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Office of Nuclear Reactor Regulation, Director

SUBJECT: Forwards investigation rept of slow CRD insertion times during Dec 1984 post-maint scram insertion time testing,rept of slow insertion times during Mar 1985 testing & response to 18 NRC questions.

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June 17, 1985

Director
Office of Nuclear Reactor Regulation
US Nuclear Regulatory Commission
Washington, DC 20555

Monticello Nuclear Generating Plant
Docket No. 50-263 License No. DPR-22

Report of Investigation Into Slow CRD Scram Time Test Results
Prior to Restart Following Recirculation Piping Replacement

During post maintenance scram insertion time testing in December, 1984 at the Monticello Nuclear Generating Plant a large number of control rod drives (CRD's) were found to have slower than normal insertion times. This event was thoroughly investigated and corrective measures were taken. NRC Region III Inspection and Enforcement personnel reviewed all aspects of this event prior to plant restart. At the request of Region III, a report of our investigation into this event is provided for the information of the NRC Staff.

Following plant restart, a program of scram time testing was initiated for CRD's of the unmodified design. During this testing in March, 1985 two CRD's were found with slow insertion times. An addendum to the original investigation report is attached which describes this event and the corrective actions taken.

Also attached are reponses prepared by the Monticello technical staff to 18 questions originally posed by the NRC Resident Inspector and Region III Staff.

Please contact us if you have any questions related to the information we have provided in the attached reports.

David Musolf
Manager - Nuclear Support Services

c: Regional Administrator III, NRC
Resident Inspector, NRC
G Charnoff

Attachments

A001
1/40

MONTICELLO NUCLEAR GENERATING PLANT
SPECIAL ENGINEERING REPORT

SLOW SCRAM TIME DUE TO PLUGGED CRD INNER FILTER

Report Date: May 1, 1985

Event Date: December 3, 1984

Description of Event:

Post maintenance scram insertion time testing was conducted on December 3, 1984 in conjunction with a vessel hydrostatic test at operational pressure. Results of that testing, indicated that 96 of the CRD's or 79% had abnormally slow scram times.

A chronological sequence of events has been reconstructed and is provided as Attachment 1.

Designation of Apparent Cause of the Event:

In the course of reconstructing the event, interviewing personnel involved, and reviewing pertinent documents; one primary cause and a number of contributing causes became apparent.

Design - The primary cause of this event was the transfer of water from the annulus into the core barrel directly above the CRD's. As directed by the Annulus Draining Procedure of Design Change 83Z049, the annulus pumps were installed on the annulus bottom with their discharges directed over the shroud through a drain connection on the core shield plug and into the core barrel. This installation configuration was necessary because the annulus pumps had inadequate discharge head to lift the water up and over the reactor flange.

As illustrated in Figure 1, sediment in the annulus was lifted over the shroud and discharged across the lower core plate. As the annulus sediment settled on the lower core plate, some of the solids fell through the cruciform opening in the fuel support piece castings. Those solids that passed through the fuel support piece casting were deposited at the bottom of the guide tube.

Later, during periodic CRD exercising, those same solids were drawn onto the CRD inner filter thereby adversely affecting scram times. Thus the primary cause of this event was the annulus pump selection and/or design which dictated the annulus pump discharge to the core barrel.

Age Related Degradation - One of the contributing causes of this event was the accumulated corrosion products along the annulus bottom. Although vessel wall hydro-lasing above the annulus may have contributed to the accumulated material along the annulus bottom, it is reasonable to attribute the bulk of the sediment to the general accumulation since the plant began operation. Records and long time staff member recollections support the premis that no cleaning of the annulus had been conducted prior to this event.

Subsequent to the annulus pumping activities, the annulus bottom was vacuumed. Operators estimate the sediment levels varied from 1/4 inch to more than 1 inch thick.

Ignorance of Product Attribute - A second contributing cause of this event was the presence of undisolved purge dam fibers throughout the reactor vessel.

Purge dam material, thought to completely disolve in water at ambient temperature, only partially dissolved. The purge dam material consists of acetate fibers bonded into paper like sheets with a starch binder. When immersed in water, the starch binder disolved releasing the fibers from their bonded state. These undisolved fibers then dispersed in the water.

Because of ignorance regarding the residual fibers from disolved purge dam material, inadequate controls were placed upon the use of the material. As a consequence, excessive purge dam material was introduced to the reactor water resulting in large purge dam fiber concentrations. These dispersed fibers acted in conjunction with solids in the guide tubes to foul the CRD inner filters.

Design - The last contributing cause of this event was the design of the installed CRD inner filters.

The CRD design present during the event provided a spud mounted inner filter which moved with the index tube. As shown in Figure 2, the movement of index tube and filter away from the stop piston produced a increasingly larger swept volume. Accumulated solids and fibers on the filter restricted water flow through the filter into the swept volume. This restriction in water flow generated a differential pressure across the filter which acted to oppose the index tube movement.

General Electric recognized this problem more than a decade prior to this event and developed a modified inner filter which is fixed to the stop piston and thus cannot develop the differential pressure as the original design could. This improvement was marketed by G.E. in SIL 52 as an improvement to reduce wear in an unrelated piecepart of the CRD. Based upon the marketing information provided, NSP chose to retain the original design spud mounted filters which later experienced fouling problems.

Improper Parts - During the investigation into slow scram times, a parts procurement problem was identified. Some of the inner filters supplied by General Electric were found to be improper. Specifically the documentation and parts packaging was in order but the wrong parts had been packaged in boxes bearing the proper part number.

Analysis of Event:

As described in the chronological sequence of events in Attachment 1, the CRD filters became plugged some time shortly after the annulus was pumped down on April 19, 1984.

Between the time the filters were plugged and the time the plugged filters were detected, approximately 8 months elapsed. During that eight month period with one exception, the CRD's were fully inserted and disarmed whenever the core was loaded. That one exception was the November 5, 1984 core physics testing. During the physics testing the vessel was depressurized and no challenge of the scram function occurred.

Had a scram signal been generated during core physics testing, all CRD's would have been automatically inserted within specifications regardless of the plugged inner filters.

In fact prior to physics testing, scram insertion time testing was conducted for those rods to be withdrawn during the physics testing. The scram insertion time test was conducted with the vessel depressurized and the resultant scram times were all within technical specification limits. The nature of the CRD scram response with a plugged inner filter is such that when the vessel is depressurized (Cold Shutdown) scram times will be uneffected by the plugged inner filter. As the vessel pressure is raised towards the normal operating pressure the inner filter differential pressure increases, the insertion speed slows and the scram time increases. This was confirmed during the diagnostic work while investigating the slow scram times. Tests showed that CRDs that took greater than 10 seconds to insert at normal operating pressure properly inserted, while depressurized, in about 2.5 seconds.

During the time period while the event condition existed, the Standby Liquid Control system was operable whenever the reactor core was fueled. There were no personnel injuries, exposures to the public, radioactive material releases or damage to systems, components, and structures as a result of the event. This event had no effect on public health or safety.

Corrective Action

Immediate corrective actions were taken after the event to prevent recurrence. Solids and particulates in the core and reactor systems were cleaned up using a combination of turbulant flows and existing water cleanup systems.

Particulates deposited in the guide tubes were cleaned up from under vessel. While the CRD's were removed from the CRD housing, a special guide tube flushing tool was temporarily installed in the CRD housing. That tool permitted the flushing and cleaning of the guide tubes from beneath the vessel.

Lastly, one at a time, all CRD's were removed from the vessel and their inner filters were replaced with new clean filters.

Investigation into the inner filter plugging identified a CRD modification which reduces the possibility of plugging the inner filter and eliminates the symptom of slow scrammming should the filter become plugged. That modification provides for relocating the original spud mounted inner filter to the preferred stop piston location.

Measures were taken to modify as many drives as possible in a minimum of time. When the filter changeout was complete, sixty-four drives had the modified design and fifty-seven had the original design.

To demonstrate that the short term corrective actions were adequate, post maintenance testing was conducted. That testing included normal drive timing, stall flow measurements, friction testing and uncoupling checks. All drives were then subjected to individual scram time testing at normal system operating pressure and all drives scrammed properly and within technical specification limits.

With this work complete sixty-four CRDs were of the modified design and fifty-seven remained unmodified.

Long term corrective actions were also committed to because of the recognized need to provide an absolute solution to the slow scram time event. Because the original design inner filters are vulnerable to the slow scram time event, 3 commitments were made to the NRC:

A. All remaining CRD's will be modified over the next three operating cycles.

B. Until such time as all CRD's are of the modified design; 4 to 8 of the remaining original design CRD's will be subjected to individual scram time testing on a quarterly basis.

C. As long as unmodified CRD's remain installed in the vessel, additional water quality limits will be imposed during all CRD manipulations.

Limits: Less than 500 PPB crud
Less than 30 fibers per liter

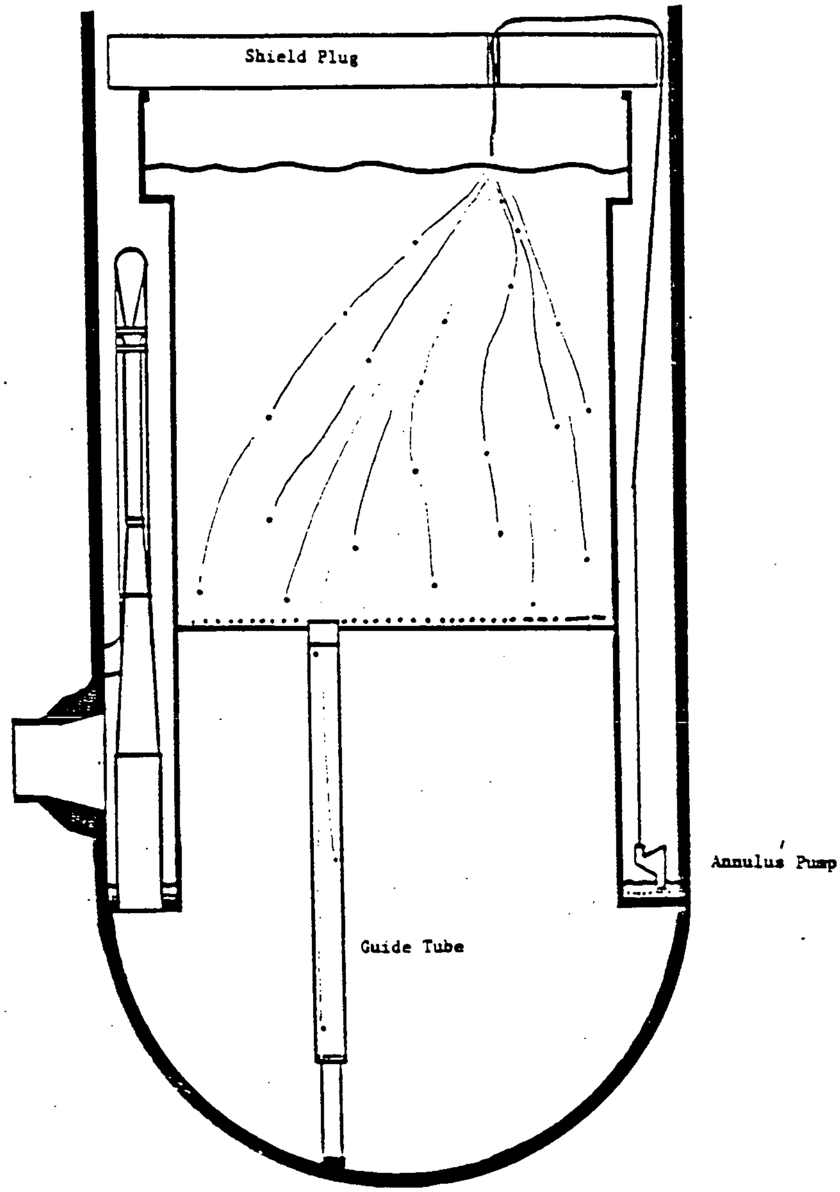
D. Investigate means of controlling the disposition of material flushed from the vessel walls during hydrolazing.

The following areas will be investigated further:

A. Improved vessel cleanliness inspections.

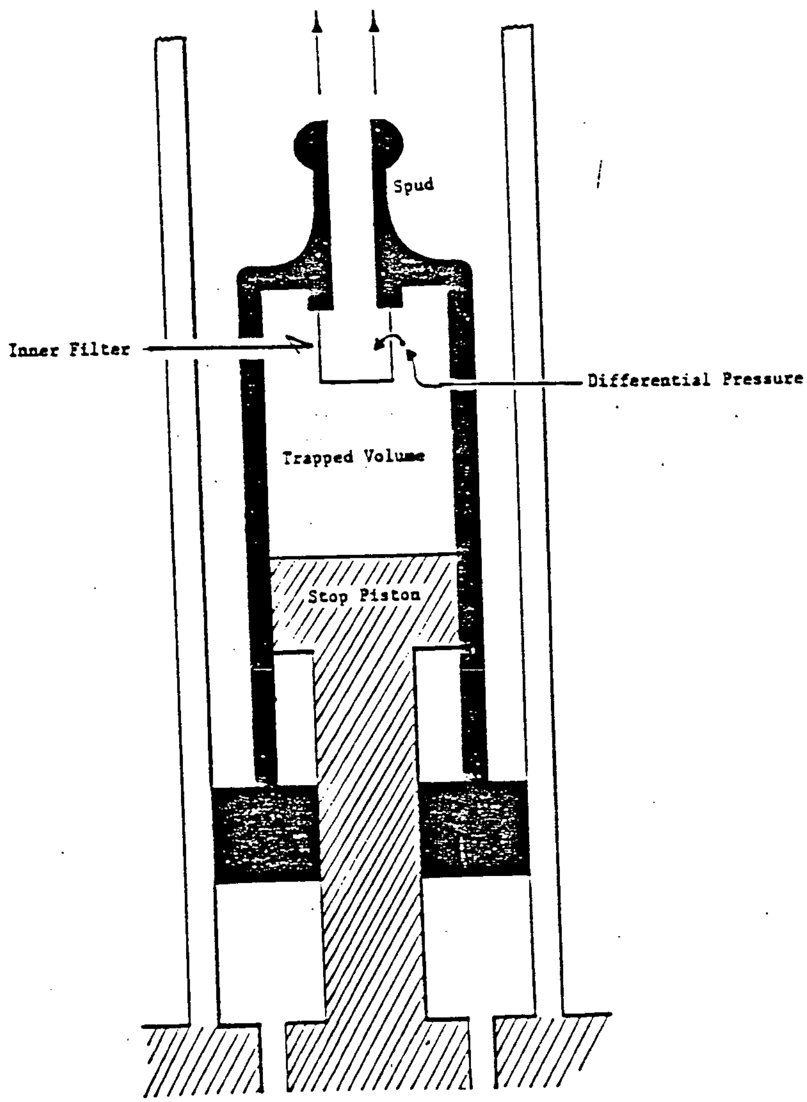
B. Improved general cleanliness control measures.

FIGURE 1



SCHEMATIC OF SEDIMENT AND CRUD MOVEMENT

FIGURE 2



SCHEMATIC OF CRD WITH
SPUD MOUNTED INNER FILTER

MONTICELLO NUCLEAR GENERATING PLANT
SPECIAL ENGINEERING REPORT

ADDENDUM #1

SLOW SCRAM TIME DUE TO PLUGGED CRD INNER FILTER

Report Date: June 7, 1985

Event Date: 1984

Description of Event:

On March 23, 1985, during accelerated scram time testing, two CRD's were observed to have abnormally slow scram times.

Designation of the Apparent Cause

Improper Parts - During the original investigation into slow scram times, a parts procurement problem was identified. Some of the inner filters supplied by General Electric were found to be improper. Specifically the documentation and parts packaging was in order but the wrong parts had been packaged in boxes bearing the proper part number.

Based upon information from available documentation the recurrence of slow scram insertion times may also be a result of improper G.E. supplied parts. As can best be reconstructed, of the inner filters provided to Northern States Power Company from Northeast Utilities which in turn were provided by General Electric, two were of 6 mil mesh instead of the required 10 mil mesh. The 6 mil mesh resulted in increased filter differential pressure and subsequent increase of scram times.

Procedure - During the receipt inspection process of inner filters provided by Northeast Utilities, the inspection procedure did not provide adequate detail to assure only the proper filters were accepted. The purchase order D59813MQ receipt inspection procedure did not specifically identify acceptable or unacceptable filter mesh size, nor was the wire diameter used to check filters specified. Consequently, because plant personnel were sensitized to the concern with 2 mil filters, it is probable that a wire greater than 2 mils but less than 6 mil in diameter was used. This being the case, 6 mil filter mesh size would go undetected and therefore be accepted.

A second procedural problem may have contributed to the installation of the incorrect 6 mil filters. It is conceivable that during the CRD work between December 11, 1984 and January 6, 1984 a replacement parts mix-up may have occurred. Procedures established to install new filters did not address the disposition of the old filters nor did they address sanitizing the work site from questionable parts provided by G.E. Although the existing work control process and general employee training should preclude this, it is possible improper 6 mil filters were inadvertently mixed in with correct filters at the work site then installed in CRD.

Analysis of the Event:

This event had no effect on the health or safety of the public. On detection of two drives with slow scram insertion times additional scram testing was conducted to verify compliance with Technical Specification 3.3.C.2. That additional testing determined there had been no violation of technical specifications. To insure no later violation would occur assuming the two drives continued to slow, the slowest of the two drives was fully inserted to position (00) and disabled.

Corrective Action:

Preparations were made for CRD maintenance, then during the week of May 3, 1985, the two slow CRDs along with 9 other unmodified CRDs were changed out. In place of those CRDs, 11 newly rebuilt and modified CRDs were installed. With this additional work seventy-five CRDs were of the modified design and forty-six remained unmodified.

Because with either cause of the incorrect filter there is no basis to rule out other improper filters, a review of the pre-shutdown scram testing was conducted. That testing when compared with testing conducted just after startup indicates that just the two drives (cells 18-31 and 14-27) exhibited significant degradation. Based upon that information it is believed all improper filters have been identified and subsequently removed.

MRK/kik

Attachment: Attachment Sequence of Events (Revised)

ATTACHMENT 1

SEQUENCE OF EVENTS

February 3, 1984	Plant shutdown for maintenance and refueling.
March 8, 1984	All fuel unloaded from core.
March 15, 1984	Selected CRD removal to support Recirc Piping Replacement Project
March 27, 1984	Decontaminate Reactor Vessel Walls
April 19, 1984	Annulus Drain Down
September 22, 1984	Replace Feedwater Spargers
September 28, 1984	CRD Maintenance
October 18, 1984	Rx vessel floodup to Fuel Pool Level
November 1, 1984	Reactor core refueled
November 3, 1984	Succesful completion of scram insertion time testing of selected CRD's with the vessel depressurized.
November 5, 1984	Conduct low power physics testing.
December 2, 1984	Begin hydrostatic test of the reactor vessel.
December 3, 1984	Conduct scram insertion time test, test results indicate 96 CRD's have slow scram times.
December 5, 1984	Two CRD's were removed from vessel and inspected. Inspection revealed gross fouling of the inner filter. Deposits contained accumulated corrosion products, unidentified fibers (later determined to be purge dam fibers) and paint chips. One of the two drives was found to have a black grease like substance in the "Under Piston" area. Neither the identity of the substance nor its source could be determined.
December 9, 1984	Reactor vessel flushing and cleaning started. Fiber concentrations calculated to be about 16,000 fibers/liters.
December 11, 1984	CRD removal, filter changeout and guide tube flushing commenced.
December 18, 1984	G.E. filters from the same batch that were used on the first 20 cleaned CRD's were found to have the incorrect 2 mil mesh. NSP Quality Assurance and General Electric were notified of the incorrectly supplied filter.
December 23, 1984	Similar to the situation on December 5, a second drive was found with a grease like substance in the "Under

Piston" area. The two drives involved did not have similar maintenance histories and no relationship between the two drives and the substance could be established.

December 24, 1984	Two CRDs installed with new spud mounted inner filters which were later determined to have 6 mil mesh.
December 26, 1984	Flow test conducted using new 10 mil filter and disolved purge dam material resulted in 1.6 PSID at 60 GPM at a concentration of about 3,000 fibers per liter. Decomposition test results from laboratory indicate partial fiber decomposition at temperatures of 400°F and below. Complete decomposition occurred at 450°F after about 8 hours.
December 31, 1984	Scram insertion time test of two CRD's with the vessel depressurized to verify thorough and complete cleaning. Subsequent inspection of the filters found no evidence of residue in either filter.
January 6, 1984	All CRD's inspected, clean filters installed and guide tubes flushed.
January 7, 1985	Plugged filter from a CRD was tested and found to produce 4.0 PSID at about 1.5 GPM. This test confirmed the cause of the slow scram time was the fouled inner filter. CRD drive speed/timing, friction testing and stall flow testing completed.
January 8, 1985	Begin hydrostatic test of the reactor vessel.
January 9, 1985	Successfully completed CRD scram insertion time testing while the vessel was at normal operating pressure.
January 19, 1985	Reactor at power and generator on line.
January 28, 1985	Successfully completed CRD scram insertion time testing of four drives while the vessel was at normal operating pressure.
March 23, 1985	CRD scram insertion time testing indicates two drives have slow scram times, the worst of the two drives was fully inserted to position (00) and disabled.
May 3, 1985	Conduct scram insertion time test for all unmodified CRDs with the exception of one intentionally disabled. Plant shutdown for maintenance.

May 6, 1985	Physical inspection of the inner filters removed from the two slow CRD's indicate both filters were of 6 mil mesh.
May 8, 1985	Successfully completed CRD scram insertion time testing of newly installed CRDs while the vessel was at normal operating pressure.

Internal Correspondence

		Date	January 4, 1985
From	D. E. Nevinski, Plt. Supt., Engrg. & Rad. Prot.	Location	Monticello
To	W. A. Shamla, Plant Manager	Location	Monticello

Subject: Responses to (18) Questions from NRC Resident Inspector Regarding Current CRD Problem

The following answers are provided to the questions received from C. A. Brown on December 29, 1984.

1. What flushing procedures were used on the CRD's during the outage and before refuel?

   Normal cooling water flow rates during power operation are 40 gpm. The drives were provided with 10-12 gpm of cooling water during most of the outage. This was the maximum flow rate that could be processed by the plant's radwaste system. The flow path was from the condensate storage system to the reactor through the CRD's. From the reactor, water was rejected to the torus. Torus water was periodically transferred to radwaste for processing back to the CST's. The CRD's were also exercised on a monthly interval. This exercising moved the seals and helped to dislodge any stagnant water from the drives to reduce the potential for pitting under seals.

   A high dp flush was avoided due to potential for inadvertent CRD motion. Some CRD's were without control rods; i.e., weighed less. This reduced the resistance to drive insertion. (It should be noted that no external method of flushing is possible to provide a flush of a CRD inner filter.) On April 4, 1984 a test was done to determine the maximum flow that could be provided to the CRD's. At 40 psi cooling water header pressure, 20 gpm of cooling water flow was provided. Normally cooling water header pressure was limited to 25 psi to prevent inadvertent drive motion.

   There were short periods of time when no water was provided to the drives. This occurred only during periods of in-vessel work to prevent inadvertent loss of level control. This happened during feedwater sparger removal and replacement.

   Assuming reactor water level was at the normal elevation of 205 inches, experienced during most of the safe end replacement work, the entire reactor inventory was exchanged every 30 hours with 10 gpm of cooling water flow. This was about 3% of inventory every hour which is proportionally 3 times the capacity of RWCU during full power operation; i.e., RWCU flow is 1% of feedwater flow at rated conditions.

2. What (if any) was the water flow path during the outage? (I'm referring to the water that was in the vessel.)

The recirc pumps were isolated early in the outage. From February 27, 1984, RWCU was also out-of-service, with several short exceptions, until October 4, 1984. Vessel flow path was primarily CRD cooling water flow into the core shroud. Water was drained from the shroud through CRD housing 34-47 and the shroud overflow standpipe from the date that reactor water cleanup was removed from service until early June. At this time, the drain was transferred to CRD housing 18-47. On August 14, 1984, level was dropped to the elevation of the CRD stub tubes.

Water flow path was into and out of the vessel shroud with the only water purification being from the "feed and bleed" process described above. Another water flow path was from the reactor vessel annulus through the annulus pumps with flow going to the shroud through the shield plug. This would only occur when the annulus was being pumped down or if a leak was occurring into the annulus. Periods of annulus pump use are listed below:

4/11/84 - Annulus initially drained using annulus pumps and drains on suction nozzle welded on plugs. Pumps were isolated as annulus leakage was zero.

4/20/84 - Annulus leak of 4.5 gpm starts when return nozzle N2-F is cut. Pumps started.

4/23/84 - Annulus leakage is reduced to 2 gpm by adjusting position of 'F' riser.

- Leakage increases to 4 gpm when nozzle N2-E is cut.

- Further adjustment of 'F' riser results in failure of jet pump plugs and loss of annulus water level control. Shroud level is decreased to point where pumps can keep up.

4/24/84 - Shroud drained to below jet pump plug elevation and annulus pumps are secured.

6/16/84 - During attempt to flood up for jet pump fit-up, a nozzle plug leaked and the annulus pumps were used to drain annulus.

6/19/84 - Vessel flooded for trial jet pump fit-up and RWCU returned to service to clarify water.

6/26/84 - Annulus drained after trial jet pump fit-up. RWCU was still in service.

7/1/84 - Vessel flooded for second trial jet pump fit-up with RWCU remaining in service to clarify water.

7/11/84 - Annulus drained after jet pump fit-up. Annulus pumps permanently removed from service.

From June 19 to July 11, 1984, RWCU was returned to service to clarify reactor water to allow the performance of in-vessel work. Flow path was from the "B" recirc suction line and the bottom head drain line back to the annulus through the FW nozzles.

The flood ups that occurred from June 16 to July 11, 1984 included the recirc suction lines on both loops and the "B" loop pump cavity. The June 16th flood up would have been the first entry of purge dam material into the reactor. The discharge piping from the recirc pumps was flooded for the first time on October 2, 1984.

3. What filtering and cleanup of water was done before refuel?

RWCU was returned to service from June 19, 1984, to July 11, 1984. This was done to clarify reactor water to allow a trial fit-up of the jet pumps.

Prior to refueling, the annulus area was vacuumed to remove a build-up of foreign material. The lower core grid and those guide tubes without control rods were also vacuumed. The recirc risers were vacuumed.

The water was cleaned up using normal methods. This included use of RWCU, Fuel Pool Cooling and Cleanup, and some "feed and bleed" cleanup by draining to radwaste or to the condensate storage tanks (from RWCU) with make-up from the condensate service system.

NOTE: This response also answers Question #17, below.

4. Why did Monticello choose not to make the G.E. recommended modification on the CRD's?

G.E. SIL #52 recommended the CRD inner filter modification as a method of reducing stop piston seal wear, thereby reducing the frequency of "02 Scrams".

The intent of the modification was to remove the spud-mounted 10-mil inner filter with a stop piston-mounted 2-mil inner filter. The reduced filter mesh size could be justified because the stop piston-mounted filter sees far less flow than the spud mounted filter. The smaller mesh filter would remove more particulates from the stop piston seals, thereby extending seal life.

The NSP response was one of cautious skepticism. Stop piston seal problems at that time were thought to have been a result of crud introduced during startup testing. After considering the G.E. recommended modification, we chose to defer taking action. If our operating experience indicated that high stop piston seal maintenance warranted the modification, then we would implement the modification.

Six months after issuing SIL #52, G.E. issued a supplement to the SIL which advised of problems in the modified CRD's. Specifically, five drives at one plant had inner filters installed improperly, ultimately resulting in advertent control rod uncoupling.

Based upon acceptable stop piston seal performance and the uncoupling problems in the modified CRD's, we chose to retain the original spud-mounted inner filter design.

5. <u>What is the status of the G.E. Part 21 report?</u>

   G.E. has indicated an investigation has been initiated regarding this Potentially Reportable Condition (PRC). The investigation may take as long as 12 months, with a minimum of 3 months expected, according to G.E.

6. <u>Does G.E. know how the parts got mixed?</u>

   At this time, G.E. is continuing its investigation and has no answer available.

7. <u>Why did NSP not do a physical check of the parts on receipt?</u>

   The receipt inspection of the inner filters included inspections for shipping damage, documentation, identification and marking, physical damage and cleanliness. Drawings showing physical dimensions and design requirements of the filters are not in NSP's drawing system. These drawings were considered proprietary by G.E. There were, therefore, no other inspections possible by NSP. There is no requirement to perform a dimensional verification of parts obtained from a vendor with an approved Q.A. program. The level of receipt inspection performed by NSP was, therefore, appropriate.

8. <u>Has NSP modified its receipt procedure to do physical checks on materials and equipment?</u>

   We currently do have provisions in our Procurement/Receipt processes to provide for physical inspections of items. All items do receive a "Shipping Damage Inspection". Additionally, requestors (usually engineers for safety-related items) may specify other physical inspections to be done as they feel prudent. The individual to do these inspections is also specified, and is usually the requestor or a QC inspector.

   In the conduct of QC inspections of procured items, two other activities may suggest further detailed physical inspections. First is a review of past problems with given vendors or of items provided. Second, a general physical inspection is conducted and if something looks questionable, more detailed inspections and/or reviews are conducted.

   It should also be recognized that these physical inspections are in addition to QC inspector review of appropriate documentation.

   It is felt that this approach is responsive to QA prgoram requirements for receipt inspection activities.

9. How many dams, or square inches of "rice paper" was initially contained in the primary coolant?

   540 square ~~inches~~ feet of DISSOLVO (not "rice paper") was placed into the primary system as purge dams to perform pipe welding.

10. Can (or did) an estimate be made for the amount of material remaining in the primary coolant?

    NE&C has determined the number of square feet of purge dam material used in the primary system during the 1984 outage to be 540 square feet.

    Using an analytical balance, we determined the weight of a 1 square inch piece of "rice paper" to be 73.4 mg. We were then able to calculate the total weight of rice paper used in the primary system as follows:

    $$(540 \text{ sq. ft.}) \times (73.4 \text{ mg/sq. in.}) \times (144 \text{ sq. in/sq. ft}) \times 4.55 \times 10^{-5} \text{ lbs/mg}) = 12.6 \text{ lbs.}$$

    We then determined a correlation between weight of paper and number of fibers. Raw data shows that 3.8 mg of "rice paper" corresponds to about 3400 fibers. This was simplified to the relationship: 1 lb. = 4.067E8 fibers, approximately.

    Primary coolant samples on 1/3/85 showed fiber concentrations of about 5 fibers per liter. With primary coolant volume = 43,000 gallons, or 1.625E5 liters, we can estimate the weight of dissolved "rice paper" remaining in the system as follows:

    $$(5 \text{ fibers/liter}) \times (1.625E5 \text{ liters})/(4.067E8 \text{ fibers/lb}) = 0.00199 \text{ lbs. or } 0.909 \text{ gms.}$$

11. Was the paper that was finally used the same as that originally proposed?

    Yes.

12. Was there a safety analysis done on the paper? Is this reflected in plant safety committee minutes?

    No/No. Review of the material used was performed by NSP (Materials & Special Processes Dept.), but not as part of the Design Change package.

13. Is there a G.E. or other specification that was issued to vendors soliciting bids on the paper?

    It is identified as an approved material in the G.E. Materials and Processes Handbook; thus, no separate spec was issued for the material.

14. If so, what was the vendor's response? Is there an accompanying spec sheet for the material?

    Not applicable, based on the answer to #13.

15. Does G.E. have any idea how many plants may have used this type of paper? How many do?

    Peachbottom, Pilgrim, and Hatch used DISSOLVO (as did Monticello) during recirc piping replacement. Nine Mile Point used DISSOLVO. Additionally, Oyster Creek used rice paper during repair of their isolation condenser.

16. Can you get a small sample of the material for us?

    This item was completed on December 29, 1984, when a sample was given to C. A. Brown.

17. What preparations were made on the coolant system prior to refuel?

    Please refer to the response to question #3. In addition:

    Several routine things were done prior to refuel. These included hotwell cleanup, primary system water cleanup, and the items listed in the response to question #3.

    Other preparations made included electropolishing of recirc pipe, vacuuming of in-vessel crud traps, jet pump replacement, recirc suction plug removal, annulus pump removal, annulus water level monitoring system removal, shield plug removal, FW sparger installation, guide tube replacement, fuel support piece replacement, control rod replacement, rebuild of recirc pumps, SBLC nozzle replacement, jet pump instrument sensing line nozzle replacement, replacement of portions of RHR and RWCU piping, etc.

18. Has any analysis been done on any possible affect that the fibers would have on restricting leakage flow which is used for lubricant and cooling? If so, what were the results?

    After initial concern regarding undiscovered fibers was raised, a review was conducted by the plant Operations Engineering and Nuclear Engineering staff. These reviews focused upon the potential for fouling of heat transfer surfaces, and the restriction or plugging of narrow flow passages. Three potential problem areas (fuel bundle spacer grids, CRD cooling water orifice set screws and recirculation pump internal cooling flow circulation paths) were identified and evaluated.

    Fuel bundle spacer grids - any fibers that collect in or on the grids will decompose during the initial phases of heatup, once the localized temperatures meet or exceed 400°F. Decomposition of the fibers will leave particulates which will readily clear with the turbulant fuel channel flow rates.

18. Cont'd.

CRD cooling water orifice set screws - the predominant source of water to the orifice set screw is from the CRD pump which is filtered through a 50 micron absolute Cuno filter. Thus the normal flow is virtually fiber free. During a scram stroke at pressure, the orifice flow will be reversed as reactor water inserts the control rod. The flow path of that reactor water comes from the CRD guide tube, through the 2-mil outer filter, down the annulus between the thermal sleeve and the CRD. The majority of flow then unseats the ball check and travels to the underside of the drive piston. A small amount of that flow bypasses the ball check by reverse flowing through the orifice to the underside of the drive piston. The combination of filtration through the 2-mil outer filter and the minimal flow volume during a scram event make fouling of the orifice with fibers improbable.

Recirculation pump internal flow paths - by procedure, the recirculation pumps operate only with an external supply of seal injection water. That water is supplied by the CRD pumps, then filtered through a 50 micron Cuno filter. The seal injection supply is supplied at such a pressure and flow rate that the injection rate exceeds the maximum seal leak-off rate. The excess seal injection rate migrates into the recirculation system, thereby providing a continuous flush preventing fiber intrusion.

Should the seal injection be lost or reduced, fiber intrusion would not present restriction or plugging problems as the limiting components [pressure breakdown coils] have a 1/8" inside diameter which would be un-effected by the minute fibers.

DENevinski

D. E. Nevinski
Plt. Supt., Engrg. & Rad. Prot.

DEN/slv

Appendix 1 to Question No. 4

Summary of SOE & OC Minutes

On May 22, 1974, scram timing testing identified 6 CRD's with scram times which exceeded the Tech. Spec. limit for the average of all operable CRD's. The slow scram times were attributed to 2-mil inner filters installed in those six CRD's.

G.E. had issued a recall letter for the 2-mil inner filters improperly supplied to NSP and all such filters in the warehouse were returned. However, six filters had been installed in rebuilt drives. The recall was not brought to the attention of the technical staff, so consequently, the six result drives with the 2-mil filters were installed.

Corrective actions taken were:

(1) Change out 2 of 6 drives prior to startup;

(2) Change out remaining 4 drives at next outage;

(3) Recommend that G.E. provide conspicuous recall warnings; and

(4) Recommend that plant technical staff receive any technical notices.

The OC reviewed the scram time problems on:

May 22, 1974 (Meeting #449) and on
May 24, 1974 (Meeting #450)

The SOE was reviewed and approved on:

July 30, 1974 (Meeting #466)