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SUBJECT: Forwards evaluation & resolution of nonconformance conditions re standby liquid control sys & RWCU sys.

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NIAGARA MOHAWK POWER CORPORATION/301 PLAINFIELD ROAD, SYRACUSE, N.Y. 13212/TELEPHONE (315) 474-1511

November 30, 1990
NMP2L 1264

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

Re: Nine Mile Point
Docket No. 50-410
NPF-69

Gentlemen:

In letters dated June 29, 1990, (NMP2L1241) and July 27, 1990, (NMP2L1246), Niagara Mohawk Power Corporation (NMPC) provided information to the Nuclear Regulatory Commission (NRC) dealing with the discovery, evaluation, and resolution of nonconforming conditions in certain piping stress calculations for Nine Mile Point Unit 2 (NMP2). In both these letters, NMPC stated it would provide the NRC further information regarding a closure plan and specific corrective actions. This letter fulfills that commitment, supersedes in its entirety the corrective actions discussed in the previous two letters and provides the basis for closure of all issues associated with the nonconforming conditions.

NMPC has concluded that no safety concerns existed in relation to the nonconforming issues discussed in the attachment to this letter. No plant modifications are required as a result of the disposition of the nonconforming conditions.

This letter also serves the purpose of providing notification to the NRC of the use of the Summer 1976 Addenda to 1974 ASME Section III Code Edition for NMP2 piping stress calculations. The use of the ASME Code subsequent to the 1974 edition is discussed in greater detail in Section VI, in the subsection entitled "Final Closure Plan for ASME Code Edition," contained in the attachment to this letter..

Very truly yours,

NIAGARA MOHAWK POWER CORPORATION

C. D. Terry
Vice President
Nuclear Engineering

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Attachment

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EVALUATION AND RESOLUTION OF NONCONFORMANCE CONDITIONS

I. INTRODUCTION

In its letter dated June 29, 1990, (NMP2L 1241), NMPC identified potential nonconforming conditions in certain piping stress calculations. In this context, nonconforming conditions were identified as: (1) the use of allowable stresses based upon CMTRs; and (2) deviations from analytical techniques and ASME Code Editions set forth in the Updated Safety Analysis Report (USAR). In a subsequent letter dated July 27, 1990 (NMP2L 1246), NMPC proposed specific corrective actions and closure plan for the issues identified in the June 29, 1990 letter. This submittal provides the basis for closure of all issues associated with the nonconforming conditions, supersedes in its entirety the corrective actions and closure plans discussed in the previous two letters, and provides the results of a root cause evaluation. The final corrective actions entail a combination of revisions to analyses and calculations, and updates to the USAR.

The subsequent portions of this attachment discuss:

1. The final corrective actions for three plant systems and primary containment penetrations:

   - Standby Liquid Control System (SLS) (Section II)
   - Reactor Water Cleanup System (WCS) (Section III)
   - Main Steam System (MSS) (Section IV)
   - Primary Containment Penetrations (Section V)

2. The final corrective actions for issues associated with the nonconforming conditions:

   - the use of Certified Material Test Reports (CMTRs) (Section VI)
   - the use of later American Society of Mechanical Engineers (ASME) Code Editions (Section VI)
   - the use of Independent Support Method (ISM) in combination with ASME Code Case N-411 damping values (Section VI)

3. Root Cause Evaluation (Section VII)

II. STANDBY LIQUID CONTROL SYSTEM

NONCONFORMING CONDITIONS

1. Certain components were assessed using allowable stress values based on Certified Material Test Reports (CMTRs) during the as-built reconciliation program. However, the reconciliation program description in the USAR (paragraph 3.7.3.8.1A, pages 3.7A-23 and 3.7A-24) states that the load combinations and stress criteria are in accordance with the ASME Code [1] and refers back to the NMP2 design criteria (USAR paragraph 3.9.1.5A, page 3.9A-2b). The design criteria require piping system analyses to be in accordance with ASME Section III 1974 Edition, subarticles NB, NC and ND3600. The ASME Code does not address the use of CMTRs in as-built stress reconciliation except to state CMTRs shall not be used in the determination of vessel wall thickness. Therefore, the error was the lack of identification of CMTR use in the USAR.

2. Seismic analysis by the Independent Support Motion (ISM) method was used in combination with ASME Code Case N-411 damping values, and intergroup responses were combined using the square-root-sum-of-squares method. The USAR describes the seismic analysis technique by the Envelope Response Method (ERM) in paragraph 3.7.3.9A, page 3.7A-27a, for Stone and Webster Scope of Supply piping. However, use of ISM has been documented in the USAR (Section 3.7.2.1B) for GE Scope of Supply piping where Regulatory Guide 1.61 damping values were used.

3. Included in the stress analysis is documentation supporting an exception to the analysis requirement for ASME Code Class 1 piping. The justification is based on an ASME Code subarticle NB-3630(d)(2) and a qualitative evaluation of the thermal transients defined for the SLS system. The

[1] Unless otherwise noted, the reference to the ASME Code is to ASME Section III, 1974 Edition.

qualitative evaluation is technically acceptable. However, the ASME Code subarticle is not valid as the 1974 Edition of ASME does not give conditions for exception from Class 1 rules. The intent was to reference a later Edition of the ASME Code (Summer of 1976 or later Edition) which gives the rules for exceptions from ASME Class 1 requirements. Therefore, the use of a later ASME Code should have been reconciled with the 1974 Edition and listed in USAR Section 3.9.1.4.2A.

4. The outboard containment isolation valves (2SLS*MOV5A and 2SLS*MOV5B) contain significant eccentric masses which were incorrectly modeled. [1]

5. Stress intensification factors (SIFs) for socket welded end preparations were not included in the analysis as required by ASME. [1]

FINAL CORRECTIVE ACTIONS

A reanalysis of the existing Standby Liquid Control piping configuration, using time history analysis techniques with Regulatory Guide (RG) 1.61 dampings, has been performed. Piping analyses, using time history techniques, are described in USAR Section 3.7.3.8.3A. In addition, this reanalysis uses the provisions of subparagraph NB-3630(d)(2) from the ASME Code Summer 1976 Addenda. The reanalysis results show that pipe stress, pipe supports, containment penetration loads and valve accelerations are qualified to existing USAR design criteria. Modification of the existing SLS piping configuration is not required.

Specifically, the following issues have been addressed by this reanalysis:

(1) ASME Code stress limits, without reliance on CMTRs are used to qualify pipe stresses and containment penetration loads.

[1] Items (4) and (5) are not nonconforming conditions but rather calculational errors. They are included in this letter for purposes of completeness. These items will be addressed in the root cause evaluation.

(2) Time history analysis method with RG 1.61 damping values is used to replace the Independent Support Motion Response Spectrum method in combination with ASME Code Case N-411 damping values.

(3) Eccentric masses of the outboard containment isolation valves (2SLS*MOV5A and 2SLS*MOV5B) have been properly modeled in the piping model.

(4) Stress intensification factors for socket welded end preparations are included in the reanalysis.

The justification for using subparagraph NB-3630(d)(2) from the Summer 1976 Addenda to the 1974 Edition of the ASME Section III Code is described in Section VI of this attachment. The approach used to qualify the primary containment penetration loads is described in Section V.

III. REACTOR WATER CLEANUP SYSTEM

NONCONFORMING CONDITIONS

1. Three components were qualified using allowable stress values based on Certified Material Test Reports (CMTRs) during the as-built reconciliation program. The three components, one of which is already noted in the USAR, are: (1) two locations on a 3/4 inch vent/drain line pipe segment, (2) a tee, and (3) an elbow. However, the reconciliation program description in the USAR (paragraph 3.7.3.8.1A, pages 3.7A-23 and 3.7A-24) states that the load combinations and stress criteria are in accordance with the ASME Code and refers back to the NMP2 design criteria (USAR paragraph 3.9.1.5A, page 3.9A-2b). The design criteria require piping system analyses to be in accordance with ASME Section III 1974 Edition, subarticles NB, NC and ND3600. The ASME Code does not address the use of CMTR's in as-built stress reconciliation except that CMTR's shall not be used in the determination of vessel wall thickness. Therefore, the error was the lack of specific identification of CMTR use in this instance in the USAR.

2. One of three piping components qualified using a CMTR also required that the CMTR be used in an equation from an ASME edition (ASME Section III, 1986, Section NC-3652) later than the code edition of record (ASME Section III, 1974). The use of the later ASME Code edition is not described in USAR Section 3.9.1.4.2A, which lists the specific provisions of later ASME Code addenda or editions that are substituted for requirements of the 1974 Edition. There is no documentation in the calculation which uses the 1986 Edition of the ASME Code demonstrating that the related requirements for the two ASME Code editions were met as required by 10CFR50.55a(c)(3) and ASME Section III, NA-1140.

FINAL CORRECTIVE ACTIONS

The use of CMTRs and the 1986 Edition ASME Section III Code equation has been eliminated from the qualification of Reactor Water Cleanup subsystem. Specifically, the following corrective actions were taken:

(1) Two locations on the 3/4 inch vent/drain line were overstressed when compared to equation (9) for the upset conditions. The major loading of concern was the OBE. A review of system geometry indicated that the applied spectra for the 3/4 inch line were being unreasonably controlled by the remainder of the Reactor Water Cleanup System.

The 3/4 inch branch line was effectively isolated from the effects of the Reactor Coolant Recirculation System (RCS) response spectra at elevation 279'-0". This isolation is achieved by the presence of the containment penetration on the downstream side of the branch line and 10 pipe supports on the upstream side (see Figure 1). By excluding the effects of the response spectra at elevation 279'-0", calculated seismic stresses in the branch line were reduced. The reduction in the calculated seismic stresses was achieved by comparing acceleration values with and without the response spectra at elevation 279'-0" and calculating scale factors that were applied to the bending moments at the overstressed locations.

(2) The tee is slightly overstressed (0.5%) in ASME Code Equation 9 (emergency plant condition) when compared to ASME allowables. Using the same moment loadings in the original calculation and the section modulus formula ($\pi r^2 t$) provided in subparagraph NC-3652.4 of 1974 Edition ASME Section III Code where "r" is the mean radius, the stress at the slightly overstressed tee component was recalculated. The new stress value was found to be less than the ASME allowables. For this case the reference to the use of CMTRs will be removed from USAR Table 6A.9-5 in the 1991 Update.

(3) The WCS elbow has been re-evaluated and now meets all ASME Code requirements including subparagraph NB-3630(d) (2) from the Summer of 1976 Addenda to the 1974 Edition. The use of ASME Code editions subsequent to the 1974 Edition is discussed in Section VI of this attachment.

IV. MAIN STEAM SYSTEM

NONCONFORMING CONDITION

1. The main steam piping system was analyzed using ISM in combination with ASME Code Case N-411 damping values.

FINAL CORRECTIVE ACTION

See the final corrective action in Section VI of this Attachment, under the subheading "ISM & ASME CODE CASE N-411".

V. PRIMARY CONTAINMENT PENETRATIONS

NONCONFORMING CONDITIONS

The nonconforming conditions identified in primary containment penetration calculations fall into one of four categories. They are:

1. The use of allowable stresses and stress intensities based on CMTRs.

2. The use of an alternate load combination not described in the USAR. Loads were combined differently from that stated in the USAR for Primary Containment Penetrations when the faulted load combination did not meet the ASME Code allowable in the calculation. Pipe rupture loads were evaluated separately by comparison to ASME Code faulted allowables.

3. The incorrect reference to the 1974 Edition of the ASME Code in the penetration calculations. The calculations reference a ASME Code edition which is different from the code edition referenced in the design specification and the USAR.

4. The USAR requires MC Design Conditions I and II to include LOCA loads. The corresponding penetration calculations do not include LOCA loads.

FINAL CORRECTIVE ACTIONS

Revision of all affected primary containment penetration calculations to reflect the following corrective actions has been completed. All primary containment penetrations were found to meet ASME Code allowables. The following specific corrective actions correspond to the statement of the nonconforming issues:

(1) The use of CMTRs has been eliminated from all affected primary containment penetration calculations. Stress intensification factors (SIFs) for various load components (shear forces, bending moments, torsional moment) on the penetrations have been developed for various penetration configurations by finite element analyses. In the original penetration calculations, the envelope of these SIFs was conservatively applied to all load components. For the revised penetration calculations, the SIFs for various load components were applied only to the corresponding load component. SIFs developed for the shear force components were applied to penetration stresses due to shear forces; and SIFs developed for bending moment components were applied to penetration stresses due to bending moment loadings.

(2) The use of alternate load calculations has been eliminated from all affected primary containment penetration calculations. Only load combinations described in the USAR were used.

(3) The penetration calculations were actually performed using the ASME Code edition consistent with both the USAR and the design specification. The internal reference within the penetration calculations to the 1974 ASME Code Edition is incorrect. The primary containment penetration calculations will be revised to correct this editorial error by December 7, 1990.

(4) USAR Table 3.8-7 will be corrected editorially in the 1991 USAR update for consistency with the primary containment penetration design specification. The load combination for Class MC penetrations should not include LOCA loads in Design Conditions I and II. LOCA loads need not be included in Design Conditions I and II as they are presently included in load combinations for the faulted condition.

VI. FINAL CORRECTIVE ACTIONS FOR CMTRs, ASME CODE EDITIONS, AND ISM & ASME CODE CASE N-411

This section addresses the closure plan for the use of CMTRs, the use of editions of the ASME Code subsequent to the 1974 Edition, and the use of ISM in conjunction with ASME Code Case N-411.

FINAL CORRECTIVE ACTIONS FOR CMTRs

The root cause evaluation, discussed in Section VII of this attachment, is based on a review of 331 pipe stress calculations and 85 penetration calculations. During the course of the root cause evaluation, it was decided that the sampling size would be expanded to include all safety-related large bore pipe stress calculations, and all primary containment penetration calculations with pipe rupture loads.

Based on the review of various calculations indicated above, 6 pipe stress calculations were found to have used CMTRs. (For disposition of CMTR issue in primary containment penetration calculations, see discussion in Section V of this attachment.) A review of these 6 pipe stress calculation showed that where CMTRs were applied, the stresses were only marginally exceeding the

ASME Code allowables. It was also determined that by refining areas of conservatism in these calculations, the use of CMTRs would be eliminated. Revision of the pipe stress calculations to eliminate the use of CMTRs has been completed. Specifically, these areas of refinement included:

(1) Using ASME Code SIF for reducer components.

(2) Using more appropriate thermal loads and weld allowables consistent with ASME Code requirements for the welded attachments on pipe.

FINAL CORRECTIVE ACTIONS FOR ASME CODE EDITIONS

In order to support the use of editions of the ASME Code subsequent to the 1974 Edition, the following corrective actions are being taken:

(1) A procedure has been completed for performing reconciliation activities associated with a change to the ASME Code Editions or Addenda referenced in the Nine Mile Point Unit 2 design basis.

(2) The NRC is hereby notified that subparagraph NB-3630(d)(2) in Summer 1976 Addenda to 1974 ASME Section III Code Edition is invoked in NMP Unit 2 pipe stress calculations. An ASME Code reconciliation calculation documenting the justification for using this subparagraph has been completed.

(3) The use of subparagraph NB-3630(d)(2) in Summer 1976 Addenda will be incorporated in the 1991 USAR update.

FINAL CORRECTIVE ACTION FOR ISM & ASME CODE CASE N-411

In its July 27, 1990, letter, NMPC indicated that a total of 9 analyses out of 198 reviewed utilized ISM in conjunction with ASME Code Case N-411. As a result of the root cause evaluation, the sampling was expanded to include 331 pipe stress calculations. No new cases were found to have utilized ISM in

conjunction with ASME Code Case N-411 damping values. However, as a result of further review of these 9 calculations, it was determined that two calculations actually utilized ISM in conjunction with Regulatory Guide 1.61 damping values. Therefore, only 7 pipe stress calculations were affected by this issue.

NMPC decided to eliminate the use of ISM in conjunction with Code Case N-411 from these 7 calculations. The SLS system has been dispositioned using the approach described in Section II of this attachment. The remaining 6 calculations are being dispositioned using the following approach:

(1) A new calculation was generated to document the time history analyses using RG 1.61 damping values for the 6 pipe stress analyses.

(2) Time history analyses are performed for 4 of the 6 subsystems. Included in these 6 subsystems are the 4 Main Steam piping runs inside the primary containment. Two of the four Main Steam analyses for piping inside primary containment were selected as representative of the four loops, and these two analyses were included in the time history analyses.

(3) The piping responses from the four time history analyses using RG 1.61 damping values were compared to those from the ISM analyses using ASME Code Case N-411 damping values. In most cases, the ISM analyses provided higher calculated stresses and forces, and therefore, already fell within USAR acceptance criteria. For the remaining piping responses, the time history analyses provided higher results. These higher results also fell within USAR acceptance criteria.

Preliminary analysis results show that existing qualification bases in the six affected calculations are still valid, and plant modifications or USAR changes are not required. The final calculations documenting the above time history analyses and comparison results will be completed by December 7, 1990.

VII. ROOT CAUSE EVALUATION

NONCONFORMING CONDITIONS

As a part of its corrective actions, NMPC has completed a root cause evaluation of the following nonconforming conditions:

(1) Use of allowable stresses based on CMTRs
(2) Use of ISM in conjunction with Code Case N-411
(3) Use of ASME code editions subsequent to the 1974 Edition referenced in the USAR
(4) Primary containment penetrations qualified with CMTRs and Alternate Load Combination not identified in the USAR
(5) Incorrect modeling of eccentric masses of the SLS outboard containment isolation valves (2SLS*MOV5A and 2SLS*MOV5B)
(6) Omission of stress intensification factors for socket welded end preparations in the SLS analysis.

NONCONFORMING ITEMS (1) THROUGH (4)

The root cause evaluation of Items (1) through (4) above, focused on piping stress calculations. This approach is supported by the following:

1. The methodology discrepancies were introduced during the final as-built reconciliation process of the installed piping. The final design calculations are based on these final as-built conditions. The additional data (e.g., CMTRs) available at the time of as-built reconciliation contributed to the possibility of their application. The requirement of reconciling as-built configuration of piping, contained in IE Bulletin 79-14, is unique to piping analysis scope of work.

2. Since the turnover of NMP2 calculations, NMPC has reviewed numerous calculations as a result of operation of and modifications to the facility. Aside from the area of as-built stress reconciliation, NMPC has found no calculations which exhibit a pattern of nonconformance to USAR criteria.

During the period in question, Stone and Webster, as "N" certificate holder, was responsible for the stress calculations and, in accordance with the project procedure then in effect, was delegated responsibility for plant design and documentation. Stone and Webster inappropriately utilized calculational methods in the as-built reconciliation process that, while technically sound, deviated from methodologies set forth in the USAR. The root cause of the failure to document these engineering practices in the USAR was Stone and Webster's failure to appreciate that the as-built reconciliation process had to be governed by the USAR methodologies. As a result, Stone and Webster failed to appropriately resolve the differences in the engineering practices utilized during the as-built process with the licensing basis set forth in the USAR.

Because the circumstances which resulted in the nonconforming items have significantly changed, no corrective actions beyond those already taken are necessary. NMPC now has overall responsibility for assuring plant modifications or revisions to analyses and calculations are performed consistent with the criteria set forth in the USAR. NMPC's present procedures assure that vendor calculations comply with USAR requirements or that the USAR is changed to reflect changes in design documentation.

In response to the discovery of these nonconforming conditions, NMPC is re-emphasizing these requirements by enhancing its procedures. The procedures are being revised to re-emphasize the requirement that vendor calculations must be reviewed to assure that calculations have been performed using documented methodologies and criteria contained in the USAR.

NMPC plans to complete the above action by January 31, 1991.

No safety concerns resulted from the nonconforming issues nor were any identified by the root cause evaluation. As a result of our evaluation, we have determined that the nonconforming items were confined to the as-built stress reconciliation program.

NONCONFORMING ITEMS (5) AND (6)

Stone & Webster (the A/E which generated the affected calculations) was responsible for the determination of the circumstances that led to nonconforming conditions in items (5) and (6). It was determined that these conditions were caused by personnel performance deficiencies. Our evaluation concluded that items 5 and 6 were isolated cases of personnel error. This conclusion is supported by a review of the only other Class 1 calculation which was developed by the preparers of the SLS calculation. This additional Class 1 calculation did not include valves and used correctly applied stress intensification factors. In order to evaluate the programmatic implications of the calculational errors, a review of the governing procedures and computer manuals was conducted. The documents were determined to be adequate for their purpose.

The evaluation also concluded that these errors, items 5 and 6, were not significant. This position is supported by the evaluation of the nonconforming conditions for SLS in this submittal. As discussed in section II of this attachment, no plant modifications are required as a result of the disposition of the nonconforming conditions associated with SLS.

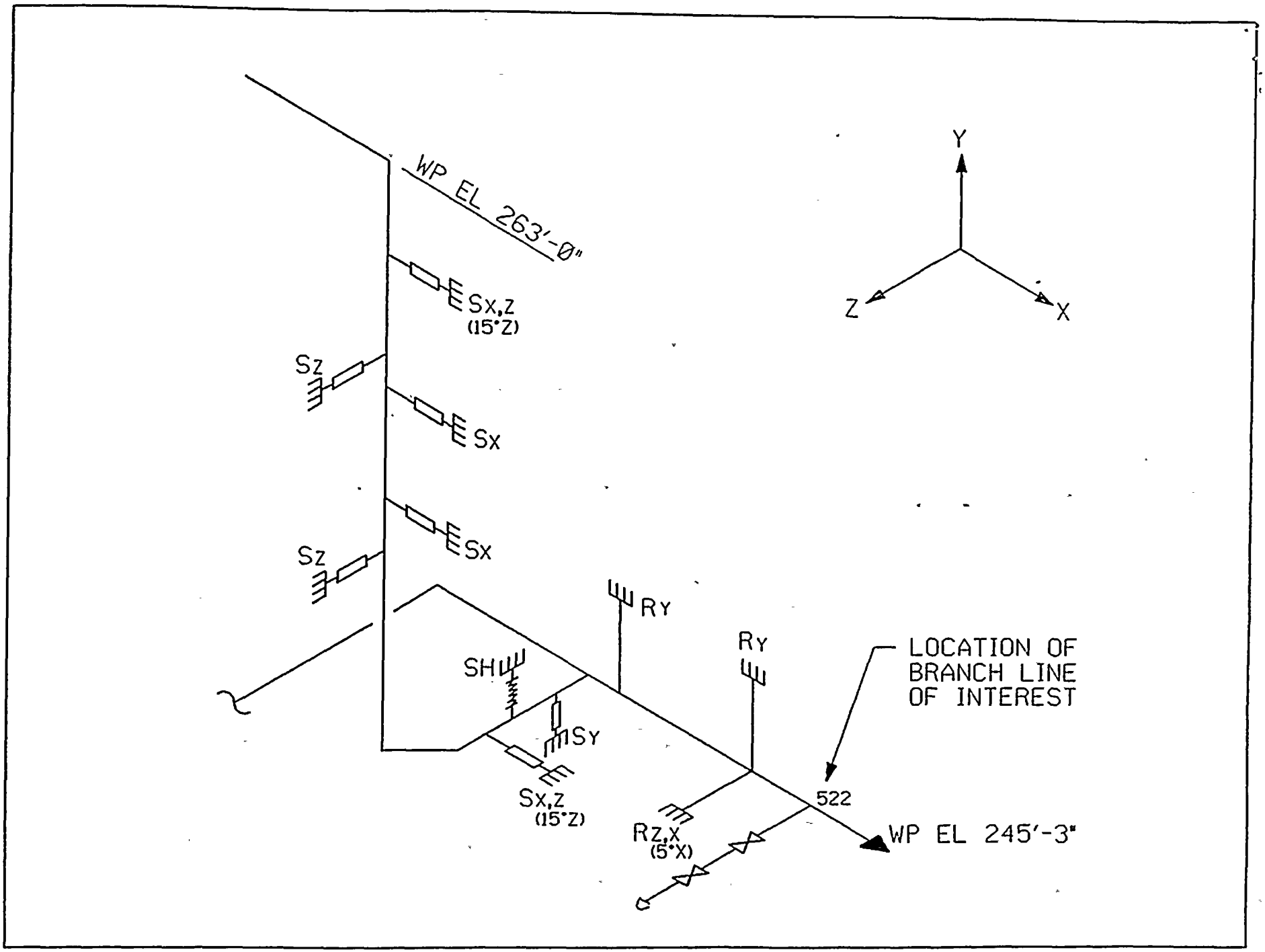
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FIGURE 1