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FIELD NOTES

APPLICATIONS OF NEW TECHNOLOGY
AT POWER GENERATING PLANTS
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Vanes Stop Fluid Shear in Pipe Elbow

A vane system placed just upstream of a submerged vertical pump at Pennsylvania Power & Light's Susquehanna station eliminated the pump's high vibration at mid-shaft. The need for frequent overhauls was also eliminated.

The pump supplies makeup water for cooling towers. It includes a vertical run of 26-in. discharge pipe, with a fabricated elbow in the pump head At the discharge of the elbow is a swinging disc type check valve.

The drive shaft of the pump runs verrtically along the centerline of the 26-in. pipe, through theelbow wall to the drive motor. This shaft is inside of an 8-in. pipe that houses the bushings for the shaft. The pump historically exhibited high vibration at the mid-shaft and required frequent overhaul.

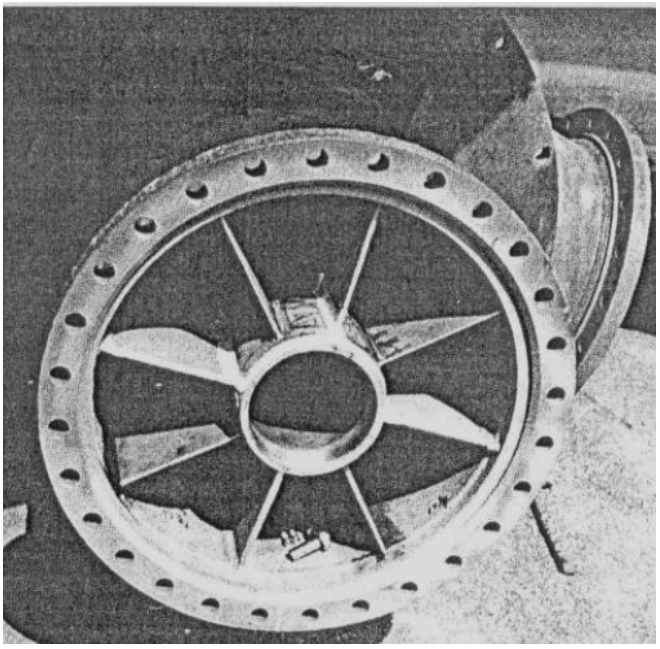
Laboratory tests showed that the existence of two seperated flow regions-outside wall flow seperation and inner wall seperation resulted in a blockage of the flow passage and an acceleration of the flow between the two. The high shear along the boundary between high speed core flow and the inner seperation region results in large cale shed vortices, representing large scale turbulence that is swept downstream.

Pressure pulses from the check valve propagating upstream to the pump caused the vibration and noise. The pulses caused the impeller to lift. The pump motor is equipped with a thrust bearing, and the pump shaft flexed causing accelerated wear at the mid-shaft bearings.

A vane system- Cheng Rotation Vane (CRV)- from Cheng Fluid Systems, Inc., Sunnyvale, Calif., was welded into the pump head elbow. The purpose of the vanes was to develop a pre-rotation of the fluid that will enable it to negotiate the turn without separation.

After start-up with the vane-fitted pump head in place, measurements were made of the pipe vibration and the shaft eccentricity by the engineering operating staff. Steve Ellis, system engineer, and Mark Anthony, maintenance engineer at Susquehanna reported that the vibration of the discharge pipe has been reduced from as high as 24 mils to as low as 8.5 mils.

Ellis also reported that the flow rate increased by 400 gpm. This increase is the result of the wider open average position of the check valve disk and the elimination of the flow-blocking separation regions in the elbow.



Vanes installed in submerged pump discharge line at Susquehanna station eliminated pump shaft vibration caused by flow turbulence.