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HW-29412

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RUPTURED SLUG AND WATER LEAK - TUBE 2483-H

Introduction

At approximately 8:10 A.M. on 8-30-53 a sudden increase in reactor gas pressure and a loss in reactivity occurred in H Reactor which indicated the possibility of a severe process tube water leak. At approximately 8:35 A.M. a panellit gage low trip occurred on tube 2483-H and the reactor was immediately shutdown with the #1 SS. Investigation revealed that tube 2483-H contained a ruptured slug which upon rupturing had split the process tube allowing water to enter the reactor.

This document reports the work done in drying out the reactor following removal of the ruptured slug. Slug removal was accomplished using normal routine methods.

Summary

Total reactor outage time for the rupture and the water leak was 109.5 hours. This amounted to a loss in production of 3468 MWD.

The reactor was dried out with the hot water recirculation system which was operated for 83.7 hours at 80° C during which time approximately 600 gallons of water were removed by the gas system driers.

The total quantity of water to enter the reactor was estimated to be approximately 1000 gallons. That which was not removed as drier condensate came out through the drip legs during the initial stages of the leak and by condensation from the gas in the drier coolers before the gas entered the drier towers. The amounts removed by these methods could not be measured.

Discussion

The initial indication of trouble occurred at approximately 8:10 A.M. on 8-30-53 when a sudden increase in reactor gas pressure to 16-17" H_2O was observed. Immediate ... the gas system did little to bring down the pressure, an indication that a severe water leak had occurred in the reactor. Since the graphite temperature is

maintained at 410° C during operation injection of water into the graphite causes evolutions of large volumes of steam with a resulting increase in gas pressure. At approximately the same time rapid losses of reactivity began to occur and in spite of the fast removal of control rods the reactor operating level could not be maintained. A traverse of process tube temperatures was begun using the flexowriter to determine the location of the leak (by a region of depressed process tube temperatures). At approximately 8:35 A.M. a momentary trip occurred on the panellit gage for tube 2483-H. This trip did not cause an automatic scram so the manual scram button was pushed to shutdown the reactor. The tube pressure had dropped, presumably as a result of the leak, to a value 20 psi below normal and 2 psi above the low trip setting on the panellit gage. When the pressure drop occurred the gage apparently hit the low trip momentarily. This momentary trip caused an alarm light but did not cause an automatic scram.

After the reactor had been shutdown investigation revealed that tube 2483-H contained a ruptured slug and was the probable source of the water leak. Because of residual heat release after the outage cooling water had to be maintained to the tube until about 2:00 P.M. after which the tube and charge were removed from the reactor.

It was estimated from the size of the hole in the tube and from the length of time cooling water was maintained on the tube following the shutdown that 1000 gallons of water entered the reactor.

Immediately after the leak occurred both the inlet and exit gas ducts became flooded with water. This water was dumped through the drip legs but the capacity of the drip legs was insufficient to enable a measurement of the amount dumped to be made. It is estimated that about 150 gallons were removed in this fashion. By about 4:00 P.M. on 8-30-53 water collection in the drip legs stopped, the remainder of the water being retained in the graphite.

At about 9:00 P.M. on 8-30-53 the hot water recirculation system was placed into operation. Approximately 2000 gpm of water heated to 80° C by a steam injector system were recirculated through the reactor process tubes to evaporate the water held in the graphite for removal by the gas drying system. The 80° C limit was set to prevent vapor locking of the recirculating pump because initial water temperatures between 85 and 90° C caused the pump to vapor lock and the recirculating flow to stop. After the system reached equilibrium at about 80° C further steam addition was unnecessary. The temperature was maintained by the residual heat in the slugs and was controlled at will by the addition of small amounts of cold water from the near high tank.

The recirculating gas system was used to remove evaporated water from the reactor. Gas was circulated at a flow rate of between 3000 and 4000 cfm. Two driers were drying at all times while the third was on regeneration. This system gave a drying cycle of two hours and a regeneration cycle of one hour per drier. Water was removed at a maximum rate of 10 gallons per hour by this system. An unmeasurable amount of water condensed out in the drier coolers during the drying cycle and was removed through lines provided to give continuous drainage.

No reliable instrumentation was available for measuring gas dew points but the instruments in use indicated that the gas from the driers was entering the reactor with a dew point of between 30° and 60° F and was emerging from the reactor nearly saturated at around 100° F.

High rates of water removal prevailed until early on 9-2-53 when the rate began to decrease. Recirculation was continued until 8:45 A.M. on 9-3-53 at which time the water removal rate had decreased to about 4 gallons per hour. A total of 600 gallons of water were removed during the recirculation and following startup of the reactor 250 gallons more water were removed before water collection rates returned to normal on 9-18-53.

H Operations Unit
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DSL/ljs

END

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