UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SEP 2 6 1984

Docket No: 50-354

MEMORANDUM FOR: Thomas M. Novak, Assistant Director
for Operating Licensing
Division of Licensing

FROM: William V. Johnston, Assistant Director
Materials, Chemical & Environmental Technololgy
Division of Engineering

SUBJECT: GDC 51 COMPLIANCE REVIEW: PUBLIC SERVICE ELECTRIC AND GAS COMPANY - HOPE CREEK UNIT 1

Plant Name: Hope Creek Generating Station, Unit 1
Suppliers: General Electric, Bechtel
Licensing Stage: OL
Docket Number: 50-354
Responsible Branch & Project Manager: LB#2; D. Wagner
Reviewer: J. Halapatz
Requested Completion Date: Open
Description of Task: SER Re GDC 51 Compliance
Review Status: Awaiting Confirmatory Information

The Materials Engineering Branch, Division of Engineering, joint review of the containment pressure boundary materials of Hope Creek Generating Station, Unit 1, was conducted with General Electric at San Jose, CA on June 21, 1983 and with Bechtel at San Francisco, CA on June 23, 1983.

The review identified the limiting materials of the containment pressure boundary and the limiting environmental temperature placed on these materials under operating, maintenance, testing and postulated accident conditions cited by GDC 51, "Fracture Prevention of Containment Pressure Boundary."

The applicant has submitted information intended to confirm that the limiting postulated design temperatures will not violate the limiting temperatures identified by the review. We have reviewed the information and conclude, with

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one contingency, that the materials of the Hope Creek containment pressure boundary are in compliance with GDC 51. Our safety evaluation is presented in the attachment to this memorandum.

William V. Johnston, Assistant Director
Materials, Chemical & Environmental
Technology
Division of Engineering

Attachment: As Stated

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ATTACHMENT

PUBLIC SERVICE ELECTRIC & GAS COMPANY
HOPE CREEK GENERATING STATION UNIT 1
Docket No. 50-354

MATERIALS ENGINEERING BRANCH
MATERIALS APPLICATION SECTION

6.2.7 Fracture Prevention of Containment Pressure Boundary

Our safety evaluation review assessed the ferritic materials in the Hope Creek Generating Station Unit 1 containment system that constitute the containment pressure boundary to determine if the material fracture toughness is in compliance with the requirements of General Design Criterion 51, "Fracture Prevention of Containment Pressure Boundary."

GDC 51 requires that under operating, maintenance, testing and postulated accident conditions, (1) the ferritic materials of the containment pressure boundary behave in a nonbrittle manner and (2) the probability of rapidly propagating fracture is minimized.

The Hope Creek Unit 1 primary containment includes a ferritic steel containment vessel (drywell), a ferritic steel suppression chamber (torus) and vent pipes providing the connection between the drywell and the torus. The ferritic materials of the containment pressure boundary, which were considered in our assessment, are those which have been applied in the fabrication of the drywell, drywell head, torus, vent pipes and primary containment equipment hatch, personnel

lock and penetrations and piping system components, including the valves required to isolate the system. These components are the parts of the containment system which are not backed by concrete and must sustain loads under the conditions cited by GDC 51 and provide a pressure boundary during the performance of the containment function.

We have determined that the fracture toughness requirements contained in ASME Code editions and addenda typical of those used in the design of the Hope Creek Unit 1 containment may not ensure compliance with GDC 51 for all areas of the containment pressure boundary. We have elected to apply in our licensing reviews of ferritic containment pressure boundary materials the criteria for Class 2 components identified in the Summer 1977 Addenda of Section III of the ASME Code. Because the fracture toughness criteria that have been applied in construction typically differ in Code classification and Code edition and addenda, we have chosen the criteria in the Summer 1977 Addenda of Section III of the Code to provide a uniform review, consistent with the safety function of the containment pressure boundary materials. Therefore, we reviewed the materials of the components of the Hope Creek Unit 1 containment pressure boundary according to the fracture toughness requirements of the Summer 1977 Addenda of Section III for Class 2 components.

Considered in our review were components of the containment system which are load bearing and provide a pressure boundary in the performance of the containment function under operating, maintenance, testing and postulated accident conditions as addressed in GDC 51. These components are the containment vessel (drywell), torus, vent pipes, drywell head, equipment hatch, personnel airlocks, penetrations and elements of specific containment penetrating systems.

Our assessment of the fracture toughness of materials is based on the metallurgical characterization of these materials and fracture toughness data presented in NUREG-0577, "Potential for Low Fracture Toughness and Lamellar Tearing on PWR Steam Generator and Reactor Coolant Pump Supports," USNRC, October 1979, for comment, and ASME Code Section III, Summer 1977 Addenda, Subsection NC.

The metallurgical characterization of these materials, with respect to their fracture toughness, was developed from a review of how these materials were fabricated and what thermal history they experienced during fabrication. The metallurgical characterization of these materials, when correlated with the data presented in NUREG-0577 and the Summer 1977 Addenda of the ASME Code Section III, provides the technical basis for our evaluation of compliance with the Code requirements.

Based on our review of the available fracture toughness data and materials fabrication histories, and the use of correlations between metallurgical characteristics and materials fracture toughness, we conclude, with one condition, that the ferritic components in the Hope Creek Unit 1 containment pressure boundary meet the fracture toughness requirements that are specified for Class 2 components by the 1977 Addenda of Section III of the ASME Code. Compliance with these Code requirements provides reasonable assurance that the Hope Creek Unit 1 reactor containment pressure boundary will behave in a nonbrittle manner, that the probability of rapidly propagating fracture will be minimized, and that the requirements of GDC 51 are satisfied. The contingency relates to the feedwater check valves (1F074 A&B).

Our review identified 24-inch feedwater check valves (1 F074 A&B) as parts of the reactor containment pressure boundary. The cast bodies of these valves are known to contain shrinkage flaws, which have been known to propagate in service. Because of the presence of these flaws and the uncertainty related to their propagation in service, we were unable to conclude, relative to fracture toughness, that sufficient margin of safety existed under the limiting environmental condition to be experienced by these valves, VIZ., 1180 psi at 40°F, postulated for HPCI, as identified by the applicant, when these valves are called upon to serve as a containment pressure boundary.

We addressed the fracture toughness of the same 24-inch feedwater check valves (1F074 A&B: 2F074 A&B) with cast bodies also known to contain shrinkage flaws, in the review of Limerick Generating Station Units 1 & 2, (Docket Nos. 50-352/353). We concluded, in this case, based on the results of our own analysis and an augmented inservice inspection program acceptable to the staff, that reasonable assurance of compliance with GDC 51 would be provided. The augmented ISI would provide confirmation that the shrinkage flaws existing in the valve bodies on entering service have not propagated to either of the surfaces. Should the augmented ISI disclose, however, that these flaws have propagated to the surface, the valves then are to be replaced by the licensee.

We request that the applicant in the matter of Hope Creek Unit 1 also consider making a commitment to an augmented inservice inspection program, which will include inspection of the outer and inner valve body surfaces at the first refueling outage and at other times when the valve is disassembled for maintenance. This condition is identified as a confirmatory item in our safety evaluation.