RANDOLPH 6-1200

Commonwealth Edison Company

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May 2, 1969

Dr. Peter A. Morris, Director
Division of Reactor Licensing
U.S. Atomic Energy Commission
Washington, D.C. 20545

Subject: Additional information relative to the applications for construction permits and operating licenses for Dresden Units 2 and 3 filed under AEC Dkts 50-237 and 50-249, respectively.

Dear Dr. Morris:

In your letter of February 17, 1969, you indicated your concern over the condition of jet pump castings which had been fabricated for Dresden Units 2 and 3 and requested a report of our action relative to those castings.

We have been working with General Electric on this matter and have decided to replace the existing Dresden Units 2 and 3 jet pump castings with castings that have been made by a modified casting process which does not result in surface carburization. We have made this decision in the interest of minimizing plant outages and possible repetitive in-service inspection requirements. The use of non-carburized castings in the jet pump assemblies for Dresden Units 2 and 3 assures us that our planned maintenance-inspection program will be adequate for the operation of these units and necessary plant availability will be achieved.

As requested in your letter, Commonwealth and General Electric have reviewed the jet pump casting matter in detail and have provided the results of our review in the balance of this letter.

The investigation of castings used in the jet pump original assemblies revealed cracks in the transition piece, 180 degree elbow, and nozzle castings (see Figure 1). Subsequent sectioning and metallographic examination of the transition piece, nozzle, and coupling castings showed surface carburization to a maximum depth of 0.10 inch with the carbon content in these areas as high as 0.31% within approximately .020 inch of the surface. These castings were produced to the General Electric specification for Type 304 stainless steel pressure containing castings. This document specifies the requirements of ASTM A351 grade CF8, and additional supplemental requirements which include:

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1 - Chromium to nickel ratio control;
2 - Columbium, tantalum and titanium control;
3 - Solution heat treatment control;
4 - Method for reporting yield point;
5 - Liquid penetrant test methods;
6 - Defect repair control;
7 - Cleaning control; and
8 - Certification control.

The original castings as supplied conformed to all requirements of the General Electric specification and the ASTM A351 specification since the chemical analysis is specified to be taken from material removed not less than 1/4 inch below the surface. All castings met the specified 0.08% maximum carbon content.

The investigation disclosed that the casting supplier was employing the shell-mold process and used carbonaceous materials in the binder and wash which have been proven to be responsible for the carburized surface condition. Subsequent development work produced modifications to the foundry practice which entirely eliminated the carburizing environment. New jet pump castings made by this technique showed no carbon pickup on chemical analysis or metallurgical examination. Following the qualification of the foundry process, and subsequent approval as required by the General Electric Quality Control Plan, all of the shell-mold castings for Dresden Units 2 and 3 were replaced with new castings. Specifically, the five different castings which were replaced in each jet pump assembly are the transition piece, 180 degree elbow, nozzle, coupling, and flange. A review has been made of the suitability of these castings for reactor service. The factors included in this review are summarized as follows:

I. Quality Control Program Summary

A. Original Jet Pump Castings

1. A review was conducted of vendor general capability for producing the types of castings, in-place quality control systems, heat treating facilities and procedures, non-destructive test techniques, etc.

2. Welding procedures for repair of defects were reviewed.

3. For each type of casting, the first piece manufactured was checked for complete conformance to the drawing (dimensional, radiographic, physical, and chemical properties per ASTM A351, liquid penetrant test).

4. Audits, during the production of the required quantities, were conducted by both General Electric and the Willamette Iron and Steel Company personnel.

B. Replacement Jet Pump Castings

In addition to the above, the following steps are being taken to preclude the production of castings with a carburized skin:

1. The casting process was evaluated after the molding process was changed.

2. Procedures for this revised process were reviewed and approved. by whom ?

3. Periodic destructive examination of production castings is being conducted to ensure continued conformance with the procedures and to assure lack of carburized skin.

4. Integrally cast test lugs on the castings are being used as an additional means of verifying the process control.

5. An additional liquid penetrant examination of the castings is being done at the Willamette Iron and Steel Company when the castings are received from the foundry.

II. Design Requirements

The new jet pump assemblies meet all original design requirements relative to material specifications, fitting tolerances, leak tightness, inspectability, and 40 year design life. The jet pumps are fully capable of meeting previously measured pumping efficiencies; there will be no change in previously measured flow calibration constants.

The capability of removing the removable portion of the jet pump assemblies from the reactor pressure vessel is not altered. In addition, the fitting tolerances as established in the specification permit complete interchangeability of the removable components.

III. Metallurgy

Duplex austenitic stainless steel castings with ferrite exhibits a high degree of resistance to stress corrosion crack propagation. The term "duplex" refers to the fact that the austenitic stainless steel alloy contains delta ferrite in the austenitic matrix. The high resistance is evidenced by observations of intergranular

stress corrosion cracks, propagating in single phase wrought austenitic stainless steel material, being terminated in weld metal composed of as-deposited duplex austenitic stainless steel with ferrite similar to cast material. Castings procured to General Electric specifications have controlled chemistry to produce austenitic stainless steel with duplex structure.

IV. Radiography

All 180 degree elbows, nozzles, couplings, and transition pieces have been radiographed in pre-selected areas as specified on the drawings. The areas of interest relative to radiography are generally those regions where thin sections join thick sections and, additionally, in the elbow region where the clamping force is applied. Because of the low stress existing in these areas, the ASTM E71 Class A acceptance standard is considered to be adequate.

Why not 100% RT ?

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V. Failure Analysis

A. An unlikely jet pump failure during normal operation would be immediately detected by the core flow measuring equipment. The partial loss of core flow due to a jet pump failure would not jeopardize reactor safety because a loss of core flow for any reason always results in a flow control type power reduction due to the BWR void-power relationships; thermal margins always increase under these circumstances. APED 5460 fully discusses loss of core flow due to jet pump failures.

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B. The stresses imposed on the jet pump assembly following the hypothetical steam line and recirculation line breaks are also discussed in APED 5460. The sensitive points have been located and analyzed for structural integrity during these accident modes. This analysis, plus an additional review of the stresses that would exist in the jet pump castings during various postulated accident modes, assures that the core flooding capability will be maintained.

In addition to three signed originals, 19 copies of this letter are also submitted.

Very truly yours,

W. B. Behnke
Assistant to the President

Subscribed and Sworn to before me this 2nd day of May, 1969.

Patricia D. Nelson
Notary Public