

# Rocky Reach C10 & C11 Water Filled Turbine Hub Conversion

Commission Study Session

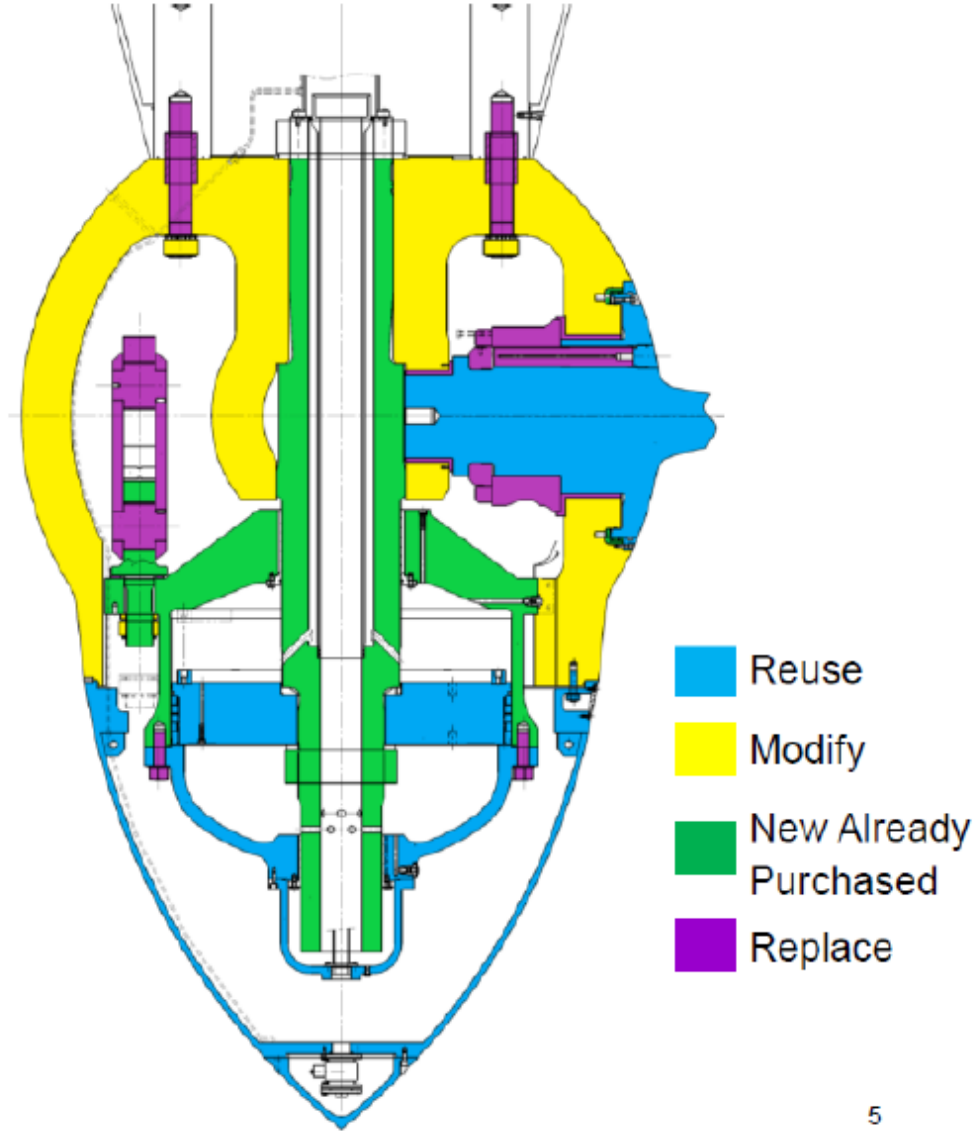
September 21, 2020

# C10 & C11 Water Filled Turbine Hub Conversion

Purpose:

Review staff recommendation to convert C10 and C11 from oil to water filled turbine hubs.

# Turbine Hub Conversion Work Scope



# Advantages

- Reduce Oil leaks
  - Environment effects, stewardship perception, fines
- Reduce Operating Cost
  - Oil purchase, cleaning and disposal expected to be less than water
- Reduce Maintenance Cost
  - Leak monitoring, leak cleanup, seal change-out frequency reduced
- Reduced Outage Time
  - Less inspections; reduced time to change seals

# Identified Concerns/Risks

- Limited history for our operating conditions
- Bushing material life
  - Premature wear requires unit disassembly to replace
  - Severe wear could cause blade strikes
- Friction factor associated with water immersion
  - Higher loads and reduced fatigue life
  - Unit output if governor pressure not enough to pitch blades full steep

# Risk mitigation

- 1) Increasing number of units with similar operating condition. 3 plants in U.S.; 25+ world wide
- 2) Blade bushings - new materials, time in service increasing
- 3) Engineering analysis can identify loads and fatigue life from range of friction values
- 4) Engineering analysis can determine required governor operating pressures and evaluate existing equipment capability

# RR C10/C11 Oil Volumes

Components	Gallons of Oil		Secondary Containment	Project Impact	Result
	C8-11 per Unit	C10/11 Total			
Turbine Runner Hub	<b>2,750</b>	5,500	No	-5500	-
Govenor Sump & Accumulator	4,500	9,000	Yes	No Change	9,000
Wicket Gate Servo	375	750	Yes	No Change	750
Turbine Guide Bearing	50	100	Yes	No Change	100
Thrust Bearing	5,600	11,200	Yes	No Change	11,200
<b>Total</b>	<b>13,275</b>	<b>26,550</b>		<b>-5500</b>	<b>21,050</b>

Eliminates oil in C10/11 without secondary containment

# RR Unit Oil Volumes

Components	Gallons of Oil			Secondary Containment	Project Impact	Result
	C1-C7	C8-C11	Total			
Turbine Runner Hub	14,000	<b>11,000</b>	25,000	No	-5500	19,500
Governor Sump & Accumulator	17,500	18,000	35,500	Yes	No Change	35,500
Wicket Gate Servo	2,100	1,500	3,600	Yes	No Change	3,600
Turbine Guide Bearing	525	200	725	Yes	No Change	725
Thrust Bearing	15,400	22,400	37,800	Yes	No Change	37,800
<b>Total</b>	<b>49,525</b>	<b>53,100</b>	<b>102,625</b>		<b>-5500</b>	<b>97,125</b>

A 22% reduction in oil volume without secondary containment



# Other Actions to Manage Oil

- RI PH2 Air filled turbine hub design in progress
  - 2000 gal. per unit x 8
- Oil tracking and volume monitoring.
- Discharge water quality monitoring
- Conversion to environmentally acceptable oils and greases (EAL's)
- Improved spill containment

# Recommendation

Authorize the General Manager to execute FWO 3-04 for design, manufacture and installation of water filled turbine hubs for C10 and C11 with Voith Hydro, Inc.

# Any Questions?



C8-C11  
Turbine