

ENCLOSURE 3

TENNESSEE VALLEY AUTHORITY  
BROWNS FERRY NUCLEAR PLANT (BFN) UNIT 1

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION  
INDIVIDUAL PLANT EXAMINATION FOR EXTERNAL EVENTS

SEISMIC-INDUCED II/I SPRAY EVALUATIONS AT BROWNS FERRY NUCLEAR  
PLANT UNIT 1

REV. 0, MARCH 2004

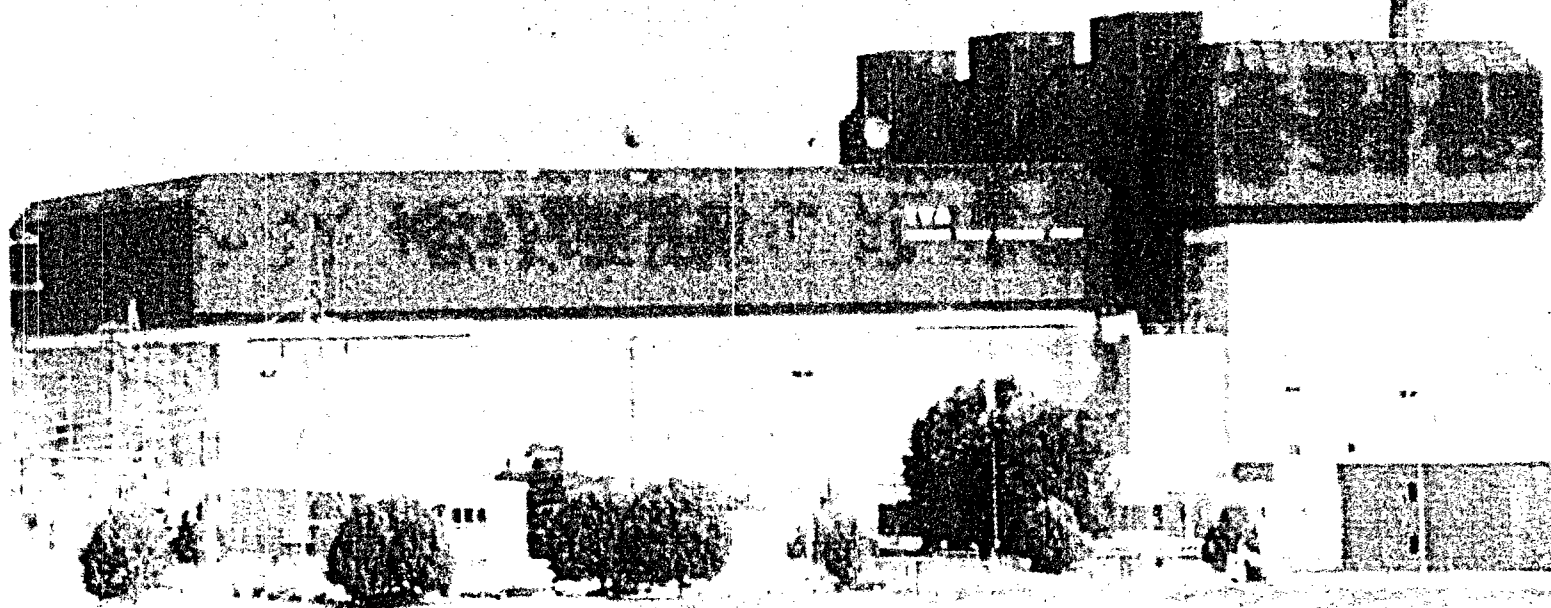
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(SEE ATTACHED)

# **SEISMIC-INDUCED III/ SPRAY EVALUATIONS AT BROWNS FERRY NUCLEAR PLANT UNIT 1**

*Prepared for:*  
**BROWNS FERRY UNIT 1 RESTART PROJECT**

**March 2004**



# **SEISMIC-INDUCED III/ SPRAY EVALUATIONS AT BROWNS FERRY NUCLEAR PLANT UNIT 1**

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**March 2004**

*Prepared for:*

**BROWNS FERRY UNIT 1 RESTART PROJECT**

*Prepared by:*

**FACILITY RISK CONSULTANTS, INC.**

## APPROVAL COVER SHEET

**Title:** Seismic-Induced II/I Spray Evaluations at Browns Ferry Nuclear Plant Unit 1

**Report Number:** TVA/BFN-01-R-002

**Client:** Browns Ferry Unit 1 Restart Project

**Project Number:** TVA/BFN-01

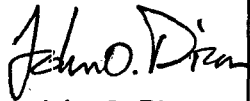
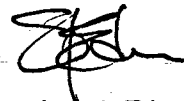
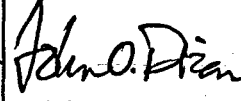
Revision Number	Approval Date	Prepared	Reviewed	Approved
0	3/26/04	 John O. Dizon	 Stephen J. Eder	 John O. Dizon

TABLE OF REVISIONS		
Revision No.	Description of Revision	Date
0	ORIGINAL ISSUE This report contains <u>102</u> pages total	3/26/04

## EXECUTIVE SUMMARY

This report summarizes the seismic-induced II/I spray evaluation program for Browns Ferry Nuclear Plant Unit 1. Key engineering attributes of the seismic II/I evaluation program consisted of the following:

- In-plant screening walkdown evaluations and identification of potential outliers;
- Further evaluations and resolution of potential outliers;
- Engineering design of plant modifications to resolve outliers;
- Work order requests to address general maintenance and housekeeping items.

In-plant screening walkdown evaluations of seismic II/I spray hazards were performed on an area-by-area basis in accordance with Walkdown Instruction WI-BFN-0-CEB-06, *"Engineering Walkdown Instruction for Evaluation of Seismic-Induced Spray Hazards."* A total of 27 designated plant areas were included. Screening evaluations focused on certain key attributes of the non-seismic Class I (Class II) piping and fluid pressure boundary systems that may potentially pose as spray hazards to surrounding seismic Class I systems and components in the event of an earthquake. Screening tools such as seismic deflection estimates and charts for various plant features, pipe flexibility and seismic anchor movement evaluation charts, support and anchorage capacity screening charts, and others, were developed for use in the in-plant screening walkdown evaluations. Certain configurations identified during the in-plant screening walkdowns as not meeting the screening criteria were documented in the Potential Outlier Sheet (POS) as potential outliers and for further evaluation and disposition. Walkdown results, including a total of 179 potential outliers identified, are documented in the Walkdown Data Packages (WDP's) for the respective plant areas.

Potential outliers identified during the in-plant screening walkdowns were further evaluated to the acceptance criteria of TVA Design Criteria BFN-50-C-7306, *"Qualification Criteria for Seismic Class II Piping, Pipe Supports, and Components."* Further evaluations and bounding analyses of these potential outliers consisted of hand calculations using basic engineering mechanics techniques for simple configurations, and rigorous piping analyses (TPIPE computer program) for more complex piping configurations. A total of 19 outliers were found to have not met the acceptance criteria. Plant modifications were designed

and Design Change Notice (DCN) issued to implement the changes so that all of these concerns were resolved. Furthermore, 13 maintenance and/or housekeeping items were also identified for corrective actions. Maintenance work order requests were issued to address these items.

Overall program results for the seismic II/I spray hazard evaluations at Browns Ferry Unit 1 are summarized in the following table:

Plant Location	Plant Area Designation	No. of Plant Area	No. of Potential Outliers	No. of Design Mods	No. of Maint. Items
RB El. 519' & 541'-6"	NWQUAD, NEQUAD, SWQUAD, SEQUAD, HPCI, TORUS	6	28	4	1
RB El. 565'	565A, 565B, 565C, 565D, STNL	5	52	4	7
RB El. 593'	593A, 593B, 593C, 593D	4	32	1	2
RB El. 621'-3"	621A, 621B, 621C, 621D	4	23	2	1
RB El. 639'	639A, 639B, 639C, 639D	4	30	4	2
RB El. 664'	664A, 664B, 664C, 664D	4	14	4	0

**Total No. of II/I Spray Walkdown Plant Areas**

**27**

**Total No. of II/I Spray Potential Outliers Identified**

**179**

**Total No. of Plant Design Modifications (DCN 51669)**

**19**

**Total No. of Misc. Maintenance and Housekeeping Items**

**13**

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## 1. INTRODUCTION

This report documents the seismic II/I spray hazard evaluations for the Browns Ferry Nuclear Plant Unit 1 (BFN-1). The evaluation was performed to assess the structural integrity and seismic adequacy of non-seismic Class I, non-safety related systems and components (Class II) in the vicinity of or over and above safety-related, seismic Class I systems and components. Key elements and highlights of the BFN-1 seismic II/I spray evaluation program are as follows:

- The BFN Final Safety Evaluation Report (FSAR) Appendix C, Section 2.1, subparagraph b states in part "An item designated Class II shall not degrade the integrity of any item designated Class I".
- Nuclear Regulatory Commission (NRC) Generic Letter (GL) 87-02 identifies that seismic spatial interaction (proximity and falling) are included within the scope for resolution of Unresolved Safety Issue (USI) A-46. USI A-46 program will be resolved under a separate task for BFN-1. However, seismic induced spray interactions are not included within the scope of USI A-46.
- TVA is committed to complete the seismic II/I spray hazards evaluation program as part of BFN-1 restart (TROI open item NCO910044001).
- Potential spray interactions are addressed at BFN-1 by in-plant screening evaluation walkdowns performed in accordance with Walkdown Instruction WI-BFN-0-CEB-06 (Reference 7-1), and subsequent analytical evaluation performed using the criteria contained in TVA Design Criteria BFN-50-C-7306 (Reference 7-2).

### 1.1 Report Organization

This report is organized as follows. Chapter 2 presents the scope of the program. Technical bases and evaluation approach for in-plant screening evaluations and further analyses and evaluations are described in Chapter 3. Summary of in-plant screening evaluations is presented in Chapter 4, while that of potential outlier resolution is in Chapter 5. Overall summary and recommendations, including plant modifications and

maintenance work orders, are provided in Chapter 6. References are listed in Chapter 7 of the report.

There are 3 appendices to this report. Appendix A contains a listing of walkdown data packages (WDP) which document the in-plant screening evaluations performed by the Walkdown Teams. Appendix B contains a list of engineering calculations which document the resolution of potential outliers by further analyses. A list of calculations containing the engineering design of plant modifications for the resolution of BFN-1 seismic II/I spray outliers are provided in Appendix C.

## 2. PROGRAM SCOPE

The Seismic II/I spray programs were completed for BFN Units 2 and 3 prior to their respective restarts (References 7-3 and 7-4, respectively), and included all common structures (intake pump house, standby gas treatment building, off gas treatment building, and diesel generator buildings) as well as the control bay common areas.

The scope of BFN-1 seismic II/I spray evaluation program includes a total of twenty-seven (27) general plant areas in Unit 1 Reactor Building as listed in Table 2-1.

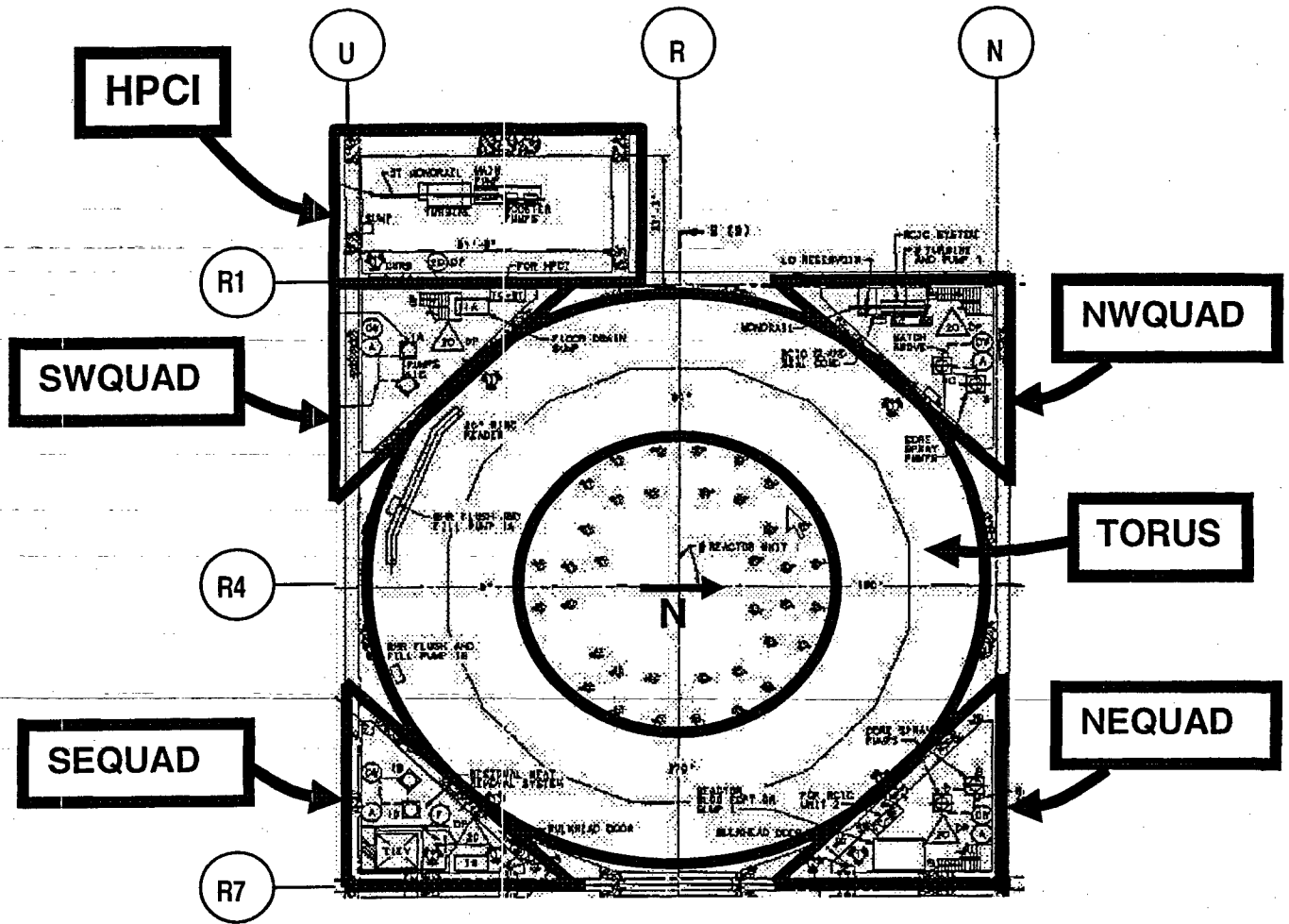
The seismic-induced II/I spray hazards program scope encompasses non-safety-related, non-seismic Class I components (Class II) that may degrade the integrity of safety-related, seismic Class I components by fluid spray initiated in the event of a design basis earthquake. Non-safety-related, non-seismic Class I components with fluid pressure boundary are evaluated as potential sources of fluid spray, while safety-related, seismic Class I components are considered as potential spray targets. Seismic Class I boundaries for BFN-1 systems (as defined in Reference 7-5) are used by this II/I spray program to identify plant components as either safety-related, seismic Class I (spray targets) or non-safety related, Class II (spray sources).

**TABLE 2-1**  
**Designated Plant Areas**

Reactor Building	Plant Area Designation <sup>(1)</sup>	No. of Area
El. 519' & 541'-6"	NWQUAD, NEQUAD, SWQUAD, SEQUAD, HPCI, TORUS <sup>(2)</sup>	6
El. 565'	565A, 565B, 565C, 565D, STNL <sup>(3)</sup>	5
El. 593'	593A, 593B, 593C, 593D	4
El. 621'-3"	621A, 621B, 621C, 621D	4
El. 639'	639A, 639B, 639C, 639D	4
El. 664'	664A, 664B, 664C, 664D	4
<b>Total Plant Areas</b>		<b>27</b>

Notes:

- <sup>(1)</sup> See Figures 2-1 to 2-6 for specific location of the above plant areas
- <sup>(2)</sup> Areas include both elevations of the four RB corner (quad) rooms, HPCI room, and areas above and below the Torus
- <sup>(3)</sup> STNL – Steam Tunnel, includes the MSIV vault and areas south of the blow-out panel



**Figure 2-1: Reactor Building El. 519 Ft. & 541.5 Ft.**

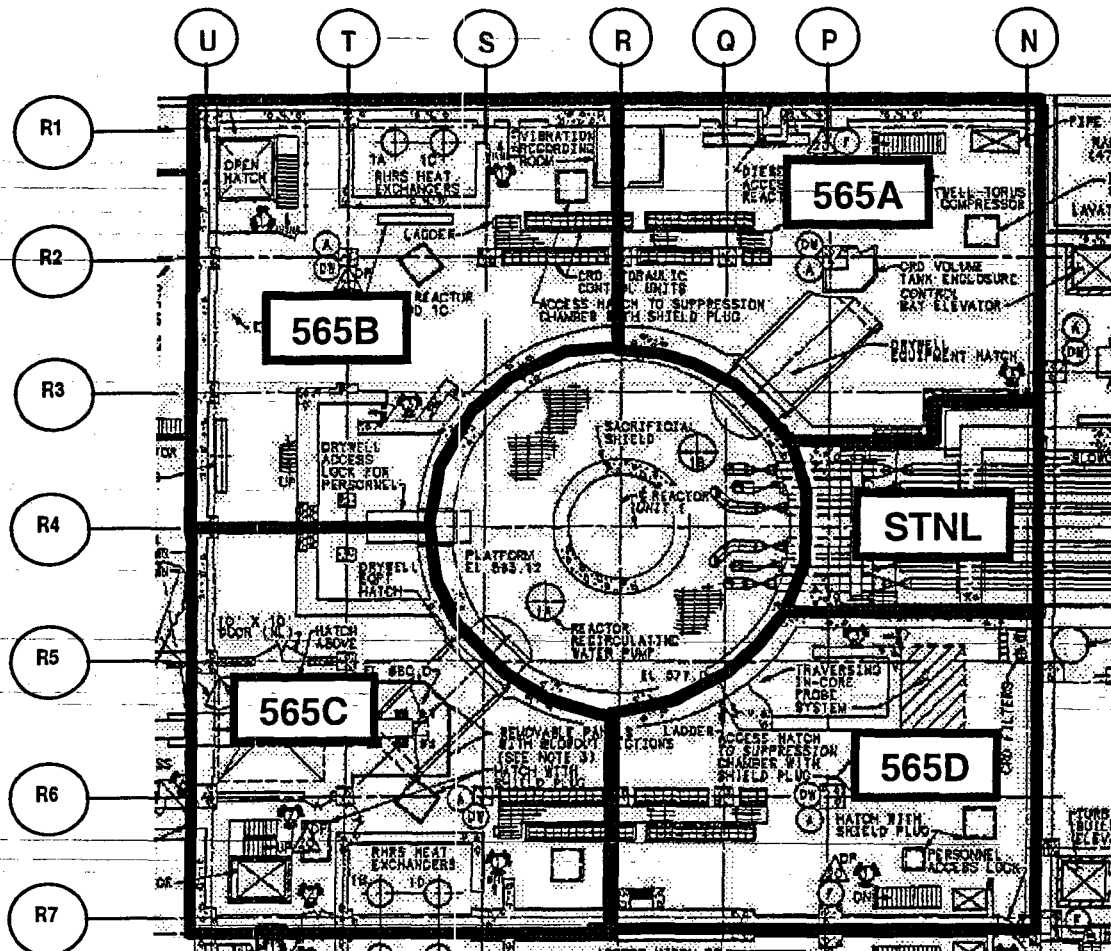


Figure 2-2: Reactor Building El. 565 Ft.



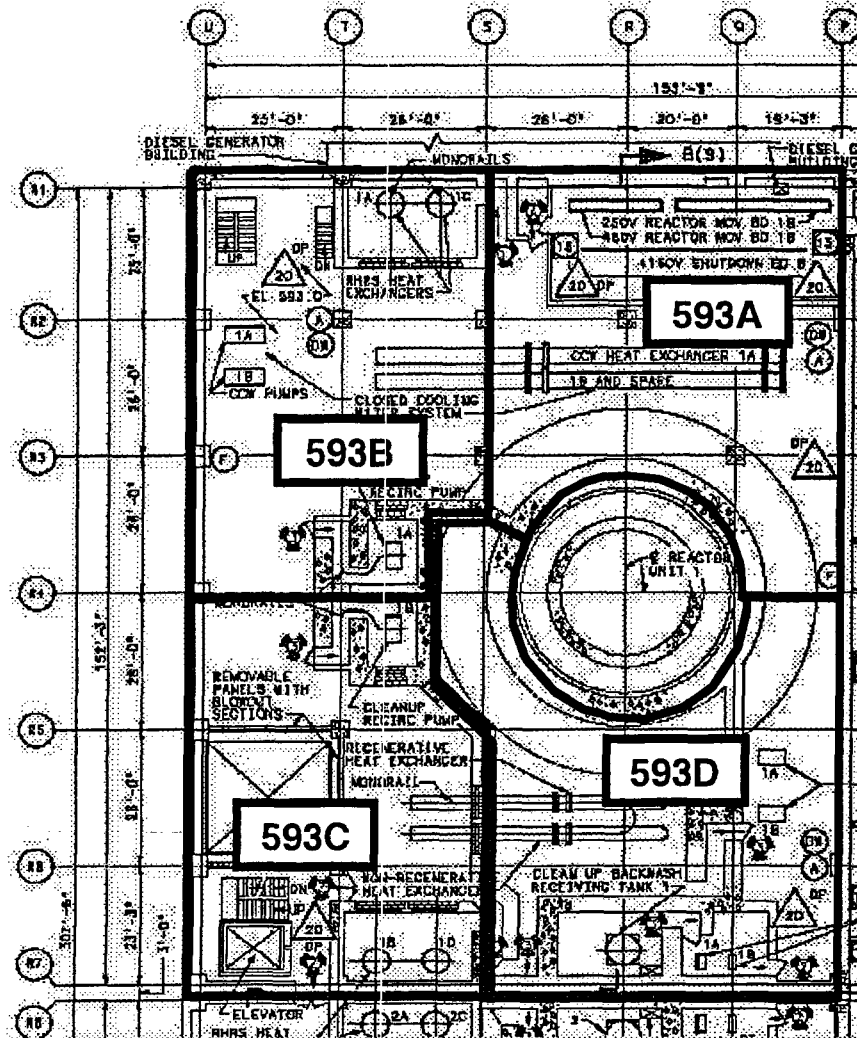
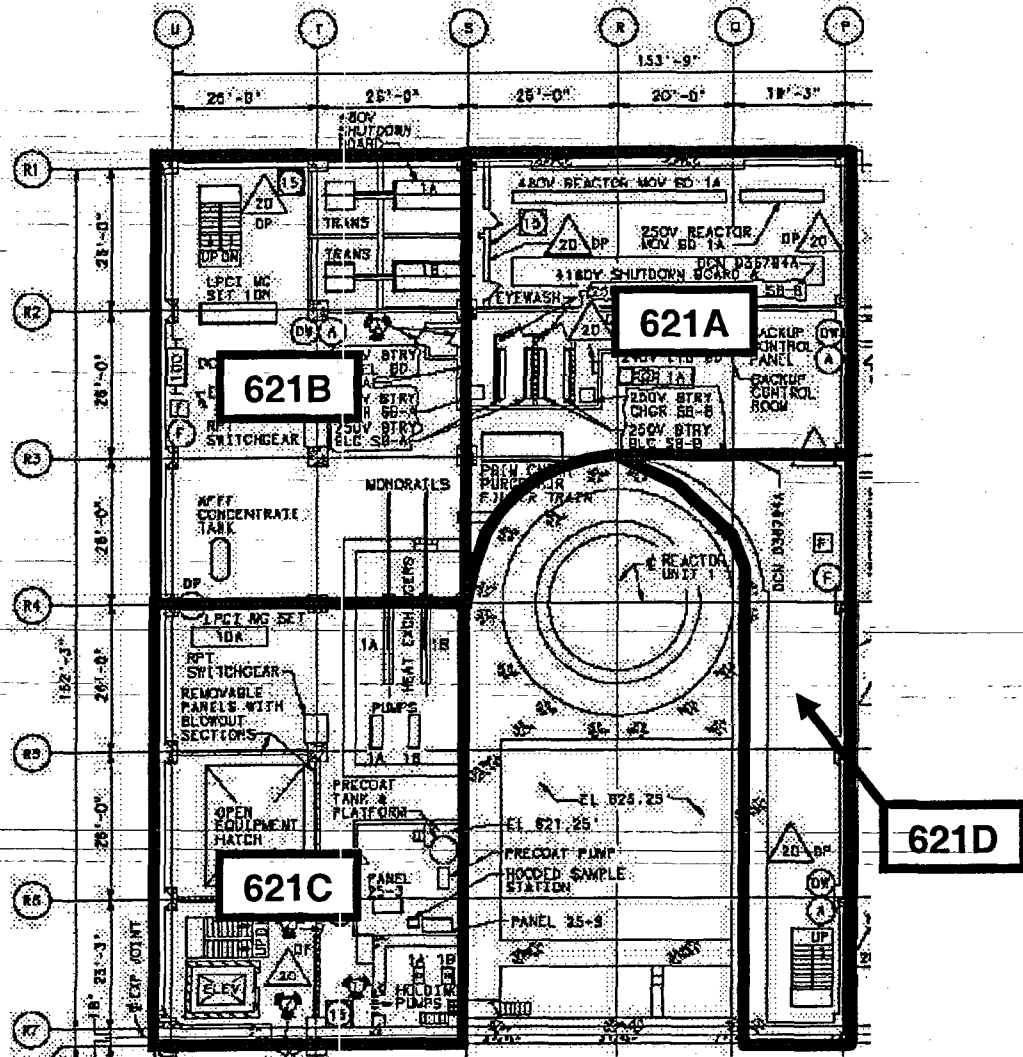


Figure 2-3: Reactor Building El. 593 Ft.



**Figure 2-4: Reactor Building El. 621.25 Ft.**

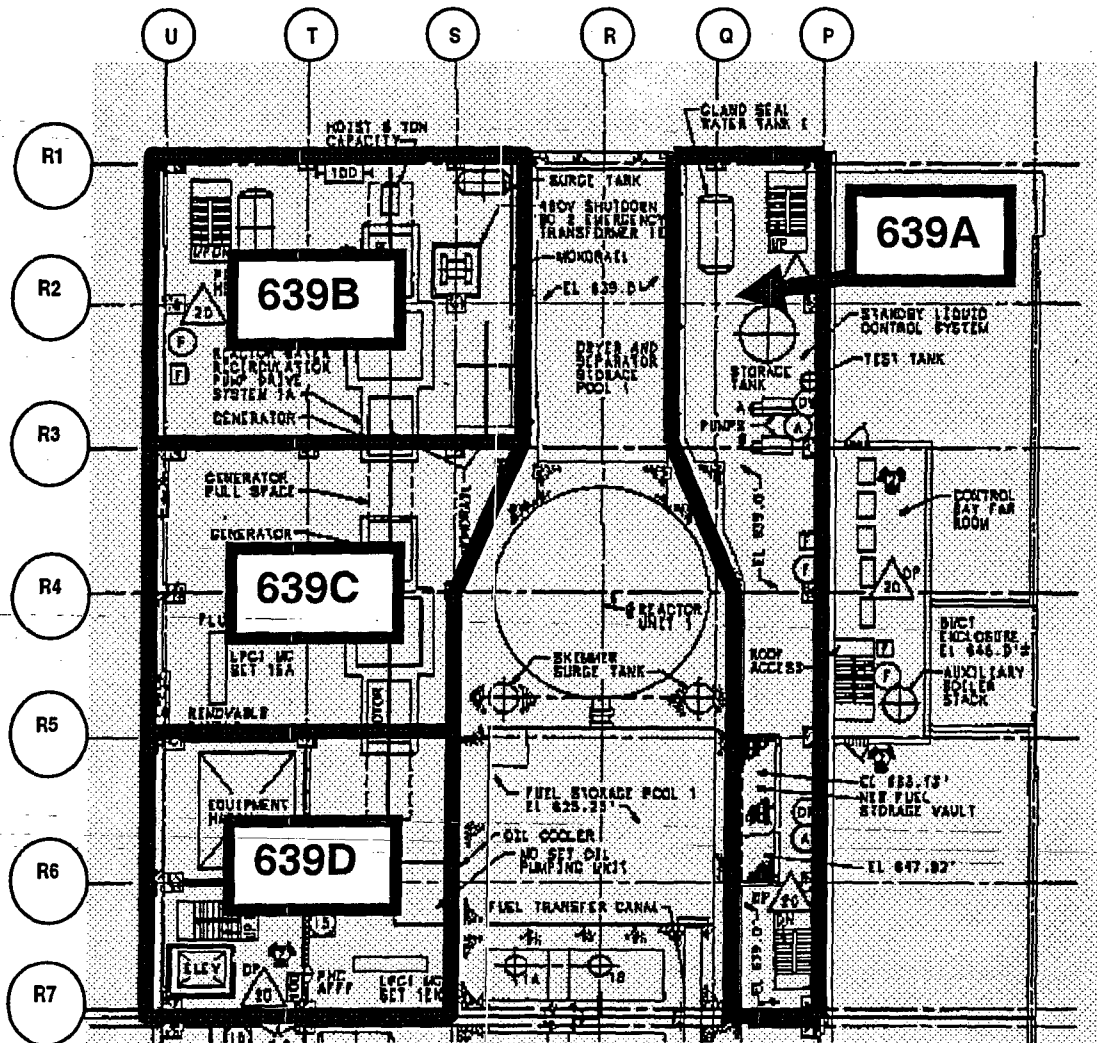


Figure 2-5: Reactor Building El. 639 Ft.

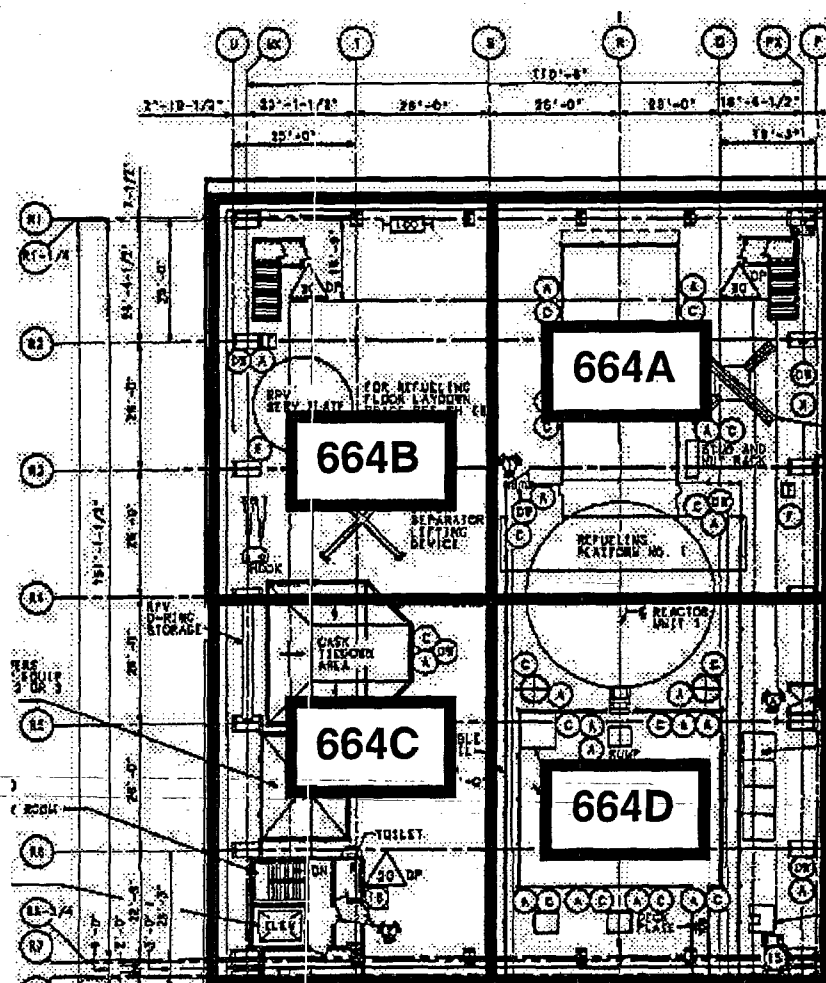


Figure 2-6: Reactor Building El. 664 Ft.

### 3. EVALUATION APPROACH AND BASES

Very few components of nuclear plant systems are unique to the nuclear facilities. Nuclear plant systems include equipment, piping, tubing, cable tray and conduit raceway systems, and many other plant features that are common components of conventional power plants and industrial facilities. Seismic experience data based methods have been developed to address seismic issues associated with the adequate performance of these equipment and commodities not designed, procured and installed to current nuclear seismic criteria. By reviewing the performance of the database facilities that contain equipment similar to that found in nuclear plants, conclusions can be drawn about the performance of nuclear plant equipment during and after earthquake events.

Extensive work has been performed documenting the performance of power plant equipment performance and the common sources of seismic damage to equipment and piping. In general, equipment, piping and tubing systems in the seismic experience database have performed very well in earthquakes, even though they were typically designed for deadweight and operating loads only, with little or no consideration for seismic loads. Performance of piping and equipment in past strong-motion earthquakes are summarized in References 7-6 and 7-7, respectively. Earthquake experience-based methods, backed by analytical-based evaluation acceptance criteria, provide the bases for the seismic-induced II/I spray hazards program at BFN-1.

The evaluation criteria for seismic-induced II/I spray hazards at BFN-1 consist of in-plant screening criteria and outlier evaluation criteria. The in-plant screening criteria focus on identification of piping and fluid pressure boundary system attributes that are known to be potential seismic hazards, as evidenced by past strong-motion earthquakes. Factors of safety for the in-plant screening assessments are set to ensure that components accepted by the screening criteria are seismically rugged. The in-plant screening criteria are discussed in detail in Section 3.1 below.

The outlier evaluation criteria are for further, more detailed analysis of configurations that do not pass the in-plant screening criteria, identified as potential outliers during the screening walkdowns. Evaluation acceptance criteria are discussed in Section 3.2.

### 3.1 In-Plant Screening Walkdown

Various design attributes of the as-installed scope of piping and tubing, and associated supports were reviewed and evaluated by trained Walkdown Teams to ensure that BFN-1 installations are representative of acceptable experience database design practices and that components are free of known seismic vulnerabilities. Earthquake experience has identified certain conditions that have resulted in failure of piping and tubing systems and components. The conditions evaluated in the screening walkdown reviews included the following:

- Piping, Pipe Support and Equipment Design Attributes
- Seismic Anchor Movement Issues
- Proximity and Falling Interaction Issues

The above design attributes and conditions are briefly discussed below.

#### 3.1.1 Piping, Pipe Support and Equipment Design Attributes

The Walkdown Teams reviewed the piping and tubing systems, and associated supports to ensure that the design attributes and conditions are consistent with good design and industry standard practices. The systems were also screened to ensure that they are free from known seismic vulnerabilities identified from earthquake experience data. These design attributes include:

- Piping with dead weight support spacing significantly in excess of the B31.1 suggested spans, or tubing with excessive sagging.
- Pipe supports that exhibit marginal capacities, prone to fatigue failures and/or non-ductile behavior.
- Heavy, unsupported, in-line components.
- Piping constructed of non-ductile materials such as cast iron or PVC.
- Non-standard fittings or unusual attachments that could cause excessive localized stresses.
- Presence of severe corrosion in piping and associated supports.

Screening criteria requirements for support adequacy include evaluation for a minimum dead load factor of safety of 2.0 using design allowable loads. Generic evaluations of pipe hanger hardware are used to establish screening charts which include the 2.0 load factor, based on dead load from maximum B31.1 piping spans. Factored capacities based on manufacturers' suggested values are used for the development of the screening charts for typical standard pipe hanger components such as rod and clevis pin, beam attachments, pipe clamps and U-bolts. Similar factor is used to develop reduced screening capacities for other support components such as welds, expansion anchor bolts and cast-in-place anchors.

Rod-hung piping systems have in general performed well in past earthquakes. The best performers are rod hangers utilizing clevis and pin connections; those impose no excessive prying loads to anchors, or high ductility demands on the rods. Certain configurations of short, fixed-end rod hangers may be subject to failure due to low-cycle fatigue effects. This is due to high rotation strains at the rod ends. Rod hanger fatigue evaluations considered cyclic response to the design basis time history as seismic demand, and rod hanger seismic capacity based on rod hanger fatigue test ultimate mean values less one standard deviation on the number of cycles to failure.

Brittle materials such as cast iron or PVC have performed poorly in past earthquakes when subjected to significant deformations. Cast iron pipe component failures included fracture of threaded fittings such as such at tees and elbows. Similarly, certain types of mechanical fittings such as victaulic coupling, compression flange or bell and spigot joint may lose pressure boundary integrity when subject to seismic-imposed deformations, especially when the as-installed piping configuration is flexible. Mechanical pipe fitting failures can also occur at the discontinuities in piping system global stiffness.

Cases of corroded piping failures have been noted in past earthquakes. The predominant failure mode observed consists of cracking and leaking at location where a significant decrease in wall thickness had occurred due to excessive corrosion. Failures have also occurred where corrosion-cracked piping had been previously weld repaired. Corrosion in piping can be detected by discoloration, paint chipping, or leakage in affected areas.

### 3.1.2 Seismic Anchor Movement Issues

Seismic anchor movement induced failures have been the most common cause of loss of piping system pressure boundary integrity in past major earthquakes. The seismic experience database includes instances of seismic damage to piping, tubing and supports that were directly attributed to excessive movement of terminal end equipment, differential movement between supports in adjacent buildings, and excessive seismic movements imposed on branch lines by flexible headers.

Anchorage of terminal equipment such as pumps, tanks, heat exchangers and others are reviewed for adequacy to preclude damages to attached piping and tubing.

For piping spanning between two building structures, adequate flexibility must be provided to accommodate the postulated building differential movement. The imposed seismic displacement may be estimated as the absolute sum of the deflection of each separate structure. Building deflection estimates may be obtained from the building floor response analysis.

Small-bore piping that spans from flexibly-supported, large-bore piping headers to a rigid support point may be subject to severe differential displacement of anchor points. Small branch lines, pipe vents, taps and drains of flexible, rod-hung large-bore headers are especially vulnerable to this type of hazard and may potentially result in breach of pressure boundary integrity. These configurations may be conservatively evaluated by uncoupled response approximations. An approximate conservative deflection estimate for large-bore piping can be obtained by considering first mode response of an equivalent simple beam span and applicable floor response spectra. This deflection can then be imposed to the small-bore branch line as seismic anchor movement to verify adequate piping flexibility based on a stress limit not to exceed  $2.4 S_h$ , where  $S_h$  is the basic material allowable stress at maximum temperature (Reference 7-8).

Thermal effects on piping systems under consideration are included in the evaluations when deemed necessary.

### 3.1.3 Proximity Interaction Issues

Proximity-related pipe-to-pipe interactions (impact) have not been a significant contributor leading to fluid spray sources for straight sections (welded or unjointed) of steel piping in past major earthquakes. However, piping constructed of non-ductile



materials such as cast iron or PVC may be more vulnerable to damage when subject to impact. Proximity-related seismic interaction to small pressure boundary components and appurtenances could potentially result in a fluid spray hazard source. Thermal effects on piping systems under consideration are included in the evaluations when deemed necessary.

#### **3.1.4 In-Plant Screening Tools**

A consolidated set of in-plant screening tools developed for use in the walkdown evaluations of potential seismic II/I spray hazards at BFN-1 is contained in Reference 7-9. This calculation includes clarification and summary of screening tools previously developed for similar II/I spray evaluations at BFN Units 2 and 3 (References 7-3 and 7-4). This also includes development of additional screening tools based on lessons learned and past experience. Some key screening data include:

- Standard support hardware component capacities
- Anchor bolt and weld capacities
- Fixed-end rod fatigue screening
- Piping deflection estimates for seismic anchor movement and proximity impact considerations
- Pipe flexibility screening for differential displacement considerations
- Deflection estimates for various plant features (cable trays, conduit, HVAC ducts) for proximity impact considerations
- Thermal deflection estimates
- Seismic demands at various elevations
- Upper bound displacement response spectrum
- Lower bound pipe frequency estimates

The in-plant screening tools are intended to help streamline the in-plant walkdown evaluation process, and to ensure consistency among the various Walkdown Teams performing the walkdown evaluations.

### **3.2 Further Analysis and Evaluation**

Conditions which do not meet the above in-plant screening guidelines or which were judged by the Walkdown Team members to require further reviews are documented as "Potential Outliers". Acceptance criteria for further analysis and evaluation of potential

outliers are contained in TVA Design Criteria BFN-50-C-7306 (Reference 7-2), and are summarized in the following sections. Seismic demand is based on 5% damped building floor response spectra derived from the Design Basis Earthquake (DBE) response analysis for both horizontal and vertical earthquake components. Realistic effects of non-linear behavior due to design features and phenomena such as proximity impact with other plant features, interferences and small clearances to stiff structures, geometric restoring forces, wall penetration sealants, and support ductile behavior are considered in the analysis as appropriate.

### 3.2.1 Equipment Anchorage Acceptance Criteria

Unanchored, unrestrained, marginally or inadequately anchored equipment components identified as potential outliers are subject to further evaluations. Anchorage capacities are based on those provided in Appendix C of the Generic Implementation Procedure (GIP) for Seismic Verification of Nuclear Plant Equipment (Reference 7-10) with appropriate reduction factors as applicable. Piping and tubing attached to equipment components with flexible support systems, such as vibration isolators, are evaluated for seismic anchor movement.

### 3.2.2 Pipe Support Acceptance Criteria

Pipe support anchorage loads are verified against capacities as provided in Appendix C of the GIP (Reference 7-10). Support components that may exhibit non-ductile behavior are accepted based the following stress allowables:

Flexural and tensile stresses:	lesser of $0.7 S_u$ and $1.2 S_y$
Shear stresses:	lesser of $0.42 S_u$ and $0.72 S_y$
Bolt stresses:	greater of $0.7 S_u$ and minimum specified $S_y$

Where,  $S_u$  is the material's ultimate strength  
 $S_y$  is the material's yield strength

When test data are available, acceptable loads based on test data consider mean less one standard deviation capacity.

Pipe supports not meeting the above criteria may be accepted if adjacent supports and the resulting pipe span can resist dead loads with a factor of safety of 2.0. In-plant

considerations regarding other consequences of support failure such as falling and excessive deflection are made when using this provision.

### 3.2.3 Pipe Stress Acceptance Criteria

Pipe stresses induced by the combination of normal operating loads (dead load and pressure) and seismic loads (DBE inertial loads and DBE seismic anchor movements) are limited to  $2.0 S_y$ .

In most cases the pressure term is not significant. The thermal stress term is not included in the criteria because majority of the Class II piping systems and components under consideration have insignificant thermal gradients, or are typically supported by rod hangers. Thermal stresses in flexibly supported piping are insignificant. The thermal stress is included in the above load combination if significant, as in the case of rigid support systems or large temperature ranges.

## **4. IN-PLANT SCREENING EVALUATION**

In-plant screening walkdown evaluations for seismic II/I spray hazards were performed on an area-by-area basis in accordance with Walkdown Instruction WI-BFN-0-CEB-06 (Reference 7-1) for the 27 designated plant areas listed in Table 2-1. Safety-related systems and components (seismic Class I) were considered as spray targets; and non-safety-related systems and components (non-seismic, Class II) were the spray sources. Other systems that have non-safety-related primary functions but have some safety-related components were conservatively regarded as being either sources or targets. Seismic boundaries for Unit 1 systems are defined in Reference 7-5.

Screening evaluations focused on certain key attributes of the non-seismic, Class II piping and fluid pressure boundary systems that may potentially pose as spray hazards to surrounding seismic Class I systems and components in the event of an earthquake. Screening tools such as seismic deflection estimates and charts for various plant features, pipe flexibility and seismic anchor movement evaluation charts, support and anchorage capacity screening charts, and others, were developed based on the qualification acceptance criteria contained in TVA Design Criteria BFN-50-C-7306 (Reference 7-2). Guidelines for in-plant screening evaluation are discussed in Section 3.1 of this report. In-plant screening tools for seismic II/I spray evaluation walkdowns are documented in Reference 7-9.

Results of in-plant screening walkdown evaluations for seismic II/I spray hazards in each of the 27 designated plant areas in Unit 1 Reactor Building are documented in the respective walkdown data package (WDP). A listing of the walkdown data packages with unique identifier number can be found in Appendix A of this report.

### **4.1 Screening Evaluation Results**

Certain configurations identified during the in-plant screening walkdowns as not meeting the screening criteria were documented in the Potential Outlier Sheet (POS) as potential outliers. In general, typical outlier conditions identified by the Walkdown Teams for the seismic-induced II/I spray hazards program at BFN-1 included one or more of the following general category of seismic concerns:

- Piping overspans
- Seismic anchor movements
- Branch line flexibility
- Inadequate support capacity or load path
- Piping deficiencies (bent pipes, leaking flange, etc.)
- Support hardware deficiencies (missing or detached components, etc.)
- Equipment anchorage issues or unanchored equipment
- Anchor bolt capacity issues (bolt spacing and edge distance violations, etc.)
- Heavy in-line components
- Large eccentric mass (valves) on small diameter lines
- Unusual or non-standard fittings
- Excessive corrosion
- Non-ductile materials
- Rod hanger fatigue concerns

Complete listing and description of all identified potential outliers, by plant areas and elevations, are presented in Tables 4-1 to 4-6.

## **4.2 Summary of Potential Outliers**

A total of one hundred seventy-nine (179) potential outliers were identified under BFN-1 seismic II/I spray evaluation program and are summarized by building elevation in Table 4-7. Distribution of potential outliers by categories is presented in Table 4-8.

Detailed description of the potential outlier conditions, including as-built data, sketches and/or photos are documented in the corresponding walkdown data packages (WDP's) for the respective plant areas. A listing of all walkdown data packages generated under BFN-1 seismic II/I spray evaluation program is provided in Appendix A.

**TABLE 4-1**

**Potential Outliers – RB Elev. 519' & El. 541'-6"**  
**(Plant Areas NWQUAD, NEQUAD, SWQUAD, SEQUAD, HPCI & TORUS)**

Potential Outlier (POS Number)	Description of Potential Outlier
NWQUAD-001	2"Ø Aux. Boiler (to PSC) line has 15' span
NWQUAD-002	Two angle supports are hanging from the 1"Ø Aux. Boiler line (i.e. Pipe is supporting the support).
NWQUAD-003	Line configuration results in excessive eccentricity for air-operated valve on 1"Ø RCIC Line
NWQUAD-004	2"Ø PSC/PSC Overflow lines have overspan conditions (14' spans).
NEQUAD-001	3/4"Ø RCW lines to CRD Pumps 1A & 1B are copper tubing with sweated fittings, prone to failure.
NEQUAD-002	3/4"Ø line to CRD Pumps 1A & 1B is completely unsupported and line is sagging.
NEQUAD-003	3"Ø Rad Waste Drain line has 15' span
NEQUAD-004	1"Ø Condensate S&S line has several overspan conditions.
NEQUAD-005	2½"Ø CRD return line with 12'-6" span has support with questionable capacity. (Long cantilever angle section)
NEQUAD-006	1"Ø Condensate S&S line has 12'-10" span with concentrated load from 4'-4" of ¾"Ø line.
NEQUAD-007	1"Ø Equipment Drain line from RHR system has 23' span
NEQUAD-008	4"Ø DW line ends at elbow after valve 1-2-1140. Existing configuration is either work-in-progress or is out-of-service. Line (as-is) is a cantilever with large mass (valve) at end.
NEQUAD-009	MOV operator on the 2½"Ø CRD line exceeds weight & height limits of SUG GIP screening guidelines.

**TABLE 4-1 (cont'd)**

**Potential Outliers – RB Elev. 519' & El. 541'-6"**  
**(Plant Areas NWQUAD, NEQUAD, SWQUAD, SEQUAD, HPCI & TORUS)**

Potential Outlier (POS Number)	Description of Potential Outlier
HPCI-001	1"ø Aux. Boiler line has 12' span
TORUS-001	Bolt missing on flange connection of 2"ø Aux. Boiler line, near connection to RHR line.
TORUS-002	Rod hanger strap missing on 1"ø Aux. Boiler line. This results in about 14' span.
TORUS-003	2"ø Aux. Boiler line has 3 consecutive spans (1 @ 13.5' & 2 @ 13').
TORUS-004	2"ø SS Rad Waste Line has 12'-1" span
TORUS-005	1"ø Aux Boiler line has 9'-8" span
TORUS-006	4"ø CS Rad Waste line has 26' span
TORUS-007	2"ø SS Rad Waste line has 17'-2" span
TORUS-008	4"ø CS Rad Waste line has 15'-3" span
TORUS-009	4"ø CS Rad Waste line has 15'-2" span
TORUS-010	4"ø CS Rad Waste line has 16' span
TORUS-011	2"ø SS Rad Waste line has 11'-5" and 13'-1" spans.
TORUS-012	3"ø CS Rad Waste has 13'-4" and 13'-8" spans
TORUS-013	2"ø CS RCIS line has 12' and 15'-3" spans.
TORUS-014	Two 1"ø socket-welded Equipment Drain lines have 10' spans.
<b>Total no. of Potential Outliers = 28</b>	

Note: No outliers were identified in plant areas SWQUAD and SEQUAD.

**TABLE 4-2**

**Potential Outliers – RB Elev. 565'**  
**(Plant Areas 565A, 565B, 565C, 565D & STNL)**

Potential Outlier (POS Number)	Description of Potential Outlier
565A-001	1"Ø branch line off 18"Ø RCW header has inadequate flexibility concern.
565A-002	1"Ø Aux. Boiler line has consecutive overspans of 13'-9" and 11'-6". Overspan also noted at the bypass valve loop.
565A-003	Edge distance violations noted on the building heater support anchor bolts.
565A-004	1"Ø DW line has an overspan of 11'.
565A-005	4"Ø Floor Drain lines have several overspan conditions involving T-branch configurations.
565A-006	2"Ø RCW line has an overspan of 18'-6".
565A-007	Two 1"Ø Building Heat lines both have overspan conditions (11'). These 2 lines are continuation of those identified in POS 565A-009 and POS 565B-014.
565A-008	2-1/2"Ø insulated Potable Water line has 18' span.
565A-009	Two 1"Ø Building Heat lines both have overspan conditions (9'). These are the same building heat lines identified in POS 565A-007 and POS 565B-014.
565A-010	2-1/2"Ø and 4"Ø Potable Water lines with visible rust at the threaded joints. Lines appear to be galvanized iron pipes.
565A-011	Disengaged rod on a 2-1/2"Ø Potable Water line.
565B-001	2"Ø Floor Drain line has multiple overspan conditions (15'-6" and 11'-6" spans). Also, a rod hanger is detached.
565B-002	Edge distance violations noted on the building heater support anchor bolts. Also, attached 1"Ø and 3/4"Ø lines have SAM-related concerns due to rod-hung heater.



**TABLE 4-2 (cont'd)**  
**Potential Outliers – RB Elev. 565'**  
**(Plant Areas 565A, 565B, 565C, 565D & STNL)**

Potential Outlier (POS Number)	Description of Potential Outlier
565B-003	Base plate anchor bolts for various RCW lines have bolt spacing violations with adjacent supports (total of 4 base plates).
565B-004	2"Ø insulated Potable Water line has an overspan of 22'.
565B-005	6"Ø Floor Drain line has an overspan of 20'-4".
565B-006	2"Ø DW line has an overspan of 13'-9".
565B-007	1"Ø Building Heat line has overspan condition involving a T-configuration.
565B-008	1"Ø Building Heat line has overspan condition involving a T-configuration.
565B-009	4"Ø Floor Drain line has overspan condition involving a T-configuration.
565B-010	2"Ø Floor Drain line has overspan condition involving a T-configuration.
565B-011	1"Ø and 1-1/2"Ø Building heat lines have overspan conditions in 2 places involving T-configuration.
565B-012	2"Ø Floor Drain line has overspan condition (15' span).
565B-013	2"Ø Potable Water line has 3 consecutive overspans (14'-9", 10'-6" and 13'-6").
565B-014	Two 1"Ø Building Heat lines have multiple overspan conditions (ranging from 8' to 10'-6"). A span of 17'-10" exists due to a detached rod hanger support. Some lines run in series (top and bottom) and are supported by common rod hanger.
565B-015	6"Ø Floor Drain line has 20'-4" span.
565B-016	4"Ø Floor Drain line has 19' span.
565B-017	1"Ø & 1-1/2"Ø Building Heat lines have two overspan conditions involving a T-branch configuration.

**TABLE 4-2 (cont'd)**  
**Potential Outliers – RB Elev. 565'**  
**(Plant Areas 565A, 565B, 565C, 565D & STNL)**

Potential Outlier (POS Number)	Description of Potential Outlier
565B-018	Vertical capacity of the ceiling-mounted bracket support on top of the 2-1/2"Ø Fire Protection riser branch line is questionable.
565B-019	Overspan on the 8"Ø Fire Protection header (22' span).
565B-020	Significant rust condition noted at the tee connection between the 8"Ø Fire Protection header and the 2-1/2"Ø branch line.
565C-001	2"Ø Condensate line has 12' span.
565C-002	8"Ø Condensate line has 20'-4" span.
565C-003	4"Ø Floor Drain line has 24' span.
565C-004	4"Ø DW line and two other lines are supported by a cantilevered Unistrut support.
565C-005	4"Ø DW line has 20'-9" span.
565C-006	1-1/2"Ø DW line has 12'-6" span.
565C-007	1"Ø unidentified line has 9' span.
565C-008	2"Ø Floor Drain line has 19' span.
565C-009	Pipe clamp is missing on a wall-mounted Unistrut pipe support for 3/4"Ø Rad Waste line.
565C-010	Edge distance violations noted on the building heater support anchor bolts. Also, attached piping to heater have flexibility concerns.
565C-011	2"Ø Raw Water Cooling line has 14' span.
565C-012	2"Ø Raw Water Cooling line has 14'-6" span (gang-supported to a 2"Ø N <sub>2</sub> Makeup line above it). In addition, a 1"Ø line (about 8' tributary span) is hanging off the RCW line via spacer supports.

**TABLE 4-2 (cont'd)**

**Potential Outliers – RB Elev. 565'  
(Plant Areas 565A, 565B, 565C, 565D & STNL)**

Potential Outlier (POS Number)	Description of Potential Outlier
565C-013	1-1/2"Ø Fire Protection branch line has 15' span.
565C-014	Missing hardware on a trapeze rod hanger support for 8"Ø Fire Protection header, resulting into piping overspan.
565D-001	4"Ø DW line has 17'-6" span.
565D-002	4"Ø Floor Drain line has 17'-5" and 18'-4" spans.
565D-003	4"Ø Floor Drain line rod hanger is detached.
565D-004	Vertical capacity of the wall-mounted bracket support on top of the 2-1/2"Ø Fire Protection riser branch line is questionable.
565D-005	4"Ø Fire Protection line has 17'-6" and 16' spans.
STNL-001	1"Ø RCIC/ Rad Waste line has 10'-2" and 10'-0" spans.
STNL-002	1"Ø Reactor Feedwater line has 12'-3" span.
<b>Total no. of Potential Outliers = 52</b>	

**TABLE 4-3**

**Potential Outliers – RB Elev. 593’  
(Plant Areas 593A, 593B, 593C & 593D)**

Potential Outlier (POS Number)	Description of Potential Outlier
593A-001	Two 6"ø Fuel Pool Cooling lines have about 22' spans.
593A-002	1"ø uninsulated Air Conditioning line has multiple overspan conditions (max. of 16'-9" span).
593A-003	Two 1"ø insulated Air Conditioning lines have several overspan conditions.
593A-004	3"ø Floor Drain has 2 overspan conditions (15' & 20'-6" spans).
593A-005	4"ø Floor Drain line has 15'-9" span.
593A-006	Two ½ "ø RBCCW socket-welded pipes have 11'-5" and 10'-10" spans.
593A-007	Line is leaking at threaded bronze hand valve near T-connection of ½ "ø tubing to 12"ø Raw Cooling Water header. Also, the ½"ø line has 13'-4" span.
593A-008	Two 3"ø insulated Building Heat lines have 2 consecutive overspans (18' and 20'-3").
593A-009	1"ø insulated Demin. Water line has 2 consecutive overspans (12' and 11'-4").
593A-010	Two 2"ø PSC/PSC Overflow lines have overspans (max. of 14'-4").
593B-001	1½ "ø, 2"ø and 3"ø Building Heat lines have multiple overspan conditions.
593B-002	1"ø Equipment Drain line has a detached rod hanger resulting in overspan condition of 17'-6". Also, even with the detached rod hanger in place, span is 11'-10".
593B-003	¾"ø Building Heat lines have 2 consecutive overspan conditions (max. of 9'-8" span).

**TABLE 4-3 (cont'd)**  
**Potential Outliers – RB Elev. 593'**  
**(Plant Areas 593A, 593B, 593C & 593D)**

Potential Outlier (POS Number)	Description of Potential Outlier
593B-004	½"Ø RBCCW pipe has multiple overspans (spans of 6'-6", 8'-2", 10' & 10'-8") and is sagging in some areas (appear to have been stepped on causing permanent deformations).
593B-005	3"Ø Floor Drain line has 16' span.
593B-006	Branch line flexibility concern on ¾"Ø and ½"Ø Building Heat lines near the rod-hung building heater.
593B-007	2"Ø RBCCW line has a detached rod hanger resulting in overspan condition of 14'-10".
593B-008	4"Ø Floor Drain line has multiple overspan conditions involving T-configurations.
593B-009	2 - 2"Ø PSC/PSC Overflow lines have overspans (max. of 11'-10").
593B-010	½"Ø Primary Containment Isolation line has 11'-9" span.
593C-001	4"Ø Floor Drain line has 20'-1" span.
593C-002	2"Ø RWCU line has 14' span.
593C-003	Edge distance violations noted on the building heater support anchor bolts.
593C-004	4"Ø Floor Drain line has an overspan condition involving T-configurations.
593C-005	½"Ø RBCCW line has typical span of 10'. Another ½"Ø RBCCW line is gang-supported from the above line at 5' span, typical.
593C-006	Branch line flexibility concern on ¾"Ø and ½"Ø Building Heat lines near the rod-hung building heater.
593D-001	2"Ø Condensate S&S line has 20'-5" span.
593D-002	3"Ø Floor Drain line has 17'-4" span.
593D-003	2"Ø RBCCW line has 13'-10" span.

**TABLE 4-3 (cont'd)**

**Potential Outliers – RB Elev. 593'  
(Plant Areas 593A, 593B, 593C & 593D)**

Potential Outlier (POS Number)	Description of Potential Outlier
593D-004	3"Ø Raw Cooling Water line has 17'-5" span.
593D-005	6"Ø Fuel Pool Cooling lines have 20' spans.
593D-006	Potential rod fatigue concerns on multiple short fixed end rods supporting 4"Ø Floor Drain line.
Total no. of Potential Outliers = 32	

**TABLE 4-4**

**Potential Outliers – RB Elev. 621'-3"**  
**(Plant Areas 621A, 621B, 621C & 621D)**

Potential Outlier (POS Number)	Description of Potential Outlier
621A-001	3/4"Ø Gland Seal line has multiple overspan conditions.
621A-002	4"Ø Equipment Drain has 17' span.
621A-003	3"Ø, 2"Ø & 1"Ø Standby Liquid Control (SLC) flush lines empty into unrestrained 55 gal. plastic drum. Drum may overturn and spill contents.
621A-004	Bracket support for eyewash station is mounted to block wall with 1/4"Ø toggle bolts. Verify support adequacy.
621A-005	1"Ø SLC line has a detached rod hanger resulting in overspan condition of 28'-10". Detached rod hanger is near midspan.
621A-006	Two 1"Ø Air Conditioning lines have several overspan conditions (max. of 10'-6" span).
621B-001	Flexibility (SAM-related) concern on 1"Ø Building Heat lines near the rod-hung building heater.
621B-002	Excessive corrosion/rust on 1"Ø & 3/4"Ø Building Heat lines near the building heater.
621B-003	1½"Ø Building Heat line has overspan condition, with additional load from 1"Ø branch line at T-intersection.
621B-004	1½"Ø Building Heat line has several overspan conditions involving T-configurations.
621B-005	Two 1"Ø Building Heat lines have several overspan conditions (max. of 10' span).
621B-006	4"Ø Floor Drain line has multiple overspan conditions involving T-configurations.
621B-007	6"Ø Condensate S&S line has 20' span.

**TABLE 4-4 (cont'd)**

**Potential Outliers – RB Elev. 621'-3"**  
**(Plant Areas 621A, 621B, 621C & 621D)**

Potential Outlier (POS Number)	Description of Potential Outlier
621C-001	4"Ø Condensate S&S line has 15'-6" span.
621C-002	3"Ø Demin. Water line has 17'-6" span.
621C-003	RWCU pumps 1A & 1B appeared to be inadequately supported. Pumps are in-line supported on 1½"Ø line with large eccentricities. Also, there are potential SAM-related flexibility concerns on the ¾"Ø lines.
621C-004	Flexibility (SAM-related) concern on 1"Ø & ¾"Ø Building Heat lines near rod-hung building heater.
621C-005	1½"Ø Building Heat line has multiple overspan conditions (max. of 13' span)
621C-006	1"Ø Building Heat line has multiple overspan conditions (max. of 13' span)
621C-007	2½"Ø air-operated valve 1-FCV-69-78 has large eccentric mass.
621D-001	Flexibility (SAM-related) concern on 1¼"Ø Fire Protection branch off the 3"Ø riser.
621D-002	Two 1"Ø Air Conditioning lines have several overspan conditions (typ. span of 11').
621D-003	2"Ø Fuel Pool Overflow line has 3 consecutive overspans (max. span of 13'-6").
<b>Total no. of Potential Outliers = 23</b>	



**TABLE 4-5**

**Potential Outliers – RB Elev. 639'**  
**(Plant Areas 639A, 639B, 639C & 639D)**

Potential Outlier (POS Number)	Description of Potential Outlier
639A-001	1"Ø GS line has 18'-4" span and wall brackets lack U-bolts (line can slide off of supports).
639A-002	1"Ø GS line has 12' span.
639A-003	3"Ø GS / Condensate S&S line has 2 consecutive overspans (19' and 15'). Also, 2"Ø DW line has an overspan of 19'.
639A-004	Anchorage appears marginal for GS storage tank.
639A-005	1"Ø DW line has 9'-6" span. Line is cut and capped, sagging noted.
639A-006	2"Ø FP Overflow line has 14'-7" span.
639A-007	3"Ø Floor Drain line has 20' span.
639A-008	1"Ø Building Heat line at interface with the unit area heater (including union) is rusted.
639A-009	Two 1"Ø Building Heat lines have 12' span.
639A-010	Area heater of Building Heat system is rod hung and may cause SAM problems for the connecting 1"Ø & 3/4"Ø lines.
639A-011	3/4"Ø FP Overflow drain line has SAM-related concern due to the E-W movement of 6"Ø Rx Head Exhaust line. Note that the pipe stanchion support for the 6"Ø line is free to slide in the E-W direction.
639B-001	4"Ø Floor Drain line has 18'-6" span.
639B-002	Lube oil cooler has marginal tack weld attachment to its support saddle.
639B-003	Building heat lines are rod hung and have several overspan conditions. Lines terminate at rod hung area heaters.
639B-004	Seismic movement of a 3"Ø FP riser imposes SAM to 1-1/2"Ø branch line (to hose station).

**TABLE 4-5 (cont'd)**

**Potential Outliers – RB Elev. 639'  
(Plant Areas 639A, 639B, 639C & 639D)**

Potential Outlier (POS Number)	Description of Potential Outlier
639B-005	1"Ø to 3"Ø Condensate S&S line has multiple overspan conditions and non-standard reducer fittings are used.
639B-006	3"Ø Floor Drain line has 23' span.
639C-001	Pipe flange is leaking on short riser of 3"Ø Condensate S&S line.
639C-002	1"Ø to 3"Ø Condensate S&S line has multiple overspan conditions and non-standard reducer fittings are used.
639C-003	4"Ø RCW line has 2 overspan conditions – 1 @ 24' and 1 @ 16' that is piggy back from the 8"Ø RCW line.
639C-004	6"Ø Rx Head Exhaust line has stanchion support that is not positively anchored.
639C-005	2"Ø DW line has 3 consecutive overspans of 16'-6", 13', and 14'.
639C-006	Building heat lines are rod hung and have several overspan conditions. Lines terminate at rod hung area heaters (SAM-related issue).
639C-007	3"Ø Floor Drain has 15'-6" span.
639C-008	3/4"Ø FP Overflow line has SAM-related concern due to movement of the 6"Ø Rx Head Exhaust line with the stanchion support that is not positively anchored (see 639C-004).
639D-001	Lube oil cooler has marginal tack weld attachment to its support saddle.
639D-002	1"Ø Condensate S&S line has multiple overspan conditions.
639D-003	2"Ø DW line has multiple overspan conditions, and 1"Ø branch has SAM concerns at 2"Ø riser.

**TABLE 4-5 (cont'd)**

**Potential Outliers – RB Elev. 639'  
(Plant Areas 639A, 639B, 639C & 639D)**

Potential Outlier (POS Number)	Description of Potential Outlier
639D-004	2"ø Potable Water line has 21'-6" span.
639D-005	Terminal equipment (Lube Oil Cooler) for RCW and lube oil piping has marginal anchorage.
Total no. of Potential Outliers = 30	

**TABLE 4-6**  
**Potential Outliers – RB Elev. 664'**  
**(Plant Areas 664A, 664B, 664C & 664D)**

Potential Outlier (POS Number)	Description of Potential Outlier
664A-001	Three (3) 1"Ø Building Heat lines have 13' spans
664A-002	3"Ø unidentified line has 13' span
664A-003	Verify seismic adequacy of the support member and weld attachment of typical building unit heater in the area. Building heater is located in col. lines R1-S and R2-Px.
664B-001	8"Ø Condensate S & S line has 26' span
664B-002	Overspan on both 1"Ø insulated Building Heat supply and return lines off the area heater located in col. lines R4-Ux. Also, verify seismic adequacy of the support member and weld attachment of typical building unit heater in the area. Building heaters are located in col. lines R2-Ux and R4-Ux.
664C-001	8"Ø Condensate S & S line has 26' span
664C-002	1"Ø Building Heat line has 11' span
664C-003	2"Ø Drain line has 15'-6" span
664C-004	Verify seismic adequacy of the support member and weld attachment of typical building unit heater in the area. Building heater is located in col. lines R6-Ux.
664C-005	Hot water heater is not anchored. Tank may slide and cause attached piping to break (3/4"Ø water heater supply lines, System 029)
664D-001	Three (3) 1"Ø Building Heat lines have 13' spans
664D-002	3"Ø Unidentified line has 13' span
664D-003	Three (3) 1"Ø Building Heat lines have 17'-6", 16'-2", and 14'-2" spans

**TABLE 4-6 (cont'd)**

**Potential Outliers – RB Elev. 664'  
(Plant Areas 664A, 664B, 664C & 664D)**

Potential Outlier (POS Number)	Description of Potential Outlier
664D-004	Verify seismic adequacy of the support member and weld attachment of typical building unit heater in the area. Building heaters are located in col. lines R4-Px and R6-Px.
Total no. of Potential Outliers = 14	

**TABLE 4-7**  
**Summary of Potential Outliers for**  
**BFN-1 Seismic II/I Spray Evaluation Program**

<b>BFN-1 Reactor Building</b>	<b>Plant Area Designation</b>	<b>No. of Potential Outlier</b>
El. 519' & 541'-6"	NWQUAD, NEQUAD, SWQUAD, SEQUAD, HPCI, TORUS (TABLE 4-1)	28
El. 565'	565A, 565B, 565C, 565D, STNL (TABLE 4-2)	52
El. 593'	593A, 593B, 593C, 593D (TABLE 4-3)	32
El. 621'-3"	621A, 621B, 621C, 621D (TABLE 4-4)	23
El. 639'	639A, 639B, 639C, 639D (TABLE 4-5)	30
El. 664'	664A, 664B, 664C, 664D (TABLE 4-6)	14
		<b>179</b>

**TABLE 4-8**

**Distribution of Potential Outliers by Category for  
BFN-1 Seismic II/I Spray Evaluation Program**

General Outlier Category	Total No. of Outliers	Percentage Distribution
Piping overspans	125	63.5
Seismic anchor movements / Branch line flexibility	16	8.1
Inadequate support capacity or load path	14	7.1
Piping / Pipe support hardware deficiencies	13	6.6
Equipment anchorage / Unanchored equipment	8	4.1
Anchor bolt capacity	6	3.0
Heavy in-line components/Large eccentric masses	5	2.6
Unusual or non-standard fittings	4	2.0
Excessive corrosion	4	2.0
Non-ductile materials	1	0.5
Rod hanger fatigue	1	0.5
		100.0 %

## 5. POTENTIAL OUTLIER RESOLUTION

Potential outliers identified during the in-plant screening walkdowns, as documented in the respective Potential Outlier Sheet (POS) and tabulated in Tables 4-1 to 4-6, were further evaluated to the acceptance criteria of TVA Design Criteria BFN-50-C-7306 (Reference 7-2) for appropriate resolution. Further evaluations and bounding analyses of these potential outliers consisted of hand calculations using basic engineering mechanics techniques for simple configurations, and rigorous piping analyses using TPIPE computer program (Reference 7-11) for more complex piping configurations.

Results of further evaluations and analyses to resolve the identified potential outliers are presented in Tables 5-1 to 5-6 for the designated plant areas by building elevations. A listing of the calculation packages associated with further evaluations and bounding analyses of potential outliers identified under BFN-1 seismic II/I spray evaluation program is provided in Appendix B of this report.

For those outliers not meeting the acceptance criteria of TVA Design Criteria BFN-50-C-7306 (Reference 7-2), plant modifications are designed and implemented to resolve the outlier conditions. Discussions of the plant modifications including general maintenance and/or housekeeping items are presented in Chapter 6 of this report.



**TABLE 5-1 - POTENTIAL OUTLIER RESOLUTION SUMMARY - RB EL. 519' & 541'-6"****Plant Areas: NW-, NE-, SW- & SE-QUAD, HPCI, TORUS**

For Potential Outliers not acceptable per calculation, identify as: M – Support modifications; D – Hardware deficiencies; O – Others

POS No.	Brief Description of Condition	Outlier Evaluation by Calculation			M	D	O	Summary of Recommendations
		O K	Not OK	Calculation Number / Comments				
NWQUAD-001	2"ø Aux. Boiler (to PSC) line has 15' span	√		See CDQ1-999-2003-1412. Existing configuration is acceptable.	-	-	-	N/A
NWQUAD-002	Two angle supports are hanging from the 1"ø Aux. Boiler line. (i.e. Pipe is supporting the support)	√		Upon further review, the current observed conditions were due to the removal of a 3"ø check valve next to 1-SHV-71-565 which is located just above these supports and are within the same piping loop (pre-startup steam supply). Note that the 2 supports in question are DL only supports.	-	-	-	N/A
NWQUAD-003	Line configuration results in excessive eccentricity for air-operated valve on 1"ø RCIC Line	√		See CDQ1-071-2003-1136. Existing configuration is acceptable.	-	-	-	N/A
NWQUAD-004	2"ø PSC/PSC Overflow lines have overspan conditions (14' spans).	√		See CDQ1-999-2003-1412. Existing configuration is acceptable.	-	-	-	N/A
NEQUAD-001	3/4"ø RCW lines to CRD Pumps 1A & 1B are copper tubing with sweated fittings, prone to failure.	√		See CDQ1-024-2003-1135. Existing configuration is acceptable.	-	-	-	N/A

**TABLE 5-1 - POTENTIAL OUTLIER RESOLUTION SUMMARY - RB EL. 519' & 541'-6"****Plant Areas: NW-, NE-, SW- & SE-QUAD, HPCI, TORUS**

For Potential Outliers not acceptable per calculation, identify as: M – Support modifications; D – Hardware deficiencies; O – Others

POS No.	Brief Description of Condition	Outlier Evaluation by Calculation			M	D	O	Summary of Recommendations
		O K	Not OK	Calculation Number / Comments				
NEQUAD-002	3/4"Ø line to CRD Pumps 1A & 1B is completely unsupported and line is sagging.		√	The existing configuration is shown to be unacceptable with no support for the 3/4"Ø line (refer to CDQ1-085-2003-1405).	√			See CDQ1-085-2003-1693. Add new support to 3/4"Ø line.
NEQUAD-003	3"Ø Rad Waste Drain line has 15' span	√		See CDQ1-999-2003-1412. Existing configuration is acceptable.	-	-	-	N/A
NEQUAD-004	1"Ø Condensate S&S line has several overspan conditions.		√	Per CDQ1-999-2003-1412, the existing configurations of 8'-3" and the 9'-6" spans are acceptable. However, for the span involving a T-configuration, it is not acceptable.	√			See CDQ1-002-2003-1617. Add support near the T-intersection to reduce the dead load span to 7'-9".
NEQUAD-005	2½"Ø CRD return line with 12'-6" span has support with questionable capacity. (Long cantilever angle section)		√	Per CDQ1-085-2003-1197, the L2½ x 2½ x 3/16 section is overstressed with 27" long cantilever. The existing welds are adequate to resist the imposed cantilever moment.	√			See CDQ1-085-2003-1616. Install new 1/2"Ø expansion bolt near the end of cantilever angle section, or provide new support for the 2½"Ø CRD return line.
NEQUAD-006	1"Ø Condensate S&S line has 12'-10" span with concentrated load from 4'-4" of ¾"Ø line.	√		See CDQ1-999-2003-1412. Existing configuration is acceptable.	-	-	-	N/A
NEQUAD-007	1"Ø Equipment Drain line from RHR system has 23' span	√		See CDQ1-999-2003-1412. Existing configuration is acceptable.	-	-	-	N/A

**TABLE 5-1 - POTENTIAL OUTLIER RESOLUTION SUMMARY - RB EL. 519' & 541'-6"****Plant Areas: NW-, NE-, SW- & SE-QUAD, HPCI, TORUS**

For Potential Outliers not acceptable per calculation, identify as: M – Support modifications; D – Hardware deficiencies; O – Others

POS No.	Brief Description of Condition	Outlier Evaluation by Calculation			M	D	O	Summary of Recommendations
		O K	Not OK	Calculation Number / Comments				
NEQUAD-008	4"Ø DW line ends at elbow after valve 1-2-1140 line is work-in-progress or is out-of-service. Line (as-is) is a cantilever with large mass (valve) at end.	√		See CDQ1-002-2003-1413. Existing configuration is acceptable.	-	-	-	N/A
NEQUAD-009	MOV operator on the 2½"Ø CRD line exceeds weight & height limits of SQUG GIP screening guidelines.	√		See CDQ1-085-2003-1415. Existing configuration is acceptable.	-	-	-	N/A
HPCI-001	1"Ø Aux. Boiler line has 12' span	√		See CDQ1-999-2003-1412. Existing configuration is acceptable.	-	-	-	N/A
TORUS-001	Bolt missing on flange connection of 2"Ø Aux. Boiler line, near connection to RHR line.		√	The existing configuration is not acceptable with spray hazard. Missing bolt should be replaced.		√		Issue maintenance request or work order to replace the missing bolt on the flange connection.
TORUS-002	Rod hanger strap missing on 1"Ø Aux. Boiler line. This results in about 14' span.		√	The existing configuration is not acceptable with 14' span.	√			See CDQ1-012-2003-1618. Replace missing strap.
TORUS-003	2"Ø Aux. Boiler line has 3 consecutive spans (1 @ 13.5' and 2 @ 13').	√		See CDQ1-999-2003-1412. Existing configuration is acceptable.	-	-	-	N/A
TORUS-004	2"Ø SS Rad Waste Line has 12'-1" span	√		See CDQ1-999-2003-1412. Existing config. is acceptable.	-	-	-	N/A

**TABLE 5-1 - POTENTIAL OUTLIER RESOLUTION SUMMARY - RB EL. 519' & 541'-6"****Plant Areas: NW-, NE-, SW- & SE-QUAD, HPCI, TORUS**

For Potential Outliers not acceptable per calculation, identify as: M – Support modifications; D – Hardware deficiencies; O – Others

POS No.	Brief Description of Condition	Outlier Evaluation by Calculation			M	D	O	Summary of Recommendations
		O K	Not OK	Calculation Number / Comments				
TORUS-005	1"ø Aux Boiler line has 9'-8" span	√		See CDQ1-999-2003-1412. Existing configuration is acceptable.	-	-	-	N/A
TORUS-006	4"ø CS Rad Waste line has 26' span	√		See CDQ1-999-2003-1412. Existing configuration is acceptable.	-	-	-	N/A
TORUS-007	2"ø SS Rad Waste line has 17'-2" span	√		See CDQ1-999-2003-1412. Existing configuration is acceptable.	-	-	-	N/A
TORUS-008	4"ø CS Rad Waste line has 15'-3" span	√		See CDQ1-999-2003-1412. Existing configuration is acceptable.	-	-	-	N/A
TORUS-009	4"ø CS Rad Waste line has 15'-2" span	√		See CDQ1-999-2003-1412. Existing configuration is acceptable.	-	-	-	N/A
TORUS-010	4"ø CS Rad Waste line has 16' span	√		See CDQ1-999-2003-1412. Existing configuration is acceptable.	-	-	-	N/A
TORUS-011	2"ø SS Rad Waste line has 11'-5" and 13'-1" spans.	√		See CDQ1-999-2003-1412. Existing configuration is acceptable.	-	-	-	N/A
TORUS-012	3"ø CS Rad Waste has 13'-4" and 13'-8" spans	√		See CDQ1-999-2003-1412. Existing configuration is acceptable.	-	-	-	N/A

**TABLE 5-1 - POTENTIAL OUTLIER RESOLUTION SUMMARY - RB EL. 519' & 541'-6"****Plant Areas: NW-, NE-, SW- & SE-QUAD, HPCI, TORUS**

For Potential Outliers not acceptable per calculation, identify as: M – Support modifications; D – Hardware deficiencies; O – Others

POS No.	Brief Description of Condition	Outlier Evaluation by Calculation			M	D	O	Summary of Recommendations
		OK	Not OK	Calculation Number / Comments				
TORUS-013	2"Ø CS RCIS line has 12' and 15'-3" spans.	√		See CDQ1-999-2003-1412. Existing configuration is acceptable.	-	-	-	N/A
TORUS-014	Two 1"Ø socket-welded Equip. Drain lines have 10' spans.	√		See CDQ1-999-2003-1412. Existing configuration is acceptable.	-	-	-	N/A

**TABLE 5-2 - POTENTIAL OUTLIER RESOLUTION SUMMARY - RB EL. 565'**  
**Plant Areas: 565A, 565B, 565C, 565D & STEAM TUNNEL**

For Potential Outliers not acceptable per calculation, identify as: M – Support modifications; D – Hardware deficiencies; O – Others

POS No.	Brief Description of Condition	Outlier Evaluation by Calculation			M	D	O	Summary of Recommendations
		O K	Not OK	Calculation Number / Comments				
565A-001	1"Ø branch line off 18"Ø RCW header has inadequate flexibility concern.	√		See Calc. CDQ1-024-2003-1408. Existing configuration is acceptable.	-	-	-	N/A
565A-002	1"Ø Aux. Boiler line has consecutive overspan of 13'-9" and 11'-6". Overspan also noted at the bypass valve loop.	√		See Calc. CDQ1-999-2003-1409. Existing configuration is acceptable.	-	-	-	N/A
565A-003	Edge distance violations noted on the building heater support anchor bolts.	√		Per Calc. CDQ1-044-2003-1410, the existing anchorage configuration was evaluated and shown to be acceptable.	-	-	-	N/A
565A-004	1"Ø DW line has an overspan of 11'.	√		See Calc. CDQ1-999-2003-1409. Existing configuration is acceptable.	-	-	-	N/A
565A-005	4"Ø Floor Drain lines have several overspan conditions involving T-branch configurations.	√		See Calc. CDQ1-999-2003-1409. Existing configuration is acceptable.	-	-	-	N/A
565A-006	2"Ø RCW line has an overspan of 18'-6".	√		See Calc. CDQ1-999-2003-1409. Existing configuration is acceptable.	-	-	-	N/A

**TABLE 5-2 - POTENTIAL OUTLIER RESOLUTION SUMMARY - RB EL. 565'****Plant Areas: 565A, 565B, 565C, 565D & STEAM TUNNEL**

For Potential Outliers not acceptable per calculation, identify as: M – Support modifications; D – Hardware deficiencies; O – Others

POS No.	Brief Description of Condition	Outlier Evaluation by Calculation			M	D	O	Summary of Recommendations
		O K	Not OK	Calculation Number / Comments				
565A-007	Two 1"Ø Building Heat lines both have overspan conditions (11'). These 2 lines are continuation of those identified in POS 565A-009 and POS 565B-014.	√		See Calc. CDQ1-999-2003-1409. Existing configuration is acceptable.	-	-	-	N/A
565A-008	2-1/2"Ø insulated Potable Water line has 18' span.	√		See Calc. CDQ1-999-2003-1409. Existing configuration is acceptable. Also note that the line is pinned on top and bottom against 3"Ø conduit near mid-span, thus, overspan may not be a concern.	-	-	-	N/A
565A-009	Two 1"Ø Building Heat lines both have overspan conditions (9'). These are the same building heat lines identified in POS 565A-007 & POS 565B-014.	√		See Calc. CDQ1-999-2003-1409. Existing configuration is acceptable.	-	-	-	N/A
565A-010	2-1/2"Ø and 4"Ø Potable Water lines with visible rust at the threaded joints. Lines appear to be galvanized iron pipes.		√	The rusted threaded joints have to be addressed due to potential brittle nature of the pipe material.			√	Issue maintenance request or work order to address the rusted threaded joints.
565A-011	Disengaged rod on a 2-1/2"Ø Potable Water line.		√	Reinstall missing rod.		√		Issue maintenance request or work order to reinstall the missing rod. Pipe elev. is 588'-1"; support is located at 14' N of col. line P and 5' E of R2.

**TABLE 5-2 - POTENTIAL OUTLIER RESOLUTION SUMMARY - RB EL. 565'**  
**Plant Areas: 565A, 565B, 565C, 565D & STEAM TUNNEL**

For Potential Outliers not acceptable per calculation, identify as: M – Support modifications; D – Hardware deficiencies; O – Others

POS No.	Brief Description of Condition	Outlier Evaluation by Calculation			M	D	O	Summary of Recommendations
		O K	Not OK	Calculation Number / Comments				
565B-001	2"ø Floor Drain line has multiple overspan conditions (15'-6" and 11'-6" spans). Also, a rod hanger is detached.		√	Per Calc. CDQ1-999-2003-1409, the overspan condition is acceptable. However, the calculation is based on the detached rod hanger being reinstalled.		√		Issue maintenance request or work order to reinstall the disengaged rod hanger. The rod hanger in question is located at about 13' N of Line T and 7'-6" W of R4. Pipe elevation is about 588'-2".
565B-002	Edge distance violations noted on the building heater support anchor bolts. Also, attached 1"ø and 3/4"ø lines have SAM-related concerns due to rod-hung heater.	√		Per Calc. CDQ1-044-2003-1410, the existing anchorage configuration is found to be acceptable. Also, the SAM-related issue is addressed in the bounding calculation for area unit heaters (refer to CDQ1-044-2003-2319).	-	-	-	N/A
565B-003	Base plate anchor bolts for various RCW lines have bolt spacing violations with adjacent supports (total of 4 base plates).	√		See Calc. CDQ1-024-2003-1411. Existing configuration is acceptable.	-	-	-	N/A
565B-004	2"ø insulated Potable Water line has an overspan of 22'.	√		See Calc. CDQ1-999-2003-1409. Existing configuration is acceptable.	-	-	-	N/A
565B-005	6"ø Floor Drain line has an overspan of 20'-4".	√		See Calc. CDQ1-999-2003-1409. Existing configuration is acceptable.	-	-	-	N/A



**TABLE 5-2 - POTENTIAL OUTLIER RESOLUTION SUMMARY - RB EL. 565'**  
**Plant Areas: 565A, 565B, 565C, 565D & STEAM TUNNEL**

For Potential Outliers not acceptable per calculation, identify as: M – Support modifications; D – Hardware deficiencies; O – Others

POS No.	Brief Description of Condition	Outlier Evaluation by Calculation			M	D	O	Summary of Recommendations
		O K	Not OK	Calculation Number / Comments				
565B-006	2"Ø DW line has an overspan of 13'-9".	√		See Calc. CDQ1-999-2003-1409. Existing configuration is acceptable.	-	-	-	N/A
565B-007	1"Ø Building Heat line has overspan condition involving a T-configuration.	√		See Calc. CDQ1-999-2003-1409. Existing configuration is acceptable.	-	-	-	N/A
565B-008	1"Ø Building Heat line has overspan condition involving a T-configuration.	√		See Calc. CDQ1-999-2003-1409. Existing configuration is acceptable.	-	-	-	N/A
565B-009	4"Ø Floor Drain line has overspan condition involving a T-configuration.	√		See Calc. CDQ1-999-2003-1409. Existing configuration is acceptable.	-	-	-	N/A
565B-010	2"Ø Floor Drain line has overspan condition involving a T-configuration.	√		See Calc. CDQ1-999-2003-1409. Existing configuration is acceptable.	-	-	-	N/A
565B-011	1"Ø and 1-1/2"Ø Building heat lines have overspan conditions in 2 places involving T-configuration.	√		See Calc. CDQ1-999-2003-1409. Existing configuration is acceptable.	-	-	-	N/A
565B-012	2"Ø Floor Drain line has overspan condition (15' span).	√		See Calc. CDQ1-999-2003-1409. Existing configuration is acceptable.	-	-	-	N/A
565B-013	2"Ø Potable Water line has 3 consecutive overspans (14'-9", 10'-6" and 13'-6").	√		See Calc. CDQ1-999-2003-1409. Existing configuration is acceptable.	-	-	-	N/A

**TABLE 5-2 - POTENTIAL OUTLIER RESOLUTION SUMMARY - RB EL. 565'**  
**Plant Areas: 565A, 565B, 565C, 565D & STEAM TUNNEL**

For Potential Outliers not acceptable per calculation, identify as: M – Support modifications; D – Hardware deficiencies; O – Others

POS No.	Brief Description of Condition	Outlier Evaluation by Calculation			M	D	O	Summary of Recommendations
		O K	Not OK	Calculation Number / Comments				
565B-014	Two 1"Ø Building Heat lines have multiple overspan conditions (ranging from 8' to 10'-6"). A span of 17'-10" exists due to a detached rod hanger support. Some lines run in series (top and bottom) and are supported by common rod hanger.		√	Per Calc. CDQ1-999-2003-1409, the identified overspan conditions on the 1"Ø Building Heat lines are generally acceptable, except for one instance where a new support is required.	√			See CDQ1-044-2003-1691. Provide a new rod hanger support to 1"Ø line at about 11'-6" E of R2 and 8' N of the first rod hanger just N of Line T. Pipe elevation is about 585'-6".
565B-015	6"Ø Floor Drain line has 20'-4" span.	√		See Calc. CDQ1-999-2003-1409. Existing configuration is acceptable.	-	-	-	N/A
565B-016	4"Ø Floor Drain line has 19' span.	√		See Calc. CDQ1-999-2003-1409. Existing configuration is acceptable.	-	-	-	N/A
565B-017	1"Ø & 1-1/2"Ø Building Heat lines have two overspan conditions involving a T-branch configuration.		√	Per Calc. CDQ1-999-2003-1409, the overspan condition is not acceptable.	√			See CDQ1-044-2003-1692. Provide a new support to the 1-1/2"Ø line at about 4' south of the T-intersection with 1"Ø line.
565B-018	Vertical capacity of the ceiling-mounted bracket support on top of the 2-1/2"Ø Fire Protection riser branch line is questionable.		√	Per Calc. CDQ1-026-2003-1606, the support in question is not acceptable.	√			See CDQ1-026-2003-2542. Provide a new support to the 2-1/2"Ø line at R2/U column, and about 5' above floor El. 565'.

**TABLE 5-2 - POTENTIAL OUTLIER RESOLUTION SUMMARY - RB EL. 565'**  
**Plant Areas: 565A, 565B, 565C, 565D & STEAM TUNNEL**

For Potential Outliers not acceptable per calculation, identify as: M – Support modifications; D – Hardware deficiencies; O – Others

POS No.	Brief Description of Condition	Outlier Evaluation by Calculation			M	D	O	Summary of Recommendations
		O K	Not OK	Calculation Number / Comments				
565B-019	Overspan on the 8"Ø Fire Protection header (22' span).	√		See Calc. CDQ1-026-2003-2151. Existing configuration is acceptable.	-	-	-	N/A
565B-020	Significant rust condition noted at the tee connection between the 8"Ø Fire Protection header and the 2-1/2"Ø branch line.		√	The rusted tee connection has to be addressed.			√	Issue maintenance request or work order to address the rusted tee connection. The tee is located at 6.5' N of U and 1' W of R2; El. 588'-1".
565C-001	2"Ø Condensate line has 12' span.	√		See Calc. CDQ1-999-2003-1409. Existing configuration is acceptable.	-	-	-	N/A
565C-002	8"Ø Condensate line has 20'-4" span.	√		See Calc. CDQ1-999-2003-1409. Existing configuration is acceptable.	-	-	-	N/A
565C-003	4"Ø Floor Drain line has 24' span.	√		See Calc. CDQ1-999-2003-1409. Existing configuration is acceptable.	-	-	-	N/A
565C-004	4"Ø DW line and two other lines are supported by a cantilevered Unistrut support.	√		Upon further review, the support in question is for a conduit supported off DW and other lines in the area. 4"Ø DW line span is < B31.1 recommended span. Existing configuration is acceptable.	-	-	-	N/A

**TABLE 5-2 - POTENTIAL OUTLIER RESOLUTION SUMMARY - RB EL. 565'**  
**Plant Areas: 565A, 565B, 565C, 565D & STEAM TUNNEL**

For Potential Outliers not acceptable per calculation, identify as: M – Support modifications; D – Hardware deficiencies; O – Others

POS No.	Brief Description of Condition	Outlier Evaluation by Calculation			M	D	O	Summary of Recommendations
		O K	Not OK	Calculation Number / Comments				
565C-005	4"Ø DW line has 20'-9" span.	√		See Calc. CDQ1-999-2003-1409. Existing configuration is acceptable.	-	-	-	N/A
565C-006	1-1/2"Ø DW line has 12'-6" span.	√		See Calc. CDQ1-999-2003-1409. Existing configuration is acceptable.	-	-	-	N/A
565C-007	1"Ø unidentified line has 9' span.	√		See Calc. CDQ1-999-2003-1409. Existing configuration is acceptable.	-	-	-	N/A
565C-008	2"Ø Floor Drain line has 19' span.	√		See Calc. CDQ1-999-2003-1409. Existing configuration is acceptable.	-	-	-	N/A
565C-009	Pipe clamp is missing on a wall-mounted Unistrut pipe support for 3/4"Ø Rad Waste line.		√	3/4"Ø Rad Waste line results in excessive overspan due to missing pipe clamp. Reinstall the missing clamp.		√		Issue maintenance request or work order to reinstall the missing pipe clamp. Support is located just N of U-Line (5" from wall) and W of R5 (nearest pipe elbow is at 5'-4" W of R5). Pipe elevation is at about 568'-6".
565C-010	Edge distance violations noted on the building heater support anchor bolts.	√		Per Calc. CDQ1-044-2003-1410, the existing anchorage configuration is acceptable.	-	-	-	N/A
565C-011	2"Ø Raw Water Cooling line has 14' span.	√		See Calc. CDQ1-999-2003-1409. Existing configuration is acceptable.	-	-	-	N/A

**TABLE 5-2 - POTENTIAL OUTLIER RESOLUTION SUMMARY - RB EL. 565'**  
**Plant Areas: 565A, 565B, 565C, 565D & STEAM TUNNEL**

For Potential Outliers not acceptable per calculation, identify as: M – Support modifications; D – Hardware deficiencies; O – Others

POS No.	Brief Description of Condition	Outlier Evaluation by Calculation			M	D	O	Summary of Recommendations
		OK	Not OK	Calculation Number / Comments				
565C-012	2"Ø Raw Water Cooling line has 14'-6" span (gang-supported to a 2"Ø N <sub>2</sub> Makeup line above it). In addition, a 1"Ø line (about 8' tributary span) is hanging off the RCW line via spacer supports.		√	Per Calc. CDQ1-999-2003-1409, the existing configuration is found to be not acceptable.	√			See CDQ1-024-2003-1619. Provide a new support for the 2"Ø N <sub>2</sub> Makeup line, which in turn is supporting the overspan 2"Ø RCW line below it.
565C-013	1-1/2"Ø Fire Protection branch line has 15' span.	√		See Calc. CDQ1-026-2003-2151. Existing configuration is acceptable.	-	-	-	N/A
565C-014	Missing hardware on a trapeze rod hanger support for 8"Ø Fire Protection header, resulting into piping overspan.		√	Per Calc. CDQ1-026-2003-2558, the existing configuration (with the support assumed to be ineffective) is acceptable. However, it is recommended that the support be restored to its original design condition.		√		Reinstall all missing hardware in the support in order for the support to be effective. The support is located 8' N of S line and 8' W of wall penetration at R7 wall. Pipe elev. is at about 576'.
565D-001	4"Ø DW line has 17'-6" span.	√		See Calc. CDQ1-999-2003-1409. Existing configuration is acceptable.	-	-	-	N/A
565D-002	4"Ø Floor Drain line has 17'-5" and 18'-4" spans.	√		See Calc. CDQ1-999-2003-1409. Existing configuration is acceptable.	-	-	-	N/A

**TABLE 5-2 - POTENTIAL OUTLIER RESOLUTION SUMMARY - RB EL. 565'****Plant Areas: 565A, 565B, 565C, 565D & STEAM TUNNEL**

For Potential Outliers not acceptable per calculation, identify as: M – Support modifications; D – Hardware deficiencies; O – Others

POS No.	Brief Description of Condition	Outlier Evaluation by Calculation			M	D	O	Summary of Recommendations
		O K	Not OK	Calculation Number / Comments				
565D-003	4"Ø Floor Drain line rod hanger is detached.		√	4"Ø Floor Drain line results in excessive overspan due to the disengaged rod hanger. Reinstall the detached rod hanger.		√		Issue maintenance request or work order to reinstall the detached rod hanger. Support is located at about 10' N of Q and 3' E of R6. Pipe elevation is at about 588'-4".
565D-004	Vertical capacity of the wall-mounted bracket support on top of the 2-1/2"Ø Fire Protection riser branch line is questionable.		√	Per Calc. CDQ1-026-2003-1952, the support in question is not acceptable.	√			See CDQ1-026-2003-2543. Provide a new support to the 2-1/2"Ø line at R7/P column. Pipe elev. is at about 582'.
565D-005	4"Ø Fire Protection line has 17'-6" and 16' spans.	√		See Calc. CDQ1-026-2003-2151. Existing configuration is acceptable.	-	-	-	N/A
STNL-001	1"Ø RCIC/ Rad Waste line has 10'-2" and 10'-0" spans.	√		See Calc. CDQ1-999-2003-1409. Existing configuration is acceptable.	-	-	-	N/A
STNL-002	1"Ø Reactor Feedwater line has 12'-3" span.	√		See Calc. CDQ1-999-2003-1409. Existing configuration is acceptable.	-	-	-	N/A

**TABLE 5-3 - POTENTIAL OUTLIER RESOLUTION SUMMARY - RB EL. 593'**  
**Plant Areas: 593A, 593B, 593C & 593D**

For Potential Outliers not acceptable per calculation, identify as: M – Support modifications; D – Hardware deficiencies; O – Others

POS No.	Brief Description of Condition	Outlier Evaluation by Calculation			M	D	O	Summary of Recommendations
		O K	Not OK	Calculation Number / Comments				
593A-001	Two 6"Ø Fuel Pool Cooling lines have about 22' spans.	√		See Calc. CDQ1-999-2003-1601. Existing configurations are acceptable.	-	-	-	N/A
593A-002	1"Ø uninsulated Air Conditioning line has multiple overspan conditions (max. of 16'-9" span).	√		See Calc. CDQ1-999-2003-1601. Existing configurations are acceptable.	-	-	-	N/A
593A-003	Two 1"Ø insulated Air Conditioning lines have several overspan conditions.	√		See Calc. CDQ1-999-2003-1601. Existing configurations are acceptable.	-	-	-	N/A
593A-004	3"Ø Floor Drain has 2 overspan conditions (15' & 20'-6" spans).	√		See Calc. CDQ1-999-2003-1601. Existing configurations are acceptable.	-	-	-	N/A
593A-005	4"Ø Floor Drain line has 15'-9" span.	√		See Calc. CDQ1-999-2003-1601. Existing configuration is acceptable.	-	-	-	N/A
593A-006	Two ½ "Ø RBCCW socket-welded pipes have 11'-5" and 10'-10" spans.	√		See Calc. CDQ1-999-2003-1601. Existing configurations are acceptable.	-	-	-	N/A

**TABLE 5-3 - POTENTIAL OUTLIER RESOLUTION SUMMARY - RB EL. 593'****Plant Areas: 593A, 593B, 593C & 593D**

For Potential Outliers not acceptable per calculation, identify as: M – Support modifications; D – Hardware deficiencies; O – Others

POS No.	Brief Description of Condition	Outlier Evaluation by Calculation			M	D	O	Summary of Recommendations
		O K	Not OK	Calculation Number / Comments				
593A-007	Line is leaking at threaded bronze hand valve near T-connection of ½"Ø tubing to 12"Ø Raw Cooling Water header. Also, the ½"Ø line has 13'-4" span.		√	Per Calc. CDQ1-999-2003-1601, the overspan condition of 13'-4" span is acceptable. However, leaking connection on the ½"Ø line is not acceptable.			√	Issue maintenance request or work order to repair the leaking connection. The ½"Ø line with leaking connection is located about 4' west of R3, between P & Q (off the 12"Ø RCW header). The ½"Ø line is at Elev. 608'-1".
593A-008	Two 3"Ø insulated Building Heat lines have 2 consecutive overspans (18' and 20'-3").	√		See Calc. CDQ1-999-2003-1601. Existing configurations are acceptable.	-	-	-	N/A
593A-009	1"Ø insulated Demin. Water line has 2 consecutive overspans (12' & 11'-4").	√		See Calc. CDQ1-999-2003-1601. Existing configurations are acceptable.	-	-	-	N/A
593A-010	Two 2"Ø PSC/PSC Overflow lines have overspans (max. of 14'-4").	√		See Calc. CDQ1-999-2003-1601. Existing configurations are acceptable.	-	-	-	N/A
593B-001	1½"Ø, 2"Ø and 3"Ø Building Heat lines have multiple overspan conditions.	√		See Calc. CDQ1-044-2003-1607. Existing configurations are acceptable.	-	-	-	N/A



**TABLE 5-3 - POTENTIAL OUTLIER RESOLUTION SUMMARY - RB EL. 593'****Plant Areas: 593A, 593B, 593C & 593D**

For Potential Outliers not acceptable per calculation, identify as: M – Support modifications; D – Hardware deficiencies; O – Others

POS No.	Brief Description of Condition	Outlier Evaluation by Calculation			M	D	O	Summary of Recommendations
		O K	Not OK	Calculation Number / Comments				
593B-002	1"Ø Equipment Drain line has a detached rod hanger resulting in overspan condition of 17'-6". Also, even with the detached rod hanger in place, span is 11'-10".		√	Per Calc. CDQ1-999-2003-1601, normal operating stresses for the 1"Ø line due to the disengaged rod (17'-6" span) is marginal. However, the span of 11'-10" is acceptable provided that the disengaged rod hanger is reinstalled.	√			See Calc. CDQ1-000-2003-1605. Reinstall the disengaged rod hanger.
593B-003	¾"Ø Building Heat lines have 2 consecutive overspan conditions (max. of 9'-8" span).	√		See Calc. CDQ1-999-2003-1601. Existing configurations are acceptable.	-	-	-	N/A
593B-004	½"Ø RBCCW pipe has multiple overspans (spans of 6'-6", 8'-2", 10' & 10'-8") and is sagging in some areas (appear to have been stepped on causing permanent deformations).		√	Existing configurations are bounded by similar overspan conditions identified in POS 593A-006 (see Calc. CDQ1-999-2003-1601) which were shown to be acceptable. However, the deformed conditions are not acceptable.	√			See Calc. CDQ1-070-2003-1604. Replace the deformed segments of the pipe routing, or reroute the piping, as necessary.
593B-005	3"Ø Floor Drain line has 16' span.	√		See Calc. CDQ1-999-2003-1601. Existing configuration is acceptable.	-	-	-	N/A
593B-006	Branch line flexibility concern on ¾"Ø and ½"Ø Building Heat lines near the rod-hung building heater.	√		Branch line flexibility (SAM-related) issues are addressed in the bounding calculation for typical area unit heaters (refer to CDQ1-044-2003-2319).	-	-	-	N/A

**TABLE 5-3 - POTENTIAL OUTLIER RESOLUTION SUMMARY - RB EL. 593'**  
**Plant Areas: 593A, 593B, 593C & 593D**

For Potential Outliers not acceptable per calculation, identify as: M – Support modifications; D – Hardware deficiencies; O – Others

POS No.	Brief Description of Condition	Outlier Evaluation by Calculation			M	D	O	Summary of Recommendations
		O K	Not OK	Calculation Number / Comments				
593B-007	2"Ø RBCCW line has a detached rod hanger resulting in overspan condition of 14'-10".		√	See Calc. CDQ1-999-2003-1601. Existing configuration is found to be acceptable. However, it is recommended that the missing rod be re-installed to preclude any falling interaction of the support hardware that are still in place.		√		Issue maintenance request or work order to re-install the missing rod. The location of the missing rod is at 7'-2" east of R2 and 2'-9" north of column line T. The 2"Ø line is at Elev. 617'-3". Note that pipe clamp is still attached to the pipe.
593B-008	4"Ø Floor Drain line has multiple overspan conditions involving T-configurations.	√		See Calc. CDQ1-999-2003-1601. Existing configuration is acceptable.	-	-	-	N/A
593B-009	2 - 2"Ø PSC/PSC Overflow lines have overspans (max. of 11'-10").	√		See Calc. CDQ1-999-2003-1601. Existing configuration is acceptable.	-	-	-	N/A
593B-010	½ "Ø Primary Containment Isolation line has 11'-9" span.	√		See Calc. CDQ1-999-2003-1601. Existing configuration is acceptable.	-	-	-	N/A
593C-001	4"Ø Floor Drain line has 20'-1" span.	√		See Calc. CDQ1-999-2003-1601. Existing configuration is acceptable.	-	-	-	N/A
593C-002	2"Ø RWCU line has 14' span.	√		See Calc. CDQ1-999-2003-1601. Existing configuration is acceptable.	-	-	-	N/A

**TABLE 5-3 - POTENTIAL OUTLIER RESOLUTION SUMMARY - RB EL. 593'**  
**Plant Areas: 593A, 593B, 593C & 593D**

For Potential Outliers not acceptable per calculation, identify as: M – Support modifications; D – Hardware deficiencies; O – Others

POS No.	Brief Description of Condition	Outlier Evaluation by Calculation			M	D	O	Summary of Recommendations
		O K	Not OK	Calculation Number / Comments				
593C-003	Edge distance violations noted on the building heater support anchor bolts.	√		Edge distance violations on the existing anchorage configuration are similar to and bounded by those identified in El. 565' (refer to Calc. CDQ1-044-2003-1410). Although the seismic demand loads are larger for El. 593', it is judged acceptable based on the large margins shown in the above calculation.	-	-	-	N/A
593C-004	4"Ø Floor Drain line has an overspan condition involving T-configurations.	√		See Calc. CDQ1-999-2003-1601. Existing configuration is acceptable.	-	-	-	N/A
593C-005	½"Ø RBCCW line has typical span of 10'. Another ½"Ø RBCCW line is gang-supported from the above line at 5' span, typical.	√		See Calc. CDQ1-999-2003-1601. Existing configurations are acceptable.	-	-	-	N/A
593C-006	Branch line flexibility concern on ¾"Ø and 1/2"Ø Building Heat lines near the rod-hung building heater.	√		Branch line flexibility (SAM-related) issues are addressed in the bounding calculation for typical area unit heaters (refer to CDQ1-044-2003-2319).	-	-	-	N/A
593D-001	2"Ø Condensate S&S line has 20'-5" span.	√		See Calc. CDQ1-999-2003-1601. Existing configurations are acceptable.	-	-	-	N/A

**TABLE 5-3 - POTENTIAL OUTLIER RESOLUTION SUMMARY - RB EL. 593'**  
**Plant Areas: 593A, 593B, 593C & 593D**

For Potential Outliers not acceptable per calculation, identify as: M – Support modifications; D – Hardware deficiencies; O – Others

POS No.	Brief Description of Condition	Outlier Evaluation by Calculation			M	D	O	Summary of Recommendations
		O K	Not OK	Calculation Number / Comments				
593D-002	3"ø Floor Drain line has 17'-4" span.	√		See Calc. CDQ1-999-2003-1601. Existing configuration is acceptable.	-	-	-	N/A
593D-003	2"ø RBCCW line has 13'-10" span.	√		See Calc. CDQ1-999-2003-1601. Existing configuration is acceptable.	-	-	-	N/A
593D-004	3"ø Raw Cooling Water line has 17'-5" span.	√		See Calc. CDQ1-999-2003-1601. Existing configuration is acceptable.	-	-	-	N/A
593D-005	6"ø Fuel Pool Cooling lines have 20' spans.	√		See Calc. CDQ1-999-2003-1601. Existing configuration is acceptable.	-	-	-	N/A
593D-006	Potential rod fatigue concerns on multiple short fixed end rods supporting 4"ø Floor Drain line.	√		See Calc. CDQ1-000-2003-1603. Existing configuration is acceptable.	-	-	-	N/A

**TABLE 5-4 - POTENTIAL OUTLIER RESOLUTION SUMMARY - RB EL. 621'-3"**  
**Plant Areas: 621A, 621B, 621C & 621D**

For Potential Outliers not acceptable per calculation, identify as: M – Support modifications; D – Hardware deficiencies; O – Others

POS No.	Brief Description of Condition	Outlier Evaluation by Calculation			M	D	O	Summary of Recommendations
		O K	Not OK	Calculation Number / Comments				
621A-001	3/4"Ø Gland Seal line has multiple overspan conditions.	√		See Calc. CDQ1-999-2003-1602. Existing configurations are acceptable.	-	-	-	N/A
621A-002	4"Ø Equipment Drain has 17' span.	√		See Calc. CDQ1-999-2003-1602. Existing configuration is acceptable.	-	-	-	N/A
621A-003	3"Ø, 2"Ø & 1"Ø Standby Liquid Control (SLC) flush lines empty into unrestrained 55 gal. plastic drum. Drum may overturn and spill contents.		√	Unrestrained drum may overturn and spill contents, thereby poses as a ll/l spray hazard during a seismic event. The plastic drum has to be restrained or removed from the area.	√			See Calc. CDQ1-063-2003-1614. Provide restraint to the free-standing plastic drum.
621A-004	Bracket support for eyewash station is mounted to block wall with 1/4"Ø toggle bolts. Verify support adequacy.	√		See Calc. CDQ1-000-2003-1613. Existing anchorage configuration for the eyewash station is shown to be adequate.	-	-	-	N/A
621A-005	1"Ø SLC line has a detached rod hanger resulting in overspan condition of 28'-10". Detached rod hanger is near midspan.		√	Per Calc. CDQ1-999-2003-1602, the overspan condition is not acceptable. However, per Calc. CDQ1-063-2003-1615, the above overspan condition was found to be acceptable provided that the detached rod hanger is reinstalled at or near midspan.	√			See Calc. CDQ1-063-2003-1615. Reinstall the disengaged rod hanger, or provide a new support near the location of the detached rod hanger.

**TABLE 5-4 - POTENTIAL OUTLIER RESOLUTION SUMMARY - RB EL. 621'-3"****Plant Areas: 621A, 621B, 621C & 621D**

For Potential Outliers not acceptable per calculation, identify as: M – Support modifications; D – Hardware deficiencies; O – Others

POS No.	Brief Description of Condition	Outlier Evaluation by Calculation			M	D	O	Summary of Recommendations
		O K	Not OK	Calculation Number / Comments				
621A-006	Two 1"Ø Air Conditioning lines have several overspan conditions (max. of 10'-6" span).	√		See Calc. CDQ1-999-2003-1602. Existing configuration is acceptable.	-	-	-	N/A
621B-001	Flexibility (SAM-related) concern on 1"Ø Building Heat lines near the rod-hung building heater.	√		See Calc. CDQ1-044-2003-1608. Existing configuration is acceptable. In addition, the SAM-related issue is also addressed in the bounding calculation for area unit heaters (refer to CDQ1-044-2003-2319).	-	-	-	N/A
621B-002	Excessive corrosion/rust on 1"Ø & 3/4"Ø Building Heat lines near the building heater.		√	The rusted threaded joints have to be addressed to preclude any potential H/I spray hazard.			√	Issue maintenance request or work order to address the rusted threaded joints.
621B-003	1½"Ø Building Heat line has overspan condition, with additional load from 1"Ø branch line at T-intersection.	√		See Calc. CDQ1-044-2003-1608. Existing configuration is acceptable.	-	-	-	N/A
621B-004	1½"Ø Building Heat line has several overspan conditions involving T-configurations.	√		See Calc. CDQ1-044-2003-1608. Existing configuration is acceptable.	-	-	-	N/A
621B-005	Two 1"Ø Building Heat lines have several overspan conditions (max. of 10' span).	√		See Calc. CDQ1-044-2003-1608. Existing configurations are acceptable.	-	-	-	N/A

**TABLE 5-4 - POTENTIAL OUTLIER RESOLUTION SUMMARY - RB EL. 621'-3"****Plant Areas: 621A, 621B, 621C & 621D**

For Potential Outliers not acceptable per calculation, identify as: M – Support modifications; D – Hardware deficiencies; O – Others

POS No.	Brief Description of Condition	Outlier Evaluation by Calculation			M	D	O	Summary of Recommendations
		O K	Not OK	Calculation Number / Comments				
621B-006	4"Ø Floor Drain line has multiple overspan conditions involving T-configurations.	√		See Calc. CDQ1-999-2003-1602. Existing configuration is acceptable.	-	-	-	N/A
621B-007	6"Ø Condensate S&S line has 20' span.	√		See Calc. CDQ1-999-2003-1602. Existing configuration is acceptable.	-	-	-	N/A
621C-001	4"Ø Condensate S&S line has 15'-6" span.	√		See Calc. CDQ1-999-2003-1602. Existing configuration is acceptable.	-	-	-	N/A
621C-002	3"Ø Demin. Water line has 17'-6" span.	√		See Calc. CDQ1-999-2003-1602. Existing configuration is acceptable.	-	-	-	N/A
621C-003	RWCU pumps 1A & 1B appeared to be inadequately supported. Pumps are in-line supported on 1½"Ø line with large eccentricities. Also, there are potential SAM-related flexibility concerns on the ¾"Ø lines.	√		See Calc. CDQ1-069-2003-1612. Existing pump support configuration and the potential SAM-related flexibility concerns on the ¾"Ø lines are shown to be acceptable.	-	-	-	N/A

**TABLE 5-4 - POTENTIAL OUTLIER RESOLUTION SUMMARY - RB EL. 621'-3"****Plant Areas: 621A, 621B, 621C & 621D**

For Potential Outliers not acceptable per calculation, identify as: M – Support modifications; D – Hardware deficiencies; O – Others

POS No.	Brief Description of Condition	Outlier Evaluation by Calculation			M	D	O	Summary of Recommendations
		O K	Not OK	Calculation Number / Comments				
621C-004	Flexibility (SAM-related) concern on 1"Ø & 3/4"Ø Building Heat lines near rod-hung building heater.	√		See Calc. CDQ1-044-2003-1608. Existing configuration is acceptable. In addition, the SAM-related issue is also addressed in the bounding calculation for typical area unit heaters (refer to CDQ1-044-2003-2319).	-	-	-	N/A
621C-005	1½"Ø Building Heat line has multiple overspan conditions (max. of 13' span)	√		See Calc. CDQ1-044-2003-1608. Existing configurations are acceptable.	-	-	-	N/A
621C-006	1"Ø Building Heat line has multiple overspan conditions (max. of 13' span)	√		See Calc. CDQ1-044-2003-1608. Existing configurations are acceptable.	-	-	-	N/A
621C-007	2½"Ø air-operated valve 1-FCV-69-78 has large eccentric mass.	√		See Calc. CDQ1-069-2003-1610. Existing valve configuration is acceptable.	-	-	-	N/A
621D-001	Flexibility (SAM-related) concern on 1¼"Ø Fire Protection branch off the 3"Ø riser.	√		See Calc. CDQ1-026-2003-1609. Existing configuration is acceptable.	-	-	-	N/A
621D-002	Two 1"Ø Air Conditioning lines have several overspan conditions (typical span of 11').	√		See Calc. CDQ1-999-2003-1602. Existing configuration is acceptable.	-	-	-	N/A
621D-003	2"Ø Fuel Pool Overflow line has 3 consecutive overspans (max. span of 13'-6").	√		See Calc. CDQ1-999-2003-1602. Existing configuration is acceptable.	-	-	-	N/A



**TABLE 5-5 - POTENTIAL OUTLIER RESOLUTION SUMMARY - RB EL. 639'**  
**Plant Areas: 639A, 639B, 639C & 639D**

For Potential Outliers not acceptable per calculation, identify as: M – Support modifications; D – Hardware deficiencies; O – Others

POS No.	Brief Description of Condition	Outlier Evaluation by Calculation			M	D	O	Summary of Recommendations
		O K	Not OK	Calculation Number / Comments				
639A-001	1"Ø GS line has 18'-4" span and wall brackets lack U-bolts (line can slide off of supports).		√	Per Calc. CDQ1-037-2003-1177, stress on the overspan segment is marginal. Also, seismic displacement of the existing configuration may cause line to slide off its supports.	√			Refer to Calc. CDQ1-037-2003-1177 for recommended plant modification – i.e., add new wall bracket to the overspan pipe.
639A-002	1"Ø GS line has 12' span.	√		Per Calc. CDQ1-999-2003-1072, the existing configuration is acceptable.	-	-	-	N/A
639A-003	3"Ø GS / Condensate S&S line has 2 consecutive overspans (19' and 15'). Also, 2"Ø DW line has an overspan of 19'.	√		Per Calc. CDQ1-999-2003-1072, the existing configurations are acceptable.	-	-	-	N/A
639A-004	Anchorage appears marginal for GS storage tank.	√		Per Calc. CDQ1-037-2003-1178, the existing configuration is acceptable.	-	-	-	N/A
639A-005	1"Ø DW line has 9'-6" span. Line is cut and capped, sagging noted.	√		Per Calc. CDQ1-999-2003-1072, the existing configuration is acceptable.	-	-	-	N/A
639A-006	2"Ø FP Overflow line has 14'-7" span.	√		Per Calc. CDQ1-999-2003-1072, the existing configuration is acceptable.	-	-	-	N/A

**TABLE 5-5 - POTENTIAL OUTLIER RESOLUTION SUMMARY - RB EL. 639'**  
**Plant Areas: 639A, 639B, 639C & 639D**

For Potential Outliers not acceptable per calculation, identify as: M – Support modifications; D – Hardware deficiencies; O – Others

POS No.	Brief Description of Condition	Outlier Evaluation by Calculation			M	D	O	Summary of Recommendations
		O K	Not OK	Calculation Number / Comments				
639A-007	3"Ø Floor Drain line has 20' span.	√		Per Calc. CDQ1-999-2003-1072, the existing configuration is acceptable.	-	-	-	N/A
639A-008	1"Ø Building Heat line at interface with the unit area heater (including union) is rusted.		√	The rusted pipe segments and threaded joints have to be addressed to preclude any potential ii/i spray hazard.			√	Issue maintenance request or work order to replace rusted pipe segments and union joints at the heater interface.
639A-009	Two 1"Ø Building Heat lines have 12' span.	√		Existing configurations are bounded by similar conditions addressed in Calc. CDQ1-044-2003-1087 for POS 639B-003, and therefore are acceptable.	-	-	-	N/A
639A-010	Area heater of Building Heat system is rod hung and may cause SAM problems for the connecting 1"Ø & 3/4"Ø lines.	√		Existing configuration is bounded by similar conditions addressed in Calc. CDQ1-044-2003-1087, and therefore is acceptable. In addition, the SAM-related issue is also addressed in the bounding calculation for typical area unit heaters (refer to CDQ1-044-2003-2319).	-	-	-	N/A

**TABLE 5-5 - POTENTIAL OUTLIER RESOLUTION SUMMARY - RB EL. 639'**  
**Plant Areas: 639A, 639B, 639C & 639D**

For Potential Outliers not acceptable per calculation, identify as: M – Support modifications; D – Hardware deficiencies; O – Others

POS No.	Brief Description of Condition	Outlier Evaluation by Calculation			M	D	O	Summary of Recommendations
		O K	Not OK	Calculation Number / Comments				
639A-011	3/4"ø FP Overflow drain line has SAM-related concern due to the E-W movement of 6"ø Rx Head Exhaust line. Note that the pipe stanchion support for the 6"ø line is free to slide in the E-W direction.		√	Existing configuration is bounded by similar conditions identified in POS 639C-004 and POS 639C-008 (refer to Calc. CDQ1-078-2003-1226), and is therefore unacceptable.	√			Refer to Calc. CDQ1-078-2003-1226 for recommended plant modification – i.e., provide a new support to the 6"ø line near the stanchion support.
639B-001	4"ø Floor Drain line has 18'-6" span.	√		Per Calc. CDQ1-999-2003-1072, the existing configuration is acceptable.	-	-	-	N/A
639B-002	Lube oil cooler has marginal tack weld attachment to its support saddle.	√		Per DCN # 51219, the MG sets will be replaced by VFD and the lube oil coolers will be removed.	-	-	-	N/A
639B-003	Building heat lines are rod hung and have several overspan conditions. Lines terminate at rod hung area heaters.	√		Per Calc. CDQ1-044-2003-1087, the existing configuration is acceptable.	-	-	-	N/A
639B-004	Seismic movement of a 3"ø FP riser imposes SAM to 1-1/2"ø branch line (to hose station).	√		Per Calc. CDQ1-026-2003-1088, the existing configuration is acceptable.	-	-	-	N/A
639B-005	1"ø to 3"ø Condensate S&S line has multiple overspan conditions and non-standard reducer fittings are used.	√		Per Calc. CDQ1-002-2003-1086, the existing configuration is acceptable.	-	-	-	N/A

**TABLE 5-5 - POTENTIAL OUTLIER RESOLUTION SUMMARY - RB EL. 639'****Plant Areas: 639A, 639B, 639C & 639D**

For Potential Outliers not acceptable per calculation, identify as: M – Support modifications; D – Hardware deficiencies; O – Others

POS No.	Brief Description of Condition	Outlier Evaluation by Calculation			M	D	O	Summary of Recommendations
		O K	Not OK	Calculation Number / Comments				
639B-006	3"Ø Floor Drain line has 23' span.	√		Per Calc. CDQ1-999-2003-1072, the existing configuration is acceptable.	-	-	-	N/A
639C-001	Pipe flange is leaking on short riser of 3"Ø Condensate S&S line.		√	This problem is not directly related to seismic adequacy and should be resolved by maintenance action.			√	Work Order # 03-005020-000 is issued to address the leaking flange connection.
639C-002	1"Ø to 3"Ø Condensate S&S line has multiple overspan conditions and non-standard reducer fittings are used.	√		Per Calc. CDQ1-002-2003-1086, the existing configuration is acceptable (included in the analysis to address POS 639B-005).	-	-	-	N/A
639C-003	4"Ø RCW line has 2 overspan conditions – 1 @ 24' and 1 @ 16' that is piggy back from the 8"Ø RCW line.	√		Per Calc. CDQ1-999-2003-1072, the existing configuration is acceptable.	-	-	-	N/A
639C-004	6"Ø Rx Head Exhaust line has stanchion support that is not positively anchored.		√	Per Calc. CDQ1-078-2003-1226, the existing stanchion support does not provide adequate restraint to the 6"Ø line, thus could result in SAM-related concern on the ¾"Ø Fuel Pool Overflow drain line.	√			Refer to Calc. CDQ1-078-2003-1226 for recommended plant modification – i.e., provide a new support to the 6"Ø line near the stanchion support.
639C-005	2"Ø DW line has 3 consecutive overspans of 16'-6", 13', and 14'.	√		Per Calc. CDQ1-002-2003-1085, the existing configuration is acceptable.	-	-	-	N/A

**TABLE 5-5 - POTENTIAL OUTLIER RESOLUTION SUMMARY - RB EL. 639'****Plant Areas: 639A, 639B, 639C & 639D**

For Potential Outliers not acceptable per calculation, identify as: M – Support modifications; D – Hardware deficiencies; O – Others

POS No.	Brief Description of Condition	Outlier Evaluation by Calculation			M	D	O	Summary of Recommendations
		OK	Not OK	Calculation Number / Comments				
639C-006	Building heat lines are rod hung and have several overspan conditions. Lines terminate at rod hung area heaters (SAM-related issue).	√		Existing configuration is bounded by similar conditions addressed in Calc. CDQ1-044-2003-1087, and therefore is acceptable. In addition, the SAM-related issue is also addressed in the bounding calculation for typical area unit heaters (refer to CDQ1-044-2003-2319).	-	-	-	N/A
639C-007	3"Ø Floor Drain has 15'-6" span.	√		Per Calc. CDQ1-999-2003-1072, the existing configuration is acceptable.	-	-	-	N/A
639C-008	3/4"Ø FP Overflow line has SAM-related concern due to movement of the 6"Ø Rx Head Exhaust line with the stanchion support that is not positively anchored (see 639C-004).		√	See Calc. CDQ1-078-2003-1226. This outlier is addressed together with POS 639C-004.	(√)			See above resolution for POS 639C-004. POS 639C-008 will be resolved with the implementation of the recommended plant modification to resolve POS 639C-004.
639D-001	Lube oil cooler has marginal tack weld attachment to its support saddle.	√		Per DCN # 51219, the MG sets will be replaced by VFD and the lube oil coolers will be removed.	-	-	-	N/A
639D-002	1"Ø Condensate S&S line has multiple overspan conditions.	√		Per Calc. CDQ1-002-2003-1086, the existing configuration is acceptable (included in the analysis to address POS 639B-005).	-	-	-	N/A

**TABLE 5-5 - POTENTIAL OUTLIER RESOLUTION SUMMARY - RB EL. 639'**  
**Plant Areas: 639A, 639B, 639C & 639D**

For Potential Outliers not acceptable per calculation, identify as: M – Support modifications; D – Hardware deficiencies; O – Others

POS No.	Brief Description of Condition	Outlier Evaluation by Calculation			M	D	O	Summary of Recommendations
		O K	Not OK	Calculation Number / Comments				
639D-003	2"ø DW line has multiple overspan conditions, and 1"ø branch has SAM concerns at 2"ø riser.	√		Per Calc. CDQ1-002-2003-1085, the existing configuration is acceptable (included in the analysis to address POS 639C-005).	-	-	-	N/A
639D-004	2"ø Potable Water line has 21'-6" span.		√	Per Calc. CDQ1-999-2003-1072, the existing configuration is not acceptable.	√			Refer to Calc. CDQ1-029-2003-1217 for recommended plant modification – i.e., add new rod hung support to the overspan pipe.
639D-005	Terminal equipment (Lube Oil Cooler) for RCW and lube oil piping has marginal anchorage.	√		Per DCN # 51219, the MG sets will be replaced by VFD and the lube oil coolers will be removed. Note that this outlier is same as POS 639D-001, but relates to RCW piping in the area.	-	-	-	N/A

**TABLE 6-6 - POTENTIAL OUTLIER RESOLUTION SUMMARY - RB EL. 664'**  
**Plant Areas: 664A, 664B, 664C & 664D**

For Potential Outliers not acceptable per calculation, identify as: M – Support modifications; D – Hardware deficiencies; O – Others

POS No.	Brief Description of Condition	Outlier Evaluation by Calculation			M	D	O	Summary of Recommendations
		O K	Not OK	Calculation Number / Comments				
664A-001	Three (3) 1"Ø Building Heat lines have 13' spans	√		See CDQ1-999-2003-1414. Existing configurations are acceptable.	-	-	-	N/A
664A-002	3"Ø unidentified line has 13' span	√		See CDQ1-999-2003-1414. Existing configuration is acceptable.	-	-	-	N/A
664A-003	Verify seismic adequacy of the support member and weld attachment of typical building unit heater in the area. Building heater is located in col. lines R1-S and R2-Px.	√		Per Calc. CDQ1-044-2003-1406, the existing support configurations of unit heaters in this area are acceptable.	-	-	-	N/A
664B-001	8"Ø Condensate S & S line has 26' span	√		See CDQ1-999-2003-1414. Existing configuration is acceptable.	-	-	-	N/A

**TABLE 6-6 - POTENTIAL OUTLIER RESOLUTION SUMMARY - RB EL. 664'**  
**Plant Areas: 664A, 664B, 664C & 664D**

For Potential Outliers not acceptable per calculation, identify as: M – Support modifications; D – Hardware deficiencies; O – Others

POS No.	Brief Description of Condition	Outlier Evaluation by Calculation			M	D	O	Summary of Recommendations
		O K	Not OK	Calculation Number / Comments				
664B-002	Overspan on both 1"Ø insulated Building Heat supply and return lines off the area heater located in col. lines R4-Ux. Also, verify seismic adequacy of the support member and weld attachment of typical building unit heater in the area. Building heaters are located in col. lines R2-Ux and R4-Ux.		√	Per Calc. CDQ1-044-2003-1198, the existing piping configuration is acceptable, thus overspan conditions are resolved. However, per Calc. CDQ1-044-2003-1406, existing support configuration of one of 2 unit heaters in this area (R4-Ux) is not acceptable. Unit heater in col. lines R2-Ux is adequate as-is.	√			Install new aircraft cable support, bracing the 1¼"Ø pipe member to the main building steel column. Refer to Calc. CDQ1-044-2003-1600 for design loads and details.
664C-001	8"Ø Condensate S & S line has 26' span	√		See CDQ1-999-2003-1414. Existing configuration is acceptable.	-	-	-	N/A
664C-002	1"Ø Building Heat line has 11' span	√		See CDQ1-999-2003-1414. Existing configurations are acceptable.	-	-	-	N/A
664C-003	2"Ø Drain line has 15'-6" span	√		See CDQ1-999-2003-1414. Existing configurations are acceptable.	-	-	-	N/A
664C-004	Verify seismic adequacy of the support member and weld attachment of typical building unit heater in the area. Building heater is located in col. lines R6-Ux.	√		Per Calc. CDQ1-044-2003-1406, the existing support configuration of unit heater in this area is acceptable.	-	-	-	N/A



**TABLE 6-6 - POTENTIAL OUTLIER RESOLUTION SUMMARY - RB EL. 664'**  
**Plant Areas: 664A, 664B, 664C & 664D**

For Potential Outliers not acceptable per calculation, identify as: M – Support modifications; D – Hardware deficiencies; O – Others

POS No.	Brief Description of Condition	Outlier Evaluation by Calculation			M	D	O	Summary of Recommendations
		O K	Not OK	Calculation Number / Comments				
664C-005	Hot water heater is not anchored. Tank may slide and cause attached piping to break (3/4"Ø water heater supply lines, System 029)		√	Per Calc. CDQ1-029-2003-1407, the seismic motion would cause the attached piping to rupture at the union connection, and result in a spray hazard.	√			Anchor the water heater with new steel clip angles and expansion anchor bolts. Refer to Calc. CDQ1-029-2003-1407 for design loads and details.
664D-001	Three (3) 1"Ø Building Heat lines have 13' spans	√		See CDQ1-999-2003-1414. Existing configuration is acceptable.	-	-	-	N/A
664D-002	3"Ø Unidentified line has 13' span	√		See CDQ1-999-2003-1414. Existing configuration is acceptable.	-	-	-	N/A
664D-003	Three (3) 1"Ø Building Heat lines have 17'-6", 16'-2", and 14'-2" spans		√	Per CDQ1-999-2003-1414, the existing configuration is not acceptable.	√			Add a new gang-support at column R7-Px to reduce the existing overspan of the 3-1"Ø lines. Refer to Calc. CDQ1-044-2003-1611 for design loads and details.
664D-004	Verify seismic adequacy of the support member and weld attachment of typical building unit heater in the area. Building heaters are located in col. lines R4-Px and R6-Px.		√	Per Calc. CDQ1-044-2003-1406, existing support configuration of one of 2 unit heaters in this area (R4-Px) is not acceptable. Unit heater in col. lines R6-Px is acceptable as-is.	√			Install new aircraft cable support, bracing the 1¼"Ø pipe member to the main building steel column. Refer to Calc. CDQ1-044-2003-1600 for design loads and details.

## 6. SUMMARY AND RECOMMENDATIONS

Of the twenty-seven (27) plant areas in the Reactor Building considered for BFN-1 seismic-induced II/I spray hazard program, a total of one hundred seventy-nine (179) potential outliers were identified during the in-plant screening walkdowns. Majority of these potential outliers were resolved by performing further analyses and evaluations to the acceptance criteria of TVA Design Criteria BFN-50-C-7306 (Reference 7-2). For the remaining outliers that did not meet the above evaluation criteria, plant design modifications are developed for appropriate resolution. In addition, work requests are initiated for those outliers that fall into the general category of maintenance and housekeeping items, such as missing support hardware, severe rust conditions and others. Table 6-1 presents a summary of the BFN-1 seismic II/I spray evaluation program.

### 6.1 Plant Modifications

Plant design modifications are developed for outliers not meeting the acceptance requirements of TVA Design Criteria BFN-50-C-7306 (Reference 7-2). Design modifications ranged from simple support hardware modifications to addition of new pipe supports, rerouting of piping and others. A total of nineteen (19) plant design modifications were implemented for the resolution of these seismic II/I spray outliers. A brief description of each of the plant modifications is provided in Table 6-2.

Engineering design of the plant modifications are documented in various calculation packages listed in Appendix C of this report. These plant modifications will be implemented under Design Change Notice DCN 51669.

### 6.2 Maintenance and Housekeeping Items

In addition to the plant modifications discussed in Section 6.1 above, a total of thirteen (13) miscellaneous maintenance and housekeeping items were identified for appropriate actions and resolution. These maintenance items, along with their locations and brief description, are tabulated in Table 6-3. These items will be disposed through maintenance work requests.

TABLE 6-1

## Summary of BFN-1 Seismic I/I Spray Evaluation Program

Plant Location	Plant Area Designation	No. of Plant Area	No. of Potential Outliers	No. of Design Mods	No. of Maint. Items
RB El. 519' & 541'-6"	NWQUAD, NEQUAD, SWQUAD, SEQUAD, HPCI, TORUS	6	28	4	1
RB El. 565'	565A, 565B, 565C, 565D, STNL	5	52	4 <sup>(1)</sup>	7
RB El. 593'	593A, 593B, 593C, 593D	4	32	1 <sup>(2)</sup>	2
RB El. 621'-3"	621A, 621B, 621C, 621D	4	23	2	1
RB El. 639'	639A, 639B, 639C, 639D	4	30	4	2
RB El. 664'	664A, 664B, 664C, 664D	4	14	4	0
<b>Total No. of I/I Spray Walkdown Plant Areas</b>		<b>27</b>			
<b>Total No. of I/I Spray Potential Outliers Identified</b>			<b>179</b>		
<b>Total No. of Plant Design Modifications (DCN 51669)</b>				<b>19</b>	
<b>Total No. of Misc. Maintenance and Housekeeping Items</b>					<b>13</b>

(1) POS 565C-012 was resolved per DCN 51178.

(2) POS 593B-004 was resolved per DCN 51182.

TABLE 6-2

**Summary of Plant Modifications**  
**BFN-1 Seismic II/I Spray Evaluation Program**

Item	Location	Ref. <sup>(1)</sup>	Description of Plant Modification	Reference DCA Drawing No. <sup>(2)</sup>
1	RB El. 541'-6"	POS NEQUAD-002	Add one new support to the 3/4"ø Control Rod Drive line (085) at El. 548'-7". Use standard typical pipe support per Dwg. 0-47B436-52. <i>See Calc. no. CDQ1-085-2003-1693</i>	1-47B600-5412
2	RB El. 541'-6"	POS NEQUAD-004	Add one new support to the 1"ø Condensate S&S line (002) at El. 551'-0". <i>See Calc. no. CDQ1-002-2003-1617</i>	1-47B553-96
3	RB El. 541'-6"	POS NEQUAD-005	Add one new support to the 2-1/2"ø Control Rod Drive line (085) at El. 558'-0". Use standard typical pipe support per Dwg. 0-47B436-52. <i>See Calc. no. CDQ1-085-2003-1616</i>	1-47B600-5411
4	RB El. 541'-6"	POS TORUS-002	Repair and reconnect existing hanger support for 1"ø Aux. Boiler line (012) at El. 555'-9". <i>See Calc. no. CDQ1-012-2003-1618</i>	1-47B404-2
5	RB El. 565'	POS 565B-014	Add one new support to the 1"ø Building Heat line (044) at El. 585'-6". <i>See Calc. no. CDQ1-044-2003-1691</i>	1-47B920-1310
6	RB El. 565'	POS 565B-017	Add one new support to the 1-1/2"ø Building Heat line (044) at El. 587'-6". Use standard typical pipe support per Dwg. 0-47B436-52. <i>See Calc. no. CDQ1-044-2003-1692</i>	1-47B920-1311

TABLE 6-2 (cont'd)

**Summary of Plant Modifications**  
**BFN-1 Seismic I/I Spray Evaluation Program**

Item	Location	Ref. <sup>(1)</sup>	Description of Plant Modification	Reference DCA Drawing No. <sup>(2)</sup>
7	RB El. 565'	POS 565B-018	Add one new support to the 2-1/2"Ø Fire Protection line (026) at El. 569'-9".  <i>See Calc. no. CDQ1-026-2003-2542 and Calc. no. CDQ1-026-2003-2566</i>	1-47B491-3323 see note (3)
--	RB El. 565'	POS 565C-012	Add one new support to the 2"Ø Raw Cooling Water line (024) at El. 578'-5". Use standard typical pipe support per Dwg. 0-47B436-52.  <i>See Calc. no. CDQ1-024-2003-1619</i>	see note (4)
8	RB El. 565'	POS 565D-004	Add one new support to the 2-1/2"Ø Fire Protection line (026) at El. 582'.  <i>See Calc. no. CDQ1-026-2003-2543 and Calc. no. CDQ1-026-2003-2566</i>	1-47B491-3324 see note (3)
9	RB El. 593'	POS 593B-002	Replace existing pipe support for the 1"Ø Floor Drain line (040) at El. 616'-5" with standard typical pipe support per Dwg. 0-47B436-52.  <i>See Calc. no. CDQ1-040-2003-1605</i>	1-47B481-5
--	RB El. 593'	POS 593B-004	Replace and resupport damaged 1/2"Ø RBCCW (070) pipe located along col. line R2, between S and U at El. 608'-5".  <i>See Calc. no. CDQ1-070-2003-1604</i>	see note (5)
10	RB El. 621'-3"	POS 621A-003	Install seismic restraints to the collection drum for Standby Liquid Control flush lines (063) located on the floor at El. 621'-3".  <i>See Calc. no. CDQ1-063-2003-1614</i>	1-47B462-2014

**TABLE 6-2 (cont'd)**

**Summary of Plant Modifications  
BN-1 Seismic I/I Spray Evaluation Program**

Item	Location	Ref. <sup>(1)</sup>	Description of Plant Modification	Reference DCA Drawing No. <sup>(2)</sup>
11	RB El. 621'-3"	POS 621A-005	Repair and reconnect existing hanger support for 1"Ø Standby Liquid Control line (063) at El. 635'-1". Use standard typical pipe support per Dwg. 0-47B436-52  <i>See Calc. no. CDQ1-063-2003-1615</i>	1-47B462-2015
12	RB El. 639'	POS 639A-001	Add one new support to the 1"Ø Gland Seal line (037) at El. 653'-6".  <i>See Calc. no. CDQ1-037-2003-1177</i>	1-47B446-311
13 & 14	RB El. 639'	POS 639C-004 639C-008 639A-011	Add new support for the 6"Ø Secondary Containment line (064) - two locations at El. 643', col. lines R4/S and R4/Q.  <i>See Calc. no. CDQ1-064-2003-1226</i>	1-47B920-1354 1-47B920-1355
15	RB El. 639'	POS 639D-004	Add one new support to the 2"Ø Potable Water line (029) at El. 653'-6".  <i>See Calc. no. CDQ1-029-2003-1217</i>	1-47B491-3322
16 & 17	RB El. 664'	POS 664B-002 664D-004	Modify existing support for Building Heater (044) - two locations at El. 674', col. lines R4/Px and R4/Ux.  <i>See Calc. no. CDQ1-044-2003-1600</i>	1-47B920-1307 1-47B920-1308
18	RB El. 664'	POS 664C-005	Install seismic restraints to the Hot Water Heater (Potable Water Tank, 029) located at El. 672'-8".  <i>See Calc. no. CDQ1-029-2003-1407</i>	1-47B491-3321

**TABLE 6-2 (cont'd)**  
**Summary of Plant Modifications**  
**BFN-1 Seismic II/I Spray Evaluation Program**

Item	Location	Ref. <sup>(1)</sup>	Description of Plant Modification	Reference DCA Drawing No. <sup>(2)</sup>
19	RB El. 664'	POS- 664D-003	Add one new support to (3) 1"Ø Building Heat lines (044) at El. 675'. <i>See Calc. no. CDQ1-044-2003-1611</i>	1-47B920-1309

- (1) Detailed description and as-built information of these items, including photos and/or sketches, can be found in the Potential Outlier Sheet (POS) contained in the respective seismic II/I spray Walkdown Data Packages (WDPs).
- (2) Refer to DCN 51669, unless noted otherwise.
- (3) Refer to DCN 51669, PIC 60370.
- (4) Subject pipe was removed per DCN 51178. Hence, no additional work is required. POS 565C-012 is resolved.
- (5) Subject pipe was removed per DCN 51182, as shown on DCA Dwgs. 51182-038 and 51182-039. Hence, no additional work is required. POS 593B-004 is resolved.

**TABLE 6-3**

**Summary of Misc. Maintenance & Housekeeping Items  
BFN-1 Seismic II/I Spray Evaluation Program**

Item	Location	Ref. *	Description	Recommended Action
1	Above Torus El. 541'-3"	POS TORUS-001	One bolt missing on flange connection of 2"ø Aux. Boiler line, near connection to RHR line.  Pipe flange is located at 8" N of AZ 90°, 6' E of R1 and about 70" below the ceiling (El. 565').	Work Order WO # 03-018259-000 was issued to replace the missing bolt on the flange connection.
2	RB El. 565'	POS 565A-010	2-1/2"ø and 4"ø Potable Water lines with visible rust at the threaded joints. Lines appear to be galvanized iron pipes.  Rusted joints in the lines are located at 14' N of P and 7'-6" E of R2. Pipe elevation is at about 576'-6".	Work Order WO # 03-018269-000 was issued to address the rusted threaded joints.
3	RB El. 565'	POS 565A-011	Disengaged rod on the 2-1/2"ø Potable Water line.  Pipe elevation is at El. 588'-1"; support is located at 14' N of col. line P and 5' E of R2.	Work Order WO # 03-022090-000 was issued to reinstall the missing rod hanger.
4	RB El. 565'	POS 565B-001	2"ø Floor Drain line has a detached rod hanger.  The rod hanger in question is located at about 13' N of T and 7'-6" W of R4. Pipe elevation is at about 588'-2".	Work Order WO # 03-018270-000 was issued to reinstall the disengaged rod hanger.
5	RB El. 565'	POS 565B-020	Significant rust condition noted at the tee connection between the 8"ø F.P. header and 2-1/2"ø branch line.  Pipe elevation is at El. 588'-1"; tee connection is located at 6.5' N of U and 1' W of R2.	Work Order WO # 03-022093-000 was issued to address the rusted tee connection.



**TABLE 6-3 (cont'd)**

**Summary of Misc. Maintenance & Housekeeping Items  
BFN-1 Seismic III/ Spray Evaluation Program**

Item	Location	Ref. *	Description	Recommended Action
6	RB El. 565'	POS 565C- 009	Pipe clamp is missing on a wall-mounted Unistrut pipe support for 3/4"Ø Rad Waste line.  Support is located just N of U-Line (5" from wall) and W of R5 (nearest pipe elbow is at 5'-4" W of R5). Pipe elevation is at about 568'-6".	Work Order WO # 03-018272-000 was issued to reinstall the missing pipe clamp.
7	RB El. 565'	POS 565C- 014	Missing hardware on a trapeze rod hanger support for 8"Ø Fire Protection header – missing rod on the south end and missing nut on the north end of the support.  The support is located about 8' N of S line and 8' W of wall penetration at R7 wall. Pipe elev. is at about 576'.	Work Order WO # 03-013733-000 was issued to reinstall the missing rod and nut.
8	RB El. 565'	POS 565D- 003	4"Ø Floor Drain line rod hanger is detached.  Support is located at about 10' N of Q and 3' E of R6. Pipe elevation is at about 588'-4".	Work Order WO # 03-018273-000 was issued to reinstall the detached rod hanger.
9	RB El. 593'	POS 593A- 007	Line is leaking at the threaded bronze hand valve near T-connection of 1/2"Ø tubing to 12"Ø Raw Cooling Water header.  The 1/2"Ø line with leaking connection is located about 4' W of R3, between P & Q (off the 12"Ø RCW header). The 1/2"Ø line is at Elev. 608'-1".	Work Order WO # 03-018274-000 was issued to repair the leaking connection.

**TABLE 6-3 (cont'd)**

**Summary of Misc. Maintenance & Housekeeping Items  
BFN-1 Seismic II/I Spray Evaluation Program**

Item	Location	Ref. *	Description	Recommended Action
10	RB El. 593'	POS 593B- 007	2"Ø RBCCW line has a detached rod hanger.  The location of the missing rod is at 7'-2" E of R2 and 2'-9" N of T. The 2"Ø line is at Elev. 617'-3". Note that pipe clamp is still attached to the pipe.	Work Order WO # 03-018275-000 was issued to re-install the missing rod.
11	RB El. 621'-3"	POS 621B- 002	Excessive corrosion & rust observed on the 1"Ø & 3/4"Ø Building Heat lines and threaded joints near the interface to area heater.  Area heater is located on the south face of RC column R2/T.	Work Order WO # 03-018277-000 was issued to replace rusted pipe segments and threaded joints.
12	RB El. 639'	POS 639A- 008	Rusted conditions observed on the 1"Ø Building Heat lines at interface with the unit area heater (including union).  Area heater is located on the north face of Q-line between R2 & R3.	Work Order WO # 03-018281-000 was issued to replace rusted pipe segments and threaded joints at the heater interface.
13	RB El. 639'	POS 639C- 001	Pipe flange is leaking on short riser of 3"Ø Condensate S&S line.  Pipe flange is located about 4'-6" S of column line S and 3'-6" E of R3. Pipe elevation is at about 659'.	Work Order WO # 03-005020-000 has been issued to address the leaking flange connection.

\* Detailed description and as-built information of these items, including photos and/or sketches, can be found in the Potential Outlier Sheet (POS) contained in the respective seismic II/I spray Walkdown Data Packages (WDPs).

## 7. REFERENCES

- 7-1 WI-BFN-0-CEB-06, "Engineering Walkdown Instruction for Evaluation of Seismic-Induced Spray Hazards." Rev. 0.
- 7-2 BFN-50-C-7306, "Qualification Criteria for Seismic Class II Piping, Pipe Supports, and Components." Rev. 1.
- 7-3 CD-Q0999-910005, "Evaluation of Seismic-Induced Spray Hazards, BFN, Unit 2 and Common."
- 7-4 CD-Q3999-931257, "BFN Unit 3 II/I Spray Evaluation."
- 7-5 NDQ0 999 920011, "Seismic Class I Piping System Boundaries."
- 7-6 EPRI Report RP-2635-1, "Piping Seismic Adequacy Criteria Recommendation Based on Performance During and After Earthquakes." February 1987.
- 7-7 EPRI Report NP-7149, "Summary of the Seismic Adequacy of Twenty Classes of Equipment Required for Safe Shutdown of Nuclear Plants." March 1991.
- 7-8 USAS B31.1.0, "Power Piping." 1967 Edition.
- 7-9 CDQ1 999 2003 0831, "In-Plant Screening Tools for Seismic II/I Spray Walkdown Evaluations." Rev. 1.
- 7-10 "Generic Implementation Procedure (GIP) for Seismic Verification of Nuclear Plant Equipment." Rev. 2A, March 1993.
- 7-11 "TPIPE Program User Manual." Version 16, July 1994.

**APPENDIX A:**

**BFN-1 SEISMIC III/ SPRAY EVALUATION**

**WALKDOWN DATA PACKAGES**

**BFN-1 Seismic II/I Spray Evaluation Walkdown Data Packages****(1 of 2)**

<b>Walkdown Data Package (WDP)</b>	<b>Title</b>	<b>Rev.</b>
BFN1-CEB-SPRY- NWQD	Seismic II/I Spray Walkdown Screening Evaluation Documentation – Plant Area NWQUAD	1
BFN1-CEB-SPRY- NEQD	Seismic II/I Spray Walkdown Screening Evaluation Documentation – Plant Area NEQUAD	0
BFN1-CEB-SPRY- SWQD	Seismic II/I Spray Walkdown Screening Evaluation Documentation – Plant Area SWQUAD	0
BFN1-CEB-SPRY- SEQD	Seismic II/I Spray Walkdown Screening Evaluation Documentation – Plant Area SEQUAD	0
BFN1-CEB-SPRY- HPCI	Seismic II/I Spray Walkdown Screening Evaluation Documentation – Plant Area HPCI	0
BFN1-CEB-SPRY- TORS	Seismic II/I Spray Walkdown Screening Evaluation Documentation – Plant Area TORUS	0
BFN1-CEB-SPRY-565A	Seismic II/I Spray Walkdown Screening Evaluation Documentation – Plant Area 565A	2
BFN1-CEB-SPRY-565B	Seismic II/I Spray Walkdown Screening Evaluation Documentation – Plant Area 565B	1
BFN1-CEB-SPRY-565C	Seismic II/I Spray Walkdown Screening Evaluation Documentation – Plant Area 565C	1
BFN1-CEB-SPRY-565D	Seismic II/I Spray Walkdown Screening Evaluation Documentation – Plant Area 565D	1
BFN1-CEB-SPRY-STNL	Seismic II/I Spray Walkdown Screening Evaluation Documentation – Plant Area Steam Tunnel	0
BFN1-CEB-SPRY-593A	Seismic II/I Spray Walkdown Screening Evaluation Documentation – Plant Area 593A	0
BFN1-CEB-SPRY-593B	Seismic II/I Spray Walkdown Screening Evaluation Documentation – Plant Area 593B	0
BFN1-CEB-SPRY-593C	Seismic II/I Spray Walkdown Screening Evaluation Documentation – Plant Area 593C	0
BFN1-CEB-SPRY-593D	Seismic II/I Spray Walkdown Screening Evaluation Documentation – Plant Area 593D	0

**BFN-1 Seismic II/I Spray Evaluation Walkdown Data Packages**

(2 of 2)

Walkdown Data Package (WDP)	Title	Rev.
BFN1-CEB-SPRY-621A	Seismic II/I Spray Walkdown Screening Evaluation Documentation – Plant Area 621A	0
BFN1-CEB-SPRY-621B	Seismic II/I Spray Walkdown Screening Evaluation Documentation – Plant Area 621B	0
BFN1-CEB-SPRY-621C	Seismic II/I Spray Walkdown Screening Evaluation Documentation – Plant Area 621C	0
BFN1-CEB-SPRY-621D	Seismic II/I Spray Walkdown Screening Evaluation Documentation – Plant Area 621D	0
BFN1-CEB-SPRY-639A	Seismic II/I Spray Walkdown Screening Evaluation Documentation – Plant Area 639A	1
BFN1-CEB-SPRY-639B	Seismic II/I Spray Walkdown Screening Evaluation Documentation – Plant Area 639B	0
BFN1-CEB-SPRY-639C	Seismic II/I Spray Walkdown Screening Evaluation Documentation – Plant Area 639C	0
BFN1-CEB-SPRY-639D	Seismic II/I Spray Walkdown Screening Evaluation Documentation – Plant Area 639D	0
BFN1-CEB-SPRY-664A	Seismic II/I Spray Walkdown Screening Evaluation Documentation – Plant Area 664A	0
BFN1-CEB-SPRY-664B	Seismic II/I Spray Walkdown Screening Evaluation Documentation – Plant Area 664B	0
BFN1-CEB-SPRY-664C	Seismic II/I Spray Walkdown Screening Evaluation Documentation – Plant Area 664C	0
BFN1-CEB-SPRY-664D	Seismic II/I Spray Walkdown Screening Evaluation Documentation – Plant Area 664D	0

**APPENDIX B:**

**BFN-1 SEISMIC III/ SPRAY EVALUATION**

**OUTLIER RESOLUTION CALCULATION PACKAGES**

**BN-1 Seismic II/I Spray Evaluation  
Outlier Resolution Calculation Packages  
(1 of 4)**

Calculation No.	Title	Rev.
CDQ1-999-2003-0831	In-Plant Screening Tools for Seismic II/I Spray Walkdown Evaluations	1
CDQ1-999-2003-1072	Evaluation of Seismic II/I Spray Potential Outliers for Overspan Piping, Reactor Bldg., El. 639'	1
CDQ1-002-2003-1085	Demineralized Water II/I Spray Seismic Analysis – Resolution of POS 639C-005	0
CDQ1-002-2003-1086	Condensate S&S II/I Spray Seismic Analysis – Resolution of POS 639B-005	0
CDQ1-044-2003-1087	Building Heat II/I Spray Seismic Analysis – Resolution of POS 639B-003	1
CDQ1-026-2003-1088	Fire Protection II/I Spray Seismic Analysis – Resolution of POS 639B-004	0
CDQ1-024-2003-1135	Raw Cooling Water Cu Tubing II/I Spray Seismic Analysis – Resolution of POS NEQUAD-001	0
CDQ1-071-2003-1136	RCIC II/I Spray Seismic Analysis – Resolution of POS NWQUAD-003	0
CDQ1-037-2003-1178	Evaluation of Seismic II/I Spray POS 639A-004, Gland Seal Storage Tank Anchorage, Reactor Building, El. 639 Ft.	0
CDQ1-085-2003-1197	CRD Piping II/I Spray Seismic Analysis – Resolution of POS NEQUAD-005	0



**BFN-1 Seismic II/I Spray Evaluation  
Outlier Resolution Calculation Packages  
(2 of 4)**

Calculation No.	Title	Rev.
CDQ1-044-2003-1198	Building Heat Supply & Return Lines at RB El. 664 ft. - II/I Spray Seismic Analysis and Resolution of POS 664B-002	0
CDQ1-085-2003-1405	Control Rod Drive Line II/I Spray Seismic Analysis – Resolution of POS NEQUAD-002	0
CDQ1-044-2003-1406	Building Heater Support Anchorage II/I Spray Seismic Analysis for Reactor Building, El. 664 ft.	0
CDQ1-024-2003-1408	Raw Cooling Water Line II/I Spray Seismic Analysis – Resolution of POS 565A-001	0
CDQ1-999-2003-1409	Evaluation of Seismic II/I Spray Potential Outliers for Overspan Piping, Reactor Bldg., El. 565 ft.	0
CDQ1-044-2003-1410	Building Heater Support Anchorage II/I Spray Seismic Analysis – Resolution of POS 565A-003, POS 565B-002 and POS 565C-010	0
CDQ1-024-2003-1411	Raw Cooling Water Support Anchorage II/I Spray Seismic Analysis – Resolution of POS 565B-003	0
CDQ1-999-2003-1412	Evaluation of Seismic II/I Spray Potential Outliers for Overspan Piping, Reactor Bldg., El. 519 ft. and 541.5 ft.	0
CDQ1-002-2003-1413	Demineralized Water II/I Spray Seismic Analysis – Resolution of POS NEQUAD-008	0
CDQ1-999-2003-1414	Evaluation of Seismic II/I Spray Potential Outliers for Overspan Piping, Reactor Bldg., El. 664 ft.	0

**BFN-1 Seismic II/I Spray Evaluation  
Outlier Resolution Calculation Packages  
(3 of 4)**

Calculation No.	Title	Rev.
CDQ1-085-2003-1415	Control Rod Drive Line II/I Spray Seismic Analysis - Resolution of POS NEQUAD-009	0
CDQ1-999-2003-1601	Evaluation of Seismic II/I Spray Potential Outliers for Overspan Piping, Reactor Building, El. 593 ft.	0
CDQ1-999-2003-1602	Evaluation of Seismic II/I Spray Potential Outliers for Overspan Piping, Reactor Building, El. 621'-3"	0
CDQ1-000-2003-1603	Floor Drain Line II/I Spray Seismic Analysis - Resolution of POS 593D-006	0
CDQ1-044-2003-1607	Building Heat Piping II/I Spray Seismic Analysis - Bounding Evaluation for El. 593'	0
CDQ1-044-2003-1608	Building Heat Piping II/I Spray Seismic Analysis - Bounding Evaluation for El. 621'-3"	0
CDQ1-026-2003-1609	Fire Protection Branch Line II/I Spray Seismic Analysis - Resolution of POS 621D-001	0
CDQ1-069-2003-1610	RWCU AOV 1-FCV-069-0078 II/I Spray Seismic Analysis - Resolution of POS 621C-007	0
CDQ1-069-2003-1612	RWCU Pump Support Anchorage II/I Spray Seismic Analysis - Resolution of POS 621C-003	0
CDQ1-000-2003-1613	Eye Wash Station Support Anchorage II/I Spray Seismic Analysis - Resolution of POS 621A-004	0

**BN-1 Seismic II/I Spray Evaluation  
Outlier Resolution Calculation Packages  
(4 of 4)**

Calculation No.	Title	Rev.
CDQ1-044-2003-2319	Building Heat Line & Area Unit Heater Seismic II/I Spray Screening Tool	0
CDQ1-026-2003-1606	Fire Protection Hose Station Piping II/I Spray Seismic Analysis – Resolution of POS 565B-018	0
CDQ1-026-2003-1952	Fire Protection Hose Station Piping II/I Spray Seismic Analysis – Resolution of POS 565D-004	0
CDQ1-026-2003-2151	Fire Protection Hose Station Piping II/I Spray Seismic Analysis – Resolution of Overspan Conditions for POS 565B-019, POS 565C-013 and POS 565D-005	0
CDQ1-026-2003-2558	Fire Protection Hose Station Piping II/I Spray Seismic Analysis – Resolution of POS 565C-014	0
CDQ1-999-2003-1404	Summary of Seismic II/I Spray Evaluation Program at Browns Ferry Nuclear Plant, Unit 1	0

**APPENDIX C:**

**BFN-1 SEISMIC III/ SPRAY EVALUATION**

**PLANT MODIFICATION DESIGN CALCULATION PACKAGES**

**BFN-1 Seismic II/I Spray Evaluation**  
**Plant Modification Design Calculation Packages**  
**(1 of 2)**

Calculation No.	Title	Rev.
CDQ1-037-2003-1177	Gland Seal Line II/I Spray Seismic Analysis – Resolution of POS 639A-001	0
CDQ1-029-2003-1217	Potable Water II/I Spray Seismic Analysis – Resolution of POS 639D-004	0
CDQ1-078-2003-1226	Fuel Pool Cooling Line II/I Spray Seismic Analysis – Resolution of POS 639C-004 & -008 and POS 639A-011	1
CDQ1-029-2003-1407	Hot Water Heater (Potable Water Tank) Anchorage II/I Spray Seismic Analysis – Resolution of POS 664C-005	0
CDQ1-044-2003-1600	Resolution of POS 664B-002 and POS 664D-004, Building Heater Support Strengthening, II/I Spray Seismic Analysis for Unit 1 Reactor Building, El. 664'	0
CDQ1-070-2003-1604	RBCCW Piping II/I Spray Seismic Analysis - Resolution of POS 593B-004	0
CDQ1-000-2003-1605	Floor Drain Line II/I Spray Seismic Analysis - Resolution of POS 593B-002	0
CDQ1-044-2003-1611	Reactor Building El. 664', Building Heat Lines II/I Spray Seismic Analysis - Resolution of POS 664D-003	0
CDQ1-063-2003-1614	Standby Liquid Control Flush Lines II/I Spray Seismic Analysis - Resolution of POS 621A-003	0
CDQ1-063-2003-1615	Standby Liquid Control Line II/I Spray Seismic Analysis - Resolution of POS 621A-005	0

**BFN-1 Seismic II/I Spray Evaluation**  
**Plant Modification Design Calculation Packages**  
(2 of 2)

Calculation No.	Title	Rev.
CDQ1-085-2003-1616	CRD Pipe Support Seismic Strengthening, II/I Spray Seismic Analysis - Resolution of POS NEQUAD-005	0
CDQ1-002-2003-1617	Condensate S&S Line II/I Spray Seismic Analysis - Resolution of POS NEQUAD-004	0
CDQ1-012-2003-1618	Auxiliary Boiler Line II/I Spray Seismic Analysis - Resolution of POS TORUS-002	0
CDQ1-024-2003-1619	Raw Cooling Water Piping II/I Spray Seismic Analysis - Resolution of POS 565C-012	0
CDQ1-044-2003-1691	Building Heat Piping II/I Spray Seismic Analysis - Resolution of POS 565B-014	0
CDQ1-044-2003-1692	Building Heat Piping II/I Spray Seismic Analysis - Resolution of POS 565B-017	0
CDQ1-085-2003-1693	Control Rod Drive Line Seismic Strengthening – Resolution of POS NEQUAD-002	0
CDQ1-026-2003-2542	Fire Protection Hose Station Piping II/I Spray Seismic Strengthening – Resolution of POS 565B-018	0
CDQ1-026-2003-2543	Fire Protection Hose Station Piping II/I Spray Seismic Strengthening – Resolution of POS 565D-004	0

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