



NHA OPERATIONAL EXCELLENCE PROGRAM

# 2015 Northwest Hydro Operators Forum

May 19, 2015



# Outline

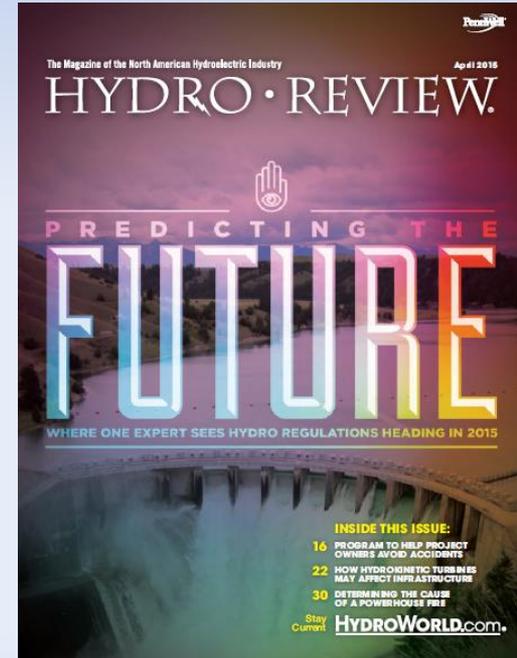
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- Branding & Communications
- Web Site Key Functions
- Results to Date
- Event Report Trends & Samples
- Future Activities
- Summary



# Branding & Communications

- *Logo & Banner Stands*
- *Hydro Review Article*
- [NHA Leadership's View](#)



# Web Site Key Functions

The screenshot displays the OP EX web interface. At the top left is a 'Help Guide' icon. 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 title 'View Event Report' and a paragraph explaining user permissions: 'Your role in this event report will allow you to see other reports within your group/organization or the entire reports generated by all groups/organizations. You may also have editing rights to your organization's draft. If you do not see a report posted or found issues, please contact OpEx@hydro.org.' A navigation menu includes 'View Event Reports', 'Create/Edit Event Reports', 'Best Practice Library', 'Subscribe to Notification', 'Resources', and 'My Profile'. The main content area shows a 'Sort by' dropdown, 'Page 1 of 3' with page numbers 1, 2, 3, and a 'Search Keywords' input field with a 'CLEAR' button. Three event report cards are visible, each with a title, description, and ID number. A circular inset image in the bottom right shows a person in a hard hat standing in front of a control room with multiple monitors.

Help Guide

**OP EX**

View Event Report

Your role in this event report will allow you to see other reports within your group/organization or the entire reports generated by all groups/organizations. You may also have editing rights to your organization's draft. If you do not see a report posted or found issues, please contact OpEx@hydro.org.

View Event Reports | Create/Edit Event Reports | Best Practice Library | Subscribe to Notification | Resources | My Profile

Sort by

Page 1 of 3 | 1 | 2 | 3

Search Keywords  
Enter keywords  
CLEAR

Filter by:  
Maintenance (25)  
Safety (9)  
Environmental (5)  
Operations (4)  
Environmental (1)

**Lifting eye failure during the lift of a head gate**  
During the lift of a head gate using an overhead crane, the lifting eye attaching the crane hook to the gate broke resulting in the gate being dropped to the bottom of the head gate slot. The gate was submerged at the time of the drop, which was approximately 30 feet, however, the bottom of the gate did sustain damage. Fortunately, no one was harmed.  
03/04/2015 | NHA05-111830644949

**Spillway Gate Radial Gate Arm Damage**  
Routine operations inspection discovered a deformation of one gate arm on a radial gate. It was not immediately clear what caused the deformation. Gate was taken out of service for detailed inspection, testing and repair.  
03/05/2015 | NHA05-3520153851

**Penstock Butterfly Valve Hydraulic Cylinder Seal Leak**  
A fisherman noted a possible gas/oil sheen in the tailrace below the Alpha Hydro Plant (AHP). Upon inspection a plant employee noted the source of oil was a leaking seal on the penstock butterfly valve operating cylinder.  
03/30/2015 | NHA05-31930152745



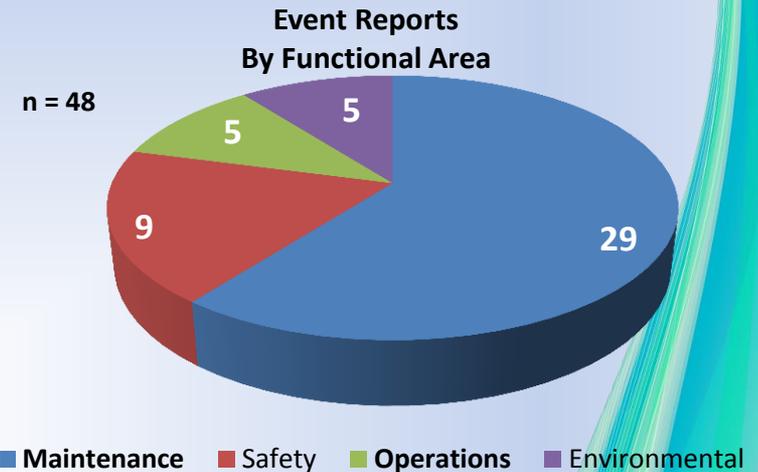
# Results To Date

## Achievements to Date

48 Event Reports from a cross section of the hydropower industry.

### Sample Reports

- Loose Generator Rotor Pole Wedges
- Lower Turbine Shrink Ring Crack
- Turbine Discharge Ring Repair
- Penstock Hydraulic Valve Seal Failure
- Inadvertent Turbine Rotation



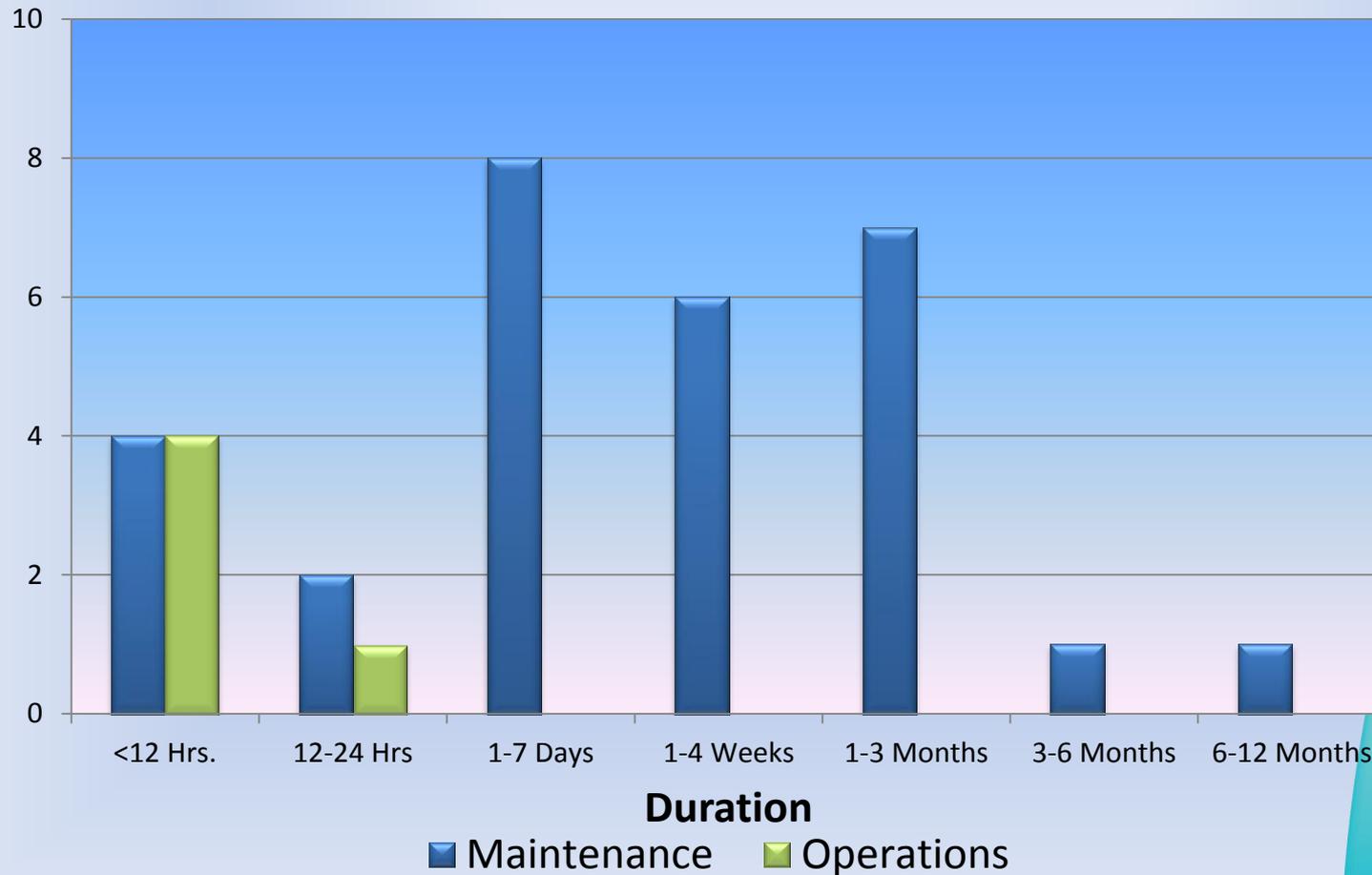
These Event Reports contain:

- 143 Corrective Actions
- 67 Lessons Learned
- 64 Recommendations



# Results To Date

## NHA OpEx Operations & Maintenance Event Duration



# Results To Date

## Maintenance Function Area – Key Facts

### Subclass

- Equipment (27)
- Human Performance (1)
- Control System (1)

### Equipment

- Powertrain (17)
- Balance of Plant (3)
- Control System (3)
- Shut Off Valves (1)
- Spillway (2)
- Sluiceway (1)

### Powertrain

- Generator (10)
- Exciter (3)
- Generator Switch Gear (2)
- Transformer (1)
- Turbine(1)

### Severity

Significant (16), Severe (6), Minor (7)

# Event Report Trends?

## Exciter Brush Failure Event Reports

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**Exciter Brush Rigging Failure**

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1) Submitting Organization: Respected	2) Name of Project, Phase & Email: Respected	3) Report Number (OE Internal Use): MNA064120140201
4) Date & Time of Event: 04/20/2012 13:15 am	5) Duration of Event: 1 - 4 weeks	6) Functional Area: Maintenance
7) Functional Area Subsystem: Equipment	8) Impact of Event: Equipment Damage, Power Outage	9) Human Performance: No

**1) Description of Event:**  
On May 27th, 2012 at 13:15, the Unit #1 Generator tripped off-line by generator field ground relay 64F as a result of a collector ring brush holder failure. This resulted in a forced outage of the generator and the unit. The generator field ground relay 64F is a safety relay that is used to protect the generator field winding from a ground fault. The generator field ground relay 64F is a safety relay that is used to protect the generator field winding from a ground fault. The generator field ground relay 64F is a safety relay that is used to protect the generator field winding from a ground fault. The generator field ground relay 64F is a safety relay that is used to protect the generator field winding from a ground fault.

**2) Actions Taken:**  
The 28 brushes and brush holders were replaced and the collector ring was re-Installed. The brush rigging parts were taken from the identical adjacent Unit that was also an extended failure replacement outage. The collector ring was re-Installed by a local machine shop where it was turned on a lathe. The ring was re-Installed and the rest was placed back into service.

**3) Cause Analysis & Findings:**  
An investigation team consisted of staff from Technical Services & OEI conducted and summarized the data and performed a root cause analysis. A cause and effect tree analysis profile the causal factors and then the root causes were determined.

**4) Corrective Actions:**  
Corrective action on Brush-Rigging: While the "Preventive" Operation team the maintenance group checks the entire brush rigging on an annual basis, it was observed the level of carbon dust buildup was excessive and should be cleaned on a more frequent basis.

**5) Root Causes:**  
The existing procedure for generator maintenance did not adequately specify maintenance and inspection practices and intervals for

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**Generator Brush Rigging Failure**

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1) Submitting Organization: Respected	2) Name of Project, Phase & Email: Respected	3) Report Number (OE Internal Use): MNA064120140201
4) Date & Time of Event: 04/20/2012 13:15 am	5) Duration of Event: 1 - 7 days	6) Functional Area: Maintenance
7) Functional Area Subsystem: Equipment	8) Impact of Event: Equipment Damage, Power Outage	9) Human Performance: No

**1) Description of Event:**  
On May 27th, 2012 at 13:15, the Unit #1 Generator tripped off-line by generator field ground relay 64F as a result of a collector ring brush holder failure. This resulted in a forced outage of the generator and the unit. The generator field ground relay 64F is a safety relay that is used to protect the generator field winding from a ground fault. The generator field ground relay 64F is a safety relay that is used to protect the generator field winding from a ground fault. The generator field ground relay 64F is a safety relay that is used to protect the generator field winding from a ground fault. The generator field ground relay 64F is a safety relay that is used to protect the generator field winding from a ground fault.

**2) Actions Taken:**  
The 28 brushes and brush holders were replaced and the collector ring was re-Installed. The brush rigging parts were taken from the identical adjacent Unit that was also an extended failure replacement outage. The collector ring was re-Installed by a local machine shop where it was turned on a lathe. The ring was re-Installed and the rest was placed back into service.

**3) Cause Analysis & Findings:**  
An investigation team consisted of staff from Technical Services & OEI conducted and summarized the data and performed a root cause analysis. A cause and effect tree analysis profile the causal factors and then the root causes were determined.

**4) Corrective Actions:**  
Corrective action on Brush-Rigging: While the "Preventive" Operation team the maintenance group checks the entire brush rigging on an annual basis, it was observed the level of carbon dust buildup was excessive and should be cleaned on a more frequent basis.

**5) Root Causes:**  
The existing procedure for generator maintenance did not adequately specify maintenance and inspection practices and intervals for

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**Exciter Brush Rigging Failure - 19 MW Unit**

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1) Submitting Organization: Respected	2) Name of Project, Phase & Email: Respected	3) Report Number (OE Internal Use): MNA064120140201
4) Date & Time of Event: 01/10/11 13:30 am	5) Duration of Event: 1 - 3 months	6) Functional Area: Maintenance
7) Functional Area Subsystem: Equipment	8) Impact of Event: Equipment Damage, Power Outage	9) Human Performance: No

**1) Description of Event:**  
Visual inspection found all four of the exciter brush holders on the lower ring damaged. The lower slip ring was damaged due to arcing from the brush holders on the ring.

**2) Actions Taken:**  
The damage originated from some melting of a brush due to complete melting of the brush holder and brush. A review of the operating history did not show any indications that could lead to the melting of the brush holder. In addition to the brush holder damage, some of the brush holder holder-grip disconnects were found damaged. The disconnects were either oxidized or completely missing.

**3) Cause Analysis & Findings:**  
One of the exciter field poles was found with damage to the control wiring and turn insulation. The pole was removed and repaired. The control wiring in the area was replaced.

### Impacts

- Forced Outage Durations
  - 80 Hours
  - 14 Days
  - 30 Days
- Expense (one outage)
  - \$142K – Equipment
  - \$162K – Lost Generation
  - \$304K - Total

### Failure Modes

- Inadequate PM Procedure / Frequency
- Training for plant staff
- Unique Causes
  - Spring tension
  - Quick disconnect tension leafs require close inspection
  - 64F Trip Cut Out Relay failed to operate

### Lessons Learned

- Revise PM Procedures
- Provide training per CEATI Report
- Test 64F TCO Relay
- Replace shunt quick disconnects on a periodic basis

# Event Report Samples

## **“Near Miss” Safety Event Report Titles**

- Near Miss - Unauthorized Use of Gas Welder Resulting in High CO Levels
- Carbon Monoxide Near Miss
- Near Miss - Incorrect Prints for 480V Feeder

## **“Near Miss” Maintenance Event Report Titles**

- Jib Crane – Near Miss

# Future Activities

- Increase Participation & Build OpEx Database
- Best Practices Development
- Discussion Forum

**Register at:**  
[hydroexcellence.org](http://hydroexcellence.org)



# Summary

## Benefits of OpEx Participation

- Support for managing aging assets
- Training for a workforce in transition
- Learn from, and collaborate with, fellow industry colleagues on:
  - Best Practices
  - Lessons Learned
  - Event Reports
- Avoid similar events experienced by others – employee injuries, forced outages, and others
- Save limited financial resources

# Contacts



## *Further Information Contact:*

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**Thank you**