



NHA's Operational Excellence Program Operations & Maintenance Case Study – Best Practices

2016 Northwest Hydro Forum

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Eugene, Oregon
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Outline

NHA & OpEx Overview

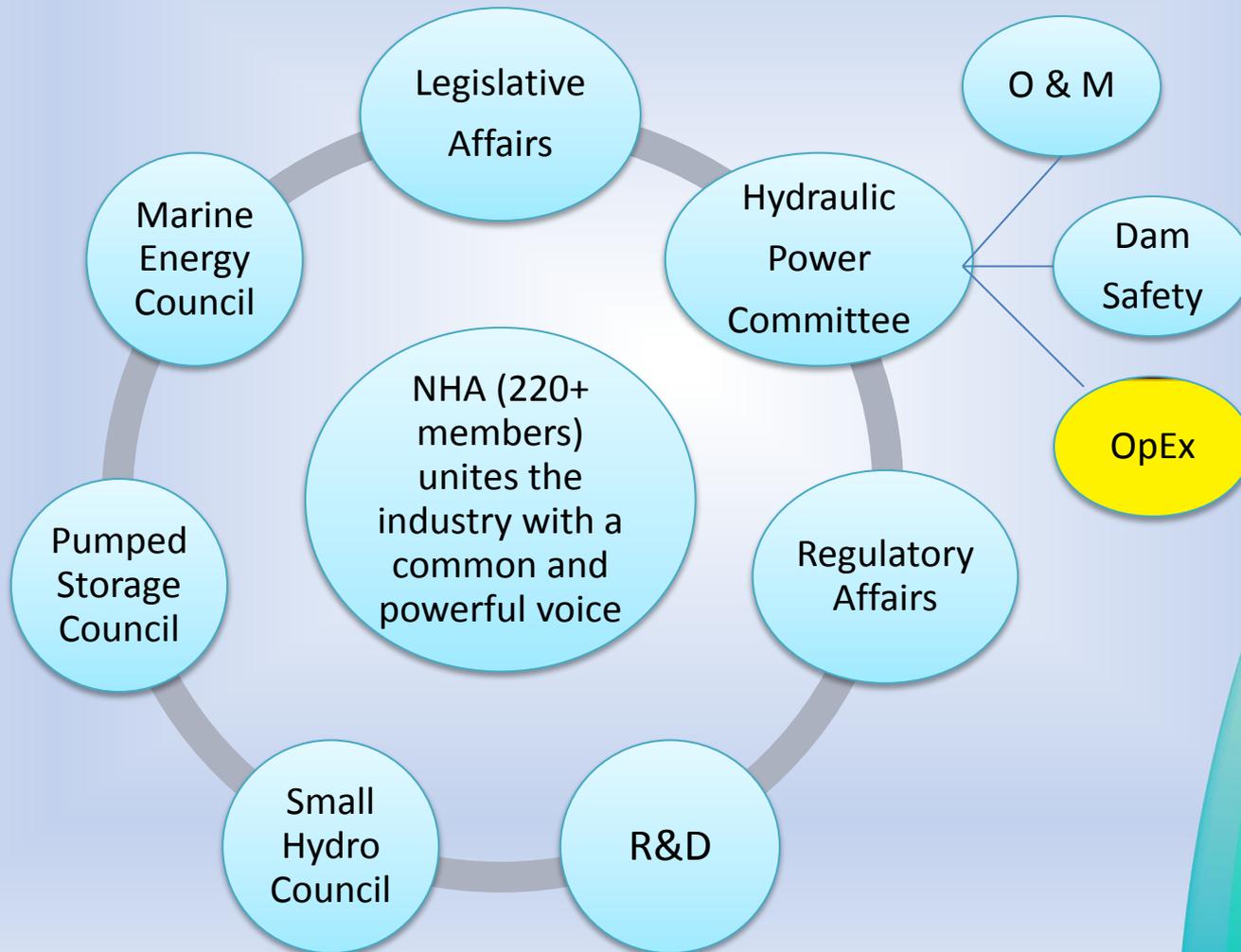
Results to Date

Case Study

Summary



NHA Overview



OpEx Overview

OpEx Is:

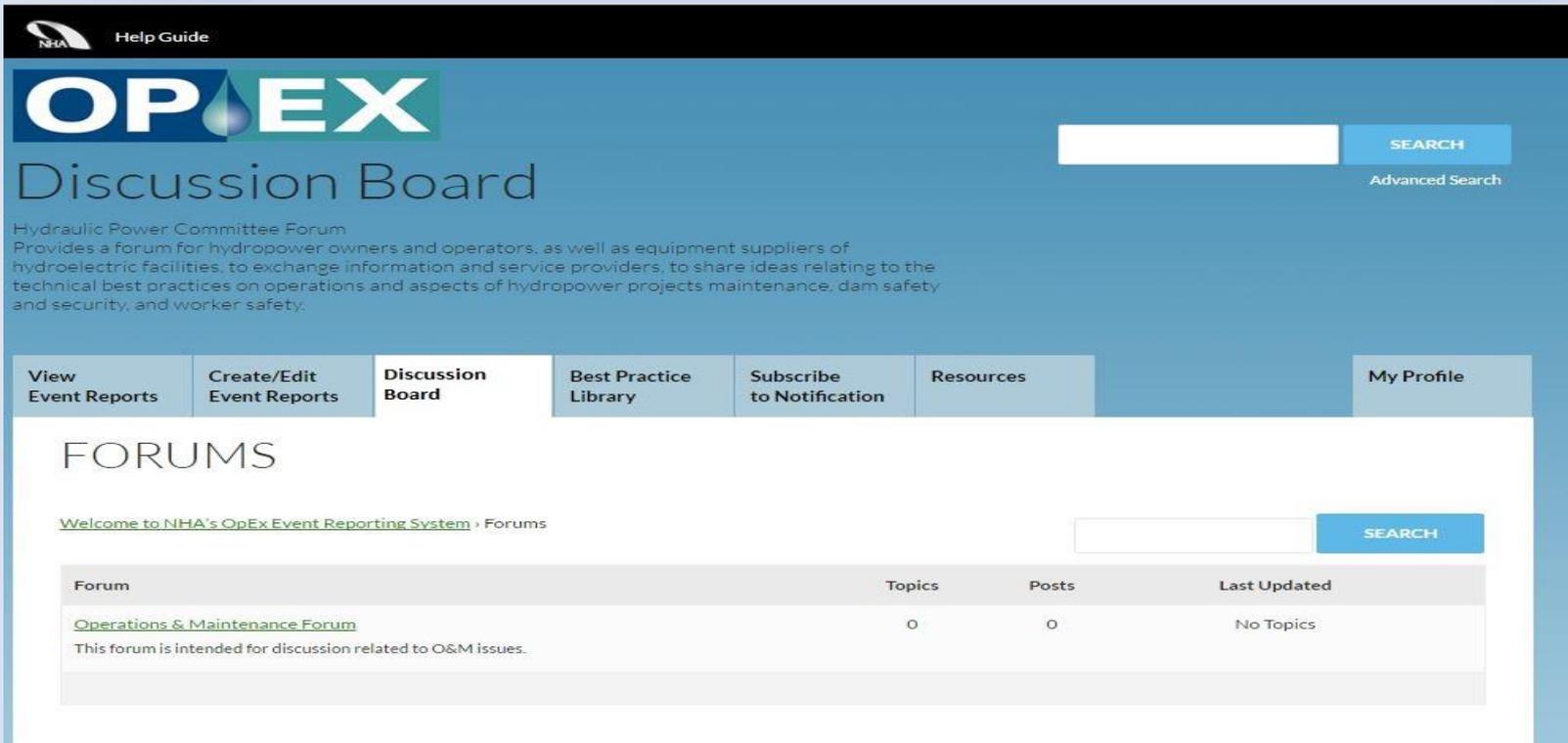
- Voluntary sharing of critical information (Event Reports), best practices and lessons learned, in a timely manner
- A tool for managing aging assets in order to raise the industry's standard of performance
- Educational resource for a workforce in transition

OpEx Scope:

- Event Reports, Best Practices, and Lessons Learned in the areas of:
 - Operations
 - Maintenance
 - Safety – Dam, Employee, and Public
 - Environmental Performance



Website Features



The screenshot shows the OP EX Discussion Board interface. At the top left is the NHA logo and a 'Help Guide' link. The main header features the OP EX logo and a search bar with a 'SEARCH' button and a link to 'Advanced Search'. Below the header is the 'Discussion Board' title and a description of the forum. A navigation menu includes 'View Event Reports', 'Create/Edit Event Reports', 'Discussion Board', 'Best Practice Library', 'Subscribe to Notification', 'Resources', and 'My Profile'. The main content area is titled 'FORUMS' and includes a search bar and a table of forum topics.

FORUMS

[Welcome to NHA's OpEx Event Reporting System](#) » Forums

Forum	Topics	Posts	Last Updated
Operations & Maintenance Forum This forum is intended for discussion related to O&M issues.	0	0	No Topics



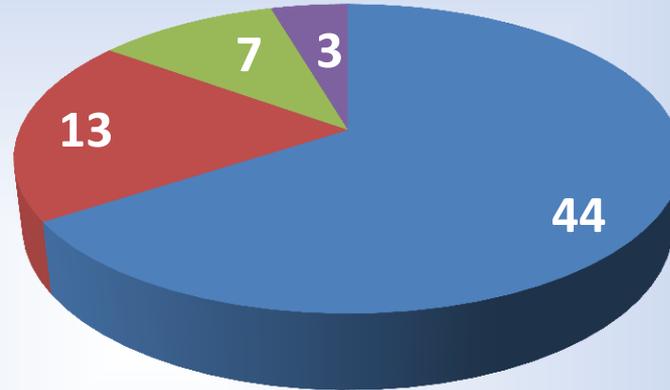
About NHA
Visit the National Hydropower Association (NHA)
© 2014 National Hydropower Association
Operational Excellence (OpEx) is a NHA maintained program.

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Results To Date

Event Reports By Functional Area

n = 67



■ Maintenance ■ Safety ■ Operations ■ Environmental

These Event Reports contain over 360 lessons learned and corrective actions.

Severity

Significant (37), Severe (12), Minor (18)



Broken Rotor Fin

Event Description

 www.hydroexcellence.org

Broken Rotor Fin

The information contained in this document is confidential and is intended for use by Operational Excellence (OpEx) participants only. It is not authorized to be distributed or shared beyond those who have permission to use the OpEx site. Participants are expected to exercise reasonable efforts to protect confidential information from unauthorized disclosures, but in no event should a participant exercise efforts less than it would exercise to protect its own confidential information. OpEx relies on integrity, and any unauthorized use or disclosure of confidential information will undermine OpEx's purpose, jeopardizing industry participation and the ability to provide and obtain necessary OpEx information in the future, which is crucial in making informed decisions.

Date of Report: 20130905

1) Submitting Organization: Redacted	2) Name of Preparer, Phone & Email: Redacted Redacted Redacted	3) Report Number (OE Internal Use): NHAOE-42220153938	
4) Date & Time of Event: 03/09/2013 12:00 am	5) Duration of Event: 1 - 3 months	6) Functional Area: Maintenance	7) Functional Area Subclass: Equipment
8) Classification: Severe	9) Impact of Event: Equipment Damage 90 city forced outage	10) Human Performance: No	

Part 1 - Report of Events

1) Description of Event:



Unit 2 - General View

A cooling fin broke off of the rotor of unit #2 generator at the Beta Hydro Plant while the unit was in operation. This is a vertical shaft, 1.2MVA unit connected to a Francis runner operating normally at a speed of 257 Rpm. The steel fin struck the stator windings at a velocity sufficient to destroy the insulation, creating a phase to phase fault. It's very likely that the broken fin bounced around, contacting the stator in several places before ultimately being thrown out of the generator and onto the powerhouse floor. A junction box containing instrumentation transformers and overcurrent protective relays was mounted on the side of the generator. The resulting flashover destroyed the equipment inside the junction box, disrupting the DC control power to the switchgear. With the control power lost, the generator main breaker was unable to trip and the machine remained energized, sustaining very high fault currents until the power utility's recloser ultimately cleared the circuit. The powerhouse was unattended at the time of the incident; the damage was discovered when the operator was called out and arrived finding the building filled with smoke.

2) Actions Taken:

1 / 4



- Generator – 1.2 MVA, 257 RPM was in normal operation
- Cooling fin broke off
- Fin struck stator winding in several locations resulting in a phase-to-phase fault
- Electrical arc flash burned the instrument transformers and over current relays which were mounted on the side of the generator housing. The DC circuit power to the generator circuit breaker was interrupted.

Case Study

Broken Rotor Fin



General View



Broken Cooling Fin



Rotor Cooling Fins



Instrumentation Cabinet



Interior View of Cabinet

Broken fin was examined and failed due to metal fatigue

Case Study

Broken Rotor Fin

Repairs

- Stator winding was completely replaced
- Instrument transformers and over current relays were replaced and relocated
- Cooling fins were replaced
- Repairs required 90 days to complete

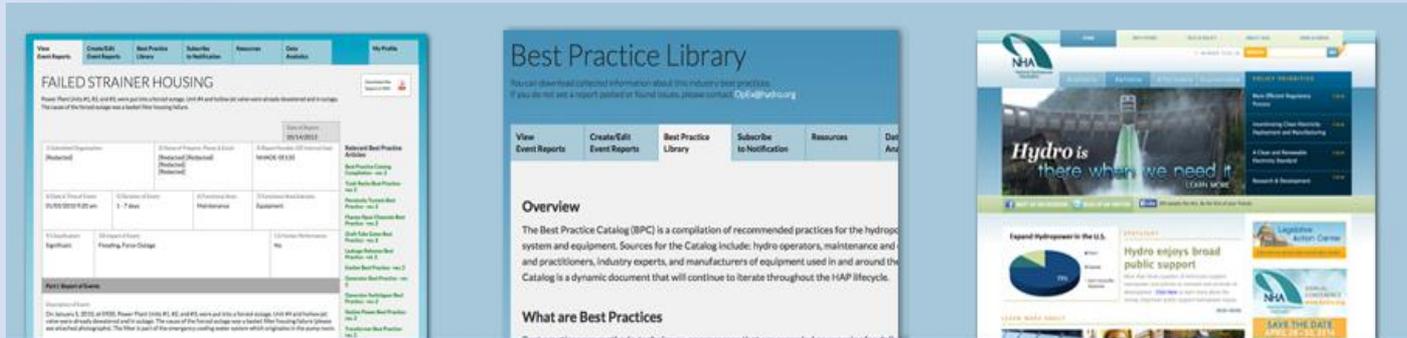
Possible Best Practices

- Include inspection of cooling fins for cracks in standard outage inspection tasks
- Locate instrumentation and relays in different location away from generator housing

Benefits of OpEx Participation

- Avoid similar events experienced by others – employee injuries, forced outages, and equipment damage by incorporating lessons learned and corrective actions into your company’s project and work planning.
- Support for managing aging assets & save limited financial resources
- Learning from industry peers through the Discussion Board
- Educational resource for a workforce in transition

How to participate?



How easy is it to register?

The OpEx program is for NHA members. However, you must still register separately to gain access to OpEx. The registration process is completed in two-steps to validate the user with their organization prior to gaining access to the event reporting system. You will be notified via email once your registration is accepted and complete.

[Click here to register!](#)

Employees of NHA member companies can participate by registering at:

hydroexcellence.org



Contacts



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Thank you