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TO:

Mr. R. W. Reid

FROM:
Metropolitan Edison Company
Reading, Pa.
J. G. Herbein

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DESCRIPTION

RE their ltr 9-28, 10-5 & 10-27-77

Consists of info. concerning Decay Heat Pump Shafts.....

(2-P)

ENCLOSURE

PLANT NAME: Three Mile Island Unit No. 1
RJL 11/14/77

FOR ACTION/INFORMATION

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November 10, 1977
GQL 1508

Director of Nuclear Reactor Regulation
Attn: R. W. Reid, Chief
Operating Reactors Branch No. 4
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Sir:

Three Mile Island Nuclear Station Unit 1 (TMI-1)
Docket No. 50-289
Operating License No. DRR-50
Decay Heat Pump Shafts

In our letters of September 28, 1977, and October 5, 1977, on the subject Decay Heat Pump Shafts, Met-Ed advised that the feasibility of metallographic replication and hardness tests to verify the heat treated condition of the TMI shafts was under investigation. Our letter of October 27, 1977, advised that we had scheduled, concurrent with the vibration and UT testing during the first week of November, a BHN Hardness Test, a Resistivity Measurement Test using a "TEVO" tester, and a Magnetic Permeability Test employing Eddy Current testing, to verify to the extent possible, the heat treated condition of the installed shafts.

In preparing for the BHN Hardness Test, it was determined that there was insufficient clearance to do this test on the shaft end. Further, since spherical indentations in excess of 0.020 inches deep can result from performing this test, it was felt that it was not advisable to perform this test on the outside diameter of the shaft, although that is the only location where sufficient clearance is available. Instead, the hardness readings were taken on the outside diameter of the pump shafts between the motor coupling and the pump housing using the Sonadur Model 100-1 Ultrasonic Hardness Tester manufactured by Krautkramer - Branson. This instrument utilizes a 665 gram load on a Vicker diamond point indentor with a direct readout in Rockwell C hardness numbers. Because of the light penetrating load used by this instrument, the hardness readings are surface values and are consequently affected by surface conditions. Therefore, any cold working of the surface as a result of the machining of the shafts will tend to produce slightly higher hardness readings, which would make the material appear as if it had been heat treated at a lower temperature than it actually was. The average hardness readings of the "A" shaft of Rc 36.52 with a standard deviation of 2.34, and the "B" shaft of Rc 35.5 with a standard deviation of 3.34, are within the range for H-1150 material of Rc 28-37.1/ In addition, the shaft material meets the specified hardness requirement of ASME:SA 564 Type 630 for the H-1150 condition of Rc 28 minimum.

1/ Armco 17-4 PH Precipitation-Hardening Stainless Steel Bar and Wire
Armco Steel Corporation, Baltimore, Maryland

Preparation for the evaluation of the Resistivity test and the Magnetic Permeability Test included the production of calibration standards by which the tests could be qualified. These standards consisted of four heats of Condition "A" material, heat treated to H900, H1025, H1075, H1100, and H1150. After preparation of the standards and upon completion of the "TEVO" tester evaluation, B&W concluded that a suitable and accurate technique had not been developed, and therefore, declined to perform the test on the pump shafts. B&W further indicated that the "TEVO" tester would probably not be able to identify the exact heat treatment of the shafts due to the large overlap in readings produced by the different heats and heat treatments.

Magnetic Analysis Corp., whose equipment and personnel were being employed to measure variations in magnetic permeability via eddy current testing, also experienced equipment calibration problems. It was determined that when using a hand held probe, it is possible to produce variations in readings simply by varying the contact pressure and angle between the probe and the test specimen. In addition, test specimen geometry appeared to affect the results. In preparing the calibration standards, different diameter bars were used. During the calibration attempts, it appeared that the size of the bar and position of the probe also affected instrument output. Because of these variables, it was decided that this test method would not be utilized until reproducible laboratory results could be obtained. However, as with the "TEVO" tester, exact identification of the shafts' heat treatments may not be possible.

In summary, the average Rockwell C hardness values are within the range for H1150 material. The other non-destructive methods for determining the heat treatment conditions of the shafts are not presently reliable, and were therefore, not employed. The only remaining method of examination that we are aware of would require removal of a chip from each shaft. This chip could be used for microhardness and metallographic analyses and retained austinite measurements. Met-Ed has considered removing a chip from the center of each shaft but deemed this to be inadvisable, since permanent damage to the shaft could result.

It is Met-Ed's present position that the heat treated condition of the Decay Heat Pump shafts has been adequately established and that further hardness and UT testing which requires shaft uncoupling is not necessary. Unless otherwise directed, Met-Ed does not intend to perform further shaft testing.

Sincerely,

J. G. Herbein
Vice President

JGH:RJS:tas

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