ATTACHMENT A

Beaver Valley Power Station, Unit No. 2
Proposed Technical Specification Change No. 46

Revise the Technical Specifications as follows:

Remove Page	Insert Page
3/4 6-9	3/4 6-9

CONTAINMENT STRUCTURAL INTEGRITY

LIMITING CONDITION FOR OPERATION

3.6.1.6 The structural integrity of the containment shall be maintained at a level consistent with the acceptance criteria in Specification 4.6.1.6.1.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

With the structural integrity of the containment not conforming to the above requirements, restore the structural integrity to within the limits prior to increasing the Reactor Coolant System temperature above 200°F.

REPLACE WITH INSERT "A"

SURVEILLANCE REQUIREMENTS

4.6.1.6.1 Liner Plate and Concrete The structural integrity of the containment liner plate and concrete shall be determined during the shutdown for each Type A containment leakage rate test (reference Specification 4.6.1.2) by:

a. a visual inspection of the accessible surfaces and verifying no apparent changes in appearance or other abnormal degradation.

b. a visual inspection of accessible containment liner test channels prior to each Type A containment leakage rate test. Any containment liner test channel which is found to be damaged to the extent that channel integrity is impaired or which is discovered with a vent plug removed, shall be removed and a protective coating shall be applied to the liner in that area.

c. a visual inspection of the dome area prior to each Type A containment leakage rate test to insure the integrity of the protective coating.

4.6.1.6.2 Reports An initial report of any abnormal degradation of the containment structure detected during the above required tests and inspections shall be made within 10 days after completion of the surveillance requirements of this specification, and the detailed report shall be submitted pursuant to Specification 6.9.2 within 90 days after completion. This report shall include a description of the condition of the liner plate and concrete, the inspection procedure, the tolerances on cracking and the corrective actions taken.

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* Surveillance requirement 4.6.1.6.1.b is only applicable for the interval, including the Type A testing conducted during the second refueling outage, up to the refueling outage for the next scheduled Type A test as per surveillance requirement 4.6.1.2.a

ADD

(Proposed Wording)

Attachment to "Containment Structural Integrity"

Insert "A"

4.6.1.6.1 Containment structural integrity shall be determined by performing ONE of the following surveillances:

a. Liner Plate and Concrete The structural integrity of the containment liner plate and concrete shall be determined during the shutdown for each Type A containment leakage rate test (reference Specification 4.6.1.2) by:

1. a visual inspection of the accessible surfaces and verifying no apparent changes in appearance or other abnormal degradation.

2. a visual inspection of accessible containment liner test channels prior to each Type A containment leakage rate test. Any containment liner test channel which is found to be damaged to the extent that channel integrity is impaired or which is discovered with a vent plug removed, shall be removed and a protective coating shall be applied to the liner in that area.

3. a visual inspection of the dome area prior to each Type A containment leakage rate test to insure the integrity of the protective coating.

b.*Containment Vessel Surfaces The structural integrity of the exposed accessible interior and exterior surfaces of the containment vessel, including the liner plate, shall be determined during the shutdown for each Type A containment leakage rate test (reference Specification 4.6.1.2) by a visual inspection of these surfaces. This inspection shall be performed prior to the Type A containment leakage rate test to verify no apparent changes in appearance or other abnormal degradation.

ATTACHMENT B

Beaver Valley Power Station, Unit No. 2
Proposed Technical Specification Change No. 46
REVISION OF TECHNICAL SPECIFICATION 4.6.1.6.1

A. DESCRIPTION OF AMENDMENT REQUEST

The proposed amendment would revise surveillance requirement 4.6.1.6.1 to include an alternative to the present surveillance requirement. The alternate surveillance requirement is consistent with the Standard Technical Specifications (STS), and does not contain specific details on the required actions pertaining to test channels. In addition, a footnote was added which limits the duration for which the alternate surveillance is applicable.

B. BACKGROUND

The Beaver Valley Power Station (BVPS) Unit No. 2 containment building has a continuously welded carbon steel membrane, supported by and anchored to the inside of the containment structure. Its' function is to act as a leak tight membrane in the event of an accident. The cylindrical portion of the liner is 3/8" thick, the hemispherical dome liner is 1/2" thick, the flat floor liner covering the mat is 1/4" thick, with the exception of areas where the transfer of loads requires either bridging bars or bridging plates. The floor liner plate is covered with approximately 2 ft of reinforced concrete that insulates it from transient temperature effects. At the intersection of the containment liner and the concrete floor, a 1/2" joint is provided. This joint is filled with a 1/2 inch premolded joint filler. The top of the joint is sealed with Sikaflex-1a elastic sealant/adhesive. All welded seams are covered with continuously welded test channels which are zoned into test areas by dams welded to the ends of the sections of the channels. Channels in the hemispherical dome and containment mat are covered with concrete while those on the cylindrical liner wall are exposed. These test channels were installed to facilitate leak testing of welds during the containment liner erection. Test ports were provided for each zone of the leak chase channels and after completion of weld testing, 1/8 - inch NPT pipe plugs (vent plugs) were installed in the test ports. These plugs remain in place during subsequent Type A leak-rate testing. The design, analysis, and construction of the BVPS Unit No. 2 containment building is similar to VEPCO's Surry and North Anna containment buildings. (Reference: Unit 2 UFSAR Section 3.8) The test channels in BVPS Unit 2 are constructed utilizing larger channel but installed in a manner similar to BVPS Unit 1.

There have been instances where several vent plugs have been found missing which would necessitate extensive grinding and cutting inside containment in order to satisfy the existing surveillance requirement. This action was performed at BVPS Unit 1 in 1982, however, the cutting and grinding of the test channels was not excessive. We have identified 25 vent plugs missing during the second refueling outage liner inspection on Unit 2 in preparation of conducting our Type A containment leakage rate test and are currently evaluating approximately 1500 feet of test channel against surveillance requirement 4.6.1.6.1.b.

C. JUSTIFICATION

The proposed alternate surveillance requirement is consist nt with the Standard Technical Specifications and 10 CFR 50 Appendix J. This proposed change adds a surveillance requirement that does not contain specific details on the required actions necessary if a test channel is found to be damaged or is discovered with a vent plug removed. The test channels, as stated in a Stone & Webster (S&W) Report titled "Containment Liner Test Channels at BVPS Unit No. 2" (Attachment 1) are capable of withstanding all loads that might be imposed on them during normal, test, and upset conditions without any loss of function. The presence of the test channels do not in any way impair the performance of the containment liner itself. This report was prepared for Unit No. 2 and is an equivalent report when compared to the Unit No. 1 report submitted with Change Request 1A-181/2A-45. The NRC recently (1989) determined the acceptability of these test channels as the containment pressure boundary at VEPCOs' Surry and North Anna Power Plants.

The containment liner welds associated with those test channels with missing vent plugs are considered acceptable for continued operation based on completion of the following activities:

1. inspections
2. chemical analyses
3. Type A testing

Visual inspection into the test channels associated with vent connections found with missing plugs was attempted using a 2 mm fiberoptic borascope with a video monitor. The borascope was passed through the vent connection tubing in an attempt to reach the associated test channel. Passage through the tubing was hampered by several 90 degree bends present in the tubing run. Each bend added additional resistance to movement of the borascope, and if too many bends were encountered, forward progress was prevented all together. Inspection results were video recorded for future reference. The borascope provided very good resolution, but had a limited area of view (approximately 1/4" - 3/8" dia). Because of the limited area of view the borascope results were inconclusive, however, borascope inspection was attempted for test channels associated with vent connections 90A, 90B, 90C, 92E, 89F, 54A, 56B and 99B.

Borascope inspection at vent connections 54A, 56B and 99B was not successful due to the number of 90 degree bends encountered (3 to 4), and tubing length (maximum insertion depth was approximately 4 1/2'). The tubing run provided too much resistance for borascope insertion into the test channel. The vent connection tubing which was observable was clean with minor corrosion noted at the pipe fittings.

Vent connection 90B was originally found with a missing vent plug, however its tubing was clogged with debris. Removal of debris was attempted using a metal brush, flexible auger, and an awl. A vacuum cleaner was used to suction out loose material. Samples of removed debris were also collected which appeared to be sand and/or sandblasting material.

The debris was very difficult to bore through, and appeared cement like. Total length of tubing cleared was approximately 3". No further cleaning was attempted so as not to damage the vent connection tubing.

Vent connections 90A and 90C were originally found with plugs installed. The test channel associated with 90A and 90C is also common with 90B; and therefore were used to gain access to the test channel.

Entry into the test channel for 90A was successful. An area of liner metal approximately 3/8" in diameter was visible. Indications of minor corrosion was visible, along with what appeared to be traces of moisture. The test channel in this area is for the horizontal weld in the base liner.

Entry into the test channel for 90C was also successful resulting in a visible area of liner metal approximately 3/8" in diameter. Indications of minor corrosion was visible, however there were no traces of moisture. The test channel in this area is for a vertical weld in the base to wall liner transition.

Vent connection 89F was originally found with a plug installed and the test channel associated with 89F did not have any missing plugs. Inspection of this test channel was attempted to determine the condition of a sealed test channel. Entry into the test channel for 89F was successful and an area of liner metal approximately 3/8" in diameter was visible. Indications of minor corrosion was visible, along with what appeared to be traces of moisture. The test channel in this area is for the horizontal weld in the base liner

Vent connection 92E was originally found with a missing vent plug and was clogged with debris. Removal of this debris was attempted using a metal brush, flexible auger, and an awl and a vacuum cleaner was used to suction out loose material.

The debris was not tightly compacted. However, difficulty was encountered in the removal of debris after the first 90 degree bend. The total length of tubing cleared was approximately 15". No further inspection could be attempted due to failure of the glass strands in the borascope probe which rendered the borascope inoperative.

Further borascopic visual inspections were not continued since previous inspections failed to provide adequate information to assess the condition of the liner or weld.

The concern of a missing test channel vent plug is the possibility of moisture entering the channel and causing corrosion. Therefore, sampling of any accumulated water was considered as a means to evaluate the possible extent of corrosion which may have occurred in the test channel.

Sampling for water was performed by inserting 1/8" diameter poly tubing into the vent connection and applying a suction source through a sample bottle. Sampling for water was performed at vent connections 85C, 85D, 85E, 85F, 85G, 13B, 90A, 92A, 92B, 83A, 83B, 83C. The 83 and 85 test channels were considered to be the most likely channels to contain water due to their close proximity to the containment sump. Water samples were obtainable from 83A and 85G only.

The results of the analysis of the samples revealed a pH of 10.1 and 11.4 with sodium (Na) in the range of 19 to 44 ppm. It is therefore assumed that the primary corrosive present is NaOH. In accordance with the information presented on page 1177 of Volume 13 of the ASM Handbook titled "Corrosion", the corrosion rates for Sodium Hydroxide solutions from very low molar solutions to very high solutions (<.0001 to >500) at room temperature range (60°F to 150°F) from a maximum of 2 mils per year to zero. The higher pH levels (11+) listed corrosion rates of .7 mils per year or less. Therefore a conservative rate of 2 mils per year is assumed. A total expected corrosion of 86 mils (40 year life plus 3 years of preservice) is bounded by the Stone and Webster evaluation on the 88 mils total allowance (Attachment 1).

This evaluation considered condensation present in the test channels due to a failed test channel fillet weld or a removed vent plug and is the worst case scenario due to oxygen supply replacement. This results in a corrosion allowance of 88 mils over a forty-year lifetime. There is sufficient margin in the containment liner thickness to accommodate a total, worst case corrosion of 88 mils over the life of the plant.

Based on current sample analyses, the S&W report conclusions and bases in the area of corrosion life are generally acceptable. Any test channel subsequently identified as holding free standing water will require further analyses and an evaluation of the corrosive properties of the sample to assure the containment liner remains capable of performing its' design function for the life of the plant.

The completion of the above evaluations in conjunction with the Type A test will provide assurance of the integrity of the containment liner for the duration of this request for a Technical Specification change.

The proposed wording for the alternate surveillance requirement 4.6.1.6.1.b contains specific requirements to inspect the exposed accessible interior and exterior surfaces of the containment vessel. This inspection will verify that no apparent changes in appearance or other abnormal degradation have occurred.

The visual inspection will continue to include the accessible exposed test channels and associated vent plugs. This proposed change to the Technical Specifications does not relax the requirement to assure the containment liner remains capable of performing its' intended function. Repairs, if any, to the liner will be made in accordance with the ASME Boiler and Pressure Vessel Code.

Therefore, this proposed change to include an alternate surveillance requirement 4.6.1.6.1.b does not affect the structural integrity or leak tightness of the containment vessel. The structural integrity of the containment vessel will still be verified by inspections and tests as required by 10 CFR 50, Appendix J, to ensure the containment structure will remain capable of performing its' intended function.

We will replace the missing vent plugs or, otherwise, seal off each test connection found with a missing vent plug following completion of the Type A test and dispositioning the subject liner welds. This will be done to preclude a corrosion rate that exceeds that assumed in the S&W containment liner test channel report by eliminating the source of possible reoxygenation to the test channels and prevent the introduction of fluids to the test channel environment, which could lower the pH.

D. SAFETY ANALYSIS

The structural integrity and leak tightness of the containment vessel will continue to be maintained to the original design standards for the life of the facility. The proposed change will not affect the capability of the containment vessel to withstand the maximum pressure expected for any postulated accident. The proposed wording for the alternate surveillance requirement is consistent with STS and the inspection criteria as stated in 10 CFR 50 Appendix J. The non-existence of the specific details pertaining to test channels and vent plugs in the alternate surveillance will not affect the ability of the containment vessel to meet its design function. Any apparent changes in appearance or other abnormal degradation discovered during the required inspection of the accessible interior and exterior surfaces of the containment vessel will be corrected in accordance with the ASME Boiler and Pressure Vessel Code prior to plant start-up. This inspection will continue to include accessible test channels, vent plugs and protective coatings. Therefore, this change is considered safe based on the fact that the proposed amendment will continue to verify the structural integrity and leak tightness of the containment vessel. This verification will ensure that the original design standards, including the ability to withstand the maximum pressure expected in the event of a design basis accident, are being maintained for the containment vessel.

E. NO SIGNIFICANT HAZARDS EVALUATION

The no significant hazards considerations involved with the proposed amendment have been evaluated, focusing on the three standards set forth in 10 CFR 50.92(c) as quoted below:

The commission may make a final determination, pursuant to the procedures in paragraph 50.91, that a proposed amendment to an operating license for a facility licensed under paragraph 50.21(b) or paragraph 50.22 or for a testing facility involves no significant hazards consideration, if operation of the facility in accordance with the proposed amendment would not:

1) Involve a significant increase in the probability or consequences of an accident previously evaluated; or

2) Create the possibility of a new or different kind of accident from any accident previously evaluated; or

3) Involve a significant reduction in a margin of safety.

The following evaluation is provided for the no significant hazards consideration standards:

1. Does the change involve a significant increase in the probability or consequences of an accident previously evaluated?

   The structural integrity and leak-tightness of the containment vessel will continue to be maintained. The ability to provide a leak-tight barrier against the uncontrolled release of radioactive material to the environment remains unchanged.

   Therefore, the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the change create the possibility of a new or different kind of accident form any previously evaluated?

   There would be no change to system configurations, plant equipment or analysis as a result of this proposed amendment. The containment structural integrity and leak-tightness will not be affected by this proposed change.

   Therefore, the proposed changes do not create the possibility of a new or different kind of accident previously evaluated.

3. Does the change involve a significant reduction in a margin of safety?

   The containment steel liner and external concrete surfaces will continue to provide the same structural integrity and leak-tightness assumed in the original design. Although not required, the existence of the plugged/sealed test channels provide additional protection in the form of a redundant barrier to the steel liner welds. The proposed amendment will continue to require that an inspection is conducted on the exposed accessible surfaces to verify no apparent changes in appearance or other abnormal degradation has occurred.

Therefore, the proposed change does not involve a significant reduction in a margin of safety.

F. NO SIGNIFICANT HAZARDS CONSIDERATION DETERMINATION
Based on the considerations expressed above, it is concluded that the activities associated with this license amendment request satisfies the no significant hazards consideration standards of 10 CFR 50.92(c) and, accordingly, a no significant hazards consideration finding is justified.

G. ENVIRONMENTAL EVALUATION

The proposed changes have been evaluated and it has been determined that the changes do not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluents that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed changes meet the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22 (b), an environmental assessment of the proposed changes is not required.

ATTACHMENT 1

Beaver Valley Power Station, Unit No. 2
Proposed Technical Specification Change No. 46
Containment Liner Test Channel Report

Attached is a Stone & Webster Engineering Report, dated September 14, 1983, which provides information relative to the evaluation of the function and the predicted performance of both the containment liner and test channels to demonstrate that the existing containment system presently provides and will continue to provide a leak-tight enclosure.

12241-S(B)-08.21

September 14, 1983

CONTAINMENT LINER TEST CHANNELS
AT
BEAVER VALLEY POWER STATION - UNIT NO. 2

Prepared for
Duquesne Light Company
by
Stone & Webster Engineering Corporation

by
P. W. Ward

Approved By: [signature] Project Engineer (Responsible Engineer) — Joseph E. Stiffano Sr. Division Head

[signature] Engineering Management

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SUMMARY

This report, for Beaver Valley Power Station - Unit No. 2 (BVPS-2), is a summary of the containment liner test channel evaluation which demonstrates that the existing containment system provides a leaktight boundary. The report further demonstrates that the leak chase channels and the associated welds meet the requirements associated with the primary containment boundary acceptance criteria, for attachments, as made applicable for the BVPS-2.

LIST OF FIGURES

INTRODUCTION

The purpose of this report is to demonstrate that the existing containment system provides a leaktight boundary.

Section 1 of this report presents a general description of the containment system; including: the concrete containment structure, metal containment liner, and liner test channels. This section describes the configuration, materials, construction procedures, tests, and inspections employed in the erection of the containment system.

Section 2 of this report presents detailed information pertaining to the control during fabrication, the control of materials, and integrity of the test channels.

CONCLUSIONS

The evaluation demonstrates that although the containment liner test channels were provided primarily for the testing of the liner seam welds during construction, and were not designed as part of the leaktight membrane, they are completely compatible with the liner; providing the same degree of leak tightness. The test channels are capable of withstanding all loads that might be imposed on them during normal, test, emergency and severe operational conditions without any loss of integrity. The presence of the test channels does not in any way impair the performance of the containment liner itself.

TECHNICAL SECTION 1

GENERAL DESCRIPTION OF CONTAINMENT LINER AND TEST CHANNELS

The containment liner is a welded carbon steel plate membrane, supported by and anchored to the inside of the reinforced concrete containment structure. The liner's function is to act as a leak tight membrane. The BVPS-2 liner is not an ASME code stamped vessel; the ASME code is used only as a guide for the selection of materials and fabrication.

The basic geometry of the containment structure consists of a cylindrical wall portion, anchored at its base to a 10 ft thick circular foundation mat and closed at the upper end with a hemispherical dome. The reinforced concrete shell varies in thickness from 4 1/2 ft in the cylinder to 2 1/2 ft in the dome. The inside diameter of the containment structure is 126 ft; the interior vertical height is 185 ft measured from the top of the foundation mat to the interior apex of the dome.

The cylindrical portion of the liner is 3/8 in thick, the hemispherical dome liner is 1/2 in thick, the flat floor liner covering the mat is 1/4 in thick, with the exception of areas where the transfer of loads requires either bridging bars or bridging plates. The floor liner plate is covered with approximately 2 ft of reinforced concrete that insulates it from transient temperature effects.

All welds of the 1/4 in floor plate to either bridging bars or bridging plates are made with a backing bar.

The 3/8 in thick cylindrical liner also serves as the internal form for the placement of concrete during construction.

All liner seams in the cylindrical shell are double butt welded, except for the lower 30 ft of the cylinder, insert plates, and penetrations where the liner plates are welded with a backing bar. The liner is anchored to the concrete shell with headed concrete anchor studs.

The 1/2 in thick hemispherical dome liner also serves as an internal form for the placement of concrete during construction.

All liner seams in the dome liner are double butt welded. The dome liner is anchored to the reinforced concrete dome with headed concrete anchor studs.

The wall to dome liner junction is a double butt welded joint.

All welded liner seems on the mat, cylindrical wall, hemispherical dome, and penetrations are covered with continuously welded test channels (sectioned into 100 ft maximum length zones). The nondestructive examination (NDE) of the liner seam welds was performed in accordance with Specification No. 2BVS-65 and the Erector's NDT procedures.

Liner Materials

The ASME Boiler and Pressure Vess^l Code, Section III, Division 1, Nuclear Vessels, 1971 edition ·· ough and including the 1972 winter addenda, is used as a guide in the selection of materials and fabrication of the containment's metal liner.

The liner material is SA 537 Gr B (quenched and tempered). The SA 537 Gr B material has a specified minimum tensile strength of 80,000 psi, a minimum yield strength of 60,000 psi, and a minimum elongation of 22 percent in a standard 2 in specimen. The material, by test, has a nil ductility transition temperature (NDTT) equal to or less than -10°F.

The test channels are fabricated of ASTM-131 Gr C material. The ASTM-131 Gr C material has a specified minimum tensile strength of 58,000 psi, a minimum yield strength of 32,000 psi, and a minimum elongation of 24 percent in a standard 2 in. specimen. The material is not impact tested for NDTT.

Both materials are required to be capable of being cold bent 180 degrees with no cracking.

Tests and Inspections

A testing and surveillance program is conducted during construction and operation to verify that the containment can perform its intended function. The program consists of examinations performed during erection, local pressure test of each channel section, a structural acceptance test, an initial preoperational integrated leakage rate test, periodic integrated leakage rate retesting and continuous subatmospheric pressure monitoring.

All applicable welding procedures and tests, specified in Section IX of the ASME Boiler and Pressure Vessel Code for Welding Qualifications, 1971 edition through and including 1972 Winter Addenda, are adhered to for qualifying the welding procedures, performance of welding machines, and welding operators who are engaged in the construction of the containment liner; including the test channels. The weld qualifications includes 180 degree bend tests of each weld test sample. These procedures ensure that the ductility of the welded seams is comparable to the ductility of the containment liner plate material.

Production quality control of the liner seam welds is performed through random radiography, as described in Regulatory Guide 1.19 and required by Specification No. 2BVS-65, using the techniques of Section V of the ASME Boiler and Pressure Vessel Code for Nuclear Power Plant Components, 1971 Edition through and including 1972 Winter Addenda. As shown in Figure 1, the radiography (RT) of the liner seams welds is 100 percent for the first 10 ft of each position, each welder. Total RT of all liner seam welds exceeds 2 percent. Other nondestructive testing (NDT), tabulated on Figure 1, includes visual, magnetic particle, and pressure/leak testing.

The leak tightness of all liner and penetration welds is verified during construction by the ability to retain pressure in the test channels using air or halogen.

Leak tests are performed section by section. On the mat and cylindrical portions of the liner, the test channels are on the inside of the liner. On the dome portion of the liner, the test channels are on the outside (concrete side) of the liner.

All of the test channel welds and liner butt welds are tested by either a halide leak detection test or a 2 hour pressure drop test.

The halide leak detection test is performed by evacuating the test channels to a pressure of 5.0 to 10.0 psia then pressurizing the test channel to 50 psig (minimum) with Freon R-22. This method assures a homogeneous test gas throughout the test channel. The welds are tested by use of a leak detection unit. After testing, the gas is vented and the test channels are evacuated to a pressure of 5.0 to 10.0 psia to assure the removal of the Freon R-22 gas. After the test, the test channels are sealed by insertion of a threaded plug.

A 2 hour pressure drop test is an alternate method of testing the test channels. The test is performed by pressurizing the channel to 45 psig and monitoring the pressure over a 2 hour period. If there is a pressure drop, other than that due to temperature changes, the channel-to-liner and liner butt welds are soap bubble tested to locate the leak. After testing the test channels are sealed by insertion of a threaded plug. Leaks detected by either method are repaired using approved welding procedures and the channel is retested.

For the dome portion of the liner, where the test channels are on the outside, the threaded connections, after leak testing, are sealed by insertion of a threaded plug and seal welded prior to the placement of concrete.

Containment Structural Acceptance Test

The containment structure will be subjected to a structural acceptance test in accordance with Regulatory Guide 1.18; during which the containment internal pressure will be 1.15 times the containment design pressure (i.e., 52 psig). This test is performed after the liner is completed, the concrete cured, and all penetration sleeves and hatches are installed and closed or blanked off.

Containment Leakage Rate Tests

The containment integrated leakage rate tests will be performed in accordance with Appendix J of 10CFR50, "Primary Reactor Containment Leakage Testing for Water Cooled Power Reactors," as published in the Federal Register.

The containment integrated leakage testing program includes the performance of Type A tests, to measure the containment overall integrated leakage rate, Type B tests, to detect local leaks or to measure leakage of certain containment components, and Type C tests, to measure containment isolation valve leakage rates.

The measured overall integrated leakage rate of the containment during Type A testing must not exceed 0.1 percent per 24 hr, of the weight of containment air at the calculated peak containment pressure of 44.6 psig.

TECHNICAL SECTION 2

DETAILS OF CONSTRUCTION, MATERIALS, AND DESIGN

As indicated in the introduction of this report, our evaluation shows that although the test channels were not designed as a part of the leakage barrier, they are completely compatible with the liner in terms of materials, construction procedures and tests, and the ability to withstand the loads and associated differential movements which might be imposed during normal, test, emergency and severe operational conditions. The following discussions will provide a summary of the materials, construction procedures and tests, and the design of the leak chase channels.

Liner Test Channels

Materials Identification and Construction Procedures

The properties of the materials used in the construction of the containment liner and test channels are listed on Figure 1, Sheets 1 and 2. The liner plate and test channel materials were purchased with certified mill documentation to assure compliance with the level of quality required for fabrication and design service.

Figures 2a, 2b, 2c, 3a, 3b, 3c, and 4 illustrate the different test channel types provided for the floor, shell, and dome sections.

The material used for the liner is ASTM A537 Gr. B.

Test channels are ASTM A131 Gr. C material. Figure 2C shows where the differences in test channel configurations occur.

Test channel plugs are 1/8 in Carbon Steel NPT pipe plugs, with socket hex heads.

Testing and Inspection

All test channel welds are 100 percent visually and magnetic particle inspected. The welds on the test channels were pressure tested simultaneously with the liner seam welds.

Regulatory Guide 1.19 criteria is used for the testing of test channel and liner seam welds at Beaver Valley Power Station Unit No. 2. except for the following deviation:

Requirement

Where leak-chase system channels are installed over liner welds, channel to liner plate welds should be tested for leak tightness by pressurizing the channels to containment design pressure and held for 2 hours with no loss of channel test pressure allowed. Leaks are to be detected with a soap solution.

DEVIATION

All test channels were pressure tested to 45 psig with air or to 50 psig with halogen and held for a minimum of 30 minutes. Channel to liner plate welds were checked with a soap solution or halogen detection equipment. The 2 hour pressure test was used as an acceptable alternate.

Structural Integrity of Test Channels for Maintaining Leak Tightness

The reinforced concrete containment structure is designed to withstand the effects of emergency, test, normal, and severe environment conditions without any strength credit being taken for the liner. Since the liner is anchored to the containment structure by closely spaced anchor studs, forces on the liner are displacement limited by the structural response of the containment structure. The 1971 edition through and including 1972 Winter Addenda of the ASME Code, Section III, was used as a guide in establishing liner stress limits. Stress calculations were made to ascertain the design adequacy of the liner. The liner material was chosen to provide the necessary ductility to withstand the displacements of the containment structure and perform the design function of providing a leaktight membrane for the containment. The liner thicknesses were chosen to facilitate construction, i.e., to act as a form for pouring concrete and a free standing structure prior to placement of concrete. At the time the liner was designed, there were no directly applicable industry codes in effect, nor were there any industry codes available which recognized displacement (strain) limits.

An analytical model of the liner was developed by representing the composite reinforcing steel and liner steel as an equivalent orthotropic shell. This model was subjected to the combined axisymmetric loadings of test, normal, emergency and severe environmental conditions in order to establish the membrane and bending stresses in the liner. The seismic shear force in the reinforced concrete containment wall was applied to the liner in order to establish the liner shear stress. The liner shear stress was combined with the liner membrane and bending stresses to determine the stress intensities. These stress intensities were compared to and found to be less than the established ASME code allowables.

The test channels were welded to the liner in order to leak test liner seam welds during construction. The test channels however, inherently provide additional containment leak protection since they cover all liner seam welds and are fabricated with material and weld quality similar to that of the liner.

The test channels, similar to the liner itself, are deformation limited by the structural response of the concrete containment structure, and will continue to provide added leakage protection for all design conditions. This is particularly true for the design conditions where the liner is in a general state of compression due to the containment temperature effects. Any undetected flaws in the welds or base metal would not propagate in a state of compression. In this regard, the pressure testing of the containment provides a much more severe environment for the liner than the normal, emergency, or severe environment condition because the test pressure produces a general state of tension in the liner and test channels.

The test channels are attached to the liner with (3/16 in) fillet welds. Channel-to-channel welds are partial penetration groove welds. The pressure testing of the test channels provides assurance that the liner seam welds and the test channel welds are leaktight. The test channel welds are also 100 percent magnetic particle and visually examined to ensure weld integrity. These test and analyses preclude any concern for the test channels becoming detached from the liner for any design or test conditions.

Surface Treatment

All exposed interior surfaces of the Beaver Valley Unit No. 2 reactor containment liner are coated in accordance with Specification 2BVS-920, which incorporates the requirements of ANSI N101.2, and ANSI N101.4.

The surface preparation of the exposed carbon steel prior to coating is performed in accordance with the SSPC-SP10. A prime coat, average 3 mils thick, of Carboline Carbo Zinc 11 inorganic zinc primer is applied to the properly prepared substrate. The finish coat is Du Pont Corlar Epoxy Chemical Resistant Enamel (2 mil DFT min).

When the liner plates were shop primed the field weld preps were masked from paint within 2 in of these edges. A temporary rust preventative coating was applied to the unpainted areas. On site, during liner erection, the rust preventative coating, as well as all oil, grease, and other contaminants were removed prior to welding.

After welding, each reactor containment liner weld seam was magnetic particle inspected in accordance with approved procedures. The approved procedures require that the weld seam and adjacent base metal be cleaned by wire brushing. This cleaning would also remove any residual mill contamination from those portions of the liner surface which would be later covered by test channels.

After the test channels were installed and used for leak testing the liner seam welds, the channel plugs were installed to seal the channels from contamination. The exterior surface of the test channels and associated fillet welds, as well as the adjacent uncoated liner plate, are cleaned of slag, weld spatter, etc, and prepared and painted with the Carbo Zinc 11/ Corlar Epoxy Coating System as detailed above.

The coating system should require little or no maintenance during plant life. However, a visual examination, for structural integrity per Appendix J of 10CFR50, is performed inside the containment prior to each Type A Integrated Leak Rate Test, at which time any significant coating failures would be noted and appropriate remedial action taken.

It should be noted that the coating system applied to the interior exposed carbon steel surfaces of the BVPS-2 containment liner aids in decontamination only and is not required by any existing code or standard.

Condensation and Corrosion Inside the Test Channels

During the testing of the liner seam welds, each test channel is pressurized with air. If an in-line air dryer is not used, or if the air dryer malfunctioned, moisture carry-over into the test channel could have occurred, resulting in condensation forming within the channel.

After erection of the reactor containment, postulating an undetected failed test channel fillet weld or removed plug, condensation within the test channel could result from containment pressure/temperature transients or from moisture produced by primary or secondary system leakage inside the reactor containment.

The moisture which could condense within the test channels as a result of condensation from either of the above sources would be similar in nature to normal power plant condensate, which has a low ionic content and which is normally contained in carbon steel systems. As such, corrosion data relating to condensate in carbon steel piping was used in the evaluation of the potential corrosion within the test channels.

The effect of pH upon corrosion rate in the range of fluids present within the reactor containment was examined. Fluids ranging in pH from 10.5 (reactor coolant high end and sodium hydroxide caustic spray) to 4.2 (boric acid in the safety injection accumulators at 2,200 ppm boron concentration) are, or may be present within the reactor containment. Figure 5, extracted from CORROSION HANDBOOK, is a plot of corrosion rates at various temperatures versus pH. The zone of interest, with a pH ranging from 4.0 to 10.5, has been highlighted. The curves demonstrate that, as pH is increased from 4.0 the corrosion rate will either remain constant or decrease as the pH increased.

The worst case of potential corrosion inside the test channels would occur where a failed fillet weld or removed plug allowed oxygen supply replenishment to the test channel interior. Since relative humidity in the channel would be less than 100 percent, corrosion would occur only in the portion of the test channel interior which was immersed in condensate. The condensate would be stagnant (less than 2 fps flow rate) and at a temperature of approximately 100 F.

Corrosion allowances published by the General Electric Corporation which are directly applicable to carbon steel condensate systems, with system conditions the same as those present in the worst-case test channel scenario, (that is, stagnant, fully oxygenated condensate at a temperature of 100 F, with full oxygen supply replenishment), specify a corrosion allowance of 88 mils for a forty-year lifetime. There is a sufficient margin in the containment liner thickness to easily accommodate a total, worst case corrosion of 88 mils over the life of the plant.

Any corrosion which would occur within the test channels would be general in nature. Review of technical literature and discussions with Professor Emeritus H. H. Uhlig, of the Massachusetts Institute of Technology, has determined that pitting corrosion will not occur within the test channels. The determination is based on the nature of the condensed fluids coupled with the material cleaning requirements of the liner seams prior to leak chase installation.

In summary, corrosion within the BVPS-2 reactor containment test channels will not present a problem during the plant lifetime.

Surveillance and Removal of Failed Test Channels

As described in previous sections, the test channel materials, welds, and workmanship are such that they will not be easily damaged. Routine activities inside the containment would not result in failure of test channels.

Visual surveillance of interior containment liner surfaces is performed prior to preservice and periodic Type A leakage testing.

Due to the fact that no repairs have been required, no procedures for repair of test channels have been developed. If a test channel were found damaged, the cause would be evaluated and the extent of the damage determined. The affected test channel could be removed, repaired, replaced, or accepted as is, depending on the nature of the damage and the accessiblity of the channel.

Floor Liner Leak Chase Channels

Plugs are installed in the floor test channel test port panels and extension tubing to prevent condensation from entering into the channels.

The test connection and panels are located in regions of the mat away from low spots inside containment and consequently would not trap water under normal conditions. Figure 2a locates the various test panels on the floor.

The floor of the containment is sloped to where a sump provides entrapment of any fluid. Pumps are provided to remove any fluid accumulation.

Approximately 80 percent of the test channel test connections are terminated in test panels on vertical concrete surfaces 2-3 ft above the concrete floor.

The test channel extensions are under no load and because of their location are protected from damage. As previously discussed, even if water were introduced, corrosion would not produce an unacceptable condition.

<u>REFERENCES</u>

1. 2BVS-950 Protective Coating Materials Within the Reactor Containment

2. 2BVS-950A Application of Protective Coating Materials Within the Reactor Containment

3. 2BVS-65 Shop Fabricated and Field Erection Containment Steel Plate Liner

4. Testing of Protective Coatings Under Design Basis Accident Environment, April 1973, by the Franklin Institute Research Laboratories. This report was submitted to the Commission under docket (50-388).

5. ASME Boiler and Pressure Vessel Code, Sections II, III, V, and IX 1971 edition through and including 1972 Winter Addenda.

6. NRC Regulatory Guide 1.18 Revision 1, dated December 28, 1972, Structural Acceptance Test for Concrete Primary Reactor Containments.

7. NRC Regulatory Guide 1.19, Revision 1, dated August 11, 1972, Nondestructive Examination of Primary Containment Liner Welds.

8. Appendix J, 10CFR50, Reactor Containment Leakage Testing for Water Cooled Reactor Containment, 1973.

9. BVPS-2 Final Safety Analysis Report.

10. ANSI N101.2-1972 Protective Coatings (Paints) for Light Water Nuclear Containment Facalities.

11. ANSI N101.4-1972 Quality Assurance for Protective Coatings Applied to Nuclear Facilities

12. SSPC-SP10 Near White Blast Cleaning, Steel Structures Painting Council.

13. Corrosion Handbook, 5th edition, Prof, E.H.H. Uhlig, M.I.T.

	LINER PLATE	TEST CHANNEL
1. MATERIAL SPECIFICATION		
FLOOR, SHELL AND DOME LINER	ASTM-A537, GR.B QUENCHED & TEMPERED	ASTM-A131, GR.C
IMPACT TEST ON THE ABOVE –	MIN NDTT - 10°F	N/A
CHEMICALS AND PHYSICALS	YES	YES
2. WELDING		
(a) METHOD	FULL PENETRATION BUTT	FILLET
(b) CODE (WELDING QUALIFICATIONS)	BOILER & PRESSURE VESSEL CODE, SECT. IX, SECT. III	BOILER & PRESSURE VESSEL CODE, SECT. IX SECT. III
(c) PROCEDURE NO.		
1 - VERTICAL	70-84A 70-85A	WPS 76-15 WPS 74-39A
2 - HORIZONTAL	71-75A	WPS 73-22
3. TESTING AND INSPECTIONS		
(a) VISUAL - 100%	YES	YES
(b) MAG. PARTICLE - 100%	YES	YES
(c) DYE PENETRANT - 100%	NO	NO
(d) RADIOGRAPH - 2% (PLUS FIRST 10 FT EACH WELDER FOR EACH POSITION - 100%)	SECT. V, BOILER & PRESSURE VESSEL CODE	N/A
(e) AIR PRESSURE TEST - 45 PSI	YES	YES
(f) HALOGEN LEAK TEST - 50 PSI	YES	YES

FIGURE 1 (SHEET 1 OF 2)
DETAILS OF MATERIALS-
LINER AND TEST CHANNELS
CONTAINMENT STRUCTURE
BEAVER VALLEY POWER STATION - UNIT NO. 2
DUQUESNE LIGHT COMPANY

CHEMISTRY/PROPERTY	ASTM A-131-GRC	ASME SA-537-GRB
CARBON, MAX, %	0.23	0.24
MANGANESE, %	0.60 – 0.90	0.70 – 1.35
PHOSPHORUS, MAX, %	0.04	0.035
SULFUR, MAX, %	0.05	0.04
SILICON, %	0.15 – 0.30	0.15 – 0.50
TENSILE STRENGTH, KSI	58 – 71	80-100
YIELD POINT, MIN, KSI	32	60
ELONGATION IN 8 IN., MIN, %	21	....
ELONGATION IN 2 IN., MIN, %	24	22

FIGURE 1 (SHEET 2 OF 2)
DETAILS OF MATERIALS
LINER AND TEST CHANNELS
CONTAINMENT STRUCTURE
BEAVER VALLEY POWER STATION-UNIT NO. 2
DUQUESNE LIGHT COMPANY

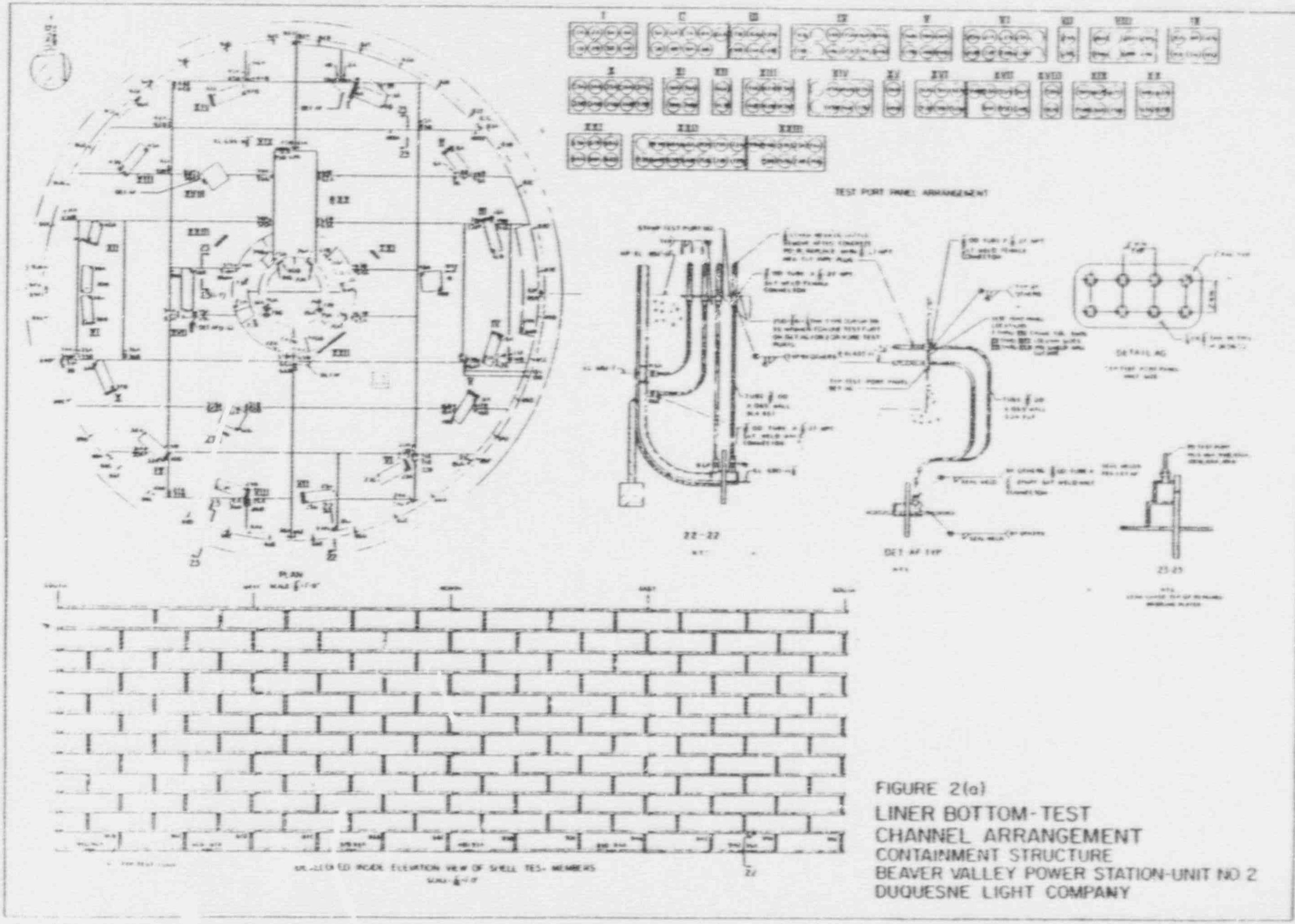


FIGURE 2(a)

LINER BOTTOM-TEST CHANNEL ARRANGEMENT

CONTAINMENT STRUCTURE

BEAVER VALLEY POWER STATION-UNIT NO 2

DUQUESNE LIGHT COMPANY

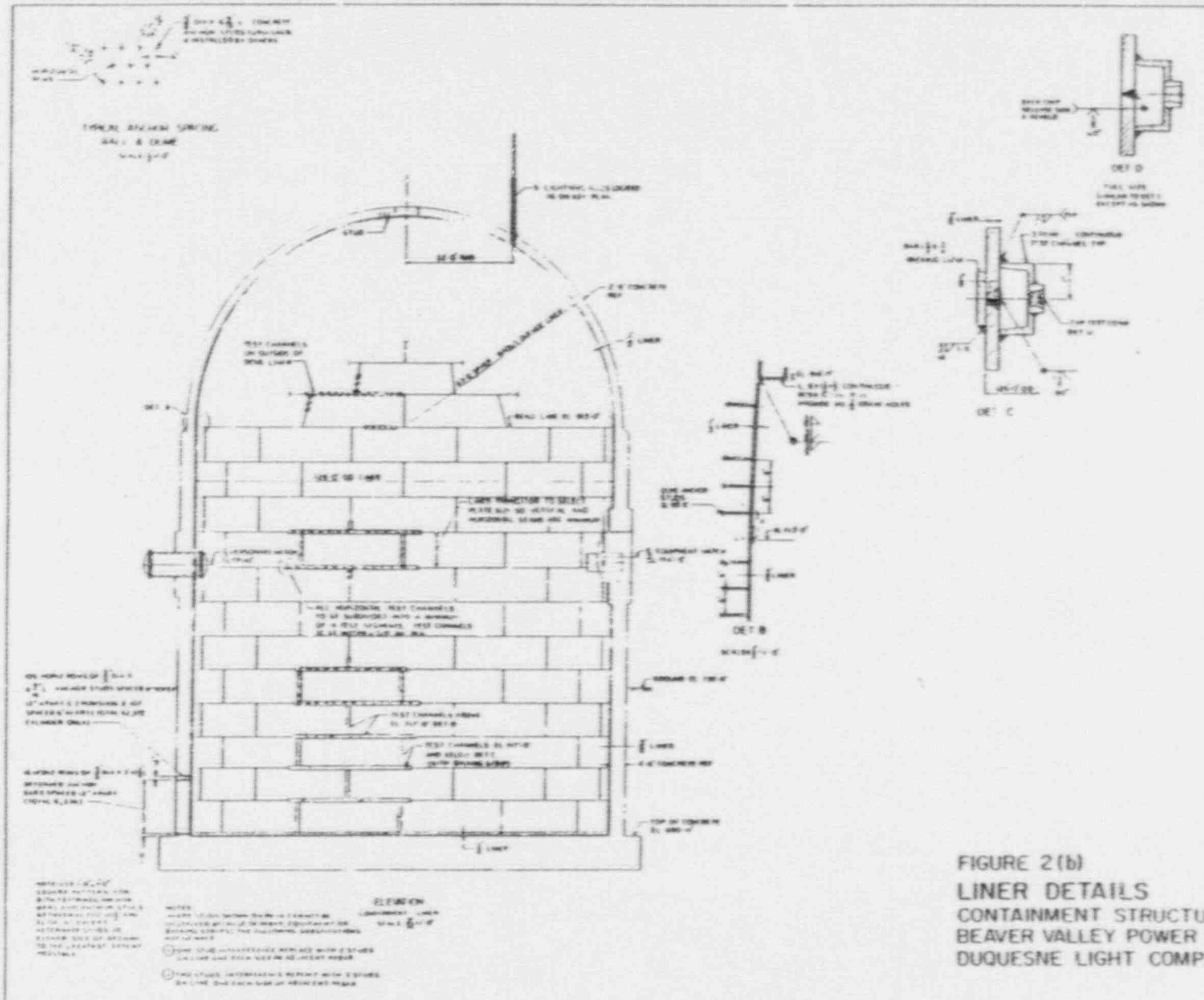


FIGURE 2(b)

LINER DETAILS

CONTAINMENT STRUCTURE
BEAVER VALLEY POWER STATION-UNIT NO.2
DUQUESNE LIGHT COMPANY

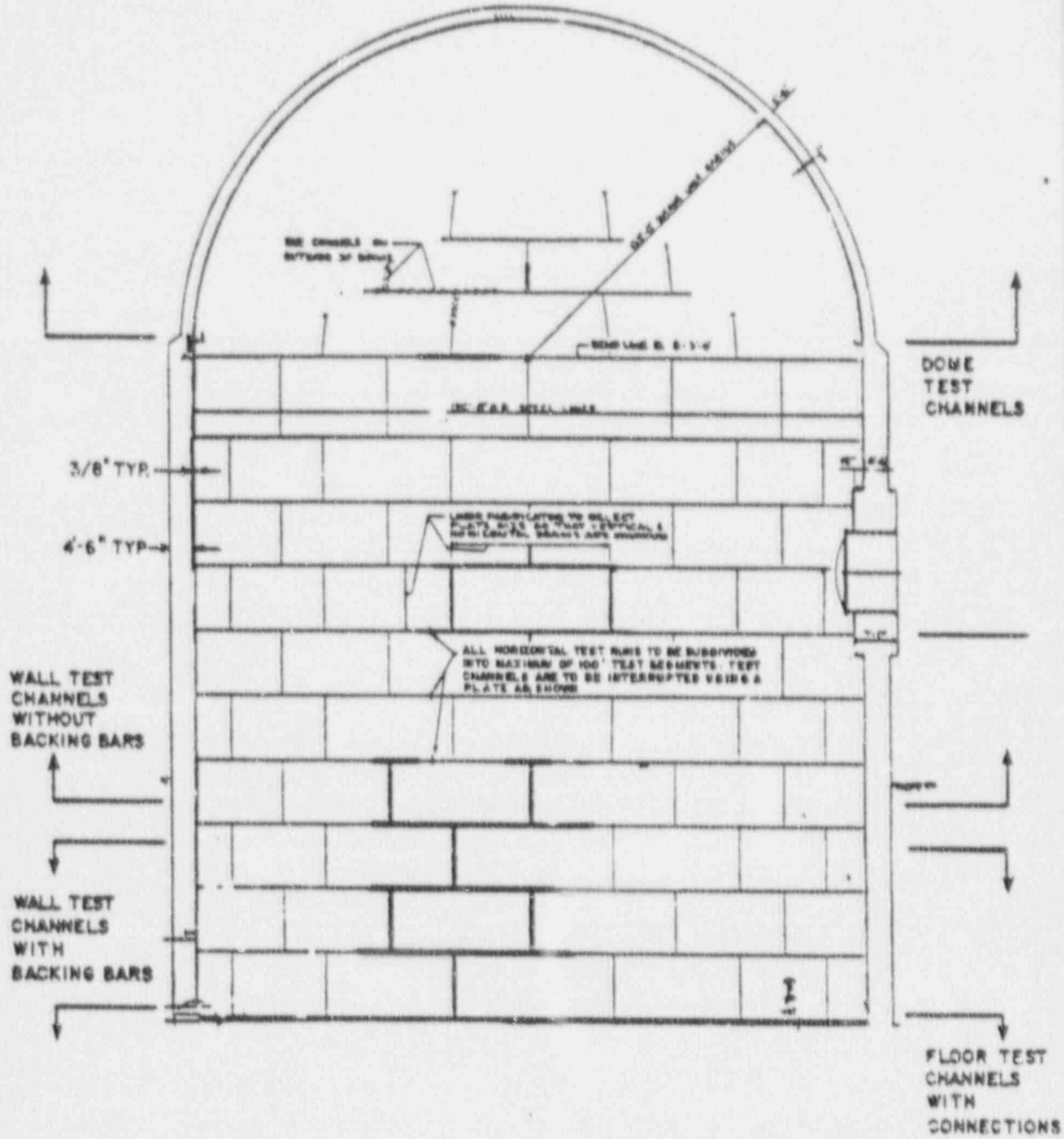


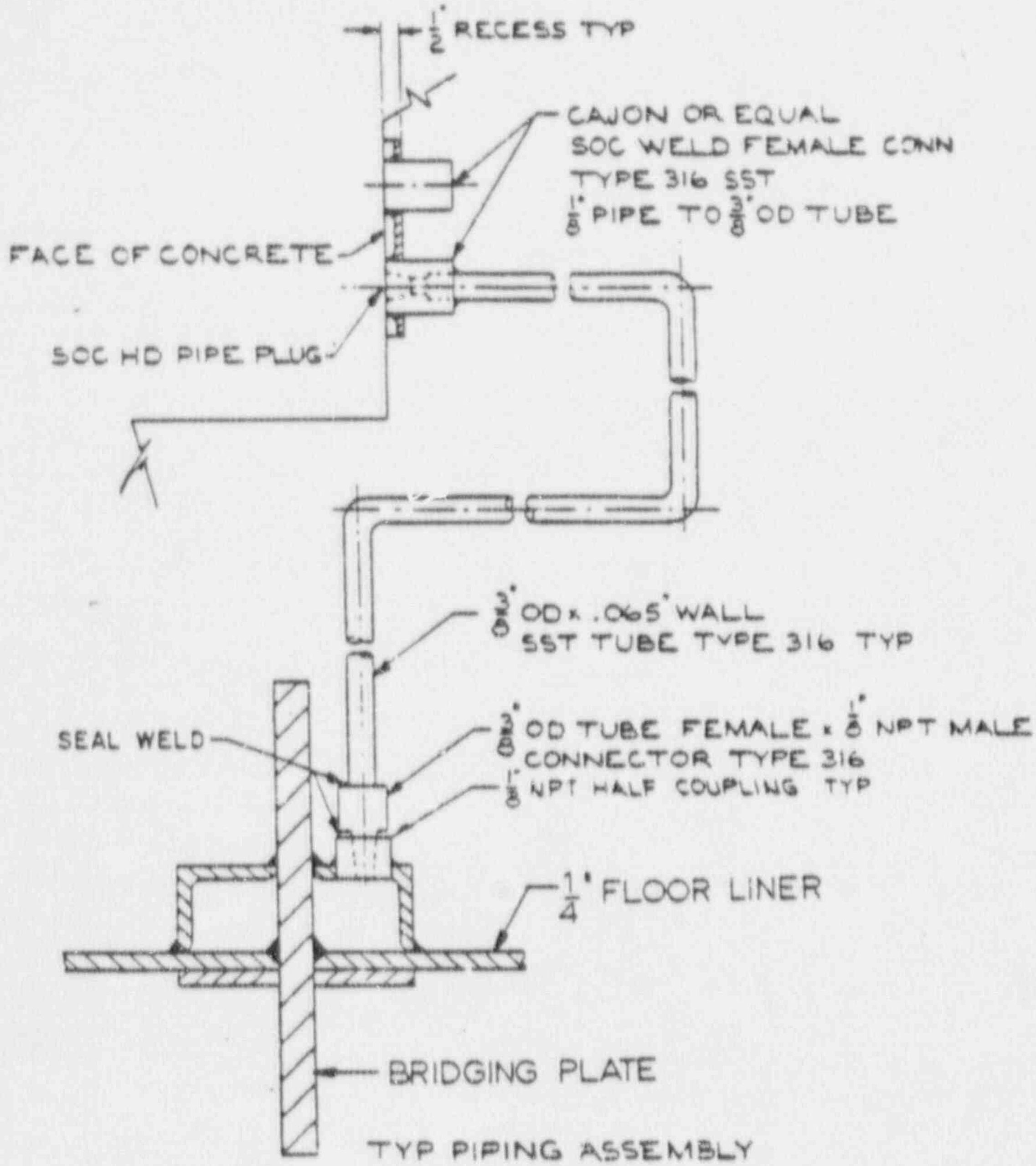
FIGURE 2(c)

LINER ELEVATION

CONTAINMENT STRUCTURE

BEAVER VALLEY POWER STATION - UNIT NO. 2

DUQUESNE LIGHT COMPANY



TYP PIPING ASSEMBLY
SCALE: NONE

FIGURE 3 (a) (SHEET 1 OF 2)
TEST CHANNELS - FLOOR DETAILS
CONTAINMENT STRUCTURE
BEAVER VALLEY POWER STATION-UNIT NO. 2
DUQUESNE LIGHT COMPANY

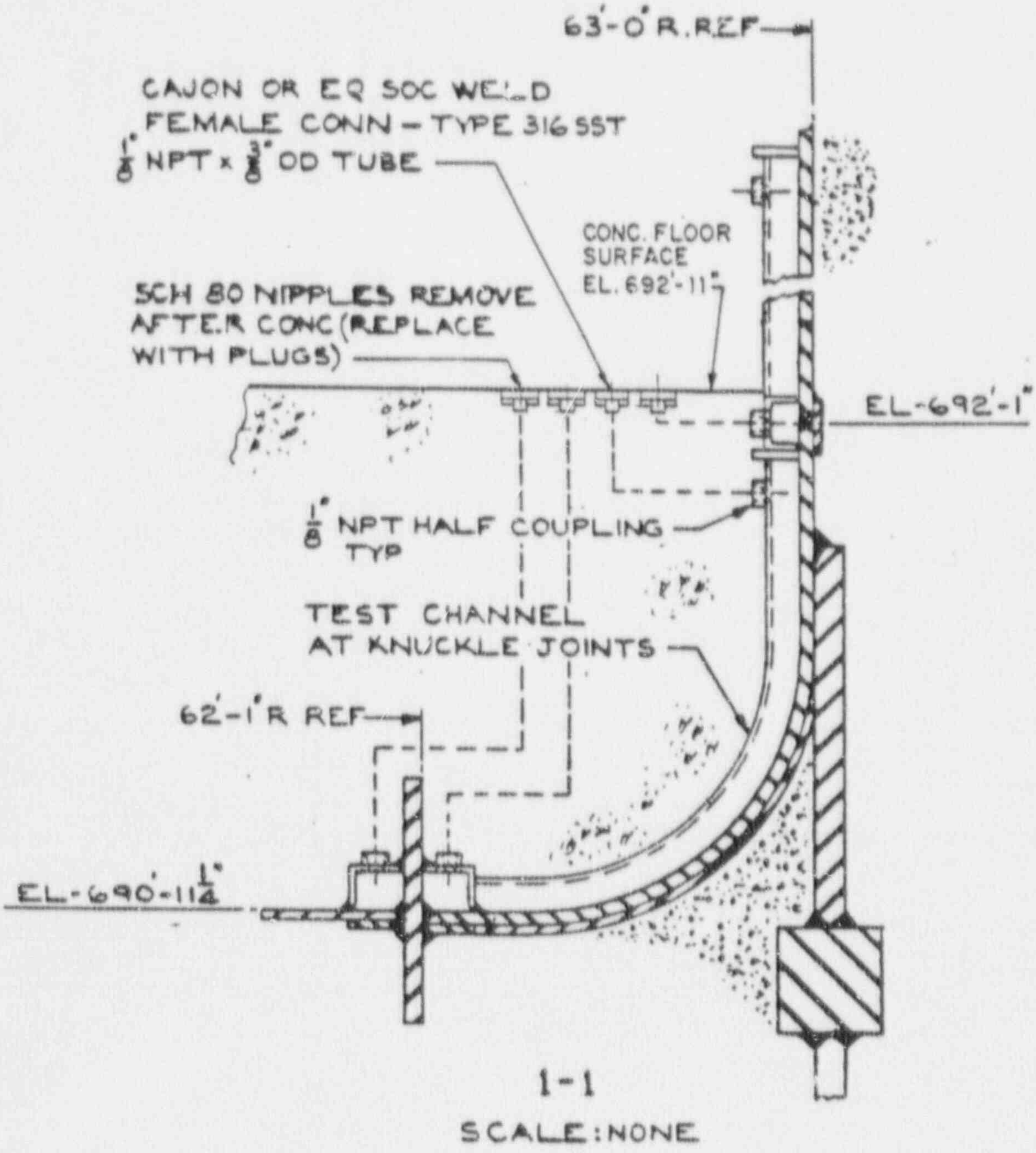


FIGURE 3 (a) (SHEET 2 OF 2)
TEST CHANNELS - FLOOR DETAILS
CONTAINMENT STRUCTURE
BEAVER VALLEY POWER STATION - UNIT NO. 2
DUQUESNE LIGHT COMPANY

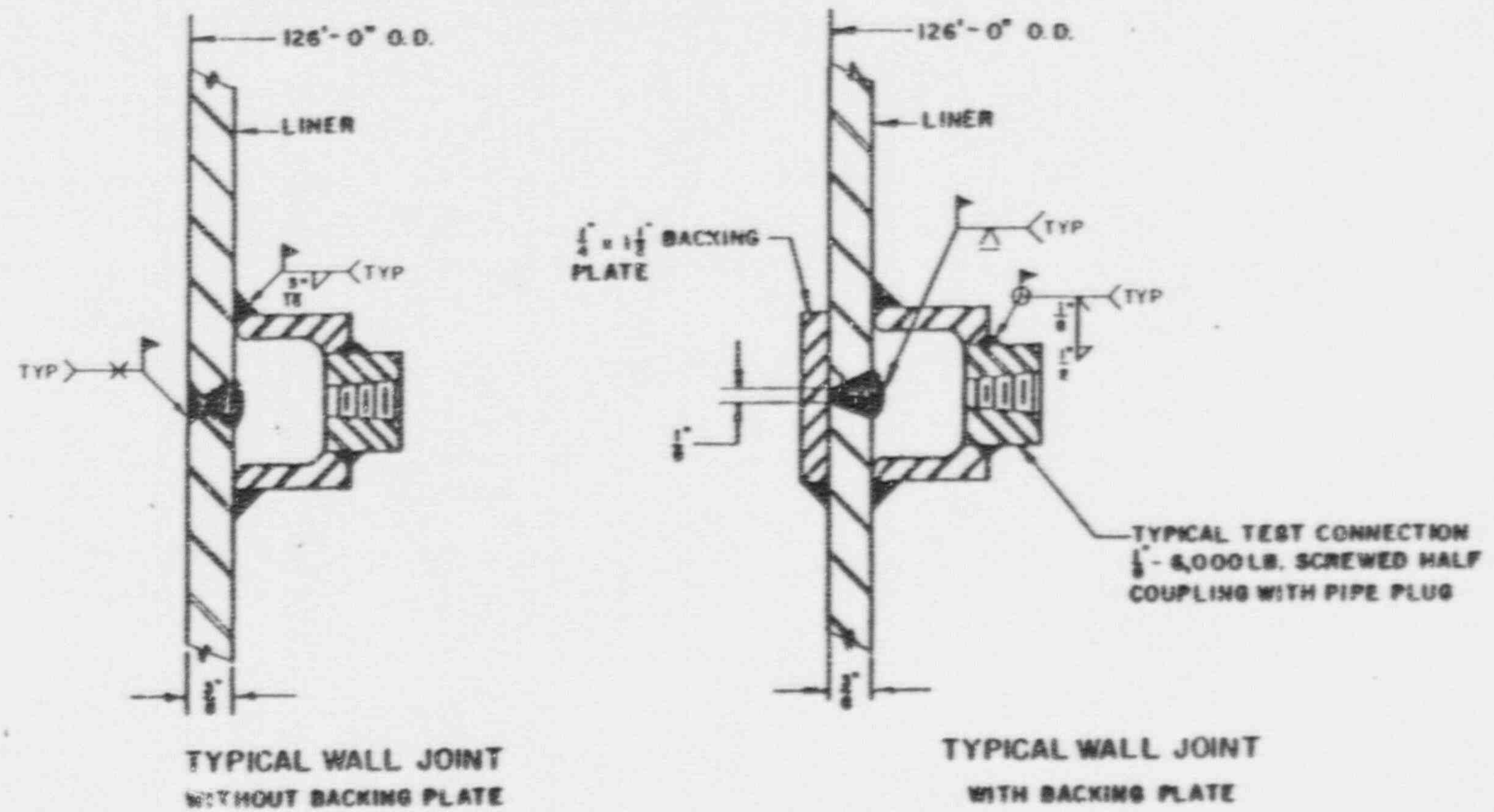


FIGURE 3 (b)

TEST CHANNELS - WALL DETAILS

CONTAINMENT STRUCTURE

BEAVER VALLEY POWER STATION-UNIT NO. 2

DUQUESNE LIGHT COMPANY

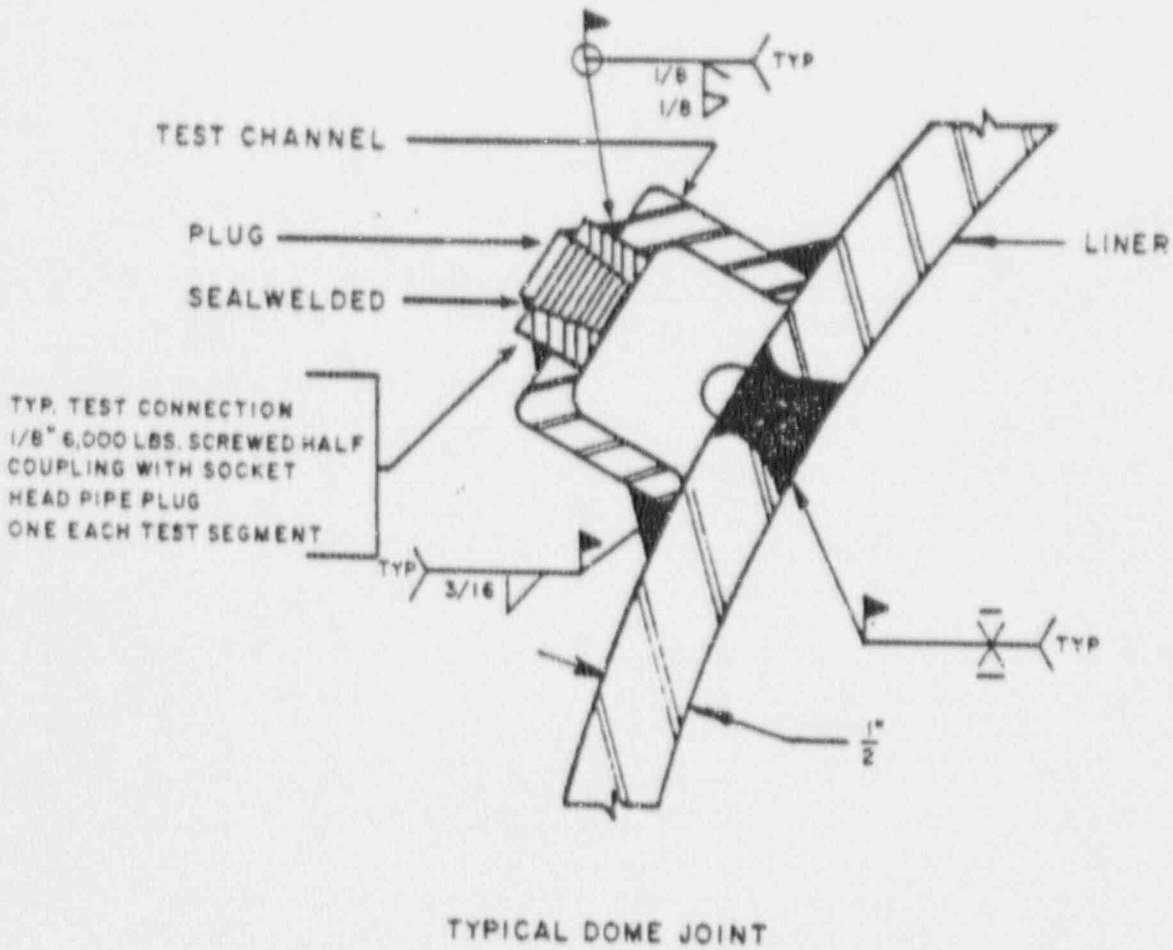


FIGURE 3(c)
TEST CHANNELS-DOME DETAILS
CONTAINMENT STRUCTURE
BEAVER VALLEY POWER STATION-UNIT NO. 2
DUQUESNE LIGHT COMPANY

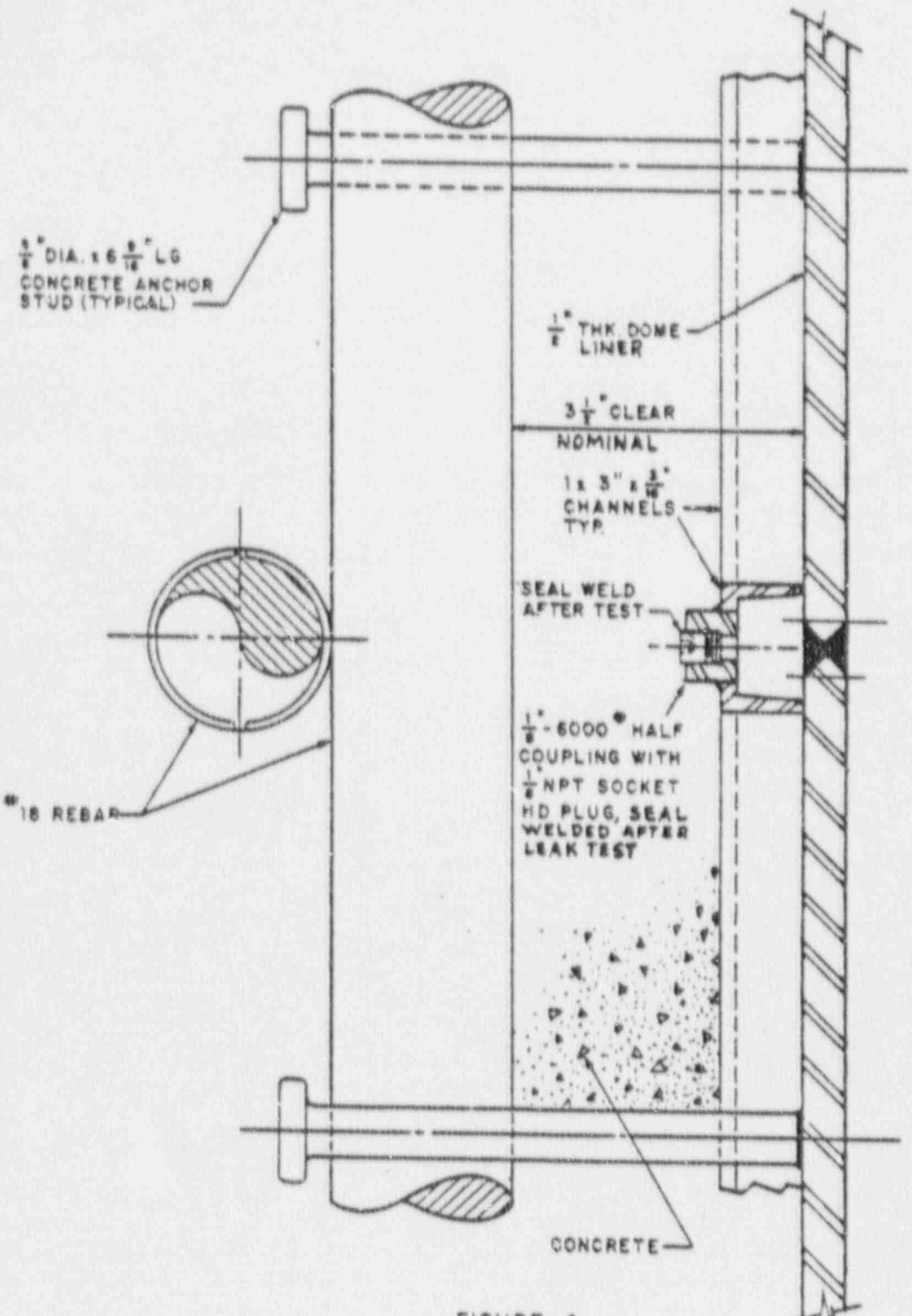


FIGURE 4
DOME - SECTIONAL ELEVATION
CONTAINMENT STRUCTURE
BEAVER VALLEY POWER STATION - UNIT NO. 2
DUQUESNE LIGHT COMPANY

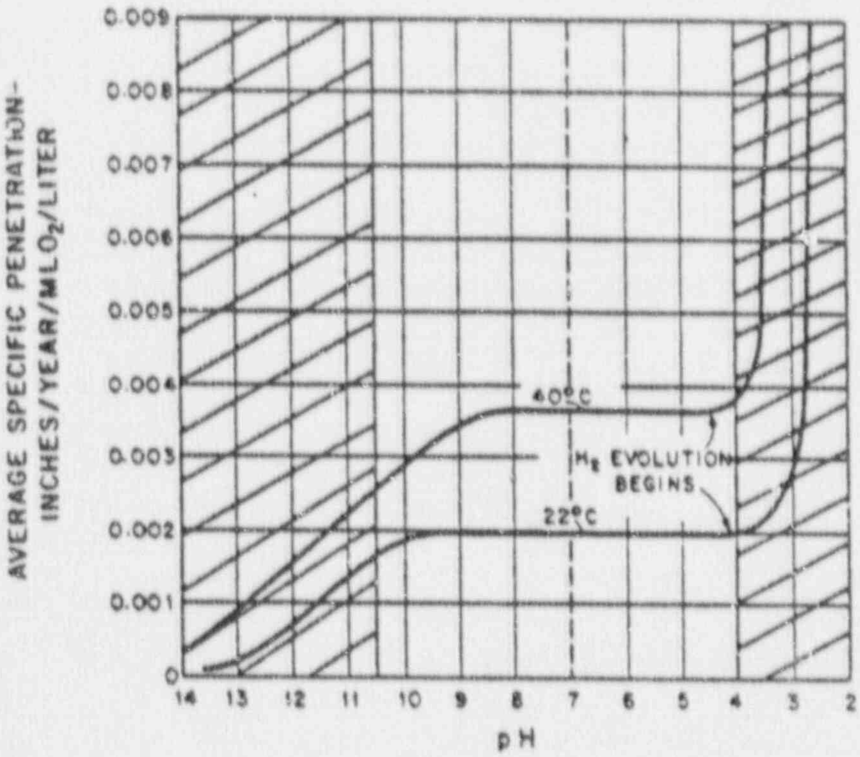


FIGURE 5
EFFECT OF pH ON CORROSION
OF MILD STEEL
CONTAINMENT STRUCTURE
BEAVER VALLEY POWER STATION-UNIT NO. 2
DUQUESNE LIGHT COMPANY

ATTACHMENT C

Beaver Valley Power Station, Unit No. 2
Proposed Technical Specification Change No. 46

Typed Pages: 3/4 6-9
3/4 6-9a

CONTAINMENT STRUCTURAL INTEGRITY

LIMITING CONDITION FOR OPERATION

3.6.1.6 The structural integrity of the containment shall be maintained at a level consistent with the acceptance criteria in Specification 4.6.1.6.1.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

With the structural integrity of the containment not conforming to the above requirements, restore the structural integrity to within the limits prior to increasing the Reactor Coolant System temperature above 200°F.

SURVEILLANCE REQUIREMENTS

4.6.1.6.1 Containment structural integrity shall be determined by performing ONE of the following surveillances:

a. Liner Plate and Concrete The structural integrity of the containment liner plate and concrete shall be determined during the shutdown for each Type A containment leakage rate test (reference Specification 4.6.1.2) by:

  1. a visual inspection of the accessible surfaces and verifying no apparent changes in appearance or other abnormal degradation.

  2. a visual inspection of accessible containment liner test channels prior to each Type A containment leakage rate test. Any containment liner test channel which is found to be damaged to the extent that channel integrity is impaired or which is discovered with a vent plug removed, shall be removed and a protective coating shall be applied to the liner in that area.

  3. a visual inspection of the dome area prior to each Type A containment leakage rate test to insure the integrity of the protective coating.

SURVEILLANCE REQUIREMENTS, (Continued)

b.*Containment Vessel Surfaces The structural integrity of the exposed accessible interior and exterior surfaces of the containment vessel, including the liner plate, shall be determined during the shutdown for each Type A containment leakage rate test (reference Specification 4.6.1.2) by a visual inspection of these surfaces. This inspection shall be performed prior to the Type A containment leakage rate test to verify no apparent changes in appearance or other abnormal degradation.

4.6.1.6.2 Reports An initial report of any abnormal degradation of the containment structure detected during the above required tests and inspections shall be made within 10 days after completion of the surveillance requirements of this specification, and the detailed report shall be submitted pursuant to Specification 6.9.2 within 90 days after completion. This report shall include a description of the condition of the liner plate and concrete, the inspection procedure, the tolerances on cracking and the corrective actions taken.

* Surveillance requirement 4.6.1.6.1.b is only applicable for the interval, including the Type A testing conducted during the second refueling outage, up to the refueling outage for the next scheduled Type A test as per surveillance requirement 4.6.1.2.a