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VICE PRESIDENT AND GROUP EXECUTIVE
NUCLEAR OPERATIONS

April 30, 1982

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

Subject: Virgil C. Summer Nuclear Station
Docket No. 50/395
NUREG 0737, Item II.F.2
Incore Thermocouple Qualification

Dear Mr. Denton:

In a recent telephone conference with the NRC Staff, South Carolina Electric and Gas Company (SCE&G) was requested to supply additional information about the existing incore thermocouple installation at the Virgil C. Summer Nuclear Station to supplement the information provided in our letter dated March 16, 1982. Specifically, the Staff requested information that would indicate the expected reliability or usefullness of the existing incore thermocouple installation during and following an event which produces a harsh environment inside the reactor building.

The attached figure provides a schematic of our existing incore thermocouple installation inside the Reactor Building. The 51 stainless steel sheathed chromel alumel incore thermocouple assemblies exit the reactor vessel head and terminate to thermocouple extension wire using Thermo Electric connectors. The thermocouple extension wire used between the thermocouples and the reference junction boxes consists of four(4) 15 pair cables. These cables are routed from the reactor vessel head through four connectors located on a plugboard which facilitates removal of the reactor vessel head and control rod drive mechanisms. From the plugboard the cables are routed to the two reference junction boxes which are located outside the primary and secondary shield walls in a location accessible during operation. Individual twisted shielded pair copper cables are routed from the reference junction boxes to electrical penetrations where the signals exit the Reactor Building.

The following paragraphs provide descriptions of the connectors, cable, reference junction boxes and penetrations with an assessment of their expected performance in a harsh environment. These assessments are based on engineering judgement and similarity to other qualified equipment where possible.

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Thermocouple Connectors

The thermocouple extension wire connectors are Thermo Electric catalog number MSP/MSj-kx connectors supplied by Westinghouse with the thermocouples. They are made of lightweight shatterproof thermosetting plastic which exhibits a low moisture absorption rate and is rated for 425°F continuous service. The flat polarized connector pins are made of thermocouple materials. They are spring loaded for positive connections and use screws for wire connection

directly to the pins. Epoxy resin is applied in the connector cavity to prevent loosening of the screws. After fuel loading the mated connectors will be sealed with either a heat shrink tubing or a silicon potting compound to protect the connector from the environment. The normal environmental conditions for these connnectors are 40°-200°F at 100% humidity with maximum radiation of 10R/HR (Gamma). This type of connector has been used successfully on Westinghouse units for years. When installed as described above these connectors are expected to function acceptably in a harsh environment.

Thermocouple Extension Cable

The thermocouple extension cable used between the thermocouples and the reference junction boxes is 15 pair chromel alumel wire with tefzel insulation and a tefzel jacket. This cable was purchased on a safety related purchase order from the Okonite Company and is similar in construction and materials to other cable on that order which is qualified for LOCA environments to IEEE-323-74. Based on this qualification report, which has been reviewed and accepted by SCE&G, this cable is expected to function acceptably in a harsh environment.

Plugboard Connectors

The plugboard connectors are manufactured by Litton Precision Products for use inside the Reactor Building and are designed for 302°F continuous operating termperature at 100% relative humidity and 10^8 rads TID. The connector shells are stainless steel and utilize silicone rubber for inserts, o-ring seals between connector halves and compression grommets which seal the connector backshell to the cable jacket. Considering the moistureproof design and the materials used these connectors are expected to function acceptably in a harsh environment.

Reference Junction Boxes

The reference junction boxes provide a uniform cold junction temperature for the incore thermocouples at the transition point from chromel alumel wire to copper wire. This transition is required inside the Reactor Building since the penetrations utilize copper conductors. The reference junction boxes are manufactured by Celesco Corporation and were supplied by Westinghouse. The reference junction temperature is maintained at 160°F by a heater and temperature controller. Each reference junction has two platinum RTD's which provide the computers and the subcooling monitors with the actual cold junction temperature for use in compensation. The cables are routed from the cable tray through conduit and a pull box into the reference junction boxes. The reference junction box and pull box both have gasketed covers to prevent moisture entry. Any moisture entering the reference junction boxes would have to travel up the conduit through the pull box and through more conduit to the reference junction boxes. The passive components in the reference junction box

(reference junction & RTD's) are expected to function acceptably in the harsh environment to which they might be exposed.

If the active components (heater and temperature controller) were to fail and the temperature of the reference junction varied up or down from 160°F the RTD's will still provide the necessary cold junction temperature for compensation. The subcooling monitors will provide accurate temperature compensation as long as the cold junction temperature is between 50°F and 350°F. If the temperature exceeds this range an alarm sounds, the reference temperature is defaulted to 160°F and the actual reference value is displayed. A default value other than 160°F can be entered manually by the operator.

The plant process computer provides normal compensation with the reference temperature between 155° and 165°F. If the temperature exceeds this range it is alarmed, all resulting displays are designated as unreliable by an "*" symbol, and the last reliable reference value is used for compensation.

The technical support center computer also displays incore thermocouple temperatures to the operators and to the technical support center staff. This system provides an alarm which propogates through all displays when the reference temperature is not between 155° and 165°F. If the reference temperature exceeds 180°F or the temperature difference between the two RTD's in a reference junction is greater than 2°F the inputs are considered bad quality. Bad quality is propagated through all displays and is indicated by "x's" instead of compensation values.

Based on the design and location of the reference junction boxes and the fact that failure of the active components will not render the system useless, they are expected to function acceptably in a harsh environment. The operator should not be misled in the event of failures due to the alarms incorporated in the indication systems.

Instrument Cable

The instrument cable used between the reference junction boxes and the Reactor Building penetratios is single twisted shielded pair copper cable manufactured by Samuel Moore Company utilizing EPDM and HYPALON Insulation. This cable was purchased as safety related and is qualified for LOCA environments. This qualification report has been reviewed and accepted by SCE&G.

Electrical Penetrations

The electrical penetration assembly used to carry these electrical signals outside of the Reactor Building is a 12 inch model M-56 penetration manufactured by D.G. O'Brien. This module has been qualified by D.G. O'Brien. The model

C-32 connectors utilized with this penetration have been through qualification testing where some anomolies were reported. After investigation of the anomolies they were largely determined to be a result of test methods used for accelerated aging and should not be of concern for these circuits carrying millivolt signals. Similar penetrations are currently in use in operating nuclear power plants. Based on this information the electrical penetrations are expected to function acceptably for these millivolt signal applications in a harsh environment.

In summary, SCE&G believes that the existing incore thermocouple installation at the Virgil C. Summer Nuclear Station is very likely to function acceptably during and following a high energy line break inside the Reactor Building. Based on this and other information provided in previous submittals on this subject, SCE&G believes that full power operation is justified until the new fully qualified equipment can be installed during the first major shutdown or refueling outage following June, 1983.

If you have additional questions, please let us know.

Very truly yours,

T. C. Nichols, Jr.

SMC:TCN:tdh

Attachment

cc: V. C. Summer (w/o attach.)
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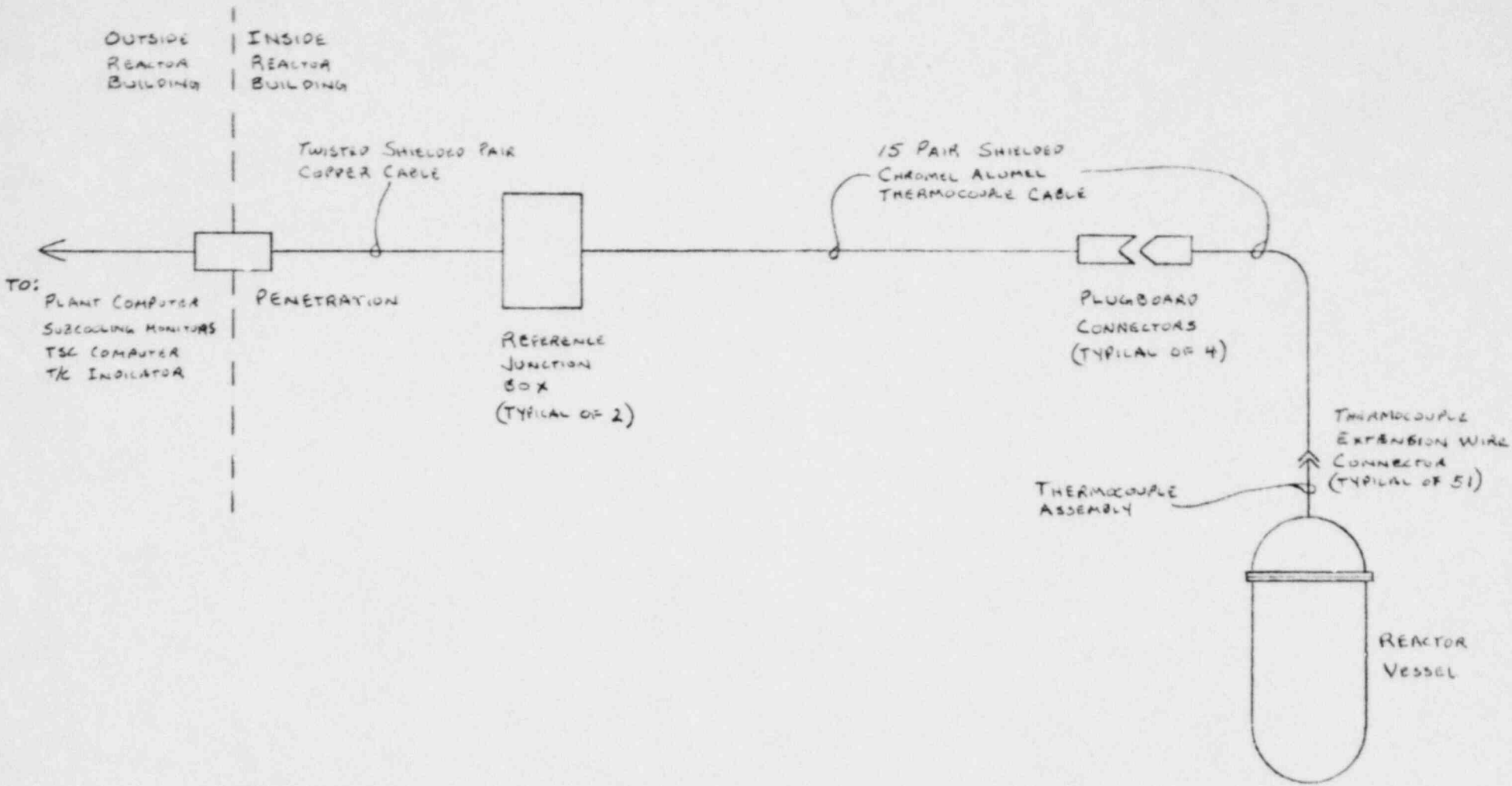

Virgil C. Summer Nuclear Station
Existing Incore Thermocouple Installation
Attachment to 4/30/82 letter