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SUBJECT: Forwards summary of open item resolution & supporting documentation re equipment environ qualification files audit, per NRC request for addl info.
See Repts.

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May 29, 1986
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Donald C. Cook Nuclear Plant Unit Nos. 1 and 2
Docket Nos. 50-315 and 50-316
License Nos. DPR-58 and DPR-74
EQUIPMENT ENVIRONMENTAL QUALIFICATION AUDIT

Mr. Harold R. Denton, Director
Office Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Denton:

During the April 30, 1986 exit interview following audit of the D. C. Cook Plant Equipment Qualification files, twelve items were identified which required futher information. Pursuant to discussions with members of your staff as well as Mr. Taylor's staff, I&MECo has reviewed available information. Based on our understanding of the items, we are providing the requested additional information as attachments to this letter. A summary of the resolution of these items is given in Attachment 1, and the supporting documentation is provided in Attachments 2 through 9.

This document has been prepared following Corporate procedures which incorporate a reasonable set of controls to insure its accuracy and completeness prior to signature by the undersigned.

Very truly yours,

M. P. Alexich
Vice President 5/29/86

MPA/rjn

cc: John E. Dolan
W. G. Smith, Jr. - Bridgman
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G. Bruchmann
G. Charnoff
NRC Resident Inspector - Bridgman

A048
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Qualification Test Program

for Terminal Blocks

TEST REPORT 45603-1

NUCLEAR ENVIRONMENTAL QUALIFICATION

Prepared for

MARATHON™ SPECIAL PRODUCTS

P.O. Box 468
Bowling Green, Ohio 43402
(419) 352-8441

FEB., 1982

Prepared by

WYLE LABORATORIES

~~8606030012A~~ 76pp

REVISION A

1.0 SCOPE

This document has been prepared by Wyle Laboratories for Marathon Special Products, hereinafter referred to as the equipment supplier, for equipment used in various nuclear power generating stations.

1.1 Objectives

The purpose of this Qualification Plan is to present the approach, methods, philosophies, and procedures for qualifying Fixed Barrier Terminal Blocks (Series 1500 NUC and 1600 NUC) and Power Stud Blocks (Series 142 NUC), assembled and/or manufactured by Marathon Special Products, for use in various nuclear power generating stations. The devices shall be qualified for use with metallic terminal lugs (uninsulated) and housed in a metal enclosure with a gasketed door.

Nuclear environmental qualification of any safety-related device to meet the intent of IEEE 323-1974 is usually a three-step process, i.e., 1) radiation exposure; 2) aging; and 3) design basis event qualification (seismic, and, for equipment inside containment, LOCA). The purpose of the first two steps is to put the sample equipment to be used for qualification into a condition that represents the worst state of deterioration that a plant operator will permit prior to taking corrective action, i.e., its end-of-qualified-life condition. The next step demonstrates that it still has adequate integrity remaining to withstand the added environmental stresses of specified design basis events and still perform its safety-related functions.

It is incumbent on the equipment supplier to assure that the components and materials contained in the equipment actually placed into service are the same as those qualified.

1.2 Applicable Qualification Standards, Specifications, and Documents

- IEEE 323-1974, "IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations"
- IEEE 344-1975, "IEEE Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations"
- NUREG 0588
- Reg. Guides 1.89 and 1.100
- "Beaver Valley Power Station - Unit No. 2, J.O. No. 12241 - O.F.E. No. 10080 - C.O. No. 6289, Duquesne Light Company, Environmental Qualification Testing of Marathon 1500 Series Terminal Blocks," Letter, S. L. Chapin, Jr. (Stone & Webster) to H. Black (Marathon), dated August 22, 1980

1.0 SCOPE (CONTINUED)

1.2 Applicable Qualification Standards, Specifications, and Documents (Continued)

- Document No. 251/140, "Allens Creek NGS Unit No. 1, Class 1E Terminal Blocks Test Condition," Letter, J. Tana (EBASCO) to H. Black (Marathon), dated October 1, 1980
- "Beaver Valley Power Station - Unit No. 2, J.O. No. 12241 - O.F.E. No. 10080 - C.O. No. 6289, Purchase Order No. 2BV-821, Terminal Block Qualification Testing," Letter, S. L. Chapin, Jr. (Stone & Webster) to J. Keglewitsch (Marathon), not dated
- Document No. AC-ES-MA-01, "Allens Creek NGS Unit No. 1, Class 1E Terminal Blocks, Revision Seismic Spectra," Letter, J. Tana (EBASCO) to H. Black (Marathon), dated October 14, 1980
- Commonwealth Edison Environmental Accident Profiles and Seismic Curves, Letter, D. C. Lamken (Commonwealth Edison) to C. G. Poplin (Wyle), dated October 14, 1980
- Commonwealth Edison Test Parameters for Joint Qualification Program, Marathon Terminal Blocks, dated September 11, 1980
- Letter, D. C. Lamken, Commonwealth Edison, to G. Endicott, Wyle, dated February 9, 1981

1.3 Equipment Description

The test specimens to be supplied by the equipment supplier shall consist of three (3) Terminal Block Assemblies, each consisting of the following items:

- Two (2) Marathon Fixed Barrier Terminal Blocks, Series 1600 NUC, Type 1612929, 600 Volts, 75 Amperes, 12 Point

  Dimensions: 9"L x 2"W x 1-3/16"H
  Weight: Approximately 1 pound

- Two (2) Marathon Fixed Barrier Terminal Blocks, Series 1500 NUC, Type 1512929, 600 Volts, 75 Amperes, 12 Point

  Dimensions: 8-1/4"L x 2"W x 1-3/16"H
  Weight: Approximately 1 pound

1.0 SCOPE (CONTINUED)

1.3 Equipment Description (Continued)

- Two (2) Marathon Power Stud Blocks, Series 142 NUC, Type 1423589, 600 Volts, 3 Circuits, 1/4-20 Studs

  Dimensions: 2-3/4"L x 2-7/8"W x 1-3/4"H
  Weight: Approximately 1 pound

- One (1) Type 4 NEMA Enclosure, Hoffman, Single-Door, Part No. A20H20ALP

  Dimensions: 20" x 20" x 6"
  Weight: 38 pounds

- One (1) NEMA Mounting Panel, Hoffman, Part No. A-20P20

  Dimensions: 17" x 17"
  Weight: 9 pounds

- Cable conduit (2), metallic, 1-1/2" I.D., 90° bend, mounted to the top panel of the NEMA enclosure

- Cable, Delco, #8 AWG, Teflon insulation, 4-inch sections (not to be qualified, for test purposes only)

- Terminal Lugs, ring-tongue, copper/tin plated, uninsulated, #8 AWG barrel:

  1) For 1512929 and 1612929 Blocks: .190-inch hole
  2) For 1423589 Blocks: .270-inch hole

The Terminal Block Assemblies shall be preassembled by the equipment supplier per the following:

1) Jumper wires shall be prepared, using commercially available crimping machinery, to assure uniform terminal lug/cable connection. Each end of each 4-inch cable section shall be stripped to bare wire per standard commercial practice. Uninsulated metallic terminal lugs shall be attached to each bare end of each wire.

2) The terminal blocks and power stud blocks shall be attached to the appropriate mounting panel, using commercially available bolts, nuts, and washers, as shown in Figure 2.

1.0 SCOPE (CONTINUED)

1.3 Equipment Description (Continued)

3) Each Type 1512929 or 1612929 terminal block shall require ten (10) jumper wires. Each Type 1423589 power stud block shall require one (1) jumper wire. The wires shall be installed on each block per the wiring diagram(s) depicted in Figure 1. When connected as shown, two (2) separate series circuits occur through each block. These circuits parallel each other for the entire length of each block (i.e., one circuit utilizes odd-numbered terminals, the other circuit utilizes even-numbered terminals). During installation, terminal screws/nuts shall be tightened in accordance with the equipment supplier's recommendations, as follow, to simulate actual installation procedures.

   o Even number series circuit (reference Figure 1) shall be torqued to 25 (+0, -5) inch-pounds.

   o Odd number series circuit (Reference Figure 1) shall be hand tightened until snug, then tightened an additional 1/8 to 1/4 turn.

4) The cable conduits shall be affixed to the top panel of the NEMA enclosure, using standard conduit mounting hardware.

5) Two (2) 1/4-inch drain holes shall be drilled in the bottom panel of the NEMA enclosure in diagonally opposite corners.

In addition to the items specified above, the equipment supplier shall furnish the following:

o Three (3) "dummy" NEMA enclosures shall be required to allow for accident (LOCA) chamber calibration.

o Terminal lugs, ring-tongue, copper/tin plated, uninsulated, #8 AWG, uncrimped, quantity (TBD)*

* TBD = To Be Determined

1.0 SCOPE (CONTINUED)

1.4 Qualification Sequence

Qualification shall be performed in the following sequence. It is considered that the radiation exposure and the aging effects on the equipment are cumulative and result in the same effects as simultaneous exposure experienced while operational in a nuclear power plant.

- Baseline Functional Tests
- Radiation Exposure
- Functional Test
- Thermal Aging
- Functional Test
- Vibration Aging
- Functional Test
- Seismic Qualification
- Functional Test
- Accident Qualification
- Functional Test
- Post-Test Inspection

Radiation prior to thermal aging is normally a more severe test sequence. Tests sponsored by the NRC and reported by Sandia Laboratories in Report No. SAND-79-092CK have shown that radiation may sensitize some polymers, which causes them to degrade to a greater extent when followed by thermal aging. The report states that the mechanistic postulate is that radiation-cleaved bonds, in the form of radicals, react with oxygen to give degradation products, including peroxides. The peroxides are chemically weak links which are susceptible to thermal cleavage. This thermal peroxide cleavage gives more radicals which, in the presence of oxygen, lead to more degradation and more peroxides.

1.5 Test Specimen Configurations

The test specimens shall be received by Wyle Laboratories in the configuration presented in Paragraph 1.3. At various stages of the test program, minor modifications to the initial configuration shall be required. The following presents these modifications as they apply to the test sequence.

1.5.1 Configuration A (Functional Tests, Vibration Aging, Seismic Qualification, and Accident Qualification)

This designation refers to the original test specimen configuration, as described in Paragraph 1.3.

1.0 SCOPE (CONTINUED)

1.5.2 Configuration B (Radiation Exposure)

The jumper wires installed on each Terminal Block Assembly shall be removed and replaced by uninsulated metallic terminal lugs (uncrimped) which are identical to those used on the jumper wires. Appropriate terminal screws/nuts shall be tightened to the torque values specified in Paragraph 1.3.

1.5.3 Configuration C (Thermal Aging)

Same as Configuration B, except all mounting panels (with terminal blocks attached) shall be removed from their respective enclosures. Each vacant enclosure and each terminal block/mounting panel combination shall constitute a subassembly.

3.0 QUALIFICATION PROGRAM (CONTINUED)

3.4 Aging

The desired qualified life of the subject equipment is 40 years. The desired qualified life for components is also 40 years. Where 40-year qualified life for components is not demonstrated during the test program, a shorter qualified life shall be established and the component assigned a maximum maintenace-replacement interval no greater than its qualified life.

Each component in the subject equipment has been reviewed for function and age-related failure mechanisms which could affect its function. A matrix, Table I, has been prepared which defines the components, manufacturer ratings, materials, service conditions, and aging mechanisms. A literature search of Wyle's Aging Library has been utilized to obtain auditable aging data. This data was used to define artificial aging procedures. The aging mechanisms to be addressed for this equipment are time-temperature effects and humidity effects.

3.4.1 Time-Temperature Effects

For many materials normal temperature conditions coupled with time create an aging mechanism known as time-temperature effects. The significance of these effects is strongly dependent on the type of material under consideration.

In general, materials may be classified in one of three broad categories: B

1) Organic materials (i.e., polymers, lubricants, etc.)
2) Inorganic materials (i.e., ceramics, minerals, etc.)
3) Metallic materials

It can be shown that the deterioration due to time-temperature effects is insignificant for inorganic materials since these materials exhibit no permanent changes in geometry or properties for the time period under consideration (Reference 1). Similarly, time-temperature effects are judged to be insignificant for metallic materials during the same time frame.

In contrast, it is known that time-temperature aging effects can result in significant deterioration of many organic materials. As noted in Reference 2, "The exposure of polymers to the influence of environmental factors over a period of time generally leads to deterioration in physical properties."

3.0 QUALIFICATION PROGRAM (CONTINUED)

3.4.1 Time-Temperature Effects (Continued)

The present state-of-the-art will allow for artificial acceleration of the time-temperature effects associated with organic materials by increasing the temperature. Therefore, the aging of these components shall be based on their organic materials.

For many organic materials, it is known that the degradation process can be defined by a single temperature-dependent reaction that follows the Arrhenius equation (References 3 and 4):

$$k = A \exp(-(Ea/k_B T)) \qquad (1)$$

where,

k = reaction rate
A = frequency factor
exp = exponent to base e
Ea = activation energy
k_B = Boltzmann's Constant
T = absolute temperature

It is further noted that, for many reactions, the activation energy can be considered to be constant over the applicable temperature range. Equation (1) can be transformed into a form which yields an acceleration factor.

The acceleration factor is defined as t_2/t_1.

The equation is:

$$t_2/t_1 = \exp(-(Ea/k_B)(1/T_1 - 1/T_2)) \qquad (2)$$

where,

t_1 = accelerated aging time at temperature T_1
t_2 = normal service time at temperature T_2
exp = exponent to base e
Ea = activation energy (eV)
k_B = Boltzmann's Constant (8.617×10^{-5} eV/°K)
T_1 = accelerated aging temperature (°K)
T_2 = normal service temperature (°K)

The transformation of the reaction rate form of the Arrhenius equation to an acceleration form is accomplished as follows:

3.0 QUALIFICATION PROGRAM (CONTINUED)

3.4.1 Time-Temperature Effects (Continued)

Life is assumed to be inversely proportional to the chemical reaction rate (References 3 and 4). In terms of life, and after converting to Napierian base logarithms, Equation (1) becomes:

$$\ln(\text{life}) = (Ea/k_B)(1/T) + \text{Constant} \tag{3}$$

Equation (3) has the algebraic form:

$$y = mx + b \tag{4}$$

where,

y = ln (life)
x = $1/T$
m = Ea/k_B, constant for single dominant reactions
b = constant

The constants, m and b, can be estimated by fitting the experimental data in the form of ln (life) versus 1/T into the above simple linear relationship.

The derivation of an acceleration factor is accomplished by taking the difference between any two points of the linear relationship.

Thus, if we substitute t for life into Equation (3), we obtain:

$$\ln t = (Ea/k_B)(1/T) + \text{Constant} \tag{5}$$

For the set of points (t_1, T_1), Equation (5) becomes:

$$\ln t_1 = (Ea/k_B)(1/T_1) + \text{Constant} \tag{6}$$

For the set of points (t_2, T_2), Equation (5) becomes:

$$\ln t_2 = (Ea/k_B)(1/T_2) + \text{Constant} \tag{7}$$

Subtracting Equation (6) from Equation (7) yields:

$$\ln t_2 - \ln t_1 = (Ea/k_B)(1/T_2) + \text{Constant} - (Ea/k_B)(1/T_1) - \text{Constant} \tag{8}$$

Simplifying and rearranging of Equation (8) yields:

$$\ln(t_2/t_1) = -(Ea/k_B)(1/T_1 - 1/T_2) \tag{9}$$

3.0 QUALIFICATION PROGRAM (CONTINUED)

3.4.1 Time-Temperature Effects (Continued)

Taking antilogarithms yields:

$$t_2/t_1 = \exp(-(E_a/k_B)(1/T_1 - 1/T_2)) \quad (10)$$

Equation (10) is the same as Equation (2).

The acceleration factor (t_2/t_1) is the reciprocal of the time compression factor, (t_1/t_2). Taking the reciprocal of Equation (10) yields:

$$t_1/t_2 = \exp((E_a/k_B)(1/T_1 - 1/T_2)) \quad (11)$$

Solving Equation (11) for t_1 yields:

$$t_1 = t_2 \exp((E_a/k_B)(1/T_1 - 1/T_2)) \quad (12)$$

Equation (12) can be used to derive the accelerated aging times for materials with known activation energies. In many cases, it is not practical to independently accelerate the time-temperature effects of each organic material. In this case, a determination is made as to which material has the lowest activation energy. The time-temperature effects are accelerated based upon the lowest activation energy for conservatism. This assures that the degradation of each age-sensitive material is accelerated to at least the equivalent degradation as that to be encountered during the qualified life.

The conservatism of basing accelerated aging on the lowest activation energy is demonstrated as follows:

The acceleration factor (t_2/t_1) of Equation (10) is greater than 1, for a constant activation energy, when the accelerated aging temperature T_1 is greater than the normal service temperature T_2.

With T_1 greater than T_2, the term ($1/T_1 - 1/T_2$) is negative. This negative multiplied by the negative in the exponent results in a positive exponent. A positive exponent, in turn, results in an acceleration factor greater than 1.

The acceleration factor versus (1/T) for various activation energies is plotted in Figure 45. Since the slope of each plot is proportional to the activation energy, per Equation (4), it is shown that a lower activation energy causes a lower slope. Thus, for a given accelerated aging temperature, different activation energies cause different acceleration factors, assuming that the normal service temperature is the same. This is demonstrated in the following example.

3.0 QUALIFICATION PROGRAM (CONTINUED)

3.4.1 Time-Temperature Effects (Continued)

EXAMPLE: Assume that a system consists of four (4) materials which have activation energies of 0.4, 0.8, 1.0, and 2.0 eV. It is assumed that each material is normally at a service temperature of 30°C for a qualified life of 40 years. It is further assumed that accelerated thermal aging shall be performed at 50°C.

If the accelerated aging program is based upon the material with an activation energy of 1.0 eV, the following results:

The relationship for the curves of Figure 1 is generated from Equation (10) and is defined as:

$$t_2/t_1 = \exp\left(-(Ea/k_B)(1/T_1 - 1/T_2)\right) \qquad (13)$$

Substituting Ea = 1.0 eV, T_1 = 323°K, T_2 = 303°K, into Equation (13) yields an acceleration factor of approximately:

$$t_2/t_1 = 11 \qquad (14)$$

Thus, for a normal service time of 40 years (t_2 = 40), the accelerated aging time from Equation (14) is:

$$t_1 = 40/11 = 3.64 \text{ years} \qquad (15)$$

Therefore, using the accelerated thermal aging program of 50°C for 3.64 years, the equivalent demonstrated normal service times at 30°C for the other materials with activation energies of 0.4, 0.8, and 2.0 eV can be calculated using Equation (13).

Thus, for Ea = 2.0 eV,

$$t_2 = 3.64 \exp\left(-(2.0/8.617^{-5})(1/323 - 1/303)\right) \qquad (16)$$

$$t_2 - 418 \text{ years} \qquad (17)$$

For Ea = 0.8 eV,

$$t_2 = 3.64 \exp\left(-(0.8/8.617 \times 10^{-5})(1/323 - 1/303)\right) \qquad (18)$$

$$t_2 = 24.3 \text{ years} \qquad (19)$$

For Ea = 0.4 eV,

$$t_2 = 3.64 \exp\left(-(0.4/8.617 \times 10^{-5})(1/323 - 1/303)\right. \qquad (20)$$

$$t_2 = 9.4 \text{ years} \qquad (21)$$

3.0 QUALIFICATION PROGRAM (CONTINUED)

3.4.1 Time-Temperature Effects (Continued)

Thus, it is seen that materials with activation energies less than 1.0, upon which the aging program was based, are underaged by the accelerated aging of 50°C for 3.64 years.

In order to assure the demonstration of a 40-year service time for all materials, the lowest activation energy should be chosen.

Basing the accelerated aging program on the lowest activation energy of 0.4 eV results in the following:

Substituting Ea = 0.4 eV, T_1 = 323°K, T_2 = 303°K, into Equation (13) yields an acceleration factor of approximately

$$t_2/t_1 = 2.6 \qquad (22)$$

Thus, the aging time is:

$$t_1 = 40/2.6 = 15.4 \text{ years} \qquad (23)$$

Rechecking the other materials for adequate aging results in the following for an accelerated aging program of t_1 = 15.4 years, T_1 = 323°K, T_2 = 303°K.

For Ea = 0.8 eV,

$$t_2 = 103 \text{ years} \qquad (24)$$

For Ea = 1.0 eV,

$$t_2 = 165 \text{ years} \qquad (25)$$

For Ea = 2.0 eV,

$$t_2 = 1{,}768 \text{ years} \qquad (26)$$

Thus, it has been demonstrated that basing an accelerated thermal aging program on the lowest activation energy, when the baseline temperatures are common, provides the conservatism desired.

END OF EXAMPLE

For components with time-temperature-related aging mechanisms, the aging was based upon available auditable aging data.

Where adequate information was available, a determination of age sensitivity was performed to determine the qualified life goal. Those items found to be age insensitive are noted in the column entitled "Aging

3.0 QUALIFICATION PROGRAM (CONTINUED)

3.4.1 Time-Temperature Effects (Continued)

Mechanisms, Time-Temperature Effects," Table I. A reference was made for the conclusion of age insensitivity. These references are to paragraphs in this document which justify the conclusion, reference documents, or other basis, such as inorganic materials.

For organic materials, a determination was made as to whether the material can be qualified for a 40-year life. This was done by using the normal service temperatures for the baseline temperature. For each organic material, the applicable Arrhenius equation was evaluated, using the baseline temperature, as demonstrated by the following example:

The Arrhenius equation, Equation (3), is repeated:

$$\ln(\text{life}) = (E_a/k_B)(1/T) + \text{Constant} \quad (27)$$

A substitution shall be made for the applicable slope and constant and the equation evaluated, e.g., for laminate, XXX, Item 1.1.6, Table I, for mechanical properties, the Arrhenius curve is:

$$\ln(\text{life}) = 14101.11669\,(1/T) - 24.3612882 \quad (28)$$

For a baseline temperature of 135°F (57.2°C):

$$T = 57.2^{\circ}C + 273^{\circ}C = 330.2^{\circ}K \quad (29)$$

$$\text{life} = \text{greater than } 10{,}000 \text{ years} \quad (30)$$

It is concluded that this laminate, XXX, can be qualified for 40 years at a baseline temperature of 57.2°C.

Based on a baseline temperature of 135°F, which shall be experienced for over 99% of the desired qualified life, projected lives of the remaining organic materials considered in this qualification program are:

Material	Projected Life (Years)
Phenolic (Genal 4000)	1.47 million
Phenolic (G.E. 12968)	2.75 million
Neoprene	42.2

The applicable Arrhenius equation refers to the equation which is most appropriate to the material application when more than one equation is known.

For components with time-temperature-related aging mechanisms, the aging was based upon available auditable aging data, as noted in Table I.

3.0 QUALIFICATION PROGRAM (CONTINUED)

3.4.2 Humidity Effects

Humidity effects are not considered to be an aging mechanism for terminal block assemblies. The ability of the equipment to perform within its relative humidity environment shall be demonstrated when safety-related functions are tested during the design basis accident.

3.5 Aging Analysis

3.5.1 Time-Temperature Effects

The time-temperature effects can be accelerated by increasing the temperature, as explained in Paragraph 3.4.1. A review of the materials indicates that the neoprene gasket utilized in the Type 4 NEMA enclosure will require the greatest amount of thermal aging. In order to avoid excessive thermal degradation of the terminal block specimens, the mounting panels (with terminal blocks attached) shall be removed from their respective enclosures and thermally aged independent of the vacant enclosures. This corresponds to Configuration C, described in Paragraph 1.5.3.

It is desirable to thermally age the equipment in one (1) environmental chamber. Therefore, the maximum aging temperature has been based on the lowest rated temperature, 120°C, for neoprene (Item 1.4.2, Table I).

3.5.1.1 NEMA Enclosure Subassemblies

For the vacant NEMA enclosures, a review of the materials indicates that the material with the lowest activation energy is the neoprene, Item 1.4.2, Table I, with a value of 1.05 eV, based on mechanical properties (Reference 8). Calculations based on this value, the baseline temperatures presented in Paragraph 2.1.1, and a projected qualified life of 40 years, yield a thermal aging time of 44 days (1,056 hours) at 120°C.

3.5.1.2 Terminal Block/Mounting Panel Subassemblies

For the terminal block/mounting panel subassemblies, the material with the lowest activation energy is the NEMA Grade XXX laminate, Item 1.1.6, Table I, which has a value of 1.21 eV, based on mechanical properties (Reference 7). Calculations based on this value, the baseline temperatures presented in Paragraph 2.1.1, and a projected qualified life of 40 years yield a thermal aging time of 18.5 days (443 hours) at 120°C.

3.5.2 Functional Test

The equipment shall be converted to Configuration A, Paragraph 1.5.1, and functionally tested per Paragraph 3.2.

Item No.	TABLE I. AGING MATRIX ITEM AND MANUFACTURER	MANUFACTURER'S RATING ENVIRONMENTAL AND OPERATIONAL	MATERIALS	ACTIVATION ENERGY (eV)	APPLICATION	AGING MECHANISMS TIME-TEMPERATURE EFFECTS	RADIATION DAMAGE THRESHOLD	
1.0	Assembly, Marathon Terminal Blocks, NEMA Type 4 Enclosure, Terminal Lugs, Cable Conduits (2)							
1.1	Terminal Blocks (2), Marathon Fixed Barrier, Series 1500 NUC (Nuclear Grade), Type 1512929, 12-Point, 600 Volts, 75 Amperes	150°C						
1.1.1	Molded Block, P/N 9783612	150°C	Cellulose Phenolic, G.E. Type P-4000	1.59(Ref 5)		X	2.7×10^6 (Ref 6)	
1.1.2	#10-32 Insert, P/N 9743805		Brass, CDA Alloy 360	NAS(Para 3.3.1)				
1.1.3	Connector, P/N 9064121		Brass, CDA Alloy 260	"				
1.1.4	#10-32 Washer-Head Machine Screw, P/N 9743307		Brass, CDA Alloy 360	"				
1.1.5	#4-40 Pan-Head Screw		Stainless Steel	"				
1.1.6	Marking Strip, .060 Thick, P/N 9795012	140°C	NEMA Grade XXX Laminate	1.21(Ref 7)		X	"	
1.2	Terminal Blocks (2), Marathon Fixed Barrier, Series 1600 NUC (Nuclear Grade), Type 1612929, 12-Point, 600 Volts, 75 Amperes	150°C	SAME AS ITEM 1.1					
1.2.1	Molded Block, P/N 9740612	150°C	"					

LEGEND: NAS = Not Age Sensitive; X = Material is sensitive to the aging mechanism.

TABLE I. AGING MATRIX (CONTINUED

Item No.	ITEM AND MANUFACTURER	MANUFACTURER'S RATING ENVIRONMENTAL AND OPERATIONAL	MATERIALS	ACTIVATION ENERGY (eV)	APPLICATION	AGING MECHANISMS: TIME-TEMPERATURE EFFECTS	AGING MECHANISMS: RADIATION DAMAGE THRESHOLD	
1.2.2	#10-32 Insert, P/N 9743805		Same as Item 1.1					
1.2.3	Connector, P/N 9064121		"					
1.2.4	#10-32 Washer-Head Machine Screw, P/N 9743307		"					
1.2.5	#4-40 Pan-Head Screw, P/N 9784035		"					
1.2.6	Marking Strip, .060 Thick, P/N 9795112	140°C	"					
1.3	Terminal Blocks (2), Marathon Power Stud Block, Series 142 NUC (Nuclear Grade), Type 1423589, 3 Circuits	150°C						
1.3.1	Molded Block, P/N 9703613	150°C	G.E. #12968 General Purpose Phenolic Molding Compound	1.67(Ref 5)		X	2.7×10^6 (Ref 6)	
1.3.2	Screw, Self-Tapping, P/N 9782508		Steel	NAS(Para 3.3.1)				
1.3.3	Connector Assembly, P/N 9513130							
1.3.3.1	Stud, 1/4-20 NC Thread, P/N 9711606		Brass	"				
1.3.3.2	Connector, P/N 9513113		Copper, CDA Alloy 260	"				

LEGEND: NAS = Not Age Sensitive; X = Material is sensitive to the aging mechanism.

TABLE I. AGING MATRIX (CONTINUED

Item No.	ITEM AND MANUFACTURER	MANUFACTURER'S RATING ENVIRONMENTAL AND OPERATIONAL	MATERIALS	ACTIVATION ENERGY (eV)	APPLICATION	AGING MECHANISMS TIME-TEMPERATURE EFFECTS	RADIATION DAMAGE THRESHOLD	
1.4	Assembly Enclosure, Hoffman, NEMA Type 4, Single-Door, 20" x 20" x 6", P/N A20H20ALP							
1.4.1	Body, Door, Hinges, Hinge Pins, Clamps, Clamp Screws, Hasp, Staple, Gasket Retaining Strip, Feet		Steel	NAS(Para 3.3.1)				
1.4.2	Gasket		Neoprene	1.05(Ref 8)		X	2×10^6 (Ref 6)	
1.4.3	Gasket Adhesive			Not Safety Related				
1.4.4	Paint		Acrylic	"				
1.5	Enclosure Mounting Panel, Hoffman, 17" x 17", P/N A-20P20		Steel	NAS(Para 3.3.1)				
1.6	Terminal Lugs, #8 AWG, Uninsulated		Metallic	"				
1.7	Cable Conduits (2), 90° Bend, 1-1/2" I.D.		"	"				

LEGEND: NAS = Not Age Sensitive; X = Material is sensitive to the aging mechanism.

TABLE I. AGING MATRIX (CONTINUED)

Item No.	ITEM AND MANUFACTURER	MANUFACTURER'S RATING ENVIRONMENTAL AND OPERATIONAL	MATERIALS	ACTIVATION ENERGY (eV)	APPLICATION	AGING MECHANISMS		
						TIME-TEMPERATURE EFFECTS	RADIATION DAMAGE THRESHOLD	
2.0	Assembly, Marathon Terminal Blocks, NEMA Type 4 Enclosure, Cable, Terminal Lugs, Cable Conduits (2)	SAME AS ITEM 1.0						
3.0	Assembly, Marathon Terminal Blocks, NEMA Type 4 Enclosure, Cable, Terminal Lugs, Cable Conduits (2)	SAME AS ITEM 1.0						

LEGEND: NAS = Not Age Sensitive; X = Material is sensitive to the aging mechanism.

Attachment 4 to AEP:NRC:0775AE

SCEW Sheet TC-13 Revisions

AMERICAN ELECTRIC POWER SERVICE CORPORATION

DATE: May 21, 1986

SUBJECT: D. C. Cook Units 1 & 2
SCEW Sheet TC-13 Revisions

FROM: R. G. Heurich

TO: CEEQF #0000A

The following changes were made to SCEW sheet TC-13, for both units, as a result of the NRC audit.

1) Added Penn Union and Marathon as the manufacturer. These are the two types of terminal blocks used at D. C. Cook

2) Added model numbers a) 6000 series (Penn Union) b) 1600 series (Marathon)

3) Changed system from "various" to "see attached list". The attached list contains all the device systems where the marathon and Penn Union terminal blocks are found.

4) Deleted qualification document reference CEEQF#63K. Test report lasts longer than what the TB's will see in an accident outside containment

5) Added qualification document reference CEEQF#45C. CEEQF#45C contains the qualification test report for Marathon terminal blocks.

6) Added qualification document reference CEEQF#46. CEEQF#46 replaces CEEQF#45 for Penn Union terminal blocks. Conax report IPS-349 (#46) includes radiation while Conax report IPS-339(#45) does not.

7) For aging, changed qualification document reference CEEQF#177 to #177A (Penn Union) and to #45C (Marathon).

8) For qualified environmental temperature, "384^{0}F" was added for Marathon Terminal Block.

9) For qualified environmental pressure, "94.7" PSIA qas added for Marathon terminal block.

10) For qualified environmental chemical spray, "2000ppmB pH 8.5-10.5" was added for Marathon terminal block.

11) For qualified environmental radiation dosage, "200 Mrad was added for Marathon terminal block.

12) Changed qualification method from "combination" and "simultaneous" to "sequential" (for perating time to radiation)

13) Deleted the following outstanding items.

a) "see Ref. 63K" for operating time
b) "see Ref. 72" for chemical spray

14) Add CEEQF#45 as a supplementary information packet (along with CEEQF#45A).

The procedure 3 for the Marathon Terminal Block Qualification Test Report explains each environmental qualification category. All other changes are administrative.

R. G. Heurich

R. G. Heurich

Approved R C Carruth / HC
R. C. Carruth

RGH:rd:52.27
Attachments
cc. W/O Attachments
T. O. Argenta/S. H. Horowitz
L. F. Caso/J. V. Ruparel
D. N. Turnberg/J. R. Anderson
K. J. Munson

SCEW Sheet Pg.	Unit	Revision No.	Date
TC-13	1	5	May 21, 1986
TC-13	2	4	May 21, 1986

DONALD C. COOK NUCLEAR PLANT UNIT NO. 1 DOCKET NO. 50-315 LICENSE NO. DPR-58

EQUIPMENT DESCRIPTION	ENVIRONMENT			DOCUMENTATION REF.*		QUALIFICATION METHOD	OUTSTANDING ITEMS
	PARAMETER	SPEC.	QUAL.	SPEC.	QUAL.		
SYSTEM: SEE ATTACHED LIST	Operating Time	4 mos.	>4 mos.	110	a) 46 b) 45C	Sequential	NONE
PLANT ID NO: NA	Temperature (°F)	230	a) 345 b) 384	107	a) 46 b) 45C	Sequential	NONE
COMPONENT: CABLE TERMINATION; MANUFACTURER: a) Penn Union b) Marathon	Pressure (PSIA)	26.2	a) 124.7 b) 94.7	107	a) 46 b) 45C	"	"
MODEL NUMBER: a) 6000 Series b) 1600 Series	Relative Humidity (%)	100	100	107	a) 46 b) 45C	"	"
FUNCTION: CABLE CONNECTION AT TERMINAL BLOCK; ACCURACY: SPEC: NA DEMON: NA	Chemical Spray	NA	a) 2500 ppm B Ph 9.0-10.0 b) 2000 ppm B pH 8.5-10.5	NA	a) 46 b) 45C	"	NONE
SERVICE: SEE ATTACHED LIST	Radiation (10^6 rads)	11.4	a) 20 b) 200	106	a) 46 b) 45C	"	NONE
LOCATION: OUTSIDE CONTAINMENT	Aging (years)	NA	40	NA	a) 17% b) 45C	Combination	None
FLOOD LEVEL ELEV: NA ABOVE FLOOD LEVEL: NA	Submergence	NA	NA	NA	NA	NA	NA

*Documentation References:

1. Supplementary Information Packet #45, 45A
2. FRC TER Item #69, See CECQF 514
2. Supplementary Information Packet #45D

Notes: 1) The Two acceptable Terminal Blocks qualified for outside containment use only are manufactured by Penn Union denoted by (a), or Marathon, denoted by (b).

"The environmental qualification parameters provided on this SCEW have been obtained from reference documents, such as test reports and the FSAR. The Westinghouse Owners Group (WOG) has undertaken a program to address potential superheated steam releases outside containment as a result of a main steam line break with steam generator U-tube uncovery. Upon completion of the WOG study these parameters may require revision. Continued operation of the D. C. Cook Plant pending completion of this effort has been justified by letter No. AEP:NRC:0775M, dated August 3, 1984 [M. P. Alexich (IMECo) to H. R. Denton (NRC)]."

Rev 5 5/21/86

Unit #1

SCEW Sheet: TC-13

Function: Control Cable Termination at Terminal Box

Device Served	MEL Pg.	Device Served	MEL Pg.
FMO-211	17	IMO-275	67
FMO-212	18	IMO-360	68
FMO-221	19	IMO-361	69
FMO-222	20	IMO-362	70
FMO-231	21	IMO-310	79
FMO-232	22	IMO-312	80
FMO-241	23	IMO-314	81
FMO-242	24	IMO-320	84
FRV-210	25	IMO-322	85
FRV-220	26	IMO-324	86
FRV-230	27	IMO-330	89
FRV-240	28	IMO-331	90
WMO-711	30	IMO-340	91
WMO-713	31	IMO-350	92
WMO-723	32	IMO-210	101
WMO-725	33	IMO-211	102
WMO-715	35	IMO-220	103
WMO-717	36	IMO-221	104
WMO-721	37	IMO-212	105
WMO-727	38	IMO-222	106
IMO-910	41	IMO-215	107
IMO-911	42	IMO-225	108
QMO-225	43	ICM-250	204
QMO-226	44	ICM-251	205
CMO-419	49	ICM-260	206
CMO-429	50	ICM-265	207
IMO-255	61	ICM-305	208
IMO-256	62	ICM-306	209
IMO-262	64	ICM-311	210
IMO-263	65	ICM-321	211
IMO-270	66		

DONALD C. COOK NUCLEAR PLANT UNIT NO. 2 DOCKET NO. 50-316 LICENSE NO. DPR-74

EQUIPMENT DESCRIPTION

SYSTEM: SEE ATTACHED LIST

PLANT ID NO: NA

COMPONENT: CONTROL CABLE TERMINATION

MANUFACTURER: a) Penn Union b) Marathon

MODEL NUMBER: a) 6000 Series b) 1600 Series

FUNCTION: CONNECT CABLES AT TERMINAL BLOCK

ACCURACY: SPEC: NA DEMON: NA

SERVICE: SEE ATTACHED LIST

LOCATION: OUTSIDE CONTAINMENT

FLOOD LEVEL ELEV: NA

ABOVE FLOOD LEVEL: NA

ENVIRONMENT			DOCUMENTATION REF.*		QUALIFICATION METHOD	OUTSTANDING ITEMS
PARAMETER	SPEC.	QUAL.	SPEC.	QUAL.		
Operating Time	4 mos	>4 mos	110	a) 46 b) 45C	Sequential	NONE
Temperature (°F)	230	a) 345 b) 384	107	a) 46 b) 45C	"	NONE
Pressure (PSIA)	26.2	a) 124.7 b) 94.7	107	a) 46 b) 45C	"	"
Relative Humidity (%)	100	100	107	a) 46 b) 45C	"	"
Chemical Spray	NA	a) 2500 PPMB pH 9-10 b) 2000 PPMB pH 8.5-10.5	NA	a) 46 b) 45C	"	NA
Radiation (10^6 rads)	1.4	a) 20 b) 200	106	a) 46 b) 45C	SEQUENTIAL	NONE
Aging (years)	NA	40	NA	a) 177a b) 45C	COMBINATION	NONE
Submergence	NA	NA	NA	NA	NA	NA

*Documentation References:

1. Supplementary Information Packet #45, 45A, 45D,
2. ~~FRC TER Item~~ #69, See CEEQF #514

Notes:

1) The Two acceptable Terminal Blocks qualified for outside containment use only are manufactured by Penn Union, denoted by (a) or Marathon, denoted by (b).

"The environmental qualification parameters provided on this SCEW have been obtained from reference documents, such as test reports and the FSAR. The Westinghouse Owners Group (WOG) has undertaken a program to address potential superheated steam releases outside containment as a result of a main steam line break with steam generator U-tube uncovery. Upon completion of the WOG study these parameters may require revision. Continued operation of the D. C. Cook Plant pending completion of this effort has been justified by letter No. AEP:NRC:0775H, dated August 3, 1984 [M. P. Alexich (INECo) to H. R. Denton (NRC)]."

Rev. 4 5/28/86

Page TC13-1

Form EQ #97-2

Unit #2

SCEW Sheet: TC-13

Function: Control Cable Termination at Terminal Box

Device Served	MEL Pg.	Device Served	MEL Pg.
FRV-210	17	IMO-360	71
FRV-220	18	IMO-361	72
FRV-230	19	IMO-362	73
FRV-240	20	IMO-310	82
FMO-211	25	IMO-312	83
FMO-212	26	IMO-314	84
FMO-221	27	IMO-320	91
FMO-222	28	IMO-322	92
FMO-231	29	IMO-324	93
FMO-232	30	IMO-330	96
FMO-241	31	IMO-331	97
FMO-242	32	IMO-340	98
WMO-712	34	IMO-350	99
WMO-714	35	IMO-212	108
WMO-724	36	IMO-222	109
WMO-726	37	IMO-221	110
WMO-716	39	IMO-220	111
WMO-718	40	IMO-210	112
WMO-722	41	IMO-211	113
WMO-728	42	IMO-215	114
IMO-910	44	IMO-225	115
IMO-911	45	ICM-250	107
QMO-225	46	ICM-251	208
QMO-226	47	ICM-260	209
CMO-419	52	ICM-265	210
CMO-429	53	ICM-305	211
IMO-255	64	ICM-306	212
IMO-256	65	ICM-311	213
IMO-262	67	ICM-321	214
IMO-263	68	MCM-221	215
IMO-270	69	MCM-231	216
IMO-275	70		

52.27

Attachment 5 to AEP:NRC:0775AE

Conax Electrical Penetration

7222(9-83)
FORM GE-8(C)

ENGINEERING DEPT.
AMERICAN ELECTRIC POWER SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OHIO

DATE 5/15/86 BY LPD CK. KM
COMPANY ________ G.O. ________
PLANT DCCNP

SUBJECT EP-14 Penetration Qualification Analysis

Objective:
This FDR provides an engineering review which addresses the environmental qualification of equipment shroud penetration assemblies which are designated as EP-14.
There is currently no documentation from the manufacturer, Conax, which certifies EP-14 to any Conax environmental qualification test report.

General Background:
~~Type EP-14~~ These penetrations are used to provide power and control to valves ICM-305 + 306. These valves are the containment sump to RHR pumps valves and are physically located in separate enclosures which are outside containment. These penetrations are installed thru the enclosures which can be subject to the containment environment under accident conditions.

Engineering Review:
The Conax drawing for the EP-14 assembly 2SK-665, was compared to Conax drawing 2325-8386 which shows a typical containment penetration assembly. The drawings indicate that similar parts are fixed in the same manner in both assemblies. Both assemblies also have pressurizing capabilities. The same

7222(9/83)
FORM GE-8(C)

ENGINEERING DEPT.
AMERICAN ELECTRIC POWER SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OHIO

DATE 5/15/86 BY LPD CK. KM
COMPANY ______ G.O. ______
PLANT DCCNP

SUBJECT EP-14 Penetration Qualification Analysis

feedthru assemblies differing in length and conductor size/arrangement only are used in both penetrations.

Containment penetration assemblies designated EP-2 thru EP-13 are environmentally qualified by Conax test report IPS-234.
Based on the similarity of parts used on EP-14 and EP-2 thru 13 assemblies, it is concluded that EP-14 would also be qualified by IPS-234.

To confirm this conclusion we have requested that Conax provide documentation which certifies EP-14 to IPS-234. (memo from L.P. DeMarco to S.J. Medved - Conax, dated 5/13/86.)

Additional References:
Conax PL-2325-8386 - Penetration Assembly Parts List.

AMERICAN ELECTRIC POWER *Service Corporation*

AEP

1 Riverside Plaza *(614) 223-1000*
P.O. Box 16631
Columbus, Ohio 43216-6631

May 13, 1986

Mr. S. J. Medwid
Conax Corporation
2300 Walden Avenue
Buffalo, NY 14225

RE: D. C. Cook Nuclear Plant Penetration Equipment Qualifications

Dear Mr. Medwid:

Please provide a quotation to provide documentation which certifies the penetrations purchased on our purchase order 06878-821-1 (copy attached) to Conax test report IPS-234.

The purchase order was for equipment shroud penetration assemblies per Conax sketch 2SK-665-03. These assemblies are similar to the containment penetrations provided by Conax in that similar parts and pressurizing capability were provided with the shroud assemblies.

Test report IPS-234 is used to establish the environmental qualification of our containment penetrations.

If there are any questions, please let me know.

Very truly yours,

Louis P. DeMarco

L. P. DeMarco
Generation and Telecommunication Division

Approved R. C. Carruth
R. C. Carruth

LPD:rd:50.90
cc. T. O. Argenta/S. H. Horowitz
L. F. Caso/J. V. Ruparel
D. N. Turnberg/J. R. Anderson
K. J. Munson

Attachment 6 to AEP:NRC:0775AE

Penetration Wire Similarity

AMERICAN ELECTRIC POWER SERVICE CORPORATION

DATE: April 26, 1986

SUBJECT: Environmental Qualification of Kapton Insulated Wire Penetration Feedthrough Extension Wire

FROM: J. A. Pria

TO: CEEQF #13

Penetration feedthrough extension wire at DCC Nuclear Power Plant includes power, control and instrument cable. The feedhtrough extension wire is all manufactured by Haveg and supplied to us by Conax Corporation (the manufacturer of DCCNP electrical penetrations).

The feedthrough extension wire is a stranded Kapton insulated wire. A stranded #10AWG Haveg, Kapton insulated penetration extension wire was tested under Westinghouse test report CWAPD-332 (CEEQF #13).

Kapton feedthrough wires in Conax penetrations were also tested under Conax test reports IPS-234 (CEEQF #1) a penetration with 37 #10 AWG conductors, and IPS-62 (CEEQF #2) ten penetrations with conductor sizes ranging from #10 AWG to 1000MCM.

Haveg Kapton insulated wires are part of the Conax Seal Assemblies (pigtails) and have been tested (24 #12 AWG, 20 #16 AWG, 8 #18 AWG) under Conax test reports IPS-409 and IPS-409.1 (CEEQF1 #75).

Foxboro instruments with Conax seal assemblies equipped with #16 AWG Kapton insulated wire instrument cable pigtails have been tested under Wyle test report 45592-4 (CEEQF #149).

Based on the results of test reports referenced above and the variety of the samples tested we, therefore, conclude that the power, control and instrument Kapton insulated penetration extension wire installed at DC Cook plant are environmentally qualified.

J. A. Pria

Approved RC Carruth / VFC
R. C. Carruth

JAP:rd:50.21
cc. T. O. Argenta/S. H. Horowitz
L. P. Caso/J. V. Ruparel
D. N. Turnberg/J. R. Anderson

Attachment 7 to AEP:NRC:0775AE

Foxboro Transmitter Test Configuration

AMERICAN ELECTRIC POWER SERVICE CORPORATION

DATE: May 14, 1986

SUBJECT: D. C. Cook Units 1 & 2
Technical Review of Differences in Tested and Installed Configuration of Foxboro Pigtails

FROM: K. J. Munson - EGS

TO: R. G. Vasey - NS & L

During the recent NRC audit of the DCCNP Environmental Qualification Program, it was noted that the DCCNP installed configuration of the Foxboro instrument pigtail condulet per PDS-1341 under RFC-01-2827 & 02-2828 was physically different than the tested configuration by the vendor in Wyle Test Report 45592-4. The tested configuration utilized a small 1/4" weep hole at a low point on a flexible metal conduit protecting the Foxboro instrument seal assembly pigtails. The weep hole was used to drain condensation near the instrument which may have accumulated inside the flex conduit during the simulated DBA test (see attached sketches).

The DCCNP installed configuration incorporated the use of a sealtite flexible conduit plus the sealing of both the entrance and exit of the flexible conduit with an RTV silicone sealant. No provisions for a weep-hole were made for the DCCNP specific design. The applicable plant design standard for the installation of the instrument, pigtails, flex conduit, splice box, and pigtail splices is shown on drawing PDS-1341 (attached).

The sealtite flexible conduit used in the installation is tradenamed Liquatite and manufactured by the Alflex Co. The plastic covering over the flexible metal conduit is made of a Polyvinyl Chloride (PVC) material. According to the manufacturer, the Liquatite flex conduit has not been environmentally qualified.

The hypothesized failure mode of the D. C. Cook configuration is that the PVC jacket on the flex conduit may fail during an accident near any elevated point on the conduit and allow steam to enter and condense. The condensation would them "pool" at the conduit low points, thereby subjecting the pigtails to possible submergence. The following paragraphs of this memo address this concern.

Through conversations with Foxboro, it has been determined that the intent of the weep-hole was to avoid the "backing-up" of condensate from the chemical spray into the Integral Junction Box used in one of the two tested configurations. The integral junction box houses a terminal block which is known to be susceptible to leakage currents when exposed to chemical spray solution. The weep-hole design was carried-over to the second configuration which was used at D. C. Cook. The second configuration incorporates an internal instrument splice to a Conax seal assembly with no Integral Junction Box or terminal block installed. Therefore, the "backing-up" of condensate near the instrument seal assembly in the D. C. Cook configuration was of no significant concern.

Additionally, in both tested configurations the metal flex conduit looped back up after the weep hole and was routed down to a penetration at the bottom of the test chamber. The bottom end of the flex conduit was sealed which created a potential for the "pooling" of chemical spray condensate during the test. In this respect, the tested configuration is similar to what is hypothesized in the D. C. Cook Plant configuration.

The potential for pigtail submergence failure is much less of a concern for the D. C. Cook configuration due to the following reasons:

1) It is not likely that the D. C. Cook sealed flex conduit configuration would fail in such a way as to create a harsher chemical submergence environment for the pigtails than what was tested. The type of submergence in the speculated D. C. Cook case involves a steam condensate and is not associated with containment flooding conditions. The steam condensate should theoretically be at a pH value which is less severe than the chemical spray exposure during the test.

2) The Kapton-insulated pigtail wires of the Conax Seal assembly are individually protected by the application of a heat shrinkable polyolefin jacket. The heat shrink tubing jacket significantly improves the ability of the pigtail wires to withstand chemical submergence by adding a protective layer of material over the Kapton insulation. Where applied, the protective layer of heat shrink reduces the exposure of the Kapton insulation to the condensate. The typical failure of Kapton insulated wire is due to an abrasion of the insulating material during installation combined with the effects of the chemical solution. The potential for abrasion or other mechanical damage of the Kapton insulation during installation at D. C. Cook has been essentially eliminated by the application of the heat shrink jacket.

3) The test report configuration, which exposed the Kapton insulated pigtails to the test chamber environment via the 1/4inch weep hole, demonstrates the ability of the pigtail wires to withstand harsh chemical conditions even without a protective heat shrink jacket.

In conclusion, we believe that the omittance of the weep-hole in the flex conduit near the instrument in the D. C. Cook configuration does not have a detrimental impact on the environmental qualification of the instrument, seal assembly or seal assembly pigtails. In addition, we believe that there is no significant functional difference between the tested and the D. C. Cook installed configurations of the foxboro instrument pigtail conduits.

K. J. Munson

K. J. MUNSON

Approved RC Carruth/VFC
R. C. Carruth

KJM:rd:50.95
cc. T. O. Argenta/S. H. Horowitz
L. F. Caso/J. V. Ruparel
D. N. Turnberg/J. R. Anderson
J. G. Feinstein - NS & L
R. Shoberg/W. G. Sotos - I & C
NCR No. REE-86-07-1/Reslog 860501

12.0 TRANSMITTER ELECTRICAL/MECHANICAL INTERFACES

12.1 Requirements

12.1.1 Electrical Interfacing

The Kapton pigtails protruding from the Conax stainless steel feed-through shall be protected using 1/2" flexible metal conduit. The conduit shall be attached to the transmitter interface by means of the conduit interface connector on each of the conductor seal assemblies. The unattached end of the conduit shall be permanently affixed to the side of the mounting bracket assembly to minimize any deleterious effects on the interface due to handling.

CAUTION: When connecting the flexible conduit to the midlock cap, DO NOT allow the cap to rotate. Rotation will damage integrity of the midlock cap seal.

The three (3) transmitters supplied with integral junction boxes shall be equipped with 18" of flexible metal conduit in the same manner as those fittings with the Foxboro-supplied Conax electrical conductor seal assemblies. However, the conduit will not be installed until the pre-LOCA transmitter test setup.

In addition, a 1/4" weep hole shall be drilled in the conduit at the lowest point of its arc to facilitate drainage of accumulated chemical spray, steam condensation, etc., during the accident simulation.

12.1.2 Mechanical Interfacing

Inlet supply pressure adaptors shall be permanently attached to the transmitters using the Swagelok fittings supplied by the manufacturer. The supply lines shall be made from 3/8" stainless steel tubing with one end flared and equipped with an AN flare fitting. The opposite end shall be deburred and left untouched to accept the Swagelok compression ring.

12.2 Procedures

12.2.1 Electrical Interfacing

A. Direct Transmitter Input

12.2.1.1 Cut a piece of 1/2" flexible metal conduit approximately 18" in length.

12.2.1.2 Install two (2) straight flexible conduit fittings, one (1) on each end of the conduit.

NOTE: The fitting at the end farthest from the midlock cap should also contain a strain relief adaptor.

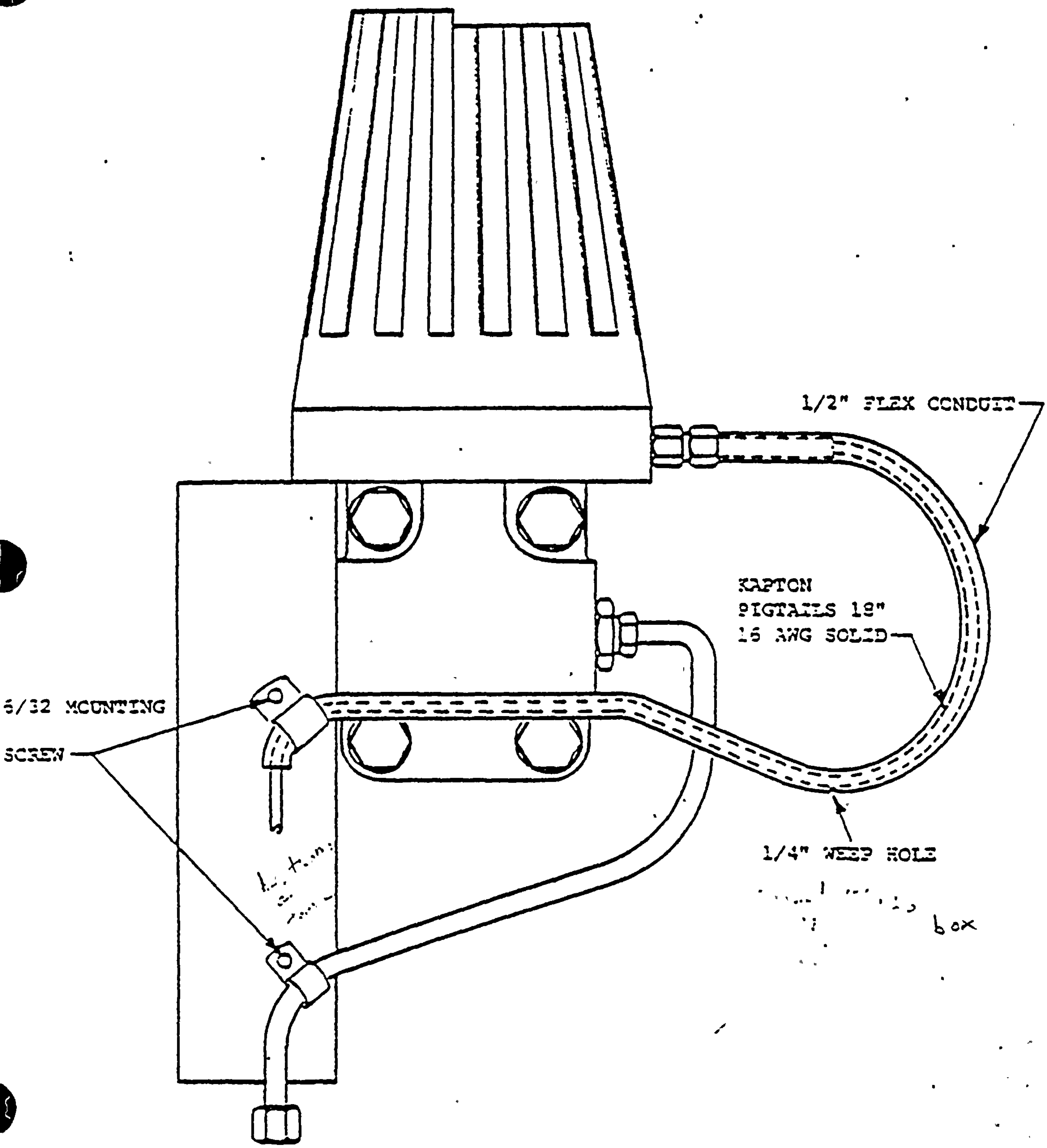

FIGURE 2. ELECTRICAL AND MECHANICAL INSTALLATIONS

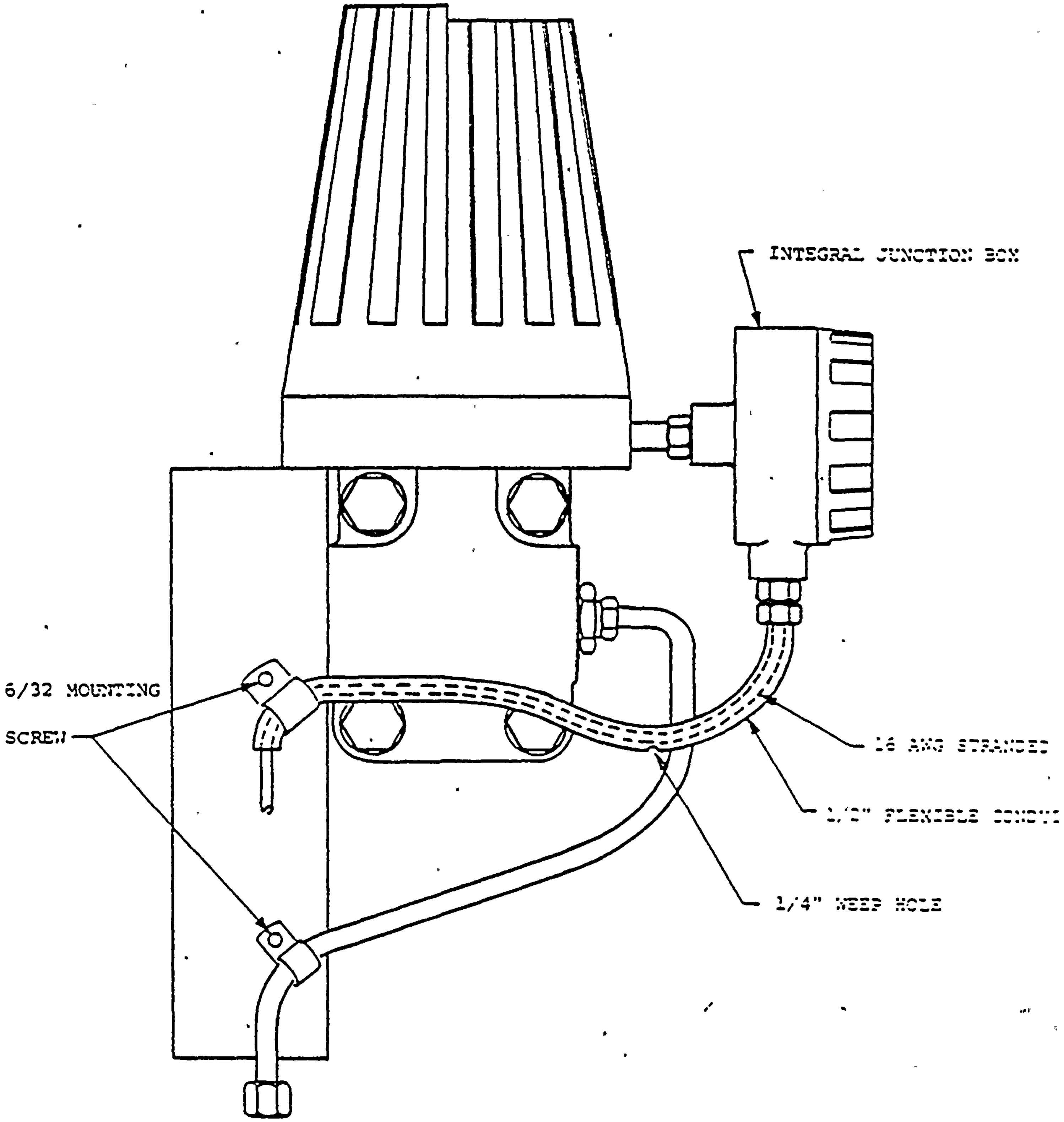

FIGURE 2A. ELECTRICAL AND MECHANICAL INSTALLATIONS

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12.0 TRANSMITTER ELECTRICAL/MECHANICAL INTERFACES (Continued)

12.2.1.3 Drill a 1/4" weep hole approximately 9" from the transmitter interface connector.

NOTE: Reference Figure 2 for the remaining steps.

12.2.1.4 Drill a 6/32 screw clearance hole in the mounting bracket assembly as shown.

12.2.1.5 Place a 4" piece of Raychem sleeving over the Kapton pigtails approximately 16"-20" from the transmitter to act as a strain relief point.

12.2.1.6 Carefully feed the pigtails and Conax stainless steel feedthrough into the flexible conduit.

12.2.1.7 Attach the conduit fitting to the Conax interface fitting. Before tightening the interface, rotate the conduit until the weep hole is positioned as shown.

12.2.1.8 Tighten the interface connections and arc the flexible conduit around to the mounting bracket while insuring that the ECSA is not disturbed.

12.2.1.9 Attach the conduit to the mounting bracket assembly using 6/32" hardware (screw, nut and lock washer) and a conduit mounting strap. Tighten the strain relief adaptor around the Raychem sleeve installed in step 12.2.1.5.

12.2.1.10 Photograph the transmitter to document the installation of the electrical interface protection.

12.2.1.11 Repeat steps 12.2.1.1 through 12.2.1.10 for each transmitter.

B. Integral Junction Box Input

12.2.1.1 Cut a piece of 1/2" flexible metal conduit approximately 18" in length.

12.2.1.2 Install two (2) straight flexible conduit fittings, one (1) on each end of the conduit.

NOTE: The fitting at the end farthest from the J-box input should also contain a strain relief adaptor.

12.2.1.3 Drill a 1/4" weep hole approximately 9" from the transmitter interface connector.

12.2.1.4 Drill a 6/32" screw clearance hole in the mounting bracket assembly.

12.2.1.5 Place a 4" piece of Raychem sleeving over the Kapton pigtails approximately 16"-20" from the transmitter to act as a strain relief point.

12.2 TRANSMITTER ELECTRICAL/MECHANICAL INTERFACES (Continued)

12.2.1.6 Attach the conduit fitting to the J-box input. Before tightening the interface, rotate the conduit until the weep hole is positioned at the lowest point of the arc.

12.2.1.7 Carefully feed the pigtails into the flexible conduit until they enter the J-box. Install a noninsulated crimp spade lug to each lead and connect them to the ± terminal within the J-box.

12.2.1.8 Tighten the interface connections and arc the flexible conduit around to the mounting bracket.

12.2.1.9 Attach the conduit to the mounting bracket assembly using 6/32" hardware (screw, nut and lock washer) and a conduit mounting strap. Tighten the strain relief adaptor around the Raychem sleeve installed in step 12.2.1.5.

12.2.1.10 Photograph the transmitter to document the installation of the electrical interface protection.

12.2.1.11 Repeat steps 12.2.1.1 through 12.2.1.10 for each transmitter with integral junction box inputs.

12.2.2 Mechanical Interfacing

12.2.2.1 Cut a piece of 3/8" stainless steel tubing and deburr each end.

12.2.2.2 Flare one end and slip on a 3/8" stainless steel "B" nut.

12.2.2.3 Bend the tubing as shown in Figure 2.

12.2.2.4 Place the Swagelok compression nut and fitting over the unflared end of the tubing. Connect the tubing to the remaining section of the Swagelok fitting mounted on the inlet port(s) of the transmitter as shown in Figure 2 using standard Swagelok procedures.

12.2.1.5 Position the tubing as shown in Figure 2 and tighten the fitting(s).

12.2.2.6 Attach the tubing to the mounting bracket assembly using 6/32 hardware (screws, nuts and lock washers) and a 3/8" tube mounting strap.

12.2.2.7 Photograph each transmitter to document the installation of the mechanical interface.

12.2.2.8 Repeat steps 12.2.2.1 through 12.2.2.7 for each transmitter.

13.0 PRESSURE/LEAK TEST

13.1 Requirements

13.1.1 Pressure Test

A Pressure Test shall be performed on each transmitter to verify the pressure integrity of the seals. A pressure medium of dry gaseous nitrogen shall be applied to the transmitter input pressure ports using a high-pressure regulator as shown in Figures 3 and 3A. The applied pressure shall be monitored using a 0.1% F.S. pressure gauge. During this test, voltage shall not be applied to the transmitter.

The applied pressures shall be supplied to the transmitters in the following manner for a duration of not less than 1 minute:

- o The differential pressure transmitter shall have both pressure input ports pressurized simultaneously to the corresponding overpressure listed below:

Model No.	Overpressure (psig)
N-E13DM-IIM1	3000
N-E13DH-HIM1	4500
N-E13DH-IIH1	4500

- o The gauge pressure transmitters shall have their single pressure input port pressurized to the corresponding overpressure listed below:

Model No.	Overpressure (psig)
N-E11GM-HIE2	4000
N-E11GH-IIM2	4500

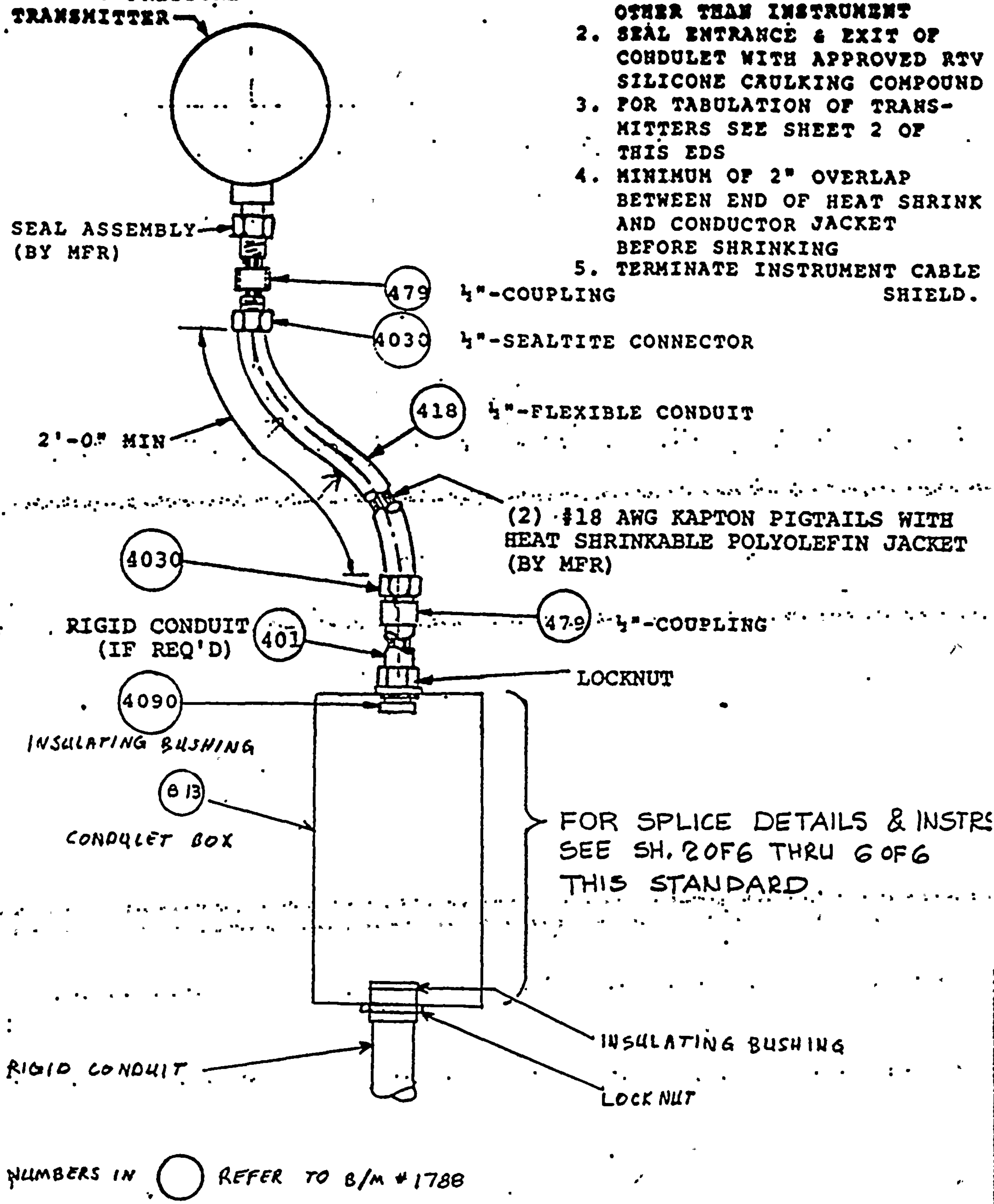
All body seals shall be leak checked using chlorine-free bubble solution, and any seal leakage from a transmitter shall be evaluated by the Lead Customer.

13.1.2 Leak Test

A Leak Test shall be performed, where specified, during all Functional Tests with the exception of the Baseline and Post-LOCA Tests. To verify the pressure integrity of the seal, a pressure medium of dry gaseous nitrogen shall be applied to the transmitter input pressure port(s) using the Marotta System as shown in Figure 4. The applied pressure shall be monitored using a 0.1% F.S. pressure gauge. During this test, input voltage shall not be applied to the transmitter.

NOTES:

1. CONDULET TO BE SUPPORTED FROM CONDUIT OR STRUCTURE OTHER THAN INSTRUMENT
2. SEAL ENTRANCE & EXIT OF CONDULET WITH APPROVED RTV SILICONE CAULKING COMPOUND
3. FOR TABULATION OF TRANSMITTERS SEE SHEET 2 OF THIS EDS
4. MINIMUM OF 2" OVERLAP BETWEEN END OF HEAT SHRINK AND CONDUCTOR JACKET BEFORE SHRINKING
5. TERMINATE INSTRUMENT CABLE SHIELD.



FOR USE IN NUCLEAR PLANT ONLY

RFC DC 01-2827
02-2828

INDIANA & MICHIGAN ELECT Co.	D. C. COOK NUCLEAR PLANT	PDS-1341-4
ELECTRICAL PLANT SECTION PLANT DESIGN STANDARD	REVISION- 4 JJm 11-10-85	FOXBORO NE SERIES TRANSMITTER CONNECTION DETAILS
APP'D JJm / DR. S.K.	CH. PG / DATE 4-19-85	
AMERICAN ELECTRIC POWER SERVICE CORP. COLUMBUS, OH.	1-2-EDS 343-4	SH. 1 OF 6

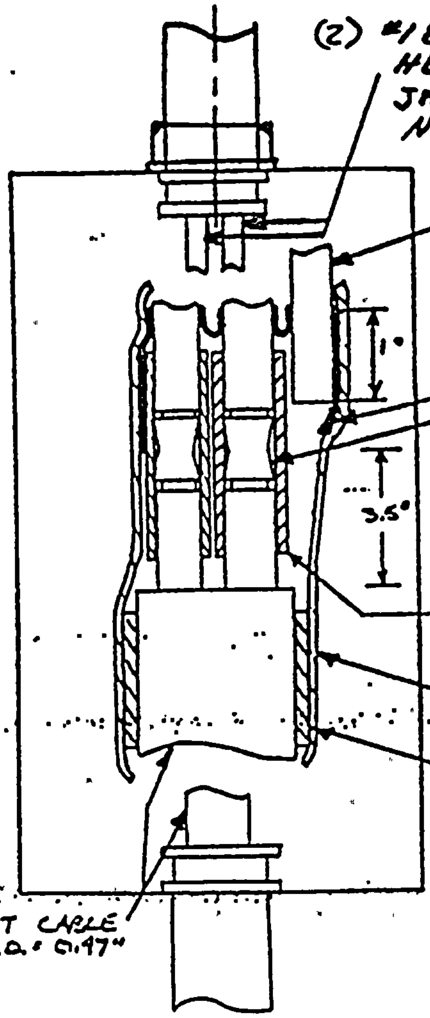


FIGURE A

LEGEND:

(G) Cable Jacket Shim
(J) Splice Sealing Sleeve
(K) Outer Sealing Sleeve
(R) Conductor Shim (not shown)
(E) Conductor Sealing Breakout

NOTES:

1. Splice to be made using RAYCHEM SPLICE KIT NPKS-2-21K
   For use range of KAPTON insulated wires & conductor, see Table A below.

TABLE A

Ranges of Conductor and Kapton Wire Dimensions for Use in Raychem Nuclear Plant Splice Kits

AEP Item No.	Kit No.	Cable Jacket Outer Diameter	Insulated Conductor Outer Diameter	Kapton Insulated Wire
6110	NPKS-2-21K	0.31" - 0.60"	0.11" - 0.23"	#16AWG - #12AWG

RFC DC.01-2827
02-2828

Number in ◯ refer to B/M 1788

INDIANA & MICHIGAN ELECT Co.	D.C. COOK NUCLEAR PLANT	PDS-1341-
ELECTRICAL PLANT SECTION PLANT DESIGN STANDARD	REVISION - 1 FJM/T.F.L. 11-10-85	FOXBORO NE SERIES TRANSMITTER CONNECTION DETAILS
APP'D FJM/T.F.L. DR. PG	CH. SL DATE 11/8/85	
AMERICAN ELECTRIC POWER SERVICE CORP COLUMBUS, OH.	1-2-EDS-393-1	SH. 2 OF 6

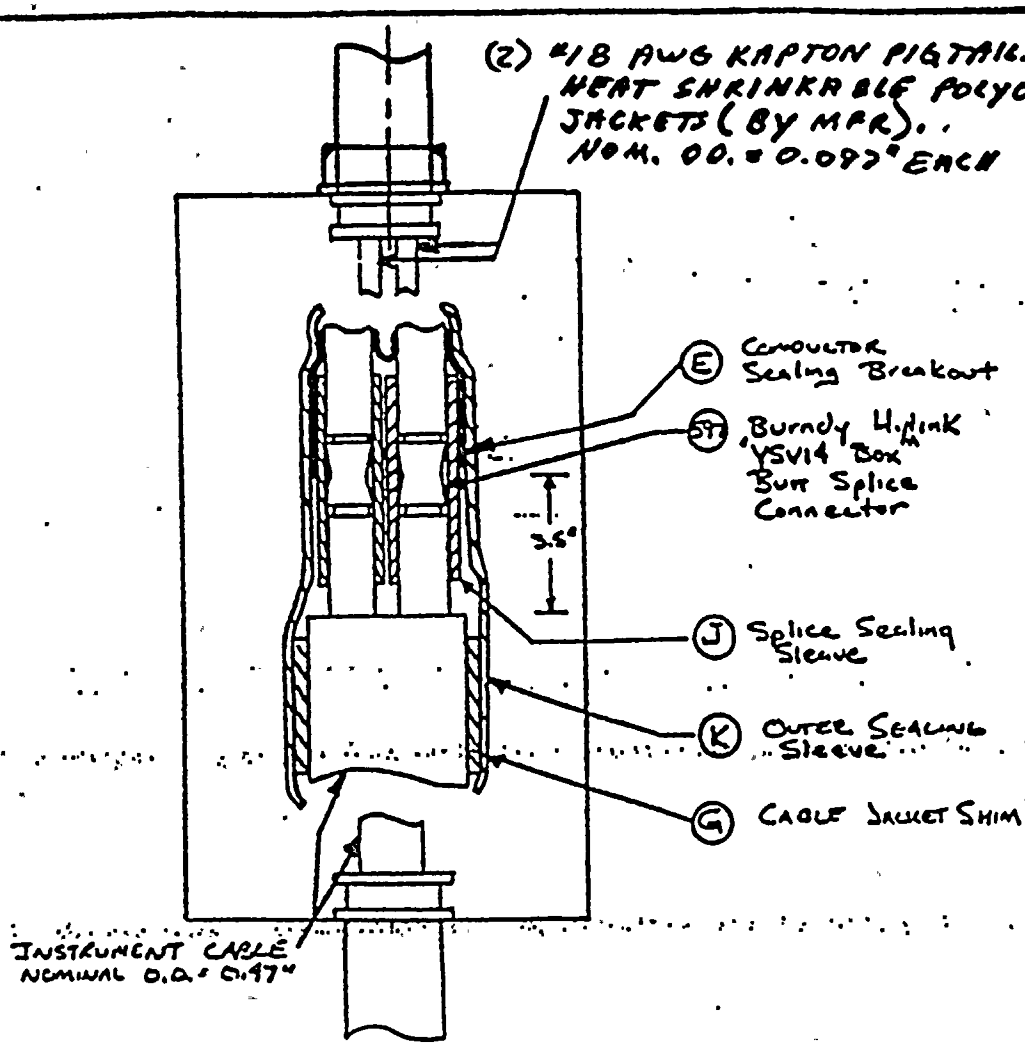


FIGURE A

LEGEND:

- (G) Cable Jacket Shim
- (J) Splice Sealing Sleeve
- (K) Outer Sealing Sleeve
- (R) Conductor Shim (not shown)
- (E) Conductor Sealing Breakout

NOTES:

1. Splice to be made using RAYCHEM SPLICE KIT. NPKS-2-21K
   For use range of KAPTON insulated wires & conductor, see Table A below.

TABLE A

Ranges of Conductor and Kapton Wire Dimensions for Use in Raychem Nuclear Plant Splice Kits

AEP Item No.	Kit No.	Cable Jacket Outer Diameter	Insulated Conductor Outer Diameter	Kapton Insulated Wire
6147	NPKX-2-21K	0.31" - 0.60"	0.11" - 0.23"	#16AWG - #12AWG

RFC DC.01-2827
02-2828

Number in ◯ refer to B/M 1788

INDIANA & MICHIGAN ELECT Co.	D.C. COOK NUCLEAR PLANT		PDS-1341-C
ELECTRICAL PLANT SECTION PLANT DESIGN STANDARD	REVISION -0 FJM/T.T.		FOXBORO NE SERIES TRANSMITTER CONNECTION DETAILS
APP'D FJM/T.T.L. DR. PG	CH. SL	DATE 11/10/85	
AMERICAN ELECTRIC POWER SERVICE CORP. COLUMBUS, OH.			1-2-EDS-393-d SH. 3 OF

INSTRUCTIONS

PREPARATION

1. Confirm that the kit selected is designated for the intended terminations (STP or STQ). Ensure that the cable and feedthrough conductor diameters are within the ranges specified in Table A of this PDS or the kit's label.

2. Remove all felted asbestos or braided jacketing material from the insulation in the splice area. Splice sealing sleeve (part J) will not seal to braided or woven surfaces.

3. Cut the end of the cable off square. Remove jacket material, tapes, fillers, shield foil and binders for a length of 3.5 inches from the end.

4. Cut the end of the feedthrough wire off square. Untwist the wires as required to install tubing.

5. Remove dirt, grease and other contaminants from the cable jacket and all insulated conductor areas which will make contact with components of the kit with a rag dampened, but not saturated, in an approved solvent such as alcohol or acetone.

INSTALLATION

1. Slide the conductor shims, Part R (not shown in Fig. A) over the Kapton insulated wires. Align with the insulation cutback. SHRINK IN PLACE.

2. When cable jacket shim, Part G, is supplied, install shim over the multi-conductor cable jacket. Align to within 1/4" of the cable jacket cutback. SHRINK IN PLACE.

3. Slide the outer sealing sleeve, Part K, over the multi-conductor cable jacket. DO NOT SHRINK.

4. Thread each Kapton insulated conductor through a leg of the Conductor Sealing Breakout, Part E. Ensure that the large open end faces the splice area. DO NOT SHRINK. FOR KIT, ITEM# 6110 INSERT #12 OR #14 GAUGE BARE SOLID CONDUCTOR WIRE. (1/2 LENGTH OF WIRE IN BOOT)

5. Slide one splice sealing sleeve, Part J, over each Kapton insulated conductor except for the drain conductor. DO NOT SHRINK.

   NOTE: Splice sealing sleeves are not used on the drain wire.

6. Strip 1/4" of insulation from the end of the cable conductors, shield wire and feedthrough wires.

FOR USE IN NUCLEAR PLANT ONLY

INDIANA & MICHIGAN ELECT Co.		D.C. COOK NUCLEAR PLANT	PDS-1341-1
ELECTRICAL PLANT SECTION PLANT DESIGN STANDARD		REVISION-1 FJM/F.L. 11-10-85	FOXBORO NE SERIES TRANSMITTER CONNECTION DETAILS
APP'D FJM/F.L.	DR. PG	CH. SL DATE 11-8-85	
AMERICAN ELECTRIC POWER SERVICE CORP. COLUMBUS, OH.		1-2-EDS-393-1	SH. 4 OF 6

7. Complete crimp connections between the cable conductors and the feedthrough wires using a Burndy YSV14 connector and the appropriate crimping tool. Ensure that wire is visible through holes in sleeve. Examine each connection area for sharp edges and protruding wire strands. Remove these with abrasive cloth or a file.

8. Center splice sealing sleeves, Parts J, over each connection area. SHRINK IN PLACE.

9. Slide the breakout body over the splice sealing sleeves. Ensure that Parts J do not protrude into the breakout legs. SHRINK IN PLACE.

10. Center the outer sealing sleeve, Part K, over the assembly such as that it covers the breakout and overlaps the cable jacket by 3" or overlaps the shim, when used. SHRINK IN PLACE.

CAUTION: DO NOT FLEX UNTIL COMFORTABLE TO TOUCH.

KIT REMOVAL INSTRUCTIONS

If the installed kit must be removed, the following procedure may be used to prevent conductor damage:

1. Warm the outer sealing sleeve with a torch or heat gun. Using a razor or sharp knive, score Part K longitudianally over its entire length at a depth of approximately 50 to 75% of its thickness. Do not scar cable jacket.

2. Gradually heat the entire surface of the sleeve. Using pliers, peel away sleeve along the cut area while continuing to apply heat.

3. This process can be repeated for each component of the Raychem splice kit; however, care must be taken not to damage the cable.

4. Remove as much of the old adhesive as possible prior to installating a new kit.

FOR USE IN NUCLEAR PLANT ONLY

INDIANA & MICHIGAN ELECT Co.	D.C. COOK NUCLEAR PLANT		PDS-1391-
ELECTRICAL PLANT SECTION PLANT DESIGN STANDARD	REVISION 1 FJM/P.L. 11-10-85	FOXBORO NE SERIES TRANSMITTER CONNECTION DETAILS	
APP'D FJM/HK. DR. PG	CH. SL DATE 11-8-85		
AMERICAN ELECTRIC POWER SERVICE CORP. COLUMBUS, OH.		1-2-EDS-343-1	SH. 5 OF (

RFC Nos. DC-01-2827 & DC-02-2828

Applicable Instruments

BLP-110
BLP-111
BLP-112
BLP-120
BLP-121
BLP-122
BLP-130
BLP-131
BLP-132
BLP-140
BLP-141
BLP-142

MFC-110
MFC-111
MFC-120
MFC-121
MFC-130
MFC-131
MFC-140
MFC-141

NLP-151
NLP-152
NLP-153

BLI-110
BLI-120
BLI-130
BLI-140

FFC-210
FFC-211
FFC-220
FFC-221
FFC-230
FFC-231
FFC-240
FFC-241

IFI-051
IFI-052
IFI-053
IFI-054
IFI-310
IFI-320

NPP-151
NPP-152
NPP-153
NPS-153

NPS-121
NPS-122

MPP-210
MPP-211
MPP-220
MPP-221
MPP-230
MPP-231
MPP-240
MPP-241
MPP-212
MPP-222
MPP-232
MPP-242

FOR USE IN NUCLEAR PLANT ONLY

INDIANA & MICHIGAN ELECT Co.	D.C. COOK NUCLEAR PLANT	PDS-1341-1
ELECTRICAL PLANT SECTION PLANT DESIGN STANDARD	REVISION - 1 11-10-85	FOXBURO NE SERIES TRANSMITTER CONNECTION DETAILS
APP'D [signature] DR. S. K.	CH [initials] DATE 4-19-85	
AMERICAN ELECTRIC POWER SERVICE CORP. COLUMBUS, OH.	1-2-EDS-343-1	SH. 6 OF 6

Attachment 8 to AEP:NRC:0775AE

Limitorque Issues

AMERICAN ELECTRIC POWER SERVICE CORPORATION

DATE: April 18, 1986

SUBJECT: Donald C. Cook Nuclear Plant Unit No. 2
Condition Reports 2-3-86-295, 310, and 323
Limitorque Internal Wiring Jumpers

FROM: D. E. van Deusen

TO: B. A. Svensson

The subject Condition Reports (C/Rs) point out the use of jumper wires which were not qualified for harsh environment, and were located inside Limitorque switches.

A review was performed by the Electrical Generation Section (memo from K. J. Munson to J. G. Feinstein dated 4/09/86) with the following key findings:

1. The unqualified jumper wires removed from 2-WMO-714, -724, and -726 have been identified as outdoor control wire taken from cable having item numbers 314, 315, or 316, purchased under specification DCCEE-159-QCN.

2. All three valves (green (A) train) listed in (1) have redundant back-up valves (2-WMO-718, -722, and -728, respectively) in the red (B) train. All of the jumper wires in the back-up valves were inspected and found to be fully qualified.

3. Valve 2-WMO-714 and its back-up (2-WMO-718) are located in an area which will not be affected by a HELB. These valves are to be removed from the Environmental Qualification List.

It should be noted that the plant has replaced these Class IE jumper wires (specified in the subject C/Rs) with Class IE wires qualified for harsh environment.

Based on the study performed on a HELB outside containment (FSAR section 14.4), there are no breaks postulated in the section of the Steam Supply to Auxiliary Feedwater Pump Turbine piping which is located in the same compartment as valves 2-WMO-724 and -726. As such, these valves will not be subjected to the harsh environment of a pipe break during a postulated HELB outside containment.

Based on this information, we believe that the Class IE jumper wires in question did not pose a threat to the health and safety of the public, nor did it create an unreviewed safety question as defined in 10 CFR 50.59. It is concluded, therefore, that this situation is not reportable under 10 CFR 50.73.

Daniel E. van Deusen

D. E. van Deusen

Approved by: James G. Feinstein
J. G. Feinstein, Manager
Nuclear Safety & Licensing

pm

cc: M. P. Alexich/J. G. Feinstein/R. G. Vasey
R. C. Carruth/L. F. Caso/K. J. Munson
J. C. Jeffrey/R. L. Shoberg/W. G. Sotos
A. A. Blind - Bridgman
J. D. Allard - Bridgman
DC-N-6947
AEP:NRC:9470
MEMOSB:LIWJ.mem

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AMERICAN ELECTRIC AEP POWER SYSTEM

DCC FILE # AEP: NRC: 9445
DATE 3/25/86
XR ~~AEP:NRC:~~ 9419
XR RESLOG 560208
DCC FILE EGS-NUC

DATE: March 21, 1986

SUBJECT: D. C. Cook Units 1&2
IE Notice 86-03, C/R 2-03-86-295, AIT No. 9445
MOV Operability with Control Wire EQ Uncertainties

FROM: K. J. Munson - EGS

TO: D. E. VanDeusen - NS&L

IE Notice 86-03 identifies potential problems with the environmental qualification of the internal control wiring in the limitorque motor operators. C/R 2-03-86-295 reports that a jumper wire was found during the MOV walkdown which was not listed as an acceptable environmentally qualified wire in my memo to the plant dated 1/9/86. The purpose of this memo is to determine typical valve operability in light of the control wire qualification uncertainties.

The control wiring in question is located completely within the Limitorque operator's limit switch compartment and is used to interconnect torque and limit switches. For D. C. Cook, terminal blocks are not installed or used inside the compartment. Instead, field cable is directly terminated onto the switches with internal jumper wiring providing any additional interconnections. The MOV control circuit voltage is ungrounded 220VAC or 250VDC.

The postulated control wire failure modes are open-circuits, single-wire grounds and wire-to-wire shorts which, depending on the circumstances explained below, may cause inadvertent or incorrect operation of the associated MOV.

Open circuits or high resistance connections are normally attributed to incorrect termination of the control circuit wiring and will generally not occur as a result of extreme environmental conditions. The internal wiring of an MOV is protected by the limit switch compartment cover from direct spray impingement during an accident which could theoretically loosen a control wire and create an open circuit.

Circuit shorts and grounds (including both high impedance/leakage current or low impedance/direct short conditions) may hypotehtically occur as a result of gross electrical insulation breakdown or as a result of insulation leakage currents sufficient to cause misoperation of the valve control circuit. For the DCCNP control voltage levels, gross electrical breakdown could only occur on direct conductor-to-conductor or conductor-to-ground contact. Electric arc-over is highly unlikely at low voltage levels during normal operation of the MOV. Direct shorts are possible only where conductor breakthrough occurs as a result of severe cable insulation

damage. Such damage could only occur when substantial insulation embrittlement due to high radiation doses combines with mechanical wear or when extremely high temperatures softens the insulation to the point of conductor exposure. Based on the generic properties of possible jumper wiring at DCCNP, we believe that this type of extreme degradation should not occur under specified accident conditions.

The configuration of the individual control wires within the limit switch compartment greatly minimizes the probability of the individual conductors achieving contact with grounded components or other exposed conductors. Most jumpers are less than a few inches long, especially between limit switch termination points. Excess wire is normally kept to a minimum with the majority of wires taking a direct path between terminal points thus reducing the likelihood of electrical contact. The general construction of the limit switch and torque switch insulating blocks also reduces the exposure of possible electrical contacts with receded terminal points.

Although conductor breakthrough should not occur, sufficient insulation degradation may cause changes in the individual wire insulation resistances for severe environments. While such changes could result in the wire's inability to adequately pass a high voltage withstand test performed as part of the qualification (e.g. IEEE-383), these changes are unlikely to cause significantly low conductor-to-conductor or conductor-to-ground Insulation Resistance (IR) values necessary to cause MOV failure or misoperation. The physical wire separation mentioned above creates long leakage current paths which effectively insure that low IR valves will not occur.

Further reducing the probability of MOV misoperation during an accident is that a large percentage of installed jumper wiring is environmentally qualified wire as explained in my memo to A. A. Blind - DCCNP dated 1/9/86. (Attached)

Additional justification for safe continued operation is the fact that the DCCNP MOV control circuit voltages are ungrounded. Ungrounded or "floating" voltage systems typically allow a single conductor to ground fault without having an impact on the control circuit. Only when two simsultaneous conductor-to-ground (i.e. conductor-to-conductor) faults occur would there be a chance for misoperation of the MOV.

The possibility of spurious operation of MOV's due to short circuits is also minimized by AEP's design philosophy of double breaking of the control circuit. The double break concept requires control contacts to be located at both polarities of the actuating circuit. With this configuration and ungrounded control voltages, a short circuit to ground of a single internal jumper wire of the MOV cannot cause a spurious operation of the valve.

Finally, it should be noted that in the unlikely event that wire degradation effects MOV operability, remote valve repositioning can be accomplished from the valve control center. Manual actuation of the motor contactor can adequately reposition the affected valve assuming the VCC is accessible during the post-DBE.

K. J. Munson

KJM/ris/47.3

Approved ______________________
/R. C. Carruth

w/Attachments
cc. T. O. Argenta/S. H. Horowitz
L. F. Caso/J. V. Ruparel
D. N. Turnberg/J. R. Anderson
J. G. Feinstein/D. VanDeusen - NS&L
R. F. Kroeger/D. Cooper - QA
IE Notice 86-03/AEP:NRC:9419 File

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AMERICAN ELECTRIC AEP POWER SYSTEM

DATE: January 9, 1986

SUBJECT: D. C. Cook Units 1 & 2
Limitorque Valve M. O. Jumper Wiring
Environmental Qualification

FROM: K. J. Munson - EGS

TO: A. A. Blind - D. C. Cook

We have been notified of a potential unresolved problem at other utilities with the environmental qualification of jumper wiring inside the limit/torque switch compartment of limitorque motor operated valves. The normal procedure during installation at DCCNP was to use a qualified wire, however this practice was not sufficiently documented. Therefore, some uncertainty exists as to the type and manufacturer of the internal jumper wiring. Since all qualified components are required to be fully documented, an inspection of the jumper wiring of all limitorque valves that are on the EQ list is necessary.

The inspection involves noting the gauge of the wire and the type of insulating material. It is suspected that most jumper wires will be a solid #12 Awg wire with an asbestos braided material surface taken from the older control cables having item nos. 3092, 3093, 3119 through 3123. Exceptions to this wire type and descriptions need to noted. Pending the outcome of the inspection, it may be necessary to replace the existing jumper wiring with a single known qualified wire which can be better documented for qualification purposes.

We have identified 78 MOV's (14 inside containment) in Unit 1 and 72 MOV's (13 inside containment) in Unit 2 which are EQ listed and need to be addressed. Attached is a listing of these MOV's including plant locations.

Requested is the inspection of these valves and an estimate of the manhours it will take to replace the existing jumper wiring with a single known qualified wire if necessary.

If you have any questions, please call me at extension 2158 or J. Anderson at 2137.

Kevin J. Munson
K. J. Munson

KJM/ris/43.95
Approved R. C. Carruth
R. C. Carruth

cc: T. O. Argenta/S. H. Horowitz
J. R. Anderson/D. N. Turnberg
L. F. Caso/J. V. Ruparel
R. Kroeger/D. Cooper
J. Feinstein
W. G. Smith, Jr. - Bridgman
J. Allard - D. C. Cook - MT

INTRA-SYSTEM

AMERICAN ELECTRIC POWER SERVICE CORPORATION

DATE: April 9, 1986

SUBJECT: D. C. Cook Units 1 & 2
Limitorque MOV Walkdown
C/R Nos. 2-03-86-295/310/323

FROM: K. J. Munson - EGS

TO: J. G. Feinstein - NS&L

The jumper wires removed from 2-WMO-714, -724, -726 have been identified as outdoor control wire taken from cable having item nos. 314, 315 or 316 purchased under specification DCCEE-159-QCN. These are a 4, 7 or 12 conductor cables having 7 strands of #18 Awg. wire with a nominal 20 mils of clear polyethylene insulation and 10 mils of color-coded PVC conductor jacket material applied directly over the polyethylene insulation. The wires and cable are rated for continual use at 75°C. The cables were purchased N-grade from either Triangle/Plastic Wire & Cable, Essex, Collyer Wire & Cable or Paige Electric.

Three individual jumper wires were taken from each valve and were used in an identical wiring application as follows:

Point-to-Point Wiring	Approx. Length
a) 46 to 56	4 to 5 1/2 inches
b) 53 to 58	11 inches
c) 43 to 57	6 1/2 to 8 inches

The three jumper wires are shown marked-up on the attached wiring drawing which is typical for all three valves. Jumper wire denoted a) above connects two limit switch contacts at the low-side polarity of the control voltage bus. Jumper wire denoted b) above connects a torque switch contact with a limit switch contact near the high-side of the control voltage bus. Jumper wire denoted c) above connects a torque switch contact with a limit switch contact at the high-side of the control voltage bus. See the attached copy of valve circuit elementary dwg. which is typical for all three valves.

2-WMO-724 and 2-WMO-726 are green (A) train valves which feed essential service water to the 2-AB and 2-CD emergency diesel generators, respectively. These valves open automatically when the EDG is running or can be opened by control switch. The redundant back-up to these two valves are red (B) train valves 2-WMO-722 and 2-WMO-728 which provide essential service water to the 2-AB and 2-CD EDG's, respectively. All four valves are

located in an HELB area pipe tunnel north of the 2-CD EDG. 2-WMO-714 is a green (A) train exit valve from the 2E containment spray heat exchanger. The redundant back-up is a red (B) train valve from the 2W Containment Spray Heat Exchanger. Both of these valves are located just east of the passenger elevator at elev. 621 ft. in the aux. building at approximately 30ft. north of an HELB area pipeway which is on the opposite side of a poured concrete wall. 2-WMO-714 and 2-WMO-718 are not in an HELB area and are to be removed from the list of equipment required to be environmentally qualified.

During the walkdown of valves 2-WMO-718, 2-WMO-722 and 2-WMO-728, no unqualified jumper wires were found. Therefore, the opposite train valves of 2-WMO-714, 2-WMO-724 and 2-WMO-726 were fully qualified with no jumper wire qualification uncertainties.

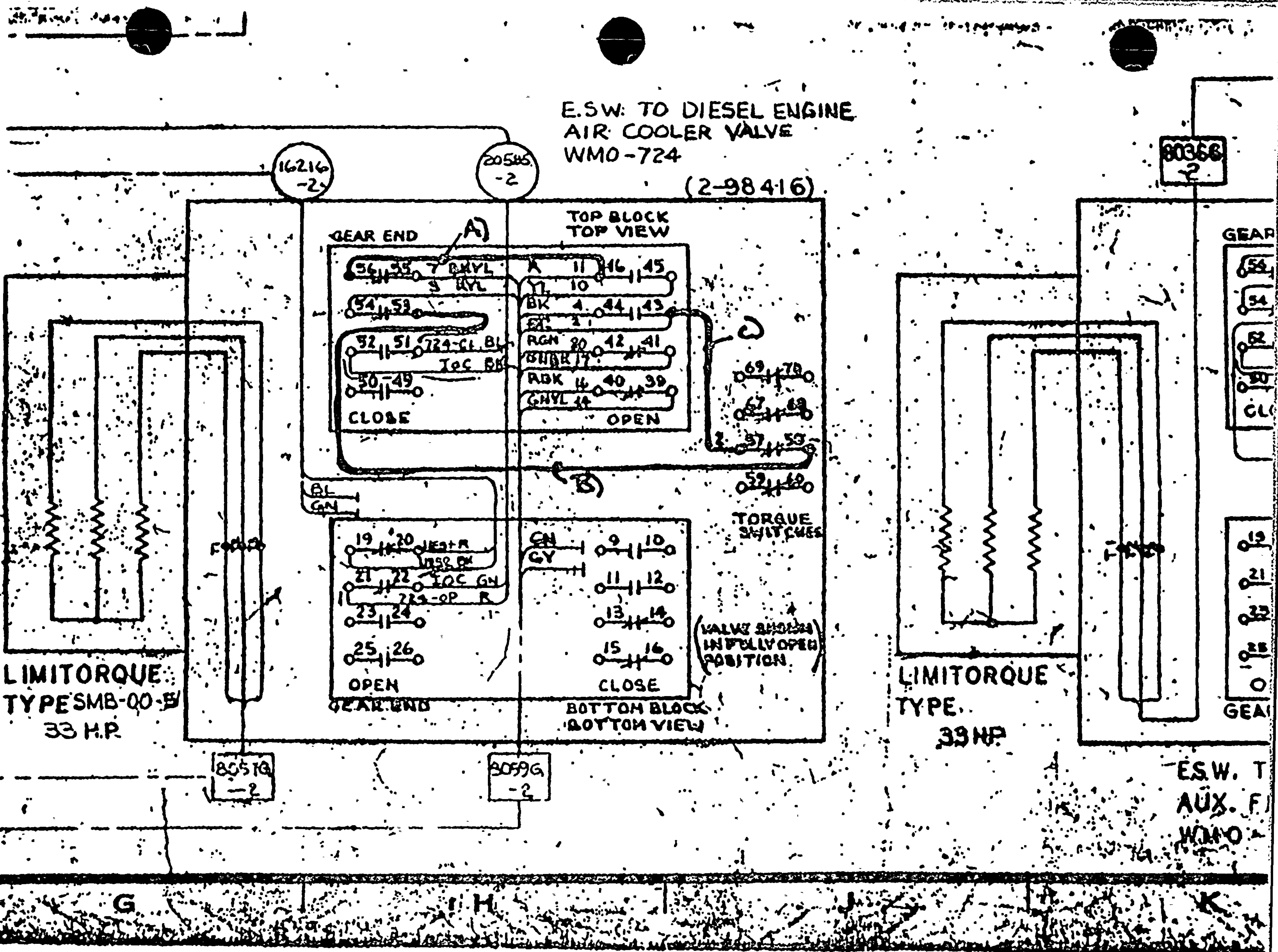
Additionally, all of the above valves are located outside containment and could be subjected to a HELB which peaks at 230°F and would have a duration of only seconds. Radiation doses are low and are not a concern. According to one wire manufacturer, polyethylene is extruded at temperatures above 300°F which can be considered the approximate melting point of this material. This is in agreement with the typical temperature specifications for polyethylene of 75°C (167°F) normal continuous operation, 90°C (194°F) emergency operation for 36 hours per year over several years and 150°C (302°F) short-circuit operation for very short durations in seconds or less. Therefore, it is highly unlikely that the polyethylene insulation on the found jumper wires would melt and expose their conductors when subjected to an outside-containment HELB temperature environment.

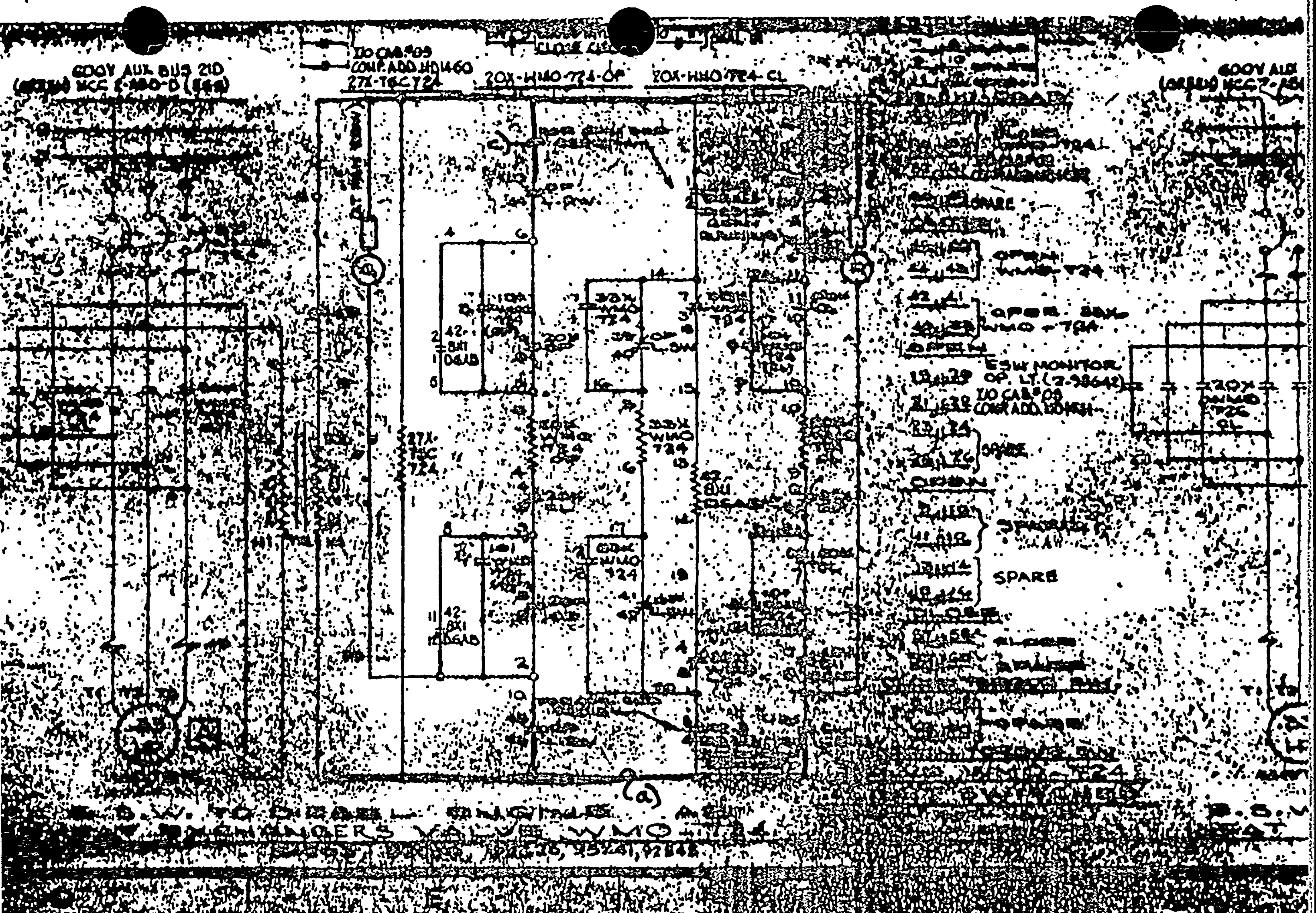
K. J. Munson

KJM/ris/49.23

Approved ______________
R. C. Carruth

w/o Attachments
cc. T. O. Argenta/S. H. Horowitz
L. F. Caso/J. V. Ruparel
D. N. Turnberg/J. R. Anderson
IE Notice 86-03/AEP:NRC:9419 File (w/attach.)


E.S.W. TO DIESEL ENGINE
AIR COOLER VALVE
WMO-724
(2-98416)
16216 -2
20585 -2
80368 -2
TOP BLOCK
TOP VIEW
GEAR END
CLOSE
OPEN
TORQUE SWITCHES
VALVE SHOWN IN FULL OPEN POSITION
BOTTOM BLOCK
BOTTOM VIEW
LIMITORQUE
TYPE SMB-00-5
33 H.P.
8057G -2
8059G -2
LIMITORQUE
TYPE
33 HP
E.S.W. T
AUX. F
WMO
G
H
J
K



600V AUX BUS 21D
I/O CAB #09
CONT. ADD. HD1460
27X-TSC724
20X-HMO-724-OP
20X-HMO-724-CL
600V AUX
ESW MONITOR
OP. LT. (2-38642)
I/O CAB #08
SPARE
SPARE
(a)

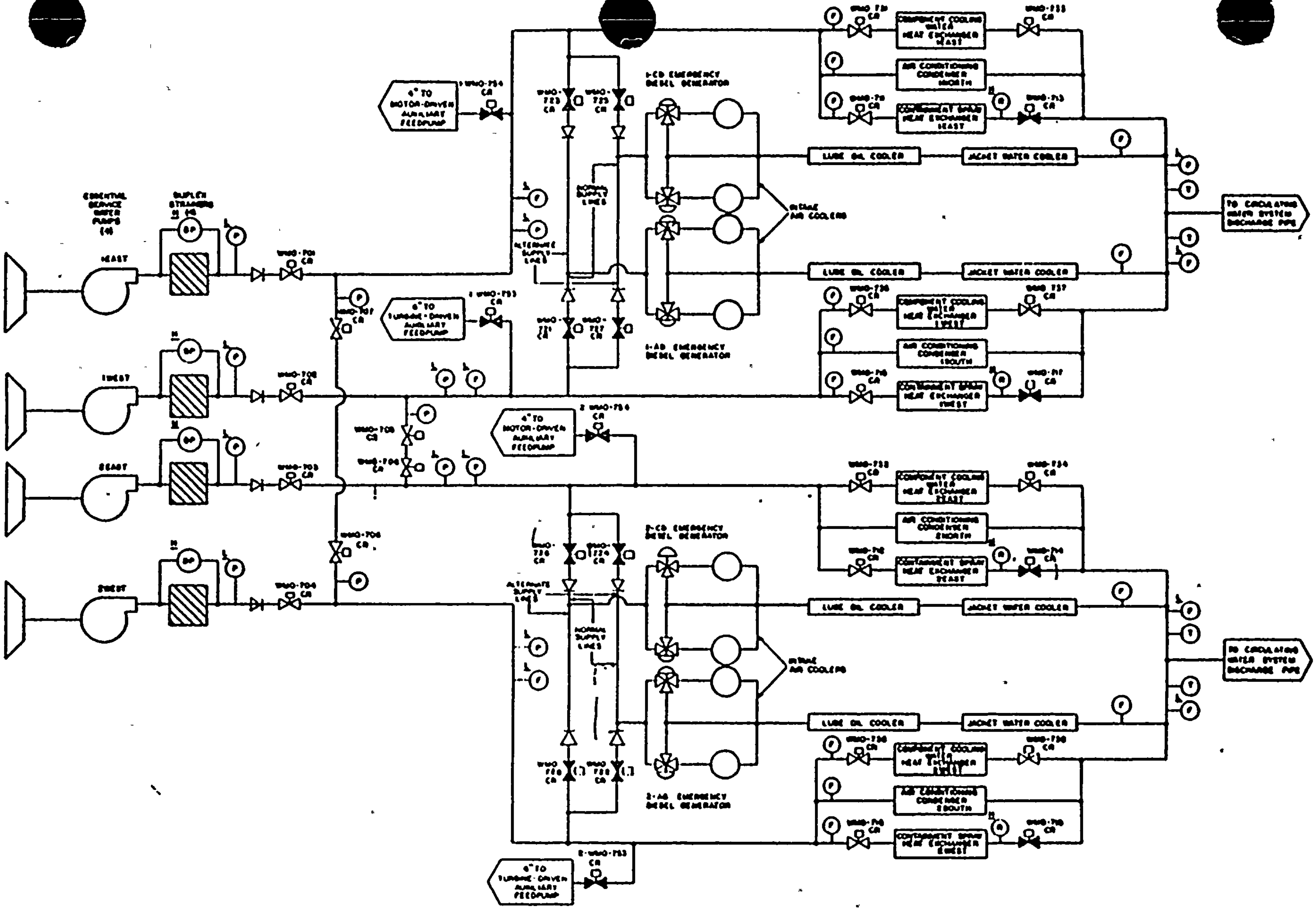
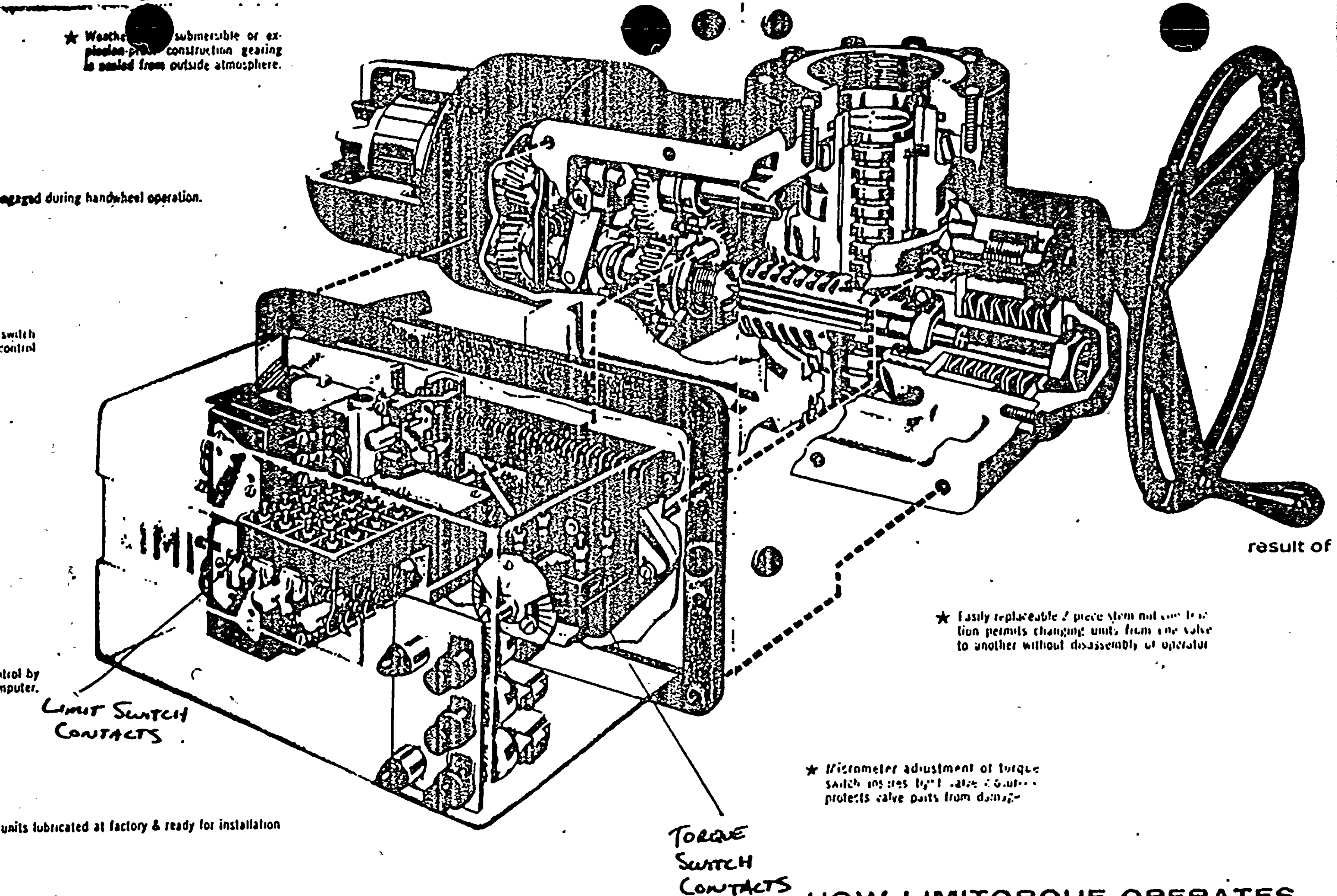


FIGURE A5-3-2

ESSENTIAL SERVICE WATER SYSTEM DIAGRAM



RQUE

xibility. Basically, it is a
ed device. It controls all
d shipboard water-tight

any position or location and can readily be adapted to
existing equipment. It can be actuated by many power
sources including electricity, hydraulic pressure, air, or

HOW LIMITORQUE OPERATES

■ Limitorque is far more than a valve actuator. It also
controls and limits the opening and closing travel of the
valve. Proper valve seating is very important in automatic
valve operation because most valves are damaged when
they are improperly seated, or by meeting a foreign obstruc-

The
nects t
be met
source
this m

LOCATION (22)

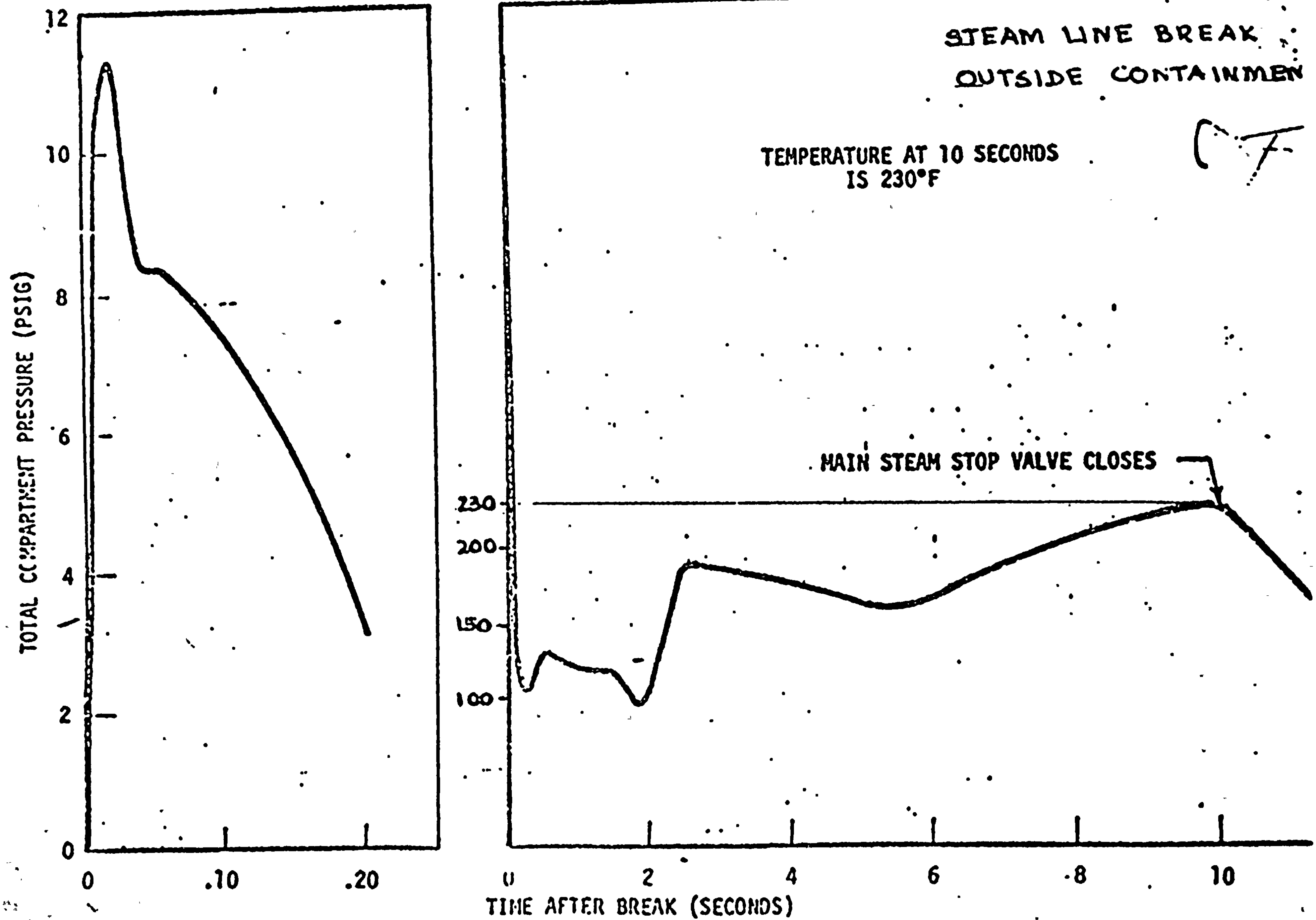


Figure 9-27 West Steam Enclosure Main Steam Line Break (Element 3), Pressure

FSAR Appendix A

AMERICAN ELECTRIC POWER *Service Corporation*

AEP

1 Riverside Plaza *(614) 223-1000*
P.O. Box 16631
Columbus, Ohio 43216-6631

May 6, 1986

Mr. Joe Drab
Limitorque Corporation
5114 Woodall Road
Lynchburg, Virginia 24506

Dear Mr Drab:

As we have previously discussed, one of the latest environmental qualification uncertainties involves the use of "T-drains" on Limitorque actuator motors. Needed from Limitorque is a clarification on the qualification requirements for the use of T-drains. Specifically, the following concerns need to be addressed:

1. In which Limitorque environmental qualification test reports were T-drains installed on motors?

2. What are the T-drain requirements with respect to inside versus outside containment building valve motor operators?

3. We understand that Limitorque has qualified actuators with and without T-drains installed in the motors. Do you consider the T-drains to be an absolute qualification requirement or a design enhancement, especially since some actuators were qualified without T-drains? If required, do you recommend that all actuator motors have T-drains installed, even where T-drain holes are not available?

4. What are the specific technical reasons for the installation of T-drains? Can there be plant-specific actuator configurations in which T-drains are not required. For example, would it be possible for the condensate to drain off through other avenues.

Please provide us with as much detail as possible in your response. If you have any questions, give me a call at (614) 223-2158.

K. J. Munson
Assoc. Engineer
AEPSC

Approved R. C. Carruth

KJM:rd:50.62
cc. T. O. Argenta/S. H. Horowitz
L. F. Caso/J. V. Ruparel
D. N. Turnberg/J. R. Anderson
A. A. Blind - Bridgman
J. Allard/L. Van Ginhaven - Bridgman
M. Marracco - MED

Attachment 9 to AEP:NRC:0775AE

Cable Acceptance Criteria

AMERICAN ELECTRIC POWER SERVICE CORPORATION

AMERICAN ELECTRIC AEP POWER SYSTEM

DATE: May 16, 1986

SUBJECT: Insulation Resistance on EQ Instrument Cables

FROM: M. J. Finissi

TO: R. L. Shoberg/E. K. Legg, Jr.

As a result of the recent NRC audit on our Equipment Qualification (EQ) files, we must document the minimum insulation resistance on our EQ instrument cables to ensure that the leakage current will not adversely affect the current loop during an accident. The Electrical Generation Section is supplying the I & C Section with the insulation resistances such that the effects from the leakage current can be determined. Attached is a table containinig the minimum insulation resistances gathered from the appropriate EQ test reports. This listing of instrument cables is not complete and as the information is obtained, it will be forwarded to the I & C Section for review.

If you have any questions, please call.

M. J. Finissi

Approved ______________
J. R. Anderson

Approved ______________
R. C. Carruth

MJF:rd:52.9
cc. T. O. Argenta/S. H. Horowitz
L. F. Caso/J. V. Ruparel
D. N. Turnberg/J. R. Anderson
K. J. Munson

SHEET 1 OF 6
DATE 5/13/86 BY MJF CK.
COMPANY IHM G.O.
PLANT DCCNP

ENGINEERING DEPT.
AMERICAN ELECTRIC POWER SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OHIO

SUBJECT I.R. on EQ Inst. Cables

Device	Cable no.	Cable length (ft)	Length of test specimen (ft)	min I.R. for Specimen (MΩ)	Min I.R. for Loop (KΩ)	TEST Report Referenced.	
FFI-210	5152-2	530	1000	.500	943	12	
FFI-220	5150-2	300	25			10	
FFI-230	5151-2	275	25			10	
FFI-240	5153-2	570	1000	.500	877	12	
NPS-121	9765CO-2	155	25			10	
NPS-122	9766CY-2	125	25			10	
NTP-110	8708CO-2	185	1000	.500	2703	12	
NTP-111	8710CO-2	185	1000	.500	2703	12	
NTP-120	8720CO-2	200	1000	.500	2500	12	
NTP-121	8722CO-2	200	1000	.500	2500	12	
NTP-130	8721CY-2	265	1000	.500	1887	12	
NTP-131	8723CY-2	265	1000	.500	1887	12	
NTP-140	8732CW-2	215	1000	.500	2326	12	
NTP-141	8734CW-2	215			2326		
NTP-210	8709CO-2	225			2222		
NTP-211	8711CO-2	225			2222		
NTP-220	8721CO-2	205			2439		
NTP-221	8723CO-2	205				8	
NTP-230	8722CY-2	280	1000	.500	1786	12	
NTP-231	8724CY-2	280			1786		
NTP-240	8733CW-2	220			2273		
NTP-241	8735CW-2	225			2222		
NTR-110	8725CO-2	165	25			10	

72229-83
FORM GE-8 (C)

72219-83) FORM GE-8(C)

ENGINEERING DEPT.
AMERICAN ELECTRIC POWER SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OHIO

SUBJECT I.R. on EQ Inst. Cables

DATE 5/13/86 BY MJF CK.
COMPANY I&M G.O.
PLANT DCCNP

SHEET 2 OF 6

Device	Cable no.	Cable length (ft)	Length of test specimen (ft)	min I.R. for Specimen (M-Ω)	Min I.R. for Loop (K-Ω)	TEST Report Referenced.	
NTR-120	8726C0-2	405	25			10	
NTR-130	8727C0-2	405	25			10	
NTR-140	8728C0-2	180	25			10	
NTR-210	8729CG-2	350	25			10	
NTR-220	8730CG-2	235	25			10	
NTR-230	8731CG-2	320	25			10	
NTR-240	8732CG-2	320	25			10	
NLP-151	8734C0-2	240	25			10	
NLP-152	8737CG-2	135	25			10	
NLP-153	9601CY-2	280	25			10	
NPP-151	8733C0-2	240	25			10	
NPP-152	8736CG-2	135	25			10	
NPP-153	9600CY-2	280	25				
NPS-153	9602CW-2	45	25				
BLP-110	8584CW-2	230	25				
BLP-111	8558CG-2	230	25				
BLP-112	8584CY-2	125	25				
BLP-120	8585CW-2	170	25				
BLP-121	8558C0-2	325	25				
BLP-122	8585CY-2	395	25				
BLP-130	8586CW-2	115	25				
BLP-131	8559C0-2	260	25				
BLP-132	8581CY-2	385	25				

SHEET 3 OF 6
DATE 5/13/86 BY MJF CK.
COMPANY I&M G.O.
PLANT DCCNP

ENGINEERING DEPT.
AMERICAN ELECTRIC POWER SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OHIO

SUBJECT I.R. on EQ Inst Cables

Device	Cable No.	Cable length (ft)	Length of test specimen (ft)	min I.R. for specimen (MΩ)	Min I.R. for Loop (KΩ)	TEST Report Referenced.	
BLP-140	8587CW-2	110	25			10	
BLP-141	8559CB-2	225	25			10	
BLP-142	8587CY-2	180	25			10	
FFC-210	90700-2	375	25			10	
FFC-211	9064B-2	500	1000	.500	1000	12	
FFC-220	90716-2	200	25			10	
FFC-221	90706-2	380				17,18	
FFC-231	9065B-2	400				8	
FFC-230	90640-2	170	25			10	
FFC-240	90650-2	445	1000	.500	1124	12	
FFC-241	90718-2	420				17,18	
MFC-110	9072CO-2	35	25			10	
MFC-111	9066CB-2	340	25			10	
MFC-120	9072CB-2	125	25			10	
MFC-121	9073CO-2	360	25			10	
MFC-130	9067CB-2	100	25			10	
MFC-131	9066CO-2	380	25			10	
MFC-140	9067CO-2	80	25			10	
MFC-141	9073CB-2	320	25			10	
MPP-210	90740-2	400	1000	.500	1250	12	
MPP-211	9068B-2	530	1000	.500	943	12	
MPP-220	90750-2	400	1000	.500	1250	12	
MPP-221	9074B-2	400	1000	.500	1250	12	

72229-83
FORM GE-8(C)

FORM GE-8(C) 22229-83

ENGINEERING DEPT.
AMERICAN ELECTRIC POWER SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OHIO

SHEET 1 OF 6
DATE 5/13/86 BY MSF CK.
COMPANY I&M G.O.
PLANT DCCNP

SUBJECT I.R. on EQ inst. Cables

Device	Cable No.	Cable length (ft)	Length of test specimen (ft)	min I.R. for specimen (MΩ)	Min I.R. for Loop (KΩ)	TEST Report Referenced.	
MPP-230	90680-2	345	1000	.500	1449	12	
MPP-231	90696-2	300	1000	.500	1667	12	
MPP-240	90690-2	420	1000	.500	1190	12	
MPP-241	90750-2	530	1000	.500	943	12	
QR-107A	20373CW-2	100	25			10	
QR-107B	20374CW-2	60	25			10	
QR-107C	20375CW-2	55	25			10	
QR-107D	20376CW-2	55	25			10	
VRA-2310	9960CB-2	310	15	10	484	138	
VRA-2310	9961CB-2	310	15	10	484	138	
VRA-2410	9960CY-2	165	15	10	909	138	
VRA-2410	9961CY-2	165	15	10	909	138	
NLA-310	8508CY-2	450	25			10	
NLI-311	8505CB-2	180	25			10	
NLI-320	8507CY-2	310	25			10	
NLI-321	8506CB-2	95	25			10	
NLI-110	9639B-2	510	25			10	
NLI-120	9640B-2	510	25			10	
NLI-130	9641B-2	510	25			10	
NLI-111	9632Y-2	485	25			10	
NLI-121	9633Y-2	485	25			10	
NLI-131	9634Y-2	485	25			10	
VRS-2210	9984CY-2	205	25			10	

72229-83)
FORM GE-8(C)

AMERICAN ELECTRIC POWER SERVICE CORP.
ENGINEERING DEPT.
1 RIVERSIDE PLAZA
COLUMBUS, OHIO

SUBJECT I.R. on EQ Inst. Cables

DATE 5/13/86 SHEET 5 OF 6
BY MJF CK
COMPANY I&M G.O.
PLANT DCCNP

Device	Cable no.	Cable length (ft)	Length of test specimen (ft)	min I.R. for Specimen (M Ω)	Min I.R. for Loop (K Ω)	TEST Report Referenced.	
VRS-2201	9985CY-2	205	25			10	
VRS-2101	9984CB-2	435	25			10	
VRS-2101	9985CG-2	435	25			10	

7222(9-83)
FORM GE-8(C)

ENGINEERING DEPT.
AMERICAN ELECTRIC POWER SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OHIO

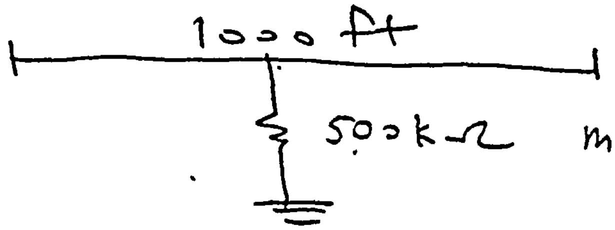
DATE 5/16/86 BY MJF CK. ______
COMPANY I&M G.O. ______
PLANT DCCNP

SUBJECT I.R. on EQ inst. Cable

Sample calculation:

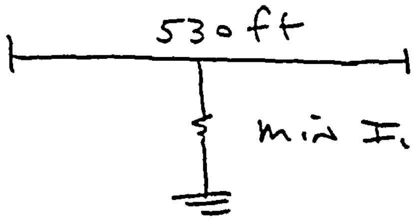
FFI-210

length of test specimen



min I.R. for specimen

Length of Cable



min I.R. for Loop

$$\frac{\text{Cable length}}{\text{test specimen}} = \frac{530}{1000} = .530$$

$$\frac{1}{\text{Min. I.R.}_{\text{Loop}}} = .530\left(\frac{1}{R_{\text{specimen}}}\right) \Rightarrow \text{min I.R.}_{\text{Loop}} = \frac{R_{\text{spec}}}{.530}$$

$$\text{min I.R. for Loop} = \frac{500\ \text{k}\Omega}{.530} = 943\ \text{k}\Omega$$

ATTACHMENT 1.0

TO

AEP:NRC:0585H

RESPONSES TO NRC QUESTIONS RELATED TO

SELECTION OF TRANSIENTS AND VALVE INLET CONDITIONS

(QUESTIONS 1-4)

Question 1:

Results from the EPRI tests on the Crosby 6M6 safety valve indicated that the test blowdowns exceeded the 5% value given in the valve specifications. If the plant-specific expected blowdowns also exceed 5%, the pressure might be sufficiently decreased such that adequate core cooling might not be achieved for decay heat removal. Expected blowdowns for Cook 1 and 2 at their current ring settings were not provided. Discuss the consequences of potentially higher blowdowns. Discuss the adequacy of decay heat core cooling at the expected reduced pressures.

Response 1:

Expected blowdown for Cook 1 and 2 pressurizer safety valves at their current ring settings is 5% or less of the set pressure. The initial factory tests were performed to meet the requirements of the ASME Code, Section III, which allows a maximum blowdown of 5%. Ring settings are often changed during set-pressure testing to achieve a crisper "pop" and to preclude damage of the valves' seating surfaces during limited steam flow and restricted lift. The ring settings are restored to the original factory settings each time the valves are set-pressure tested.

Question 2:

The Westinghouse Inlet Fluid Conditions Report states that the conditions resulting from cold overpressure transients were presented for only those plants for which Westinghouse performed the specific design and analysis for their cold overpressurization protection system. Cook 1 and 2 were not among the plants which had their cold overpressurization protection systems designed and analyzed by Westinghouse. Cook 1 and 2 do, however, use the PORV's for cold overpressure protection. The report further states that the fluid conditions for the cold overpressurization event may vary between steam and water. The submittal did not state the expected steam and water. The submittal did not state the expected inlet fluid conditions for the cold overpressurization event.

Discuss the range of expected fluid conditions for the varying types of fluid discharge and identify test data demonstrating operability over the range of expected conditions.

Response 2:

The following response follows the suggested approach given in Appendix F of EPRI Interim Report, July 1982, entitled "EPRI PWR Safety and Relief Valve Test Program Guide for Application of Valve Test Program Results to Plant-Specific Evaluations".

The D. C. Cook Nuclear Plant cold overpressurization protection system includes the following:

- Two Masoneilan Series 20,000 Control Valves (PORV)

- PORV opening set points are reduced from 2335 psig to 435 psig whenever the reactor coolant system liquid temperature is below 188°F (Unit 1) or 152°F (Unit 2). (Ref. Tech. Spec. Pages 3/4 4-31 and 3/4 4-29)

The plant cold overpressurization event analysis* indicates that:

- The design basis event is starting a reactor coolant pump when steam generator temperature is 50°F greater than RCS temperature.

- The pressurizer generally has a steam bubble but can be water solid for low reactor cooling system temperatures.

- The PORV at 435 psig.

- The peak pressurizer pressure is 499 psig.

---

* Two design basis events were analyzed: Heat input and mass input. The heat input event is based on starting a reactor coolant pump when steam generator temperature is 50°F greater than RCS temperature. The mass input event is the result of inadvertent starting of a charging pump. Since the analysis indicated a higher peak pressure for the heat input event, it was selected as the limiting design basis event.

Response 2 (cont.):

Based on the plant analysis, the expected ranges of fluid inlet condition resulting from cold overpressurization events are as follows:

- Maximum Pressure = 499 psig
- Actuation can be on steam or water
- Maximum Liquid Temperature = 470°F (Saturation at 499 psig)
- Minimum Liquid Temperature = Approximately 100°F (At temperatures below 100°, the reactor vessel head is generally off or the reactor coolant system is open for maintenance.)

The comparison of plant conditions to tested conditions for the Masoneilan PORV is as follows:

	In-Plant	Tested	EPRI Test No.
Max. Pres. - Steam	499 psig	2750 psig	52
Max. Pres. - Water	499 psig	2657 psig	62
Max. Temp. at Max. Pres.	470°F	683°F	52
Min. Temp. at Max. Pres.	100°F	101°F	58

Based on the above comparison, it is concluded that the tested conditions are representative of expected conditions for cold overpressurization events at D. C. Cook Nuclear Plant.

[illegible]

[illegible]

Attachment 1.0
AEP:NRC:0585H

Question 3:

The Westinghouse Inlet Fluid conditions Report stated that liquid discharge through both the safety and relief valves is predicted for an FSAR feedline break event. The Westinghouse report provided expected peak pressure and pressurization rates for specific plants having an FSAR feedline break analysis. The Cook unit 1 plant was not included in this list of plants having such an FSAR analysis. The Cook unit 2 plant was included in the list of plants having an FSAR feedline break analysis. The plant submittal did not discuss the feedline break event. The NUREG-0737, however, requires analysis of accidents and occurrences referenced in Regulatory Guide 1.70, Revision 2, and one of the accidents so required is the feedline break. Provide a discussion on the feedwater line break event for Cook 1 and 2 identifying the fluid pressure, pressurization rate, fluid temperature, valve flow rate, and time duration for the event. Assure that the fluid conditions were enveloped in the EPRI tests and demonstrate operability of the safety and relief valves for this event. Further, assure that the feedline break event was considered in analysis of the safety/relief valve piping system.

Response 3:

Results of the feedline break accident analysis for D. C. Cook Units 1 and 2 have shown that the pressurizer will not go water solid before the operator can take corrective action. Therefore, the pressurizer safety and relief valves will not pass water under a feedline break event and consequently this question is not applicable to the D. C. Cook Nuclear Plant. The results for the feedwater line break for both units will be included in the 1985 Updated FSAR.

[illegible] [illegible]

Question 4:

The Westinghouse valve inlet fluid conditions report indicates that a spurious initiation of high pressure injection at power is expected to result in water discharge through the safety valves for four-loop Westinghouse plants. The analysis presented in the submittal, however, considered only steam discharge through the safety valves. Justify one of the following: (a) that the safety valves will indeed discharge only steam, or (b) that a steam discharge will result in more severe dynamic loads than a water discharge transient.

Response 4:

We have reviewed the accidents and transients included in our FSAR and concluded that only three could result in water discharge from the pressurizer. These events are spurious initiation of the safety injection system, reactivity additions due to either rod movement or boron dilution, and the feedwater line break. In all cases, our evaluation has shown the pressurizer will not become filled with water before a least 10 minutes following the event, thus allowing sufficient time for the operator to take appropriate action to terminate the filling of the pressurizer. Thus the only event(s) which can result in solid water discharge from the pressurizer is a cold overpressurization due to heat and mass additions to the primary system. Current Technical Specifications prevent the loads on the safety valves and associated piping from exceeding the design basis under cold overpressurization conditions. On this basis, analysis has been performed for only a steam discharge through the safety valves for accidents and transients which occur when at power.

ATTACHMENT 2.0

TO

AEP:NRC:0585H

RESPONSES TO NRC QUESTIONS RELATED TO

VALVE OPERABILITY

(QUESTIONS 5-10)

[illegible] [illegible] [illegible]

Question 5:

The Cook 1 and 2 plant safety valves are Crosby 6M6 and were tested by EPRI. EPRI testing of the 6M6 was performed at varying ring settings. The submittal did not provide details discussing the applicable EPRI tests which demonstrates the operability of the plant safety valves. The submittal did not provide the present Cook 1 and 2 safety valve ring settings. If the plant current ring settings were not used in the EPRI tests, the results may not be directly applicable to the Cook 1 and 2 safety valves. Identify the Cook 1 and 2 safety valve ring settings. If the plant specific ring settings were not tested by EPRI, explain how the expected values for flow capacity, blowdown, and the resulting backpressure corresponding to the plant-specific ring settings were extrapolated or calculated from the EPRI test data. Identify these values so determined and evaluate the effects of these values on the behavior of the safety valves.

Response 5:

The Cook Units 1 and 2 pressurizer safety valves (PSVs) are Crosby style HB-BP-86-6M6. Three valves are installed in each unit. EPRI tested this style Crosby valve, and the results are discussed in Section 3.5 of their test report (NP-2628-SR). The valves have two adjustable rings, the nozzle (lower) ring and the adjusting (upper) ring. The nozzle ring controls the crispness of the pop, and the adjusting ring is used to control the valve blowdown. Raising the adjusting ring decreases blowdown. Ring settings are determined by factory test prior to valve shipment and each valve's ring settings are unique. Valve capacity and backpressure are not affected by ring adjustments.

The EPRI test valve ring settings are representative of the Cook valve ring settings as shown in the following table. All nozzle ring settings were the same, namely -18. The EPRI adjusting ring position is shown relative to "top-most" ring position. The positions shown in the report (-71 and -77) for tests 929 thru 1419, which are relative to the bottom of the disc ring, were converted to -221 and -227 by adding the "level position" of the adjusting ring (-150) to the ring settings shown to get the settings relative to "top-most" position. The level position of the tested valve was determined from conversation with Crosby's chief engineer. Six (6) of nine (9) Cook valves (including three spares) have adjusting ring settings very close to those of the tested valve. In the few instances where the ring settings are different (-200, -310, -295) from the tested valve, the differences are not significant since all valves have exhibited acceptable blowdown characteristics in factory tests and independent laboratory tests.

Response 5 (cont.):

COMPARISON OF RING SETTINGS BETWEEN EPRI TEST VALVE

AND COOK PLANT PRESSURIZER SAFETY VALVES

CROSBY STYLE HB-BP-86-6M6

EPRI Test Numbers	EPRI Valve		Cook Unit 1 Valves		Cook Unit 2 Valves		Cook Spare Valves	
	A.R.	N.R.	A.R.	N. R.	A.R.	N.R.	A.R.	N.R.
929- 932	-221	-18	-200	-18	-225	-18	-225	-18
1406-1419	-227	-18	-225	-18	-225	-18	-230	-18
			-225	-18	-310	-18	-295	-18

A.R. = Adjusting ring setting relative to top-most position

N.R. = Nozzle ring setting relative to top-most position

Question 6:

The EPRI Inlet Fluid Justification Report suggested a method for demonstrating safety valve stability. This method compares the total pressure drop for the in-plant safety valves and piping to the applicable EPRI test safety valve and piping combinations. The total pressure drop is composed of a frictional and acoustic wave component evaluated under steam conditions. The Cook 1 and 2 plant submittal did not provide pressure drop calculations or any other methods to demonstrate safety valve stability. Provide the necessary documentation and discussion demonstrating stability for the Cook 1 and 2 plant safety valves at the expected inlet conditions, ring settings and inlet piping configuration.

Response 6:

A comparison was made between the EPRI inlet piping configuration "G" used for testing the Crosby 6M6 safety valve and the Cook Plant PSV inlet piping. The pressure drop was estimated for both piping configurations based on rated steam flow and inlet conditions.

The pressure drop for the Cook piping was estimated to be 1.4 psi higher than that of the EPRI piping arrangement (15.8 psi versus 14.4 psi). This difference is judged to be insignificant relative to the set pressure (2485 psig). To assess the effect of this higher pressure drop on valve stability, the concept of valve blowdown must be considered. By definition, valve blowdown is the difference between actual piping pressure and actual reseating pressure expressed as a percentage of set pressure. The design blowdown of the subject valves is 5%. Since the set pressure is 2485 psig, the design blowdown is 124 psi.

According to EPRI Report NP-2628-SR, Safety and Relief Valve Test Report, stable valve operation is defined as when "the valve opens, remains open and closes without flutter and/or chatter." Chatter is defined as "rapid reciprocating motion of movable parts in which the disc contacts the seat." Flutter is defined the same as chatter without the disc making contact with the seat. Since the valve inlet pressure will decrease only 15.8 psi below the popping pressure after rated flow is reached, there will be no tendency for the valve disc to move towards the closed position. Inlet pressure would have to drop 124 psi for that to occur. Therefore, the valve will not exhibit flutter or chatter. Based on the above logic, it is concluded that the stability of Cook PSVs was demonstrated during the EPRI Test Program.

[illegible]

Attachment 2.0
AEP:NRC:0585H

Question 7:

The Cook Units 1 and 2 were modified by draining the loop seals, such that steam is present at the valve inlet. The Crosby 6M6 safety valves for the Cook Units 1 and 2 were designed for loop seal operation and as such have valve internals compatible for water at the valve inlet. Are the Cook 1 and 2 safety valves internals to be modified to steam internals versus loop seal internals? If no change is planned, discuss valve operability with the loop seal internals on steam.

Response 7:

Valve inventory at the D. C. Cook Nuclear Plant includes nine (9) pressurizer safety valves. Six (6) valves have been modified to the "soft seat" design; i.e., 316 S.S. nozzles without stellite facing and "flexidisc" geometry Inconel disc inserts. Three (3) of these valves have been in service in Cook Unit 1 since January of 1985. The three (3) modified spare valves are scheduled to be installed in Cook Unit 2 during the last quarter of 1985, replacing the three (3) remaining "hard seated" valves currently in service in Unit 2. The existing Unit 2 valves will then be converted to the "soft seat" design and retained as spares.

Question 8:

During testing of the Masoneilan 20,000 series PORV, stroke time was found to be sensitive to actuator supply pressure and actuator supply line size. To achieve the 2 second stroke time requirement, the line size was increased and the actuator supply pressure was increased to 60 psig. Review of the EPRI Safety and Relief Valve Selection and Justification Report for the Masoneilan PORV (Drawing A 8529, Revision B) indicated that a maximum of 55 psig is allowed to the actuator to prevent component damage. Provide a discussion on the action being taken by Cook 1 and 2 to assure the required stroke time will be achieved without potentially damaging components.

Response 8:

Cook Plant PORV actuators are rated for a maximum air pressure of 60 psig (Ref: Masoneilan Technical Data Supplement No. 700). Normal supply air is regulated to 57 psig. Two (of three) valves which are used for low temperature overpressure protection (LTOP) are equipped with a back-up air supply (storage bottles) which are regulated to 55 psig. Stroke time is verified by periodic testing. The Cook PORVs' required opening time is approximately 5 seconds as established during hot functional testing. All air tubing has been enlarged from 1/4" to 1/2" size and air receiver tanks were added near the valves to serve as accumulators to maintain pressure to the actuator during stroking.

[illegible]

Question 9:

The Westinghouse Valve Inlet Fluid Conditions Report states that liquid discharge could be expected through the safety valves for both the feedline break and extended high pressure injection events. During some tests, the EPRI 6M6 test safety valve experienced some chatter and flutter while discharging liquid. Testing was terminated after observing chattering to minimize valve damage. Inspection revealed some valve damage which was presumably caused by the valve chatter and flutter. Liquid discharge for Cook 1 and 2 may conceivably occur for longer periods of time than the EPRI testing. Thus longer periods of valve chattering may cause severe valve damage. Discuss the implications this may have on the operability and reliability of the Cook 1 and 2 safety valves. Identify any actions that will be taken to inspect for valve damage following safety valve lift events.

Response 9:

Review of the transients resulting from a feedline break, spurious safety injection and slow and fast rod withdrawal at full power have shown that the pressurizer will not completely fill with water during any of these events. (See response to Question 4 for discussion of this issue.) The valve loop seals are drained and the valves are exposed only to steam. Therefore, Question 9 is not applicable to the D. C. Cook Nuclear Plant.

[illegible]

Question 10:

NUREG-0737 Item II.D.1 requires that the plant-specific PORV control circuitry be qualified for design-basis transients and accidents. Please provide information which demonstrates that this requirement has been fulfilled.

Response 10:

For those events described in the FSAR which require the PORV to function, the control circuitry should not be subject to an environment significantly different than its normal environment. Procedures used in the design, procurement, test and maintenance of the circuitry are considered sufficient to ensure qualification to these expected plant conditions.

ATTACHMENT 3.0

TO

AEP:NRC:0585H

RESPONSES TO NRC QUESTIONS RELATED TO

THERMAL HYDRAULIC ANALYSIS

(QUESTIONS 11-13)

[illegible] [illegible] [illegible]

Question 11.

A single pressurizer pressure-time history was provided to TES by the American Electric Power Service Corporation for use in the subject analysis. As a result, it was not possible to evaluate the appropriateness of the selected valve inlet conditions with respect to those discussed in the EPRI Valve Inlet Conditions Report for Westinghouse Designed Plants (EPRI-NP-2296). The selection of the pressurizer-time history should be justified in relationship to the EPRI report.

Response 11.

EPRI report No. EPRI-NP-2296 entitled "Valve Inlet Fluid conditions For Pressurizer Safety and Relief Valves in Westinghouse-Designed Plants" prepared by Westinghouse Corporation presents the expected range of fluid inlet conditions for pressurizer safety and relief valves utilized in Westinghouse plants. The objective of this report was to demonstrate that the fluid conditions under which the valves were tested represented the expected fluid conditions during the assumed transients. In the above analyses, to determine the valve inlet conditions, Westinghouse determined that for a steam discharge, i.e., without a loop seal, Loss of Load and Locked Rotor events described in the FSAR as the most limiting events in determining the inlet fluid conditions for PORV and safety valves. The limiting conditions are the peak pressurizer pressure and the rate of pressurization reached during the course of the transients.

Westinghouse also performed an evaluation of the performance of the safety and relief valve observed during the EPRI testing and compared the test results to the assumed valve performance during the transients analyses. The results of this comparative evaluation is published by Westinghouse Corporation in WCAP report No. WCAP-10105 entitled, "Review of Pressurizer Safety Valve Performance as Observed in the EPRI Safety and Relief Valve Test Program" dated June 1982. The effect of the FSAR transient and time delay in safety valve opening (observed during testing) on the Reactor Coolant System overpressure is evaluated in Section 4-1 of the WCAP. The above analyses utilized the limiting overpressure transients for Condition II (Loss of load) and Condition IV (locked rotor) events. Other transients are expected to be conservatively bounded by these two transients. Based on a parametric study of the critical parameters such as power rating, fuel stored energy, RCS temperature and volume, safety valve capacity etc. a W-reference plant was selected which could represent the most severe conditions for the safety valve. A four loop plant was most limiting for the loss of Load transient and a two loop plant was most limiting for a Locked rotor transient. In the above analyses, the maximum RCS pressure peaks @ 2700 psig (Fig. 4-2 and 4-3 of WCAP) for the loss of load event and 2750 psia for the (Fig. 4-6) Locked Rotor event. As such among these two transients locked rotor event enveloped the loss of load event.

[illegible]

Response 11 (cont.):

The RCS pressure-time history for locked rotor transient given in Fig. 4-6 of WCAP-10105 peaked at 2750 psia and that given in D. C. Cook Plant FSAR (Fig. 14.1.6-13) peaked at 2633 psia. Therefore the WCAP curve was overlapped onto the D. C. Cook Plant FSAR Curve and a single curve was derived which enveloped the boundaries of both curves conservatively. This enveloped curve represents the results of EPRI valve testing, results of the Westinghouse reference plant evaluation based on EPRI valve test results and the Donald C. Cook Plant FSAR transient analyses. The enveloped curve shown in the attached figure was given to Teledyne for the evaluation of the discharge piping systems.

Response 11 (cont.):

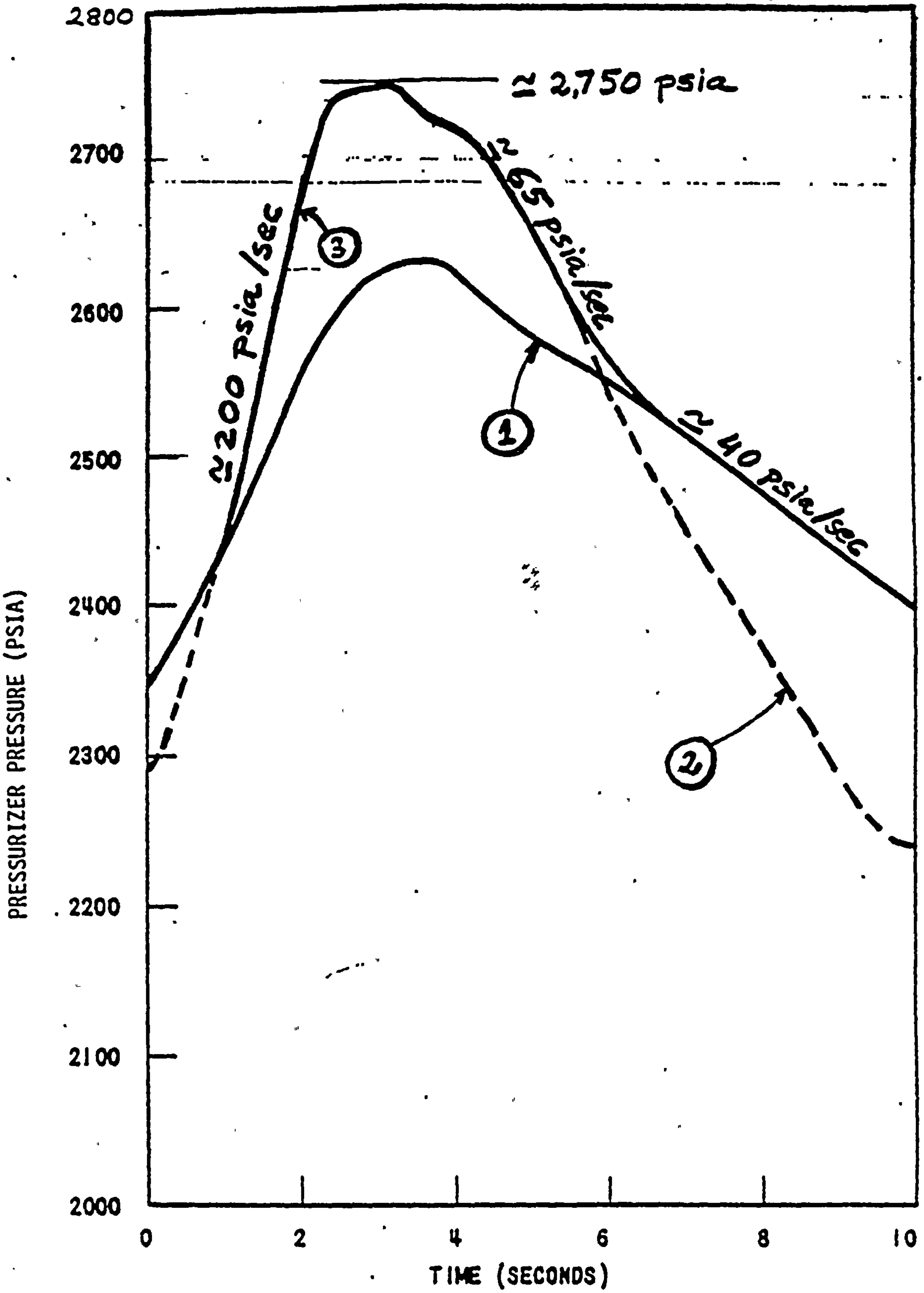


FIGURE 1

(1) : Four loops operating, one locked rotor (Unit 2 FSAR Fig. 14.1.6-13)

(2) : Locked rotor pressure transient, 1.0 second delay opening time (WCAP 10105, Figure 4-6)

(3) : Envelope Curve (recommended)

[illegible]

Question 12:

Overpressure transients cause the pressurizer sprays to activate which adds moisture to the steam volume. When the safety or relief valves open they would thus pass a steam-water mixture. The hydrodynamic effects of the water slug discharge case for the safety valves was analyzed in the original TES reports (TR-5364-3 and TR-5364-4). It has been concluded that the steam-water mixture conditions is enveloped by the steam and loop seal discharge cases and need not be addressed. However, it was not clear in the submittal if the relief valve piping analysis included the relief valve opening on water at the expected overpressure and temperature condition. The piping analysis report contained in the submittal does not present a description or results of the PORV fluid transient analysis. Provide an explanation of whether this steam-water case was considered in selecting the transients that produces the maximum loading on the PORV piping system.

Response 12:

Included as Attachment 3.1 to this submittal is the preliminary response from Teledyne Engineering Services regarding their previous analysis discussed in Question 12.

[illegible]

Question 13:

The REPIPE momentum equations contain an acceleration term which, when used with RELAPS results, commonly introduces spurious spikes into the calculated fluid forces for liquid discharge situations. These spikes can be avoided by using a large time step in the REPIPE calculations, but this may result in losing the peak force values. In the event that liquid discharge resulting from cold overpressurization transients needs to be considered, an assessment of the use of REPIPE in conjunction with RELAPS should be provided.

Response 13:

Included as Attachment 3.2 to this submittal is the preliminary response from Teledyne Engineering Services regarding their previous analysis discussed in Question 13.

ATTACHMENT 3.1

TO

AEP:NRC:0585H

TELEDYNE INPUT

(QUESTION 12)

TELEDYNE
ENGINEERING SERVICES

130 SECOND AVENUE
WALTHAM, MASSACHUSETTS 02254
(617) 890-3350 TWX (710) 324-7508

June 20, 1985
6233-19

American Electric Power Service Corp.
1 Riverside Plaza
Columbus, Ohio 43216-6631

Attention: [redacted]

Subject: NRC Questions Relative to the D. C. Cook Units 1 and 2 PORV/SV Discharge Piping Analysis

Reference: Question No. 12, PORV Fluid Transients

Gentlemen:

Attached you will find a copy of our response to Question 12 for your review. This is not a formal transmittal and therefore, this package should be considered preliminary until officially transmitted through our Document Control Department.

Very truly yours,

TELEDYNE ENGINEERING SERVICES

Lenin B. Semprucci

Lenin B. Semprucci
Project Manager

LBS/lh

Attachment

[illegible] [illegible] [illegible]

NRC Question 12 (Reference 1) states in part that ... "it was not clear in the submittal if the relief valve piping analysis included the relief valve opening on water ... The piping analysis report contained in the submittal does not present a description or results of the PORV fluid transient analysis. Provide an explanation on whether this steam-water case was considered in selecting the transients that produce the maximum loading on the PORV piping system."

The pressurizer safety and relief valve discharge piping analysis for the D. C. Cook Units 1 and 2 plants was presented in four reports: TR-5364-1, 2, 3 and 4 (References 2, 3, 4 and 5). Reports TR-5364-1 and 2 contained the details of the PORV analysis for Units 1 and 2, respectively. Reports TR-5364-3 and 4 contained the details of the safety valve anlaysis for Units 1 and 2, respectively. The support loads, nozzle loads, valve end moments and valve accelerations from PORV discharge are summarized in TR-5364-3 and 4. However the PORV pipe stresses are not included in TR-5364-3 and 4.

The D. C. Cook Unit 1 safety and relief valve discharge piping was analyzed for two cases of relief valve operation. The first case was the relief valve opening on steam followed by steam discharge. The second case is the relief valve opening on water followed by water discharge. For both cases the pressurizer pressure was assumed to follow the envelope curve (Figure 1) provided by AEPSC (Reference 6) which is based on the Unit 2 FSAR Figure 14.1.6-13 and Westinghouse Report WCAP 10105, Figure 4-6.

The pressurizer steam in Case 1 is assumed to be saturated at the pressures specified in Figure 1. The subcooled water in Case 2 is assumed to be at 400^{0}F as specified in the AEPSC directive shown in Table 1 and obtained from Reference 6.

Cases 1 and 2 were run on a RELAP 5 mod 1 model of D. C. Cook Unit 1 as is described in detail in Reference 2. Force time histories of both cases

were developed using REPIPE (Reference 7). These force-time histories were submitted to the structural dynamic program THRSAP (Reference 8). It was determined that Case 2 produced the bounding loads and therefore pipe stresses and loads were reported for this case. Based on the Unit 1 analysis only Case 2 was considered for Unit 2.

PORV discharge is taken to be an upset condition. PORV discharge is included in the following load combinations specified in Reference 6 and labeled B2 and B3 for stress combinations and D2 for support load combinations.

B2: PORV transient pressure + deadweight + $\left[OBE^2 + PORV^2\right]^{1/2} \leq 1.2\ S_h$

B3: PORV thermal stress range $\leq 1.25\ S_c + .25\ S_h$

D2: $\underset{\text{Weight}}{\text{PORV transient}} + \underset{\text{Thermal}}{\text{PORV transient}} \pm \left[(OBE)^2 + \underset{\text{Blowdown}}{(PORV)^2}\right]^{1/2}$

The results of the stress analysis, support loads, nozzle loads, valve end moments and valve accelerations for Case 2 of the PORV discharge are reported in TES Technical Reports TR-5364-1 and 2 for D. C. Cook Units 1 and 2, respectively.

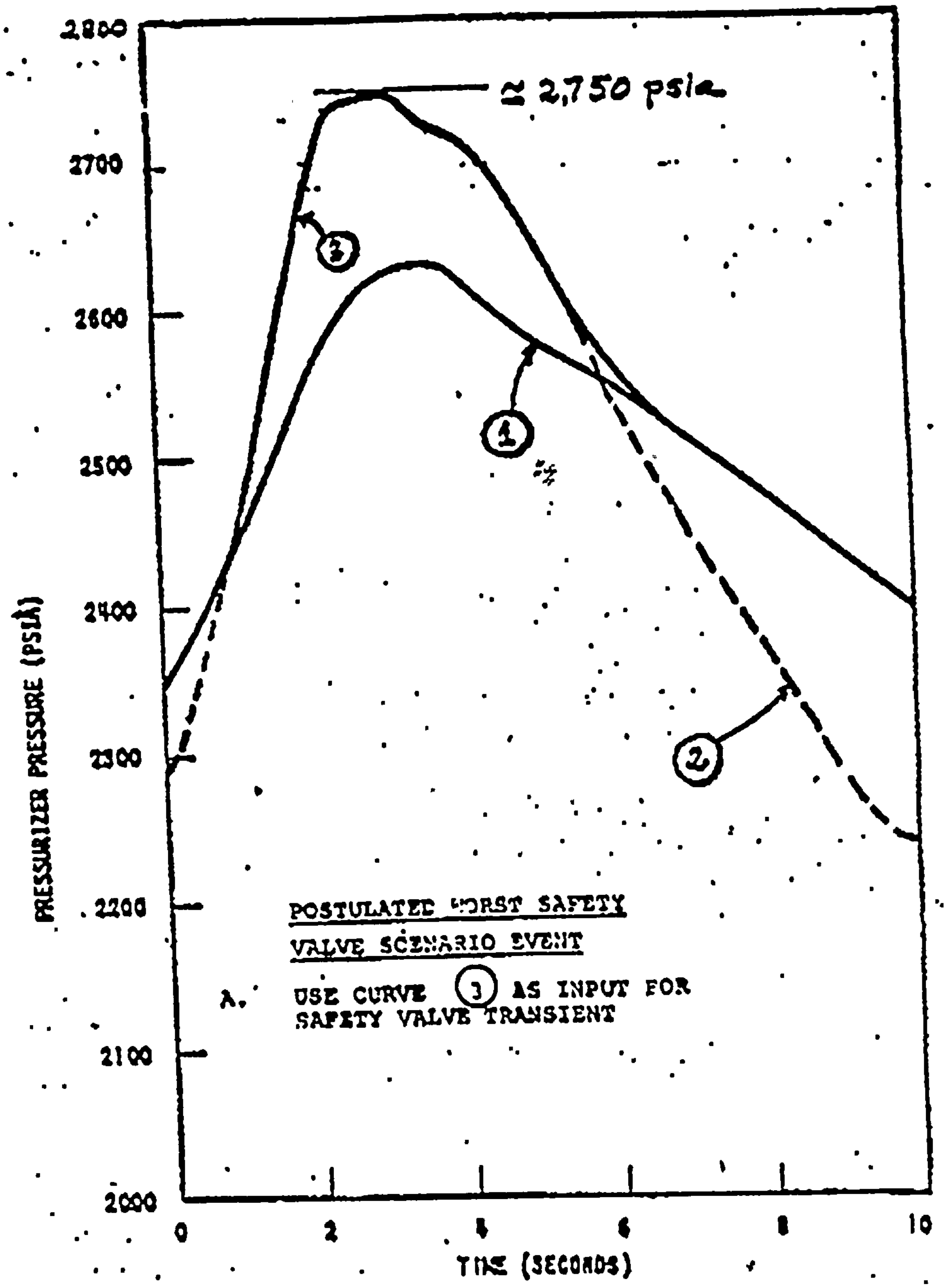


FIGURE 1

1 : Four loops operating, one locked rotor (Unit 2 FSAR Fig. 14.1.6-13

2 : Locked rotor pressure transient, 1.0 second delay opening time (WCAP 10105, Figure 4-6)

3 : Envelope Curve

SK 11/29/82

Table 1

APPENDIX I - SHEET 5 of 7

DEFINITIONS AND EXPLANATIONS TO TABLES I AND II

V. PORV AND SV TRANSIENT SHOCK : Piping stresses and support loads shall be determined from the time-history dynamic structural analyses of the piping system using the forcing functions obtained from the Thermal-Hydraulic transient analyses.

1. These analyses shall assume the largest piping stresses and support loads will occur when either 3 PORV's discharge simultaneously or when 3 SV's discharge simultaneously, for the respective transient shocks.

2. The types of transients to be investigated shall include:

   A. PORV TRANSIENTS -

      a. Condensate slugs of water followed by steam discharge, from upset pressure rises.

      b. Continuous warm water discharge from shut-down abnormal event: Temp. = 400°F.

   B. SV TRANSIENT -

      a. Condensate slugs of water followed by steam discharge, from emergency pressure rises; see sheet 6 for postulated worst scenario event.

NOTES:

1. The PORV discharge piping was analyzed for the transients described in AEP directive dated November 29, 1982.

2. The condensate slugs referred to in PORV transient "a" above are due to the fact that the PORV inlet piping for D. C. Cook Units 1 and 2 is slightly sloped toward the PORV's, therefore a small slug of condensate is formed before each of the valves.

REFERENCES

1. NRC Questions Relative to D. C. Cook Units 1 and 2 Pressurizer PORV/SV Discharge Analysis, Transmitted to TES in AEP Letter Dated March 26, 1985 from Osman Yasin to L. B. Semprucci.

2. TES Technical Report TR-5364-1, D. C. Cook Nuclear Generating Plant, Analysis of Pressurizer Safety/Relief Valve Discharge Piping System per NUREG 0737, II.D.1 Unit 1, June 6, 1983.

3. TES Technical Report TR-5364-2, D. C. Cook Nuclear Generating Plant, Analysis of Pressurizer Safety/Relief Valve Discharge Piping System per NUREG 0737, II.D.1 Unit 2, June 6, 1983.

4. TES Technical Report TR-5364-3, D. C. Cook Nuclear Generating Plant, Analysis of Pressurizer Safety Valve Discharge Piping System with Drained Loop Seals per NUREG 0737, II.D.1 Unit 1, July 18, 1983.

5. TES Technical Report TR-5364-4, D. C. Cook Nuclear Generating Plant, Analysis of Pressurizer Safety Valve Discharge Piping System with Drained Loop Seals per NUREG 0737, II.D.1 Unit 2, July 18, 1983.

6. AEPSC directive on transients to be analyzed and load combinations, letter dated November 29, 1982 from Sam Ulan (AEPSC) to L. B. Semprucci (TES).

7. REPIPE Computer Program, Control Data Corporation. A computer program to develop forces from RELAP output.

8. TMRSAP: A computer program to perform structural dynamic analysis of piping systems, copyright © 1976 by Teledyne Materials Research.

ATTACHMENT 3.2

TO

AEP:NRC:0585H

TELEDYNE INPUT

(QUESTION 13)

TELEDYNE
ENGINEERING SERVICES

130 SECOND AVENUE

WALTHAM, MASSACHUSETTS 02254

(617) 890-3350 TWX (710) 324-7508

June 20, 1985
6233-20

American Electric Power Service Corp.
1 Riverside Plaza
Columbus, Ohio 43216-6631

Attention: [redacted]

Subject: NRC Questions Relative to the D. C. Cook Units 1 and 2 PORV/SV Discharge Piping Analysis

Reference: Question No. 13, REPIPE Calculations

Gentlemen:

Attached you will find a copy of our response to Question 13 for your review. This is not a formal transmittal and therefore, this package should be considered preliminary until officially transmitted through our Document Control Department.

Very truly yours,

TELEDYNE ENGINEERING SERVICES

Lenin B. Semprucci

Lenin B. Semprucci
Project Manager

LBS/lh

Attachment

NRC Question 13 states:

"The REPIPE momentum equations contain an acceleration term which, when used with RELAP5 results, commonly introduces spurious spikes into the calculated fluid forces for liquid discharge situations. These spikes can be avoided by using a large time step in the REPIPE calculations, but this may result in losing the peak force values. In the event that liquid discharge resulting from cold overpressurization transients needs to be considered, an assessment of the use of REPIPE in conjunction with RELAP5 should be provided."

Teledyne Engieering Services' response to this question is as follows:

The REPIPE time step used in the S/RV analysis was equal to 0.001 seconds and was not increased to avoid spurious spikes. This time step was based upon the criteria that it should be less than or equal to 1/10th of the period of the highest significant natural frequency of the piping system.

Spurious spikes were observed in some of the fluid forces generated by REPIPE. When these spikes occurred they were investigated to determine their source. It was found that these spikes resulted from fluctuations in the RELAP mass flowrate. The fluctuations were due to sudden changes in the sonic velocity calculated by the two-phase choked flow correlations contained in RELAP.

In conclusion, the force calculation time step was based upon the piping system response characteristics, and not increased to avoid spurious spikes. Therefore, the "peak force values" have not been lost.

ATTACHMENT 4.0

TO

AEP:NRC:0585H

RESPONSES TO NRC QUESTIONS RELATED TO THE

STRUCTURAL ANALYSIS

(QUESTIONS 14-18)

[illegible]

Question 14:

Bending moments are induced on the safety and relief valves during the time they are required to operate because of discharge loads and thermal expansion of the pressurizer vessel and inlet piping. The Teledyne Engineering Services (TES) Report (TR-5364-3 & TR-5364-3) provided the bending moment components for the safety and relief valves. Make a comparison of the predicted Cook 1 and 2 safety and relief valve bending moments to the tested valve bending moments to demonstrate that the operability of the valves are not impaired.

Response 14:

Included as Attachment 4.1 to this submittal is the preliminary response from Teledyne Engineering Services regarding their previous analysis discussed in Question 14.

[illegible]

[illegible]

Question 15:

According to results of EPRI tests, high frequency pressure oscillations of 170-260 Hz typically occur in the piping upstream of the safety valve while loop seal water passes through the valve. An evaluation of this phenomenon is documented in the Westinghouse report WCAP 10105 and states that the acoustic pressures occurring prior to and during safety valve discharge are below the maximum permissible pressure. The study discussed in the Westinghouse report determined the maximum permissible pressure for the inlet piping and established the maximum allowable bending moments for Level C Service Condition in the inlet piping based on the maximum transient pressure measured or calculated. While the internal pressures are lower than the maximum permissible pressure, the pressure oscillations could potentially excite high frequency vibration modes in the piping, creating bending moments in the inlet piping that should be combined with moments from other appropriate mechanical loads. Provide one of the following: (1) a comparison of the expected peak pressures and bending moments with the allowable values reported in the WCAP report or (2) justification for other alternate allowable pressure and bending moments with a similar comparison with peak pressures and moments induced in the plant piping.

Response 15:

The pressurizer safety valve loop seals at the D. C. Cook Nuclear Plant have been drained and are maintained in a drained condition. Therefore, the question does not apply to this installation. (Refer to response for Question 9.)

Question 16:

Further information is required to evaluate the structural analyses of the safety valve and PORV piping systems. The submittal states that the TMRSAP computer program was used to perform the structural analyses. Provide a description of the methods used in this program and explain how the program has been verified for the type of transient analyzed. Describe the methods used to model the connections to the pressurizer and relief tanks and the safety valve bonnet assemblies and PORV actuators. Also the submittal presents the calculated values for forces and moments on the pressurizer and quench tank nozzles and moments on the valve flanges. It does not, however, present a statement on the acceptability of these forces and moments. Provide a statement regarding the acceptability of these nozzle loads.

Response 16:

Included as Attachment 4.2 to this submittal is preliminary input from Teledyne Engineering Services regarding their previous analysis discussed in Question 16. The nozzle loads calculated by Teledyne for the pressurizer and pressurizer relief tank are in some instances higher than the nozzle umbrella loads furnished in the pressurizer equipment specification. We have reviewed these calculated forces and moments and have judged that the increases in magnitude are sufficiently low, that the allowable stress levels in the nozzles will not be exceeded. We have, however, transmitted these revised loads to Westinghouse Electric Corporation for review.

[illegible]

Question 17:

The piping analysis report presents calculated pipe stresses for load combinations corresponding to emergency conditions and states that normal and upset conditions were shown to be acceptable in TES Technical Reports TR-5364-3 and TR-5364-4. The loading combinations used for the emergency condition are identified in the submittal and are in accord with recommendations of the EPRI PWR Safety and Relief Valve Test Program Guide for Application of Valve Test Program Results in Plant-Specific Evaluation, March 1982. Specify which load combinations and stress limits were used for the normal and upset conditions. The EPRI Guide also recommends that the Class 1 portion of the piping be analyzed for a faulted condition where SSE and fluid transient loads are combined. Provide justification for not including the recommended load combination for faulted condition in the Class 1 portion of the piping.

Response 17:

Plants with an FSAR can use their original design basis in conjunction with the appropriate system operating transient definitions given in Appendix E, Table 3 of the "EPRI PWR Safety and Relief Valve Test Program Guide for Application of Valve Test Program Results to Plant Specific Evaluation," Interim Research Report V-102 Rev. 2, dated July 1982. (Reference Table 1, Note 1) As such in conformance with the D. C. Cook Plant FSAR - Table 2.9-2, Part B, "The Loading Conditions and Stress Limits for Pressure Piping" have been utilized.

The piping is assumed to be in the elastic range for the safe shutdown of the plant and an inelastic analysis with higher yield strength allowables is not needed. The C1 emergency stress load combination (Ref. Section 6.1, Teledyne Report TR-5364-3, Book 2 of 3) therefore includes a design basis earthquake load. However, the likelihood of an SSE earthquake concurrently occurring during an SRV event seems highly remote and was henceforth not included in the C2 emergency load combinations (Ref. Section 6.1, Teledyne Report TR-5364-3, Book 2 of 3). The evaluation of a faulted load event such as a DBE in the Cook emergency load combinations with a lesser allowable stress is conservative relative to present nuclear industry codes and standards.

[illegible] [illegible]

Question 18:

The analysis report lists the load combinations that were considered for the pipe supports. The load combinations listed meet recommendations for the EPRI Guide except that they do not include a combination for a faulted condition nor do they identify acceptance criteria used. Justify not including a faulted condition in the evaluation of the pipe supports and explain what acceptance criteria were used to evaluate support adequacy.

Response 18:

Plants with an FSAR can use their original design basis in conjunction with the appropriate system operating transient definitions given in Appendix E, Table 3 of the EPRI PWR Safety and Relief Valve Test Program Guide for Application of Valve Test Program Results to Plant Specific Evaluation," Interim Research Report V-102 Rev. 2, dated July 1982. (Reference Table 1, Note 1) As such in conformance with the D. C. Cook Plant FSAR - Table 2.9-2, Part C, "The Loading Conditions and Stress Limits for Equipment Supports" have been utilized.

Since our supports are required to remain within the elastic range for the safe shutdown of the plant, an inelastic analysis with higher yield strength allowables is not needed. The E1 emergency support load combination (Ref. Section 6.2, Teledyne Report TR-5364-3, Book 2 of 3) therefore includes a design basis earthquake load. However, the likelihood of an SSE earthquake concurrently occurring during an SRV event seem highly remote and was henceforth not included in the E2 emergency load combinations (Ref. Section 6.2, Teledyne Report TR-5364-3, Book 2 of 3). The evaluation of a faulted load event such as a DBE, in the Cook emergency load combinations assuming permanent support deformation is conservative relative to present nuclear industry codes and standards.

ATTACHMENT 4.1

TO

AEP:NRC:0585H

TELEDYNE INPUT

(QUESTION 14)

TELEDYNE
ENGINEERING SERVICES

130 SECOND AVENUE

WALTHAM, MASSACHUSETTS 02254

(617) 890-3350 TWX (710) 324-7508

June 7, 1985
6233-17

American Electric Power Service Corp.
1 Riverside Plaza
Columbus, Ohio 43216-6631

Subject: NRC Questions Relative to the D.C. Cook Unit 1 and 2 PORV/SV Discharge Piping Analysis

Reference: Question No. 14 Valve End Moments

Dear [redacted]

Enclosed you will find a copy of our response to Question 14 for your review. This is not a formal transmittal and therefore, this package should be considered preliminary until officially transmitted through our Document Control Department.

Very truly yours,

TELEDYNE ENGINEERING SERVICES

Lenin B. Semprucci

Lenin B. Semprucci
Project Manager

LBS/cbw

Enclosure

COMPARISON

OF

PREDICTED SAFETY AND RELIEF VALVE

BENDING MOMENTS

TO THE

EPRI TESTED MOMENTS

TABLE OF CONTENTS

1.0 INTRODUCTION

Question no. 14 from the NRC letter (Ref 1). Requested that AEP "Make a comparison of the predicted Cook 1 and 2 safety and relief valve bending moments to the tested valve bending moments to demonstrate that the operability of the valves is not impaired

The power operated relief valves (PORV's) at the D.C. Cook 1&2 plants are Masoneilan 20,000 series 2" NPS relief valves. The EPRI/WYLE PORV test data indicates that for the steam preload condition these valves are capable of withstanding a maximum induced bending moment of 35,600 in-lbf. (Ref 2)

The safety valves are Crosby 6M6 HB-BP-86 valves. The EPRI/CE safety valve test data indicates that these valves are capable of operating successfully with an induced moment of 286,800 in-lbf (Ref 3)

2.0 LOAD COMBINATIONS (REF 4)

NORMAL AND UPSET CONDITIONS

D1 NORMAL WEIGHT LOAD + NORMAL THERMAL LOAD ± O.B.E LOAD

D2 PORV TRANSIENT WEIGHT LOAD + PORV TRANS THERMAL $\pm \sqrt{\left(\text{O.B.E LOAD}\right)^2 + \left(\text{PORV TRANS SHOCK LOAD}\right)^2}$

THE LARGEST CONCURRENT LOAD FROM D1 OR D2 SHALL BE THE DOMINANT FACTOR

EMERGENCY CONDITIONS

E1 NORMAL WEIGHT LOAD + NORMAL THERMAL LOAD ± D.B.E LOAD

E2 S.V. TRANSIENT WEIGHT LOAD + S.V. TRANSIENT THERMAL ± S.V. TRANSIENT SHOCK LOAD

THE LARGEST CONCURRENT LOAD FROM E1 OR E2 SHALL BE THE DOMINANT FACTOR

3.0 ASSUMPTIONS

1. PORV end moments are not calculated for the Emergency Conditions E1 and E2 because the PORV's are not required to operate during this condition

2. Safety Valve end moments are not calculated for the Normal and Upset Conditions D1 and D2 because the Safety Valves are not expected to operate during these conditions

4.0 CONCLUSION

The relief valve and safety valve end moments for D.C. Cook units 1 and 2 are within the allowable values provided in Ref 2 and 3.

TELEDYNE ENGINEERING SERVICES

BY LBS DATE 6-3-85
CHKD. BY RCH DATE 6/5/85

NEP D.C. COOK UNITS 1 & 2

SHEET NO. 7 OF 27
PROJ. NO. 6257

5.0 SUMMARY

VALVE END MOMENTS

SUMMARY

UNIT 1

RELIEF VALVE	CALCULATED (in-lbf)	ALLOWABLE (in-lbf)
NRV-151	34,810	35,600
NRV-152	29,444	
NRV-153	24,380	

SAFETY VALVE	CALCULATED (in-lbf)	ALLOWABLE (in-lbf)
SV-45A	105,147	286,800
SV-45B	93,148	
SV-45C	94,733	

UNIT 2

RELIEF VALVE	CALCULATED (in-lbf)	ALLOWABLE (in-lbf)
NRV-151	28412	35,600
NRV-152	31,544	
NRV-153	33,288	

SAFETY VALVE	CALCULATED (in-lbf)	ALLOWABLE (in-lbf)
SV-45A	96,614	286,800
SV-45B	81,953	
SV-45C	105,343	

6.0 METHOD OF ANALYSIS

Review of the load combinations given on sheet 4 of this package and the valve end moments given in references 5 and 6 indicate that the worst load combination for the PORV's is the D2 combination. The details of this calculation are presented on sheets 9 thru 27 following and summarized on the preceeding sheet (sheet 7). Similiarly the worst load combination for the safety valves is E2.

For the PORV's the resultant end moment was determined on each side of the valve. For the safety valves the largest moment component on either side of the valve was used to determine a single resultant moment. This is conservative and reduced the calculation volume.

The maximum M_x, M_y and M_z from each of the three thermal runs was conservatively used for the load combinations. If these moment components yeilded a resultant moment which exceeded the allowable the resultant moment was recalculated using the moment components from the one thermal case which yielded the highest final load. For these points the thermal run that was used is noted.

7.0 CALCULATIONS UNIT 1

NRV-151 (635)

$$M_i = \text{PORV WGHT} + \text{PORV TRANS THERM} \pm \sqrt{(OBE)^2 + (\text{PORV SHOCK})^2}$$

$i = x, y, \text{or } z$

$$M_x = 7219 + \underset{\text{(thermal 2)}}{4882} \pm \sqrt{(9577)^2 + (\overset{8600*}{8007})^2} = 24584$$

21,716 *

$$M_y = 42 + \underset{\text{(thermal 2)}}{(-5146)} \pm \sqrt{(4397)^2 + (\overset{401*}{4980})^2} = -11,747$$

-9519 *

$$M_z = 5939 + \underset{\text{(thermal 2)}}{1466} \pm \sqrt{(4585)^2 + (\overset{17490*}{17493})^2} = 25,488$$

25,486 *

M_R = 37,310 in-lbf ← uses maximum PORV blowdown M_x, M_y and M_z

34,810 * ← 2 was time at which max M_{RMS} occurs

ALLOWABLE = 35,600 in-lbf

* The first attempt at this calc. was done by using maximum M_x, M_y and M_z from the PORV blowdown case. When this conservative attempt failed the M_x, M_y and M_z were taken at the time that the maximum RMS moment occurs. This occurred at time t = 0.443 seconds and can be found on microm film roll # 842 which contains the PORV trans run.

TELEDYNE ENGINEERING SERVICES

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NRV-151 625

$$M_x = 5091 + 7775 \pm \sqrt{(5763)^2 + (5207)^2} = 19{,}461$$

$$M_y = -575 - 3196 \pm \sqrt{(4843)^2 + (2431)^2} = -9{,}190$$

$$M_z = 670 + 4472 \pm \sqrt{(2129)^2 + (8262)^2} = 13{,}674$$

$$M_R = 25{,}498 \text{ in-lbs} < M_{allow} = 35{,}600 \text{ in-lbs}$$

NRV-152 (385)

$$M_x = -347 - 1418 \pm \sqrt{(4646)^2 + (4233)^2} = -8050$$

$$M_Y = 595 + 1634 \pm \sqrt{(2854)^2 + (1847)^2} = 5629$$

$$M_Z = -4480 + 78 \pm \sqrt{(1240)^2 + (3336)^2} = -7961$$

$M_e = 12{,}643$ in-lbs $< M_{ALLOW} = 35{,}600$ in-lbs

NRV-152 (4CO)

$$M_X = 1429 - 704 \pm \sqrt{(9380)^2 + (11543)^2} = 15,599$$

$$M_Y = -1879 - 3349 \pm \sqrt{(4125)^2 + (3164)^2} = -10,427$$

$$M_Z = -5198 + 60 \pm \sqrt{(12514)^2 + (12310)^2} = -22,692$$

$$M_R = 29,444$$

$$M_{ALLOW} = 35,600$$

NRV-153 510

$$M_X = -6710 + 2961 \pm \sqrt{(4646)^2 + (7079)^2} = -12{,}183$$

$$M_Y = 2225 - 3923 \pm \sqrt{(4981)^2 + (4021)^2} = -8{,}099$$

$$M_Z = -6561 + 2271 \pm \sqrt{(8759)^2 + (11669)^2} = -19{,}502$$

$M_R = 24{,}380$ $\quad M_{ALLOW} = 35{,}600$

NEV-153 (525)

$$M_X = -5959 + 2852 \pm \sqrt{(9951)^2 + (3998)^2} = -13,831$$

$$M_Y = 3595 - 4053 \pm \sqrt{(5546)^2 + (2113)^2} = -6393$$

$$M_Z = -4701 + 1999 \pm \sqrt{(1702)^2 + (9683)^2} = -12,533$$

$$M_R = 19,730 \text{ in-lbs} < M_{allow} = 35,600 \text{ in-lbs}$$

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AEP D.C. COOK UNIT 1

SHEET NO. 15 OF 27
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UNIT 1

SV-45 A VALVE END MOMENTS

	WGHT	THERM	S.V. TRANS	D.B.E	$M_{R S.V}$	$M_{R OBE}$
M_x	10304	24,503	49933	10,129	84740	44936
M_y	909	11620	10927	4736	23.456	17,265
M_z	7910	18857	30894	8259	57,661	35026

	M_{RSV}	M_{ROBE}
SRSS	105,147	59,533

ALLOWABLE = 286,800 in-lbs

SV-45B VALVE END MOMENTS

	WGHT	THERM	S.V. TRANS	D.B.E	$M_{R\,S.V.}$	$M_{R\,DBE}$
M_x	3252	16818	13943	18079	34,013	38,149
M_y	1606	11254	11172	5616	24,032	18,476
M_z	16289	13166	53,865	10582	83,320	40,037
					M_{RSV}	M_{RDBE}
				5855	93,148	58,306

$M_{ALLOW} = 286,800$ in-lbf

SV-45C VALVE END MOMENTS

	WGHT	THERM	S.V. TRANS	D.B.E.	$M_{R_{S.V.}}$	$M_{R_{DBE}}$
M_X	16 095	8605	46 416	10 645	71 116	35 345
M_Y	2369	9858	15 645	5324	27,872	17 551
M_Z	5536	20154	30 346	22508	56,036	48 198

		$M_{R_{SV}}$	$M_{R_{OBE}}$
	SRSS	94,733	62,292

$M_{ALLOW} = 286,800$

UNIT 2

NRV-151 (292)

$$M_X = 1305 + 6579 \pm \sqrt{(7008)^2 + (3576)^2} = 15752$$

$$M_Y = 1338 + 1741 \pm \sqrt{(6142)^2 + (1129)^2} = 9324$$

$$M_Z = 6953 - 2379 \pm \sqrt{(1983)^2 + (7671)^2} = 12{,}477$$

$M_R = 22{,}153$ in-lbs < $M_{ALLOW} = 35{,}600$ in-lbs

NRV-151 (296)

$M_X = 1460 + 6375 \pm \sqrt{(7941)^2 + (7647)^2} = 18,859$

$M_Y = 1690 - 1096 \pm \sqrt{(7814)^2 + (2661)^2} = 8,849$

$M_Z = 6549 - 2044 \pm \sqrt{(6151)^2 + (13478)^2} = 19,320$

$M_e = 28412$ ... $M_{ALLOW} = 35,600$ in-lb

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O.C. COOK UNIT 2

SHEET NO. 20 OF 27
PROJ. NO. 6233

NRV-152 350

$$M_X = -2482 + 10447 \pm \sqrt{(4329)^2 + (8822)^2} = 17{,}792$$

$$M_Y = -389 + 1662 \pm \sqrt{(5260)^2 + (2339)^2} = 7{,}030$$

$$M_Z = 54 + 7895 \pm \sqrt{(7278)^2 + (7346)^2} = 18{,}294$$

$$M_C = 26{,}470 \text{ in-lbs} < M_{ALLOW} = 35{,}600 \text{ in-lbs}$$

NRV-152 346

$M_x = 809 + 15,552 \pm \sqrt{(3106)^2 + (7740)^2} = 24,501$

$M_y = -275 + 5888 \pm \sqrt{(4196)^2 + (1096)^2} = 9,950$

$M_z = 1382 + 9607 \pm \sqrt{(5116)^2 + (4492)^2} = 17,197$

$M_e = 31,541$ $\quad$ $M_{allow} = 35,600$ in-lbf

[illegible]

NRV-153 266

$M_x = 5265 - 10151 \pm \sqrt{(4528)^2 + (6328)^2} = -12{,}667$

$M_y = -41 - 6228 \pm \sqrt{(2563)^2 + (1946)^2} \quad -9814$

$M_z = -8350 - 6280 \pm \sqrt{(4959)^2 + (13676)^2} \quad -29{,}177$

$M_e = 33{,}288$ in-lbs $\qquad M_{allow} = 35{,}600$ in-lbs

TELEDYNE ENGINEERING SERVICES

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CHKD. BY [illegible] DATE 6/15/85

AEP D.C. COOK UNIT 2

PROJ. NO. 6233

NRV-153 (262)

$$M_x = -3490 - 9400 \pm \sqrt{(9149)^2 + (2573)^2} = -22,394$$

$$M_Y = -224 - 7895 \pm \sqrt{(770)^2 + (1296)^2} = -9626$$

$$M_Z = -3953 - 8140 \pm \sqrt{(4255)^2 + (7121)^2} = -20388$$

$$M_R = 31,778 \text{ in-lbs} < M_{allow} = 35,600 \text{ in-lbs}$$

UNIT 2

SV-45A VALVE END MOMENTS

	WGHT	THERM	SV TRANS	DBE		$M_{R_{SV}}$	$M_{R_{DBE}}$
M_X	3242	22224	18332	14573	=	43,798	40,039
M_Y	1046	12244	8701	6220	=	21,991	19,570
M_Z	14021	15648	53593	14684	=	83,262	44,353
						$M_{R_{SV}}$	$M_{R_{DBE}}$
			SRSS			96,614	62,875

$M_{ALLOW} = 286,800$

SV-45B VALVE END MOMENTS

	WGHT	THERM	S.V. TRANS	D.B.E.	$M_{R_{S.V.}}$	$M_{R_{DBE}}$
Mx	13848	11581	73216	11460	68,745	36,989
My	1588	7505	8612	6423	17,705	15,516
Mz	5144	14663	21,143	20813	40,950	40,620
					$M_{R_{SV}}$	$M_{R_{DBE}}$
			SRSS		81,953	57,087

$M_{ALLOW.} = 286,800$ in-lb

[illegible]

SV-45C VALVE END MOMENTS

	WGHT	THERM	S.V. TRANS	D.B.E	$M_{R_{S.V.}}$	$M_{R_{DBE}}$
M_X	7708	15796	37040	17131	60544	40635
M_Y	1492	14223	21524	5077	37239	20,792
M_Z	10836	21464	45,449	13374	77,749	45674
					$M_{R_{SV}}$	$M_{R_{DBE}}$
				SRSS	105,343	64,573

M_{ALLOW} = 286,800 in-lbs

8.0 REFERENCES

1. NRC Questions. Letter from Osman Yasin (AEPSC) to L.B.S (TES) dated 3-26-85
2. Letter Osman Yasin (AEPSC) to L.B. Sempucci (TES) dated 5-20-85 containing PORV allowables
3. Letter Osman Yasin (AEPSC) to L.B. Sempucci (TES) dated 4-30-85 containing Safety Valve allowables
4. Letter Sam Ulan (AEPSC) to L.B. Sempucci (TES) dated containing load combinations
5. TES TECHNICAL REPORT TR-5364-3 DATED 7-18-83
6. TES TECHNICAL REPORT TR-5364-4 DATED 7-18-83

ATTACHMENT 4.2

TO

AEP:NRC:0585H

TELEDYNE INPUT

(QUESTION 16)

TELEDYNE
ENGINEERING SERVICES

130 SECOND AVENUE

WALTHAM, MASSACHUSETTS 02254

(617) 890-3350 TWX (710) 324-7508

June 12, 1985
6233-18

American Electric Power Service Corp.
1 Riverside Plaza
Columbus, Ohio 43216-6631

Attention: [redacted]

Subject: NRC Questions Relative to the D. C. Cook Units 1 and 2 PORV/SV Discharge Piping Analysis

Reference: Question No. 16

Gentlemen:

Enclosed you will find a copy of our response to Question 16 for your review. This is not a formal transmittal and therefore, this package should be considered preliminary until officially transmitted through our Document Control Department.

Very truly yours,

TELEDYNE ENGINEERING SERVICES

Lenin B. Semprucci

Lenin B. Semprucci
Project Manager

LBS/lh

Enclosure

ATTACHMENT I

TMRSAP DYNAMIC ANALYSIS METHODS & VERIFICATION INFORMATION

A. DYNAMIC ANALYSIS METHODS

THE METHODS USED IN THE TMRSAP TIME HISTORY ANALYSIS ARE DESCRIBED IN TELEDYNE ENGINEERING SERVICES TECHNICAL REPORT TR-5872-1, TMRSAP VERIFICATION MANUAL DATED OCTOBER, 1983. THE DIRECT INTEGRATION METHOD WAS USED & IS DESCRIBED ON THE FOLLOWING 3 PAGES EXTRACTED FROM TR 5872-1.

B. VERIFICATION

THE VERIFICATION IS PRESENTED IN THE TMRSAP VERIFICATION MANUAL, TR 5872-3, DATED OCTOBER 1983. THE PAGES FROM THIS REPORT (55-75) ARE ATTACHED FOR YOUR REVIEW

8.0 DYNAMIC ANALYSES

In dynamic response analysis, the solution of the equations

$$M\ddot{u} + C\dot{u} + Ku = R(t) \tag{15}$$

is required, where R(t) can be a vector of arbitrary time varying loads or of effective loads which result from ground motion. Specifically, in the case of ground motion, if it is assumed that the structure is uniformly subjected to the ground acceleration $\ddot{u}_g$ (Ref. 5), the equilibrium equations considered are:

$$M\ddot{u}_r + C\dot{u}_r + Ku_r = -M\ddot{u}_g \tag{16}$$

Where u_r is the relative displacement of the structure with respect to the ground; i.e., $u_r = u - u_g$.

The program can carry out a history analysis for solution of Eqs. (15) or (16), or a response spectrum analysis for solution of Eq. (16). The history analysis can be carried out using mode superposition or direct integration. The response spectrum analysis necessitates, of course, first the solution of the required eigensystem.

8.1 Response History Analysis by Mode Superposition

In the mode superposition analysis, it is assumed that the structural response can be described adequately by the p lowest vibration modes, where $p \ll n$. Using the transformation $u = \Phi X$, where the columns in Φ are the p M-orthonormalized eigenvectors, Eq. (15) can be written as

$$\ddot{X} + \Delta\dot{X} + \Omega^2 X = \Phi^T R \tag{17}$$

where

$$\Delta = \text{diag.}\ (2\omega_i \xi_i); \qquad \Omega^2 = \text{diag.}\ (\omega_i^2) \tag{18}$$

In Eq. (18), it is assumed that the damping matrix C satisfies the modal orthogonality condition

$$\phi_i^T C \phi_j = 0 \quad (i \neq j) \tag{19}$$

Equation (17) therefore represents p uncoupled second order differential equations. These are solved in the program using the Wilson-θ method, which is an unconditionally stable step-by-step integration scheme (Refs. 5 and 6). The same time step is used in the integration of all equations to simplify the calculation of stress components at pre-selected times.

In the case of prescribed ground motion $U_r = \phi X$ and in Eq. (17), the right hand side if given by $- \phi^T M\ddot{u}_g$, where the ground acceleration is considered as the sum of the components in the X, Y, and Z directions as described in Section 8.3.

8.2 Response History Analysis by Direct Integration

The solution of the equations of motion, Eqs. (15) and (16), can be obtained by direct integration (Refs. 5 and 6). In the program the Wilson-θ method is used, which is unconditionally stable. The algorithm employed is summarized in Figure 8-1. It need be noted that Rayleigh damping is assumed; i.e., $C = \alpha M + \beta K$ (Ref. 5). This form of damping is easily taken account of in the analysis, because no storage and no multiplications for a damping matrix are required.

8.3 Response Spectrum Analysis

In this analysis, the ground acceleration vector in Eq. (16) is written as:

Initial Calculations

1. Calculate the following constants (Assume $C = \alpha M + \beta K$).

$\theta = 1.4, \quad \tau = \theta\Delta t$

$a_0 = (6 + 3\alpha\tau)/(\tau^2 + 3\beta\tau)$

$b_0 = \alpha - \beta a_0$

$a_1 = 6/\tau^2 + 3b_0/\tau$

$a_2 = 6/\tau + 2b_0$

$a_3 = 2 + \tau b_0/2$

$a_4 = 6/[\theta(3\beta\tau + \tau^2)]$

$b_1 = \beta a_4$

$a_5 = 3b_1/\tau - 6/(\tau^2\theta)$

$a_6 = 2b_1 - 6/(\tau\theta)$

$a_7 = b_1\tau/2 + 1 - 3/\theta$

$a_8 = \Delta t/2$

$a_9 = \Delta t^2/3$

$a_{10} = \frac{1}{2} a_9$

2. Form effective stiffness matrix $K^* = K + a_0 M$.

3. Triangularize K^*

For Each Time Increment

1. Form effective load vector R_t^*.

$$R_t^* = R_t + \theta(R_{t+\Delta t} - R_t) + M[a_1 u_t + a_2\dot{u}_t + a_3\ddot{u}_t].$$

2. Solve for effective displacement vector u_t^*.

$$K^* u_t^* = R_t^*$$

3. Calculate new acceleration, velocity and displacement vectors,

$$\ddot{u}_{t+\Delta t} = a_4 u_t^* + a_5 u_t + a_6\dot{u}_t + a_7\ddot{u}_t$$

$$\dot{u}_{t+\Delta t} = \dot{u}_t + a_8(\ddot{u}_{t+\Delta t} + \ddot{u}_t)$$

$$u_{t+\Delta t} = u_t + \Delta t\,\dot{u}_t + a_9\ddot{u}_t + a_{10}\ddot{u}_{t+\Delta t}$$

4. Calculate element stresses if desired.

FIGURE 8-1 Step-by-step direct integration algorithm

2

4.14 A & B Dynamic Analysis of a Three-Dimensional Piping System Subjected to Time Varying Loads - FTMS1, FTDI1 & FTMS120

Introduction - A dynamic analysis is performed with the piping system shown in Figure 4.14-1 using the STARDYNE program and the TMRSAP program with analysis types,

NDYN = 2; Dynamic Response Analysis for arbitrary time dependent loads using mode superposition. (Problem 4.14A)

NDYN = 4; Dynamic Response Analysis for arbitrary time dependent loads using step-by-step integration. (Problem 4.14B)

Problem Description - The computer model is shown in Figure 4.14-1 and is composed of sections of straight pipe, curved pipe (elbows) and a valve with a concentrated weight. Nodes 1 and 48 are fully fixed and therefore, are prevented from having any displacement or rotation. The time varying loads applied to the nodal points on the structure are shown in Figure 4.14-2.

Property Data

(a) Member Properties

FROM NODE	TO NODE	O.D. (in.)	t (in.)	Wt. (lb/in)	Comments
1	42	18.0	0.562	8.71	-------
42	46	24.0	2.0	39.12	5000 lb.concentrated weight at node 44
46	48	16.0	0.50	6.89	------

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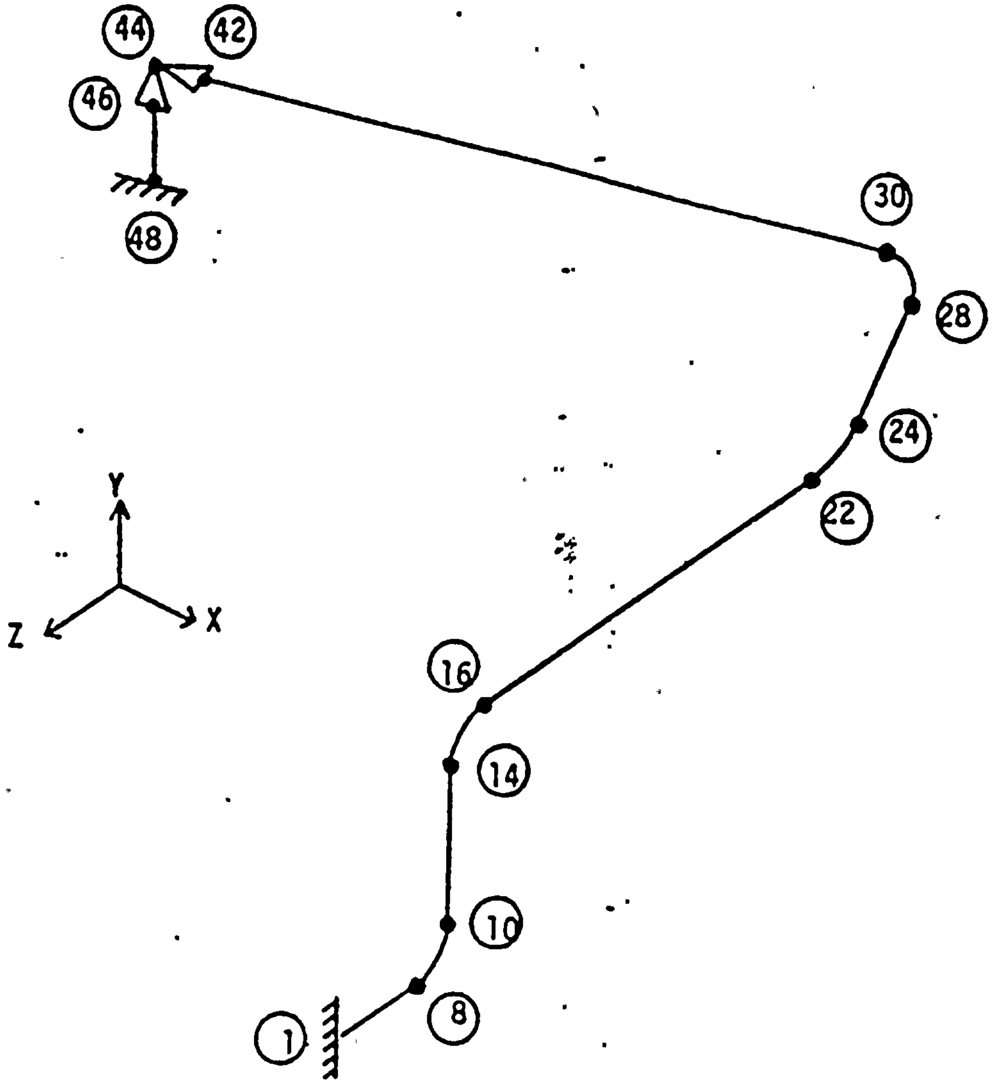

Node 44 has a 5000 lb. weight

FIGURE 4.14-1 3-D PIPING SYSTEM

(b) Geometry

NODE NO.		COORDINATES*	
	X	Y	Z
1	0	0	0
8	0	0	-10.752
10	0	27.000	-37.752
14	0	90.277	-37.752
16	0	117.275	-64.474
22	0	118.638	-196.736
24	0	126.545	-215.549
28	0	136.858	-225.862
30	-26.728	156.138	-244.764
42	-327.240	160.392	-244.764
44	-347.244	160.680	-244.764
46	-347.244	144.672	-244.764
48	-347.244	135.732	-244.764

(c) System Restraints

Nodes 1 and 48 are fully fixed

Time Varying Load Input

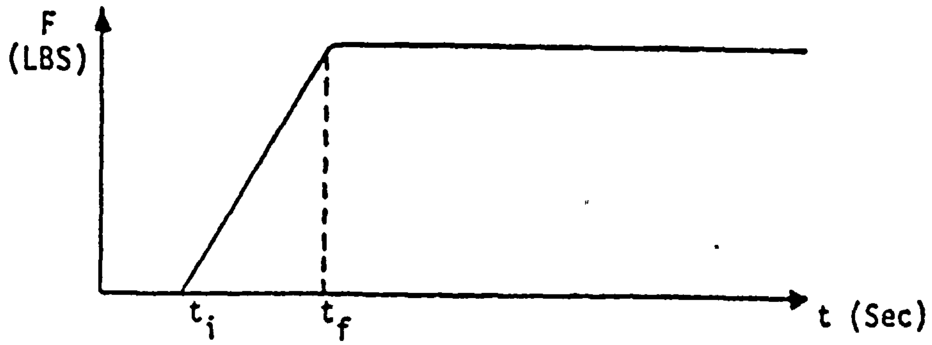

FIGURE 4.14-2

*Note: There are slight differences in the coordinates of previous publication of this problem (ref. 12) due to changes in formats on this version of the code.

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NODAL LOADS

Node	t_i	t_f	F_x, LB	F_y, LB.	F_z, LB.
44	0.0	0.05	-34,460.6	--	--
30	.01993	.06993	33,200.7	--	--
28	.01993	.06993	--	23,476.4	-23,476.4
24	.02303	.07303	--	-23,058.9	23,058.9
22	.02303	.07303	--	--	-32,610.2
16	.03310	.08310	--	--	31,664.7
14	.03310	.08310	--	31,664.7	--
10	.04004	.09004	--	-30,543.6	--
8	.04004	.09004	--	--	-30,543.6

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Problem 4.14A

Mode Superposition Parameters for TMRSAP

Number of Modes, NF	= 5
Damping	= 0.005
Solution Time Step	= 0.002 sec
Displacement & Stress Print Time Step	= 0.01 sec

Note: The maximum and minimum displacements and pipe end loads are obtained from the solution time step.

Computer Reference #14

Problem 4.14B

Direction Integration parameters for TMRSAP

α, Mass Factor,	= .256
β, Stiffness Factor,	= .0000395
Solution time step, DT	= 0.002 sec
Print Interval Time Step	= 0.01 sec

Computer Reference #15

Results

The selected responses from TMRSAP and STARDYNE are plotted in Figures 4.14-3 through 4.14-8.

Comments

The M_y bending respnse for superposition at Element #12, Node 48, doesn't agree very well initially with the STARDYNE results. This can be attributed to the following:

1. STARDYNE uses a different integration technique; this is expected to have a small effect.

2. STARDYNE calculated the response by a technique that uses star static. The elements' response plotted is not a summation of the elements modal response. Instead, the modal nodal acceleration responses are summed and converted into equivalent force vectors at each time step and added to the external load vector. This force vector is statically applied to the entire structure resulting in displacements that may be different than those obtained by mode superposition alone. Since the displacements are different, then the element load can be expected to be different. This method approximates treating the higher modes (the modes not considered) statically.

Item 2 can be tested by running TMRSAP with more modes and observing if the responses from STARDYNE are in closer agreement. It would also be expected if damping is not a significant factor, that the responses from direct integration would be closer to the TMRSAP's mode superposition. This is indeed the case, the initial M_y response by mode superposition for 20 modes is plotted in Figure 4.14-9 and shows closer agreement to STARDYNE results and TMRSAP direct integration results. The results are obtained from Computer Reference #16.

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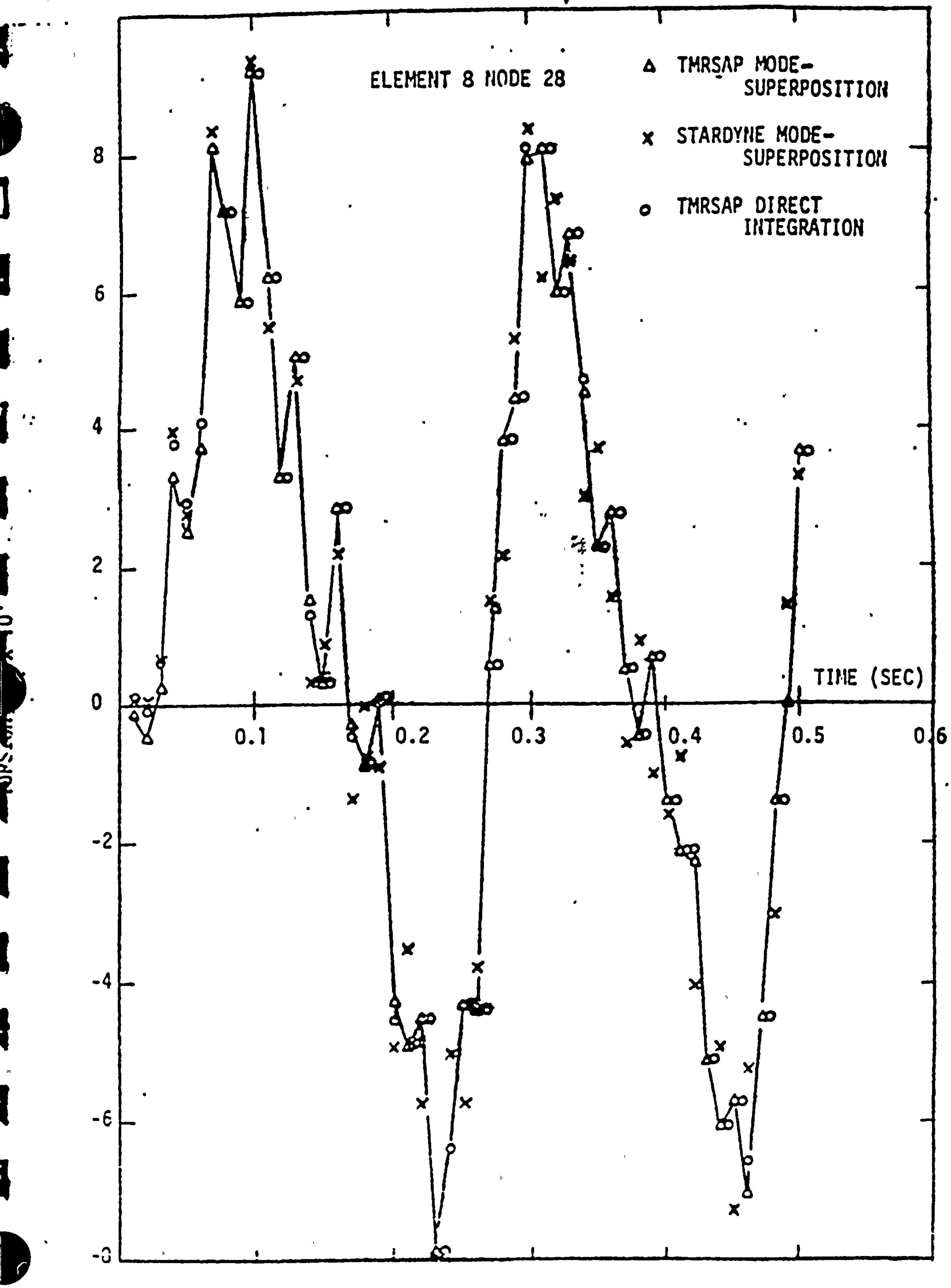

Figure 4.14-3 Time History Response Node 28 - Torsion T_x

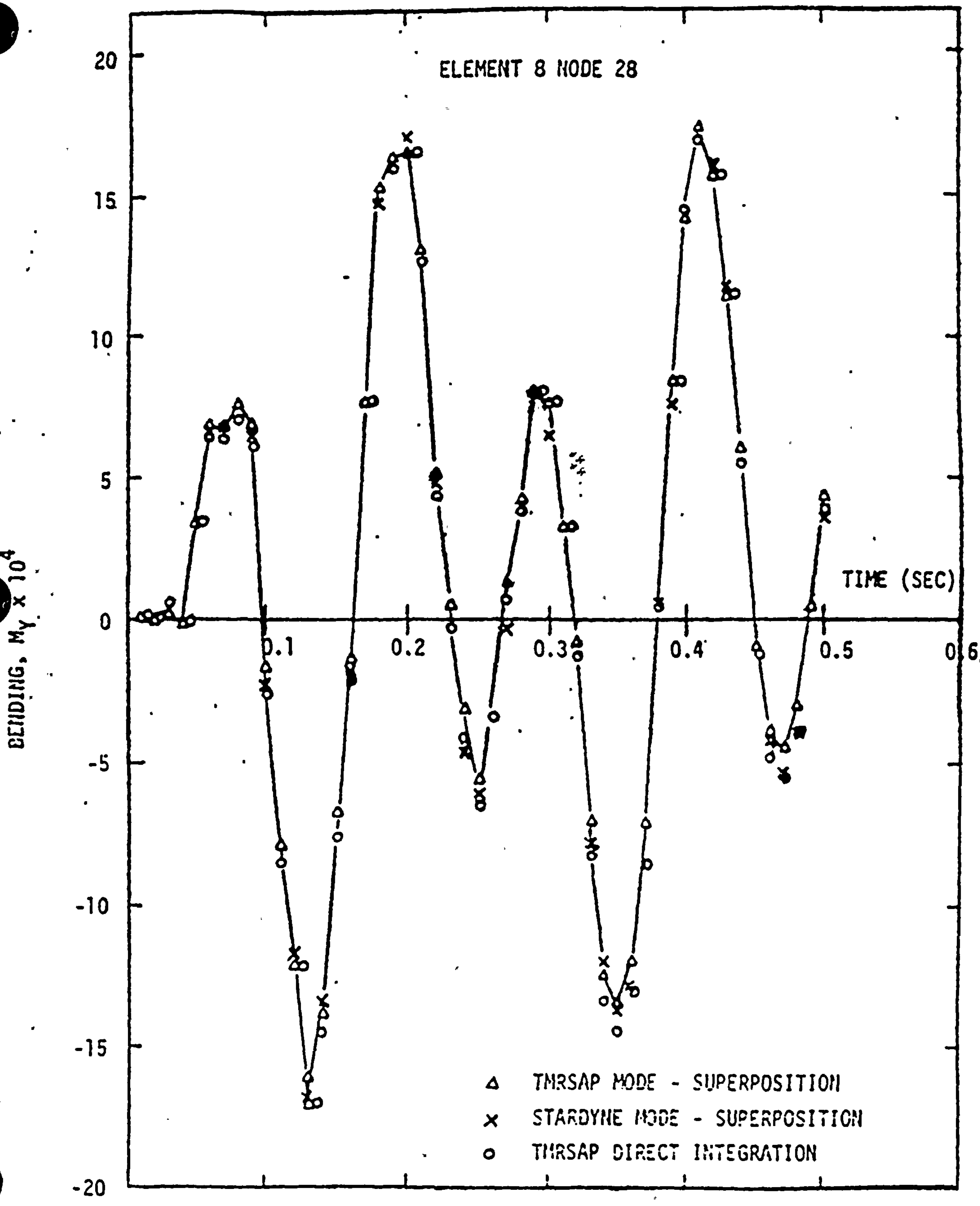

Figure 4.14-4 Time History Response Node 28 - Bending M_y

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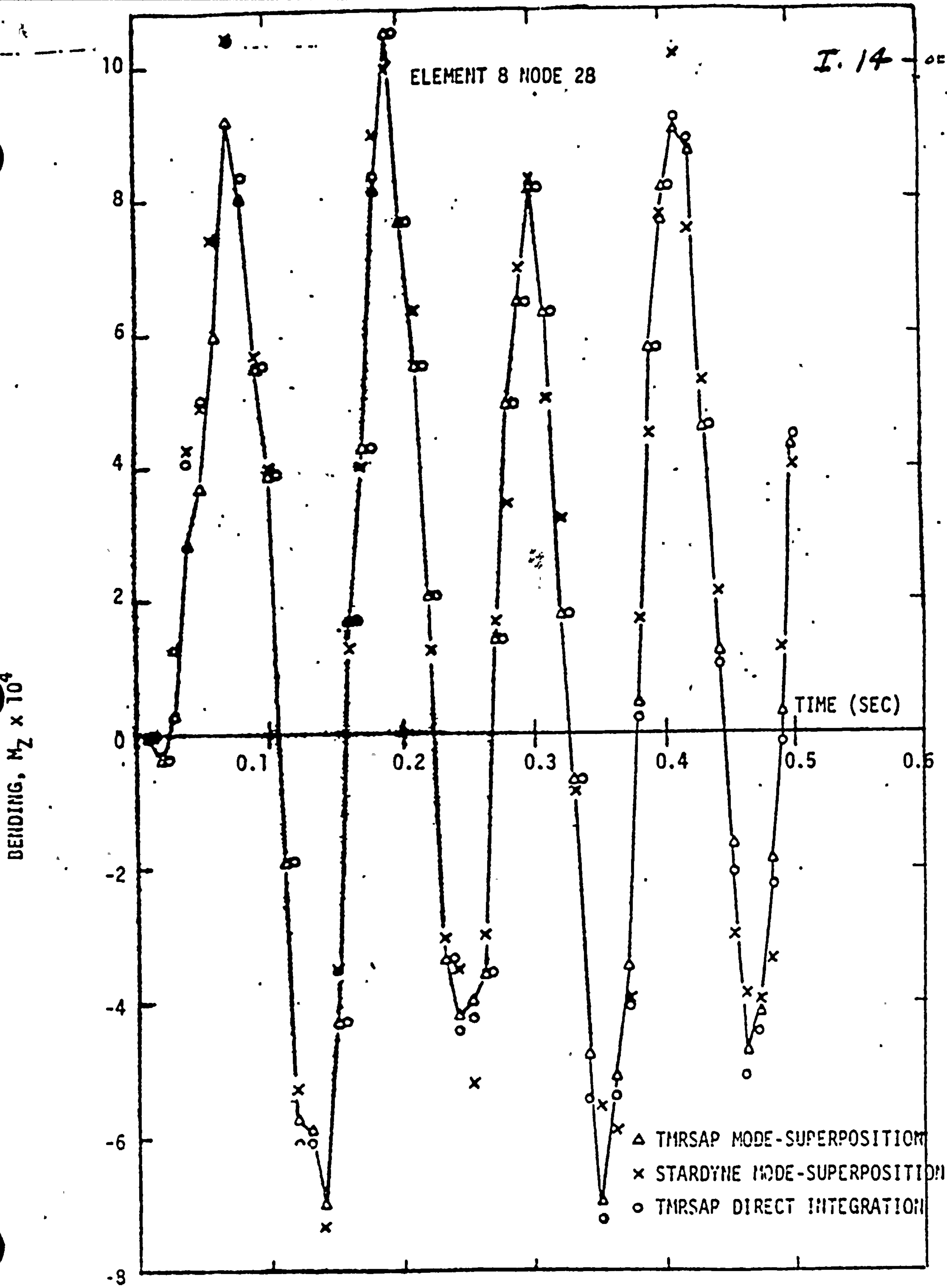

Figure 4.14-5 Time History Response Node 28 - Bending M_z

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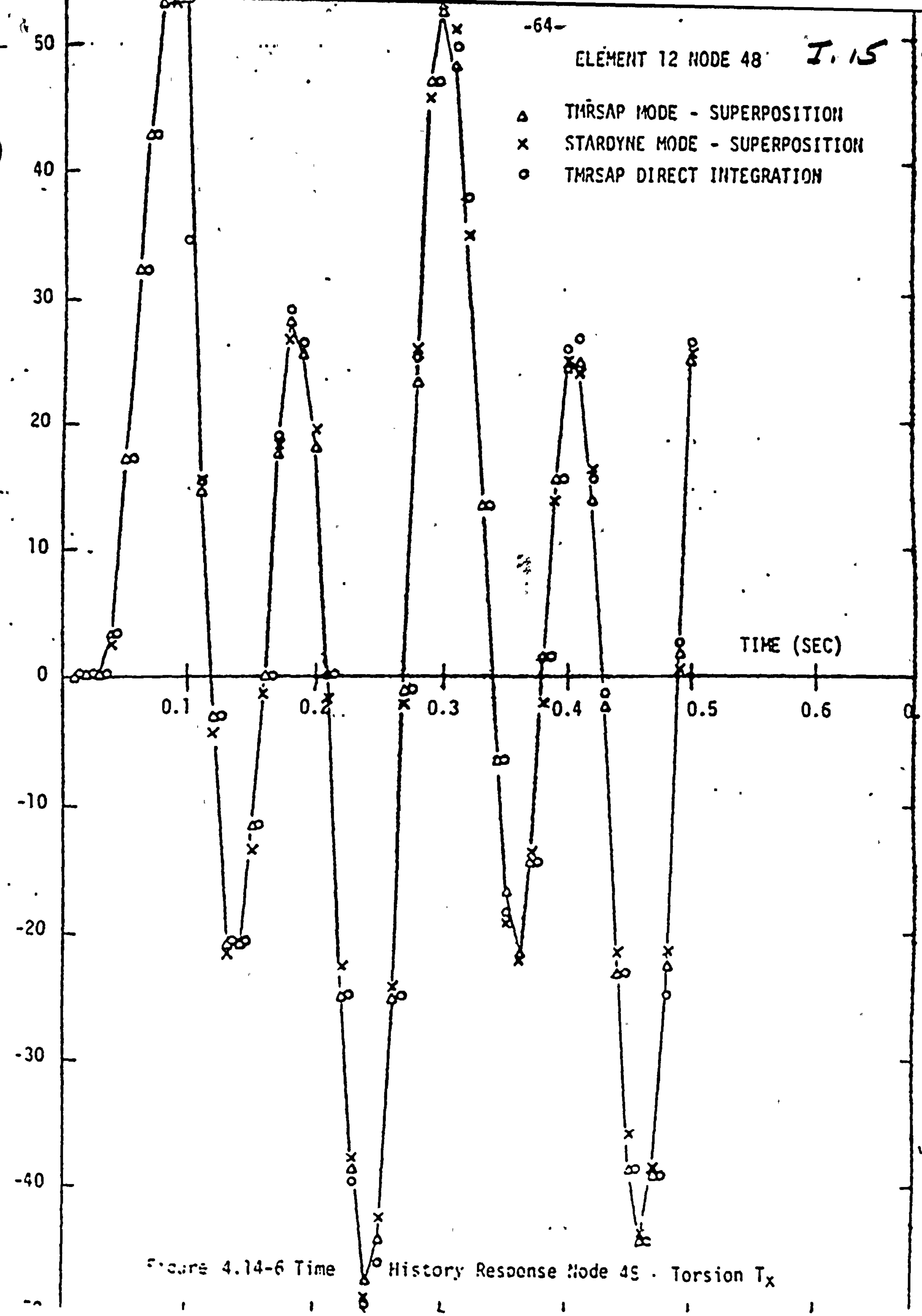

Figure 4.14-6 Time History Response Node 48 · Torsion T_x

I, 16 of

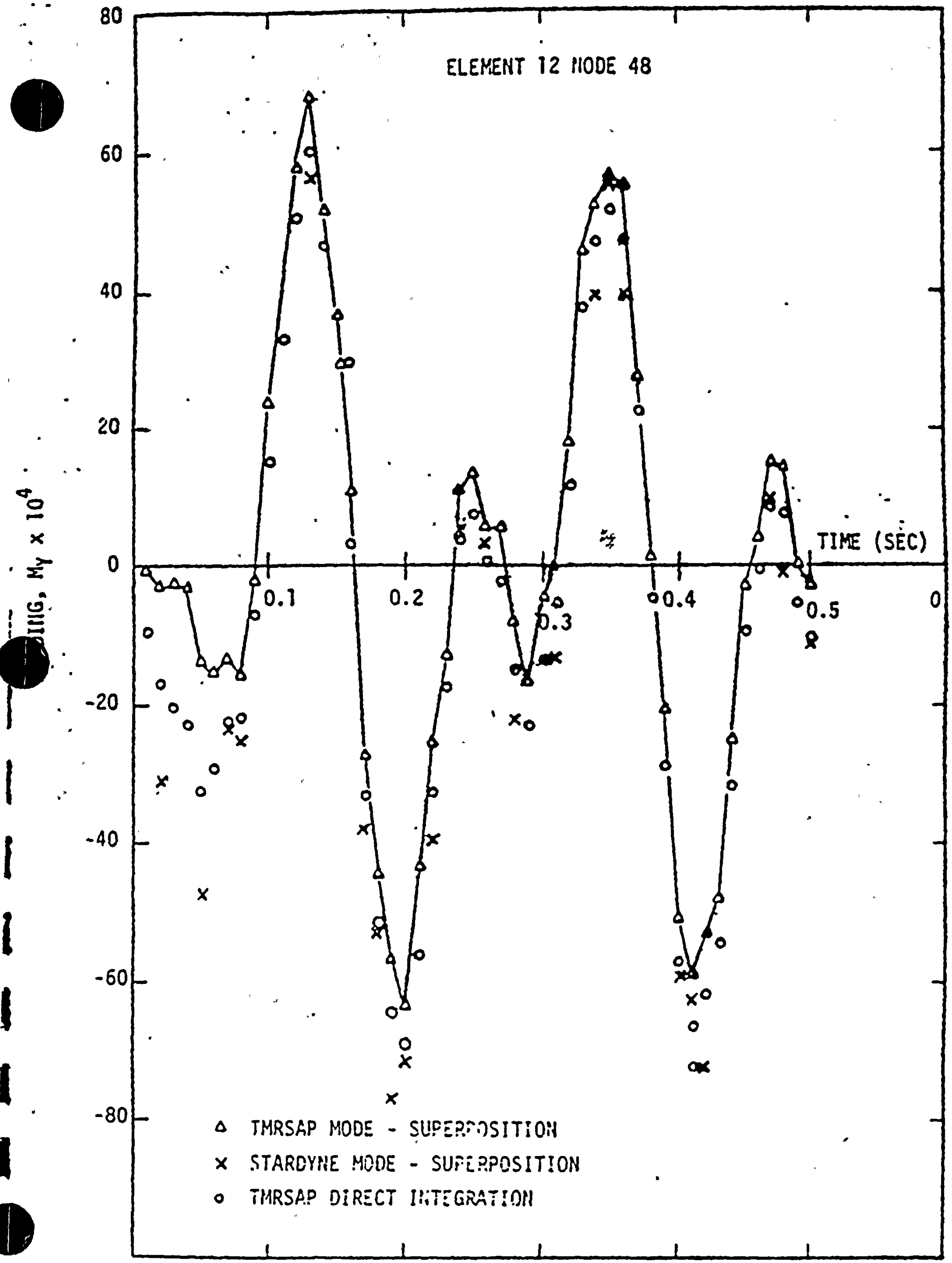

Figure 4.14-7 Time History Response Node 48 - Bending M_y

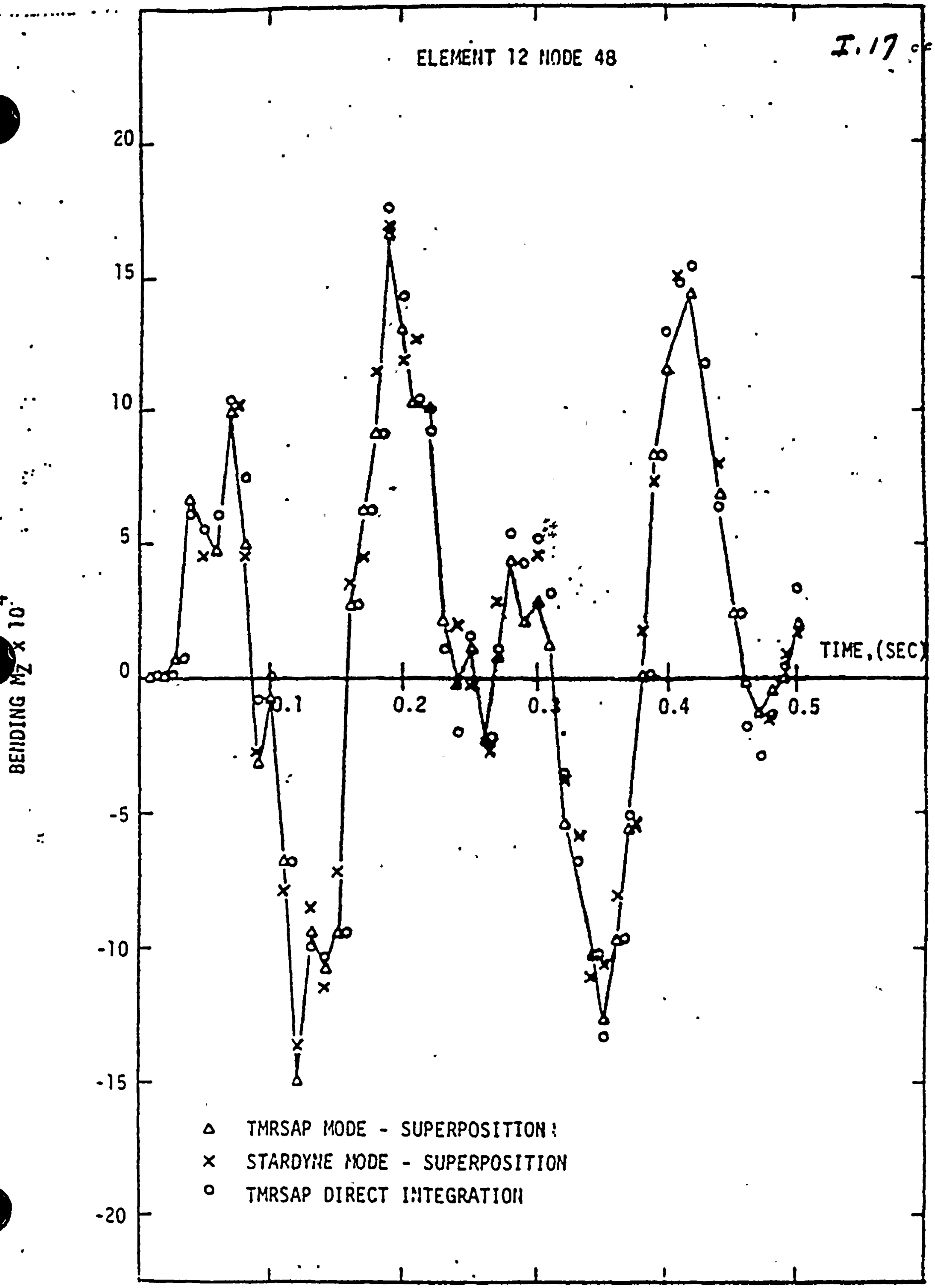

Figure ... Time History Response Node 48 Bending M

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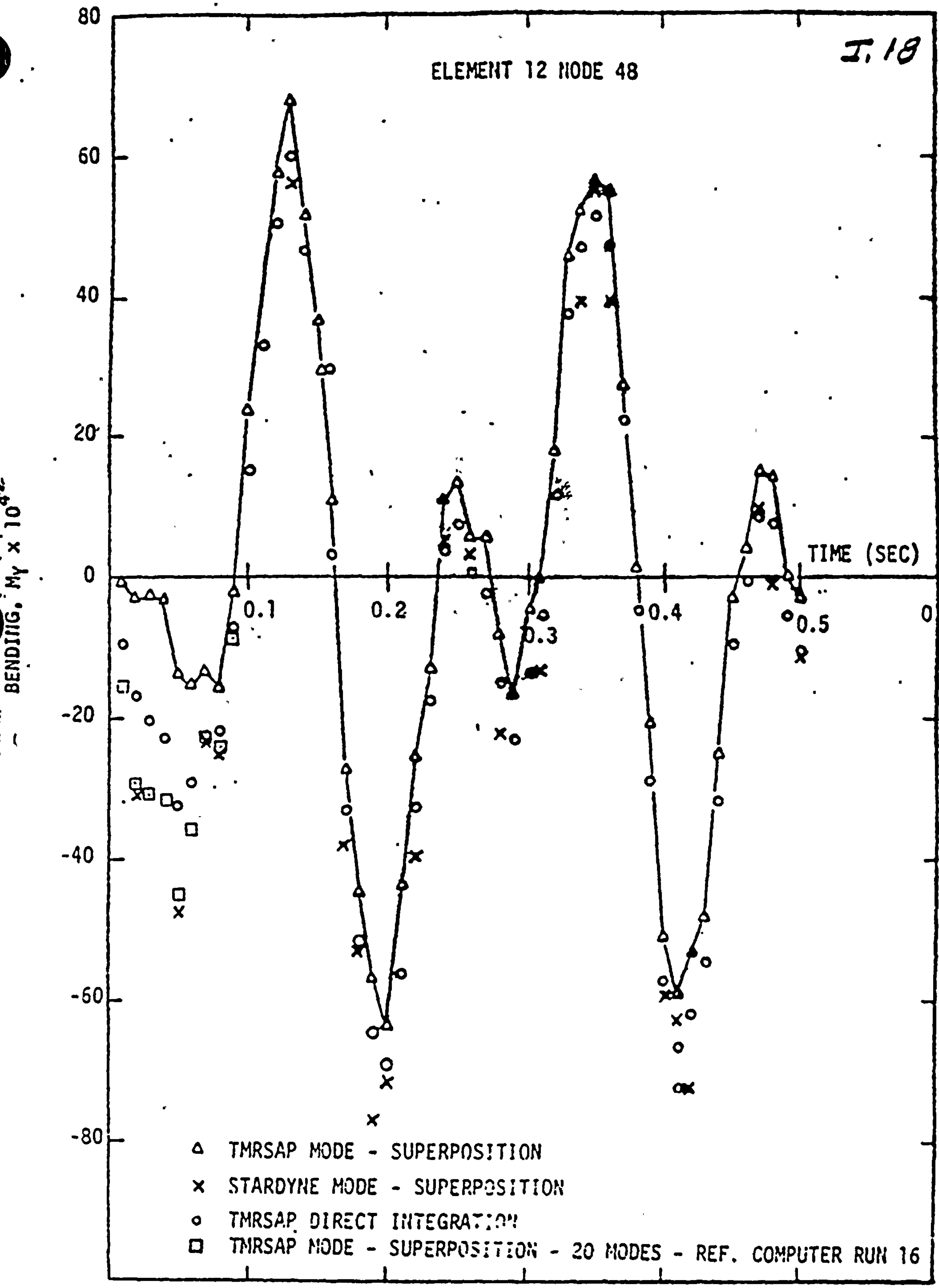
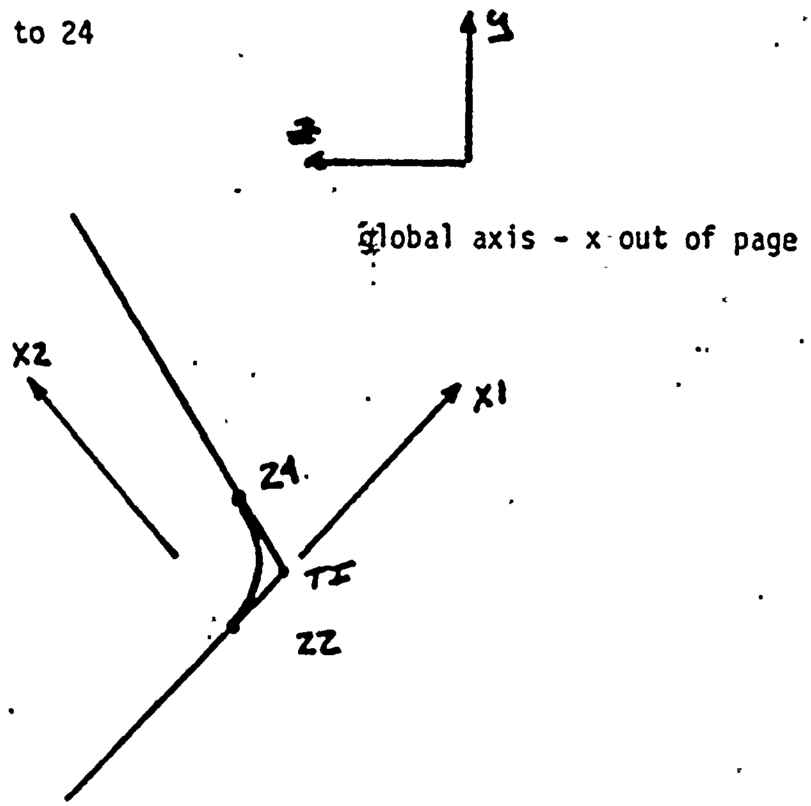


Force Transformation - Mode Superposition

A sample calculation of the global forces is shown for element #6 (Elbows) to show the correctness of the global forces. This calculation is made at only one time step. The method used in this hand calculation is not the method used in the TMRSAP program, but should yield identical results.

ELEMENT #6 Node 22 to 24



Coordinates of TI

X = 0.0
y = 118.752
z = -207.756

from Computer Reference #14

I, 20 or 26

Coordinates of Node 22

$$x = 0.0$$
$$y = 118.6384$$
$$z = -196.7355$$

Coordinates of Node 24

$$x = 0$$
$$y = 126.5451$$
$$z = -215.5491$$

Direction of X1 Vector $\left\{\text{Coordinates of TI - Coordinates of 22}\right\}$

$$X1 = \begin{Bmatrix} 0. & - & 0 \\ 118.752 & - & 118.6384 \\ -207.756 & - & -196.7355 \end{Bmatrix} = \begin{Bmatrix} 0.0 \\ 0.1136 \\ -11.0205 \end{Bmatrix}$$

Unit vector of X1

$$= \begin{Bmatrix} 0.0 \\ 0.010307 \\ -.9999468 \end{Bmatrix}$$

Vector from 22 to 24, YZ

$$YZ = \begin{Bmatrix} 0. & - & 0.0 \\ 126.5451 & - & 118.6384 \\ -215.5491 & - & -196.7355 \end{Bmatrix} = \begin{Bmatrix} 0.0 \\ 7.9067 \\ -18.8136 \end{Bmatrix}$$

Direction of X3 (local Z axis)

$$X3 = \left\{X1\right\} \times \left\{YZ\right\}$$

$$= \begin{Bmatrix} 7.7123 \\ 0.000 \\ 0.000 \end{Bmatrix}$$

Unit Vector X3

$$\begin{Bmatrix} 1.0 \\ 0. \\ 0. \end{Bmatrix}$$

X2 Vector (local Y Axis)

$$X2 = \{X3\} \times \{X1\}$$

$$= \begin{Bmatrix} 0.0 \\ .9999468 \\ 0.010307 \end{Bmatrix}$$

$$F_G = L^{-1} F'$$

F' - local axis forces

L - Transformation matrix

$$L^{-1} = \left[X1 : X2 : X3 \right]$$

$$= \begin{bmatrix} 0.0 & 0.0 & 1.0 \\ 0.010307 & .9999468 & 0.0 \\ -.9999468 & .010307 & 0.0 \end{bmatrix}$$

At $t = 0.74$ sec

$$F' = \begin{Bmatrix} -3952 \\ -3082 \\ +629.8 \end{Bmatrix}^*$$

$$F_G = L^{-1}F' = \begin{Bmatrix} 629.8 \\ -3122.56 \\ 3920.0 \end{Bmatrix}$$

* Note sign convention of local I end forces are reversed.

$$M' = \begin{Bmatrix} 8328. \\ -120949 \\ 34840 \end{Bmatrix}$$

M' - Local axis moments

M_G - Global axis moments

$$M_G = L^{-1}M' = \begin{Bmatrix} 3480. \\ -120183. \\ -9575.7 \end{Bmatrix}$$

J-end Calculation

Direction of X1 vector coord. of 24-TI

$$= \begin{Bmatrix} 0.0 \\ 7.7931 \\ -7.7931 \end{Bmatrix}$$

Unit vector of X1

$$\begin{Bmatrix} 0.0 \\ 0.707106 \\ -.707106 \end{Bmatrix}$$

Unit vector of X3 is the same as at I end

$$X3 = \begin{Bmatrix} 1.0 \\ 0.0 \\ 0.0 \end{Bmatrix}$$

X2 vector (local y axis at J-end)

$$X2 = \{X3\} \times \{X1\} = \begin{Bmatrix} 0.0 \\ .707106 \\ .707106 \end{Bmatrix}$$

$$L'_{jend} = \begin{bmatrix} 0.0 & 0.0 & 1.0 \\ 0.707106 & .707106 & 0. \\ -.707106 & .707106 & 0. \end{bmatrix}$$

at t=0.74 sec

$$F'_{jend} = \begin{Bmatrix} 4980. \\ -563.7 \\ -629.8 \end{Bmatrix}$$

$$F_G = L'F' = \begin{Bmatrix} -629.8 \\ 3122.79 \\ -3919.98 \end{Bmatrix}$$

$$M'_{jend} = \begin{Bmatrix} 7393.0 \\ 80420. \\ -62600. \end{Bmatrix}$$

$$M_{G_{jend}} = L'M'. = \begin{Bmatrix} -62600. \\ 109141.8 \\ 4589.11 \end{Bmatrix}$$

Check of REsultant Moment (RMS)

t= 0.74 sec, element #6, J end

$$M_{RMs} = \sqrt{M_X^2 + M_Y^2 + M_Z^{\ 2}}$$

$$= \left((62,600)^2 + (109,141.8)^2 + (4589.11)^2 \right)^{1/2}$$

$$= 125,903 \text{ lb-in}$$

The foregoing values agree with the TMRSAP computer output problem FTMS1.

I.24

Check of Stress Summary

Stress is calculated at a selected point to show the method of the stress calculation in time history analysis. The method is identical to the static analysis method, but the user should be aware that the maximum bending and torsional moments are used.

Element #1 I End

T_{max} = 109,000 lb-in   Computer Reference #14

M_y = 78910 lb-in

M_Z = 561400 lb-in

O.D = 18"   tw = .562" (wall thickness)

I = 1172.78in^4 S = 130.19 in^3 J = 2343.5in^4

Torsion

$$\sigma_T = \frac{Tc}{J} = \frac{(109{,}000)\ (9)}{2343.5} = 418.6 \text{ psi}$$

In-Plane, out of plane

$$M_{\text{out of plane}} = \sqrt{M_Y^2 + M_Z^2} = 566918.6 \text{ lb-in.}$$

$$\sigma_{B \text{ out of plane}} = \frac{M}{S} = \frac{566918.6}{130.19} = 4354.5 \text{ psi}$$

Combine Stress

$$M_{RMS} = \sqrt{T^2 + M_Y^2 + M_Z^2} = 577302.1 \text{ lb-in}$$

$$\sigma \text{ combined} = \frac{577302.12}{130.19} = 4434.3$$

These values agree with the TMRSAP computer output, problem FTMS1.

FORCE TRANSFORMATION - DIRECT INTEGRATION

A sample calculation of the global forces is shown for element No. 6 (elbow) to demonstrate the correctness of the global forces. This calculation is made at only one time step. The method used in this hand calculation is not the method used in the TMRSAP program, but should yield identical results. The transformation matrices are the same as those used for the hand calculation of global forces for the mode superposition analysis, page 70.

I end   T = 0.74 sec

$$F' = \begin{Bmatrix} -4098. \\ -3710. \\ -30.02 \end{Bmatrix}^{*}$$

$$F_G = L^{-1} F' = \begin{Bmatrix} -30.02 \\ -3751.92 \\ 4059.3 \end{Bmatrix}$$

$$M' = \begin{Bmatrix} -3975. \\ -103700 \\ 18800 \end{Bmatrix}^{*}$$

$$M_G = L^{-1} M' = \begin{Bmatrix} 18800. \\ -103735.4 \\ 2905.95 \end{Bmatrix}$$

*Note: The sign convention is reversed for local forces at the I end.

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J end   T = 0.74

$F' = \begin{Bmatrix} 5524. \\ -217.7 \\ 30.02 \end{Bmatrix}$ $M' = \begin{Bmatrix} 75670. \\ 71900 \\ -57290 \end{Bmatrix}$

$F_G = L^{-1} F'$ $M_G = L^{-1} M'$

$F_G = \begin{Bmatrix} 30.02 \\ 3752.1 \\ -4059.99 \end{Bmatrix}$ $M_G = \begin{Bmatrix} -57290. \\ 104347.6 \\ -2665.79 \end{Bmatrix}$

Check of Resultant Moment @ t = .74, element No. 6, I end

$$M_{RMS} = \sqrt{Mx^2 + My^2 + Mz^2} = 119070.16$$

These values agree with the TMRSAP computer output, problem FTDI1.

ATTACHMENT II

MODELLING METHODS

QUESTION 16-2

TMRSAP

The structural analysis of the pressurizer safety and relief valve discharge line analysis was performed using the TMRSAP computer code. A description of the methods used in this program and how this program was verified for use in this type of analysis is presented in the verification manual for this program. Pertinent excerpts from this verification manual are presented in ATTACHMENT I

METHODS OF ANALYSIS

The piping model connections to the pressurizer and the quench tank were assumed to be rigid. At each nozzle the pipe was assumed to be restrained translationally and rotationally in all directions

The valves were modeled as straight pipe with the length of the valve, twice the o.d of the attached piping, a thickness which is one inch thicker than the attached pipe with the total weight of the valve and operator located at the C.G position specified on the valve dwg.

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Enclosure 1

ATTENDANCE AT 6/26/85 MEETING

P. Barrett	AEP, Safety and Licensing
P. Infanger	AEP, Safety and Licensing
M. Imhoff	AEP, Safety and Licensing
B. Svensson	Cook Plant
J. Feinstein	AEP, Nuclear Safety & Licensing
D. Hahn	MDPH - Rad. Health Div., St. of Michigan
D. Wigginton	NRC - NRR - ORB#1
R. Emch	NRC - TSIP
J. Heller	Resident Inspector
A. Auvil	AEP, Safety & Licensing
W. Smith, Jr.	Cook Plant
K. Baker	Cook Plant
M. Ackerman	AEP, Safety & Licensing
E. Witaker	Cook Plant
D. Butterfield	CECo*
S. Wigginton	USNRC

* Chairman of the Westinghouse Owners Group

Enclosure 2

GUIDELINES FOR SIMPLIFICATION AND MODIFICATION OF THE TECHNICAL SPECIFICATIONS FOR THE DONALD C. COOK NUCLEAR PLANT

- REGULATORY AND INDUSTRY IMPACT ON FORMAT
- CONTENT OF REVISED TECHNICAL SPECIFICATIONS
- IMPLEMENTATION OF PROGRAM
- WRITER'S GUIDE

TECHNICAL SPECIFICATION CATEGORIES REQUIRED BY 10 CFR 50.36:

1) DEFINITIONS
2) SAFETY LIMITS AND LIMITING SAFETY SYSTEM SETTINGS
3) LIMITING CONDITIONS FOR OPERATION
4) SURVEILLANCE REQUIREMENTS
5) DESIGN FEATURES
6) ADMINISTRATIVE CONTROLS

BASES SECTION MAY CONTAIN:

1) INTERPRETATIONS OF TECHNICAL SPECIFICATIONS
2) ALTERNATVIES TO SURVEILLANCE REQUIREMENTS
3) LISTS OF EQUIPMENT AND INSTRUMENTS
4) LISTS OF SUPPORT SYSTEMS
5) SETPOINTS, INSTRUMENT RANGES, ETC., TO SPECIFY ACCEPTABLE PERFORMANCE

PURPOSE OF THE BASES SECTION:

1) DESCRIBE SAFETY IMPORTANCE OF THE PIECE OF EQUIPMENT AND PLACE IT INTO ONE OF THE FOUR SAFETY CATEGORIES.

2) STATE HOW THE SAFETY PERFORMANCE IS TO BE MEASURED, INCLUDING REASONS FOR SPECIFIC PARAMETERS.

3) DESCRIBE ALTERNATIVE METHODS OF DEMONSTRATING SAFETY.

4) PROVIDE OTHER INFORMATION USEFUL IN INTERPRETING TECHNICAL SPECIFICATIONS.

REORGANIZING THE TECHNICAL SPECIFICATIONS:

PROBLEM: REQUIREMENTS FOR A SINGLE SYSTEM ARE OFTEN SCATTERED THROUGHOUT THE DOCUMENT.

SOLUTION: ORGANIZE THE TECHNICAL SPECIFICATIONS ON THE BASIS OF EQUIPMENT.

ADVANTAGES:
1) SAVE TIME FOR USERS OF THE DOCUMENT.
2) HELP IN REMOVING OVERLAPPING REQUIREMENTS.

SAFETY CATEGORIES

ALL EQUIPMENT FALLS INTO ONE OF THE FOLLOWING CATEGORIES:

1. Equipment which is absolutely essential for safety, as described in the Safety Limits section of our present T/S's. Deletion of requirement for this equipment could result in an unreviewed safety question.

2. Equipment for which sufficient redundancy exists so that multiple failures of the same equipment must occur in order to create a safety problem. Repair time for equipment in this category would usually be one week.

3. Equipment whose failure alone would not create a safety problem. However, a safety problem could result from a combination of 1) a design-basis accident and 2) an additional outside event such as fire, severe natural phenomena, loss of offsite power, or an NUREG-0737-type accident. Repair time for equipment in this category would usually be one month.

4. Equipment that does not constitute a basis for safety and for which no specific action is required. Failure of equipment in this category will not result in a safety problem unless accompanied by 1) a low-probability event and 2) failure of redundant equipment. Repair time for equipment in this category shall be based on agreements between the plant operators and regulatory authorities.

R	T/S	3.4.6.2	RCS--OPERATIONAL LEAKAGE
[illegible]	T/S	3.4.9.3	OVERPRESSURE PROTECTION SYSTEMS
[illegible]	T/S	3.4.11	RELIEF VALVES OPERATING

THERE ARE 5 ITEMS REFERENCED FOR SYS 12

HONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
13 STEAM GENERATORS

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
R	T/S	3.3.3.9	RADIOACTIVE LIQUID EFFLUENT INSTRUMENTATION
*	T/S	3.4.1.1	RCS LOOPS--STARTUP AND POWER OPERATION
*	T/S	3.4.1.2	RCS LOOPS--HOT STANDBY
*	T/S	3.4.1.3	RCS LOOPS--SHUTDOWN
*	T/S	3.4.1.4	RCS LOOPS--THREE LOOP OPERATION
*	T/S	3.4.5	STEAM GENERATORS
R	T/S	3.4.6.2	RCS--OPERATIONAL LEAKAGE
R	T/S	3.6.3.1	CONTAINMENT ISOLATION VALVES
R	T/S	3.7.1.1	SECONDARY SAFETY VALVES
R	T/S	3.7.1.2	AUXILIARY FEEDWATER SYSTEM
R	T/S	3.7.1.5	STEAM GENERATOR STOP VALVES
*	T/S	3.7.2.1	STEAM GENERATOR PRESSURE/TEMPERATURE LIMITS
R	T/S	3.7.7.1	SNUBBERS

THERE ARE 15 ITEMS REFERENCED FOR SYS 13

HONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
14 REACTOR COOLANT PUMPS

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
2	T/S	3.1.1.3	BORON DILUTION
R	T/S	3.1.3.4	ROD DROP TIME
*	T/S	3.4.1.1	RCS LOOPS--STARTUP AND POWER OPERATION
*	T/S	3.4.1.2	RCS LOOPS--HOT STANDBY
*	T/S	3.4.1.3	RCS LOOPS--SHUTDOWN
*	T/S	3.4.1.4	RCS LOOPS--THREE LOOP OPERATION
R	T/S	3.4.6.2	RCS--OPERATIONAL LEAKAGE
R	T/S	3.4.10.1	RCS--STRUCTURAL INTEGRITY (ASME CLASS 1,2,3)
R	T/S	3.6.3.1	CONTAINMENT ISOLATION VALVES
R	T/S	3.7.1.1	SECONDARY SAFETY VALVES
R	T/S	3.7.7.1	SNUBBERS
R	T/S	3.7.9.2	SPRAY AND/OR SPRINKLER SYSTEMS
R	T/S	5.7.1	COMPONENT CYCLIC OR TRANSIENT LIMIT

THERE ARE 15 ITEMS REFERENCED FOR SYS. 14

HONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
15 REACTOR COOLANT SYSTEM VENTS

SIGNIF. ITEM NO. REFERENCED ITEM

TECHNICAL SPECIFICATION CLARIFICATION

1) MEET WITH NRC TO DISCUSS PROPOSED GUIDELINES.

2) COMPILE A CROSS-REFERENCE LIST.

3) SUBMIT A TABLE OF CONTENTS.

4) WRITE SAMPLE TECHNICAL SPECIFICATIONS AND BASES.

5) WRITE ALL LIMITING CONDITIONS FOR OPERATION AND BASES.

6) WRITE SAMPLE ACTION STATEMENTS AND SURVEILLANCE REQUIREMENTS.

7) REWRITE TECHNICAL SPECIFICATION SECTIONS 1-5.

8) DEVELOP PROGRAM FOR ADMINISTRATIVE CONTROLS SECTION.

PURPOSE OF THE WRITER'S GUIDE:

1) OBSERVE PRINCIPLES IN THE GUIDELINES.

2) PRODUCE A CLEAR, COHERENT SET OF TECHNICAL SPECIFICATIONS.

3) WRITE TECHNICAL SPECIFICATIONS THAT ENSURE SAFETY BUT ARE NOT BURDENSOME.

STEPS IN REWRITING INDIVIDUAL SPECIFICATIONS:

1) EXAMINE ALL EXISTING SPECIFICATIONS PERTAINING TO ONE PIECE OF EQUIPMENT.

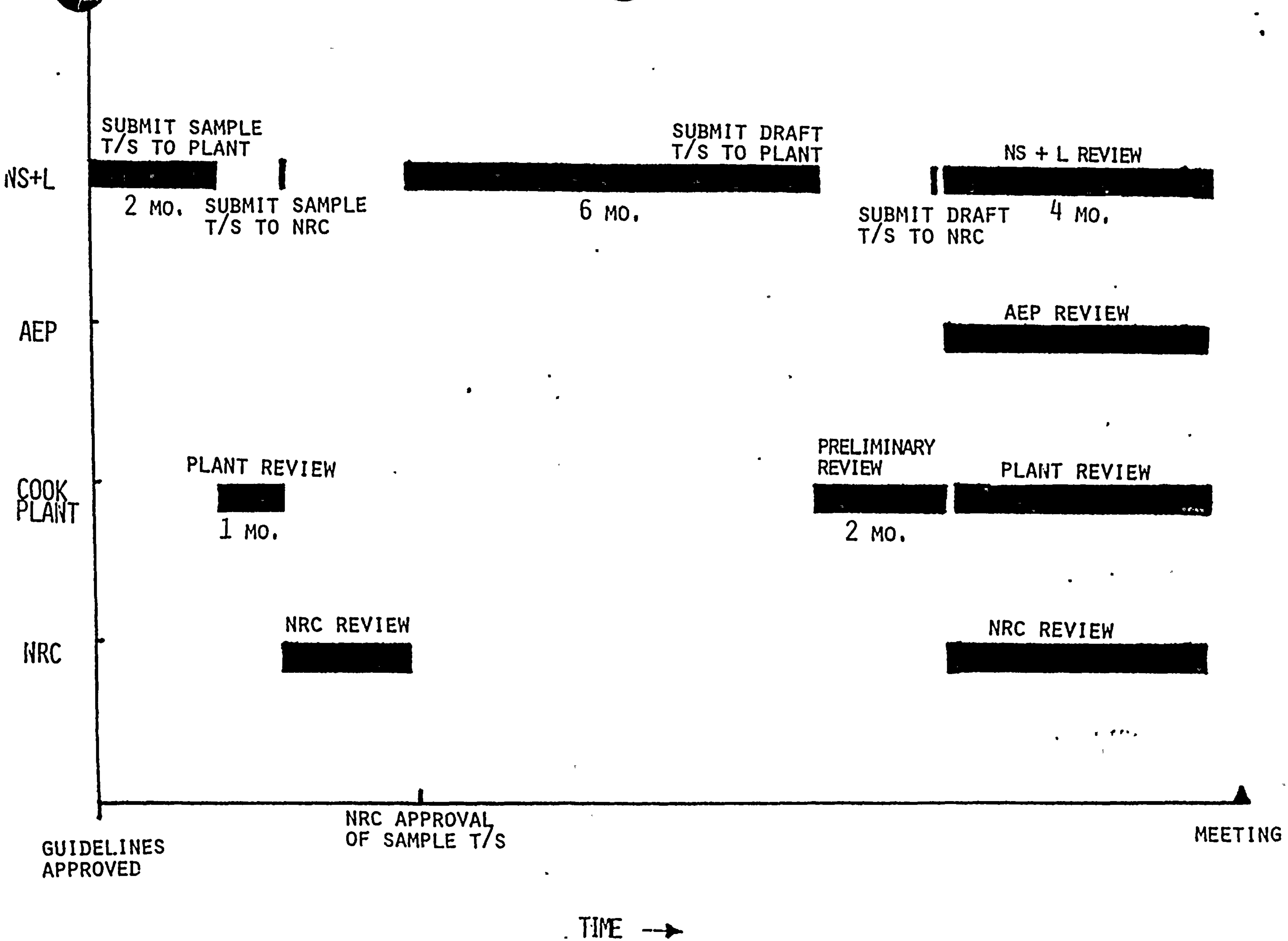
2) DESCRIBE METHODS FOR DEMONSTRATING HOW THAT PIECE OF EQUIPMENT MEETS ITS SAFETY REQUIREMENTS.

3) WRITE LIMITING CONDITION FOR OPERATION, WHICH NORMALLY DEFINES THE SAFETY BASIS IN THE OPERATOR'S TERMS.

4) LIST SUPPORT SYSTEMS IN ORDER TO DEFINE THE OPERABILITY OF THE BASE SYSTEM.

5) WRITE ACTION STATEMENTS AND SURVEILLANCE REQUIREMENTS. MANY DETAILS OF THE SURVEILLANCE REQUIREMENTS WILL BE PLACED IN OTHER DOCUMENTS.

SCHEDULE FOR TECHNICAL SPECIFICATION SIMPLIFICATION PROGRAM



Enclosure 3

DRAFT

Guidelines For Simplification

And Modification of the

Technical Specifications for the

Donald C. Cook Nuclear Plant

Unit Nos. 1 and 2

Table of Contents

I. Purpose and Scope

A. Introduction

The purpose of this document is to provide administrative and technical guidance for the preparation and proposed modification of Technical Specifications for the Donald C. Cook Nuclear Plant. The regulatory requirements for Technical Specifications are contained in Title 10 of the Code of Federal Regulations, Part 50.36. The guidance provided herein is to be consistent with 10 CFR 50.36, and is intended to form a coherent basis for the simplification of the Technical Specifications for the Donald C. Cook Nuclear Plant.

The Technical Specifications should represent the minimum requirements necessary to ensure the common defense and security, the continued health and safety of the public, and the protection of the environment. The simplified Technical Specifications must meet the requirements of all published regulations, and do so in such a manner that there is a common level of understanding between the plant designers, operators, and regulators as to the meaning of each individual specification.

B. Regulatory and Industry Impact on Format

The purpose of this section is to provide general information regarding the anticipated format of the revised Technical Specifications. Specific information is provided later in a section entitled "Writer's Guide."

1. Regulatory Impact on Format

The generic categories required by 10 CFR 50.36 are:

- Definitions
- Safety Limits and Limiting Safety System Settings
- Limiting Conditions For Operations
- Surveillance Requirements
- Design Features
- Administrative Controls

In addition to the above, the T/S's are accompanied by a Bases section, which, in accordance with 10 CFR 50.36, is not officially a part of the Technical Specifications. The Bases are approved by the Office of Nuclear Reactor Regulation, however, and thus form an integral part of the licensing and compliance basis with the Technical Specifications and Plant Operating Procedures. As such, the Bases section is a summary statement of the bases or reasons for the Technical Specifications, and may contain:

- interpretations of T/S's
- alternatives to T/S Surveillance Requirements (only if allowed by the specific T/S),
- lists of equipment, components, and/or instruments directly subject to the specific T/S requirement,
- lists of attendant systems, components, and/or instruments required to function in order to ensure safety if that is not clear from the specification itself,
- explanation, justification, or purpose of the T/S's,
- setpoints, instrument ranges, performance curves, etc, if necessary to specify acceptable performance or capability,
- additional information that may clarify the T/S's.

2. Industry Activities

The Westinghouse Owners Group (WOG) is currently working with proposed changes to the format and content of Technical Specifications. Although AEP is currently working closely with the WOG, this activity is considered separate from that effort. However, it is noted that this document may be revised based on WOG-associated activity.

3. Regulatory Guidance

NUREG-0452, Rev. 4, "Standard Technical Specifications for Westinghouse Pressurized Water Reactors," provides specific guidance on the currently acceptable format for preparing and modifying Standard Technical Specifications (STS). Revision 5 has been issued for comment and may provide additional guidance as appropriate. From time to time, the NRC will issue additional guidance documents on preparation of Technical Specifications. These guidance documents are handled on a case-by-case basis in responding to the NRC concern. The revision to the D. C. Cook Plant's T/S's will incorporate many but not all of the features of the STS's.

4. Approval Requirements for Revised Technical Specifications

In order to be useful, the revised T/S's must be consistent with the construction, design, and operation of the plant. Technical Specifications that are generic in nature, but do not have clear and specific applicability to the Donald C. Cook Nuclear Plant, must be changed as necessary for this purpose. Both plant personnel and regulatory authorities must clearly understand the meaning of the document.

In order to provide a coherent set of guidelines, the Technical Specifications, the Bases, and existing plant procedures must be well integrated. The requirements for safety, as defined in the Bases, will match on an item-by-item basis the individual T/S's. The Limiting Conditions for Operation will state minimum conditions expected for component operation. If an alternative method of meeting an LCO is stated in the Bases, then meeting this alternative is considered acceptable. The same logic is true for Surveillance Requirements. All Surveillance Requirements are implemented by plant procedures, and are considered sufficient to demonstrate compliance with the LCO's. If an alternative to the LCO or surveillance is required, it is expected that a plant procedure can be written to implement the alternative. The utility can determine the basis for that procedure as meeting the minimum requirements for safety without prior NRC approval. Although changes to the Bases require NRC approval, they are not considered license amendments, as are T/S changes.

This table summarizes the types of approval required for changes to the following documents:

	T/S's	Bases	Procedures
Subject to Inspection and Enforcement	X	X	X
Require Prior NRC Approval	X	X	
Require Formal License Amendment	X		

C. Content of Revised Technical Specifications

1. Definitions

Technical Specification definitions provide a common reference for operators, engineers, and regulatory authorities. Definitions must be written with sufficient clarity so that anyone in any of these categories will interpret them in the same way. Special emphasis should be placed on providing clear and precise definitions for words and phrases that are commonly used by one of these groups but whose meaning may not be immediately clear to other users of the T/S document.

Defined words, when used as defined in the Definitions, are written in all capital letters in the T/S's. When a defined word is not written in all capital letters, its meaning is defined in the context.

2. Safety Limits and Limiting Safety System Settings

10 CFR 50.36(c)(1)(i)(A) states:

> "Safety limits for nuclear reactors are limits upon important process variables which are found to be necessary to reasonably protect the integrity of certain of the physical barriers which guard against the uncontrolled release of radioactivity. If any safety limit is exceeded, the reactor shall be shut down. The licensee shall notify the Commission, review the matter and record the results of the review, including the cause of the condition and the basis for corrective action taken to preclude reoccurrence. Operation shall not be resumed until authorized by the Commission."

In accordance with the Regulation, if any of these limits are exceeded, the reactor must be shut down (the Action Statements require this), a review performed and recorded which includes the cause and corrective action, and operation not resumed until the approval to do so is provided by the Commission.

In general, the equipment described in the Safety Limits corresponds to Safety Category 1, defined in Attachment 2. Specific plant numbers, limits, settings, etc. for this section must appear in the T/S's. This section of the T/S's has a Basis, but it is currently reserved for a statement of the reason for the specification. However, we plan to move such data as setpoints from this section to the Bases.

3. <u>Limiting Conditions For Operation (LCO's) and Surveillance Requirements</u> (SR's)

10 CFR 50.36(c)(2) states in part:

> "Limiting conditions for operation are the lowest functional capability or performance levels of equipment required for safe operation of the facility. When a limiting condition for operation of a nuclear reactor is not met, the licensee shall shut down the reactor or follow any remedial action permitted by the technical specification until the condition can be met. The licensee shall notify the Commission, review the matter, and record the results of the review, including the cause of the condition and the basis for corrective action taken to preclude reoccurrence."

10 CFR 50.36(c)(3) states:

> "Surveillance requirements are requirements relating to test, calibration, or inspection to assure that the necessary quality of systems and components is maintained, that facility operation will be within the safety limits, and that the limiting conditions of operation will be met."

In accordance with 10 CFR 50.36, our present T/S Section 3/4 includes the following required parts:

1. Title

2. Limiting Conditions for Operation

3. Applicability (specific; usually the appropriate mode)

4. Action

5. Surveillance Requirement

The General Applicability Section is divided into those related to LCO's (3.0.1 thru 3.0.5) and those related to Surveillance Requirements (4.0.1 thru 4.0.5). Modifications to General Applicability sections are uncertain at this time. As the T/S clarification program proceeds, it may be necessary to modify these sections also.

The titles in total represent the equipment required for safe operation of the facility. Together with the Limiting Conditions for Operation, they represent the <u>lowest</u> functional capability or performance levels required.

The STS's further divide the combined section into twelve subsections covering a variety of areas. Since this necessarily results in multiple T/S's for the same equipment in different sections, it leads to confusion. In light of our proposed system-oriented approach it is anticipated that, if subgrouping is required, it will not follow the STS format but will be as follows:

1. Requirements in modes 1 - 6.

2. Special test exceptions.

3. Specifications required at all times.

To the extent possible, the following principles should be observed in preparing and modifying the T/S's:

- Technical Specifications for systems should include all related T/S requirements together without further need to cross-reference to other sections.

- Limiting Conditions for Operation define the minimum requirements for safety. Compliance with these minimum requirements can be demonstrated by alternative methods described in the Bases.

- Applicability or modes should be limited to the LCO.

- Action Statements should address actions associated with an LCO to ensure that safety requirements can be maintained. The Action Statements will not require placing the plant in an unsafe condition.

- Action Statements allow time to return the system to service or take some action intended to return the level of safety lost by the failure. Reductions in power or plant shutdown are transients which depend upon equipment to start and operate; unwarranted transients are therefore to be avoided. Time to implement Action Statements will be commensurate with the safety function and level of risk to the public health and safety. Guidelines for acceptable times are discussed in Attachment 2 under "safety categories."

- If alternative actions are available and have been approved by the NRC, an "or equivalent" statement will be included in the corresponding Bases section. The T/S should be worded or annotated to indicate that alternatives are available. Plant procedures will detail how the alternative is to be carried out. NRC approval of the procedures is not a usual practice.

- Lists of equipment, instruments, etc. should be included in the Bases section or be referenced in that section to another document.

- With regard to instrumentation, the Technical Specification will, in general, state the limit to be read by the operator on an instrument. The Basis will state the minimum requirement for safety without taking uncertainties into account. The Basis will also account for differences between the LCO and the minimum requirement for safety. If the Limiting Condition for Operation (actual reading) has been exceeded, but the minimum requirement for safety (as stated in the Basis) has not, then plant safety shall not be considered compromised.

- To the extent possible, Surveillance Requirements are not to duplicate other programmatic requirements (e.g., Section XI of ASME Boiler & Pressure Vessel Code for ISI and IST) if these requirements are covered by other T/S provisions.

- Surveillance intervals should be consistent with safety concerns but may be established in conjunction with proven maintenance intervals, scheduled outages such as refueling, or as may be determined by risk analyses or safety importance. Every effort will be made to maintain consistent safety intervals for similar safety functions.

- Surveillance Requirements relate to test, calibration, or inspection to ensure that the quality of the system is maintained, that operation is within safety limits, and that LCO's will be met. Acceptance criteria for the test, calibration, etc. may be included in the Bases section since these vary with plant modifications, new or different equipment, or approved changes in analysis or operation which could affect the acceptance criteria. Changing these values does not constitute a change in the Surveillance Requirement (to test, calibrate, inspect) of the T/S's.

- Surveillance intervals should be addressed only in the Surveillance Requirements section and not in the Action Statements section.

4. <u>Design Features</u>

10 CFR 50.36(c)(4) states in part:

> "Design features to be included are those features of the facility such as materials of construction and geometric arrangements, which, if altered or modified, would have a significant effect on safety and are not covered in the Safety Limits and Limiting Safety System Settings, LCO's or Surveillance Requirements."

It is not anticipated that changes will be necessary to these T/S's; therefore, no additional guidance is needed at this point. Nevertheless, this section will be reviewed once the LCO program is under way.

5. Administrative Controls

10 CFR 50.36(c)(5) states:

> "Administrative controls are the provisions relating to organization and management, procedures, recordkeeping, review and audit, and reporting necessary to assure operation of the facility in a safe manner."

This section is to be dealt with at a later stage in this program.

6. Bases

For each piece of equipment described in the Technical Specifications, there will be a corresponding Basis section which not only states the function of the piece of equipment but also explains how it performs its function. The Basis will also describe the safety importance of the piece of equipment in terms of the safety analysis and place it in one of the four safety categories defined in Attachment 2 of this document.

Futhermore, the Basis shall state how the safety performance is to be measured. The reasons for specific safety parameters are to be described and details of surveillance methods are to be provided. The Basis will describe the main methods of demonstrating that the piece of equipment meets its safety requirements, and it will also define alternative methods for demonstrating compliance, which are to be used when the main methods cannot be employed.

The Basis section may also contain other information which will be useful in interpreting the T/S to which it corresponds.

D. Proposed Method for Reorganization of Technical Specifications

One problem with the current T/S's is that requirements for a single piece of equipment are often scattered throughout the document. In order to make the document easier to use during operations, we propose to reorganize the T/S's on the basis of equipment. Consolidating all the T/S requirements for a single system in a single section of the document will result in two principal advantages: 1) Users of the document will save time otherwise lost in searching through it for related requirements. This is particularly important under emergency or accident conditions. 2) Juxtaposing all the requirements for a single system will help in removing competing and overlapping requirements.

One way to achieve this system-oriented organization is to reduce the current divisions of Section 3/4 to a single section listing all the systems and their T/S's. The Bases will be reorganized in an identical manner.

While many factors will have to be taken into consideration in developing a comprehensive list of systems for such a T/S reorganization, a sample list based on the current T/S organization follows.

Proposed List of Technical Specification Systems

1 REACTOR CORE
2 MOVABLE CONTROL ASSEMBLIES
3 FUEL ASSEMBLIES
4 ROD POSITION INDICATOR (RPI) INSTRUMENTATION
5 MOVABLE IN-CORE DETECTORS
6 THERMOCOUPLES
7 REACTOR COOLANT SYSTEM
8 REACTOR PRESSURE VESSEL
9 PRESSURIZER
10 PRESSURIZER RELIEF TANK (PRT)
11 SAFETY VALVES
12 RELIEF VALVES
13 STEAM GENERATORS
14 REACTOR COOLANT PUMPS
15 REACTOR COOLANT SYSTEM VENTS
16 EMERGENCY CORE COOLING SYSTEM
17 ACCUMULATORS
18 BORON INJECTION TANK
19 REFUELING WATER STORAGE TANK
20 CENTRIFUGAL CHARGING (CC) SYSTEM--EAST
21 CENTRIFUGAL CHARGING (CC) STSTEM--WEST
22 SAFETY INJECTION (SI) SYSTEM--NORTH
23 SAFETY INJECTION (SI) SYSTEM--SOUTH
24 RESIDUAL HEAT REMOVAL (RHR) SYSTEM--EAST
25 RESIDUAL HEAT REMOVAL (RHR) SYSTEM--WEST
26 CHEMICAL AND VOLUME CONTROL SYSTEMS (CVCS)
27 CVCS BORON MAKE-UP
28 CVCS BORON HOLD-UP
29 CVCS BORIC ACID EVAPORATOR PACKAGE--NORTH
30 CVCS BORIC ACID EVAPORATOR PACKAGE--SOUTH
31 CVCS REACTOR LETDOWN AND CHARGING
32 VOLUME CONTROL TANK (VCT)
33 CVCS COOLANT DEMINERALIZATION
34 WASTE DISPOSAL SYSTEM
35 NORMAL SAMPLING SYSTEM
36 POST-ACCIDENT SAMPLING SYSTEM
37 SECONDARY STEAM CYCLE SYSTEMS
38 TURBINE AUX. COOLING SYSTEM
39 SECONDARY SAFETY VALVES
40 CONDENSATE STORAGE TANK (CST)
41 STEAM GENERATOR STOP VALVES (MSIV'S)
42 MAIN FEEDWATER SYSTEM--EAST
43 MAIN FEEDWATER SYSTEM--WEST
44 AUX. FEEDWATER SYSTEM (MD)--EAST
45 AUX. FEEDWATER SYSTEM (MD)--WEST
46 AUX. FEEDWATER SYSTEM (TURBINE DRIVEN)
47 CONDENSERS
48 SECONDARY VENT AND DRAIN SYSTEM

49 CHEMICAL FEED SUB-SYSTEM
50 SERVICE WATER SYSTEMS
51 ESSENTIAL SERVICE WATER (ESW)--NORTH
52 ESSENTIAL SERVICE WATER (ESW)--SOUTH
53 NON-ESSENTIAL SERVICE WATER (NESW)--NORTH
54 NON-ESSENTIAL SERVICE WATER (NESW)--SOUTH
55 COMPONENT COOLING WATER (CCW) SYSTEM--EAST
56 COMPONENT COOLING WATER (CCW) STSTEM--WEST
57 MAKE-UP WATER SYSTEM
58 PRIMARY WATER SYSTEM--NORTH
59 PRIMARY WATER SYSTEM--SOUTH
60 CONTROL ROOM EMERGENCY VENTILATION SYSTEM
61 ESF VENTILATION SYSTEM--AES-1
62 ESF VENTILATION SYSTEM--AES-2
63 HYDRAULIC SNUBBERS
64 RADIATION SHIELDING
65 FIRE SUPRESSION SYSTEMS
66 FIRE SUPPRESSION WATER SYSTEM
67 SPRAY AND/OR SPRINKLER SYSTEMS
68 LOW PRESSURE CO2 SYSTEMS
69 HALON SYSTEM
70 PENETRATION FIRE BARRIERS
71 FIRE RATED ASSEMBLIES
72 FIRE HOSE STATIONS
73 ELECTRICAL POWER SYSTEMS
74 4160 VOLT SYSTEM--T11A & T11B
75 4160 VOLT SYSTEM--T11C & T11D
76 600 VOLT SYSTEM--11A & 11B
77 600 VOLT SYSTEM--11C & 11D
78 69 KV MANUAL ALTERNATE RESERVE SOURCE
79 DIESEL GENERATORS--AB
80 DIESEL GENERATORS--CD
81 120 VOLT AC SYSTEM--C1
82 120 VOLT AC SYSTEM--C2
83 120 VOLT AC SYSTEM--C3
84 120 VOLT AC SYSTEM--C4
85 250 VOLT DC SYSTEM--AB
86 250 VOLT DC SYSTEM--CD
87 250 VOLT BATTERY N SYSTEM
88 REFUELING OPERATIONS
89 SPENT FUEL POOL
90 SPENT FUEL COOLING AND CLEANUP SYSTEM
91 REFUELING CANAL DRAIN
92 SPENT FUEL POOL VENTILATION SYSTEM
93 REFUELING WATER PURIFICATION
94 MANIPULATOR CRANE
95 SPENT FUEL CASK HANDLING CRANE
96 CONTAINMENT SYSTEMS
97 CONTAINMENT VENTILATION SYSTEMS
98 CONTAINMENT VENTILATION SYSTEM
99 CONTAINMENT AIR RECIRCULATION SYSTEM--CEQ-1
100 CONTAINMENT AIR RECIRCULATION SYSTEM--CEQ-2
101 CONTAINMENT PRESSURE RELIEF SYSTEM
102 CONTAINMENT PURGE AND EXHAUST SYSTEM
103 CONTAINMENT AUX. CHARCOAL FILTER SYSTEM
104 HOT SLEEVE VENTILATION SYSTEM
105 ICE CONDENSER

106 ICE BED
107 ICE CONDENSER DOORS--LOWER INLET
108 ICE CONDENSER DOORS--INTERMEDIATE DECK
109 ICE CONDENSER DOORS--TOP DECK
110 ICE CONDENSER DRAIN
111 REFRIGERATION SYSTEM
112 INSULATED DUCT PANELS AND INSULATION
113 DIVIDER BARRIER SEALS
114 CONTAINMENT PENETRATIONS
115 PERSONNEL AND EQUIPMENT HATCH
116 CONTAINMENT ISOLATION VALVES
117 CONT. PENETRATION & WELD CHANNEL PRESSURIZATION
118 CONTAINMENT STRUCTURE
119 DEPRESSURIZATION AND COOLING SYSTEMS
120 SPRAY ADDITIVE SYSTEM
121 CONTAINMENT RECIRCULATION SUMP
122 CONTAINMENT SPRAY SYSTEM--EAST
123 CONTAINMENT SPRAY SYSTEM--WEST
124 COMBUSTIBLE GAS CONTROL
125 HYDROGEN ANALYZERS
126 HYDROGEN RECOMBINERS--HR-1
127 HYDROGEN RECOMBINERS--HR-2
128 DISTRIBUTED IGNITION SYSTEM
129 INSTRUMENTATION AND CONTROL SYSTEMS
130 MANUAL REACTOR TRIP
131 NEUTRON FLUX (POWER RANGE)
132 NEUTRON FLUX (INTERMEDIATE RANGE)
133 NEUTRON FLUX (SOURCE RANGE)
134 OVERTEMPERATURE DELTA T
135 OVERPOWER DELTA T
136 PRESSURIZER PRESSURE
137 PRESSURIZER WATER LEVEL
138 LOW REACTOR COOLANT FLOW
139 SAFETY INJECTION INSTRUMENTATION
140 TURBINE-GENERATOR
141 STEAM GENERATOR WATER LEVEL
142 CONTAINMENT SUMP INDICATION
143 CONTAINMENT HUMIDITY INDICATION
144 CONTAINMENT TEMPERATURE INDICATION
145 CONTAINMENT PRESSURE
146 CONTAINMENT RADIATION
147 ICE CONDENSER TEMPERATURE MONITORING INST.
148 ICE CONDENSER DOOR POSITION INDICATORS
149 SEALED SOURCE CONTAMINATION
150 FIRE DETECTION EQUIPMENT
151 METEOROLOGICAL INSTRUMENTATION
152 SEISMIC MONITORING
153 REFUELING WATER STORAGE TANK LEVEL INDICATORS
154 LIQUID EFFLUENT RADIATION MONITORING
155 GASEOUS EFFLUENT RADIATION MONITORING
156 RESISTANCE TEMPERATURE DETECTOR (RTD)--T HOT
157 RESISTANCE TEMPERATURE DETECTOR (TRD)--T COLD
158 AUX. FEEDWATER (AFW) FLOW RATE
159 RCS SUBCOOLING MARGIN MONITOR (SMM)
160 PORV INDICATION
161 BLOCK VALVE INDICATION
162 ACOUSTIC MONITOR

163	REACTOR COOLANT SYSTEM T AVG.
164	AXIAL FLUX DIFFERENCE (AFD) INDICATION
165	STEAM/FEEDWATER FLOW MISMATCH
166	REACTOR COOLANT PUMP BUSES
167	REACTOR COOLANT PUMP BREAKER POSITION
168	REACTOR TRIP BREAKER
169	STEAM LINE DELTA P
170	STEAM FLOW
171	STEAM LINE PRESSURE
172	4 KV BUS LOSS/DEGRADED VOLTAGE
173	LOSS OF MAIN FEEDWATER

II. Implementation of Program

Current Status and Future Steps in the Program

1. A sample T/S has been prepared and will soon be submitted to the NRC. The NRC's approval of our approach is required before we make a major commitment to the program.

2. The first step in making a T/S cross-reference list has been completed, and is included as Attachment 3.

3. The new Table of Contents of the T/S's will probably be similar to the list of systems in the Format section of these guidelines, once the list is finalized.

4. We will submit an example of a new T/S Table of Contents to the NRC and await their approval.

5. Upon approval of the example Table of Contents, a few T/S's and Bases will be written to determine whether our approach is acceptable to the NRC. These will include only LCO's and Bases. Action Statements and Surveillance Requirements are not to be included at this time.

6. Upon NRC approval of Step 5, we will write LCO's and Bases for all new T/S's.

7. Upon NRC approval of the results of Step 6, we will prepare a few sample Action Statements and Surveillance Requirements.

8. Upon NRC approval of Step 7, we will begin an iterative process that will provide new T/S's to replace entire existing Sections 1-5 of T/S's as well as Bases.

9. Once all of the above is completed, a separate program for simplifying administrative T/S's will be initiated.

III. Writer's Guide for Technical Specifications

A. Introduction

The purpose of this Writer's Guide is to aid in rewriting the Technical Specifications in accordance with the principles explained in the Guidelines.

It is recognized that the initial review of the modified T/S's must be performed by engineers and operators to ensure that the document is technically correct. At the same time, the document must be reviewed by technical writers, whose language skills will enable them to ensure that it is written in clear, precise English and that wording and sentence structure are never a source of ambiguity or misinterpretation.

This Writer's Guide should assist the reviewer in achieving the following goals of the program:

- Rewrite Sections 1 through 4 of the T/S's in order to produce an understandable, coherent document that 1) ensures that the plant is operating safely, 2) is easily enforceable, and 3) does not burden the plant staff with unnecessary surveillances.

- Rewrite administrative T/S's so that basic administrative safety concerns are addressed, but unnecessary paperwork and items unimportant to safety are eliminated.

- Rewrite T/S Bases so that the function and relevance to safety of each piece of equipment are clearly understood.

B. Style and Mechanics

The two most important principles to be observed in rewriting the Technical Specifications are clarity and consistency.

For the sake of precision and clarity, choose the simplest and most direct words possible. For example, "in the event" or "with" should not be used where "if" will do.

Action Statements and Surveillance Requirements that deal with time limits or intervals must be written in such a way that no confusion is possible. Time limits should have precise beginnings and endings.

Correct and consistent grammar and punctuation must be used for the sake of clarity. References such as The Gregg Manual and the Westinghouse Engineering Writing Guide should be used for these points, with special attention to features that contribute to clarity. For example, hyphenating compound modifiers--"power-operated relief valves," "three-loop operation"--can make long sentences more readable and help eliminate ambiguity.

A list of all abbreviations and acronyms used in the T/S should be added to the Definitions Section of the T/S. In addition, these should be spelled out with their first use in each section. Letters used in equations should also be defined.

Symbols (for example, $\geq$, μ, Δ, σ) that cannot easily be typed should be spelled out. This procedure will reduce mistakes, since $\geq$ is easier to misread the "greater than or equal to." An exception to this principle is tables, in which format requires symbols rather than words.

When subscripts, superscripts, or equations are used, line spacing should be adjusted for the sake of legibility.

Consistency should be maintained in as many ways as possible. The content of the T/S's for the two units of a plant should be the same whenever appropriate, and the wording should be identical whenever possible. Spelling, punctuation, use of abbreviations, and format should be consistent throughout the document. One method that writers can use to achieve this consistency is to keep a running list of all cases in which one alternative was chosen over another.

It is important to make the numbering sequence for the two units identical, even if this means issuing T/S's to point out that no T/S is applicable.

The Limiting Conditions for Operation and Surveillance Requirements will be combined into a single Section 3. Section 4 will be Design Features, and Section 5 will be Administrative Controls.

Page numbers will begin with a section number followed by a hyphen and will be sequentially ordered by section.

C. Guidelines for Writing Definitions

All words not included in the Definitions section of the T/S's or in the definitions in Attachment 2 of this guide must have meanings that are clear to all three groups of T/S users: operators, inspectors, and engineers. Some words will need to be defined in context rather than globally. Words and phrases that have been the source of ambiguity may need to be defined in context or replaced with less troublesome words.

Words will be defined as needed for a particular T/S section. The existing definitions as well as those in Attachment 2 will serve as a starting point. Attachment 2 also contains a description of the four safety categories.

Definitions should be organized alphabetically, and a list of abbreviations should be added. Defined words may be used in the T/S's with meanings different from those in the Definitions section. In this case, they should not be written in all capital letters.

D. Guidelines for Writing Individual Technical Specifications

The first step in this process is to examine the existing applicable T/S's for that piece of equipment. The writer will determine the purpose and safety basis for the T/S. The basis for the T/S will be compared with the minimum safety requirements of the equipment as determined by a review of the safety analysis documentation, including the FSAR.

The next step is to describe the methods for demonstrating that the piece of equipment meets its safety requirements. Alternative methods of demonstrating safety functions should be listed in case the primary method is not available. Any possible tradeoffs in the Limiting Conditions for Operation should be indicated in case the main component is out of service.

All of the above constitutes the Basis for that particular T/S. The writer examines this Basis and writes the LCO for the T/S. The LCO defines the safety basis in terms of the values measured or seen by the operator unless indicated otherwise. The T/S Revision Checklist (Attachment 1) may be used to assist the reviewer throughout this process.

The writer then lists all the support systems required to make the system functional. Operability will be determined by a combination of the base system and the support systems which are necessary to meet the requirement of the safety basis.

After the LCO's have been defined, the Action Statements and Surveillance Requirements are written. The equipment referred to in the Action Statements should then be placed in one of four groups, corresponding to the four safety categories. The proposed times to be allowed by the Action Statements are as follows:

1. Immediate action

2. Action within 1 week

3. Action within 1 month

4. Action based on agreement between operators and regulatory authorities

The NRC should be consulted to confirm that the Actions and time limits meet the requirements of the regulations.

Since many SR's are performed by personnel other than operators, a minimum level of detail should be put in the T/S. The details of the surveillance should be placed in other documents, such as plant procedures, and should only be referred to in the T/S. As part of the SR, a list of essential support equipment (listed in the Bases) will also be required operable.

In addition to normal management review, there will be a thorough review for consistency and clarity of language. This review will also ensure that the principles of this Writer's Guide are adhered to. As a final check a simulated walk-through at the plant will be conducted to ensure the feasibility and practicality of the T/S.

Attachment 1

Technical Specification Revision Checklist

The purpose of this checklist is to provide a list of questions to use as a guide when evaluating the need to incorporate the existing T/S with respect the new revised format. Each question or set of questions should identify whether a particular T/S should be incorporated, revised or deleted with regard to the simplified T/S.

The T/S checklist includes general questions and some specific to sections of the T/S's (Definitions, Systems, Limiting Conditions for Operation, Applicability, Action, Surveillance Requirements and Bases). This checklist will be an aid in rewriting each of the specified sections. However, several sections of the T/S's will not undergo this rewrite. One such section is Section 2.1, Safety Limits. Section 2.2 of this section will be incorporated in the appropriate T/S's associated with the instrumentation. The trip setpoints will be moved to the Bases, as will information such as the algorithm used to determine overtemperature T.

Sections 3/4.0 and 3/4.1 should not be rewritten until after the other sections of 3/4 are completed since changes to these sections will rely heavily on the changes to later sections.

GENERAL

a. Are all parts of the T/S still applicable?

b. Have any parts of the T/S been superseded by changes in 10 CFR or industry standards?

c. Can the numbering or organization be simplified?

d. Are the T/S's for the two units consistent where possible?

e. Do the Westinghouse Standard T/S's, NUREG-0452, Revision 4 or Revision 5, offer any insight to improve the T/S?

f. Are universal statements (e.g., "at all time," "continuous operation") used correctly? Is there a more accurate way to word the T/S taking into account possible exceptions?

g. Are the punctuation and symbols used correctly and consistently?

h. Place all reporting requirements in a single location--the Administrative Controls section of the T/S's.

i. Make a list of all abbreviations and words requiring definitions used in the T/S.

DEFINITIONS

a. Is the definition correct?

b. Is the definition used consistently throughout the T/S's?

c. Is the definition too vague/too specific?

d. Is the definition clear, or can it be interpreted several ways?

e. Is the definition needed in this section? Is it used in the T/S's?

f. Do other words need to be defined in this section? Note: Wordiness and awkwardness of some T/S's can be reduced by the use of a well-defined word or phrase.

g. Definitions should be reorganized alphabetically, and a list of acronyms and abbreviations should be added.

The following set of questions is designed for use in the review of Section 3/4 of the T/S's.

1. SYSTEMS

a. Is the system needed in the T/S's? Specifically, is this system required by the control room operator for the safe operation of the plant?

b. Is knowledge of this system's operability essential for everyday or accident operations?

c. Is the description of the system too specific/too general?

d. Can several sections be reduced into one?

e. Can one T/S function better than two or more T/S's? That is, can two or more T/S's be reduced to one requirement?

2. LIMITING CONDITIONS FOR OPERATIONS (LCO's)

a. Is the justification for the LCO explained in the T/S or Basis?

b. Does the LCO correspond to the number the operator will actually read?

c. Is the LCO needed for safe operation of the plant? If not, should it be in the T/S's?

d. Is adherence to the LCO sufficient to ensure safe plant operation?

e. Can this LCO be interpreted to require more/less than is intended?

f. Does this LCO affect an LCO of a different system? Is this LCO affected by any of the other systems listed in the Basis for this T/S?

g. Does the LCO accurately reflect our plant design?

h. Is the LCO written in such a way as not to require entry into an Action Statement unless there is an equipment failure?

i. Can the LCO be consolidated with other LCO's to simplify the T/S?

3. APPLICABILITY

a. Are all the required modes or plant conditions needed?

b. Are the bases for modes listed understood?

c. Is the basis for the excluded modes understood?

4. ACTION

a. Does completion of the Action restore the plant to safe operating status?

b. Does the Action address all failure possibilities?

c. Is the Action too strict; e.g., require plant shutdown for failure of systems not required for safe plant operations?

d. Is the Action "reasonably achievable"?

e. Does the Action contain a surveillance interval that could be placed in the Surveillance Requirements?

f. Is the Action Statement clearly written so that it cannot be misinterpreted?

g. Is the Action consistent with other actions that may be required of equipment in the same safety category?

h. If the Action is not obvious, is its purpose explained in the Basis?

i. Does the Action Statement in itself place the plant in a more hazardous condition than if the Action had not been taken?

5. SURVEILLANCE REQUIREMENTS (SR's)

a. Does the SR demonstrate directly or indirectly the capability of the system to perform its minimum safety function?

b. If the relation between the SR and the safety function of the equipment is not obvious, is its purpose explained in the Basis?

c. Does the SR frequency involve excessive or destructive testing of equipment? If so, can the surveillance interval be reduced by comparison to newer requirements allowed by the NRC?

d. Is the basis of SR understood--vendor recommendation, PRA, ASME, Industry practice, engineering analysis?

e. Are alternates to performing these SR's discussed in the Bases? Should they be?

f. Can the surveillance be done with a reasonable amount of manpower?

g. Are surveillance intervals adequate in light of the safety importance of the equipment?

h. Is the SR written in a manner that both the plant operators and regulatory authorities will understand it to mean the same thing?

i. Is the SR clear and not subject to misinterpretation?

j. Can the details of the SR be moved to the Bases?

6. BASES

a. Does the Basis contain minimum requirements for safety associated with the equipment?

b. Does the Basis discuss why specific values for parameters are required (in terms of the safety analysis or accident scenario)?

c. Are the numbers reported in the Basis the actual numbers from the FSAR?

d. Does the Basis contain direction on how to perform SR for the system--as well as alternative methods should the main method become unavailable?

e. Is there a Basis for each T/S?

f. Does the Basis contain a listing of other equipment required to support the particular T/S?

g. Does the Basis explain any SR's that are not obvious?

h. Does the Basis define the appropriate safety category for the equipment?

i. Is the Basis written in a manner that can be understood by a person not technically familiar with that piece of equipment?

Attachment 2

Definitions

NOTE: Many of these definitions are copied or adapted from the Writer's Guide of the Westinghouse Owners Group Emergency Response Guidelines.

actuate	to put into action or motion. Commonly used to refer to automated, multi-faceted operations.
align	to arrange components into a desired configuration. Examples: Align the system for normal charging. Align valves as appropriate.
at	(in reference to process parameters read from control room instruments) "at a value" means closer to that value than to any other that can be reasonably read from the available scale.
automatic actions	preprogrammed sequence of actions performed by electronic or mechanical means once initiated.
block	to inhibit an automatic actuation. Example: Block SI actuation.
check	to note a condition and compare with some requirement.
close	to change the physical position of a mechanical device. Closing a valve prevents fluid flow. Closing a breaker allows electrical current flow.
design-basis accident	one that is reviewed in Chapter 14 of the FSAR.
determine	to calculate or evaluate using formulae or graphs.
energize	to supply electrical energy to (something). Commonly used to describe an electrical bus or other dedicated electrical path.
enter	1) to go into 2) begin compliance with the conditions of. Example: Enter the Action statement.
establish	to bring about a stated condition.

evaluate	to examine and decide
equalize	to make the value of a given parameter equal to the value of another parameter.
initiate	to take the steps that begin a process.
inoperable	refers to a structure, system, or component that cannot meet its minimum requirement for safety.
intended design function	the capability of a structure, system, or component to perform the minimum requirements for safety.
load	to connect an.electrical component or unit to a source of electrical energy. May involve a "start" in some cases.
local	refers to an action performed by an operator at the physical location of some component (as opposed to operating from a remote control room).
maintain	to control a given plant parameter to some requirement continuously.
manual	performed by hand. Refers to operator actions performed in the control room as distinguished from from automatic actions performed without operator intervention or from actions performed locally.
monitor	1) a device that continuously measures a specified parameter 2) to observe the output of a measuring device at designated intervals.
normal	refers to plant conditions that are routine, that is, not emergency, transient, or accident conditions.
open	to change the physical position of a mechanical device to the unobstructed position. Opening a valve permits fluid flow. Opening an electrical breaker prevents electrical flow.
operable	refers to a structure, system, or component that is capable of meeting its minimum requirement for safety.
operate	to turn on, turn off, or otherwise control as necessary to achieve the stated objective.
out of service	refers to an active system that is incapable of performing its safety function, but that can be placed in a condition in which its minimum requirement for safety can be met.

reset	to remove an active output signal from a retentive logic device even with the input signal still present. Commonly used in reference to protection/safeguards logics in which the actuating signal is "locked in." The reset allows equipment energized by the initial signal to be de-energized.
record	to document specified characteristics.
safety category	All equipment falls into one of the following categories:

1. Equipment which is absolutely essential for safety, as described in the Safety Limits section of our present T/S's. Deletion of requirement for this equipment could result in an unreviewed safety question.

2. Equipment for which sufficient redundancy exists so that multiple failures of the same equipment must occur in order to create a safety problem. Repair time for equipment in this category would usually be one week.

3. Equipment whose failure alone would not create a safety problem. However, a safety problem could result from a combination of 1) a design-basis accident and 2) an additional outside event such as fire, severe natural phenomena, loss of offsite power, or an NUREG-0737-type accident. Repair time for equipment in this category would usually be one month.

4. Equipment that does not constitute a basis for safety and for which no specific action is required. Failure of equipment in this category will not result in a safety problem unless accompanied by 1) a low-probability event and 2) failure of redundant equipment. Repair time for equipment in this category shall be based on agreements between the plant operators and regulatory authorities.

sample	to take a representative portion for the purpose of examination. Commonly refers to chemical or radiological examination.
shutdown	the condition of a reactor core when it cannot sustain a chain reaction (subcritical)
support equipment	equipment associated with a structure, system, or component and necessary for its minimum safety requirements.

throttle	to operate a valve in an intermediate position to obtain a certain flow rate.
trip	to manually actuate a semiautomatic feature. Commonly, "trip" refers to component deactuation.
try	to make a continued effort when success may not be immediately obtainable.
unreviewed safety question	defined in 10 CFR 50.59.
verify	to observe that an expected characteristic or condition exists. Typically the expectation comes from some previous automatic or operator action. The appropriate contingency, either stated or implied, is to establish the expected condition. The means of verification must be stated in the T/S's or the Bases, or the plant procedures.

Attachment 3

Cross-Reference List for Technical Specifications

INDEX

REFERENCED SYSTEM IS:
1 REACTOR CORE

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.2	DEF. OF THERMAL POWER
R	T/S	1.3	DEF. OF RATED THERMAL POWER
R	T/S	1.4	DEF. OF OPERATIONAL MODE
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	1.12	DEF. OF CORE ALTERATION
R	T/S	1.13	DEF. OF SHUTDOWN MARGIN
R	T/S	1.18	DEF. OF QUADRANT POWER TILT RATIO
R	T/S	1.24	DEF. OF AXIAL FLUX DIFFERENCE
R	T/S	1.25	DEF. OF PHYSICS TESTS
*	T/S	2.1.1	SAFETY LIMITS--REACTOR CORE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
*	T/S	3.1.1.1	BORATION/SHUTDOWN MARGIN--T AVG > 200 DEG. F
*	T/S	3.1.1.2	BORATION/SHUTDOWN MARGIN--T AVG < 200 DEG. F
R	T/S	3.1.1.4	MODERATOR TEMPERATURE COEFFICIENT
R	T/S	3.1.1.5	MINIMUM TEMPERATURE FOR CRITICALITY
R	T/S	3.1.2.5	BORIC ACID TRANSFER PUMPS--SHUTDOWN
R	T/S	3.1.2.6	BORIC ACID TRANSFER PUMPS--OPERATING
R	T/S	3.1.2.7	BORATED WATER SOURCES--SHUTDOWN
*	T/S	3.2.1	AXIAL FLUX DIFFERENCE
*	T/S	3.2.2	HEAT FLUX HOT CHANNEL FACTOR
*	T/S	3.2.4	QUADRANT POWER TILT RATIO
R	T/S	3.2.5	DNB PARAMETERS
*	T/S	3.2.6	AXIAL POWER DISTRIBUTION
R	T/S	3.3.3.2	MOVABLE INCORE DETECTORS
R	T/S	3.3.3.7	AXIAL POWER DISTRIBUTION MONITORING SYS
R	T/S	3.4.8	RCS--SPECIFIC ACTIVITY
R	T/S	3.5.4.1	BORON INJECTION TANK
2	T/S	3.9.2	REFUELING OPERATIONS--INSTRUMENTATION
R	T/S	3.9.3	REFUELING OPERATIONS--DECAY TIME
*	T/S	3.10.1	TEST EXCEPTION--SHUTDOWN MARGIN
*	T/S	3.10.2	TEST EXCEPTION--HEIGHT,INSERTION,POWER DIST.
*	T/S	3.10.3	TEST EXCEPTION--PHYSICS TESTS
R	T/S	3.10.5	TEST EXCEPTION--POSITION INDICATOR CHANNELS
*	T/S	5.3.1	FUEL ASSEMBLIES
*	T/S	5.3.2	CONTROL ROD ASSEMBLIES

THERE ARE 35 ITEMS REFERENCED FOR SYS 1

MONDO (TECH SPEC/FSAR) INDEX

REFERENCED SYSTEM IS:
2 MOVABLE CONTROL ASSEMBLIES

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	1.12	DEF. OF CORE ALTERATION
R	T/S	1.13	DEF. OF SHUTDOWN MARGIN
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
*	T/S	3.1.3.1	MOVABLE CONTROL ASSEMBLIES
R	T/S	3.1.3.2	POSITION INDICATOR CHANNELS--OPERATING
2	T/S	3.1.3.3	POSITION INDICATOR CHANNELS--SHUTDOWN
*	T/S	3.1.3.4	ROD DROP TIME
*	T/S	3.1.3.5	SHUTDOWN ROD INSERTION LIMIT

THERE ARE 15 ITEMS REFERENCED FOR SYS 4

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
5 MOVABLE IN-CORE DETECTORS

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	1.12	DEF. OF CORE ALTERATION
R	T/S	1.25	DEF. OF PHYSICS TESTS
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
R	T/S	3.1.3.1	MOVABLE CONTROL ASSEMBLIES
R	T/S	3.1.3.2	POSITION INDICATOR CHANNELS--OPERATING
*	T/S	3.2.2	HEAT FLUX HOT CHANNEL FACTOR
*	T/S	3.2.3	RCS FLOW RATE AND R
R	T/S	3.2.4	QUADRANT POWER TILT RATIO
*	T/S	3.2.6	AXIAL POWER DISTRIBUTION
R	T/S	3.3.1.1	REACTOR TRIP SYSTEM INSTRUMENTATION
*	T/S	3.3.3.2	MOVABLE INCORE DETECTORS
*	T/S	3.3.3.7	AXIAL POWER DISTRIBUTION MONITORING SYS
R	T/S	3.6.3.1	CONTAINMENT ISOLATION VALVES
R	T/S	3.10.2	TEST EXCEPTION--HEIGHT,INSERTION,POWER DIST.
R	T/S	3.10.3	TEST EXCEPTION--PHYSICS TESTS

THERE ARE 16 ITEMS REFERENCED FOR SYS 5

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
6 THERMOCOUPLES

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	1.12	DEF. OF CORE ALTERATION
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER

THERE ARE 3 ITEMS REFERENCED FOR SYS 6

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
7 REACTOR COOLANT SYSTEM

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.2	DEF. OF THERMAL POWER
R	T/S	1.3	DEF. OF RATED THERMAL POWER
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	1.12	DEF. OF CORE ALTERATION
R	T/S	1.14	DEF. OF IDENTIFIED LEAKAGE
R	T/S	1.15	DEF. OF UNIDENTIFIED LEAKAGE
R	T/S	1.16	DEF. OF PRESSURE BOUNDARY LEAKAGE
R	T/S	1.17	DEF. OF CONTROLLED LEAKAGE
*	T/S	2.1.2	SAFETY LIMITS--RCP PRESSURE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
*	T/S	3.1.1.1	BORATION/SHUTDOWN MARGIN--T AVG > 200 DEG. F
*	T/S	3.1.1.2	BORATION/SHUTDOWN MARGIN--T AVG < 200 DEG. F
*	T/S	3.1.1.3	BORON DILUTION
*	T/S	3.1.1.4	MODERATOR TEMPERATURE COEFFICIENT

THERE ARE 12 ITEMS REFERENCED FOR SYS 8

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
9 PRESSURIZER

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
2	T/S	2.1.2	SAFETY LIMITS--RCP PRESSURE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
R	T/S	3.2.5	DNB PARAMETERS
*	T/S	3.4.4	PRESSURIZER
R	T/S	3.4.9.1	RCS--PRESSURE/TEMPERATURE LIMITS
*	T/S	3.4.9.2	PRESSURIZER TEMPERATURE LIMITS
R	T/S	3.4.9.3	OVERPRESSURE PROTECTION SYSTEMS
R	T/S	3.6.3.1	CONTAINMENT ISOLATION VALVES
R	T/S	3.7.7.1	SNUBBERS
*	T/S	5.4.1	RCS DESIGN PRESSURE AND TEMPERATURE

THERE ARE 11 ITEMS REFERENCED FOR SYS 9

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
10 PRESSURIZER RELIEF TANK (PRT)

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
2	T/S	3.4.9.3	OVERPRESSURE PROTECTION SYSTEMS
R	T/S	3.6.3.1	CONTAINMENT ISOLATION VALVES
R	T/S	3.7.7.1	SNUBBERS

THERE ARE 5 ITEMS REFERENCED FOR SYS 10

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
11 SAFETY VALVES

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
*	T/S	3.4.2	PRESSURIZER SAFETY VALVES--SHUTDOWN
*	T/S	3.4.3	PRESSURIZER SAFETY VALVES--OPERATING
R	T/S	3.4.6.2	RCS--OPERATIONAL LEAKAGE
*	T/S	3.4.9.3	OVERPRESSURE PROTECTION SYSTEMS

THERE ARE 6 ITEMS REFERENCED FOR SYS 11

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
12 RELIEF VALVES

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER

	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
*	T/S	3.4.9.3	OVERPRESSURE PROTECTION SYSTEMS

THERE ARE 3 ITEMS REFERENCED FOR SYS 15

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
16 EMERGENCY CORE COOLING SYSTEM

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
R	T/S	3.5.1	ACCUMULATORS
R	T/S	3.5.2	ECCS SUBSYSTEMS--T AVG > 350 DEG F
R	T/S	3.5.3	ECCS SUBSYSTEMS--T AVG < 350 DEG F
R	T/S	3.5.4.1	BORON INJECTION TANK
R	T/S	3.5.4.2	HEAT TRACING FOR BORON INJECTION TANK
R	T/S	3.5.5	REFUELING WATER STORAGE TANK
R	T/S	3.6.3.1	CONTAINMENT ISOLATION VALVES

THERE ARE 9 ITEMS REFERENCED FOR SYS 16

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
17 ACCUMULATORS

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
*	T/S	3.5.1	ACCUMULATORS
R	T/S	3.6.3.1	CONTAINMENT ISOLATION VALVES

THERE ARE 4 ITEMS REFERENCED FOR SYS 17

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
18 BORON INJECTION TANK

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
*	T/S	3.5.2	ECCS SUBSYSTEMS--T AVG > 350 DEG F
*	T/S	3.5.3	ECCS SUBSYSTEMS--T AVG < 350 DEG F
*	T/S	3.5.4.1	BORON INJECTION TANK
2	T/S	3.5.4.2	HEAT TRACING FOR BORON INJECTION TANK
R	T/S	3.6.3.1	CONTAINMENT ISOLATION VALVES
R	T/S	5.2.2	CONTAINMENT DESIGN PRESSURE AND TEMPERATURE

THERE ARE 8 ITEMS REFERENCED FOR SYS 18

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
19 REFUELING WATER STORAGE TANK

SIGNIF. ITEM NO. REFERENCED ITEM

22 SAFETY INJECTION (SI) SYSTEM--NORTH

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
R	T/S	3.1.2.3	BORATION SYS/CHARGING PUMP--SHUTDOWN
2	T/S	3.3.2.1	ESF ACTUATION SYSTEM INSTRUMENTATION
R	T/S	3.4.1.4	RCS LOOPS--THREE LOOP OPERATION
*	T/S	3.5.2	ECCS SUBSYSTEMS--T AVG > 350 DEG F
*	T/S	3.5.3	ECCS SUBSYSTEMS--T AVG < 350 DEG F
R	T/S	3.6.3.1	CONTAINMENT ISOLATION VALVES
2	T/S	3.7.6.1	ESF VENTILATION SYSTEM
R	T/S	3.7.7.1	SNUBBERS
R	T/S	3.7.9.2	SPRAY AND/OR SPRINKLER SYSTEMS

THERE ARE 11 ITEMS REFERENCED FOR SYS 22

HONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
23 SAFETY INJECTION (SI) SYSTEM--SOUTH

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
R	T/S	3.1.2.3	BORATION SYS/CHARGING PUMP--SHUTDOWN
2	T/S	3.3.2.1	ESF ACTUATION SYSTEM INSTRUMENTATION
R	T/S	3.4.1.4	RCS LOOPS--THREE LOOP OPERATION
*	T/S	3.5.2	ECCS SUBSYSTEMS--T AVG > 350 DEG F
*	T/S	3.5.3	ECCS SUBSYSTEMS--T AVG < 350 DEG F
R	T/S	3.6.3.1	CONTAINMENT ISOLATION VALVES
2	T/S	3.7.6.1	ESF VENTILATION SYSTEM
R	T/S	3.7.7.1	SNUBBERS
R	T/S	3.7.9.2	SPRAY AND/OR SPRINKLER SYSTEMS

THERE ARE 11 ITEMS REFERENCED FOR SYS 23

HONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
24 RESIDUAL HEAT REMOVAL (RHR) SYSTEM--EAST

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
2	T/S	3.1.1.3	BORON DILUTION
2	T/S	3.3.2.1	ESF ACTUATION SYSTEM INSTRUMENTATION
*	T/S	3.4.1.3	RCS LOOPS--SHUTDOWN
*	T/S	3.4.1.4	RCS LOOPS--THREE LOOP OPERATION
2	T/S	3.4.2	PRESSURIZER SAFETY VALVES--SHUTDOWN
R	T/S	3.4.6.2	RCS--OPERATIONAL LEAKAGE
R	T/S	3.4.9.3	OVERPRESSURE PROTECTION SYSTEMS
*	T/S	3.5.2	ECCS SUBSYSTEMS--T AVG > 350 DEG F
*	T/S	3.5.3	ECCS SUBSYSTEMS--T AVG < 350 DEG F
R	T/S	3.6.3.1	CONTAINMENT ISOLATION VALVES
2	T/S	3.7.6.1	ESF VENTILATION SYSTEM
R	T/S	3.7.7.1	SNUBBERS
*	T/S	3.9.8.1	RHR AND COOLANT CIRCULATION--CORE ALTERATIONS
*	T/S	3.9.8.2	LOW WATER LEVEL--REFUELING OPERATIONS

T/S 3.10.1 TEST EXCEPTION--SHUTDOWN MARGIN

THERE ARE 27 ITEMS REFERENCED FOR SYS 26

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
27 CVCS BORON MAKE-UP

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
*	T/S	3.1.2.1	BORATION SYS/FLOW PATHS--SHUTDOWN
*	T/S	3.1.2.2	BORATION SYS/FLOW PATHS--OPERATING
*	T/S	3.1.2.5	BORIC ACID TRANSFER PUMPS--SHUTDOWN
*	T/S	3.1.2.6	BORIC ACID TRANSFER PUMPS--OPERATING
*	T/S	3.1.2.7	BORATED WATER SOURCES--SHUTDOWN
*	T/S	3.1.2.8	BORATED WATER SOURCES--OPERATING
2	T/S	3.5.4.2	HEAT TRACING FOR BORON INJECTION TANK

THERE ARE 9 ITEMS REFERENCED FOR SYS 27

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
28 CVCS BORON HOLD-UP

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
2	T/S	3.5.4.2	HEAT TRACING FOR BORON INJECTION TANK

THERE ARE 3 ITEMS REFERENCED FOR SYS 28

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
29 CVCS BORIC ACID EVAPORATOR PACKAGE--NORTH

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
2	T/S	3.5.4.2	HEAT TRACING FOR BORON INJECTION TANK

THERE ARE 3 ITEMS REFERENCED FOR SYS 29

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
30 CVCS BORIC ACID EVAPORATOR PACKAGE--SOUTH

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
2	T/S	3.5.4.2	HEAT TRACING FOR BORON INJECTION TANK

THERE ARE 3 ITEMS REFERENCED FOR SYS 30

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:

	T/S	3.11.2.3	ASSORTED RADIOACTIVE STUFF IN THE AIR--D
*	T/S	3.11.2.4	GASEOUS RADWASTE TREATMENT
*	T/S	3.11.2.5	EXPLOSIVE GAS MIXTURE
*	T/S	3.11.2.6	GAS STORAGE TANKS
*	T/S	3.11.3	SOLID RADIOACTIVE WASTE
R	T/S	3.11.4	RADIOACTIVE EFFLUENTS--TOTAL DOSE

THERE ARE 21 ITEMS REFERENCED FOR SYS 34

MONDO (TECH SPEC/FSAR) INDEX

REFERENCED SYSTEM IS:

35 NORMAL SAMPLING SYSTEM

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER

THERE ARE 2 ITEMS REFERENCED FOR SYS 35

MONDO (TECH SPEC/FSAR) INDEX

REFERENCED SYSTEM IS:

36 POST-ACCIDENT SAMPLING SYSTEM

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER

THERE ARE 2 ITEMS REFERENCED FOR SYS 36

MONDO (TECH SPEC/FSAR) INDEX

REFERENCED SYSTEM IS:

37 SECONDARY STEAM CYCLE SYSTEMS

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
R	T/S	3.7.1.1	SECONDARY SAFETY VALVES
R	T/S	3.7.1.2	AUXILIARY FEEDWATER SYSTEM
R	T/S	3.7.1.3	CONDENSATE STORAGE TANK
R	T/S	3.7.1.4	SECONDARY COOLANT SYSTEM--ACTIVITY
R	T/S	3.7.1.5	STEAM GENERATOR STOP VALVES
R	T/S	3.7.2.1	STEAM GENERATOR PRESSURE/TEMPERATURE LIMITS
R	T/S	3.7.7.1	SNUBBERS
*	T/S	5.7.1	COMPONENT CYCLIC OR TRANSIENT LIMIT

THERE ARE 10 ITEMS REFERENCED FOR SYS 37

MONDO (TECH SPEC/FSAR) INDEX

REFERENCED SYSTEM IS:

38 TURBINE AUX. COOLING SYSTEM

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER

THERE ARE 2 ITEMS REFERENCED FOR SYS 38

T/S 3.7.7.1 SHUBBERS

THERE ARE 4 ITEMS REFERENCED FOR SYS 43

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
44 AUX. FEEDWATER SYSTEM (MD)--EAST

SIGNIF.	ITEM NO.	REFERENCED ITEM
R	T/S 1.6	DEF. OF OPERABLE
R	T/S 3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
2	T/S 3.3.2.1	ESF ACTUATION SYSTEM INSTRUMENTATION
R	T/S 3.4.1.3	RCS LOOPS--SHUTDOWN
*	T/S 3.7.1.2	AUXILIARY FEEDWATER SYSTEM
R	T/S 3.7.1.3	CONDENSATE STORAGE TANK

THERE ARE 6 ITEMS REFERENCED FOR SYS 44

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
45 AUX. FEEDWATER SYSTEM (MD)--WEST

SIGNIF.	ITEM NO.	REFERENCED ITEM
R	T/S 1.6	DEF. OF OPERABLE
R	T/S 3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
2	T/S 3.3.2.1	ESF ACTUATION SYSTEM INSTRUMENTATION
R	T/S 3.4.1.3	RCS LOOPS--SHUTDOWN
*	T/S 3.7.1.2	AUXILIARY FEEDWATER SYSTEM
R	T/S 3.7.1.3	CONDENSATE STORAGE TANK

THERE ARE 6 ITEMS REFERENCED FOR SYS 45

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
46 AUX. FEEDWATER SYSTEM (TURBINE DRIVEN)

SIGNIF.	ITEM NO.	REFERENCED ITEM
R	T/S 1.6	DEF. OF OPERABLE
R	T/S 3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
2	T/S 3.3.2.1	ESF ACTUATION SYSTEM INSTRUMENTATION
R	T/S 3.4.1.3	RCS LOOPS--SHUTDOWN
*	T/S 3.7.1.2	AUXILIARY FEEDWATER SYSTEM
R	T/S 3.7.1.3	CONDENSATE STORAGE TANK
2	T/S 3.7.10	FIRE RATED ASSEMBLIES
2	T/S 3.8.2.5	D.C. DISTRIBUTION--OPERATING--TRAIN N BATTERY

THERE ARE 8 ITEMS REFERENCED FOR SYS 46

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
47 CONDENSERS

SIGNIF.	ITEM NO.	REFERENCED ITEM
R	T/S 1.6	DEF. OF OPERABLE
R	T/S 3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
R	T/S 3.3.3.10	RAD. GAS. PROCESS AND EFFLUENT MONTIORING INST.

R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
2	T/S	3.3.2.1	ESF ACTUATION SYSTEM INSTRUMENTATION
R	T/S	3.7.1.3	CONDENSATE STORAGE TANK
*	T/S	3.7.4.1	ESSENTIAL SERVICE WATER SYSTEM
2	T/S	3.7.5	CONTROL ROOM EMERGENCY VENTILATION SYSTEM

THERE ARE 6 ITEMS REFERENCED FOR SYS 52

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
53 NON-ESSENTIAL SERVICE WATER (NESW)--NORTH

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
R	T/S	3.6.3.1	CONTAINMENT ISOLATION VALVES

THERE ARE 3 ITEMS REFERENCED FOR SYS 53

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
54 NON-ESSENTIAL SERVICE WATER (NESW)--SOUTH

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
R	T/S	3.6.3.1	CONTAINMENT ISOLATION VALVES

THERE ARE 3 ITEMS REFERENCED FOR SYS 54

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
55 COMPONENT COOLING WATER (CCW) SYSTEM--EAST

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
R	T/S	3.6.3.1	CONTAINMENT ISOLATION VALVES
2	T/S	3.6.5.6	CONTAINMENT AIR RECIRCULATION SYSTEMS
*	T/S	3.7.3.1	COMPONENT COOLING WATER SYSTEM
R	T/S	3.7.7.1	SNUBBERS

THERE ARE 6 ITEMS REFERENCED FOR SYS 55

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
56 COMPONENT COOLING WATER (CCW) SYSTEM--WEST

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
R	T/S	3.6.3.1	CONTAINMENT ISOLATION VALVES
2	T/S	3.6.5.6	CONTAINMENT AIR RECIRCULATION SYSTEMS
*	T/S	3.7.3.1	COMPONENT COOLING WATER SYSTEM

	T/S	3.7.9.2	SPRAY AND/OR SPRINKLER SYSTEMS

THERE ARE 6 ITEMS REFERENCED FOR SYS 61

MONDO (TECH SPEC/FSAR) INDEX

REFERENCED SYSTEM IS:

62 ESF VENTILATION SYSTEM--AES-2

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
R	T/S	3.3.3.8	FIRE DETECTION INSTRUMENTATION
R	T/S	3.3.3.10	RAD. GAS. PROCESS AND EFFLUENT MONTIORING INST.
2	T/S	3.7.6.1	ESF VENTILATION SYSTEM
R	T/S	3.7.9.2	SPRAY AND/OR SPRINKLER SYSTEMS

THERE ARE 6 ITEMS REFERENCED FOR SYS 62

MONDO (TECH SPEC/FSAR) INDEX

REFERENCED SYSTEM IS:

63 HYDRAULIC SNUBBERS

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
*	T/S	3.7.7.1	SNUBBERS

THERE ARE 3 ITEMS REFERENCED FOR SYS 63

MONDO (TECH SPEC/FSAR) INDEX

REFERENCED SYSTEM IS:

64 RADIATION SHIELDING

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER

THERE ARE 2 ITEMS REFERENCED FOR SYS 64

MONDO (TECH SPEC/FSAR) INDEX

REFERENCED SYSTEM IS:

65 FIRE SUPRRESSION SYSTEMS

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
R	T/S	3.3.3.8	FIRE DETECTION INSTRUMENTATION
*	T/S	3.7.9.1	FIRE SUPPRESSION WATER SYSTEM
*	T/S	3.7.9.2	SPRAY AND/OR SPRINKLER SYSTEMS
*	T/S	3.7.9.3	LOW PRESSURE CO2 SYSTEMS
*	T/S	3.7.9.4	HALON SYSTEM
*	T/S	3.7.9.5	FIRE HOSE STATIONS
R	T/S	3.7.10	FIRE RATED ASSEMBLIES

THERE ARE 9 ITEMS REFERENCED FOR SYS 65

RE ARE 6 ITEMS REFERENCED FOR SYS 69

HONDO (TECH SPEC/FSAR) INDEX

REFERENCED SYSTEM IS:

70 PENETRATION FIRE BARRIERS

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
*	T/S	3.7.10	FIRE RATED ASSEMBLIES

THERE ARE 3 ITEMS REFERENCED FOR SYS 70

HONDO (TECH SPEC/FSAR) INDEX

REFERENCED SYSTEM IS:

71 FIRE RATED ASSEMBLIES

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
*	T/S	3.7.10	FIRE RATED ASSEMBLIES

THERE ARE 3 ITEMS REFERENCED FOR SYS 71

HONDO (TECH SPEC/FSAR) INDEX

REFERENCED SYSTEM IS:

72 FIRE HOSE STATIONS

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
*	T/S	3.7.9.1	FIRE SUPPRESSION WATER SYSTEM
R	T/S	3.7.9.2	SPRAY AND/OR SPRINKLER SYSTEMS
R	T/S	3.7.9.3	LOW PRESSURE CO2 SYSTEMS
R	T/S	3.7.9.4	HALON SYSTEM
*	T/S	3.7.9.5	FIRE HOSE STATIONS

THERE ARE 7 ITEMS REFERENCED FOR SYS 72

HONDO (TECH SPEC/FSAR) INDEX

REFERENCED SYSTEM IS:

73 ELECTRICAL POWER SYSTEMS

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
R	T/S	3.3.3.8	FIRE DETECTION INSTRUMENTATION
R	T/S	3.4.4	PRESSURIZER
*	T/S	3.8.1.1	A.C. SOURCES--OPERATING
*	T/S	3.8.1.2	A.C. SOURCES--SHUTDOWN
*	T/S	3.8.2.1	A.C. DISTRIBUTION--OPERATING
*	T/S	3.8.2.2	A.C. DISTRIBUTION--SHUTDOWN
*	T/S	3.8.2.3	D.C. DISTRIBUTION--OPERATING
*	T/S	3.8.2.4	D.C. DISTRIBUTION--SHUTDOWN
*	T/S	3.8.2.5	D.C. DISTRIBUTION--OPERATING--TRAIN N BATTERY
*	T/S	3.8.3.1	ALTERNATIVE A.C. POWER SOURCES

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
77 600 VOLT SYSTEM--11C & 11D

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
R	T/S	3.7.9.3	LOW PRESSURE CO2 SYSTEMS
R	T/S	3.7.9.5	FIRE HOSE STATIONS
R	T/S	3.8.1.1	A.C. SOURCES--OPERATING
R	T/S	3.8.1.2	A.C. SOURCES--SHUTDOWN
*	T/S	3.8.2.1	A.C. DISTRIBUTION--OPERATING
*	T/S	3.8.2.2	A.C. DISTRIBUTION--SHUTDOWN

THERE ARE 8 ITEMS REFERENCED FOR SYS 77

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
78 69 KV MANUAL ALTERNATE RESERVE SOURCE

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
R	T/S	3.7.9.3	LOW PRESSURE CO2 SYSTEMS
*	T/S	3.8.3.1	ALTERNATIVE A.C. POWER SOURCES

THERE ARE 4 ITEMS REFERENCED FOR SYS 78

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
79 DIESEL GENERATORS--AB

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
2	T/S	3.1.2.3	BORATION SYS/CHARGING PUMP--SHUTDOWN
2	T/S	3.3.2.1	ESF ACTUATION SYSTEM INSTRUMENTATION
R	T/S	3.3.3.8	FIRE DETECTION INSTRUMENTATION
R	T/S	3.4.11	RELIEF VALVES OPERATING
R	T/S	3.7.9.3	LOW PRESSURE CO2 SYSTEMS
R	T/S	3.7.9.5	FIRE HOSE STATIONS
*	T/S	3.8.1.1	A.C. SOURCES--OPERATING
*	T/S	3.8.1.2	A.C. SOURCES--SHUTDOWN
2	T/S	3.8.2.1	A.C. DISTRIBUTION--OPERATING
2	T/S	3.8.2.2	A.C. DISTRIBUTION--SHUTDOWN
2	T/S	3.8.2.3	D.C. DISTRIBUTION--OPERATING
2	T/S	3.8.2.4	D.C. DISTRIBUTION--SHUTDOWN
R	T/S	3.8.2.5	D.C. DISTRIBUTION--OPERATING--TRAIN N BATTERY

THERE ARE 15 ITEMS REFERENCED FOR SYS 79

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
80 DIESEL GENERATORS--CD

SIGNIF. ITEM NO. REFERENCED ITEM

*	T/S	3.8.2.2	A.C. DISTRIBUTION--SHUTDOWN

THERE ARE 6 ITEMS REFERENCED FOR SYS 83

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
84 120 VOLT AC SYSTEM--C4

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
R	T/S	3.8.1.1	A.C. SOURCES--OPERATING
R	T/S	3.8.1.2	A.C. SOURCES--SHUTDOWN
*	T/S	3.8.2.1	A.C. DISTRIBUTION--OPERATING
*	T/S	3.8.2.2	A.C. DISTRIBUTION--SHUTDOWN

THERE ARE 6 ITEMS REFERENCED FOR SYS 84

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
85 250 VOLT DC SYSTEM--AB

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
R	T/S	3.4.11	RELIEF VALVES OPERATING
*	T/S	3.8.2.3	D.C. DISTRIBUTION--OPERATING
*	T/S	3.8.2.4	D.C. DISTRIBUTION--SHUTDOWN

THERE ARE 5 ITEMS REFERENCED FOR SYS 85

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
86 250 VOLT DC SYSTEM--CD

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
R	T/S	3.4.11	RELIEF VALVES OPERATING
*	T/S	3.8.2.3	D.C. DISTRIBUTION--OPERATING
*	T/S	3.8.2.4	D.C. DISTRIBUTION--SHUTDOWN

THERE ARE 5 ITEMS REFERENCED FOR SYS 86

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
87 250 VOLT DC BATTERY N SYSTEM

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
R	T/S	3.4.11	RELIEF VALVES OPERATING
*	T/S	3.8.2.5	D.C. DISTRIBUTION--OPERATING--TRAIN N BATTERY

THERE ARE 4 ITEMS REFERENCED FOR SYS 87

R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER

THERE ARE 2 ITEMS REFERENCED FOR SYS 90

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
91 REFUELING CANAL DRAIN

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
R	T/S	3.5.2	ECCS SUBSYSTEMS--T AVG > 350 DEG F
R	T/S	3.5.3	ECCS SUBSYSTEMS--T AVG < 350 DEG F
*	T/S	3.6.5.8	REFUELING CANAL DRAINS

THERE ARE 5 ITEMS REFERENCED FOR SYS 91

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
92 SPENT FUEL POOL VENTILATION SYSTEM

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
*	T/S	3.9.12	STORAGE POOL VENTILATION SYSTEM

THERE ARE 3 ITEMS REFERENCED FOR SYS 92

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
93 REFUELING WATER PURIFICATION

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
R	T/S	3.9.9	CONTAINMENT AND EXHAUST ISOLATION--ALTERATIONS

THERE ARE 3 ITEMS REFERENCED FOR SYS 93

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
94 MANIPULATOR CRANE

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
R	T/S	3.9.3	REFUELING OPERATIONS--DECAY TIME
*	T/S	3.9.6	MANIPULATOR CRANE DURING CORE ALTERATIONS

THERE ARE 4 ITEMS REFERENCED FOR SYS 94

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
95 SPENT FUEL CASK HANDLING CRANE

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER

THERE ARE 2 ITEMS REFERENCED FOR SYS 98

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
99 CONTAINMENT AIR RECIRCULATION SYSTEM--CEQ-1

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
2	T/S	3.3.2.1	ESF ACTUATION SYSTEM INSTRUMENTATION
*	T/S	3.6.5.6	CONTAINMENT AIR RECIRCULATION SYSTEMS

THERE ARE 4 ITEMS REFERENCED FOR SYS 99

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
100 CONTAINMENT AIR RECIRCULATION SYSTEM--CEQ-2

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
2	T/S	3.3.2.1	ESF ACTUATION SYSTEM INSTRUMENTATION
*	T/S	3.6.5.6	CONTAINMENT AIR RECIRCULATION SYSTEMS

THERE ARE 4 ITEMS REFERENCED FOR SYS 100

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
101 CONTAINMENT PRESSURE RELIEF SYSTEM

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	1.34	DEF. OF VENTING
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
R	T/S	3.6.3.1	CONTAINMENT ISOLATION VALVES

THERE ARE 4 ITEMS REFERENCED FOR SYS 101

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
102 CONTAINMENT PURGE AND EXHAUST SYSTEM

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	1.33	DEF. OF PURGE-PURGING
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
2	T/S	3.3.2.1	ESF ACTUATION SYSTEM INSTRUMENTATION
R	T/S	3.3.3.10	RAD. GAS. PROCESS AND EFFLUENT MONTIORING INST.
*	T/S	3.6.1.7	CONTAINMENT VENTILATION SYSTEM
R	T/S	3.6.3.1	CONTAINMENT ISOLATION VALVES

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
107 ICE CONDENSER DOORS--LOWER INLET

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
2	T/S	3.6.5.1	ICE BED
R	T/S	3.6.5.2	ICE BED TEMPERATURE MONITORING SYSTEM
*	T/S	3.6.5.3	ICE CONDENSER DOORS
R	T/S	3.6.5.4	INLET DOOR POSITION MONITORING SYSTEM

THERE ARE 6 ITEMS REFERENCED FOR SYS 107

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
108 ICE CONDENSER DOORS--INTERMEDIATE DECK

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
2	T/S	3.6.5.1	ICE BED
R	T/S	3.6.5.2	ICE BED TEMPERATURE MONITORING SYSTEM
*	T/S	3.6.5.3	ICE CONDENSER DOORS

THERE ARE 5 ITEMS REFERENCED FOR SYS 108

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
109 ICE CONDENSER DOORS--TOP DECK

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
2	T/S	3.6.5.1	ICE BED
R	T/S	3.6.5.2	ICE BED TEMPERATURE MONITORING SYSTEM
*	T/S	3.6.5.3	ICE CONDENSER DOORS

THERE ARE 5 ITEMS REFERENCED FOR SYS 109

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
110 ICE CONDENSER DRAIN

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
R	T/S	3.6.3.1	CONTAINMENT ISOLATION VALVES
2	T/S	3.6.5.1	ICE BED
*	T/S	3.6.5.7	FLOOR DRAINS

THERE ARE 5 ITEMS REFERENCED FOR SYS 110

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
111 REFRIGERATION SYSTEM

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	1.8	DEF. OF CONTAINMENT INTEGRITY
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
*	T/S	3.6.1.1	CONTAINMENT INTEGRITY
*	T/S	3.6.1.2	CONTAINMENT LEAKAGE
*	T/S	3.6.1.3	CONTAINMENT AIR LOCKS
*	T/S	3.6.5.5	PERSONNEL AND EQUIPMENT HATCH
*	T/S	3.9.4	CONTAINMENT BLDG. PENETRATIONS--REFUELING
R	T/S	3.9.8.1	RHR AND COOLANT CIRCULATION--CORE ALTERATIONS

THERE ARE 9 ITEMS REFERENCED FOR SYS 115

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
116 CONTAINMENT ISOLATION VALVES

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	1.8	DEF. OF CONTAINMENT INTEGRITY
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
2	T/S	3.3.2.1	ESF ACTUATION SYSTEM INSTRUMENTATION
*	T/S	3.6.1.1	CONTAINMENT INTEGRITY
*	T/S	3.6.1.2	CONTAINMENT LEAKAGE
*	T/S	3.6.3.1	CONTAINMENT ISOLATION VALVES
R	T/S	3.8.2.3	D.C. DISTRIBUTION--OPERATING
R	T/S	3.8.2.4	D.C. DISTRIBUTION--SHUTDOWN
*	T/S	3.9.4	CONTAINMENT BLDG. PENETRATIONS--REFUELING
R	T/S	3.9.8.1	RHR AND COOLANT CIRCULATION--CORE ALTERATIONS

THERE ARE 11 ITEMS REFERENCED FOR SYS 116

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
117 CONT. PENETRATION & WELD CHANNEL PRESSURIZATION

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	1.8	DEF. OF CONTAINMENT INTEGRITY
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
*	T/S	3.6.1.1	CONTAINMENT INTEGRITY
*	T/S	3.6.1.2	CONTAINMENT LEAKAGE
R	T/S	3.6.3.1	CONTAINMENT ISOLATION VALVES
*	T/S	3.9.4	CONTAINMENT BLDG. PENETRATIONS--REFUELING

THERE ARE 7 ITEMS REFERENCED FOR SYS 117

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
118 CONTAINMENT STRUCTURE

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	1.8	DEF. OF CONTAINMENT INTEGRITY
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER

	T/S	3.6.2.1	CONTAINMENT SPRAY SYSTEM
	T/S	3.6.2.2	SPRAY ADDITIVE SYSTEM
R	T/S	3.6.5.8	REFUELING CANAL DRAINS
R	T/S	3.7.7.1	SNUBBERS

THERE ARE 7 ITEMS REFERENCED FOR SYS 122

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
123 CONTAINMENT SPRAY SYSTEM--WEST

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
2	T/S	3.3.2.1	ESF ACTUATION SYSTEM INSTRUMENTATION
*	T/S	3.6.2.1	CONTAINMENT SPRAY SYSTEM
R	T/S	3.6.2.2	SPRAY ADDITIVE SYSTEM
R	T/S	3.6.5.8	REFUELING CANAL DRAINS
R	T/S	3.7.7.1	SNUBBERS

THERE ARE 7 ITEMS REFERENCED FOR SYS 123

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
124 COMBUSTIBLE GAS CONTROL

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
R	T/S	3.6.4.1	HYDROGEN ANALYZERS
R	T/S	3.6.4.2	ELECTRIC HYDROGEN RECOMBINERS

THERE ARE 4 ITEMS REFERENCED FOR SYS 124

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
125 HYDROGEN ANALYZERS

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
R	T/S	3.6.3.1	CONTAINMENT ISOLATION VALVES
*	T/S	3.6.4.1	HYDROGEN ANALYZERS

THERE ARE 4 ITEMS REFERENCED FOR SYS 125

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
126 HYDROGEN RECOMBINERS--HR-1

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
*	T/S	3.6.4.2	ELECTRIC HYDROGEN RECOMBINERS

THERE ARE 3 ITEMS REFERENCED FOR SYS 126

[illegible]NCED SYSTEM IS:
130 MANUAL REACTOR TRIP

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	1.9	DEF. OF CHANNEL CALIBRATION
R	T/S	1.10	DEF. OF CHANNEL CHECK
R	T/S	1.11	DEF. OF CHANNEL FUNCTIONAL TEST
R	T/S	1.22	DEF. OF REACTOR TRIP SYSTEM RESPONSE TIME
*	T/S	2.2.1	REACTOR TRIP SYSTEM INST. SETPOINTS
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
*	T/S	3.3.1.1	REACTOR TRIP SYSTEM INSTRUMENTATION

THERE ARE 8 ITEMS REFERENCED FOR SYS 130

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
131 NEUTRON FLUX (POWER RANGE)

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.4	DEF. OF OPERATIONAL MODE
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	1.9	DEF. OF CHANNEL CALIBRATION
R	T/S	1.10	DEF. OF CHANNEL CHECK
R	T/S	1.11	DEF. OF CHANNEL FUNCTIONAL TEST
R	T/S	1.18	DEF. OF QUADRANT POWER TILT RATIO
R	T/S	1.22	DEF. OF REACTOR TRIP SYSTEM RESPONSE TIME
R	T/S	1.24	DEF. OF AXIAL FLUX DIFFERENCE
R	T/S	1.25	DEF. OF PHYSICS TESTS
R	T/S	2.1.1	SAFETY LIMITS--REACTOR CORE
*	T/S	2.2.1	REACTOR TRIP SYSTEM INST. SETPOINTS
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
2	T/S	3.1.1.4	MODERATOR TEMPERATURE COEFFICIENT
R	T/S	3.1.3.1	MOVABLE CONTROL ASSEMBLIES
R	T/S	3.1.3.2	POSITION INDICATOR CHANNELS--OPERATING
2	T/S	3.2.1	AXIAL FLUX DIFFERENCE
2	T/S	3.2.2	HEAT FLUX HOT CHANNEL FACTOR
*	T/S	3.2.4	QUADRANT POWER TILT RATIO
R	T/S	3.2.5	DNB PARAMETERS
R	T/S	3.2.6	AXIAL POWER DISTRIBUTION
*	T/S	3.3.1.1	REACTOR TRIP SYSTEM INSTRUMENTATION
R	T/S	3.3.2.1	ESF ACTUATION SYSTEM INSTRUMENTATION
R	T/S	3.3.3.2	MOVABLE INCORE DETECTORS
R	T/S	3.4.1.4	RCS LOOPS--THREE LOOP OPERATION
R	T/S	3.7.1.1	SECONDARY SAFETY VALVES
R	T/S	3.10.2	TEST EXCEPTION--HEIGHT,INSERTION,POWER DIST.
*	T/S	3.10.3	TEST EXCEPTION--PHYSICS TESTS

THERE ARE 27 ITEMS REFERENCED FOR SYS 131

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
132 NEUTRON FLUX (INTERMEDIATE RANGE)

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.4	DEF. OF OPERATIONAL MODE
R	T/S	1.6	DEF. OF OPERABLE

[illegible]	T/S 1.9	DEF. OF CHANNEL CALIBRATION
R	T/S 1.10	DEF. OF CHANNEL CHECK
R	T/S 1.11	DEF. OF CHANNEL FUNCTIONAL TEST
R	T/S 1.22	DEF. OF REACTOR TRIP SYSTEM RESPONSE TIME
*	T/S 2.2.1	REACTOR TRIP SYSTEM INST. SETPOINTS
R	T/S 3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
*	T/S 3.3.1.1	REACTOR TRIP SYSTEM INSTRUMENTATION
R	T/S 3.4.1.4	RCS LOOPS--THREE LOOP OPERATION

THERE ARE 9 ITEMS REFERENCED FOR SYS 134

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
135 OVERPOWER DELTA T

SIGNIF.	ITEM NO.	REFERENCED ITEM
R	T/S 1.6	DEF. OF OPERABLE
R	T/S 1.9	DEF. OF CHANNEL CALIBRATION
R	T/S 1.10	DEF. OF CHANNEL CHECK
R	T/S 1.11	DEF. OF CHANNEL FUNCTIONAL TEST
R	T/S 1.22	DEF. OF REACTOR TRIP SYSTEM RESPONSE TIME
*	T/S 2.2.1	REACTOR TRIP SYSTEM INST. SETPOINTS
R	T/S 3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
2	T/S 3.2.2	HEAT FLUX HOT CHANNEL FACTOR
*	T/S 3.3.1.1	REACTOR TRIP SYSTEM INSTRUMENTATION
R	T/S 3.4.1.4	RCS LOOPS--THREE LOOP OPERATION

THERE ARE 10 ITEMS REFERENCED FOR SYS 135

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
136 PRESSURIZER PRESSURE

SIGNIF.	ITEM NO.	REFERENCED ITEM
R	T/S 1.6	DEF. OF OPERABLE
R	T/S 1.9	DEF. OF CHANNEL CALIBRATION
R	T/S 1.10	DEF. OF CHANNEL CHECK
R	T/S 1.11	DEF. OF CHANNEL FUNCTIONAL TEST
R	T/S 1.22	DEF. OF REACTOR TRIP SYSTEM RESPONSE TIME
R	T/S 2.1.1	SAFETY LIMITS--REACTOR CORE
R	T/S 2.1.2	SAFETY LIMITS--RCP PRESSURE
*	T/S 2.2.1	REACTOR TRIP SYSTEM INST. SETPOINTS
R	T/S 3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
*	T/S 3.2.5	DNB PARAMETERS
*	T/S 3.3.1.1	REACTOR TRIP SYSTEM INSTRUMENTATION
*	T/S 3.3.2.1	ESF ACTUATION SYSTEM INSTRUMENTATION
*	T/S 3.3.3.5	REMOTE SHUTDOWN INSTRUMENTATION
*	T/S 3.3.3.6	POST-ACCIDENT INSTRUMENTATION
R	T/S 3.4.7	RCS--CHEMISTRY
R	T/S 3.4.9.1	RCS--PRESSURE/TEMPERATURE LIMITS
R	T/S 3.4.9.2	PRESSURIZER TEMPERATURE LIMITS
R	T/S 3.5.1	ACCUMULATORS
R	T/S 3.5.2	ECCS SUBSYSTEMS--T AVG > 350 DEG F
R	T/S 3.5.3	ECCS SUBSYSTEMS--T AVG < 350 DEG F
R	T/S 3.7.2.1	STEAM GENERATOR PRESSURE/TEMPERATURE LIMITS
R	T/S 5.4.1	RCS DESIGN PRESSURE AND TEMPERATURE
R	T/S 5.7.1	COMPONENT CYCLIC OR TRANSIENT LIMIT

[illegible]	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO PO[illegible]
[illegible]	T/S	3.3.1.1	REACTOR TRIP SYSTEM INSTRUMENTATION
*	T/S	3.3.2.1	ESF ACTUATION SYSTEM INSTRUMENTATION
R	T/S	3.5.1	ACCUMULATORS
R	T/S	3.7.3.1	COMPONENT COOLING WATER SYSTEM
R	T/S	3.7.4.1	ESSENTIAL SERVICE WATER SYSTEM
R	T/S	3.7.5	CONTROL ROOM EMERGENCY VENTILATION SYSTEM
R	T/S	3.8.1.1	A.C. SOURCES--OPERATING
R	T/S	3.8.1.2	A.C. SOURCES--SHUTDOWN

THERE ARE 16 ITEMS REFERENCED FOR SYS 139

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
140 TURBINE-GENERATOR

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	1.9	DEF. OF CHANNEL CALIBRATION
R	T/S	1.10	DEF. OF CHANNEL CHECK
R	T/S	1.11	DEF. OF CHANNEL FUNCTIONAL TEST
R	T/S	1.22	DEF. OF REACTOR TRIP SYSTEM RESPONSE TIME
R	T/S	1.23	DEF. OF ESF RESPONSE TIME
*	T/S	2.2.1	REACTOR TRIP SYSTEM INST. SETPOINTS
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
*	T/S	3.3.1.1	REACTOR TRIP SYSTEM INSTRUMENTATION
*	T/S	3.3.2.1	ESF ACTUATION SYSTEM INSTRUMENTATION

THERE ARE 10 ITEMS REFERENCED FOR SYS 140

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
141 STEAM GENERATOR WATER LEVEL

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	1.9	DEF. OF CHANNEL CALIBRATION
R	T/S	1.10	DEF. OF CHANNEL CHECK
R	T/S	1.11	DEF. OF CHANNEL FUNCTIONAL TEST
R	T/S	1.22	DEF. OF REACTOR TRIP SYSTEM RESPONSE TIME
R	T/S	1.23	DEF. OF ESF RESPONSE TIME
*	T/S	2.2.1	REACTOR TRIP SYSTEM INST. SETPOINTS
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
*	T/S	3.3.1.1	REACTOR TRIP SYSTEM INSTRUMENTATION
*	T/S	3.3.2.1	ESF ACTUATION SYSTEM INSTRUMENTATION
*	T/S	3.3.3.5	REMOTE SHUTDOWN INSTRUMENTATION
*	T/S	3.3.3.6	POST-ACCIDENT INSTRUMENTATION

THERE ARE 12 ITEMS REFERENCED FOR SYS 141

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
142 CONTAINMENT SUMP INDICATION

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	1.9	DEF. OF CHANNEL CALIBRATION

	T/S	3.6.2.2	SPRAY ADDITIVE SYSTEM
	T/S	3.7.6.1	ESF VENTILATION SYSTEM
R	T/S	5.2.2	CONTAINMENT DESIGN PRESSURE AND TEMPERATURE

THERE ARE 15 ITEMS REFERENCED FOR SYS 145

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
146 CONTAINMENT RADIATION

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	1.9	DEF. OF CHANNEL CALIBRATION
R	T/S	1.10	DEF. OF CHANNEL CHECK
R	T/S	1.11	DEF. OF CHANNEL FUNCTIONAL TEST
R	T/S	1.23	DEF. OF ESF RESPONSE TIME
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
*	T/S	3.3.2.1	ESF ACTUATION SYSTEM INSTRUMENTATION
*	T/S	3.3.3.1	RADIATION MONITORING SYSTEM
*	T/S	3.4.6.1	RCS--LEAKAGE DETECTION SYSTEMS
R	T/S	3.4.6.2	RCS--OPERATIONAL LEAKAGE
R	T/S	3.6.1.7	CONTAINMENT VENTILATION SYSTEM
R	T/S	3.6.3.1	CONTAINMENT ISOLATION VALVES
R	T/S	3.9.9	CONTAINMENT AND EXHAUST ISOLATION--ALTERATIONS

THERE ARE 13 ITEMS REFERENCED FOR SYS 146

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
147 ICE CONDENSER TEMPERATURE MONITORING INST.

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	1.9	DEF. OF CHANNEL CALIBRATION
R	T/S	1.10	DEF. OF CHANNEL CHECK
R	T/S	1.11	DEF. OF CHANNEL FUNCTIONAL TEST
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
2	T/S	3.6.5.1	ICE BED
*	T/S	3.6.5.2	ICE BED TEMPERATURE MONITORING SYSTEM
R	T/S	3.6.5.3	ICE CONDENSER DOORS
2	T/S	3.6.5.4	INLET DOOR POSITION MONITORING SYSTEM

THERE ARE 9 ITEMS REFERENCED FOR SYS 147

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
148 ICE CONDENSER DOOR POSITION INDICATORS

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	1.9	DEF. OF CHANNEL CALIBRATION
R	T/S	1.10	DEF. OF CHANNEL CHECK
R	T/S	1.11	DEF. OF CHANNEL FUNCTIONAL TEST
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
2	T/S	3.6.5.1	ICE BED
R	T/S	3.6.5.2	ICE BED TEMPERATURE MONITORING SYSTEM
*	T/S	3.6.5.3	ICE CONDENSER DOORS

R	T/S	1.6	DEF. OF OPERABLE
R	T/S	1.9	DEF. OF CHANNEL CALIBRATION
R	T/S	1.10	DEF. OF CHANNEL CHECK
R	T/S	1.11	DEF. OF CHANNEL FUNCTIONAL TEST
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
*	T/S	3.3.3.3	SEISMIC INSTRUMENTATION
R	T/S	5.7.1	COMPONENT CYCLIC OR TRANSIENT LIMIT

THERE ARE 7 ITEMS REFERENCED FOR SYS 152

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
153 REFUELING WATER STORAGE TANK LEVEL INDICATORS

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	1.9	DEF. OF CHANNEL CALIBRATION
R	T/S	1.10	DEF. OF CHANNEL CHECK
R	T/S	1.11	DEF. OF CHANNEL FUNCTIONAL TEST
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
R	T/S	3.1.2.7	BORATED WATER SOURCES--SHUTDOWN
R	T/S	3.1.2.8	BORATED WATER SOURCES--OPERATING
*	T/S	3.3.3.6	POST-ACCIDENT INSTRUMENTATION

THERE ARE 8 ITEMS REFERENCED FOR SYS 153

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
154 LIQUID EFFLUENT RADIATION MONITORING

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	1.9	DEF. OF CHANNEL CALIBRATION
R	T/S	1.10	DEF. OF CHANNEL CHECK
R	T/S	1.11	DEF. OF CHANNEL FUNCTIONAL TEST
R	T/S	1.30	DEF. OF OFFSITE DOSE CALCULATION MANUAL
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
*	T/S	3.3.3.9	RADIOACTIVE LIQUID EFFLUENT INSTRUMENTATION
R	T/S	3.7.1.4	SECONDARY COOLANT SYSTEM--ACTIVITY
*	T/S	3.11.1.1	RADIOACTIVE LIQUID EFFLUENTS--CONCENTRATION
R	T/S	3.11.1.2	RADIOACTIVE LIQUID EFFLUENTS--DOSE
R	T/S	3.11.1.3	RADIOACTIVE LIQUID WASTE--TREATMENT
R	T/S	3.11.1.4	RADIOACTIVE LIQUID HOLDUP TANKS
R	T/S	3.12.1	ENVIRONMENTAL RADIATION MONITORING
R	T/S	3.12.2	LAND USE CENSUS
R	T/S	3.12.3	INTER LABORATORY COMPARISON PROGRAM
R	T/S	5.1.3	SITE BOUNDARY FOR EFFLUENTS

THERE ARE 16 ITEMS REFERENCED FOR SYS 154

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
155 GASEOUS EFFLUENT RADIATION MONITORING

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
156 RESISTANCE TEMPERATURE DETECTOR (RTD)--T HOT

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.2	DEF. OF THERMAL POWER
R	T/S	1.3	DEF. OF RATED THERMAL POWER
R	T/S	1.4	DEF. OF OPERATIONAL MODE
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	1.12	DEF. OF CORE ALTERATION
R	T/S	1.13	DEF. OF SHUTDOWN MARGIN
R	T/S	1.18	DEF. OF QUADRANT POWER TILT RATIO
R	T/S	1.24	DEF. OF AXIAL FLUX DIFFERENCE
R	T/S	1.25	DEF. OF PHYSICS TESTS
*	T/S	2.1.1	SAFETY LIMITS--REACTOR CORE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
*	T/S	3.1.1.1	BORATION/SHUTDOWN MARGIN--T AVG > 200 DEG. F
*	T/S	3.1.1.2	BORATION/SHUTDOWN MARGIN--T AVG < 200 DEG. F
R	T/S	3.1.1.4	MODERATOR TEMPERATURE COEFFICIENT
R	T/S	3.1.1.5	MINIMUM TEMPERATURE FOR CRITICALITY
R	T/S	3.1.2.5	BORIC ACID TRANSFER PUMPS--SHUTDOWN
R	T/S	3.1.2.6	BORIC ACID TRANSFER PUMPS--OPERATING
R	T/S	3.1.2.7	BORATED WATER SOURCES--SHUTDOWN
*	T/S	3.2.1	AXIAL FLUX DIFFERENCE
*	T/S	3.2.2	HEAT FLUX HOT CHANNEL FACTOR
*	T/S	3.2.4	QUADRANT POWER TILT RATIO
R	T/S	3.2.5	DNB PARAMETERS
*	T/S	3.2.6	AXIAL POWER DISTRIBUTION
R	T/S	3.3.3.2	MOVABLE INCORE DETECTORS
R	T/S	3.3.3.7	AXIAL POWER DISTRIBUTION MONITORING SYS
R	T/S	3.4.8	RCS--SPECIFIC ACTIVITY
R	T/S	3.5.4.1	BORON INJECTION TANK
2	T/S	3.9.2	REFUELING OPERATIONS--INSTRUMENTATION
R	T/S	3.9.3	REFUELING OPERATIONS--DECAY TIME
*	T/S	3.10.1	TEST EXCEPTION--SHUTDOWN MARGIN
*	T/S	3.10.2	TEST EXCEPTION--HEIGHT,INSERTION,POWER DIST.
*	T/S	3.10.3	TEST EXCEPTION--PHYSICS TESTS
R	T/S	3.10.5	TEST EXCEPTION--POSITION INDICATOR CHANNELS
*	T/S	5.3.1	FUEL ASSEMBLIES
*	T/S	5.3.2	CONTROL ROD ASSEMBLIES

THERE ARE 35 ITEMS REFERENCED FOR SYS 156

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
157 RESISTANCE TEMPERATURE DETECTOR (RTD)--T COLD

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	1.12	DEF. OF CORE ALTERATION
R	T/S	1.13	DEF. OF SHUTDOWN MARGIN
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
*	T/S	3.1.3.1	MOVABLE CONTROL ASSEMBLIES
R	T/S	3.1.3.2	POSITION INDICATOR CHANNELS--OPERATING
2	T/S	3.1.3.3	POSITION INDICATOR CHANNELS--SHUTDOWN
*	T/S	3.1.3.4	ROD DROP TIME
*	T/S	3.1.3.5	SHUTDOWN ROD INSERTION LIMIT

THERE ARE 15 ITEMS REFERENCED FOR SYS 159

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
160 PORV INDICATION

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	1.12	DEF. OF CORE ALTERATION
R	T/S	1.25	DEF. OF PHYSICS TESTS
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
R	T/S	3.1.3.1	MOVABLE CONTROL ASSEMBLIES
R	T/S	3.1.3.2	POSITION INDICATOR CHANNELS--OPERATING
*	T/S	3.2.2	HEAT FLUX HOT CHANNEL FACTOR
*	T/S	3.2.3	RCS FLOW RATE AND R
R	T/S	3.2.4	QUADRANT POWER TILT RATIO
*	T/S	3.2.6	AXIAL POWER DISTRIBUTION
R	T/S	3.3.1.1	REACTOR TRIP SYSTEM INSTRUMENTATION
*	T/S	3.3.3.2	MOVABLE INCORE DETECTORS
*	T/S	3.3.3.7	AXIAL POWER DISTRIBUTION MONITORING SYS
R	T/S	3.6.3.1	CONTAINMENT ISOLATION VALVES
R	T/S	3.10.2	TEST EXCEPTION--WEIGHT,INSERTION,POWER DIST.
R	T/S	3.10.3	TEST EXCEPTION--PHYSICS TESTS

THERE ARE 16 ITEMS REFERENCED FOR SYS 160

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
161 BLOCK VALVE INDICATION

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	1.12	DEF. OF CORE ALTERATION
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER

THERE ARE 3 ITEMS REFERENCED FOR SYS 161

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
162 ACOUSTIC MONITOR

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.2	DEF. OF THERMAL POWER
R	T/S	1.3	DEF. OF RATED THERMAL POWER
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	1.12	DEF. OF CORE ALTERATION
R	T/S	1.14	DEF. OF IDENTIFIED LEAKAGE
R	T/S	1.15	DEF. OF UNIDENTIFIED LEAKAGE
R	T/S	1.16	DEF. OF PRESSURE BOUNDARY LEAKAGE
R	T/S	1.17	DEF. OF CONTROLLED LEAKAGE
*	T/S	2.1.2	SAFETY LIMITS--RCP PRESSURE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
*	T/S	3.1.1.1	BORATION/SHUTDOWN MARGIN--T AVG > 200 DEG. F
*	T/S	3.1.1.2	BORATION/SHUTDOWN MARGIN--T AVG < 200 DEG. F
*	T/S	3.1.1.3	BORON DILUTION
*	T/S	3.1.1.4	MODERATOR TEMPERATURE COEFFICIENT

THERE ARE 12 ITEMS REFERENCED FOR SYS 163

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
164 AXIAL FLUX DIFFERENCE (AFD) INDICATION

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
2	T/S	2.1.2	SAFETY LIMITS--RCP PRESSURE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
R	T/S	3.2.5	DNB PARAMETERS
*	T/S	3.4.4	PRESSURIZER
R	T/S	3.4.9.1	RCS--PRESSURE/TEMPERATURE LIMITS
*	T/S	3.4.9.2	PRESSURIZER TEMPERATURE LIMITS
R	T/S	3.4.9.3	OVERPRESSURE PROTECTION SYSTEMS
R	T/S	3.6.3.1	CONTAINMENT ISOLATION VALVES
R	T/S	3.7.7.1	SNUBBERS
*	T/S	5.4.1	RCS DESIGN PRESSURE AND TEMPERATURE

THERE ARE 11 ITEMS REFERENCED FOR SYS 164

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
165 STEAM/FEEDWATER FLOW MISMATCH

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
2	T/S	3.4.9.3	OVERPRESSURE PROTECTION SYSTEMS
R	T/S	3.6.3.1	CONTAINMENT ISOLATION VALVES
R	T/S	3.7.7.1	SNUBBERS

THERE ARE 5 ITEMS REFERENCED FOR SYS 165

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
166 REACTOR COOLANT PUMP BUSES

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
*	T/S	3.4.2	PRESSURIZER SAFETY VALVES--SHUTDOWN
*	T/S	3.4.3	PRESSURIZER SAFETY VALVES--OPERATING
R	T/S	3.4.6.2	RCS--OPERATIONAL LEAKAGE
*	T/S	3.4.9.3	OVERPRESSURE PROTECTION SYSTEMS

THERE ARE 6 ITEMS REFERENCED FOR SYS 166

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
167 REACTOR COOLANT PUMP BREAKER POSITION

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER

SIGNIF.	ITEM NO.		REFERENCED ITEM
[illegible]	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
*	T/S	3.4.9.3	OVERPRESSURE PROTECTION SYSTEMS

THERE ARE 3 ITEMS REFERENCED FOR SYS 170

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
171 STEAM LINE PRESSURE

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
R	T/S	3.5.1	ACCUMULATORS
R	T/S	3.5.2	ECCS SUBSYSTEMS--T AVG > 350 DEG F
R	T/S	3.5.3	ECCS SUBSYSTEMS--T AVG < 350 DEG F
R	T/S	3.5.4.1	BORON INJECTION TANK
R	T/S	3.5.4.2	HEAT TRACING FOR BORON INJECTION TANK
R	T/S	3.5.5	REFUELING WATER STORAGE TANK
R	T/S	3.6.3.1	CONTAINMENT ISOLATION VALVES

THERE ARE 9 ITEMS REFERENCED FOR SYS 171

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
172 4 KV BUS LOSS/DEGRADED VOLTAGE

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
*	T/S	3.5.1	ACCUMULATORS
R	T/S	3.6.3.1	CONTAINMENT ISOLATION VALVES

THERE ARE 4 ITEMS REFERENCED FOR SYS 172

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
173 LOSS OF MAIN FEEDWATER

SIGNIF.	ITEM NO.		REFERENCED ITEM
R	T/S	1.6	DEF. OF OPERABLE
R	T/S	3.0.5	LIMITING CONDITIONS/APPLICABILITY--NO POWER
*	T/S	3.5.2	ECCS SUBSYSTEMS--T AVG > 350 DEG F
*	T/S	3.5.3	ECCS SUBSYSTEMS--T AVG < 350 DEG F
*	T/S	3.5.4.1	BORON INJECTION TANK
2	T/S	3.5.4.2	HEAT TRACING FOR BORON INJECTION TANK
R	T/S	3.6.3.1	CONTAINMENT ISOLATION VALVES
R	T/S	5.2.2	CONTAINMENT DESIGN PRESSURE AND TEMPERATURE

THERE ARE 8 ITEMS REFERENCED FOR SYS 173

MONDO (TECH SPEC/FSAR) INDEX
REFERENCED SYSTEM IS:
174 AXIAL POWER DISTRIBUTION MONITORING SYSTEM

SIGNIF. ITEM NO. REFERENCED ITEM