Davis-Besse Nuclear Power Station

Modification of High Pressure Injection Pumps

Agenda

- Opening Remarks……..…….. Gary Leidich
- Modification Design…….. Bob Schrauder
- Analysis and Qualification Testing …….Bob Coward, MPR
- Conclusion……Gary Leidich

Gary Leidich
President and Chief Nuclear Officer - FENOC

Opening Remarks

Gary Leidich

President and Chief Nuclear Officer - FENOC

Desired Outcome

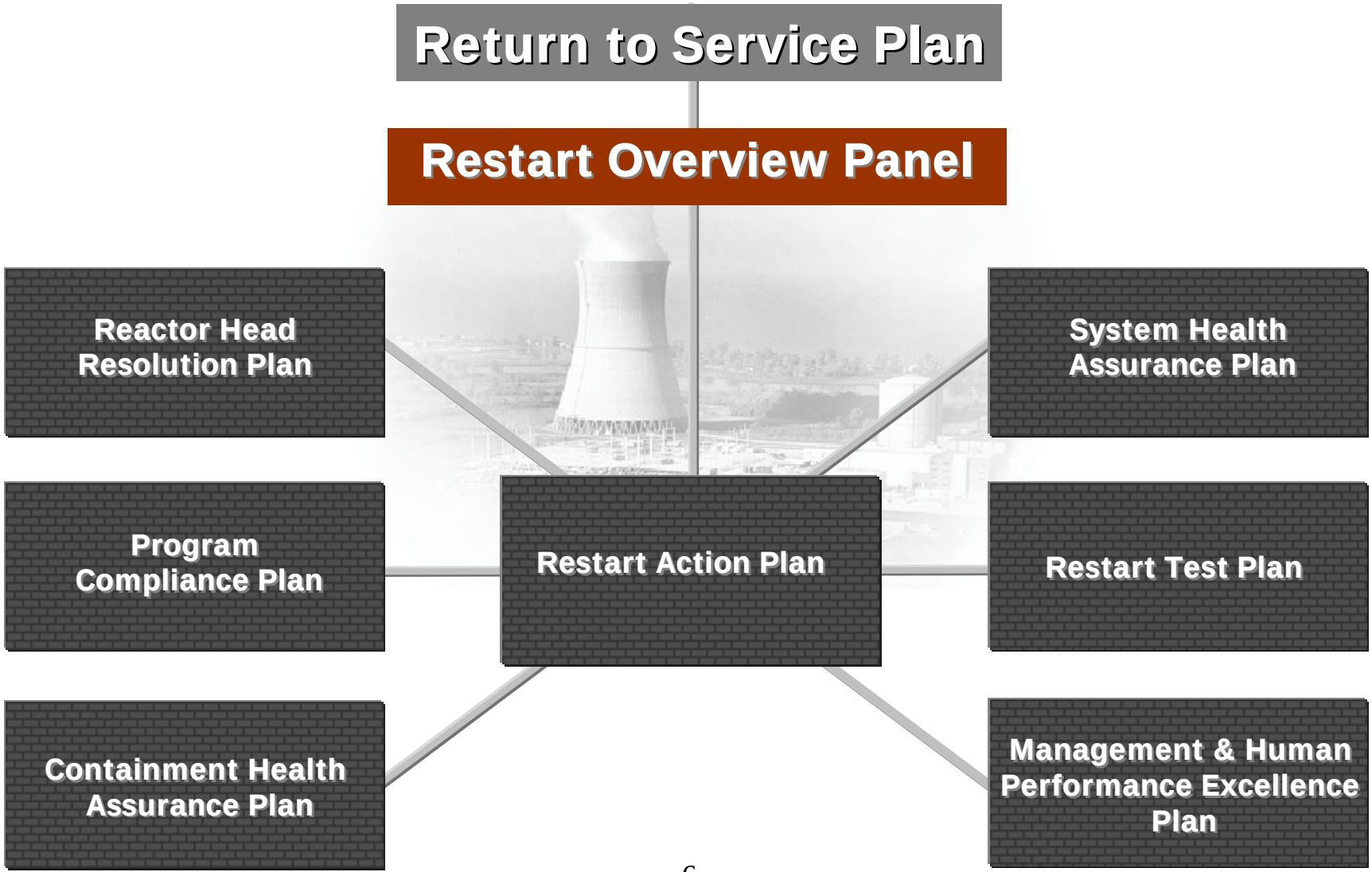
- NRC and the public gain confidence that pump modifications and associated testing and analysis ensure the HPI pumps will perform their required safety functions under all design conditions

Overview

- Background
  - Implemented Building Block approach in 2002 that included assuring the health of plant systems
  - System Health Assurance identified the High Pressure Injection Pumps as an original design issue since fine particles from the Containment Emergency Sump could potentially damage the pumps during the loss-of-coolant accident (LOCA) recirculation mode

- Today
  - Present how these findings were resolved and provide assurance the HPI Pumps are capable of performing their design function

Davis-Besse Restart Building Blocks



Modification Design

Bob Schrauder
Director -Support Services

High Pressure Injection Pumps

- Manufacturer
  - Babcock and Wilcox Canada
- Type
  - Horizontal, eleven stage centrifugal pumps
  - 600 HP electric motors
  - Hydrostatic bearing
- Design Pressure/Temperature
  - 2000 psig/ 300^0F
- Design/Manufacture Code
  - ASME Pump & Valve Code, Class II, November 1968
- Surveillance Test/Inservice Testing
  - ASME Operation and Maintenance Code (1995 Edition with 1996 Addenda)
- This design is unique to Davis-Besse in domestic nuclear industry

HPI Pump Operational Environment

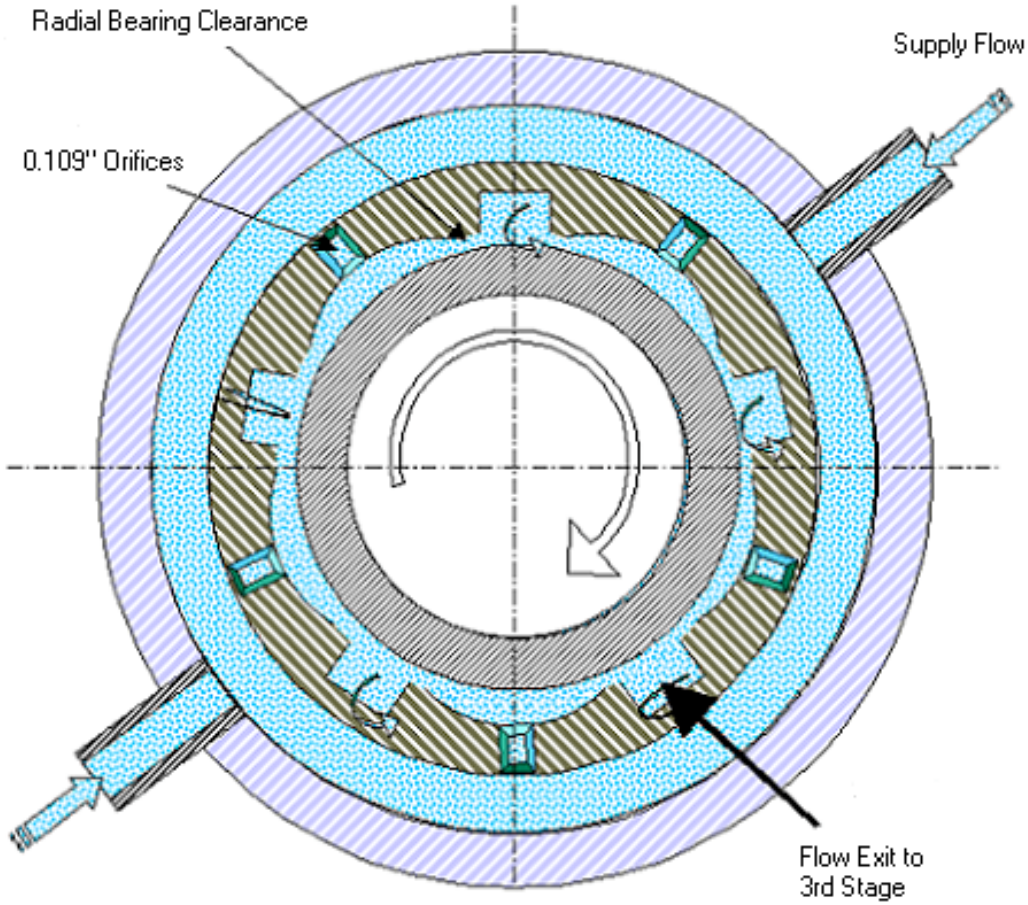
- Borated Water Storage Tank Operation
  - Surveillance Testing
  - Initial Post-LOCA mode
- Sump Recirculation Operation
  - In post-LOCA recirculation mode operation, HPI pump suction is from Containment Emergency Sump through LPI pumps
  - Sump may contain debris from LOCA blowdown and containment spray actuation
  - HPI Pumps must be capable of operating with debris in the pump flow

HPI Pump Original Design Issues

- System Health Assurance identified design issues
  - Hydrostatic bearing plugging
    - Bearing orifices are smaller than emergency sump strainer and could become plugged
    - Bearing pocket clearances are smaller than sump strainer
  - Close clearance wear
    - Preliminary rotordynamics analyses suggested increases in clearances due to wear by debris could lead to operation at critical speeds
    - Increased clearances will degrade pump hydraulic performance
  - Supply path to cyclone separator (seal water) could be smaller than sump strainer and may become plugged

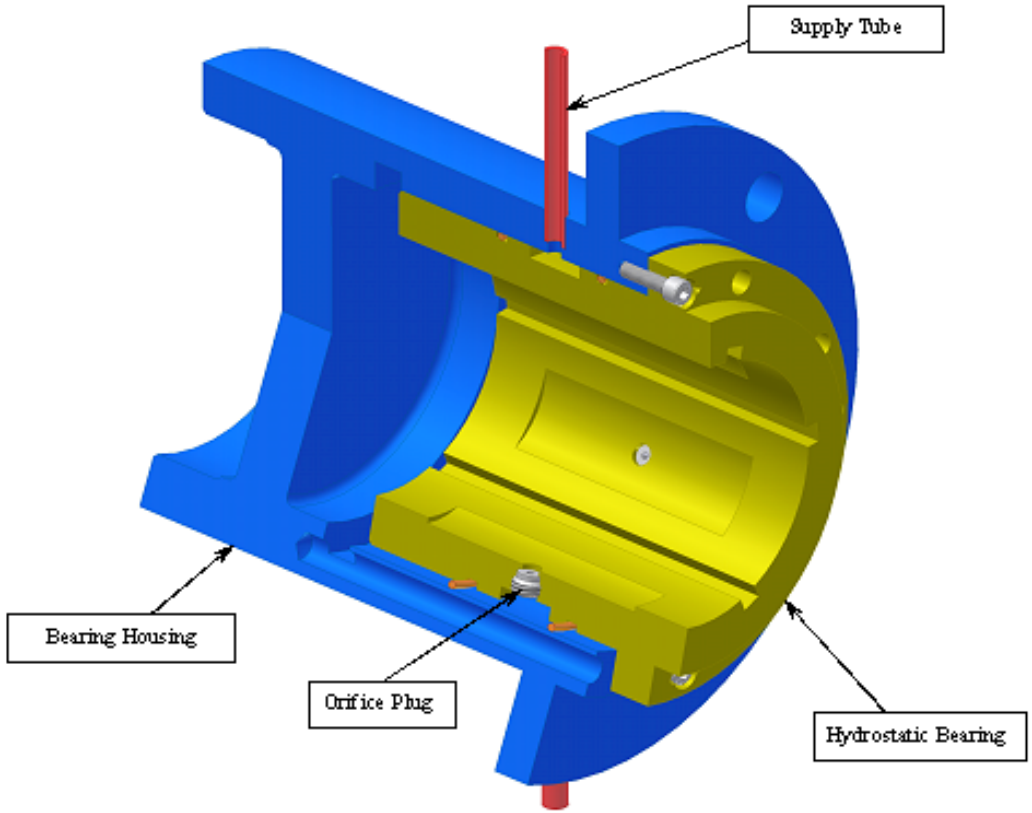
Original Hydrostatic Bearing

- Orifices in supply to hydrostatic bearing pockets are 0.109 inch diameter
- New containment emergency sump strainer has 0.188 inch diameter openings
- Orifices may plug with debris that passed through sump strainer, degrading bearing performance



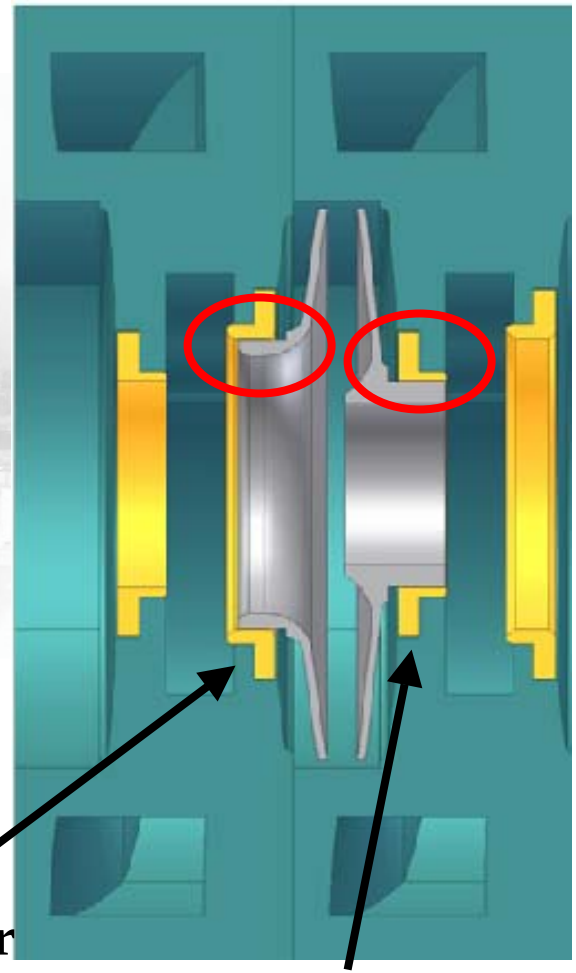
Original Hydrostatic Bearing

- Bearing includes tight clearances (0.006 inch to 0.007 inch) at edges of pockets
- Debris in supply water may be larger than clearance and accumulate in the bearing pocket
- Degradation of bearing performance may impact pump operation

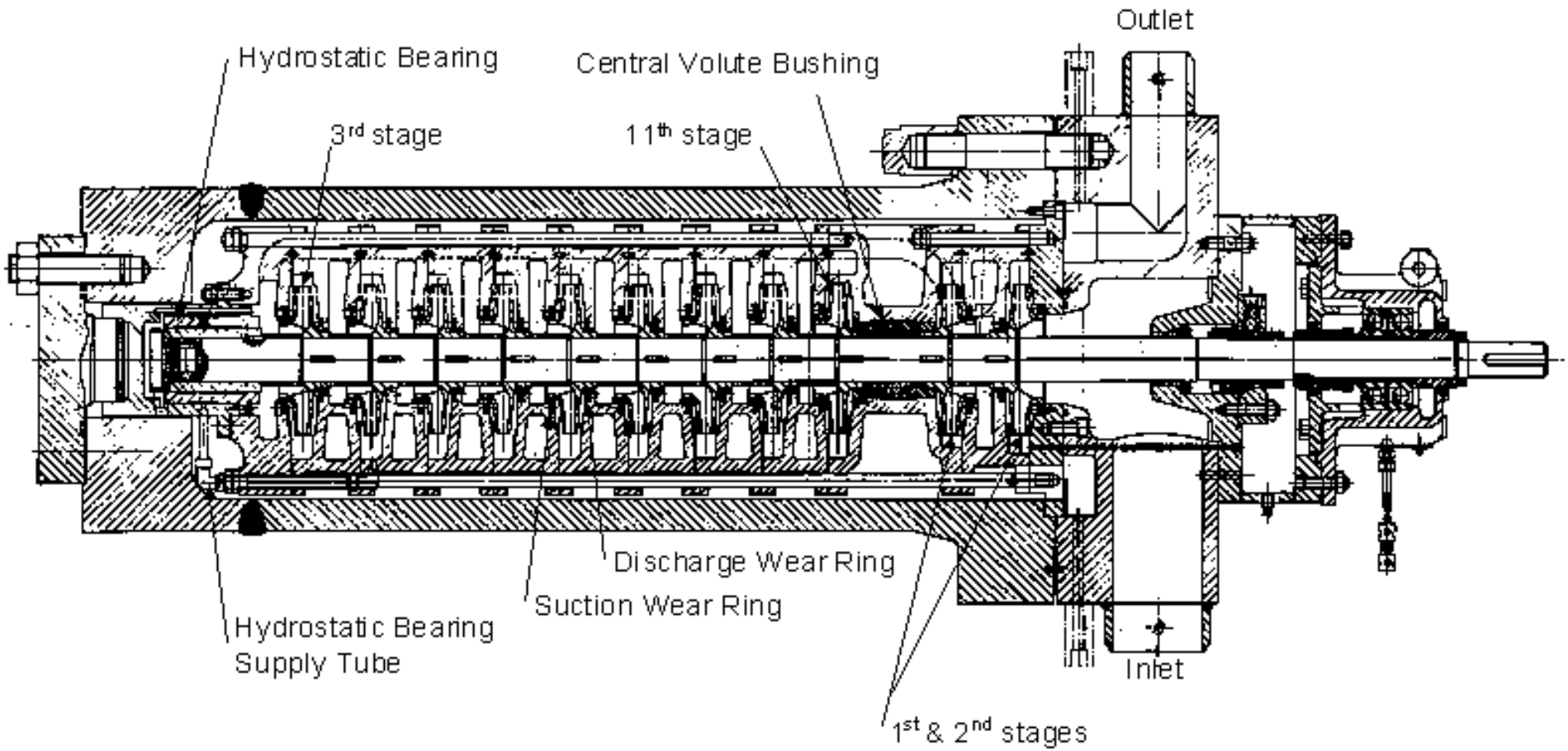


Close Clearances Wear

- Pump design includes tight clearances
  - Central volute bushing (0.006 inch to 0.007 inch)
  - Hydrostatic bearing (0.006 inch to 0.008 inch)
  - Wear rings (0.009 inch to 0.010 inch)
- Debris in water may increase rate of wear of the fine clearances
  - Increased clearances could result in operation at critical speeds
  - Increased clearances could decrease hydraulic performance capability



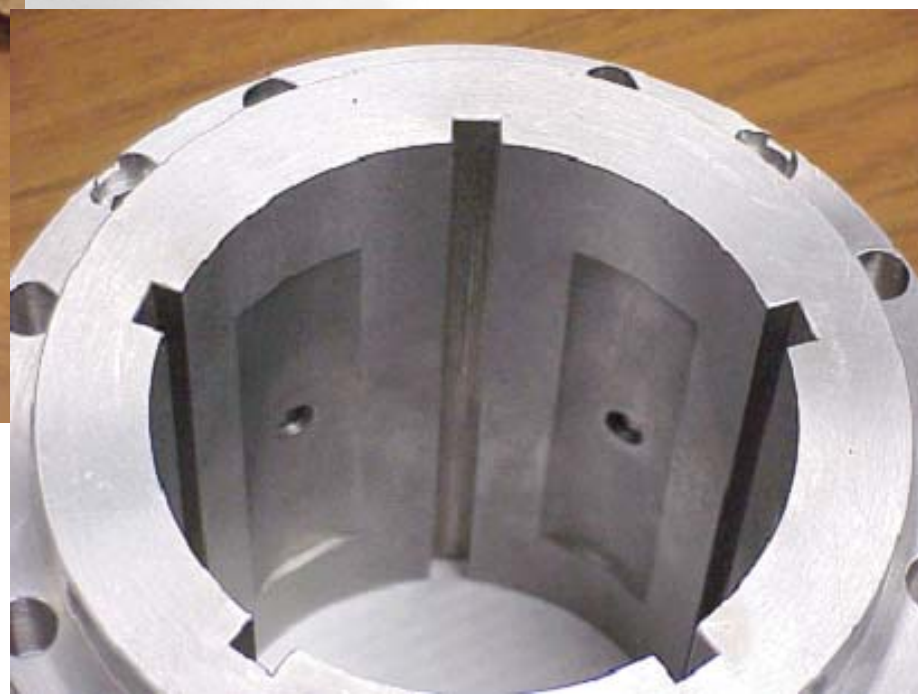
HPI Pump Configuration



HPI Pump Internal Assembly

HPI Pump Volute

Original Hydrostatic Bearing



Resolution Objective

- Implement a resolution plan that fully resolves HPI pump debris issue that
  - Modifies only the HPI pump
  - Assures compliance with existing licensing basis, procedures, Updated Safety Analysis Report, and design basis documents
  - Meets requirements of Technical Specifications

Initial Modification Approach

- Modifications
  - Install self-flushing strainer on volute to prevent plugging of hydrostatic bearing supply line orifice
  - Move supply line take-off to suction side of volute

Initial Modification Approach

- Key Assumptions to be verified
  - Strainer would be self-flushing and remain clear of debris
  - Debris larger than bearing clearance would be crushed by bearing and pass through clearance
  - Wear of close clearances would be minimal and uniform
  - Pump operation at critical speeds would not cause vibration or other operational challenges