The background image shows a large concrete dam structure spanning a river. The dam has several spillways and a powerhouse building. The surrounding area is lush with green trees and vegetation. The sky is overcast. The text is overlaid on the center of the image.

Unit Operating Guidelines at Carmen Powerhouse

Dalen Willhite

Eugene Water & Electric Board

NWHF 2016

Site Overview

- Two vertical Francis units; carbon steel; modified from original
- 55 MVA each; 500 ft head
- Peaking facility
- Operational in 1963

Background

- Aging units/
Overhauls
- Maintenance and
Reliability Concerns
- Operations Staff
concerns
- Remote Operations
 - Ramping
 - Load following
 - Subjective opinions
about output range
- Delayed overhauls



Approach and Considerations

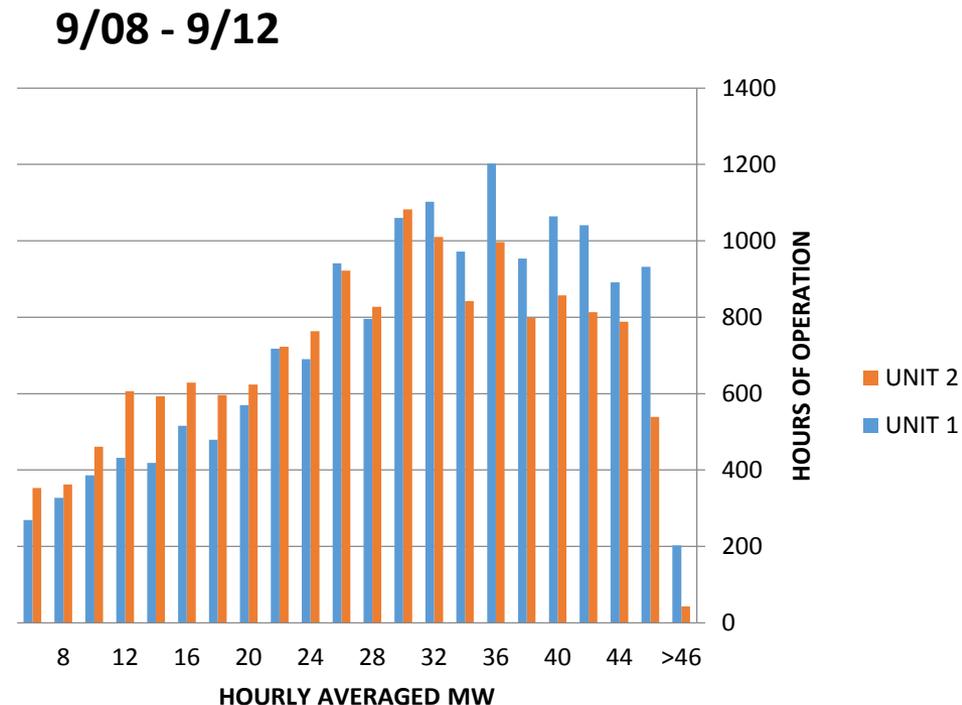
- Only operate at rated load and never stop.
- Operational reality
 - License Requirements
 - Water Management
 - \$\$
- Start conservative and obtain feedback from stakeholders

What information is available?

- Quantitative
 - Vibration monitoring
 - Bearing and Stator Temperatures
 - O&M \$\$
- Qualitative
 - Cavitation Damage Guidelines: BOR & CEATI
 - Generator Operating Guidelines: BOR
 - Operation/Maintenance Personnel Input
 - Interpretation of Vibration Results

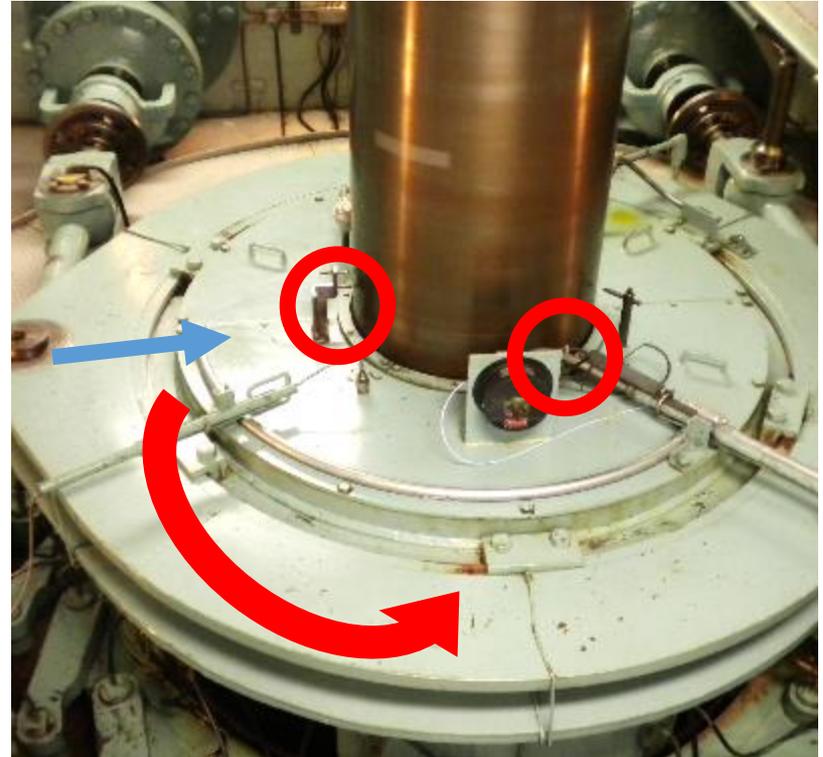
Qualitative: Guidelines

- Resources
 - EPRI 4719
 - CEATI: Overhaul Guide
 - BOR: Reports/EM
- Comparing Maintenance History with Ops History
 - Operating Range
 - Starts and Stops



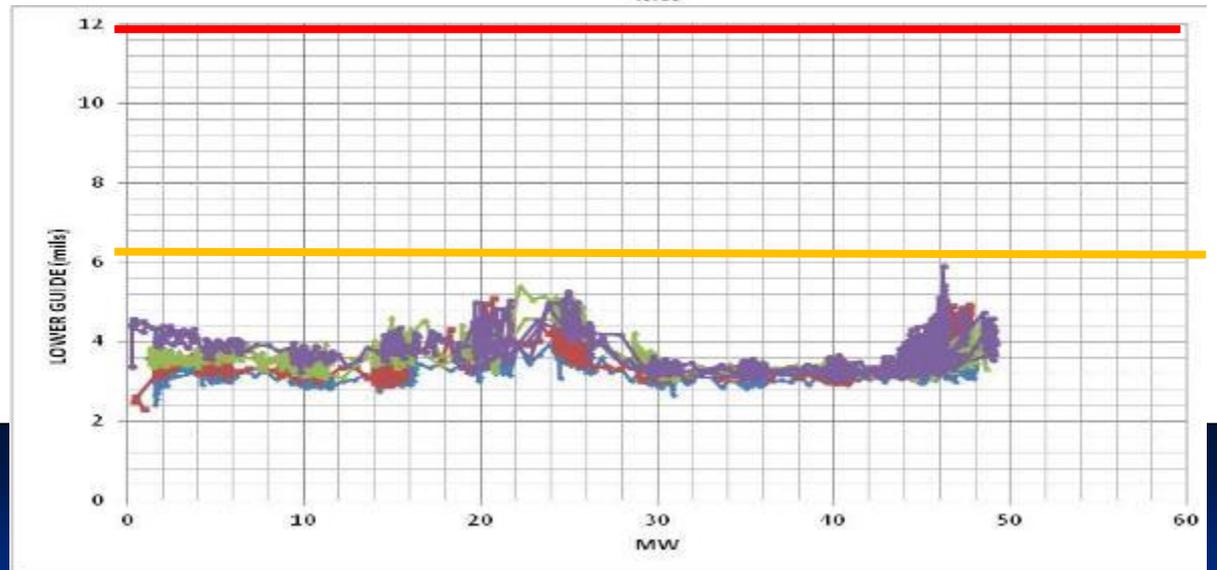
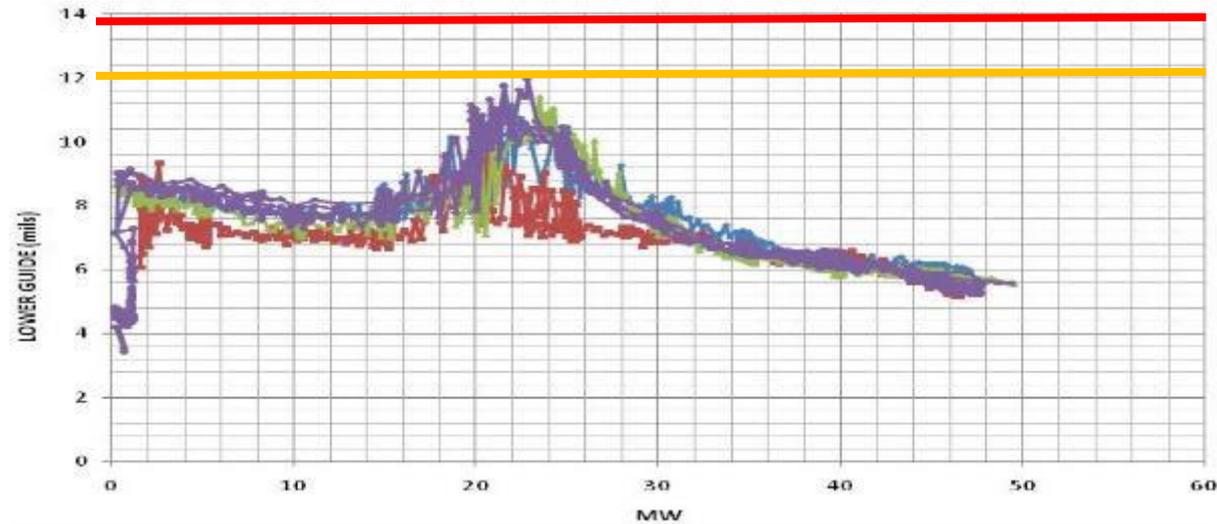
Quantitative: Vibrations

- Installation of system
 - Proximity probes and speed reference to rack
 - Shaft vibration near each bearing
 - Draft tube accelerometer



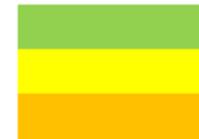
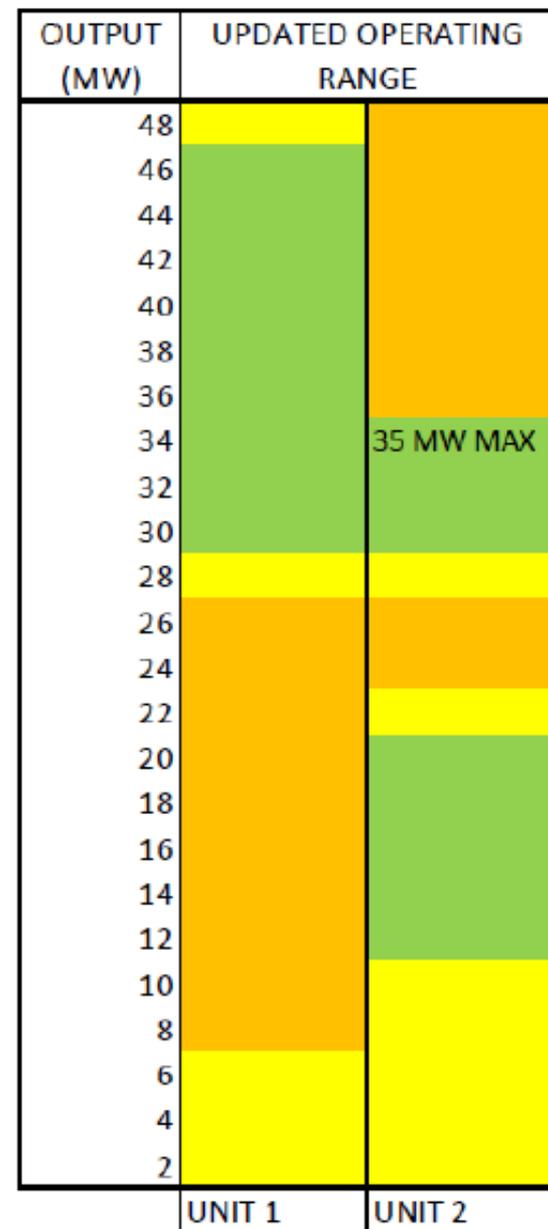
Interpreting the Results

- Professional
- Relative
- Conservative



Communicating Results

- Simple Presentation!
- Feedback
- Adjustment and Monitoring



Results

- Short term results hard to quantify
- Remote operations awareness
- Pressure on overhaul schedule
- Units still spinning

Questions?

