

Dresden Nuclear Power Station Unit 3

30 Day Special NRC Report, Revision 1

Both Off Gas Recombiners Inoperable During an Off Gas Fire
NRC Docket Number 50-249.

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INTRODUCTION

This letter report is provided pursuant to Dresden Technical Specification 3.8.A.6 which requires submittal of a special report within 30 days when either recombiners have been inoperable. Unit 3 Recombiners (3A and 3B) were inoperable when Unit 3 experienced fires of short duration within the Off Gas system on November 12, and November 18, 1995.

- | On November 12, 1995, with the Unit 3 reactor in run mode, increasing power to 810 MWe, pressure at 1003 psi, both the 3A and 3B Off Gas Recombiners were inoperable for 5 hours and 32 minutes. Again on November 18, 1995, with the Unit 3 reactor in run mode and reactor power steady at 600 MWe, pressure at 970 psi, both the 3A and 3B Off Gas Recombiners were inoperable for 45 minutes. The 3A Recombiner was inoperable due to a Hydrogen fire within its train and the 3B Recombiner was inoperable due to condensate blockage. An additional fire was experienced within the 3B Recombiner on November 20, 1995, however, the 3A Recombiner was available during this period.

The fires were extinguished by injecting service air per station procedure. The condensate was evaporated from the 3B Recombiner using the normal startup configuration. No Off Gas system damage was experienced. The fires occurred within the Unit 3, 3A Recombiner train while utilizing the 3A Steam Jet Air Ejectors (SJAE) train.

No increase in the volume and curie content of the effluent were observed.

DESCRIPTION OF EVENT

- | On November 12, 1995, when the reactor reached 810 MWe, operations personnel observed indication of an Off Gas fire in the 3A Recombiner train. The symptoms of the fire included reduced SJAE flow and greatly reduced recombiner temperatures. After identification, the fire was extinguished by reducing load to 600 MWe and injecting service air at the SJAE common suction per station procedures. Plant load remained at 600 MWe while an investigation was conducted per station procedure. The investigation found that there was no damage to the Off Gas system and that the fire was most likely the result of recombiner fines traveling upstream of the recombiner, igniting the hydrogen in the system. Thus, a power level of 600 MWe was maintained until a transfer to the stand-by 3B Recombiner could be performed.

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On November 14, 1995, during an attempt to place the 3B Recombiner into service, it was found to be blocked with condensate due to the drain lines being plugged. On November 16, 1995, the 3B Recombiner train was placed into the startup configuration to allow steam to enter the train and heat the Recombiner to evaporate the condensate. Upon the completion of the condensate removal on November 20, 1995, the 3B Recombiner train was ready for use.

On November 18, 1995, the second Off Gas fire occurred within the 3A Recombiner train when the Main Condenser's Circulating Water flow was reversed. This fire was promptly extinguished with service air per procedure. A preliminary investigation concluded that the fire was caused by an instantaneous increase in hydrogen and oxygen in the SJAE discharge, which was created by the very short interruption in gas flow that occurs when the SJAE supply suction transfers from one end of the Main Condenser to the other. This transfer takes place automatically as part of the Circulating Water flow reversal, and results in a slight build up of gas in the Main Condenser. When this volume of gas was drawn into the system by the SJAEs, the fire occurred immediately as shown by the SJAE flow recorder. Plant operation continued at 600 MWe with Off Gas lined up to the 3A SJAE and the 3A Recombiner. This fire was also attributed to catalyst fines in the system.

The plant shifted to the 3B Recombiner while at 600 MWe, on November 20, 1995, in order to bypass the suspected train and to achieve full power. Approximately three hours after shifting, another fire occurred, also attributed to catalyst fines. This fire was put out with Service Air while the plant remained at 600 MWe. The plant remained at 600 MWe and shifted to the 3B SJAEs, on November 22, 1995, then reversed Circulating Water flow again and ascended to full power with no further fires. The combination of the 3B SJAE and 3B Recombiner has been used for many years with no fires.

ANALYSIS

The fires are believed to have been initiated by recombinaer catalyst fines that migrated upstream of the booster jet for the recombinaers. Off Gas fires are not a new phenomena in BWRs and have been extensively analyzed at Dresden and elsewhere. The catalyst fines, in a combustible mixture of hydrogen and oxygen, heat up to the point of gas ignition. The hydrogen and oxygen then burn back to the point where a combustible mixture begins to exist, after the second stage air ejector, which is in the After Condenser. The fire continues to burn there until extinguished. This is proven by the characteristic decrease in SJAE flow, and the drop in recombinaer temperature.

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SAFETY SIGNIFICANCE

There is no reactor safety impact due to an Off Gas fire. There is no known short term harmful effect from Off Gas fires. The most limiting long term effect is thought to be possible damage to the After Condenser tubes, shell, or discharge piping. The recent Off Gas fires at Dresden have caused no damage to system components. This conclusion is based on previous experience with Off Gas fires on Dresden Unit 2, consultations with the Original Equipment Manufacture (GE) Designer and a review of plant parameters for the November 12 fire that shows no indication of failed components.

PREVIOUS EVENT HISTORY

Dresden has experienced Off Gas System fires during the mid 1980s which resulted in no known damage to the Off Gas system components. As a result of the previous Unit 2 fires, the 2A and 2B trains were modified and piping cleaned. The 2A train modification added a fire suppression spray in the SJAE discharge loop. The 2B train modification installed the GE recommendation which provides only two stages of air ejectors and never has a combustible mixture of gas in the Recombiner portion of the system. However, the modifications have not been used and it appears that the pipe cleaning was sufficient to prevent the fires.

ROOT CAUSE

The root cause of the fires is the original design and specification, which did not consider generation of fines from the catalyst and provide provisions for preventing their migration.

A contributing cause is inadequate record keeping and corrective actions from previous Off Gas fires which occurred during the 1980s.

If the fires which had occurred on Unit 3 during the 1980s had been documented, the current System Manager would have been aware of them and been able to implement an action plan prior to attempting to place the 3A SJAE and 3A Recombiner in-service. In addition, the November 18, 1995, fire, induced by Circulating Water flow reversal, was a repetition of a cause of a fire in the 1980s. No procedure revisions or equipment corrective actions were taken to prevent recurrence of fires induced this way and the corrective actions taken for Unit 2 were not applied to Unit 3.

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| A second contributing cause was the Off Gas system was not operated within design parameters.

| The Off Gas system was operated as of about five years ago, with the low steam pressure interlock for the SJAE suction valves in "BYPASS". This could allow backflow through the Recombiner during Main Steam Isolation Valve closure events, causing migration of catalyst fines upstream.

| The root cause for the blocked condensate drain line in the Recombiner was a poor design. Because of the narrowness of the drain line, the line can become easily clogged with rust or other sediment.

| A contributing cause for condensate in the Recombiner was a steam leak into the Recombiner through the Booster Jet/ Dilution steam Pressure Control Valve (PVC) bypass valve due to a lack of preventive maintenance on the valve's reach rod.

CORRECTIVE ACTION

| Plant Engineering will determine if any design changes are required to prevent further migration of catalyst fines. (2491329500101S1)

| Plant Engineering will determine if any preventive maintenance is required for the catalyst fines, and implement as appropriate. (2491329500102S1)

| The 3A Offgas After Condenser tubes, shell and discharge piping will be inspected for potential damage. (2491329500103S1)

| The SJAE and Recombiner startup procedures will be revised to eliminate the use of the bypass line around the recombiners. (2491329500104S1)

| The corrective action process has been significantly improved since the mid- 1980s. The improvements include the Nuclear Tracking System (NTS) and the Integrated Reporting Process (IRP) data bases. In addition, events are now reviewed by a team of department level managers to insure proper corrective actions are identified and implemented.

| An Action Request was initiated to re-time the SJAE suction valves so that Circulating Water flow reversal will not induce an Off Gas fire if catalyst fines are present. (2491329500105S1)

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- | The Recombiner PCV bypass valve was closed from within the Recombiner room.
- | The reach rod will be included in the Performance Centered Maintenance program (preventive maintenance program). (2491329500106S1)

- | An Engineering Request was written to replace the Recombiner drain line with a larger pipe. (2491329500107S1)