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Dresden Nuclear Power Station
R. R. #1
Morris, Illinois 60450
January 17, 1975

Mr. James G. Keppler, Regional Director
Directorate of Regulatory Operations-Region III
U. S. Atomic Energy Commission
799 Roosevelt Road
Glen Ellyn, Illinois 60137

SUBJECT: REPORT OF AN ABNORMAL OCCURRENCE PER SECTION 6.6.A OF THE TECHNICAL SPECIFICATION
OFF GAS HIGH RADIATION ON UNIT 3

References: 1) Regulatory Guide 1.16 Rev. 1 Appendix A

2) Notification of Region III of AEC Regulatory Operations
Telephone: P. Johnson, 1500 hours on January 7, 1975
Telegram: J. Keppler, 1545 hours on January 7, 1975

Report Number: 50-249/74-38

Report Date: January 17, 1975

Occurrence Date: October 31, 1974

Facility: Dresden Nuclear Power Station, Morris, Illinois

IDENTIFICATION OF OCCURRENCE

Rapid local power changes causing an abnormal degradation of one of the several boundaries designed to contain radioactive materials. No Technical Specification peaking limits were exceeded.

CONDITIONS PRIOR TO OCCURRENCE

On October 30, 1974 Dresden 3 changed load for control rod movements to redistribute the neutron flux prior to preconditioning the fuel. Control rod position alterations began at 0248 hours on October 31, 1974 and were completed at 0500 hours. At that time, the power distribution was checked and found to be satisfactory. Electrical load was approximately 520 MWe.

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DESCRIPTION OF OCCURRENCE

At 0624 hours, excessive power peaking was observed in the lower region of the core. Control rod movements were made in an attempt to reduce the peaking, but observations showed that the peaking had increased. At this time, the high off gas radiation alarm actuated. Control rods were immediately inserted to reduce peaking and power. The off gas radiation transient continued during the initial power reduction. The hi-hi offgas radiation alarm tripped, starting the 15 minute isolation timer. Additional control rods were inserted and at 0735 hours, the hi-hi off gas radiation alarm cleared. A subsequent offgas sample analysis at 1421 hours showed a stack release rate of 81, 634 μci/sec.

DESIGNATIONOF APPARENT CAUSE OF OCCURRANCE (Personnel Error)

The apparent cause of the Occurrence was that during a xenon transient which, combined with a very low fuel exposure at the core bottom, rapid changes in local power low in the core resulted in fuel rod perferation.

ANALYSIS OF OCCURRENCE

Prior to control rod movement, power was approximately 440 MWe. Power during control rod movements increased to approximately 520 MWe. After the off gas radiation hi alarms, MWe power level was reduced to about 370 MWe. During the transient, the maximum total peaking factor recorded was 3.87. For the core thermal power of 1432 MWth at the time of the transient, the maximum LHGR in any fuel rod was 12.56 KW/ft and the maximum APLHGR was 10.90 KW/ft. Neither value violates technical specification limits.

The action level on maximum LHCR at the existing 57% power condition is 9.92 KW/ft. This level was exceeded for less than one hour during which, corrective actions were being applied.

A conservative calculation of the minimum critical heat flux ratio (MCHFR) yielded a MCHFR of 2.78 at the maximum peak. This is well within the unit tech spec limit of 1.90.

Unit 3 has had a flux and exposure distribution peaked toward the top of the core for at least two cycles. The net result of this distribution of exposure has been to leave the lower section of the core with relatively unexposed fuel. The unit was brought down to about 50 percent power on October 30, 1974 in an effort to correct this situation by positioning control rods such that the power distribution was peaked (within limits) toward the core bottom. Operation in this mode for a significant period of time would have resulted in a more even axial exposure distribution.

Control rods were moved to change the axial power distribution, of the core at the same time as the xenon was peaking. When xenon started burning out, the bottom peak, which had just been formed by control rod movement, increased rapidly. Since the bottom of the core had relatively little exposure, the peaking problem was exaggerated.

An attempt was made by the nuclear engineer to reduce peaking by spreading the peak over a larger volume. This action resulted in higher peaking and the peak shifting to segments of fuel rods which were previously controlled and operating at low LHGR's. Subsequently the off gas radiation monitor hi and hi- hi alarms occurred.

The maximum instantaneous stack offgas release rate that occurred during the transient is indeterminent, but is estimated to be in the vicinity of 300,000 μci/sec. (The 48 hour Technical Specification maximum limit was exceeded for less than 10 minutes, well within the Tech Spec limit).

Since the time of this occurrence, Unit 3 operation has been accompanied by undesirably high off gas radiation levels which has resulted in a station imposed derating of up to 50% power. Thus, it now appears that several fuel rods failed by rupture of their cladding during the event on October 31, 1974. This is an abnormal degradation in one of the several boundries designed to contain fission products and represents an Abnormal Occurrence. This occurrance was reclassified following Station Review of the original Deviation on January 7, 1975. The cause of these failures is evidently fuel-cladding interaction, since no fuel safety limits were approached. This mode of fuel failure has occurred previously in the Dresden Units and has occurred during normal reactor operation.

An isotopic analysis of the off gas composition yielded an approximately 75% "recoil" distribution. A recoil distribution implies little or no holdup in the pellet or fuel column for fission product gases, predicting that a few relatively large cladding perferations occurred during the peaking transient.

There was no effect to the public health and safety. The off gas release rate for Unit 3 for the day of October 31, 1974 has been conservatively estimated to be an average of about 45,000 μci/sec which is less than half the technical specification limit. Since the occurrance, the stack gas release rate has been about 24,000 μci/sec at a derated load of 400 MWe.

CORRECTIVE ACTION

The initial corrective action when the excessive peaking occurred was to withdraw a control rod. This action was taken in an attempt to broaden the flux distribution and thus lower the peak. The peaking increased by about 10% in the area of the highest peak. Upon discovery of this fact, control rods were inserted in a timely fashion to lower the power level and reduce the core peaking.

A thorough review of the occurrence by On-site Review has concluded that two actions are suspect. The first was the withdrawal of control rods to a given power shape during a xenon transient and the second was the initial response to the excessive power peaking.

Several corrective actions have been made with regard to the training of the nuclear engineers. These are:

1) Training is being given all of the nuclear engineers at Dresden on approximately a weekly basis.

2) It is planned to send a nuclear engineer to the General Electric training course in Nuclear Engineering in 1975. This course is 3 months of intensive course work in all aspects of station nuclear engineering.

3) A directive from the Superintendent of Nuclear and Fossil systems of CECO has been received which details a review and approval procedure for BWR control rod sequences and planned changes thereto. This directive has been implemented at Dresden and a review process will be followed for control rod movements in the future.

4) A qualification program for station nuclear engineers is being developed for implementation by 1976.

FAILURE DATA

A review of fuel failures at Dresden is inconclusive since no certain cause for most fuel failures cannot be assigned. The most comprehensive data available at Dresden is the fuel examination of Dresden 3 fuel during March and April, 1973. This examination was done prior to reconstituting some of the unit 3 fuel assemblies. Evidence from individual rod examinations has indicated that roughly 50% of all the fuel assembly failures (which numbered 100) were caused by fuel-clad interaction during normal operations. Based partly on this data, General Electric has recommended certain operational measures to reduce the number of fuel failures experienced decreasing normal operation. CECO has implemented these recommendations in a timely manner and continues to try to minimize fuel failures in its nuclear units.

Arthur M Roberts

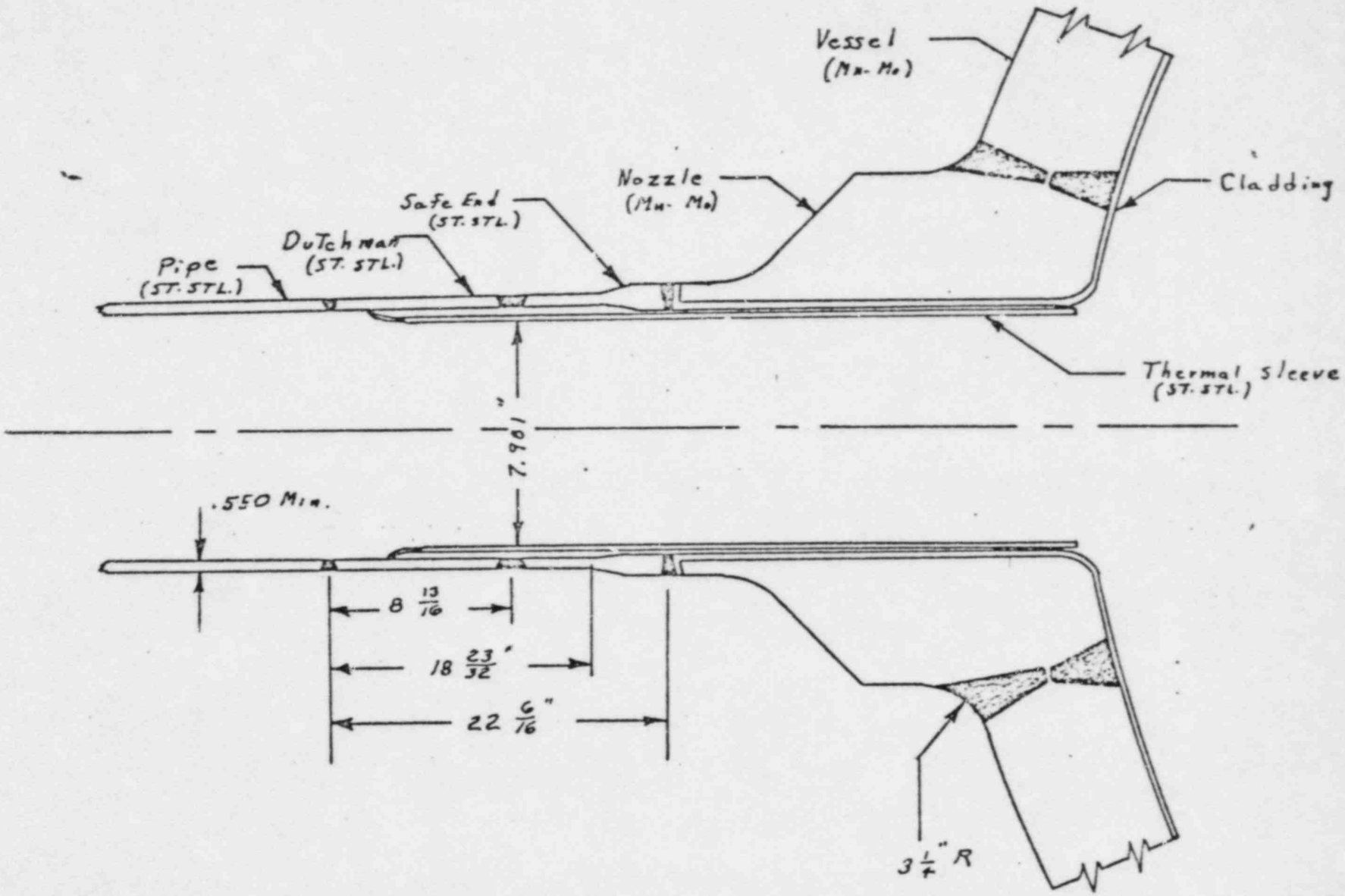
for B. B. Stephenson
Superintendent

BBS:smp

File/AEC

10" Core Spray Nozzle

(Typical of 2)



ATTACHMENT A