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NSIC

Omaha Public Power District

1623 HARNEY • OMAHA, NEBRASKA 68102 • TELEPHONE 536-400

April 21, 1980

Mr. K. V. Seyfrit, Director
U. S. Nuclear Regulatory Commission
Office of Inspection and Enforcement
Region IV
611 Ryan Plaza Drive
Suite 1000
Arlington, Texas 76011

Reference: Docket No. 50-285

Dear Mr. Seyfrit:

This letter is to advise you that the Omaha Public Power District will have completed inspections, analyses, and modifications (as described in Enclosures 1 and 2) for the Fort Calhoun Station, performed pursuant to the requirements of IE Bulletin 79-14 and IE Bulletin 79-02, prior to unit startup currently scheduled for May, 1980. Enclosure 1, attached hereto, provides the District's response to IE Bulletin 79-14, including information in regard to implementation status, methods, criteria, and schedules. A final report will be submitted after completion of the voluntary verification program (see Enclosure 1), which will provide a compilation of required data and summarize results of the verification program.

Enclosure 2 provides a status summary of work performed in accordance with IE Bulletin 79-02. A final report summarizing the disposition of inspections performed will be submitted in conjunction with the IE Bulletin 79-14 final report.

Sincerely,

K. J. Morris
for W. C. Jones
Division Manager
Production Operations

WCJ/KJM/BJH:jmm

Enclosures

cc: U. S. Nuclear Regulatory Commission
Office of Inspection & Enforcement
Washington, D. C. 20555

LeBoeuf, Lamb, Leiby & MacRae
1333 New Hampshire Avenue, N. W.
Washington, D. C. 20036

8006040 024

IE BULLETIN 79-14 RESPONSE

Request 1

Identify inspection elements to be used in verifying that the seismic analysis input information conforms to the actual configuration of safety-related systems. For each safety-related system, submit a list of design documents, including title, identification number, revision, and date, which were sources of input information for the seismic analyses. Also submit a description of the seismic analysis input information which is contained in each document. Identify systems or portions of systems which are planned to be inspected during each sequential inspection identified in Items 2 and 3. Submit all of this information within 30 days of the date of this bulletin. (Includes safety-related piping 2-1/2 inches in diameter and greater per IE Bulletin 79-14, Rev. 1, dated July 18, 1979.)

Response

The District responded to this request in a letter dated August 3, 1979. This information is reproduced in Attachment 1 for your reference, except for the list of drawings. The drawings listed below were originally included but were later found to be non-safety-related:

IC-160	Plant Air
IC-161	Plant Air
IC-159	Plant Air

In addition, all drawings previously listed, and discussed on page 4 of Attachment 1, as unavailable have been located or redrawn. These were on the following systems/components:

Hydrogen Purge (Auxiliary Building)
Fire Protection (Intake Structure)
Miscellaneous Supports

Requests 2 and 3

For portions of systems which are normally accessible, inspect one system in each set of redundant systems and all non-redundant systems for conformance to the seismic analysis input information set forth in design documents. Include in the inspection: pipe run geometry; support and restraint design, locations, function and clearance (including floor and wall penetration); embedments (excluding those covered in IE Bulletin 79-02); pipe attachments and valve and valve operator locations and weights (excluding those covered in IE Bulletin 79-04).

Inspect all other normally accessible safety-related systems and normally inaccessible safety-related systems.

Response

All normally accessible and inaccessible safety related systems have been thoroughly inspected in accordance with the bulletin, including all revisions and supplements, except for portions of systems included on the following isometric drawings which were located in areas inaccessible both during power operation and cold shutdown:

IC-228	Auxiliary Coolant (AC)
IC-278	(Partial) Chemical & Volume Control (CVCS)
IC-352	CVCS
IC-359	(Partial) CVCS
IC-365	CVCS
IC-248	Waste Disposal (WD)
IC-250	WD
IC-315	WD
IC-226	(Partial) AC
IC-277	AC
IC-275	(Partial) AC
IC-332	(Partial) AC
IC-334	(Partial) AC

After reviewing each of the above noted exceptions, it was concluded that the consequence of not performing inspections presents no significant safety problem or in any way endangers the health and safety of the public. Generally, for the sections of piping which were not accessible for inspection, the following assurances were provided by the safety review. In the event of a breakage of the affected section of piping:

a) Safe shutdown can be achieved.

b) Safe shutdown can be maintained.

c) Equipment and methods required to be used to effect a safe shutdown are evaluated in the FSAR.

d) The break can be detected.

e) The break can be isolated without impairment of the function of essential safety systems.

Response (Continued)

f) No safety system required to mitigate any FSAR analyzed accident is affected.

These inaccessible portions of piping are associated with the following systems and/or subsystems: liquid waste disposal (within waste holdup tank vaults), spent fuel pool cooling, and chemical and volume control (letdown).

The criteria referenced below were used for guidance in performing inspections and to identify potentially significant discrepancies for normally accessible and inaccessible systems:

a) For accessible systems inspected prior to issuance of supplement #2 of the bulletin, the criteria used is provided in Attachment 2.

b) For inaccessible and accessible* systems inspected after issuance of supplement #2 (all items addressed in supplement #2 were incorporated), the criteria is provided in Attachment 3.

In addition to inspecting all safety related systems, portions of certain non-safety related systems were inspected and evaluated for their impact on safety related systems (i.e., piping which could damage nearby safety related equipment in the advent of failure).

*For consistency and accuracy, all previously inspected accessible systems were reinspected using the revised criteria noted above.

Reque:. 4

If nonconformances are identified:

a) Evaluate the effect of the nonconformance upon system operability under specified earthquake loadings and comply with applicable action statements in your technical specifications including prompt reporting.

b) Submit an evaluation of identified nonconformances on the validity of piping and support analyses as described in the Final Safety Analysis Report (FSAR) or other NRC approved documents. Where you determine that reanalysis is necessary, submit your schedule for: (i) completing the reanalysis, (ii) comparisons of the results to FSAR or other NRC approved acceptance criteria, and (iii) submitting descriptions of the results of reanalysis.

c) In lieu of b), submit a schedule for correcting nonconforming systems so that they conform to the design documents. Also submit a description of the work required to establish conformance.

d) Revise documents to reflect the as-built conditions in plant, and describe measures which are in effect which provide assurance that future modifications of piping systems, including their supports, will be reflected in a timely manner in design documents and the seismic analysis.

Response

Philosophy of Evaluation Program

Determining system operability and establishing conformance, as referenced in the bulletin, would require a detailed pipe rupture analysis and/or making modifications to return everything to the original design configuration. It was decided that a more expeditious approach to evaluating nonconformances and establishing system operability would be to analyze "as-built" pipe and support stresses and perform modifications as necessary to ensure that these stresses were within original design stress limits. Modifications made as a result of this approach were not necessarily required for system operability, but it was expected that less time would be needed to make these modifications than to establish conformance (which might be physically impractical due to construction interferences, etc.) or to determine system operability. In addition, this conservative approach ensures operability of the system by maintaining all calculated induced stresses at less than or equal to conservative allowable design limits.

As a first step toward analyzing pipe/support system stresses, discrepancies were identified between the "as-built" and "as-designed" configurations of pipe/support systems. Discrepancies are defined as being dimensional or geometric differences (between the as-built and as-designed pipe/support systems) which exceed previously identified acceptance criteria and could potentially affect system operability.

Philosophy of Evaluation Program (Continued)

After analyzing pipe/support system stresses to account for the reported discrepancies, modifications were made when necessary to bring calculated stresses within appropriate limits. Very few calculated pipe overstress problems were identified (some were due to thermal) and the majority of support modifications resulted from calculated compressive loads on rod hangers and lateral loads on U-bolts (in excess of catalog rated capacities).

The detailed program which has resulted in establishing system integrity and thereby ensuring operability is as follows:

Implementation Methods

The sequence of events, which concluded with assurance of system operability, is outlined below. See Logic Diagram, Attachment 4.

a) Field inspections were made to determine the "as-built" configurations of all safety related systems. The as-built configurations were shown by marked up design drawings prepared by the field teams.

b) Discrepancy reports were generated for all dimensional differences between the design isometric and the as-built configurations judged to have potentially significant impact on the original seismic analysis and/or system operability as follows:

   1) For the normally accessible systems, the judgement of system operability was made by members of the Plant Review Committee (PRC). The qualifications of these people were forwarded to the Commission by letter dated February 19, 1980.

   2) In response to certain NRC staff members' concerns in regard to the qualifications of PRC members to make these judgements, the District has voluntarily elected to have all work performed under 1) verified by the District's A/E.

   3) For the normally inaccessible systems, all judgements were made by the District's A/E. Their qualifications are provided in Attachment 5.

c) Discrepancy reports were forwarded to qualified piping analysts for review as follows:

   1) Where discrepancies were judged to be within the original design criteria, the piping was classified as being in conformance with the original design. The guidelines used by the A/E in evaluating the impact of discrepancies on piping integrity are provided in Attachment 6.

Implementation Methods (Continued)

2) Where discrepancies were not within the guidelines identified in 1) above, a dynamic analysis for thermal, deadweight and seismic induced stresses using TPIPE code was performed to ascertain pipe stresses.

3) Where pipe stresses were found to be within the original design limits, no changes were necessary in support location. The original design limits are shown in Attachment 7.

4) Where pipe stresses were found to exceed the design allowables, modifications were recommended by the piping analyst and coordinated with field personnel to ensure constructability as proposed.

d) Pipe support discrepancies (other than location which was analyzed in c) above) were evaluated by the District's A/E to determine if support stresses were within original design limits. Criteria used to evaluate support stresses are provided by Attachment 8. Evaluations were performed as follows:

1) Where a new piping analysis was not performed, supports with discrepancies were analyzed using original design loads as taken from the support detail drawings.

2) Where a new piping analysis was performed, the supports with discrepancies were analyzed using new TPIPE loads. In addition, supports having no discrepancies were analyzed when their new loads exceeded their original design loads.

3) Where support stresses were found to be within original design limits, the support was judged to be in conformance.

4) Where support stresses exceeded design limits, modifications were recommended which would ensure support integrity.

e) All modifications required to ensure system operability were made in compliance with applicable limiting conditions for operation in the Technical Specifications.

f) As-built sketches for all field inspected items, which were found to differ from the original design or were modified as a result of analysis, will have been produced prior to unit startup. These sketches are verified by second party review with signatures and dates for documentation.

g) All new and revised documents generated during work performed for compliance with the bulletin will be supplied to the District by the A/E at the completion of this task.

Status of Work

All modifications on accessible piping systems have been completed, as required by initial inspection and evaluation. All modifications required in normally inaccessible areas will be completed prior to startup of the Fort Calhoun Station, except for those evaluated in the response to Requests 2 and 3 above. All modifications required as a result of the verification work being performed in accessible areas will be completed prior to unit startup following the 1981 refueling outage. Any nonconformances (discrepancies) identified in the verification phase of inspections in the auxiliary building will be evaluated to determine the effect upon system operability under specified earthquake loadings and applicable action statements in the Fort Calhoun Technical Specifications, including proper reporting, will be complied with.

Justification for Continued Operation

1) All essential modification work, in compliance with the bulletin, will have been completed prior to unit startup. "Essential" modifications are defined in Attachment 9. Any modification work resulting from the District's voluntary verification work (referenced in b)2) above) will be performed in accordance with the applicable Technical Specifications. A system of recordkeeping was established which documents all modifications recommended by the A/E and when they were performed. This system assures the District that all work will have been completed.

2) Modifications performed to date have resulted in some upgrading over the original design basis for the Fort Calhoun Station.

3) The Fort Calhoun Station will continue to be operated in conformance with the Final Safety Analysis Report and the Technical Specifications. No unreviewed safety question has been identified with regard to continued operation and the health and safety of the public are not jeopardized in any way by return to power before the final report is submitted.

4) Verification work performed to date on accessible piping systems has shown that no seismic overstressing of piping is present. The District believes the remainder of the normally accessible systems which remain to be verified will show similar results.

RESPONSE TO REQUEST IN IE BULLETIN 79-14, DATED JULY 2, 1979

Request

1. Identify inspection elements to be used in verifying that the seismic analysis input information conforms to the actual configuration of safety-related systems. For each safety-related system, submit a list of design documents, including title, identification number, revision, and date, which were sources of input information for the seismic analyses. Also submit a description of the seismic analysis input information which is contained in each document. Identify systems or portions of systems which are planned to be inspected during each sequential inspection identified in Items 2 and 3. Submit all of this information within 30 days of the date of this bulletin.

Response

Inspection Elements

The elements to be inspected are the geometry in 2-1/2 inch or larger diameter, safety-related piping plus associated valve and valve operator locations and types; pipe attachments; and seismic restraint configurations, dimensions, embedments, and locations.

Description of Seismic Analysis Input Information Contained in Design Documents and Verifications to be Made

The design documents to be checked are the piping and instrumentation diagrams (P&ID's), piping isometrics with seismic restraint locations identified, and seismic hanger/support drawings. The P&ID's indicate the piping isometric numbers for each segment of the various systems. The isometrics will be verified by measuring the as-built piping geometry to include locations of pipe attachments, valves, and seismic hangers/supports. The isometrics give hanger/support identification numbers for each specified restraint location. The hanger/support configuration, dimensions, clearances, embedments, and type will be compared with the individual drawings for each one. Embedments will be visually inspected for correct location, type, and general condition. The valves will be checked for specified manufacturer and type by comparing information stamped on the valve body and actuator with that contained in the valve files and on the valve lists. On valves with no identifying numbers visible, e.g., check valves totally covered by insulation, a cross check between the valve file information and valve lists will be made.

Systems or Portions to be Checked During Each Phase

The systems or portion of systems that will be checked during the two phases of the inspection are listed below. Phase I is for piping which is normally accessible during reactor operation; Phase II is for

Systems or Portions to be Checked During Each Phase (Continued)

all the rest. Some of the items to be checked are either in very high radiation fields or are inaccessible due to geometry considerations. Pipe and components in these areas will be viewed from a safe distance, if possible, to confirm proper configuration. In no case will buried piping be inspected.

1. Reactor Coolant System

   Phase I - None

   Phase II - All accessible piping.

2. Chemical and Volume Control System

   Phase I - Piping for one charging pump, one boric acid pump, and one concentrated boric acid storage tank. All the re maining non-redundant piping outside the reactor containment building, with the exception of that in very high radiation areas; e.g., piping for the ion exchangers, purification filters, and volume control tank.

   Phase II - All the remaining accessible piping.

3. Safety Injection and Containment Spray System

   Phase I - Piping in the auxiliary building for one high pressure safety injection pump, one low pressure safety injection pump, two containment spray pumps, one shutdown cooling heat exchanger, and one recirculation line.

   Phase II - All the remaining accessible piping. Containment spray rings and supply pipes will be inspected via field glasses or some other similar scheme.

4. Main Steam

   Phase I - Piping in auxiliary building up to the containment isolation valves.

   Phase II - All the remaining piping.

5. Feedwater/Auxiliary Feedwater System

   Phase I - Feedwater and steam generator blowdown lines in the auxiliary building between the containment penetration and containment isolation valves. Piping for the motor-driven auxiliary feedwater pump up to the containment penetration.

   Phase II - All the remaining piping.

Systems or Portions to be Checked During Each Phase (Continued)

6. Component Cooling Water System

Phase I - Piping for two component cooling water pumps, one control room air conditioner, one shutdown cooling heat exchanger, the spent fuel pool heat exchanger, waste evaporator, three component cooling heat exchangers, cooling water supply and return headers to safety injection/containment spray pumps, sample heat exchanger, and component cooling water surge tank. Piping in auxiliary building for the safety injection tanks leakage coolers and seal coolers/ lube oil coolers for the reactor coolant pumps.

Phase II - All the remaining piping.

7. Raw Water System

Phase I - Piping for two raw water pumps and three component cooling heat exchangers.

Phase II - All the remaining piping.

8. Spent Fuel Pool Cooling

Phase I - All accessible piping. Some restraints in the spent fuel pool are virtually inaccessible; others underwater may be visible from the surface. The storage pool demineralizer and filter are always very high radiation areas. Piping in that area will be viewed from a safe distance to confirm configuration.

9. Radioactive Waste Disposal System

Phase I - All 2-1/2 inch or larger, nuclear class piping in the auxiliary building. Exceptions include piping around the spent resin storage tank and concentrate tanks because they are very high radiation areas.

Phase II - All remaining 2-1/2 inch or larger, nuclear class piping.

10. Fire Protection System

Phase I - All piping within intake structure.

11. Containment Hydrogen Purge

Phase I - All piping in auxiliary building.

Phase II - All remaining piping.

Systems or Portions to be Checked During Each Phase (Continued)

12. Plant Air System

Phase I - Piping in auxiliary building between the containment penetration and the containment isolation valve.

Phase II - Piping inside containment.

List of Design Drawings

A list of design drawings that will be checked is attached. Drawings that have not been located are listed by title only; identification numbers, revision, and date are left blank. We will continue our attempt to locate these drawings. On the fire protection and containment hydrogen purge systems there are no piping isometrics with restraint locations marked available in the files.

CRITERIA FOR IE BULLETIN 79-14 INSPECTION

The following criteria were utilized in determining recordable discrepancies for IE Bulletin 79-14 for normally accessible safety related systems:

1) Restraint location: Restraint locations which deviated from the design documents by >1 foot were recorded on the marked-up isometrics; restraint locations which deviated from the design documents by >2 feet were recorded on a discrepancy report form.

2) Valve type and manufacturer: Deviations from the design documents in either type or manufacturer were recorded on a discrepancy report form.

3) Restraint configuration: Restraint dimensions which deviated from the design documents by >15% were recorded on a discrepancy report form; restraint material deviations were recorded on a discrepancy report form; restraint orientations which visual inspection found to be different from the design documents were reported on a discrepancy report form.

4) Anchor location: Measurable deviations from the design documents were reported on a discrepancy report form.

5) Piping geometry: Deviations in geometry were recorded on a discrepancy report form; dimensions which deviated from the design documents by >15% were recorded on a discrepancy report form.

(Please note that all discrepancies recorded on discrepancy report forms also appear on the marked-up isometric drawings.)

CRITERIA FOR IE BULLETIN 79-14 INSPECTION

The following criteria were utilized in determining discrepancies for IE Bulletin 79-14 for normally inaccessible safety related systems:

1.0 PURPOSE

To establish inspection requirements for 2 1/2" and larger piping and piping support assemblies for safety related piping systems including Seismic Category 1 piping.

2.0 References

2.1 NRC's IE Bulletin 79-14, dated July 2, 1979.

2.2 NRC's IE Bulletin 79-14, Rev. 1, dated July 18, 1979.

2.3 NRC's IE Bulletin 79-14, Supplement, dated August 15, 1979.

2.4 Letter: T.E. Short: The District to K.V. Seyfrit, NRC, dated August 3, 1979.

2.5 Fort Calhoun Station, Unit No. 1, Technical Specification.

2.6 Omaha Public Power District Containment Composite Piping Drawings.

2.7 Omaha Public Power District System P&I Diagrams.

2.8 Dravo Corporation pipe fabrication drawings (piping isometric drawings) that are stamped by Bergen Paterson Pipesupport Corporation which incorporate the pipe supports/restraints.

2.9 Bergen Paterson Pipesupport Corporation support/restraint drawings.

3.0 Prerequisites

Sign Off/Date

3.1 Notify Q.C. at the start of procedure. Q.C. is to spot check the work to ensure that the work is performed in accordance with procedure.

______/______
Q.C.

3.2 Notify the shift supervisor at start of procedure.

______/______
Shift Supervisor

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NOTE: Q.C. refers to OPPD Q.C. unless otherwise noted.

Sign Off/Date

3.3 Obtain proper radiation work permit (RWP) for work in radiation controlled areas.

RWP No. ____________ ______/______

3.4 This work is covered by:

M.O. No. ____________ ______/______

4.0 Precautions/Limitations

4.1 Precautions and limitations shall be as per the radiation work permit.

5.0 Equipment Required

5.1 Miscellaneous tools required will be flashlights, fifty-foot steel tapes and six-foot folding rules.

5.2 Equipment for climbing will be required such as six-foot step ladders, twenty-five to thirty-foot extension ladders and safety belts.

6.0 Procedure

6.1 General

6.1.1 Support/restraints assemblies include: fixed hangers and supports, variable and constant support hangers and supports, seismic restraints and snubbers. The complete hanger, together with the support steel to the embedments or building steel, and the base plate or embedments are included in the inspection. Base plates and concrete expansion anchor bolts are inspected per "Special Procedure S. P. Anchor-1".

6.1.2 Inspection criteria which applies to all types of supports/restraints are listed herein.

6.1.3 Where visual inspection is necessary due to access limitations, this condition shall be recorded on all applicable data sheets.

6.2 Isometric And Support/Restraint Inspection Procedure

6.2.1 Pipe run geometry will be inspected to the piping isometric drawings. Actual dimensions shall be taken and recorded on the piping isometric drawing for any piping not run as per the piping isometric drawing, within plus or minus ($\pm$4") tolerance. This deviation will also be noted on the Isometric Evaluation Data Sheet.

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6.2.2 Pipe support/restraint attachment locations will be inspected and compared to the piping isometric drawing. The actual dimensions locating the attachment shall be recorded on the appropriate piping isometric drawings, when the following tolerances are exceeded:

Nominal Pipe Size	Location Tolerance
- to 6"	± 4"
8" to 18"	± 8"
20" to 36"	± 12"

the support/restraint shall be recorded on the Isometric Evaluation Data Sheet as being out of tolerance.

6.2.3 Valve and valve operators shall be located as shown on piping isometric drawing with a tolerance of plus or minus four (±4"). Actual dimensions shall be taken and recorded on the appropriate piping isometric drawing for each valve and operator not meeting or not shown on the piping isometric drawing. Valves added or valves indicated on the piping isometric drawing as not having proper information in the valve list shall have as much information as possible taken from valve and operator at time of inspection and recorded on the piping isometric drawing. The valve and operator not in conformance shall be noted on the Isometric Evaluation Data Sheet. Valve operator orientation relative to cross section of pipe shall be within plus or minus fifteen degrees (±15°) of orientation shown on the piping isometric drawing.

6.2.4 All additional supports/restraints that are existing on the pipe, that are not shown on the piping isometric drawing shall be recorded. A sketch showing function and location shall be included on the Isometric Evaluation Data Sheet.

6.2.5 All support/restraint deviations found during the inspection shall be recorded on the System Evaluation Data Sheet.

6.2.6 The piping system shall be checked for anything that may prevent pipe expansion other than that which is designed to prevent pipe expansion i.e. other pipes, structure steel or a cable. Any interferences not shown on the piping isometric drawing shall be recorded on the System Evaluation Data Sheet.

6.2.7 Pipe floor and wall penetration clearance at four ninety degree (90°) locations shall be checked and recorded on the penetration Data Sheet. Each floor or wall penetration shall have a penetration no. assigned on each piping isometric draiwng which is assigned by the reviewer. The reviewer shall assign each penetration no. in the form X-PY, where X is the two or three digit IC no. and Y is 1, 2, 3, etc. Each floor or wall penetration shall have a Penetration Data Sheet. If pipe is cast integral with the wall, this condition should be recorded on the Penetration Data Sheet as well as the thickness of the wall.

6.2.8 Each support/restraint shall be checked in accordance with the Bergen Paterson support/restraint drawings and deviations recorded on the Support/Rrestraint Data Sheet. Deviation recorded shall be but not limited to items such as member sizes and shape, all dimensions, plate sizes, weld sizes, weld types, weld lengths and bolt sizes.

6.2.9 Base plates with anchors which are shown on the support/restraint drawings shall be checked as a minimum:

a) Plate thickness, plate dimensions and orientation.
b) Anchor location.
c) Edge distance from center of anchor bolt to edge of plate.

6.2.10 Concrete Anchors for other supports within a radius of eight inches (8") of any anchor on the support/restraint being inspected shall be recorded on the Support/Restraint Data Sheet.

6.2.11 Attachments to base plates shall be checked dimensionally with the support/restraint drawing. Deviations shall be recorded on the Support/Restraint Data Sheet.

6.2.12 Document deviations as precisely as possible. Use blank sheet and attach, if needed.

6.2.13 When unistrut is used, identify and record size of bolt installed on Support/Restraint Data Sheet.

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6.3 Hanger Acceptance Criteria

6.3.1 Supports/restraints shall be of the correct type that is shown on the support/restraint drawings: rigid rod, structural framed restraint, spring, U-bolt, stanchion, trapeze, snubber assembly, etc. Differences in support/restraint type and function shall be recorded on the Support/Restraint Data Sheet as well as on the System Evaluation Data Sheet.

6.3.2 Rigid Rod Hangers

6.3.2.1 Single rigid rod hangers can be changed to double rod trapeze hangers provided that the new configuration is adequate to carry the resulting loads.

6.3.2.2 Double rod rigid trapeze hangers can be changed to single rigid rod hangers provided that the diameter of the single rod is one and one-half (1 1/2) times the double rod diameter or greater.

6.3.2.3 Rigid rod hangers shall not deviate from design by more than approximately plus or minus seven degrees ($\pm 7^{\circ}$).

6.3.3 Cantilever Concrete Attachment

6.3.3.1 The elevation of a cantilever concrete attachment can vary by plus or minus twelve inches ($\pm$12") provided the angle of the hanger rod(s) does not deviate from design by more than approximately plus or minus seven degrees ($\pm 7^{\circ}$).

6.3.4 Spring Hangers

6.3.4.1 Spring hangers shall be the correct size that is shown on the support/restraint drawing. The angle of the hanger rod shall not deviate from design by more than approximately plus or minus four degrees ($\pm 4^{\circ}$).

6.3.4.2 Types "A", "B" and "C" spring hangers can be interchanged.

6.3.4.3 The elevation of a Type "A", "B", and "C" spring can be changed.

6.3.5 Constant Support Hangers

6.3.5.1 Constant support hangers shall be the correct size and type that is shown on the support/restraint drawing. The angle of the hanger used shall not deviate from design by more than approximately plus or minus four degrees ($\pm 4^{\circ}$).

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6.3.6 Hydraulic Snubbers

6.3.6.1 Hydraulic snubbers shall be the correct bore and stroke sizes that are shown on the support/restraint drawing. A larger bore snubber may be subsititued.

6.3.6.2 The hydraulic snubber cold set dimension, shown on the support/restraint drawing, shall be within plus or minus one-half inch ($\pm$1/2"). In all cases, one quarter inch (1/4") from full extension or full compression is required to provide functionability.

6.4 Support/Restraint Orientation

6.4.1 The vertical support/restraint orientation shall be within approximately plus or minus seven degrees ($\pm 7^{\circ}$) of vertical.

6.4.2 Beam brackets or equal can be rotated ninety degrees (90°) for rigid rod hanger type supports.

6.4.3 Beam brackets, when used with sway braces, shall be oriented so as not to hinder axial expansion, unless otherwise required on the support/restraint drawing.

6.4.4 Restraints installed to act in pairs are to provide the same function as the designed support.

6.5 Welded Pipe Attachments

All welded pipe attachments shall conform to the configuration on the support/restraint drawing. Deviations shall be recorded on Support/Restraint Data Sheet.

6.6 Components Substitution

6.6.1 Components Substitution General

a) All components, except spring hangers, constant support hangers, and hydraulic snubber cylinder assemblies, may be substituted provided the size of the substituted material is equal to, or greater than, the original material.

b) All components that are related to the overall adjustment of the support/restraint may be substituted if the substituted material provides overall adjustment.

c) All components that are related to the load carrying capacity of the support/restraint shall be installed.

6.6.2 Structural Steel Attachments

6.6.2.1 Two (2) steel plates may be substituted for a beam bracket; dimension should be noted on data sheet.

6.6.2.2 Hanger attachment plates with forged clevises may be interchanged with beam brackets with welded eyerods provided the sizes are equal to or greater than that shown on the support/restraint drawing.

6.6.3 Weldless Eyenuts

6.6.3.1 Weldless eyenuts with threaded rod and welded eyerods may be interchanged.

6.6.4 Pipe Insulation Saddles

6.6.4.1 Field fabricated pipe insulation saddles may be substituted for vendor supplied pipe insulation saddles; dimension shall be recorded on Support/Restraint Data Sheet.

6.7 Welding

6.7.1 Welding - Symbol Shown

6.7.1.1 Welding support/restraint auxiliary steel to existing steel shall be one quarter inch (1/4") fillet weld all-around or shall be welded in accordance with AISC standards as a minimum.

6.7.2.2 Welding of all other support/restraint materials shall be one quarter inch (1/4") fillet weld all-around, or in cases where this is not achieved, the weld must develop, as a minimum, the strength of the weaker of the two members being joined.

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6.8 Insulation

6.8.1 Insulation on piping and valves consist of calcium silicate, reflective, elastimer, and fiberglass.

6.8.2 Insulation type and thickness shall be noted on the Isometric Evaluation Data Sheet.

6.8.3 Insulation shall be removed from piping as noted by the Engineer. This includes but is not necessarily limited to the following:

a) Stanchons
b) Lugs
c) Valves (only where additional information is required)
d) Reducers when not visually noticable.

6.8.3.1 Personnel removing and reinstalling insulation will be required to wear at least a half face mask due to the dust and insulation particles that may become airborne. (Some of the old insulation may contain carcinogenic materials.) If the airborne dust and insulation particles become such a problem that it gets into the eyes, either goggles worn with the half face mask or a full face mask may be required.

6.8.4 If insulation is removed, it shall be noted on the Isometric Evaluation Data Sheet, the actual Isometric Drawing, and forwarded to OPPD Q.C.

NOTE: If the piping is heat traced contact OPPD electrician to move heat tracing.

6.9 Evaluation and Modification

6.9.1 Inspection reports shall be reviewed and appropriate analysis performed when necessary. The Engineer shall recommend any modifications and/or changes in support configuration or locations.

7.0 Maintenance Items

The following are items which require a maintenance order (MO) to resolve. These items do not affect the function of the support/restraint as found. This should be recorded in the Comments section of the Support/Restraint Data Sheet.

7.1 Loose Rigid Rod Hanger

7.2 Locknuts

Locknuts must be installed to a tight condition in accordance with the support/restraint drawing with the following exceptions:

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7.2.1 Only one locknut is required at turnbuckles on rigid rod hangers that have eyerods at the steel attachment and at the pipe attachment points. Ths locknut may be either on the top or bottom of the turnbuckle.

7.2.2 Two locknuts are required on any hanger that has a rod threaded at both ends between a clevis or eyenut and a turnbuckle. One locknut can be at the clevis/eyenut end or at the turnbuckle end of the rod. The other locknut shall be on the connection at the other end of the turnbuckle.

7.3 Full Thread Engagement

7.3.1 "Full hex nut engagement' is defined as one full thread exposed beyond the hex nut.

7.3.2 Full thread engagement for clevises and turnbuckles is defined as the extension of one full thread beyond the end of the clevis/turnbuckle.

7.4 Other items found during inspection which do not affect the function or load capability of the support shall be reported on a maintenance order (MO) for action by the plant staff as necessary. This can be recorded as comments on the Support/Restraint Data Sheet.

Gilbert Commonwealth Companies	Commonwealth Associates Inc. engineers/consultants/architects	OMAHA PUBLIC POWER DISTRICT FT. CALHOUN, UNIT 1	FILING CODE ______ JOB NO ______
	INSPECTED BY/DATE ______ APPROVED BY/DATE ______	SYSTEM EVALUATION DATA SHEET	SHEET ____ OF ____ BOOK NO ______

REV

SYSTEM NAME: ______________________

DRAVO ISO IC- ______, IC- ______, IC- ______, IC- ______

IC- ______, IC- ______, IC- ______, IC- ______

IC- ______, IC- ______, IC- ______, IC- ______

IC ______, IC- ______, IC- ______, IC- ______

TOTAL NUMBER OF SUPPORTS/RESTRAINTS: ______

LIST SUPPORTS/RESTRAINTS NOS. WITH DEVIATIONS:

MISSING SUPPORTS/RESTRAINTS NOS.:

TOTAL NUMBER OF PENETRATIONS: ______

COMMENTS: (NOTE IF VISUALLY INSPECTED)

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FEB 1 1980

R1 2-1-80

Gilbert Commonwealth Companies	Commonwealth Associates Inc. engineers/consultants/architects	OMAHA PUBLIC POWER DISTRICT FT. CALHOUN, UNIT 1	FILING CODE ____ JOB NO ____
	INSPECTED BY/DATE ____ APPROVED BY/DATE ____	ISOMETRIC EVALUATION DATA SHEET	SHEET ____ OF ____ BOOK NO ____

REV.

DRAVO ISO IC– ____________________

CHECK LIST	YES	NO	N/A
PIPE RUN GEOMETRY	___	___	___
SUPPORT/RESTRAINT DESIGN CHECKED	___	___	___
FLOOR OR WALL PENETRATIONS	___	___	___
PIPE ATTACHMENTS	___	___	___
VALVES	___	___	___
VALVE OPERATOR LOCATION	___	___	___

TOTAL NUMBER OF SUPPORTS/RESTRAINTS: ____________________

TOTAL NUMBER OF FLOOR OR WALL PENETRATIONS: ____________________

LIST SUPPORT/RESTRAINT NOS. WITH DEVIATIONS:

OTHER DEVIATIONS:

COMMENTS: (NOTE IF VISUALLY INSPECTED)

ISSUED

FEB 1 1980

R1 2-1-80

Gilbert Commonwealth Companies	Commonwealth Associates Inc. engineers/consultants/architects	OMAHA PUBLIC POWER DISTRICT FT. CALHOUN, UNIT 1	FILING CODE ____ JOB NO ____
	INSPECTED BY/DATE ____ APPROVED BY/DATE ____	SUPPORT/RESTRAINT DATA SHEET	SHEET ____ OF ____ BOOK NO ____

REV

SUPPORT/RESTRAINT NO: ____________________

DRAVO ISO IC– ____________________

	YES	NO	N/A
SUPPORT/RESTRAINT LOCATED CORRECTLY	___	___	___
SUPPORT/RESTRAINT CONFIGURATION CHECKED	___	___	___
BASE PLATE SIZE AND CONFIGURATION CORRECT	___	___	___
SUPPORT STEEL CHECKED	___	___	___
PART SIZES CORRECT	___	___	___
WELDS CHECK FOR SIZE, TYPE AND QUALITY	___	___	___
CLEARANCES ADEQUATE	___	___	___
EMBEDMENTS SIZE AND LOCATION CHECKED	___	___	___

DEVIATIONS:

COMMENTS (NOTE IF VISUALLY INSPECTED)

ISSUED

FEB 1 1980

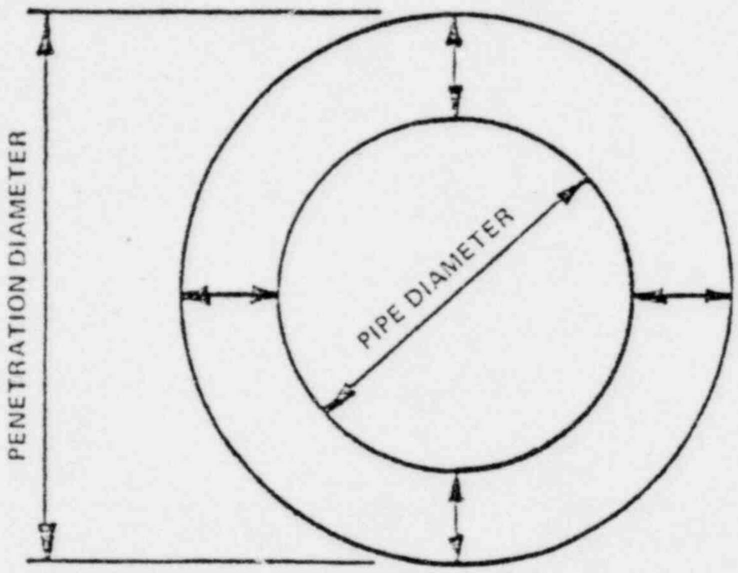
R1 2-1-80

Gilbert Commonwealth Companies	Commonwealth Associates Inc. engineers/consultants/architects	OMAHA PUBLIC POWER DISTRICT FT. CALHOUN, UNIT 1	FILING CODE ____ JOB NO ____
	INSPECTED BY/DATE ____ APPROVED BY/DATE ____	PENETRATION DATA SHEET	SHEET ____ OF ____ BOOK NO ____

REV

DRAVO ISO IC– ____________________

PENETRATION NO: ____________________ (ASSIGNED BY INSPECTOR, MARKED ON ISO)



COMMENTS: (NOTE IF VISUALLY INSPECTED)

ISSUED
FEB 1 1980

R1 2-1-80

DETAILED WORK INSTRUCTIONS

M.O. No. ___________

Reinstallation of Piping Insulation

Dravo Isometric No. ________________ Point _______________

SIGN OFF/DATE

1. Q.C. to verify certified insulation is used.

   P.O. No. ___________________ ________/________ Q.C.

2. H.P. to be notified prior to installation of insulation (Precaution of clothes, area, etc.). ________/________ H.P.

3. OPPD electrician to be notified if heat tracing is present. ________/________ Elect.

   3.1 OPPD Q.C. to be notified if SR heat tracing present. ________/________ Q.C.

4. Appropriate Radiation Work Permit is being used.

   RWP No. _________________ ________/________

5. Notify the plant H.P. prior to entry into a high radiation or high contaminated area. N/A and and initial if not applicable. ________/________

6. Due to cancer causing material in the insulation, all personnel working on the installation of insulation will be required to wear a full face mask. ________/________

7. All dust and insulation material to be collected at the time of installation. ________/________

REMARKS: ____

____

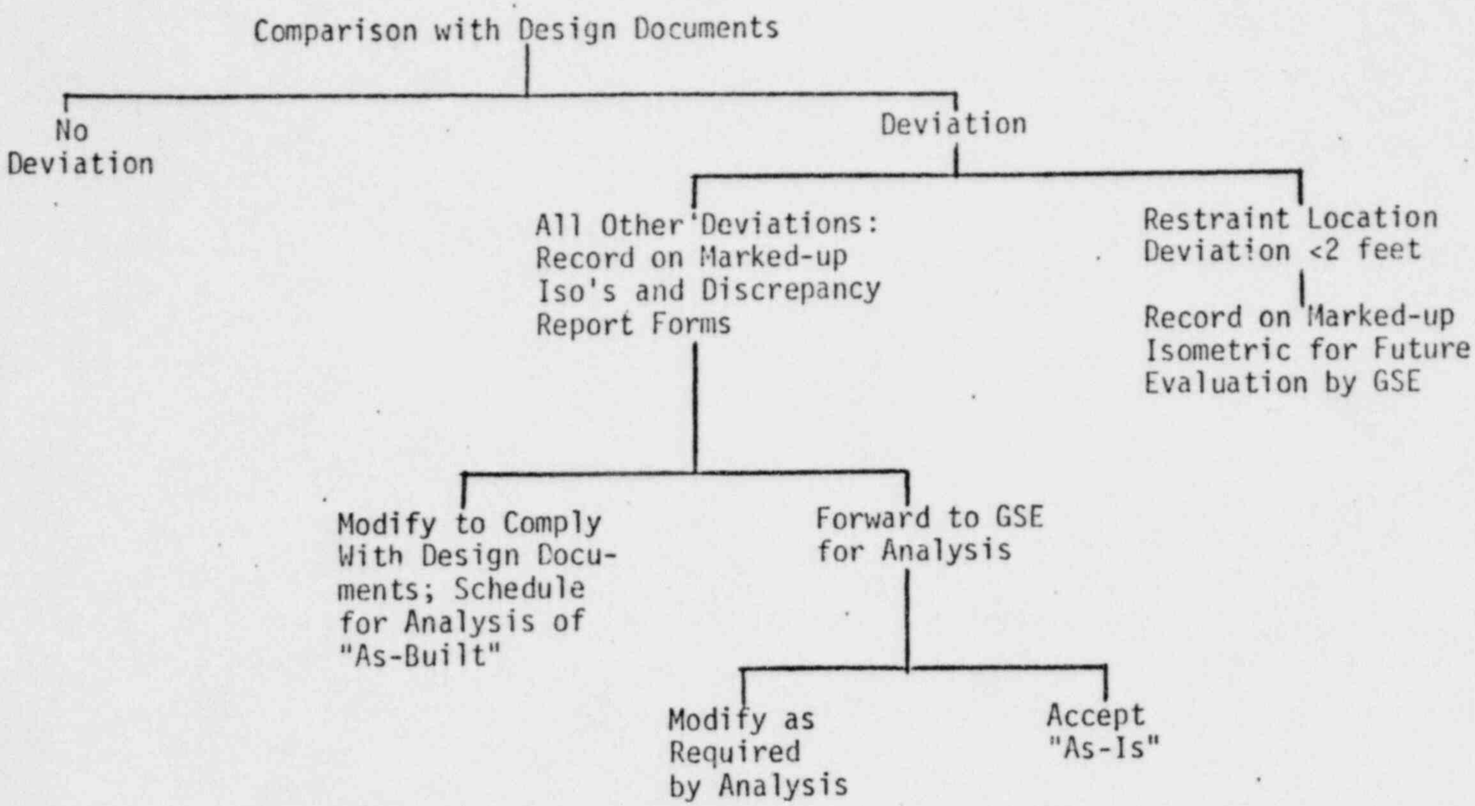
____

____

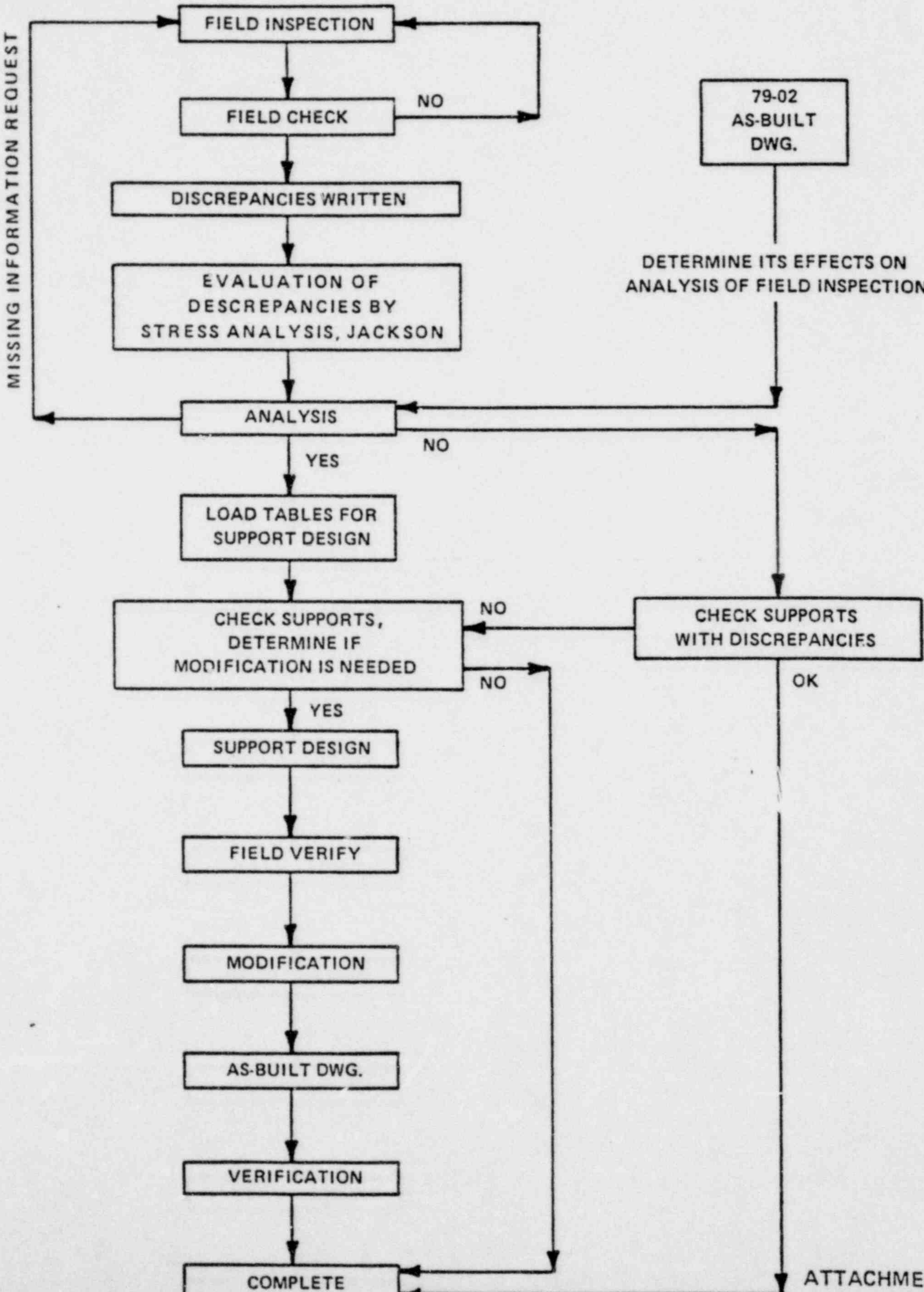
____

Work Completed By ________________________________ Date Time ____________

LOGIC DIAGRAM
(NORMALLY ACCESSIBLE SYSTEMS)
IE BULLETIN 79-14



PROGRAM LOGIC FOR NRC BULLETIN I&E 79-14



PAUL DAVID OSBORNE
Senior Mechanical Engineer

Background in mechanical engineering, with concentration in piping and valves for use in nuclear power plants, petroleum and petrochemical process work, and mining. Also experienced in inservice inspection for nuclear plants.

EXPERIENCE:	**Gilbert/Commonwealth since 1977**
1979 to Present	Supervising Inspection Engineer on Omaha Public Power District's Fort Calhoun, Unit 1. Responsible for technical and administrative supervision of thirty people inspecting the containment building for compliance with the NRC Bulletin IE 79-14. Includes inspection of piping and supports and assuring that seismic analysis meets the design conditions.
1979	Inspection Engineer on Florida Power and Light's Crystal River Power Plant for compliance with NRC Bulletin IE 79-14.
1977-79	Lead Mechanical Engineer – piping and valves on Ohio Edison's Erie Nuclear Plant, Units 1 and 2. Responsible for all piping, valves and piping specialties, including specifications, procurement, design specifications and design guidelines. Also responsible for client and vendor coordination and bid evaluation, including coordination and implementation of the Inservice Inspection Program (ISI).
1977-74	Stearns-Roger, Inc., Denver, Colorado Piping Engineer responsible for piping design and engineering and supervision of designers and drafters on petroleum and petrochemical projects. Piping Engineer on field assignment responsible for checking installation of all piping and instrumentation on nuclear power plant. Also prepared schedule for plant start-up procedures. Piping Engineer charged with design of all types of piping, as well as stress analysis for molyblenum mill site project.
1972-74	**Newport News Shipbuilding and Dry Dock Company** Design Engineer in the nuclear submarine department with duties of piping and structural design, as well as acting liaison between engineering office and actual ship construction.
EDUCATION:	B.S., Engineering Technology, University of South Florida, 1972 A.S., Engineering and Drafting Technology, Brevard Community College, 1970 Additional ASME courses in valve design, nuclear piping, quality assurance, inservice inspection, maintainability, and research and development for nuclear power plants.
SOCIETIES:	American Nuclear Society
CLEARANCES:	Department of Defense – "Secret", 1973 Atomic Energy Commission – "Secret", 1973

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LEE C. LINDGREN
Senior Associate Mechanical Engineer

Over six years experience in design and layout, inspection, and drawings verification of piping, ducting, pollution, and emission control systems for new and existing power and commercial projects.

EXPERIENCE:	**Gilbert/Commonwealth since 1977**
1979 to Present	Pipe Support Engineer, responsible for pipe support design and modification in response to the NRC I & E Bulletin on 455 MW PWR Omaha Public Power District's Fort Calhoun Plant.
1978-79	Associate Mechanical Engineer, responsible for design and layout of piping, equipment selection, technical specifications writing, and bid evaluations for Northern States Power Company's Tyrone Energy Park 1160 MW nuclear power plant project (SNUPPS).
1977-78	Assistant Mechanical Engineer, responsible for design and system design description writing for site-related systems for Northern States Power Company's Tyrone Energy Park.
1976-77	**Teller Environmental Systems, Worcester, Massachusetts** Mechanical Designer, responsible for design, layout, and arrangement of equipment, and design and detailing of bag houses and scrubbers.
1974-77	**Riley Stoker Corporation, Worcester, Massachusetts** Assistant Systems Engineer, responsible for support design of primary and secondary air duct, cold piping, and miscellaneous small piping for Southern Mississippi Electrical Utilities, Dairyland Power Co-op, and Carolina Power and Light Company projects. Also responsible for development of engineering studies, and design of new and existing equipment. As Draftsman, responsible for design of fuel-burning equipment, foundations, dampers, pipe and duct systems.
1966-73	**Unites States Air Force** Staff Sergent – Weapons Technician, responsible for a load crew trained in loading air munitions of jet aircraft and for maintenance of equipment for U. S. Air Force's Tatical Air Command.
EDUCATION:	B.S.E.T., Mechanical Engineering, Central New England College of Technology, 1974 A.E., Mechanical Engineering, Worcester Jr. College, 1965 Additional Courses: Advanced Strength of Materials, Worcester Poly-Technical Institute Environmental Chemistry, Worcester State College

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ANANT D. NAYAKWADI
Manager of Piping and Applied Analysis Section

Background of fourteen years in mechanical and structural engineering with particular emphasis on stress analysis and design and fabrication of piping systems for nuclear power plants.

EXPERIENCE:	Gilbert/Commonwealth since 1976
1980 to Present	Manager of Piping and Applied Analysis Section. Responsible for technical and administrative supervision of section personnel responsible for reliability engineering, nuclear safety analysis, education analysis, compressible flow transient analysis, pipe stress and support Design Analysis. Also as a Project Engineer on TVA SEQUOYAH Unit 1 and 2 and Watts Bar Unit Number 1 design basis accident pipe stress analysis. Responsibility included client coordination, budget control and scheduled completion of the pipe stress efforts.
1978-79	Supervising Piping Engineer on a two-unit 1280 MWe (each) nuclear power plant. Responsible technical and administrative supervision of the following mechanical design groups: piping and valve group, pipe stress group, pipe support group, analytical group and mechanical drafting. Reviews and approves design and procurement specifications for piping and valves. Performs bid evaluations and makes recommendations to the client. Reviews and approves pipe stress analysis and pipe support designs. Prepares manpower estimates and work schedule projections. Reviews plant design for protection against postulated pipe failures in the high energy fluid system. Review and implementation of the NRC Standard Review Plans (SRP) on the nuclear project.
1975-76	**Bechtel Power Corporation, Gaithersburg, Maryland** Senior Engineer and Assistant Stress Group Leader on Standarized Nuclear Unit Power Plant Systems (SNUPPS). Responsible for supervising the Stress Group. Performed time-history dynamic anaylsis of main steam system subjected to turbine trip-out forces. Reviewed stress efforts on other piping systems. Also responsible for all Class I Piping Systems Analysis and postulated design basis pipe breaks on high energy systems. Reviewed procurement specifications, pipe stress and pipe support design calculations.
1972-75	**Stone and Webster Engineering Corporation, Boston, Massachusetts** Piping Engineer on 1250 MW PWR Millstone Unit 3 Nuclear Power Plant Project. Responsible for preparing technical specifications for design, engineering and procurement of piping and valves; review and approval of piping drawings, vendor's isometrics, pipe stress reports; and coordination of pipe break and protection efforts. Also prepared class I transient Listograms for pipe stress analysis. As Lead Stress Analyst on VEPCO's North Anna Unit 3 Plant, was responsible for the complete project pipe stress efforts and supervision of 20 stress analysts. Performed combined deadweight thermal, seismic, and fatigue analysis for ASME Code Class I Piping Systems on North Anna, Units 1 and 2.

(Continued)

ANANT D. NAYAKWADI (Cont'd.)

1968-72 **V.J.T. Institute, Bombay, India**
Lecturer in the Mechanical Engineering Department; teaching course in Power Plant Engineering.

1967-68 **Indian Plastic Limited, Bombay, India**
Mechanical Engineer in Chemical Division. Responsible for preventive maintenance of chemical plants, and erection of piping.

1967-68 **M.H.S. Polytechnic, Bombay, India**
Associate Lecturer in Mechanical Engineering Department. Taught Theory and Practice of Engineering Drawings, Heat Engines, and Refrigeration and Air Conditioning to graduate students.

1966-67 **Maharastra State Electricity Board, Bombay, India**
Junior Engineer in the Inspection Wing of Store and Purchase Division.

EDUCATION: B.S., Mechanical Engineering, Bombay University, 1966
M.S., Mechanical Engineering, Bombay University, 1971

REGISTRATION: Professional Engineer in Ohio (1977), Missouri (1976), Virginia (1974), Massachusetts (1974) and New York (1979).

SOCIETIES: American Society of Mechanical Engineers
Attends ASME Boiler and Pressure Vessel Code, Section 3 meetings of Working Group on Piping and Subgroup on Fabrication and Examination.

VINUBHAI SHAH
Consulting Mechanical Engineer

Background of professional experience in mechanical engineering including stress analysis, finite element analysis, heat transfer analysis and fluid transient analysis for numerous power engineering projects. Also specialized in the area of computer programming.

EXPERIENCE:	**Gilbert/Commonwealth since 1977**
1978 to Present:	Supervising Piping Engineer responsible for supervision and coordination of pipe stress analysis support design selected to NRC I & E Bulletin 79-14 for Ft. Calhoun nuclear plant.
1978-79	Senior Mechanical Engineer responsible for the analysis of transients in piping network and component stress analysis using finite element technique. This also included special problems relating to stress analysis and development of computer programs. As a Lead Engineer on TVA SEQUOYAH Unit 1 and 2 design Basis Accident pipe stress analysis, responsible for supervision and coordination of stress analysis using T-pipe Computer program. Developed seismic spring criteria for Safety related piping system on the Erie Nuclear power plant.
1977-78	Mechanical Engineer responsible for piping analysis including steam hammer analysis on fossil and nuclear power plants. Clients included Ohio Edison Company, Consumers Power Company and Pennsylvania Power Company.
1972-77	**Stone and Webster Engineering Corporation, Boston, Massachusetts** Engineer responsible for the maintenance of MARC finite element program including thermal transient analysis, stress analysis and water hammer analysis. Stress analysis of ASME Section III Class 1 and 2 piping system.
1971-72	**Brown University, Providence, Rhode Island** Research Assistant involved in mechanical and thermal analysis using MARC program. Also involved in finite element analysis and computer program development.
1969-70	**Littleton Research and Engineering Corporation, Littleton, Massachusetts** Mechanical Engineer involved in ship structure vibration analysis.
1965-66	**Gujaret Electrical Board, India** Engineer – Involved in the operation of a fossil power plant.
EDUCATION:	B.M.E., Birla Vishvarkarma, Mahavidyalaya, 1965 M.S.M.E., Worcester Polytechnic Institute, 1969 Additional advanced courses in system programming and finite element analysis.
REGISTRATION:	Mechanical Engineer in Massachusetts, (1976)

(Continued)

VINUBHAI SHAH (Cont'd.)

SOCIETIES: American Society of Mechanical Engineers

PUBLICATIONS: Co-author with S.P. Ying, "Transient Pressures in Boiler Steam Lines," presented at the Ninth Annual Winter Meeting of the ASME in San Francisco, California, December 1978.

ASME Code Committee:
Attends code committee meeting on piping analysis and support design.

The following guidelines shall be used in evaluating the discrepancies for computerized pipe stress analysis to satisfy the requirements of NRC IE Bulletin 79-14.

A computerized piping stress analysis using TPIPE code will be performed if as-built piping system does not conform to the original design as follows:

a) The as-built piping is missing supports or supports have been added.

b) The support locations on as-built piping are different than the design locations. Reanalysis is generally required if support location is more than 12 inches away from the original design. An engineering judgement depending on the pipe size shall be used in such cases.

c) The as-built support geometry does not conform to the original design geometry of the support, resulting in a change in the degree of restraints on the piping system.

d) The as-built piping system geometry is different from the original piping geometry used for seismic analysis. It is required to use an engineering judgement to evaluate the geometry change in deciding whether reanalysis of the piping system is required.

If reanalysis of the piping system is required, the first analysis should be based on the as-built geometry and support systems of the piping. The pipe stresses of as-built piping should be checked against the allowables set forth in The Stress Analysis Criteria. If stresses are not within the original design allowables, the piping system shall be reanalyzed adding or deleting supports.

ATTACHMENT 7

PIPE STRESS ANALYSIS CRITERIA

The piping systems listed as Class I in F-1.3 of Appendix F to the FSAR of Fort Calhoun #1 are considered seismic category I systems. These Class I systems are covered by NRC IE Bulletin 79-14.

The Class I piping systems are analyzed for seismic effects and designed/fabricated to USAS B 31.7 Nuclear Power Piping Code. The primary stress allowables and design loading combinations are given in Table F-1 of Appendix F. The terminology used in this table is as follows:

Design Loading: This is the same as sustained loads defined in the ASME Section III NC-3652-1 which include the effects of pressure, weight and other sustained mechanical loads.

Design Earthquake: This term is used to define Operational Basis Earthquake (OBE).

Normal Operating Loadings: This includes the effects of pressure, weight, system operating transients and other sustained mechanical loads. The system operating transient primary effects are such as thrust from relief and safety valve loads from pressure and flow transients, the dynamic effect due to sudden closure of valves in the system.

Maximum Hypothetical Earthquake: This earthquake is known as Design Basis Earthquake (DBE). The modern term for DBE is known as Safe Shutdown Earthquake (SSE).

Primary Stress Calculation: The pipe stress analysis for primary stress consideration includes the effects of pressure, weight, other sustained mechanical loads, system operating transient and earthquake (OBE and DBE).

The allowable stress limits as given in Table F-1 of Appendix F for piping are:

1. OBE and Sustained Loads

   Design Loading + Design Earthquake = $P_B + P_m \leq 1.2S_h$

   (See Table F-1, FSAR, for definition of terms.)

2. DBE and Sustained Load and System Operating Transients

   Normal Operating Loadings + Maximum Hypothetical Earthquake

   $= P_B \leq \frac{4}{\pi} S_D \text{ Cos } (\pi/2 \; \frac{P_m}{S_D})$

   $P_m \leq S_D$

The S_h and S_D values should be selected from USAS B 31.7. These S_h values are tabulated in Table A-8 of the code. The S_D value which is defined as Design Stress in the Appendix F is equal to S_y at operating temperature for ferritic steels and $1.2S_m$ for austenitic steel. The S_y values are given in Table A-3 and S_m values are given in Table A-2.

Secondary Stress Calculation: The section F.2-2 of the Appendix F defines that the preliminary thermal analysis was done in accordance with USAS B 31.1. It also says that movements of pipe supports due to seismic or containment post tensioning were considered. There are no secondary stress limits as well as loading conditions due to secondary effects given in the Appendix F. Therefore, the following criteria and stress allowable be used for secondary stress calculation in the piping system.

$$S_E = \frac{i\ Me}{Z} \leq S_A$$

$$S_A = f(1.25S_c + 0.25S_h)$$

Where S_E = Secondary Stress

S_C = Allowable stress at ambient temperature from Table A-8 of B 31.7.

S_h = Allowable stress as defined under primary stress calculation.

Z = Section modulus of pipe.

M_E = Range of resultant moments due to thermal expansion and moment effects of anchor displacement due to earthquake.

i = Stress intensification factor.

If secondary stress criterion as defined above could not be satisfied for certain hot end less flexible system, the following combination of secondary stress plus stresses due to sustained load shall be satisfied.

Pressure stress + dead load and other sustained load stress + expansion stress $\leq S_h + S_A$.

Combination of Stresses: The FSAR Appendix F commitment for combining the stresses is as follows:

a. The final combination of stresses is done manually.

b. Stresses are combined at the stress level, rather than moment level as permitted by B 31.7.

However, the reanalysis of the safety related piping systems uses the stress combination criteria as permitted by B 31.7. The TPIPE computer post-processor combines loads at the moment level as required by USAS B 31.7.

Final Stress Summary Report: The following summary sheets shall be completed for the final stress summary report.

1. The maximum stress level sheet.
2. Equipment - nozzle, anchor and penetration loads sheets.
3. Support load sheet.

ATTACHMENT 8

SUPPORT DESIGN CRITERIA

1. CODES & STANDARDS

1.1 USAS B31.7-1969 NUCLEAR POWER PIPING

1.2 ANSI B31.1.0-1967 POWER PIPING

1.3 AISC, SPECIFICATION FOR DESIGN, FABRICATION & ERECTION OF STRUCTURAL STEEL FOR BUILDINGS, 1969

1.4 AWS D1.0-69 CODE FOR WELDING IN BUILDING CONSTRUCTION

2. STRUCTURAL STEEL ALLOWABLE STRESSES

The following guidelines will be used in evaluating support steel:

2.1 FSAR, APPENDIX F, TABLE F-1, PAGE F-4

2.2 <u>TENSION</u>

AISC, "MANUAL OF STEEL CONSTRUCTION", 7th Edition, Section 1.5.1.1, Page 5-16

2.3 <u>SHEAR</u>

AISC, "MANUAL OF STEEL CONSTRUCTION", 7th Edition, Section 1.5.1.2, Page 5-16

2.4 <u>COMPRESSION</u>

AISC, "MANUAL OF STEEL CONSTRUCTION", 7th Edition, Section 1.5.1.3, Page 5-16

2.5 <u>BENDING</u>

AISC, "MANUAL OF STEEL CONSTRUCTION", 7th Edition, Section 1.5.1.4, Page 5-17

2.6 <u>AXIAL COMPRESSION AND BENDING</u>

AISC, "MANUAL OF STEEL CONSTRUCTION", 7th Edition, Section 1.6.1, Page 5-22

2.7 <u>AXIAL TENSION AND BENDING</u>

AISC, "MANUAL OF STEEL CONSTRUCTION", 7th Edition, Section 1.6.2, Page 5-23

3. COMPONENTS STANDARD SUPPORTS ALLOWABLE LOADS The manufacturer's maximum recommended loads will be used as the allowable loads, refer to Bergen-Paterson Catalog No. 66.

4. WELDING ALLOWABLE STRESSES - James F. Lincoln Arc Welding Foundation, "Design of Welded Structures" by Blodgett, Section 7.1, Page 7.4-6 will be used to determine calculated forces and allowable forces.

CRITERIA FOR "ESSENTIAL" MODIFICATIONS

1) All modifications needed to ensure piping integrity based on analytical analysis (support stresses not evaluated).

2) All supports found by "support analysis" to have a Factor of Safety less than 1 based on ASTM yield stress values of materials (structural shapes and bolts).

3) All Unistrut anchors which exceed "Unistrut Catalog Values" (new designs will follow District approved criteria).

4) All snubbers carrying a load greater than 85% of the relief valve setting as specified in Bergan-Paterson hydraulic snubber data.

5) Only supports on safety related piping (and those supports on non-safety related piping which effect the 79-14 analysis of safety related piping) will be modified.

ENCLOSURE 2

SUMMARY OF WORK RELATED TO IE BULLETIN 79-02

Prior to plant startup, all modifications required because of IE Bulletin 79-02 will be completed in the containment and inaccessible areas of the auxiliary building on the safety related piping 2-1/2 inches in diameter and greater. The scope of the modifications was originally based on the original design loads shown on the Bergen-Paterson support detailed drawings to provide for safety factors of 4 or 5, as applicable. Some modifications have been found to be unnecessary because of decreased loads determined from the IE Bulletin 79-14 analysis.

In addition, all modifications of safety related portions of the small diameter piping (2 inches and under) in the containment and in the inaccessible areas of the auxiliary building will be completed prior to plant startup. These modifications are based on performance of a visual inspection followed by an engineering evaluation of all those supports that failed the inspection.

Modifications of supports on safety related piping, 2-1/2 inches in diameter and greater, in accessible areas of the auxiliary building will be completed prior to startup to ensure that all anchors have a safety factor of 2 or greater. In addition, approximately 80% of the anchors will have factors of safety of 4 or 5, as applicable. Modification work for base plates/anchors with safety factors greater than 2, but less than 4 or 5, will be integrated with the IE Bulletin 79-14 verification effort being performed in the auxiliary building (referenced in Enclosure 1). This will ensure that modifications are made which account for the loads as calculated by TPIPE.

Inspection and modification to the accessible safety related portions of piping 2 inches in diameter and less will continue after plant operation. This small piping represents a minor percentage of the total amount of small piping already inspected.

Verification of the calculations for the containment and inaccessible areas in the auxiliary building, based on the original design loads or in some cases the new loads generated by the IE Bulletin 79-14 analysis, will be completed prior to plant startup. Verification of the calculations for accessible areas in the auxiliary building (2-1/2 inch piping and greater), based on the original loads, will continue after plant startup.

The final report for IE Bulletin 79-02 will provide verification that all seismic support base plates, on the safety related portions of systems, will have safety factors in accordance with IE Bulletin 79-02 and will include consideration of loads generated by the above referenced IE Bulletin 79-14 verification program.