

CONTROL BLOCK:

(PLEASE PRINT OR TYPE AND REQUIRED INFORMATION)

01 NY IPS 2 00 - 00 000 - 00 03 41 11 1 4 5
7 8 9 14 15 25 26 30 57 CAT 58

CON'T

01 REPORT SOURCE L 05 00 02 47 7 0 10 68 1 8 05 19 81 9
7 8 60 61 68 69 74 75 80

EVENT DESCRIPTION AND PROBABLE CONSEQUENCES (10)

02 During cycle 4/5 fuel shuffle operations, grid strap damage in the
03 form of torn or missing corners was observed on a number of fuel
04 assemblies. No damage to the fuel cladding has been identified that
05 would be attributable to the grid strap problem. Evaluation of the
06 grid strap damage indicates that there will be no adverse effects on
07 Cycle 5 normal operation or postulated accident conditions.

08
7 8 9

09 SYSTEM CAUSE CAUSE COMPONENT COMP. VALVE
CODE CODE SUBCODE CODE SUBCODE SUBCODE
R C 11 E 12 B 13 F U E L X X 14 Z 15 Z 16
9 10 11 12 13 18 19 20

17 LER/RO EVENT YEAR SEQUENTIAL OCCURRENCE REPORT REVISION
REPORT NUMBER 81 002 99 X 2
21 22 24 26 27 28 29 30 31 32

ACTION FUTURE EFFECT SHUTDOWN HOURS ATTACHMENT NPRD-4 PRIME COMP. COMPONENT
TAKEN ACTION ON PLANT METHOD 22 SUBMITTED FORM SUB. SUPPLIER MANUFACTURER
X 18 Z 19 Z 20 Z 21 0000 Y 23 N 24 N 25 W 1 2 0 26
33 34 35 36 37 40 41 42 43 44 47

CAUSE DESCRIPTION AND CORRECTIVE ACTIONS (27)

10 Grid strap damage was caused by corner-to-corner interaction between
11 adjacent assemblies during fuel handling operations. The core was com-
12 pletely discharged and all assemblies were visually inspected. Following
13 evaluation, the core was reloaded using modified refueling procedures
14 that minimize corner interaction between adjacent assemblies.

15 FACILITY % POWER OTHER STATUS 30 METHOD OF DISCOVERY DISCOVERY DESCRIPTION 32
STATUS 000 29 N/A C 31 Visual Fuel Inspection
7 8 9 10 11 12 13 44 45 46 80

16 ACTIVITY CONTENT RELEASED OF RELEASE AMOUNT OF ACTIVITY 35 LOCATION OF RELEASE 36
Z 33 Z 34 N/A N/A
7 8 9 10 11 12 13 44 45 80

17 PERSONNEL EXPOSURES NUMBER TYPE DESCRIPTION 39
0 0 0 37 Z 38 N/A
7 8 9 10 11 12 13 80

18 PERSONNEL INJURIES NUMBER DESCRIPTION 41
0 0 0 40 N/A
7 8 9 10 11 12 80

19 LOSS OF OR DAMAGE TO FACILITY TYPE DESCRIPTION 43
Z 42 N/A
7 8 9 10 80

20 PUBLICITY ISSUED DESCRIPTION 45
Z 44 N/A
7 8 9 10 80

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NRC USE ONLY

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Consolidated Edison Company of N.Y., Inc.
Indian Point Unit No. 2

DISCUSSION

Cycle 4/5 fuel shuffle operations started on December 30, 1980. During fuel handling, apparent grid damage was observed on assembly F-65. When inspected, assembly F-65 was found to have a damaged grid strap at one corner. Among the adjacent assemblies inspected, assembly F-19 was found to have sustained similar damage at one of its corners. As shuffle operations continued, some assemblies experienced handling difficulties and therefore all the interacting assemblies in problem areas were inspected for damage. Some of these assemblies were also discovered to have damaged grid corners.

As a result of these findings, a decision was made to completely discharge the reactor core and visually inspect all assemblies belonging to Regions 4, 5, 6 and 7*. This involved all 193 assemblies used in Cycle 4, 58 new Region 7 fuel assemblies, and 7 additional Region 4 assemblies discharged from third cycle. Videotapes of this inspection were reviewed and grid damage was evaluated. Subsequently, cycle 5 was redesigned and a revised loading pattern was developed. Cycle 5 core was reloaded using special handling instructions. The reloading of the core was concluded on 2/21/81.

FUEL INSPECTION RESULTS

Using an underwater TV camera and the videotaping system, 258 assemblies were visually examined. The grid straps in 87 assemblies were found damaged (mostly at corners), and 19 additional assemblies which had trapped debris, subsequently had undergone cleaning. Following review and evaluation of videotapes, 63 damaged assemblies were categorized as follows:

<u>Category</u>	<u>Assemblies</u>	<u>Assembly Reuse Status</u>
1	5	Accepted as is.
2	39	Conditionally accepted with special handling instructions.
3	10	Conditionally accepted with special handling instructions for one more cycle. Then evaluate for clad wear, and reuse
4	9	Not used in Cycle 5 pending further evaluation or repairs.

Because of lower priority (i.e., fuel not used in Cycle 5), remaining 24 assemblies with damaged grid straps are yet to be categorized. If these assemblies are considered for use in the future, they will then be evaluated as to their acceptability.

*14 assemblies of new Region 7 were not handled and therefore needed no inspection.

Where the grid strap damage was minor and inconsequential (i.e., small chipping of strap edges), the assemblies were accepted for further use (Category 1). There are 5 assemblies in this Category and 3 of these assemblies were loaded into the core for Cycle 5.

For the Category 2 assemblies, grid damage was still minor and continued to satisfy the clad wear criteria. However, the nature of the grid material damage was such that the damage could propagate to the interacting assemblies during handling operations. For the 39 assemblies in this Category, reuse was considered acceptable only on the basis of special handling to preclude deterioration of existing damage or propagation of existing damage to other assemblies through interactions. Thirty six of the Category 2 assemblies were loaded in Cycle 5.

For Category 3 assemblies, damage was such that the rod support was affected and the fretting wear was calculated to exceed normal design limit but has been analyzed not to result in clad failure. These assemblies are to be re-examined after each cycle of operation to determine acceptability for duty beyond one additional cycle. Under this condition, ten (10) assemblies were accepted and loaded in Cycle 5. Moreover, special handling similar to those imposed for the Category 2 assemblies would also apply for this Category.

When grid damage was such that the rod support was affected and the clad wear was calculated to be large enough to potentially cause clad failure, the assembly was considered to require further evaluation and/or repair prior to reuse. Nine (9) such assemblies placed in this Category 4 were not used in Cycle 5.

Thus in the Cycle 5 core, there are 49 assemblies with damaged grids as mentioned above. The remaining 144 assemblies contain no grid damage.

EVALUATION OF POTENTIAL IMPACT OF GRID DAMAGE

Grid damage was considered both as regards normal operation and accident conditions. The areas addressed include:

1. Potential propagation or worsening of existing damage due to assembly-to-assembly interactions.
2. Lessened structural integrity and potential for additional fuel rod wear.
3. Thermal/hydraulic consideration due to local flow blockage caused by unrecovered grid strap material.
4. Possible mechanical binding of controls rods (RCCAs) due to unrecovered grid strap debris.

Additionally, it should be noted that grid damage observed is small and localized and that, the more basic structural aspect of the fuel assemblies are unaffected. The following is a summary of the evaluations performed to determine the impact of fuel grid damage.

1. As discussed earlier, special handling instructions have been and will be used for those cases where the damaged grid may cause adjacent assembly grid-to-grid interactions when inserting or removing assemblies. Thus, existing damage will be precluded from progressing.
2. As discussed earlier, the effect of the loss of grid material on the structural integrity of the assembly is limited to the effect on the fuel rod support. Inadequate rod support (spring-dimple) could cause additional rod vibration and clad fretting/wear. A fretting analysis was done on a case by case basis, when the rod support was affected. On the basis of the fretting analysis results, assemblies were categorized for reuse as previously discussed.

It should be noted that these analyses, and the resultant categorization of fuel assemblies are considered to be very conservative; in particular, for Westinghouse PWR cores no known incident of fuel rod failure has been traced to grid damage, even in documented instances where assemblies have operated for one or more cycles with large missing sections of outer grid straps.

3. Due to the missing chips from the damaged grids, the potential for local flow blockage (due to unaccounted for chips) was considered. This assessment includes both DNB and LOCA. For the videotapes of the inspection it was estimated that the area of the pieces torn from the outer straps of the damaged grids was 17.7 sq. in. Of the loose pieces retrieved following core unloading, chips with an estimated area of 5.97 sq. in. were identified as grid material. This left approximately 11.7 sq. in. of grid material unaccounted for.

Flow blockage potential was considered for material that could become entrapped at the fuel assembly bottom nozzles and material that could be carried upward through the bottom nozzles and then through the grids(s) with the potential of being entrapped in the core. For analysis, the unrecovered pieces were assumed to accumulate either at the bottom nozzle or be randomly distributed in the core. Since interaction between assemblies had no core-wide pattern, material torn from the grids was either entrapped in the interacting assemblies or fell to the lower core plate in a random distribution. If unrecovered material in the latter case was later flushed into the core by coolant flow, the distribution would still be random. THINC-IV analysis for the first condition (partial blockage at nozzles) showed a full flow recovery in less than 30 inches downstream and in this region of the core DNB and LOCA are not limiting.

For the second condition, the potential for material reaching higher elevations in the core was considered. Of the inventory of material unaccounted for, the maximum area of the largest piece capable of passing through the nozzle and grid is 0.29 square inches. This is equivalent to 0.8% local assembly blockage.

For this second condition, where material could move upward in the fuel, analysis and tests on open lattice assemblies show that large local blockage (~41%) is acceptable. The blockage has little effect on subchannel enthalpy rise and, in reality, the blockage is expected to promote turbulence with no effect at all on DNB. Thus, the effect of potential blockage on DNB is not a concern.

LOCA analysis indicates that the effect of local blockage on peak clad temperature occurs during the steam cooling phase of core reflood. A conservative evaluation of the assembly blockage was carried out to address the steam cooling phase. It showed that the effect of the blockage would be to increase the PCT (peak clad temperature) by only 1°F. This is an insignificant temperature rise and therefore the effect on LOCA is not a concern.

4. Possible binding of RCCAs due to the unrecovered grid strap debris was considered. The analysis concluded that there was a low likelihood of this problem. In past instances at other facilities, grid damage or debris in the reactor core has never resulted in operational problems. The existing technical specification requirement of stepping of the control rods every 2 weeks will provide the necessary safeguard against RCCA binding.

CONCLUSION

Grid damage was caused primarily by corner-to-corner interactions during assembly handling. The refueling procedures were revised such that corner interactions between assemblies were minimized. Assemblies with damaged grid straps were loaded with special handling instructions so that the existing damage was not aggravated further or propagated to adjacent assemblies.

Based on the evaluations performed, it has been concluded that safe Cycle 5 operation will not be affected by the grid damage and the assumed presence of unrecovered grid strap material. Also, during Cycle 5 operation, the required routine monitoring of coolant activity and stepping of control rods will provide a check against fuel rod cladding leakage or RCCA binding.