PROCEDURE

FOR

VERIFYING CONFORMANCE OF SEISMIC ANALYSIS TO ACTUAL CONFIGURATION OF SAFETY-RELATED PIPING SYSTEMS IN RESPONSE TO IE BULLETIN 79-14

FOR

DUANE ARNOLD ENERGY CENTER UNIT 1

IOWA ELECTRIC LIGHT AND POWER COMPANY

CEDAR RAPIDS, IOWA

BY

BECHTEL ASSOCIATES PROFESSIONAL CORPORATION

ANN ARBOR, MICHIGAN

REV. 1

APPROVED BY J. C. M. Vance

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PROCEDURE FOR VERIFYING CONFORMANCE OF SEISMIC ANALYSIS TO ACTUAL CONFIGURATION OF SAFETY-RELATED PIPING SYSTEMS IN RESPONSE TO IE BULLETIN 79-14

I. Purpose

This procedure describes the method and steps to be taken to verify that the seismic analyses of safety-related piping systems conform to the actnal configurations of the installed piping systems at Duane Arnold Energy Center. The procedure is intended to be responsive to the requirements of NRC IE Bulletin 79-14 dated July 2, 1979. The procedure applies to piping systems 2½" and larger.

II. General Discussion

This paragraph describes the overall approach to be taken to provide the verification that the seismic analyses performed conforms to the actual configuration of the piping systems installed. The general steps are listed below and the detailed description of procedures required to accomplish each step are provided in subsequent sections:

1. Identify all 2½" and larger piping lines which are safety-related.
2. Determine and identify which lines are accessible during plant operation and are in non-redundant safety systems or in one train of redundant safety systems. Identify all other lines separately from the above lines.
3. Develop "as-built" inspection documents for the field surveys of the piping systems. The inspection documents are to contain all information required to be verified by the field inspection.
4. Develop "as-designed" documents which reflect the piping configuration which was used as input to the seismic analysis.

5. Perform field inspection of actual piping system configurations using the "as-built" inspection documents described above. Document any deviations from the inspection documents as a result of the inspection.

6. Compare the verified "as-built" documents with the completed "as-designed" documents for conformance with the seismic analysis input.

7. Evaluate the significance of any non-conformances between the verified "as-built" documents and the "as-designed" documents.

8. Evaluate the results of the field inspections and any re-analyses to determine whether verification inspections beyond the initial phase are warranted.

III. Identify Safety-Related Lines

To identify the safety-related piping lines 2½" and larger which have been seismically analyzed use the DAEC Piping Summary Sheets - Drawing No. M-190, (current revision). The seismic classification of each line is noted on the summary sheets. Once identified a list of all Seismic Class I (S.C.I.) lines is to be prepared.

IV. Inspection Plan

The non-redundant and redundant safety systems are to be identified using the DAEC FSAR. One train of the redundant systems is to be selected for inspection. Area Piping Drawings and System P&ID's are to be used to identify accessible portions of these systems. A list of the lines associated with non-redundant and the selected trains of redundant systems in accessible areas is to be prepared for the initial field inspection phase. A list of the remaining lines to be inspected in a subsequent inspection phase is also to be prepared.

V. Develop "As-Built" Inspection Document

For each line in the field inspection effort, an inspection package is to be developed. The basic documents in the package for each line are the hanger isometric(s) and the hanger detail drawings. This package is assembled as follows:

1. An inspection data sheet for each line to be inspected is prepared. The data sheet lists the line identification number and the DAEC system start-up number for the system containing the line.
2. The system P&ID which contains the selected line is checked to determine the seismic boundaries of the line. All hanger isometrics which show the line or portions of the line will be listed on the inspection data sheet. If the line connects to a non-Seismic Class I line the SCI line ends at the first rigid anchor after the seismic boundary. The hanger isometric for this portion of the non-SCI line will also be listed.
3. Copies of all hanger isometrics associated with a line will be collected for the inspection package.
4. The hanger isometrics will be reviewed to identify all seismic supports or restraints. The list of supports/restraints and the hanger detail drawing number for each will be listed on the data sheet.
5. Copies of all hanger detail drawings will be collected for inclusion in the package.
6. The dimensions of the hanger locations are to be extracted from the seismic calculation input and added to the hanger isometric. If, because of the availability of inspection packages required to support the inspection teams, there isn't ample time to extract these dimensions, then the dimensions are to be added from the field measurements to the hanger isometric and compared to the calculation dimensions after the inspection.

7. The function of the hanger, that is the restriction or load-carrying direction, is to be extracted from the calculation input and checked against the function indicated on the hanger detail drawing. Conformance is to be noted on the inspection data sheet. Again, for schedule reasons the check on the hanger function may be made following the field inspection when the verified "as-built" isometrics and hanger drawings are compared to the stress isometric and calculation input.

8. Valve mark numbers are to be extracted from the system P&ID's and marked on the inspection data sheet and the hanger isometrics. The inspection data sheet, the hanger isometric(s), and the hanger detail drawing(s) will comprise the field inspection package.

VI. Develop "As-Designed" Documents

The stress isometric represents the "as-designed" configuration which was used as input to the seismic calculation. Copies of the stress isometric will be obtained for each line identified in the inspection effort. If the stress isometric does not contain the location dimensions of the hangers then the calculation input will be reviewed to extract the dimensions from the input data.

VII. Field Inspection

The actual configuration of the piping systems included in this procedure are to be verified by field inspections or walkdowns of each safety-related line. The inspections are to be conducted using the guidelines listed below. The personnel involved in the field inspections are to receive qualifications training prior to conducting the inspections. Documentation of the qualification training for the individuals is to be provided. The inspection package described in Section V is to be provided to the inspection team assigned to a given line.

The inspection teams are to verify that:

A. Piping geometry conforms to the "as-built" hanger isometric. The dimensions of the piping configuration are to be checked.

B. Branch connection locations conform to the hanger isometric. The dimensions to the connections are to be checked.

C. Valve locations and valve identification numbers conform to the hanger isometric. The dimensions of the valve location within the piping run are to be checked.

D. Support/restraint locations conform to the hanger isometric. The dimensions of the support/restraint within the piping run are to be checked. Those supports/restraints with CEB's are being inspected under bulletin 79-02 and only the location of these support/restraints is to be verified under this procedure.

For dimensional checks on the pipe geometry, branch connections, and valve location a tolerance of ± 6" or ± 5% of the total length of any individual piping run between changes of direction, whichever is larger, is acceptable. For dimensional checks on support/restraint location a tolerance of ± 6" for pipe sizes 4" and smaller and ± two pipe diameters with a maximum of ± 24" for all other sizes is acceptable. For checks on support/restraint orientation a tolerance of ± of 15° is acceptable. It is expected that verification of the majority of the location dimensions will be performed by the use of a measuring device. However, visual verification is acceptable in those situations where the inspector is assured that the dimension can be judged within the above tolerances. Examples are; when the piping is larger diameter and the runs are fairly short, then the distance can usually be visually determined to be within the established tolerances or where a pipe run may cross two column lines which have a known spacing.

E. Valve operator orientation conforms to the hanger isometric. The orientation of the valve operator in the plane normal to the piping run is to be checked. A tolerance of $\pm 10^{\circ}$ from the drawing orientation is acceptable.

F. Support/restraint function conforms to the function indicated on the hanger detail drawing. This relates to the type and load direction. The type is one of the following: spring, rod, strut or snubber. The loading direction is to be checked against the hanger design shown on the hanger detail drawing.

G. Support/restraint assembly details conform to the hanger detail drawings. Items to be checked are: existence and size of structural members, existence of reinforcing members, existence of attachment welds (exact size need not be measured), and orientation. ⚠

H. Clearances specified for restraints are no larger than 1/8" and clearances for floor and wall penetrations which are not designed to act as restraint are no smaller than 1/8".

I. Anchor assembly details are in general compliance with the detail drawing. Visual inspection of anchors is acceptable.

It is not necessary to remove insulation for inspections, except for inspections of clearances specified in H above. A random sample of approximately 20% of those restraints which are insulated and require checking of clearances shall be selected and the insulation removed ⚠

for the check to be made. A high incidence of clearances found out of tolerance shall be cause for further inspection of insulated restraints. In the conduct of the field inspections the information on the inspection drawings which is in conformance with the actual installation will be yellowed out. Inspection information which is a deviation from the inspection documents will be added to the inspection documents with a green pen. Any information added to the inspection documents from any source other than the field inspection will be added with a red pen.

VIII. Comparison of the "As-Built" and "As-Designed" Configurations

A completed inspection package for each line will contain:

1. The completed inspection data sheet signed and dated by the field inspector.
2. The verified hanger isometric marked to indicate the measured dimensions which conform to the hanger isometric. Any deviation of the dimensions, piping geometry, or valve orientation will also be marked on the verified hanger isometric.
3. The hanger detail drawings marked to show any deviations of the actual installation from the detail drawing.

The verified hanger isometric is to be compared to the stress isometric for conformance. A Piping System Design Conformance Data Sheet is to be prepared to document the comparison. Any nonconformances are to be noted on the data sheet. If the hanger location dimensions were not added to the hanger isometric before the field walkdown, then the dimensions measured in the field (green pen) will be yellowed out during the conformance comparison. The hanger detail drawings which indicate nonconformances will also be listed on the data sheet. The completed verification package will include:

1. Inspection data sheet.
2. Hanger isometric.
3. Hanger detail drawings.
4. Stress isometric.
5. Design conformance data sheet.

A Summary description of the results of the inspection and verification is to be prepared for the initial phase for submittal to the NRC by September 1, 1979.

IX. Evaluation of Nonconformances

Following the comparison of the "as-built" and "as designed" configurations the completed verification package with nonconformances noted on the Design Conformance Data Sheet, will be turned over to a stress analyst for evaluation of the nonconformances. The stress analyst will determine if the noted nonconformances will significantly affect the seismic analysis originally performed. If it is determined that the original seismic analysis is likely to be significantly affected by the nonconformances, then the line will be re-analyzed.

If the re-analysis indicates that the piping stresses and the loads on the piping supports/restraints are acceptable, the results will be noted on a Nonconformance Resolution Sheet which will be prepared for each S.C.I. line.

If the nonconformances are judged to have an insignificant effect on the original seismic calculation, the Nonconformance Resolution Sheet will indicate that a re-analysis is not necessary.

If the re-analysis indicates that piping stresses or support/restraint loads are not acceptable, then the results will be reported to the NRC and the appropriate action will be taken in compliance with the DAEC technical specifications.

X. Evaluate Need for Further Inspections

In the initial inspection phase the accessible portions of non-redundant and one train of redundant safety related piping systems will be inspected. It is expected to complete the initial phase by September 1, 1979. If the results of the initial inspection phase indicates that there were no significant nonconformances then these results will be evaluated to determine if further inspections are warranted. The NRC would be contacted to determine if further inspections can be waived on the basis of this evaluation.

SPOOL CHECKLIST

1. Spool Number: ______________________

2. Complete set of Iso's to boundaries ☐ yes ☐ no; if no list missing drawings

3. Complete set of hanger drawings ☐ yes ☐ no; if no list missing drawings

4. Hanger locations and function extracted from stress input ☐ YES ☐ NO

5. Items 1,2,3 and proper columns of items 5 & 6 completed on data sheet

   By______________________ date______________

6. Hanger list sent for 79-02 check By________________ date__________

7. 79-02 check complete, record attached date______________

8. Released to field By__________________ date_______________

9. Number of data sheets in complete spool package_________

PIPING SYSTEM WALKDOWN DATA SHEET

1. Spool Identification: ____________________ SUS#:

2. Hanger Iso used for inspection: ____________________ Rev: ________ DATE: ________

3. Stress Iso: ____________________ Rev: ________ DATE: ________

4. Pipe Geometry: This includes spool dimensions, valve locations, and clearances

   ☐ Meets Iso
   ☐ Differs from Iso (Attach sketch or description)

5. Valves (including operators):

Valve #	Wt Analyzed	Wt From Vendor Print	Vendor Print #

6. Supports/Restraints:

Ident #	Dwg #/Rev	Type	Location Per Iso	Configuration Per Detail	Calc. Function Matches Detail	As-Built Function Matches Detail	Clearances Acceptable

7. Pipe attachments per spool dwg.: ☐ Yes ☐ No (Explain)

8. Clearances required around pipe: ____________________

9. Tolerances: Pipe location: ____________________ Hanger location: ____________________

10. Inspection by: ____________________ Signature: ____________________ Date: ________

PIPING SYSTEM DESIGN CONFORMANCE DATA SHEET

1. Spool Identification:________________ SUS #________________

2. Verified Hanger Iso:________________ Rev________ Date________

3. Stress Iso:________________ Rev________. Date________________

4. Calculation No.________________

5. Pipe Geometry:

   Stress Iso Conforms to Verified Inspection Iso ☐

   Does NOT Conform ☐

   List Nonconformances:____

6. Hanger Details: List hanger detail drawings which have nonconformances:

7. Valves: List valves in which the vendor wt did not conform to the analyzed wt.________________________________

BY________________________________ DATE________________________

PIPING SYSTEM NONCONFORMANCE RESOLUTION SHEET

1. Spool Identification ______________________ SUS# ______________________

Resolution of Nonconformances:

By ______________________ Date ______________________