CONNECTICUT YANKEE ATOMIC POWER COMPANY
HADDAM NECK PLANT
RR #1, BOX 127E, EAST HAMPTON, CONN. 06424

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DOCKET NO. 50-213

U. S. Nuclear Regulatory Commission
Region 1
Office of Inspection and Enforcement
631 Park Avenue
King of Prussia, Pennsylvania 19406

Attn: Mr. Boyce Grier,
Director

Subject: Informational Report, Core 9 Fuel Inspection

Dear Mr. Grier:

This letter forwards a report on our Core 9 fuel inspection. The inspection was performed as part of our ongoing Post Irradiation Examination of fuel assemblies and the resulting report is transmitted for your information.

An additional three (3) copies of the report are enclosed.

Very truly yours,

Richard H. Graves
Station Superintendent

RHG/jhb
Enclosures

cc: USNRC c/o Document Management Branch, Washington, D. C. (1)

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CY POST IRRADIATION EXAMINATION PROGRAM--CORE 9

I. INTRODUCTION

As a part of our ongoing fuel inspection program, Connecticut Yankee Atomic Power Company (CYAPCO) made preparations to sip and inspect select fuel assemblies during the Core 10 refueling outage. The assemblies sipped consisted of fuel semblies of high burn-up histories which would be discharged from the core. See Tables 1 and 2. Of these assemblies, 6 were found to have leaks while 1 showed possible but inconclusive signs of leaking. Additionally, 17 fuel assemblies were inspected visually with the aid of a periscope. See Table 3. The assemblies visually inspected consisted of 7 leakers, identified by sipping, (1 inconclusive leaker included) and 10 assemblies determined more likely prone to leaking of those to be returned to the core.

II. EVENT DESCRIPTION

Trend evaluations have shown that although Iodine 131 activity decreased during Cycle 9 when compared to Cycle 8; Cycle 9 activity was still higher than Cycle 7 and two to ten fuel rods were predicted to be defective. Cycle 8 I-131 radioactivity was .3 Ci/ml at end of core which corresponded to a coolant activity during normal operation of approximately 10-12 percent of the Technical Specifications limit at the time of shutdown for the Cycle 9 refueling outage. This is compared to a I-131 end of core activity of .05 (decreased by a factor of 6) for Cycle 9 operation. Although the coolant level of activity was not limiting, to continue the ongoing fuel failure study, a fuel sipping operation along with a visual examination using a periscope were conducted during the Cycle 10 refueling outage.

III. SIPPING

All 52 Batch 9 discharged assemblies were sipped. Six (6) were found to be leaking, one (1) was found to be a possible leaker, and the remaining 45 were found sound. Also, the Batch 7 center assembly was sipped and found to be sound. This assembly, as all the assemblies sipped, has been discharged to the spent fuel pool. With 11.5 percent of Batch 9 discharged assemblies of varying core positions having failed, it was felt a reasonable set of criteria for selecting assemblies for visual inspection by periscope was to select ones that would be returned to the core, had a relatively high burn-up rate, and had a Core 9 location near failed fuel assemblies. By doing so, this would provide one means to ensure a sound Core 10. Tables 1 and 2 summarize the results of the fuel sipping operation.

IV. VISUAL INSPECTION USING PERISCOPE

Visual Inspection by periscope took place between June 4, 1980, and June 21, 1980. One objective of the visual inspection by periscope was to attempt to identify possible failure modes of the fuel assemblies identified as leakers during sipping. Therefore, 7 of the 17 assemblies visually inspected were known or possible leakers from Batch 9. The visual inspection was documented on 35 mm still color photographs.

The other objective of the visual inspection was to inspect fuel assemblies thought the most probable to be failed of those to be returned for the Core 10 cycle. As mentioned earlier, one criteria for selection was the physical relationship with respect to failed fuel assemblies as determined by sipping. Three (3) Batch 10 assemblies (K16, K10 and K08) were chosen using this criteria. Four (4) additional Batch 10 assemblies (K23, K42, K44 and K53) were chosen as a continuation of the Post Irradiation Examination Program. These assemblies had baffle plate contact in Core 8 and had been visually inspected during the Core 9 refueling outage. One (1) other Batch 10 assembly (K01) was chosen because during Core 8 loading the lower nozzle was jarred. Consequently this assembly was inspected and later used in the Core 9 cycle. It also had high burn-up. The two (2) Batch 11 assemblies chosen were assemblies which experienced a high burn-up for Batch 11.

No unusual defects were discovered as a result of the visual inspection. In general, the assemblies showed an increasing amount of crud build-up towards the top of the assembly. A more complete characterization of visual inspection results is provided in Table 3.

V. RESULTS

This past irradiation fuel inspection was designed to 1) identify failed fuel assemblies, 2) determine the extent of fuel failures through a radiochemical analysis, 3) visually inspect to provide insight as to probable failure mechanisms, 4) give assurance of Core 10's soundness and 5) provide a data reference point for ongoing trend analysis.

No failures, as exhibited in Core 8, Batch 8 fuel, were discovered in the approximately 950 fuel rods visually inspected. For example, no failures of the fuel cladding similar in visual characteristics to those found during the Core 8 investigation appeared. Of the Batch 9 fuel, 11.5 percent of the assemblies sipped were leakers. No one parameter for the Batch 9 assemblies can be identified conclusively as a common parameter effecting the probability of failure. However, an assembly's burn-up seems to have some bearing on the probability of failure. From Table 2, it can be seen that failures were confined to fuel assemblies of greater than 33,000 MWD/MTU.

VI. FINAL REMARKS

Further investigations are being conducted to establish the nature of fuel failures and operating recommendations and/or design changes will be developed as necessary. Based on the short term work done to date, such as fuel sipping, visual examinations, review of operational records, review by the Plant Operations Review Committee, review by the offsite Nuclear Review Board and review by individuals knowledgeable in fuel performance and fabrication, results achieved to date provide reasonable assurance that Core 10 is sound. A program is underway to research fuel history and specific operating events to be correlated with the sipping and inspection results so a failure mechanism may eventually be verified. As part of this continuing program, three fuel assemblies from Core 8 were shipped to Battelle Laboratories, Columbus, Ohio, for further research into the cause of their failure. This particular effort was partially funded by EPRI who because of potential generic interest have undertaken a research program in this area. Through this kind of industry-wide cooperation and directed research, it is our hope to further the betterment of Nuclear Fuel.

TABLE 1

CY FUEL EXAMS

SUMMARY OF RESULTS

FUEL TYPE	NO. SIPPED	RESULTS
Batch 9 Fuel-J	52	6 Leaking 1 Questionable 45 Sound
Batch 7 Fuel-G	1	Sound

TABLE 2

CY BATCH 8 SIPPING RESULTS
AS A FUNCTION OF BURNUP

ASSEMBLY BURNUP (MWD) MTU	LEAKING	GOOD	QUESTIONABLE
37033	J01, J42	J38, J41	
36824		J20, J10, J19, J07	
35877		J08, J03	
35855	J12	J18	
35828		H47, J16	
35726		J48, J14	
35556		J72	H57
35254		J13, J15	
34924		J27, J31, J21, J09	
34615		J24, J11, J22, J17	
33404	J33, J04	J29, J43	
33393		H54, H55, H48, H55	
33162	J23	J25, J30, J28	
32975		J26, J34, J32, J35	
31845		J44, J45, J46, J47	
31568		J02, J05, J71, J06	
29549		G29	
TOTALS	6 J's	40 J's, 5 H's, 1 G	1 H

TABLE 3

CY--FUEL, VISUAL EXAMINATIONS 6/04/80 - 6/20/80

Periscope (Poolside Examination)

K-23 - pellet-cladding interaction, some discoloration due to crud build-up, swirl pattern of crud above 2 spacers.
K-42 - pellet-cladding interaction, some discoloration due to crud build-up, swirl pattern of crud above 2 spacers.
K-44 - select pellet-cladding interaction, greater crud build-up in top nozzle plenum area, swirl pattern of crud above 2 spacers.
K-53 - pellet-cladding interaction, greater and build-up in top nozzle plenum area, swirl pattern of crud above 2 spacers.
K-16 - pellet-cladding interaction, some discoloration due to crud build-up, swirl pattern of crud above 2nd and 3rd spacers.
K-10 - slight crud build-up upper end of assembly, swirl pattern of crud above 2nd and 3rd spacers.
K-08 - slight crud build-up upper end of assembly swirl pattern of crud above 2nd and 3rd spacers.
L-10 - less crud build-up than "K" assemblies, swirl pattern of crud above 2nd and 3rd spacers, pellet-cladding interaction.
L-04 - crud build-up at bottom and top of fuel assembly, slight pellet-cladding interaction.
K-01 - pellet-cladding interaction on 70% of surfaces, crud build-up at bottom and top of fuel assembly.
J-12 - pellet-cladding interaction along lower 3rd of assembly, greater crud build-up on upper portion of fuel assembly, swirl patterns above spacers.
J-04 - pellet-cladding interaction, increased crud build-up on upper 1/3 of assembly.
J-23 - pellet-cladding interaction lower 1/3, swirl pattern above 1st spacer, crud build-up upper 1/3.
H-57 - pellet-cladding interaction.
J-33 - pellet-cladding interaction swirl pattern of crud above spacers, greater crud build-up on upper portion fuel assembly.
J-01 - pellet-cladding interaction upper 1/3 of assembly, greater crud build-up on upper portion fuel assembly.
J-42 - pellet-cladding interaction 50% of assembly, swirl patterns of crud above 2 spacers.