To: Engineering Management-Ted Addis, Fred Royal, Robert Ottman, and Milton, Lindsey

From: Lewis Martin, Mechanical Engineering

Date: 12/15/97

Subject: Recommendation on A and B Recirculation Pump

Introduction
A management meeting was held on the subject of further operation of the “B” Recirculation Pump. The meeting objective was stated as: “Provide Plant Management an Engineering recommendation on continued operation of “B” Recirculation Pump through Cycle 18 in its’ current condition.”

The following items were addressed toward that end:
- Review “A”/”B” Recirculation Pump operating history through Cycle 17
- Review observations and conclusions from “A” Recirculation Pump internals disassembly inspection (compared to expected findings)
- Discuss as-found condition of “B” Recirculation Pump impeller (based on detailed video inspection performed 10/31/97)
- Review Engineering recommendations and the bases for those recommendations

Recommendations
The recommendation was to run “B” Recirculation Pump for Cycle 18 in the “first off, last on” mode. Continued vibration trending/analysis as well as further impeller video inspections(s) (in future outage(s)) were also recommended to determine the appropriate timeframe for pump replacement. The basis for these recommendations are as follow:

With respect to the potential for loose parts generation (loss of impeller structural integrity)—
- No through vane damage was detected in “B” Pump detailed video inspection and, based on the visual inspection of the “A” Pump impeller, through vane damage will precede vane fracture.
- No thinning or cracking was detected on “B” Pump impeller vane tip(s) in the video inspection. No apparent secondary failure mechanisms exist.
- The worst damage seen in the “B” Pump inspection video did not appear as severe as the least damage seen in the “A” Pump visual inspection.
- The impeller degradation can be halted with changes to operating procedures which restrict operating the “B” Pump at low suction head (system pressure) and single pump in a loop.

With respect to the possibility for a degrading vibration condition through the cycle—
- Historical review of “B” Pump vibration performance reveals:
  - Vibration behavior is predictable
  - Stable shaft vibration at, or below, 10 mils at steady state (hot) conditions
  - The root cause of excessively elevated shaft vibration at off-design (cold) conditions is
hydraulic imbalance that adds to the imbalance which already exists as a result of running the cold conditions.)

- Root cause of “A” Pump impeller failure in June, 1997 is vane fracture due to inadequate operating guidance (procedures).

**Action items are as follows:**

- *Engineering* - Determine the need (if any) for Recirculation Pump “five minute runs” and provide recommended operating procedure changes accordingly.
- *Engineering* - Inspect/review “B” loop pump impellers using the video inspection device. If cavitation damage is bounded in severity by the “B” Pump case, no further action is required. If not, Engineering will notify plant management. (NOTE: This is scheduled to occur 10/15)
- *Operations* - Review procedures and identify areas of concern based on the “first off - last on” “B” Pump operation recommendation. Work with Engineering to establish reasonable criteria for operation of this pump.