100 power plant units and industrial facilities in actual recorded earthquakes. Based on this post-earthquake reconnaissance, the BWR Owners Group (BWROG) seismic experience study has identified limited realistic seismic hazards, including support design attributes and proximity interaction issues, as potential sources of damage on a limited number of components. The BWROG's study is documented in NEDC-31858P, "BWROG Report for Increasing MSIV Leakage Rate Limits and Elimination of Leakage Control Systems". A review and evaluation was performed for Pennsylvania Power and Light, Susquehanna Steam Electric Station (SSES), Units 1 and 2, to ensure that no such issues are present, thus providing reasonable assurance of the integrity of these systems and components.

This report summarizes the methodology used and some of the results of the seismic adequacy review of the MSIV Leakage Alternate Treatment Method.

1.0 SCOPE OF REVIEW

The main turbine condensers form the ultimate boundary of the "Main Steam Isolation Valve (MSIV) Leakage Alternate Treatment Method". Boundaries were established upstream of the condensers by utilizing existing valves to limit the extent of the seismic verification walkdown. The boundaries are shown in Figure 1 of this evaluation.

The boundary valves were selected using the criteria outlined in NEDC-31858P and documented in PP&L Engineering Studies, Analyses, and evaluations (SEA), SEA-ME-423, "MSIV Leakage Seismic Verification Boundary Determination Study, SSES Unit 1" and SEA-ME-424, "MSIV Leakage Seismic Verification Boundary Determination Study, SSES Unit 2". The following criteria was used in selecting the boundary valves:

1. Normally open valve, automatically closes as a result of MSIV isolation signal

2. Normally open valve, which can be remotely closed from control room

3. Normally locked closed, manually operated valve

4. Normally closed, manually operated valve

5. Automatically or remotely operated valves that fail closed, as a result of loss of power or air (pneumatic operators) to the valve operator

6. Normally closed valve, which can be remotely closed from the control room

7. Normally closed valve, which can be remotely closed from a control panel outside the control room

In NEDC-31858P, a seismic database was assembled. This database served as historical documentation of the performance of non-seismic designed piping systems and main turbine condensers, at various power plants throughout the world, which have gone through varying levels of seismic events. This database provided the basis for demonstration of seismic adequacy of non-seismically designed systems. In order to demonstrate that SSES piping and components fall within the bounds of the experience database, two reviews were performed.

The first review consisted of reviewing the construction codes to demonstrate that the designated piping and components were built to standards similar to those plants identified in the experience database of NEDC-31858P.

The second review consisted of seismic verification walkdowns to assure that the condensers and piping systems fall within the bounds of the design characteristics of the seismic experience database contained in NEDC-31858P. Conditions that might lead to piping configurations which are outside the bounds of the experience database were noted during the walkdowns. Tables 5 and

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6 of this report summarize the identified conditions (termed "outliers"), and their resolution status. Note that the outliers are being resolved by demonstrating analytically that they did not create hazards beyond the seismic inertial loading. These hazards include interaction, differential displacement, and/or failure/falling. If evaluation can not qualify some outliers, modifications will be designed to provide seismically acceptable configurations.

Where analysis was used to resolve the walkdown outliers, the 5% damped conservative floor curves are extrapolated from the existing 1/2% and 1% damped floor curves that were based on the SSES ground design basis earthquake (DBE) anchored at 0.1g peak ground acceleration.

As an alternate method for generation of seismic input, 5.0% damped realistic median-centered, with no intentional conservative bias, floor curves will be developed, if judged to be necessary, based on the NUREG/CR-0098 median ground spectra anchored at 0.1g and 0.067g peak ground accelerations for horizontal and vertical directions, respectively. Variabilities associated with structure frequency, structure damping, and rock modulus are significant in the development of the seismic floor curves. These model parameters will be selected in a random process. A number of earthquake time histories will be utilized with the randomly selected sets of model parameter values.

To account for the uncertainty in the structural frequency calculations, the peaks of the seismic floor curves are shifted rather than be broadened.

In addition to the ongoing resolution of the walkdown outliers, seismic margin assessment of a representative bounding sample of pipe supports on the main drain line will be conducted. This assessment is more conservative and more restrictive than the evaluation referenced in NEDC-31858P.

2.0 TURBINE BUILDING

Performance of the turbine building during a seismic event is of interest to the issue of MSIV leakage to the extent that non-seismically designed structures and components should survive and not degrade the capabilities of the selected main steam and condenser fluid pathways. A BWROG survey of this type of structure has, in general, confirmed that excellent seismic capability exists. There are no known cases of structural collapse of either turbine buildings at power stations or structures of similar construction.

The SSES turbine building houses two in-line about 1100 megawatt turbine generators with all auxiliary equipment including two 220 ton overhead service cranes. The building is entirely founded on rock with reinforced concrete retaining walls extending up to grade level. The superstructure is framed with structural steel and reinforced concrete. Exterior walls are pre-cast reinforced concrete panels except for the upper 30 feet, which is metal siding. The roof has metal decking with built-up roofing. Each of the two turbine generator units is supported on a free standing reinforced concrete pedestal extending down to rock. Separation joints are provided between the pedestals and the turbine building floors and slabs to prevent transfer of vibration to the building. The operating floor is supported on vibration damping pads at the top edge of the pedestals. A seismic separation gap is provided near the center of the building between the two units. A seismic separation gap is also provided against the reactor building.

The design of the SSES turbine building includes both seismic and tornado loadings. The turbine building is designed to prevent collapse under both the DBE and tornado load conditions. The deflections from these loadings have been kept to a value such that interaction with Category I structures is avoided. The ground acceleration associated with the DBE is 0.10g. The turbine building horizontal shears resulting from the DBE are presented in Figure 2. Based upon the above, it is concluded that the SSES turbine building is a seismically robust structure with little risk of damage to the structure that would degrade the capability of the main steam and condenser fluid pathways. Specific parameters included in the evaluation are presented below.

2.1 Lateral Force Resisting Systems

The lateral load resisting system superstructure type, above the turbine floor, is a braced or rigid frame structure depending on the direction of lateral load consists of the following:

> Column lines G and K comprise alternating bays of cross-bracing that resist N-S wind or seismic lateral loading conditions.
>
> E-W lateral forces are resisted by rigid frame bents from column line 12 to 29 (Unit 1).

Lateral force resisting system substructure, below the turbine floor:

> Concrete walls serve as shear walls for lateral loads in the N-S directions.

FIGURE 2A

Seismic Design Forces for the SUSQUEHANNA Turbine Building in the East-West Direction

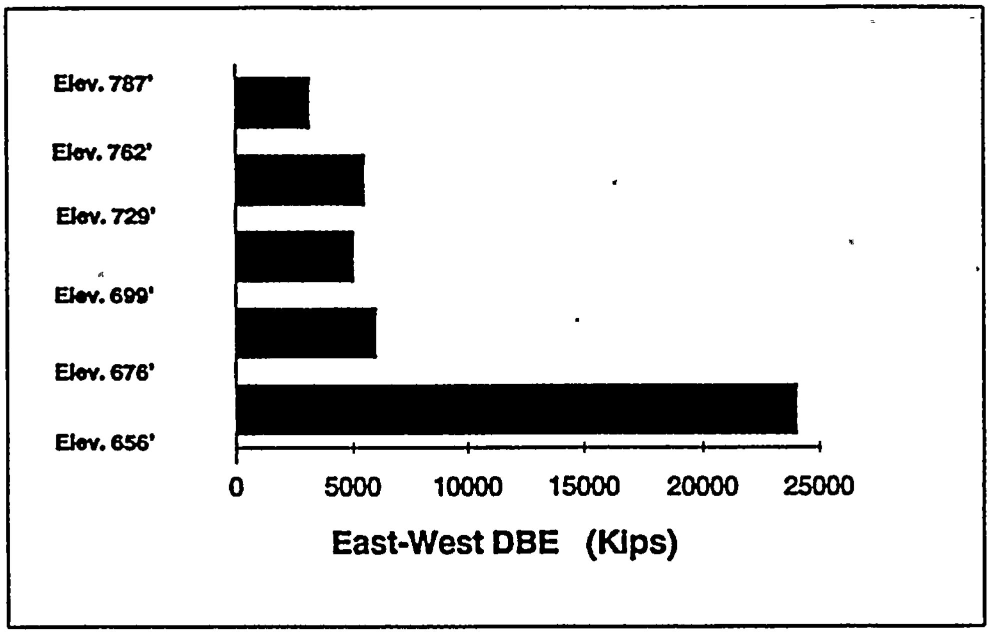
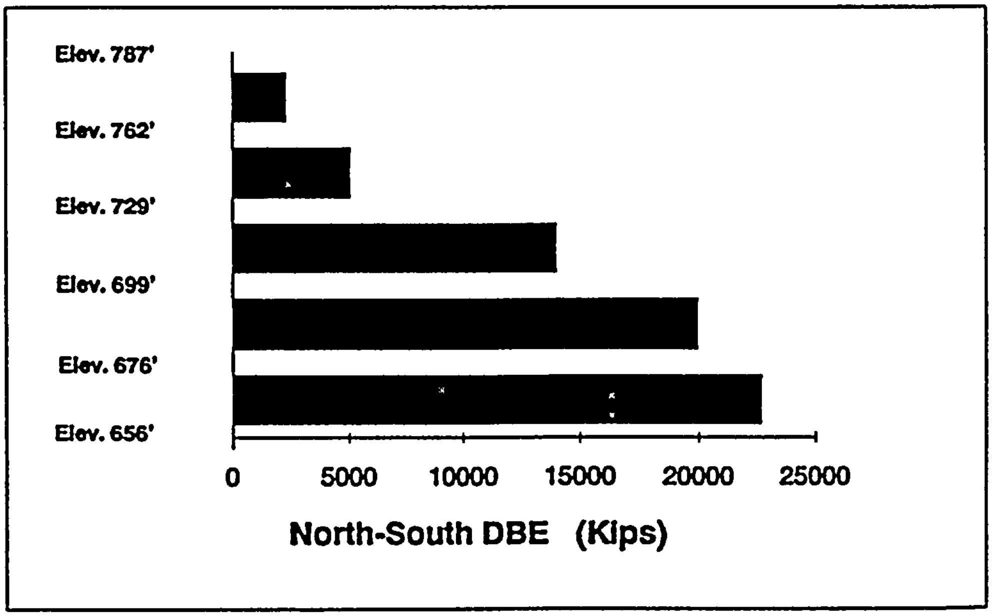


FIGURE 2B

Seismic Design Forces for the SUSQUEHANNA Turbine Building in the North-South Direction



2.2 Seismic Design Codes

All non-category I structures are designed to conform to the requirements of:

- American Institute of Steel Construction (AISC) Specification for the Design, Fabrication, and Erection of Steel Buildings.
  American Concrete Institute (ACI) Building Code Requirements for Reinforced Concrete (ACI 318-71).
  American Welding Society (AWS) Structural Welding Code AWS D1.1-72.

2.3 Seismic Design Basis

A seismic analysis of the turbine building was performed for the DBE loading in the north-south, east-west, and vertical directions in order to assure that the building will not collapse. The resulting deflections were also utilized to confirm that there is no interaction with the reactor building.

2.4 Wind Design Codes

The turbine building is designed to conform to the requirements of:

American Society of Civil Engineers, paper number 3269, Wind Design Requirements.

American Institute of Steel Construction (AISC) Specification for the Design, Fabrication, and Erection of Steel Buildings.

American Concrete Institute (ACI) Building Code Requirements for Reinforced Concrete (ACI 318-71).

American Welding Society (AWS) Structural Welding Code AWS D1.1-72.

2.5 Wind Design Basis

The dynamic wind pressures used in the design of SSES are derived from the ASCE Publication No. 3269 using the following equation.

$$q = 0.002558V^2$$

Where q is the velocity pressure in psf, and V is the wind velocity (mph). It was

assumed that 80% of q is acting on the windward side and 50% is suction on the leeward side of the building.

The local pressure at any point on the surface of the building is equal to :

$$p = qC_p$$

where p is the pressure and C_p is the pressure coefficient.

The total pressure on the building is equal to:

$$p = qC_D$$

where C_D is the shape coefficient and is equal to 1.3. The wind loads are provided in Table 1.

The turbine building frame is designed to resist tornado wind forces assuming that two thirds of the siding is blown away. In addition, each exterior column and its connections are designed for the full tornado wind in the event that no siding blows away in the tributary area of the column. The maximum interaction ratio for the structural steel, resulting from the case with no failure of the siding, is approximately the same as that obtained from the DBE load. The load combinations utilized for the design of the turbine building are presented in Table 2.

TABLE 1

Tornado Wind Loads

Height (ft)	Basic Velocity (mph)	Wall Load: Dynamic Pressure with 1.1 Gust Factor q	Wall Load: Pressure 0.8q	Wall Load: Suction 0.5q	Wall Load: Total Design Pressure 1.3q	Roof Load: Suction 0.6q
0-50	80	20	16	10	26	12
50-150	95	30	24	15	39	18
150-400	110	40	32	20	52	24
Over 400	120	45	36	23	59	27

TABLE 2

Load Combinations

D + L + E'	See Note 1
D + L + W	See Note 1
D + L + W'	USD
D + L + E'	USD

D = Dead Load
L = Live Load
W = Wind Load
W' = Tornado Wind
E' = Design Basis Earthquake

(1) In no case shall the allowable base metal stress exceed 0.9Fy in bending, 0.85Fy in axial tension or compression, and 0.5Fy in shear. Where Fs is governed by requirements of stability (Local or lateral buckling), fs shall not exceed 1.5Fs. In no case shall be allowable bolt or weld stress exceed 1.7Fs.

3. MAIN TURBINE CONDENSERS

3.1 General Description of Susquehanna Condensers

The main turbine condenser is a triple shell multipressure surface condenser which consists of three (3) rectangular shaped welded steel plate condensers of the single pass quad-divided type. The circulating water flow is 448,000 gallon per minute. The heat exchange area of the high pressure shell consists of 28,040 1-inch diameter tubes, approximately 50 foot long, giving a heat transfer area of 367,000 square feet. The heat exchange area of the intermediate pressure shell consists of 28,008 1-inch diameter tubes, approximately 40 foot long, giving a heat transfer area of 293,300 square feet. The heat exchange area of the low pressure shell consists of 27,972 1-inch diameter tubes, approximately 30 foot long, giving a heat transfer area of 219,700 square feet. The dry weight and the operating weight of the three shells are a s follows:

	Dry Weight (lb)	Operating Weight (lb)
High Pressure Condenser	678,200	2,132,700
Intermediate Pressure Condenser	643,000	1,984,300
Low Pressure Condenser	567,800	1,572,700

The base of the condenser (hotbox shell) is 29'x49', 29'x39', and 29'x29' in plan for the high, intermediate, and low pressure condensers, respectively.

Each condenser shell is supported from the concrete base slab of the turbine pedestal on 6 embedded plate assemblies. Positive attachment is provided by anchor bolts and welds to the embedded plate assemblies. The embedded plates assemblies only project their plate thickness above the base slab, so there are no legs or piers between the condenser and the base slab. The condenser shells neck down at the top where they weld to the turbine. The necks include a rubber expansion joint which structurally isolates the condenser shell from the turbine, so that the anchors to the base slab provide the entire support for the condenser shell. The height of each shell to the expansion joint is approximately 56'.

The condensers were tested by filling the shell with water. The design conditions for the condensers include a vacuum pressure of 26" of Mercury, and "zone 1" seismic coefficients of 0.03g vertical and 0.05g horizontal.

The .75" thick shells of the condensers are stiffened by the tube support plates and by struts that connect the tube support plates to the sidewalls and to the condenser bottom. Plate dividers, which separate each shell into four flow paths, also serve to stiffen the shell.

3.2 Comparison of Susquehanna Condensers with Database Condensers

This report will show that each SSES condenser shell is comparable to the database condensers in its capability to resist seismic forces. In addition, this report will also show that each shell anchor systems have the capability to withstand the forces associated with DBE in combination with operating loads.

Since each condenser (high, intermediate, and low pressure) is independently supported from the other shells we can compare its structural characteristics to the similar condensers addressed in NEDC-31858P, "BWROG Report for Increasing MSIV leakage Rate Limits and Elimination of Leakage Control System". Comparable condensers that have experienced significant earthquakes as identified in NEDC-31858P will be hereafter called "database" condensers.

Each SSES condenser shell is specifically compared to the database condensers from Moss Landing, Units 6 and 7, and from Ormond Beach, Units 1 and 2. These condensers have similar physical arrangements of components and construction details to the SSES condenser, and would function similarly to resist seismic forces. From Table 3 and from Figures 3 through 5, it is apparent that most of the physical features of the SSES condenser that would be significant in seismic considerations, are either enveloped by the database condensers, or would be less critical than the database condensers. One possible exception is the greater height of the SSES condensers. Another is the capacity to demand ratio (Figure 5) for the intermediate pressure shell. The significance of this greater height is discussed in the paragraph below. The capability of the anchors for all three shells is discussed in subsection 3.3.

The SSES condenser is higher than the database condensers (See Figure 4a). This feature cannot be considered as either enveloped by or less critical than the database condensers, since larger ratios of height to base width tend to give larger overturning forces. In the case of the SSES condenser shells, we can say that this greater height is not that significant for three reasons. The first reason is that the operating weight of each shell in comparison to the shell side area is comparable to that of the database condensers; therefore the shear stresses in the shell plate would not be any higher than the database condensers for the same "g" load. This is apparent from the data in Table 3. The second reason is that the anchor bolt shear areas in comparison to operating weights are comparable to the database condensers for all shells except the intermediate pressure shell. This is illustrated in Figure 5 in which the SSES condenser anchors are actually less critical than the anchors of the database condensers except for the intermediate pressure shell. The third reason is that the anchors for the SSES condenser have more than enough capacity to withstand the forces from a DBE event in combination with operating loads. This specific anchor capability is discussed in subsection 3.3.

The anchor configuration for the SSES condenser shells is not necessarily the same as that of the database condensers. For the SSES condenser shells, base shear loads are taken by welds of the condenser to embedded plates at locations 1 and 4 of Figure 7. The anchor bolts are not designed for shears because the holes in the condenser base are oversized, and the welds and guides are a stiffer load path for shear loads. Since the anchor at location 4 is a guide in one direction, the welds at location 1 are sized to take all the shear in the direction parallel to the turbine axis. For loads perpendicular to the turbine axis the anchors at location 1 and 4 both contribute to resisting shears. In Figure 5 the "lower bound" anchor area is only the root area of the welds active in the given directions. The "upper bound" area is the total of anchor bolts area only. This conservatively assumes that the welds fail before the anchor bolts are effective in resisting shears. The capacity to

TABLE 3

Comparison of SUSQUEHANNA Condenser to Database* Condensers

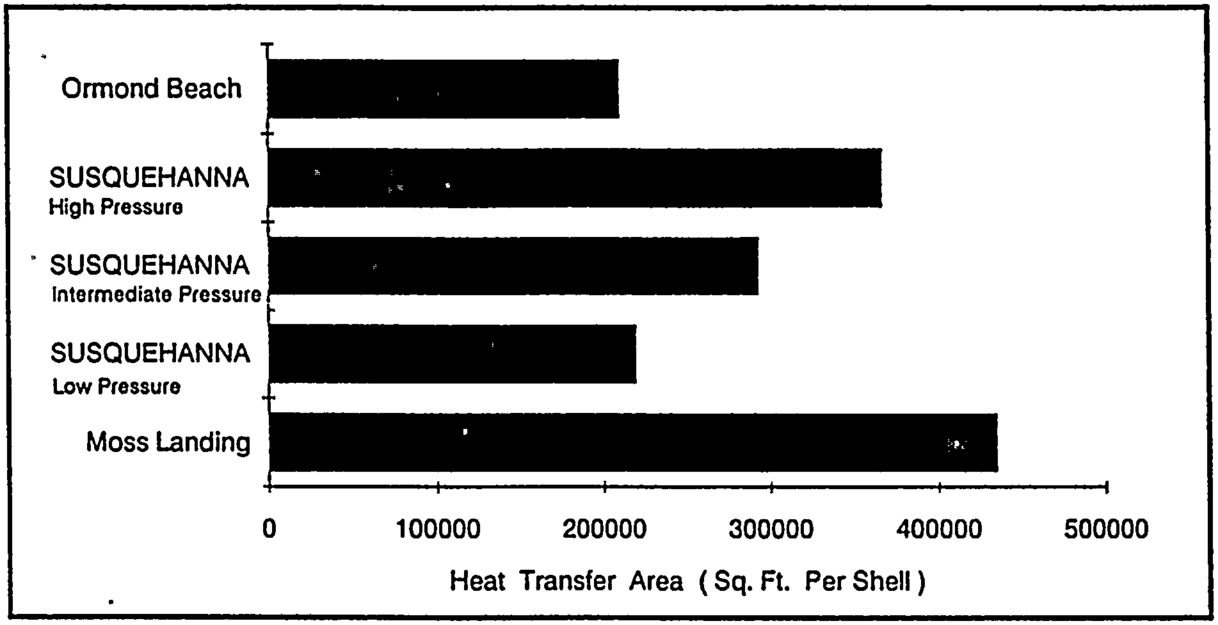
Plant Name	Horizontal "g" Level Experienced	Manufacture	Width x Length x Height (Ft)	Heat Exchange Area (Ft^2)	Operating Weight (Lbs)	Shell Thickness / Mateial (In) / (ASTM)	Tube Supports Thickness / Number (In)	Tube Sheets Thickness (In)	Tube Size Diameter (In) / Length (Ft)
Moss Landing	0.40	Ingersoll Rand	36 x 65 x 47	435000	3115000	3/4" A-285C	3/4" - 15	1.50	1" / 65'
Ormond Beach	0.20	South-Western	27 x 52 x 20	210000	1767500	3/4" A-285C	5/8" -14	1.25	1" / 53'
SUSQUEHANNA (High Pressure)	0.21 **	Ingersoll Rand	29 x 49 x 56	367000	2132700	3/4" A-285C	5/8" -14	1.50	1" / 50'
SUSQUEHANNA (Intermediate Pressure)	0.21 **	Ingersoll Rand	29 x 39 x 56	293300	1984300	3/4" A-285C	5/8" -11	1.50	1" / 40'
SUSQUEHANNA (Low Pressure)	0.21 **	Ingersoll Rand	29 x 29 x 56	219700	1572700	3/4" A-285C	5/8" -8	1.50	1" / 30'

* Database information from NEDC-31858P Revision 2, September 1993, Appendix D, Table 4-1 and Table 4-3

** DBE design basis is 0.21g horizontal for 5% damping, peak of ground response curve, at condenser base (See Figure 6)

FIGURE 3

Size Comparison of the SUSQUEHANNA Condenser (Unit 1 or 2) with Representative Condensers from Earthquake Experience



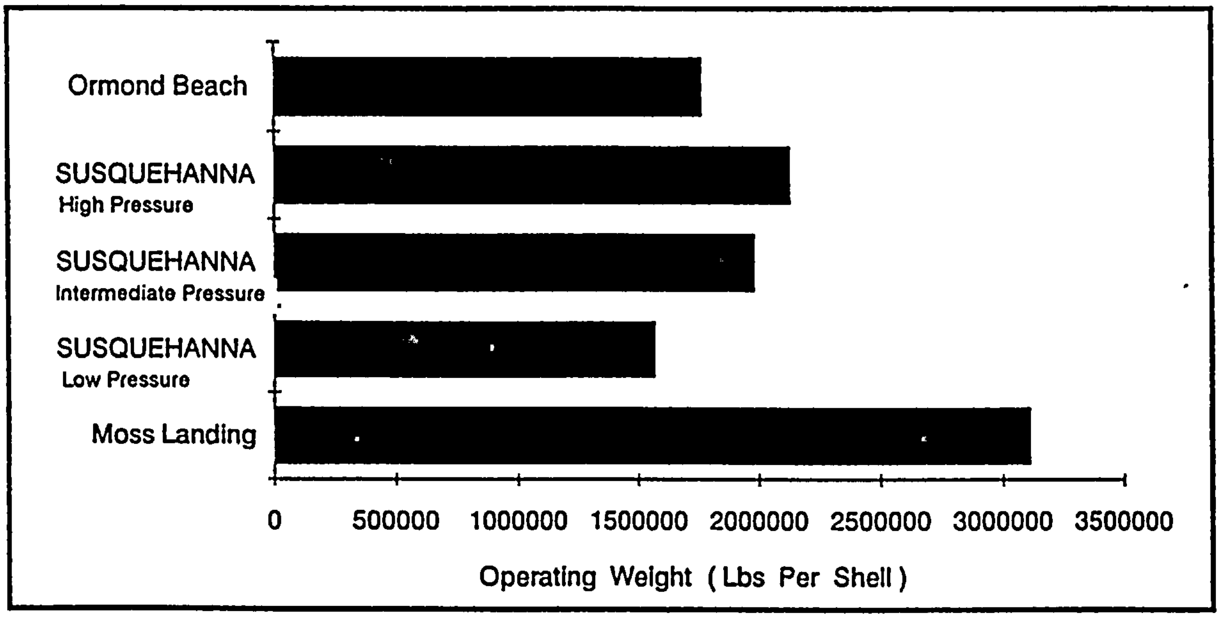
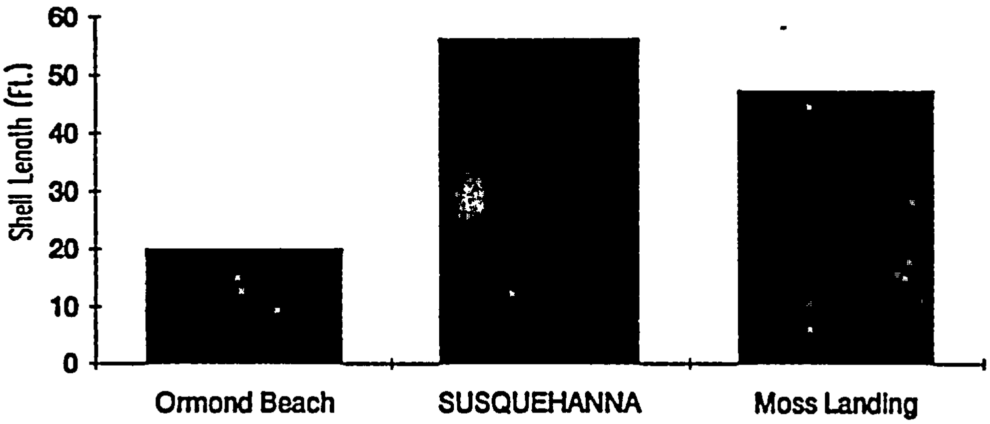
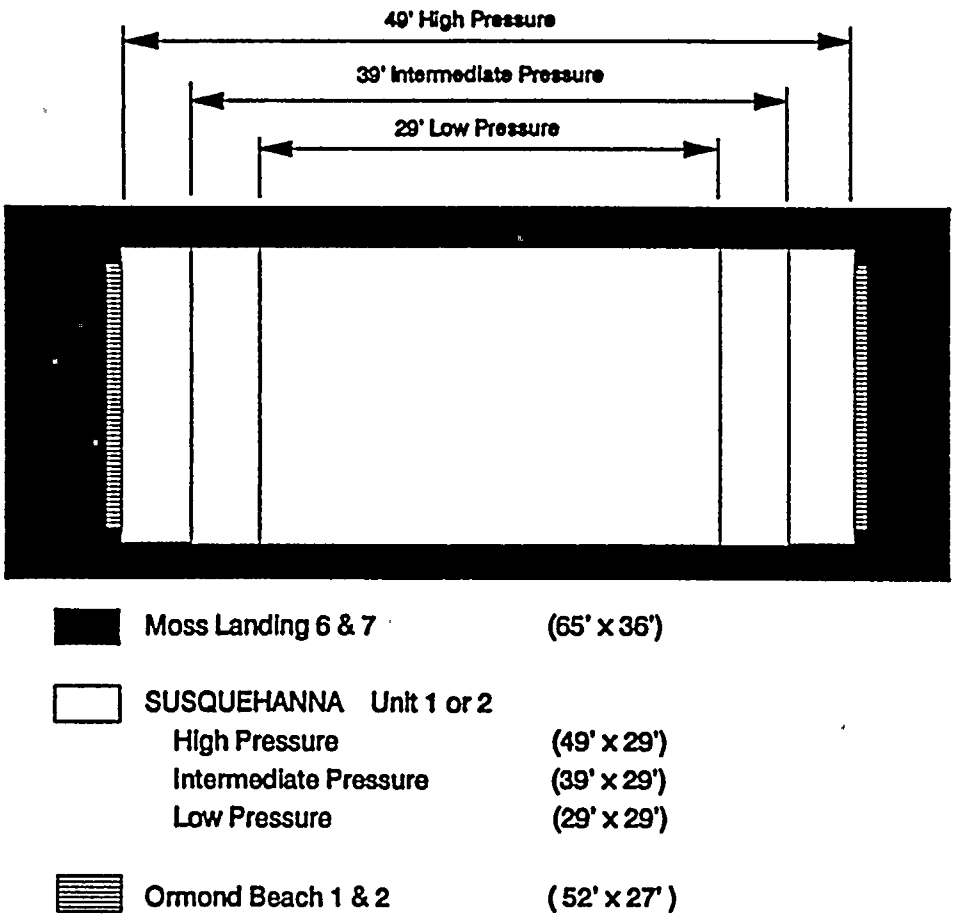


FIGURE 4

Dimensional Comparison of SUSQUEHANNA Condenser (Unit 1 or 2) and Representative Condensers from the Earthquake Experience Database



(a) Height Comparison
(Base To Expansion Joint)



(b) Shell Footprint Comparison

FIGURE 5A

Anchorage Capacity-to-Demand Ratio : Parallel to Turbine Generator Axis

Comparison of SUSQUEHANNA Condenser (Unit 1 or 2)

with Representative Condensers from Earthquake Experience Database

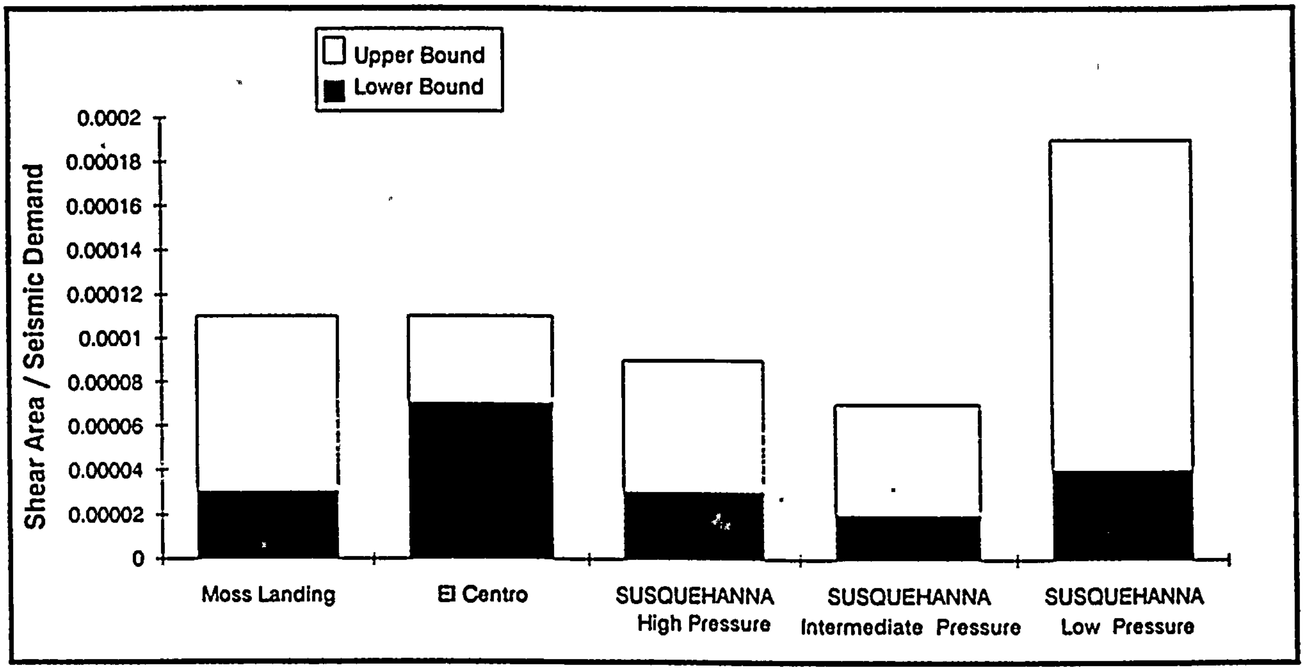
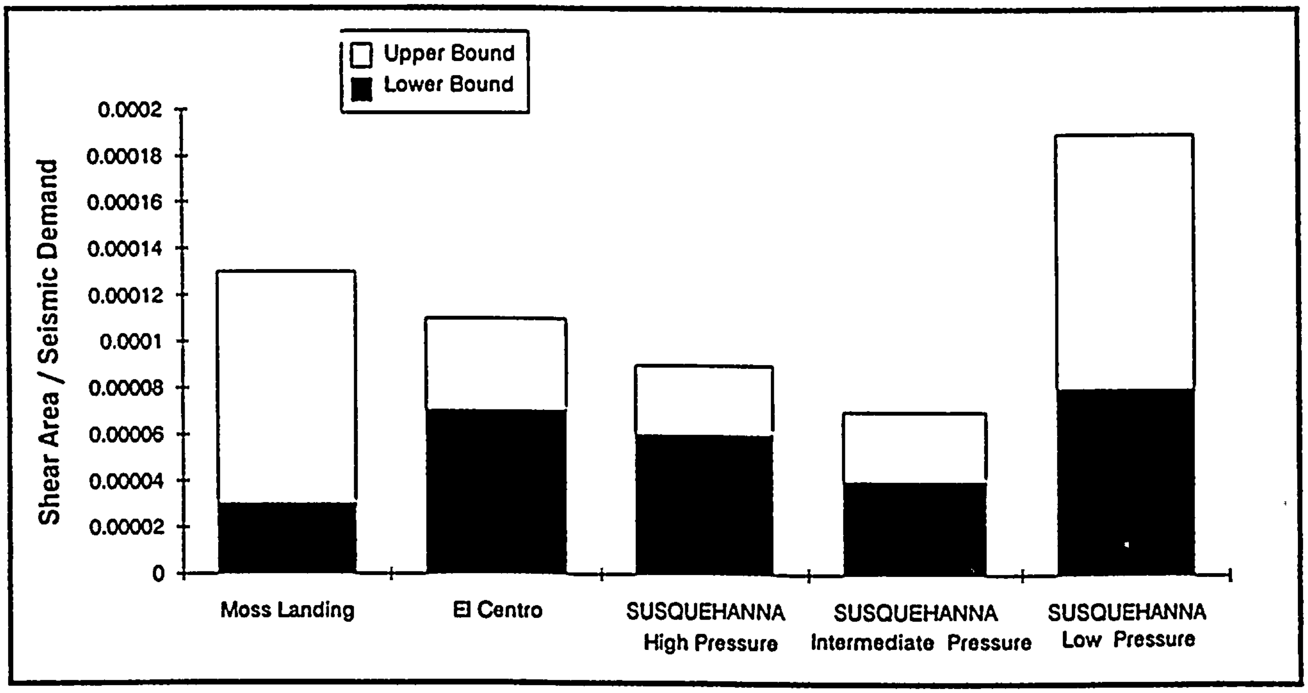


FIGURE 5B

Anchorage Capacity-to-Demand Ratio : Perpendicular to Turbine Generator Axis

Comparison of SUSQUEHANNA Condenser (Unit 1 or 2)

with Representative Condensers from Earthquake Experience Database



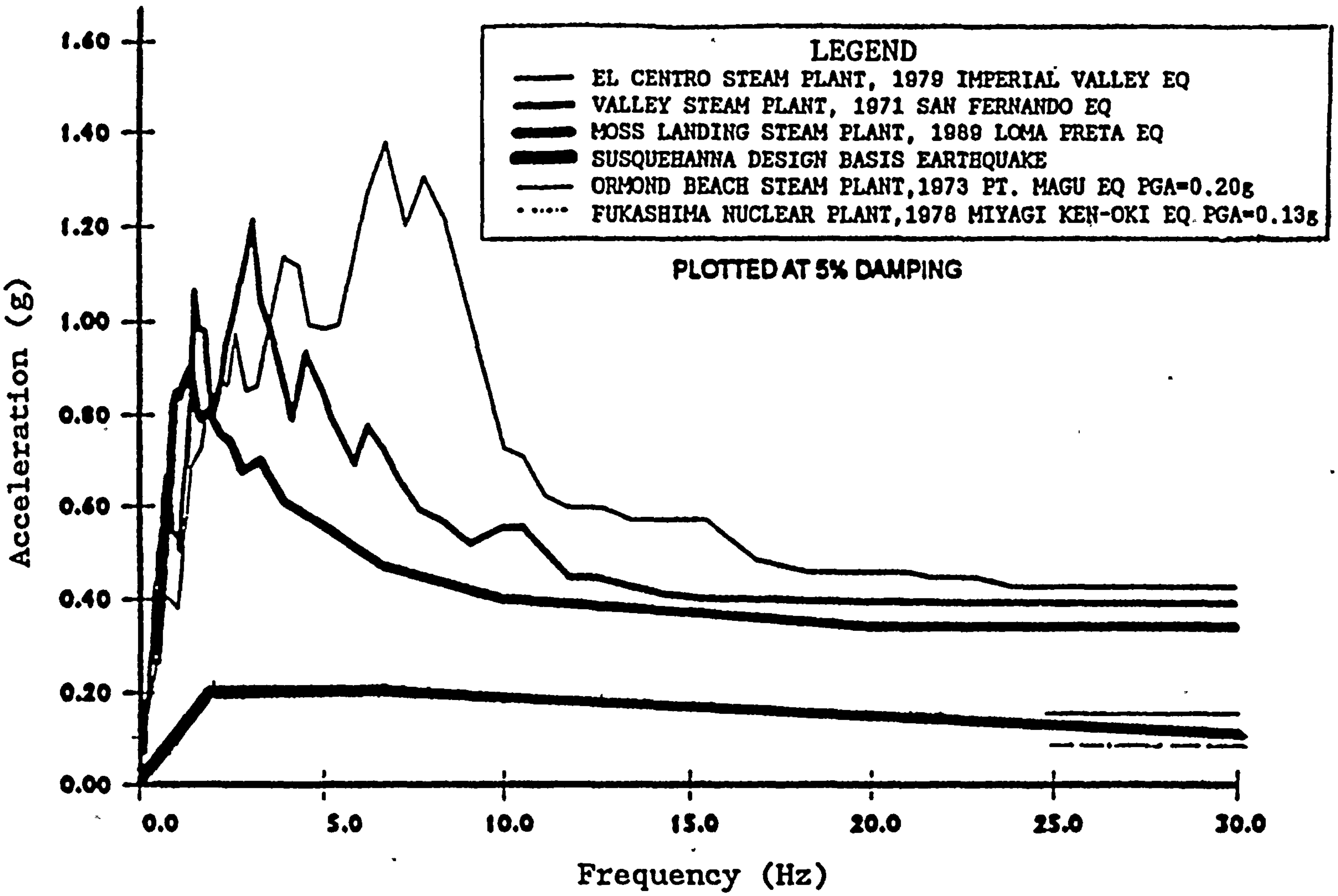
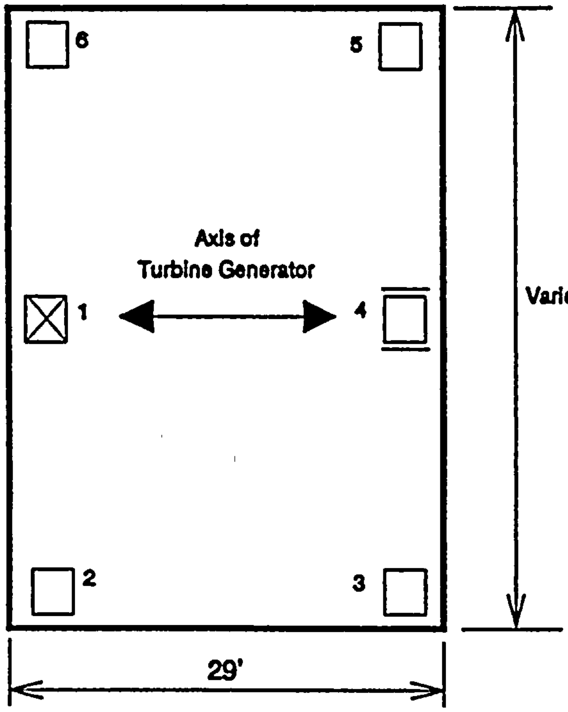


Figure 6: Comparison of Susquehanna Ground Response Spectrum to Data Base Spectra

FIGURE 7

Anchor System for SUSQUEHANNA Condenser

Unit 1 or 2

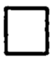


Distribution of Anchor Bolts by Tensile Area / Location

Location	Shell Unit		
	High Pressure (in^2)	Intermediate Pressure (in^2)	Low Pressure (in^2)
1	7.60	7.60	7.60
2	9.50	3.80	20.00
3	9.50	3.80	20.00
4	7.60	7.60	7.60
5	3.80	3.80	3.80
6	3.80	3.80	3.80
Total	41.80	30.40	62.80

KEY


Anchor bolts resist load in vertical direction.
Welds to embedded plate assembly resist loads in horizontal directions.


Anchor Bolts resist load in vertical direction.
No hard restraint in horizontal directions (sliding friction only).


Anchor Bolts resist load in vertical direction.
Guide bars resist load in direction perpendicular to axis of turbine generator.
No hard restraint parallel to axis of turbine generator (sliding friction only).

demand ratios for the intermediate pressure condenser are lower than the comparable database condensers. This does not represent a concern when the actual anchor capacity is compared to the seismic loads in subsection 3.3.

3.3 Capability of Anchors to Withstand Design Basis Earthquake Loads.

High Pressure Condenser:

The maximum tension from the DBE forces in combination with the operating loads is estimated to be 493.4 kips at locations 2 or 3 compare to the anchor bolts capacity of about 897 kips.

The maximum base shear from DBE is 448 kips. This shear would be resisted in a number of ways: friction, shear in the welds to the embedded plates, and finally by anchor bolts assuming small movements to develop bolt shears. It would be unconservative to assume that the welds and anchor bolts act concurrently to resist shear since the bolt holes are oversize. Capacities of the three shear resistant phenomenon are as follows:

> friction from resultant normal forces between condenser and embedded plate using a 0.10 friction factor = 183 kips
>
> weld capacity = 445 kips
>
> shear capacity of anchor bolts not in tension = 1814 kips

It is reasonable to assume that the friction is available in combination with weld capacity or in combination with bolt capacity. It is apparent that the anchor system has more than enough capacity to resist base shears from DBE.

Intermediate Pressure Condenser:

The maximum tension from the DBE forces in combination with the operating loads is estimated to be 91 kips at locations 2 or 3 compare to the anchor bolts capacity of about 359 kips.

The maximum base shear from DBE is 417 kips. This shear would be resisted in a number of ways: friction, shear in the welds to the embedded plates, and finally by anchor bolts assuming small movements to develop bolt shears. It would be unconservative to assume that the welds and anchor bolts act concurrently to resist shear since the bolt holes are oversize. Capacities of the three shear resistant phenomenon are as follows:

RES 11/22/94
Typo
0.10

> friction from resultant normal forces between condenser and embedded plate using a ~~0.20~~ friction factor = 171 kips

weld capacity = 284 kips

shear capacity of anchor bolts not in tension = 1814 kips

It is reasonable to assume that the friction is available in combination with weld capacity or in combination with bolt capacity. It is apparent that the anchor system has more than enough capacity to resist base shears from DBE.

Low Pressure Condenser:

The maximum tension from the DBE forces in combination with the operating loads is estimated to be 905 kips at locations 2 or 3 compare to the anchor bolts capacity of about 1890 kips.

The maximum base shear from DBE is 330 kips. This shear would be resisted in a number of ways: friction, shear in the welds to the embedded plates, and finally by anchor bolts assuming small movements to develop bolt shears. It would be unconservative to assume that the welds and anchor bolts act concurrently to resist shear since the bolt holes are oversize. Capacities of the three shear resistant phenomenon are as follows:

DES 11/22/94.
Typo
0.10

friction from resultant normal forces between condenser and embedded plate using a ~~0.20~~ friction factor = 135 kips

weld capacity = 445 kips

shear capacity of anchor bolts not in tension = 1814 kips

It is reasonable to assume that the friction is available in combination with weld capacity or in combination with bolt capacity. It is apparent that the anchor system has more than enough capacity to resist base shears from DBE.

4.0 MSIV LEAKAGE CONTROL PIPING

Seismically analyzed piping within the MSIV Leakage Alternate Treatment Method includes the main steam line from containment isolation valves to the turbine stop valves, the bypass piping from the main steam line to the main condensers, the main steam drain line header from containment isolation valves to in-line pipe anchors, and portions of main steam branch connection lines to in-line pipe anchors. Design methods for these analyzed lines are consistent with seismic category I qualification methods for the SSES and design margins are accordingly adequate to assure acceptable seismic performance.

Portions of these main steam and drain line piping systems have not been seismically analyzed. Since system redesign to seismic category I requirements would be exceedingly costly, an alternate evaluation method has been utilized to demonstrate seismic adequacy. Non seismically analyzed piping systems were assessed to demonstrate that SSES piping and pipe supports fall within the bounds of a "seismic experience database". Section 1.0 details the background for this historical database as well as the construction code and seismic walkdown reviews performed to demonstrate seismic adequacy. The code review purpose was to insure adequate dead load support margin and ductile support behavior when subjected to lateral loads. Seismic walkdowns were performed to verify that SSES piping and instrumentation are free of impact interactions from falling and the proximity or differential motion hazards. Conditions outside the experienced database boundary (outliers) are being reviewed to demonstrate reasonable assurance of the integrity of the associated piping systems and components under normal and earthquake loading. In addition, a representative bounding pipe support sample on the 4" main drain line will be evaluated to demonstrate anchorage margins.

These reviews demonstrated that the non-seismic analyzed piping systems consist of welded steel pipe and standard support components, consistent with the construction standards associated with the seismic experience database piping systems. Reviews also demonstrated that adequate design margins exist for typical or bounding piping system supports. Specific data used in the evaluations is summarized below. For the main steam drain interconnected piping, it was demonstrated that adequate design margins exist to provide reasonable assurance that piping position retention will be maintained by the piping system dead weight supports under normal as well as earthquake loadings. Walkdown results indicated that additional supports would be required to eliminate the potential for piping system interactions.

4.1 Main Steam and Turbine Bypass

No failures of main steam piping were found in the earthquake experience database as documented in NEDC-31858P.

These piping systems at SSES were designed in accordance with the ASME Code Section III, Class 2 and ANSI B31.1 requirements, using response spectrum analysis techniques. The analysis models included the main steam piping, the bypass lines, and branch piping up to seismic anchors.

The main steam lines envelop the piping from containment isolation valves FO28A/B/C/D to the turbine stop valves MSV-1/2/3/4 and include the drip legs plus portions of the supply lines to the steam seal evaporators up to in-line pipe anchors. The turbine bypass analysis includes piping from the main steam lines to the condenser plus portions of the steam supply lines to the reactor feed pump turbines and steam air ejectors up to in-line anchors. These piping systems were designed using reactor and turbine building response spectra inputs to perform dynamic seismic analysis to withstand the OBE and DBE loadings in combination with other applicable design loads in accordance with the SSES defined loading combinations. Design margins for the referenced main steam and turbine bypass piping systems are those inherent by application of the seismic design codes.

4.1.1 Design Basis

4.1.1.1 Piping Design Code

ASME III, Class 2, 1971 Edition including Winter 1972 Addenda and B31.1, 1973 Edition

4.1.1.2 Piping Design

A. Design Temperature: 585 F
Design Pressure: 1350 psi - main steam
1350 psi - turbine bypass

B. Pipe size, schedule, and D/t

Size(NPS)	Thickness	D/t
24	1.076	22
24	0.941	25
18	1.156	16
10.75	0.719	15
10.75	0.594	18
8.625	0.594	14
4.500	0.438	10

C. Typical Support Spacing: B31.1 suggested span

D. Support Types: springs, struts, snubbers, box type,

E. Design Loading: weight, thermal, seismic, steam hammer

F. Analysis Method: linear elastic, seismic response spectrum, steam hammer time history

G. Seismic and Dynamic Design Basis: response spectra analyses using floor response spectra that were derived based on the ground DBE with a peak ground acceleration of 0.10g.

4.1.1.3 Pipe Support Design Code

AISC and ANSI B31.1

4.1.2 Margin Assessment

Design methods for the analyzed main steam and turbine bypass piping are consistent with seismic Category I qualification methods for SSES. The seismic walkdowns identified minor interaction issues that could be potential source of damage. Actions have been initiated to resolve these issues. Based on action implementation, the design margins associated with these systems and their supporting structures will be adequate to insure piping system integrity under projected seismic performance.

4.1.3 Verification Walkdown Results

The walkdown results are presented in Tables 5 and 6 for Units 1 and 2, respectively.

4.2 Main Steam Drains to Condenser

The main steam drain line to the condenser consists of safety (Class 2) and non-safety related piping. The safety related pipe and portions of the non-safety piping up to in-line pipe anchors downstream of isolation valves HV-1/241F019 and F020 were seismically analyzed. These piping systems were designed in accordance with the ASME Code, Section III, Class 2 and ANSI B31.1 requirements, using response spectra analysis techniques. The remaining main steam drain and associated piping were analyzed for dead weight and thermal loads using computer analysis and spacing criteria. This piping is similar to piping found in the seismic experience database. The seismic verification walkdowns identified minor interaction issues that could be potential sources of damage. Actions have been initiated to resolve these issues.

4.2.1 Design Basis

4.2.1.1 Piping Design Code

ASME III, Class 2, 1971 Edition including Winter 1972 Addenda and B31.1, 1973 Edition

4.2.1.2 Piping Design

A. Design Temperature: 585 F
Design Pressure: 1350 psi

B. Pipe size, schedule, and D/t

Size(NPS)	Thickness	D/t
4.5	0.438	10
3.5	0.438	8
1.315	0.250	5
1.315	0.358	4

C. Typical Support Spacing: B31.1 suggested span

D. Support Types: springs, struts, snubbers

E. Design Loading: weight, thermal, seismic

F. Analysis Method: linear elastic, seismic response spectrum

G. Seismic and Dynamic Design Basis: response spectra analyses using floor response spectra that were derived based on the ground DBE with a peak ground acceleration of 0.1g.

4.2.1.3 Pipe Support Design Code

AISC, ANSI B31.1, and MSS SP58

4.2.2 Margin Assessment

Design methods for the seismically analyzed drain piping are consistent with seismic Category I qualification methods for SSES. Therefore, the design margins associated with these systems and their supporting structures will be adequate to insure piping system integrity under projected seismic performance.

The objective of the assessment of the non-seismic Main Steam Drain piping is to demonstrate that piping position retention will be maintained during a seismic event plus provides assurance that the pipe supports will behave in a ductile manner and that all lines are free of known seismic hazards. In addition, it will establish that these SSES piping systems will perform in a manner similar to piping and supports that have been observed to demonstrate good seismic performance.

The methodology utilized to demonstrate the margins inherent in the SSES non-seismic piping support designs is based on:

- The ground seismic input is based on the ground DBE which is conservatively defined.

- The calculated piping seismic response is based on 5% damped in-structure response spectra as recommended in EPRI NP-6041. The reader is referred to the following subsection 4.2.2.1 for more details.

- The component support capacity is conservatively estimated based on the vendor rated values.

The evaluations' goal is to produce a High-Confidence-Low -Probability of Failure (HCLPF) for the walkdown outliers and a representative pipe support sample. This should provide the desired reasonable assurance of good seismic performance.

4.2.2.1 Seismic Demand

The original seismic design of the Turbine Building included the development of three lumped mass models for the east-west, north-south, and vertical directions. The seismic floor curves were generated to determine seismic anchor forces and displacements for the piping systems that are attached to the Turbine Building. The seismic floor curves were only generated for 1/2% and 1.0% equipment damping values. The existing 1/2% and 1% damped floor curves will be extrapolated to generate 5% damped DBE floor curves for the evaluation of the walkdown outliers and a representative pipe support sample.

During the margin assessment, 5.0% damped realistic median-centered, with no intentional conservative bias, floor curves will be developed, if necessary, based on the NUREG/CR-0098 median ground spectra anchored at 0.1g and 0.067g peak ground accelerations for horizontal and vertical directions, respectively. Variabilities associated with structure frequency, structure damping, and rock modulus are significant in the development of the seismic floor curves. These model parameters will be selected in a random process. A number of earthquake time histories will be utilized with the randomly selected sets of model parameter values.

To account for the uncertainty in the structural frequency calculations, the peaks of the seismic floor curves are shifted rather than be broadened.

It should be noted that the identified items during the seismic verification walkdowns are tagged as outliers since they did not fall within the bounds of the earthquake experience database. The peak acceleration values of the data base ground spectra are usually greater than 0.9g while the peak acceleration value for the DBE at SSES is about 0.21g for 5% equipment damping as shown in Figure 6.

In addition to the seismic DBE loads, dead weight and operating mechanical loads are accounted for. Operating mechanical loads for this system are thermal expansion loads and design dead weight support loads are consistent with tributary area weight procedures.

4.2.2.2 Pipe Support Component Capacities

The supplemental field verification determined that the support types used are considered to have good seismic performance. The system is predominantly supported for dead weight utilizing rod hangers. Component designs are constructed from standard support catalog parts typically consisting of clamps, threaded rods, weldless eye nuts, turnbuckles, welding lugs and are attached to either concrete or structural steel. These support types are designed to resist vertical loads in tension. Design capacities are provided by manufactures' load rating data sheets.

Load capacity ratings for component standard supports are typically based on testing and utilize a factor of safety of five in accordance with MSS SP-58. The load on which the load capacity data (LCD) is based is therefore a factor of five higher than the catalog load rating. The margin capacities for each support component are taken as the LCD x 5 x 0.7 (EPRI NP-6041).

Including thermal effects on allowable loads, component standard supports designed by load rating is calculated as follows:

$$TL \times 0.7Su/Su^*$$

where:

TL : Support test load is less than or equal to load under which support fails to perform its intended function; TL = LCD x 5

Su : Material ultimate strength at temperature

Su*: Material ultimate strength at test temperature

Structural steel support members are evaluated using section strength based on the plastic design methods in Part 2 of AISC or 1.7 times the AISC working stress allowables. Concrete anchor bolts are evaluated using data from the A46/SQUG criteria, Appendix C.

4.2.3 Verification Walkdown Results

The walkdown results are presented in Tables 5 and 6 for Units 1 and 2, respectively.

4.3 Interconnected Systems

The interconnected systems consist of the remaining piping within the MSIV Leakage Alternate Treatment Method that was not seismically analyzed. These systems are composed of welded steel piping and standard support components. Analyzed by rule and approximate methods, these piping systems are similar to the piping found in the seismic experience database that have experienced seismic events in excess of the SSES design basis earthquake. Interaction issues identified in the walkdown that could be potential sources of damage were evaluated, and, where necessary, actions have been initiated to eliminate this potential. It will be demonstrated that adequate design margins exist for these interconnected systems to provide reasonable assurance that piping position retention will be maintained by the piping system dead weight supports under normal and DBE loadings.

4.3.1 Design Basis

Table 4 lists the design parameters associated with these interconnected piping systems.

4.3.2 Margin Assessment

Same as for Main Steam Drains to Condenser, Section 4.2.2.

Based on the piping system construction material reviews, seismic walkdowns performed for impact interaction assessment, and the representative system evaluations, interconnected system piping position retention will be insured and system similarity to the seismic experience database will be demonstrated. The goal is to demonstrate that the interconnected systems are capable of functioning to support the operation of the MISV Leakage Alternate Treatment Method during and following the applicable SSES DBE.

4.3.3 Verification Walkdown Results

The walkdown results are presented in Tables 5 and 6 for Units 1 and 2, respectively.

5.0 BLOCKWALLS

Block walls in the Turbine Building have been designed using the working stress method of reinforced concrete design in accordance with the 1973/1976 UBC. The walls have been rechecked for seismic loads using the 1979 UBC with a resulting seismic loading of 0.084g minimum. In addition some of the walls have been designed for a pipe rupture pressure of 480 lb/ft^2 and large bore (4" diameter and larger) pipe support loads. All of the walls have been designed for the maximum loads from field run attachments. Field run attachments have been controlled and documented . Cutting of reinforcing steel in the block walls has been controlled and documented. Construction of the walls per the civil drawings and specifications has assured compliance with the block wall design requirements.

All of the block walls which are of concern for the MSIV LCS Elimination Project have been designed as composite walls constructed as double wythe reinforced concrete block walls with 3000 psi fill concrete between the wythe's with all open cells grouted. The thickness of these walls varies from 2'-0" minimum to 4'06" maximum. One wall located in the Reactor Building which was designed for OBE/DBE, SRV and LOCA loads is only 1'-9" thick.

The block walls which are of concern for the MSIV LCS Elimination Project are evaluated with seismic loads using the DBE floor spectra.

TABLE 4

INTERCONNECTED SYSTEM DESIGN PARAMETERS

UNIT 1 AND 2

System Designation	Piping Design	Temp (°F)	Pres. (psig)	Size	Sch	D/t	Supports Spacing	Support Types	Design Code	Loading (Note 1)	Seismic Design Basis: To Anchor	Seismic Design Basis: Remainder
Main Steam Drains From 8" Drip Legs & 12" Drip Leg	ASME Section III ANSI B31.1	585	1350	4" 2" 1.5" 1" 1" 0.5"	40 160 xxs xxs 160 160	19 7 4.8 3.7 5.3 4.5	ANSI B31.1	Rod Hangers Springs Concrete Anchors Pipe Straps Struct. Memb.	AISC MSS SP58	DW Thermal Hydro	None	None
Main Steam Drip Leg Level Instrumentation	ASME Section III	585	1350	1"	xxs	4.8	ANSI B31.1	Rod Hangers Springs Conc. Anch. Pipe Straps Struct. Memb. Struts	AISC MSS SP58	DW Thermal Hydro	None	None
Main Steam Averaging Manifold to Pressure Transducer Panels	ASME Sect III ANSI B31.1	585	1350	6" 1.5" 1" 1"	120 xxs xxs 80	11.8 4.8 3.7 7.3	ANSI B31.1	Rod Hangers Springs Struts Conc. Anch. Pipe Straps Struct. Memb	AISC MSS SP58	DW Thermal Hydro	None	None
Main Steam Turbine Stop Valve Drains	ANSI B31.1	540	500	2" 1"	160 160	7 5.3	ANSI B31.1	Rod Hangers Springs Box Type Struct. Memb	AISC MSS SP58	DW Thermal Hydro	None	None

TABLE 4

INTERCONNECTED SYSTEM DESIGN PARAMETERS

UNIT 1 AND 2

System Designation	Piping Design	Temp (^{o}F)	Pres. (psig)	Size	Sch	D/t	Supports Spacing	Support Types	Design Code	Loading (Note 1)	Seismic Design Basis To Anchor	Seismic Design Basis Remainder
MSIV Drain In-Line Anchors to HP Condenser (includes Drain to LRW & Bypass from HV1/241-F021)	ANSI B31.1	585	1350	4" 3" 3" 1"	120 160 40 xxs	10.3 8 16.2 3.7	ANSI B31.1	Rod Hangers Springs Struct Memb. Conc. Anch.	AISC MSS SP58	DW Thermal Hydro	None	None
HPCI Turbine Steam Drain from In-Line Anchor to M.S. Drain Header	ANSI B31.1	585	1350	1"	xxs	3.7	ANSI B31.1	Rod Hangers Conc. Anch. Spring Pipe Straps	AISC MSS SP58	DW Thermal Hydro	None	None
RCIC Turbine Steam Drain from In-Line Anchor to M.S. Drain Hdr.	ANSI B31.1	585	1350	1"	xxs	3.7	ANSI B31.1	Rod Hangers Pipe Straps Conc. Anch.	AISC MSS SP58	DW Thermal Hydro	None	None
Steam Supply to Air Ejector Beyond HV-1/20107 to first seismic anchor	ANSI B31.1	585	1350	4"	120	10.3	ASME Sect. III ANSI B31.1	Snubbers Struct. Memb.	AISC MSS SP58	DW Thermal Hydro Seismic	R. S. Analysis using DBE (Note 2)	None
RFPT Supply Beyond Valve HV-1/20111 to first seismic anchor	ANSI B31.1	585	1350	8"	100	14.5	ASME Sect. III ANSI B31.1	Springs Snubbers Struct. Memb.	AISC MSS SP58	DW Thermal Hydro Seismic	R. S. Analysis Using DBE (Note 2)	None
Steam Seal Evaporator Line Beyond HV-1/20109 to first seismic anchor	ANSI B31.1	585	1350	8"	100	14.5	ASME Sect. III ANSI B31.1	Springs Snubbers Struct. Memb.	AISC MSS SP58	DW Thermal Hydro Seismic	R.S. Analysis using DBE (Note 2)	None

TABLE 4

INTERCONNECTED SYSTEM DESIGN PARAMETERS

UNIT 1 AND 2

NOTES:

1. ANALYSIS METHOD IS LINEAR ELASTIC FOR BOTH HAND CALCULATIONS USING SPACING CRITERIA AND ME101 COMPUTER ANALYSIS.

2. SEISMICALLY ANALYZED FROM THE MAIN STEAM BRANCH CONNECTION TO THE FIRST IN-LINE ANCHOR.

TABLE 5
Outlier Identification and Resolution Status
UNIT 1

SYSTEM DESCRIPTION	ID	OUTLIER	OUTLIER TYPE (POTENTIAL FAILURE MODE)					RESOLUTION STATUS
			A	F	P	D	V	
Main Steam Drain to Condenser	B5-1	Support EBD-114-H10 may slide off	X					Pipe seismic movement is being evaluated
	B5-2	4" EBD-114 in proximity to block wall		X				Block wall is evaluated and found acceptable as-is
	B5-3	Support EBD-114-H31 & SP-EBD-114-H83 may slide off	X			X		Differential seismic movement between Reactor Building and Turbine Building is being evaluated
	B5-4	Valve HV141-F021 outside SQUG Criteria					X	Valve seismic operability and pipe integrity are being evaluated
Main Steam from MSIV to stop Valve & 8" Drip Legs	A1-1	8" EBD-113 attached to block wall		X				Block wall seismic capacity is being evaluated
	A1-2	Hoists above MSIV A thru D		X				Hoists are being evaluated for position retention
Main Steam Bypass to Condensor	A6-1	Interaction between EBD-102-H43 & 42" cross around pipe			X			Seismic prying action of 42" line on support is being evaluated
	A6-2	DBB-105-H6, H7 in proximity to block wall		X				Block wall is evaluated and found acceptable as-is
	A6-3	DBB-109-H3, EBD-109-H5, DBB-105-H12 attached to block wall		X				Block wall is evaluated and found acceptable as-is
Main Steam to HV-10107 Steam Jet Air Ejector	A6-4	Valve HV-10107 in proximity to block wall		X				Block wall is evaluated and found acceptable as-is
	A6-5	Valve HV-10107 in proximity to Fire Protection Spray			X			Valve is being evaluated for fail safe position

TABLE 5
Outlier Identification and Resolution Status
UNIT 1

SYSTEM DESCRIPTION	ID	OUTLIER	OUTLIER TYPE (POTENTIAL FAILURE MODE)					RESOLUTION STATUS
			A	F	P	D	V	
Main Steam to Steam Jet Air Ejector (from HV-10107 to HV-10701B)	C1-1	4" EBD-109 in proximity to block wall		X				Acceptable as-is
	C1-2	4" EBD-109 Stanchions may slide off	X				X	Acceptable as-is
	C1-3	Valve HV-10701B in proximity to Fire Protection Spray					X	Acceptable as-is
Main Steam Drip Leg Drains	B1-1	1-1/2" DBB-101,2 & 4 under Cable Tray		X				Adequacy of cable tray supports is being evaluated
	B1-2	Interaction between 1-1/2" DBB-104 & 10" FW line				X		Seismic movements of both lines are being evaluated
	B1-3	Interaction between 1-1/2" DBB-101 & 10" FW line				X		Seismic movements of both lines are being evaluated
	B1-4	Interaction between 1-1/2" DBB-102 4" Aux. Steam line				X		Seismic movements of both lines are being evaluated
	B1-5	Interaction between 1" DBB-105, 4" EBD-109 & block wall		X		X		Block wall is evaluated and found acceptable as-is Seismic movement of 4" pipe is being evaluated
	B1-6	1" DBB-105, 17' Span between supports	X					Support overspan is being evaluated
	B1-7	GAD-138, GBD-123 under cable tray		X				Adequacy of cable tray supports is being evaluated
Main Steam Drip Leg Level Instrumentation	B2-1	1" DBB-105 in proximity to block wall		X				Block wall is evaluated and found acceptable as-is

TABLE 5
Outlier Identification and Resolution Status
UNIT 1

SYSTEM DESCRIPTION	ID	OUTLIER	OUTLIER TYPE (POTENTIAL FAILURE MODE) A	F	P	D	V	RESOLUTION STATUS
Main Steam Averaging Manifold to pressure transducer panel	B3-1	1" DCD-112 in proximity to block wall		X				Block wall seismic capacity is being evaluated
Stop Valve Seat Drains to Condenser	B4-1	Valves HV-10101 A,B,C,D may require seismic restraints	X				X	Seismic loads from valves are being evaluated
	B4-2	SP-GBD-144-H9,H10 & H11 Stanchions may slide off	X					Pipe seismic movement is being evaluated
HPCI Steam Drain to Main Steam Drain Header	B6-1	1" EBD-114 in proximity to block wall		X				Block wall is evaluated and found acceptable as-is
	B6-2	SP-EBD-114-H23,H24 & H25 Stanchions may slide off	X					Pipe seismic movement is being evaluated
Main Steam pressure sensing lines	B8-1	1" Pipe & 3/8" Tubing in proximity to block wall		X				Block wall seismic capacity is being evaluated

Key to outlier types:

A - Anchorage or Support Capacity
F - Failure and Falling (II/I)
P - Proximity and Impact
D - Differential Displacement
V - Valve Operator Screening

TABLE 6

Outlier Identification and Resolution Status

UNIT 2

SYSTEM DESCRIPTION	ID	OUTLIER	OUTLIER TYPE (POTENTIAL FAILURE MODE)					RESOLUTION STATUS
			A	F	P	D	V	
Main Steam Drain to Condenser	A5-1	3" EBD-214 & 20" JRD-233 interaction			X			Seismic movements of both lines are being evaluated
	B5-1	4" EBD-214 Supports H1 & H2 attached to two different building	X			X		Differential seismic movement between Reactor Building & Turbine Building is being evaluated
	B5-2	Valve HV241F021 outside SQUG criteria					X	Valve seismic operability & pipe integrity are being evaluated
	B5-3	4" EBD-214 in proximity to block wall		X				Block wall is evaluated and found acceptable as-is
	B5-4	EBD-214-H16,17,18,19 stanchion supports may slide off	X					Pipe seismic movement is being evaluated
Main Steam from MSIV to stop valve & 8" Drip Legs	A1-1	Hoists above MSIV A thru D		X				Hoists are being evaluated for position retention
	A1-2	8" EBD-113 in proximity to block wall						Block wall seismic capacity is being evaluated
Main Steam Bypass to Condenser	A8-1	Interaction between EBD-202-H42 & 42" cross around pipe			X			Seismic prying action of 42" line on support is being evaluated
	A8-2	24" DBB-205 & 4" EBD-209 supports attached to Block Wall		X				Block wall is evaluated and found acceptable as-is
	A8-3	2" EHC line and steel platform interaction			X			Steel platform was modified to clear the 2" line
Main Steam to HV-20107 Steam Jet Air Ejector	A8-4	Valve HV-20107 and bypass supports in proximity to block wall		X				Block wall is evaluated and found acceptable as-is
	A8-5	Valve HV-20107 in proximity to Fire Protection Spray			X			Valve is being evaluated for fail safe position

TABLE 6
Outlier Identification and Resolution Status
UNIT 2

SYSTEM DESCRIPTION	ID	OUTLIER	OUTLIER TYPE (POTENTIAL FAILURE MODE)					RESOLUTION STATUS
			A	F	P	D	V	
Main Steam to Steam Jet Air Eject (from HV-20107 to HV-20701B)	C1-1	4" EBD-209 in proximity to block wall		X				Acceptable as-is
	C1-2	Valves HV-20701A/B impact with Wall	X				X	Acceptable as-is
	C1-3	Valve HV-20701B in proximity to Fire Protection Spray					X	Acceptable as-is
Stop Valve Seat Drains to Condenser	B4-1	Valves HV-20101A,B,C,D may require seismic restraints	X					Seismic loads from valves are being evaluated
RCIC Steam Drain to Main Steam Drain Header	B7-1	1" EAD-214 & 4" HBD-227 interaction			X			Seismic movement of 4" line is being evaluated
HPCI Steam Drain to Main Steam Drain Header	B8-1	1" EBD-214 & 4" HBD-227 interaction			X			Seismic movement of 4" line is being evaluated
Main Steam Drip Leg Drains	B1-1	Valves HV-20108A & B may require seismic restraint	X					Supports for HV-20108A & B are being evaluated
	B1-2	1" GBD-238 & 4" HBD-2124 interaction			X			Seismic movements of both lines are being evaluated
	B1-3	1" GBD-238 & EBD-202-H15 interaction			X			Seismic movements of both lines are being evaluated
	B1-4	1-1/2" DBB-202 & 10" FW line interaction			X			Seismic movements of both lines are being evaluated
	B1-5	Valve HV-20112A1 & 4" Aux. Steam line interaction			X			Seismic movements of HV-20112A1 & 4" line are being evaluated
	B1-6	4" GBD-238 under 6" Fire Protection line		X	X			Fire Protection line supports are being evaluated
	B1-7	Valves HV-20112B1 & B2 may require seismic restraint. Also interaction with 4" Aux. Steam line			X			Supports for HV-20112B1 & B2 & seismic movement of 4" line are being evaluated
	B1-8	1-1/2" DBB-204 & 10" FW line interaction			X			Seismic movements of both lines are being evaluated
	B1-9	SP-DBB-203-H8006 & 8" HBD-296 line interaction	X					Seismic prying action of 8" Steam line on support is being evaluated
	B1-10	1-1/2" DBB-203 & 10" FW line interaction			X			Seismic movements of both lines are being evaluated

TABLE 6
Outlier Identification and Resolution Status
UNIT 2

SYSTEM DESCRIPTION	ID	OUTLIER	OUTLIER TYPE (POTENTIAL FAILURE MODE)					RESOLUTION STATUS
			A	F	P	D	V	
Main Steam Drip Leg Level Intrumentation	B2-1	1" DBB-205 & 30" Lube Oil line interaction			X			Seismic movements of both lines are being evaluated
	B2-2	1" DBB-203 & 16" Extraction Steam line interaction			X			Seismic movements of both lines are being evaluated
	B2-3	1" DBB-202 & 16" Extraction Steam line interaction			X			Seismic movements of both lines are being evaluated
	B2-4	SP-DBB-203-H8087 & 14" FW Htr 3A drain interaction			X			Seismic movement of 14" line is being evaluated
Main Steam Averaging Manifold to Pressure transducer panel	B3-1	1" DCD-212 Stanchion Supports may slide off	X					Seismic movement of 1" line is being evaluated
	B3-2	1" DCD-212 under HVAC Duct		X				HVAC seismic support capacity is being evaluated
	B3-3	1" DCD-212 in proximity to block wall		X				Block wall seismic capacity is being evaluated
Main Steam pressure sensing lines	B8-1	Tubing under HVAC		X				HVAC seismic support capacity is being evaluated
	B8-2	Tubing in proximity of block wall		X				Block wall seismic capacity is being evaluated

Key to outlier types:

- A - Anchorage or Support Capacity
- F - Failure and Falling (II/I)
- P - Proximity and Impact
- D - differential Displacement
- V - Valve Operator Screening

ENCLOSURE 3

SUSQUEHANNA LOCA DOSE

Attachment 2

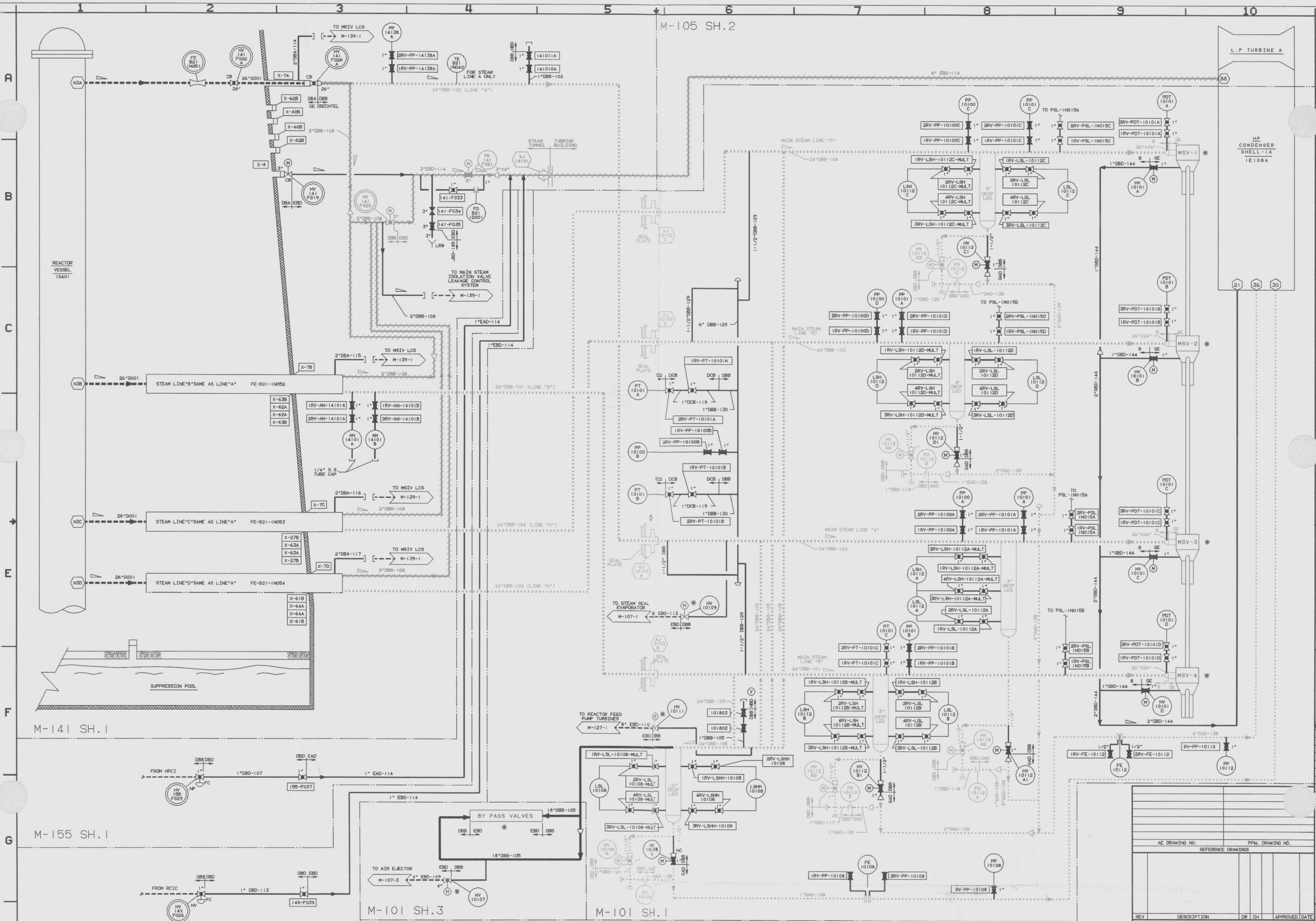
SUSQUEHANNA LOCA DOSES FOR A COMBINED MSIV LEAKAGE RATE OF 300 SCFH USING THE ISOLATED CONDENSER TREATMENT METHOD SUSQUEHANNA STEAM ELECTRIC STATION - EACH UNIT

		Whole Body (rem)	Thyroid (rem)	Beta (rem)
Exclusion Area Boundary (2-Hour)	A. 10 CFR 100 Limit	25	300	*
	B. Doses using MSIV-LCS Treatment**	2.47	127.8	
	C. Previous Calculated Doses w/o MSIV Leakage**	2.21	125.5	
	D. Contribution from MSIVs @ 300 SCFH Total ***	0.007	0.11	
	E. New Calculated Doses Using IC Treatment	2.217	125.61	
Low Population Zone (30-Day)	A. 10CFR100 Limit	25	300	*
	B. Doses Using MSIV-LCS Treatment**	0.37	30.4	
	C. Previous Calculated Doses w/o MSIV Leakage**	0.33	29.6	
	D. Contribution from MSIVs @300 SCFH Total***	0.04	12.14	
	E. New Calculated Doses Using IC Treatment	0.37	41.74	
Control Room (30-Day)	A. GDC-19	5	30	75
	B. Doses using MSIV-LCS Treatment**	0.38	14.19	12.0
	C. Previous Calculated Doses w/o MSIV Leakage**	0.35	13.6	11.0
	D. Contribution from MSIVs at 300 SCFH Total***	0.41	4.95	1.17
	E. New Calculated Doses using IC Treatment	0.76	18.55	12.17

* No limit specified.

** Doses calculated for Power Uprated conditions in PP&L Calculation EC-RADN-1009

*** Per GE correspondences OG94-574-09 and OG93-1021-09



LEGEND:

- SECONDARY DRAIN PATHWAY (NOT CREDITED IN RADIOLOGICAL DOSEMODEL)
- PRIMARY DRAIN PATHWAY (CREDITED IN RADIOLOGICAL DOSEMODEL)
- BLOCKED FLOW PATH
- TRANSFER CONNECTOR PAST BLOCK VALVE
- * BLOCK VALVES (REQUIRED TO BE REPOSITIONED FOLLOWING AN ACCIDENT)

NOTES:

1. THIS FIGURE IS REPRESENTATIVE OF BOTH THE UNITS 1 AND 2 MSIV-LCS FLOW PATH CONFIGURATIONS. THE COMPONENT TAG NUMBERS CONTAINED ON THIS FIGURE REPRESENT UNIT 1 COMPONENTS. TO OBTAIN UNIT 2 TAG NUMBERS, REPLACE THE FIRST DIGIT IN THE TAG NUMBER WITH 2.

REF. DRAWINGS:

M-101 MAINSTREAM
M-105 CONDENSTATE
M-141 NUCLEAR BOILER
M-149 REACTOR CORE ISOLATION COOLING
M-150 HIGH PRESSURE COOLANT INJECTION

9411290142-01 C

AE DRAWING NO.	PP&L DRAWING NO.
REFERENCE DRAWINGS	

REV	DESCRIPTION	DR	CH		APPROVED	DATE

QUALITY RELATED

PRELIMINARY

P&ID
MSIV LEAKAGE ALTERNATE FLOW PATH
FIGURE 1

AREA	ELEV .	SCALE

PENNSYLVANIA POWER & LIGHT COMPANY
ALLENTOWN PA.

PP&L DRAWING NO.	SHEET NO.	REV. NO.
AE DRAWING NO.	SHEET NO.	

M-141 M SKETCH1 001 000 Z

LOCATION CODES SORTS