Case study: Effects of Creating a Comprehensive Maintenance Management Plan – Exciter Fires at Priest Rapids Dam

NW Hydro Association, 2020 Annual Conference
Grant PUD
General Info

- Public Utility formed in 1938
- Service Area: Grant County, Central WA
  - Population Served: ~92,000
  - Area Served: ~2780 square miles
  - Customer Type: Industrial, Agricultural, Residential
Grant PUD Power Production

- Two hydroelectric projects on the Columbia River
  - Priest Rapids and Wanapum
  - Total generating capacity ~2,200 MW
    - 10 Kaplan turbines each
    - ~80 feet of head each
Agenda

- The Event
- Damage
- Costs
- Unrealized Risks
- Direct Cause
- Root Cause
- Cultural Factors
A Healthy Exciter
The Carnage...
The Carnage…
# What Did It Cost?

## Actual Costs - October

<table>
<thead>
<tr>
<th>Unit</th>
<th>Labor</th>
<th>Outage</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>P01</td>
<td>$57,706.79</td>
<td>$3,766.00</td>
<td>$61,472.79</td>
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<tr>
<td>P07</td>
<td>$18,043.97</td>
<td>$700.00</td>
<td>$18,743.97</td>
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<tr>
<td>Other Unit Checks</td>
<td>$4,289.16</td>
<td>-</td>
<td>$4,289.16</td>
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<tr>
<td><strong>Grand Total</strong></td>
<td></td>
<td></td>
<td><strong>$84,505.92</strong></td>
</tr>
</tbody>
</table>

## Potential Costs - July

<table>
<thead>
<tr>
<th>Unit</th>
<th>Labor</th>
<th>Outage</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>P01</td>
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<td>$276,631.79</td>
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<td>$18,043.97</td>
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<td>$324,345.97</td>
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<tr>
<td>Other Unit Checks</td>
<td>$4,289.16</td>
<td>-</td>
<td>$4,289.16</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td></td>
<td></td>
<td><strong>$605,266.92</strong></td>
</tr>
</tbody>
</table>
What Did It Cost?

Other Costs

- Interruptions to planned maintenance
  - Annual unit inspection/overhaul
  - Other maintenance – still assessing
- Other unit outages – checking exciter condition
- Morale
  - More havoc, more unplanned work
  - Operators: Felt ‘on their heels’
What Could It Have Cost?

Safety

- Fire & Smoke
  - Risk to responders
  - Risk to others in powerhouse

Risk to other equipment

- More unit outages
- Even larger?
Missed Opportunities - Maintenance

- Breaker contactor gap adjustment
  - Spec: 2.5 – 4.0 mm
  - Actuals
    - P01: ?
    - P07: ?
    - P09: 0.685
    - Others: 1.0 to 2.5
- Gaps not checked since install
- Contributing: Contamination
Timeline

P01 Exciter Installed
April 1992

P07 Exciter Installed
Oct 1994

...25 Years

P01 Exciter Fire
Oct 3, 2019

P07 Exciter Fire
Oct 21, 2019
Causes – A Deeper Look

• Exciter Brand
  • Designed and built by Siemens
  • Except for the breaker – built by ABB
• During contract submittals
  • Engineer discovered the breaker didn’t meet spec
  • Engineer required a different breaker
• During contract closeout
  • Siemens provided O&M manual, except for breaker
  • ABB provided a brochure for breaker
• Project Manager, Maintenance Engineer didn’t catch lack of maintenance info
  • No maintenance in system for breaker
Our Challenge - Cultural Factors

- Build different understanding why & how people matter
- Rely less on individual skill and memory
- Focus less on blame
- Build systems that help people succeed
- Our foundation:
  - Human Performance
  - Operational Excellence
  - Corrective Action Program
Powering our way of life.