Defining and Integrating Hydraulic Turbine-Generator Operating Ranges at Mossyrock
OVERVIEW

• Complication
• Recommendation
• Evaluation
• Integration
• Continuation
COMPLICATION

• Increased Cost of Operations
• Changing Market Conditions
• Capacity Limitations
• Flexibility Limitations
• Low Reservoir Constraints
• Unit Asset Management
• High Minimum MW Setpoints
  • 110 MW on U51 (203.4 MW)
  • 90 MW on U52 (175.3 MW)
RECOMMENDATION

OPTIONS:

1. Accept manufacturer’s recommendations and do not operate below min MW setpoints

2. Disregard manufacturer’s recommendations and operate in the rough zone without analysis

3. Engage in systematic study of operating parameters
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   a) Perform onsite testing, collect observable data, and analyze observations
   b) Pay a company to complete field testing, including a turbine runner strain gauge study ($500k/Unit)
   c) Use instrumentation to collect data for further analysis
EVALUATION

Instrumentation Used For Data Analysis:
• Our senses (eyes, ears, touch)
• Radial Vibration
• Axial Vibration*
• Pressure Pulsations
  ▪ Penstock
  ▪ Headcover*
  ▪ Draft Tube Acceleration*

*Denotes Added Instrumentation
EVALUATION (U51)

Head Cover Pressure Pulsations (PSI pk-pk)
EVALUATION (U51)

Side View of Head Cover Pressure Pulsation

Diagram showing the U51 Head Cover Pressure Pulsation (Maximum). The graph illustrates the pressure (psi peak-peak) and its relation to net head (ft). The diagram highlights exclusion zones at different pressure levels: 13.4-20.1 psi peak-peak, 6.7-11.4 psi peak-peak, and 0-6.7 psi peak-peak. The excluded zones are marked for all net heads and for some net heads.
EVALUATION (U51)

Turbine Guide Bearing X-Axis (mils pk-pk)
EVALUATION

Turbine Guide Bearing X-Axis (mils pk-pk)
EVALUATION

Turbine Guide Bearing Y-Axis (mils pk-pk)
EVALUATION

Penstock Pressure Pulsations (PSI pk-pk)
INTEGRATION
U51
• Runner Inspection Performed Prior to New Operation
• Allowed for 500hrs of operation
• Performed Runner Inspection
• Allowing for an additional 750hrs of operation

U52: Integration Pending Runner Inspection
QUESTIONS?