



# PG&E's DAM SAFETY PROGRAM

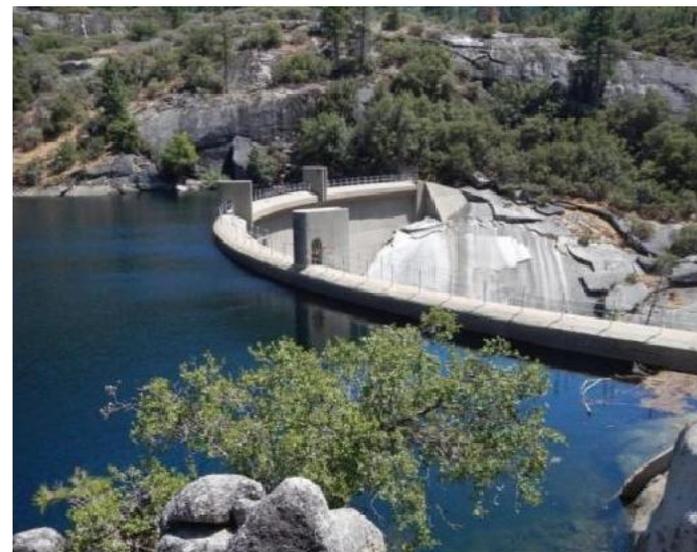
## May 20, 2014

Northwest Hydro Operators Forum  
Spokane, WA

# PG&E Hydro Facilities



- ◆ 97 Reservoirs and 53 Diversions
- ◆ 170 dams
  - 148 dams under FERC jurisdiction
    - 38 “high hazard”
    - 19 “significant hazard”
    - 91 “low hazard”
  - 96 dams under DSOD jurisdiction
- ◆ 2.35 million acre-feet of storage
- ◆ 173 miles of canals
- ◆ 43 miles of flumes
- ◆ 132 miles of tunnels
- ◆ 65 miles of pipe (penstocks, siphons, and low-head pipe)



# Facility Safety Program – Overview



PG&E's Hydro Facility Safety Program (FSP) manages operational risk for the largest privately held hydroelectric system in the nation.

## **Program Objectives:**

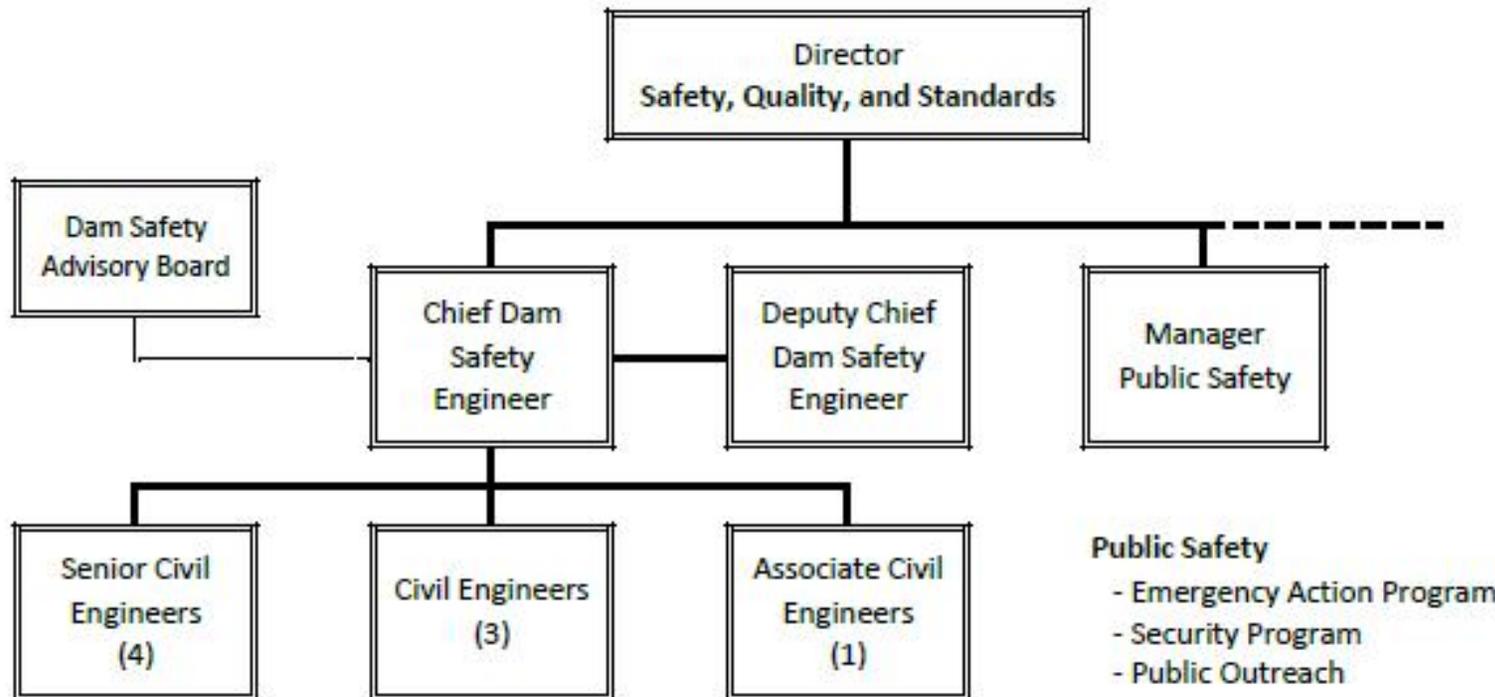
Continual, long-term safe and reliable operation of Company dams and water conveyance facilities while meeting or exceeding minimum regulatory requirements.

No public safety incidents associated with our operation of Hydro assets.

## **Key Success Factors:**

- Organizational commitment (resources, policies and procedures, safety culture, continuous improvement)
- In-house technical expertise (engineering and seismology)
- Active use of recognized experts

# FSP – Organization and Staffing



## Facilities Safety

- Surveillance and Inspection
- Instrumentation and Monitoring
- Engineering Studies
- Condition Assessments (Asset Management Support)
- Facility Testing
- Technical Support for O&M, Project Execution
- Response to Emergent Issues
- Regulatory Relationships - FERC Dam Safety and DSOD
- Reporting/Technical Response to Agencies
- Training

## Supporting Organizations

- Geosciences
- Power Gen Project Execution, License & Compliance, and SQS Public Safety
- Land and ATS Departments
- Various outside consulting firms, as needed
- Industry-recognized technical experts, project-specific boards of consultants

# PG&E's Dam Safety Program (DSP)



## ◆ Historical Development

- Enterprise Risk Management (ERM) Program
- Internal Guidance Documents
  - ◆ Policies
  - ◆ Standards
  - ◆ Procedures
- Regulatory Requirements
- External Consultation
- ODSP – Revision 1 (2012)
  - ◆ Dam Safety Policy
  - ◆ Dam Safety Program Standard
- ODSP – Revision 2 (2013)
  - ◆ Updated Dam Safety Program Standard

# Dam Safety Program Objectives



The objective of PG&E's Dam Safety Program is to facilitate long-term, safe, and reliable operation of the Company's dams by:

- Maintaining public and employee safety as well as compliance with FERC and DSOD (Safety First!)
- Communicating policies and expectations regarding dam safety and regulatory compliance to DSP team members, O&M, and other stakeholders
- Establishing protocols for reporting dam safety issues without fear of reprisal
- Defining the roles and responsibilities of key dam safety personnel, including the Chief Dam Safety Engineer (CDSE)

# Dam Safety Program Objectives (Continued)

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- Establishing and conducting effective dam safety surveillance (inspection) and monitoring programs
- Implementing best practices for quality control and quality assurance
- Facilitating knowledge transfer (training) and succession planning
- Monitoring and verifying compliance through internal and external audits and assessments
- Striving for continuous improvement

# ODSP Components



- **Design Review and Documentation**
- **Construction Support**
- **Analyses**
- **FERC Part 12D Reviews, Inspections, and Reports (PFMA, STID)**
- **Surveillance and Monitoring**
- **Operational Exercises**
- **Maintenance**
- **Mitigation Projects**
- **Emergency Action Plans (EAPs)**
- **Security**
- **Regulatory Compliance (FERC/DSOD)**
- **Standards and Procedures**
- **Training**
- **Communications**
- **Reporting**
- **Record Keeping**
- **Succession Planning**
- **Dam Safety Advisory Board**
- **Continuous Improvement**
- **Audits / Assessments**

# Dam Safety Advisory Board (DSAB)



- ◆ Experts representing a broad range of dam safety experience
  
- ◆ How they contribute to our Dam Safety Program
  - Audits
  - Reviews of selected work
  - Outside perspective
  - Guidance and direction based on expertise and experience

# FERC Best Practices



- ◆ **The DSP is for all dams**
  - PG&E’s ODSP encompasses all of the Company’s dams, regardless of size, location, hazard potential, or regulatory jurisdiction
  
- ◆ **Reference Applicable Regulations**
  - PG&E’s ODSP includes the following references:
    - ◆ Links to online information at FERC website
    - ◆ Links to supporting PG&E standards and procedures
    - ◆ Definitions of key words and concepts
  
- ◆ **No Fear of Reprisal**
  - Safety is Job #1 at PG&E and it has always been our policy that anyone has the ability / right to bring up safety issues without fear of repercussions
  - CDSE has direct access to PG&E’s President

## ◆ Dam Safety Priority

- First paragraph of the executive summary states: “Power production and other business objectives cannot take precedence over dam safety or regulatory compliance issues.”

## ◆ Recordkeeping

- New asset records maintained within corporate record management systems, including:
  - ◆ Documentum
  - ◆ SAP Work Management (WM)
  - ◆ Geographic Information System (GIS)
  - ◆ Supervisory Control and Data Acquisition (SCADA)
- Regulatory correspondence and compliance records retained in SAP WM and Documentum
- Old records (hard copy formats) will be maintained in central engineering and licensing files, and migrated to the electronic file locations indicated above

# FERC Best Practices



## ◆ Training and Succession Planning

- Developed on-line training modules for all employees working on the program to learn about industry standards and best practices
- Company provides a tracking program to ensure the proper training is completed and recorded
- Senior engineers mentor younger engineers

## ◆ Audits and Continuous Improvement

- Dam Safety Advisory Board (DSAB)
- Convened bi-annually to advise CDSE & PG&E on emerging issues in the area of dam safety
- Performs and recommends external audits, as needed

# Surveillance and Monitoring



## 2013 Dam Safety Inspections

- PG&E O&M (regular walkdowns)
- PG&E Engineering (117 dams)
- DSOD Annual (79 dams, 69 reservoirs)
- FERC Annual (23 licenses)
- FERC 5-year Part 12D (23 dams, 15 reservoirs in Drum system)
- FERC 10-year Radial Gate follow-up (8 sites)
- Very Small Dams (38 dams)
- Low-level Outlets (7 dams)

# Continuous Improvement Initiatives

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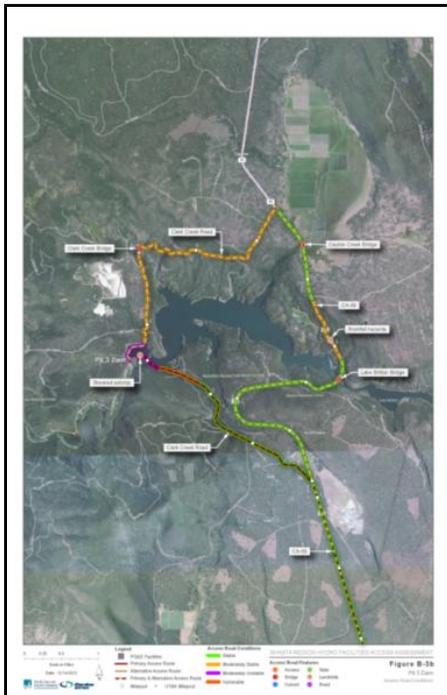
## Enterprise Risk Management and Dam Safety Programs

- ◆ Emergency Access to Large Dams
- ◆ Standard and Emergency Operating Procedures
- ◆ Surveillance and Monitoring
- ◆ Small and Very Small Dams
- ◆ Water Conveyance and Auxiliary Equipment
- ◆ Knowledge Transfer – Standards, Procedures, and Training

# Large Dam Emergency Access



Evaluation of access to all of PG&E's large dams in emergency situations.

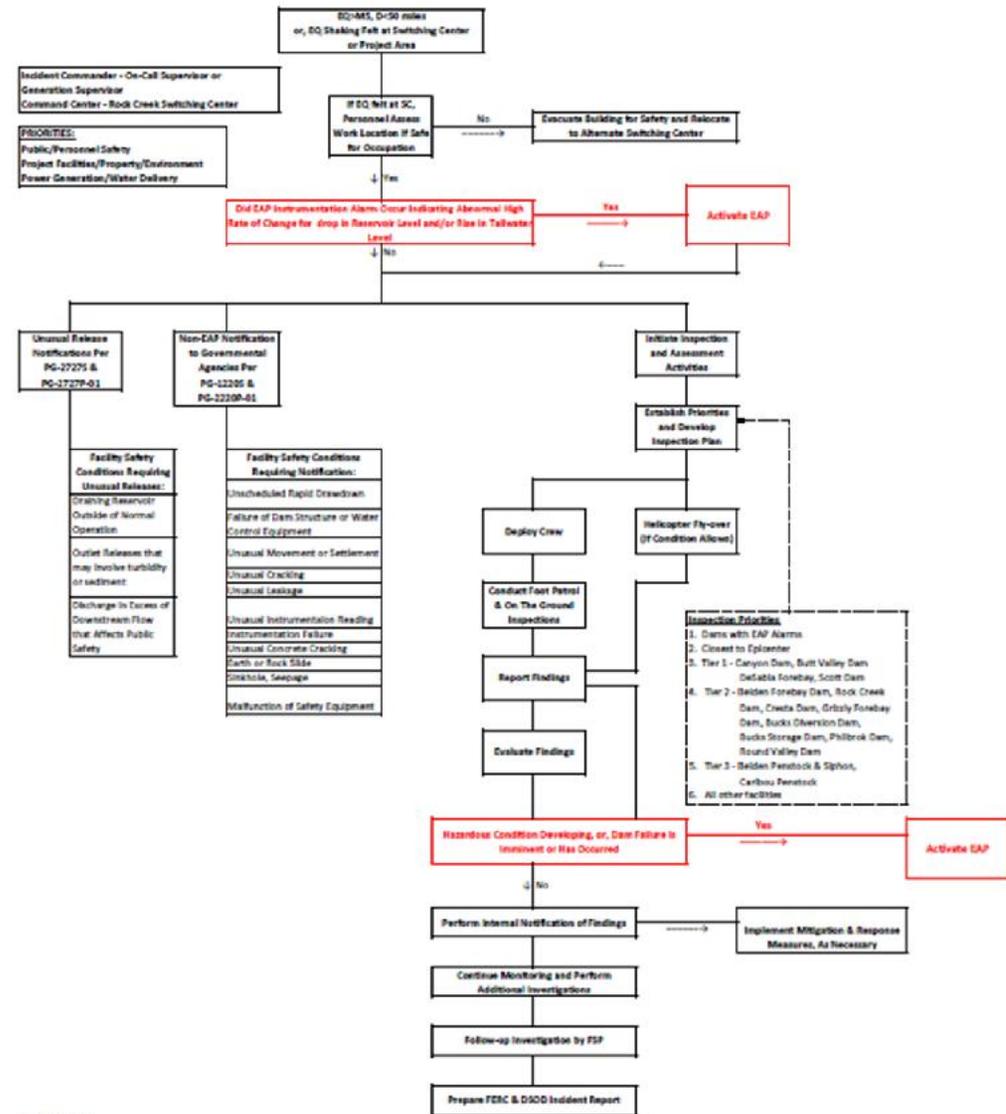


# Standard and Emergency Operating Procedures



## Completed:

- ◆ Standard Operating Procedures (SOPs) for large dams (51)
- ◆ Regional Emergency Operating Procedures (EOPs) for all areas.



BY CONTIN

# Surveillance and Monitoring



- ◆ External audit of monitoring instruments and records
- ◆ New reporting template that combines the Dam Safety Surveillance and Monitoring Plan (DSSMP) and Dam Safety Surveillance and Monitoring Report (DSSMR) for each instrumented facility
- ◆ Visual job aids for O&M walkdowns and monitoring data collection for all 64 instrumented dams

# Surveillance and Monitoring

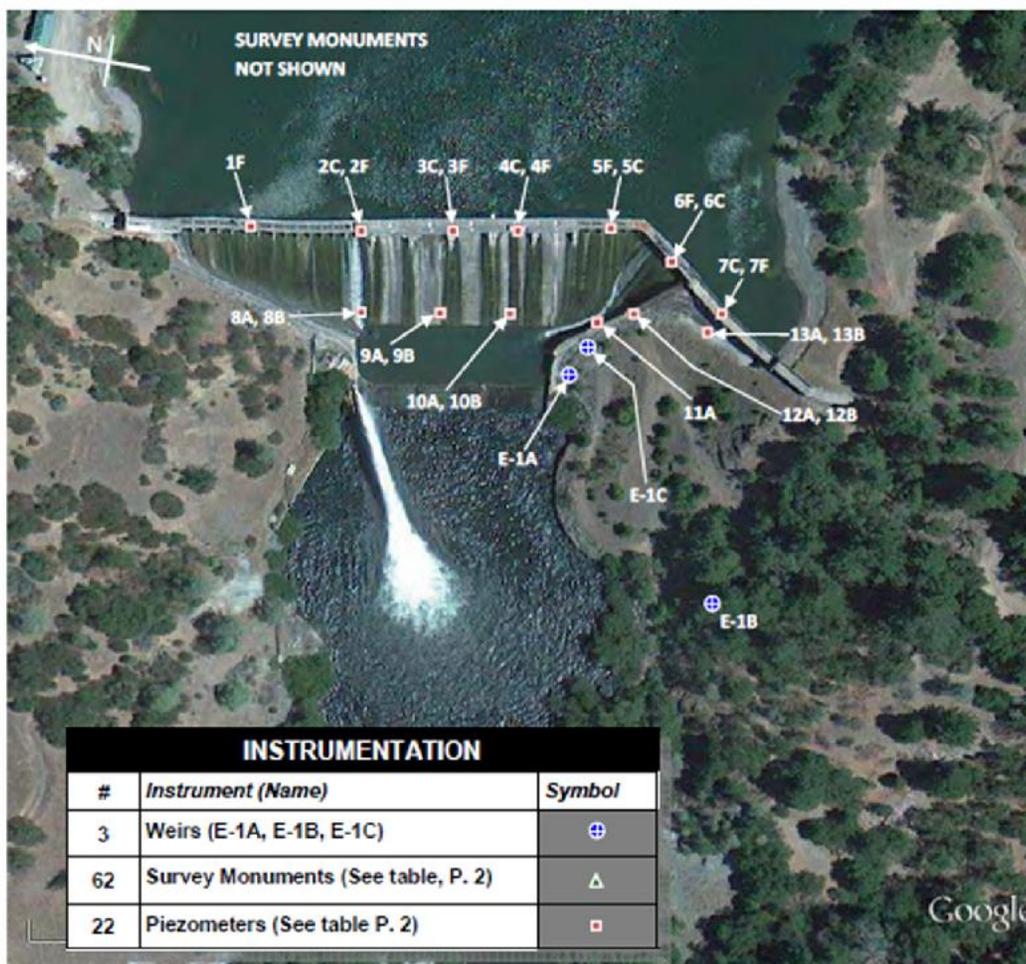


## SCOTT DAM (High Hazard Potential)

Eel River, CA

Dam Safety and Surveillance Monitoring - Instrumentation Summary Table

FERC Project No. 77-CA (State Dam No. 97-101)



### PERTINENT INFORMATION

Location: 30.0 mi NE of Ukiah, CA  
 Dam Type: Concrete Gravity  
 Date of Construction: 1921  
 Dam Height: 122.5 ft max  
 Dam Crest Elevation: El. 1,920.6 ft (PG&E)  
 Normal Maximum Reservoir Elevation: El. 1,910.0 ft (PG&E) ≈ 10.0 ft freeboard  
 Note: PG&E datum = USGS datum + 81.7 ft

### CONTACT INFORMATION

**Potter Valley Powerhouse**  
 PT&T#: (707) 743-1197

**Facilities Safety Program**  
 Charles Ahlgren, Chief Dam Safety Engineer  
 Ph: (415) 973-1523  
 David Ritzman, Deputy Chief Dam Safety Engineer  
 Ph: (415) 973-4412

**Hydro Generation**  
 Rick Pompoti, Generation Supervisor  
 PT&T#: (530) 520-4220

**Hydro Licensing**  
 Joelle Aiello, License Coordinator  
 PT&T#: (415) 973-5612

### INSTRUMENTATION

#	Instrument (Name)	Symbol
3	Weirs (E-1A, E-1B, E-1C)	⊕
62	Survey Monuments (See table, P. 2)	△
22	Piezometers (See table P. 2)	□

August 2013  
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# Small and Very Small Dams



- ◆ Completed 49 small dam screenings
  - On-site inspections
  - Stability assessments (static, seismic, and flood loading)
  - Spillway adequacy to pass 100-year flood
  - Downstream inundation potential from dam failure
- ◆ Completed 38 very small dam on-site inspections

# Auxiliary Dam Equipment, Canals, and Penstocks



## ◆ Large Dam Electrical and Mechanical Equipment

- Seismic restraint assessments

## ◆ Canals

- Walkdowns and assessments
- Tunnel walkdowns (for high consequence canals)



## ◆ Penstocks

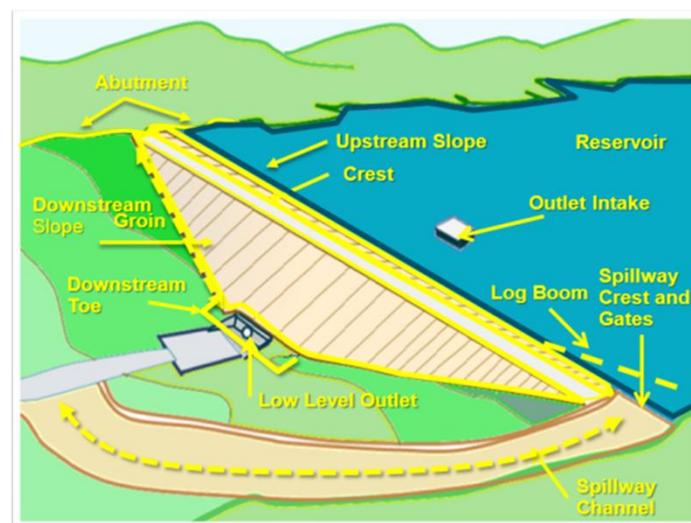
- Penstock D/C calculations
- Field verifications for banded penstock
- Development of acceptance criteria for penstock assessment



# Standards, Procedures, and Training



- ◆ Computer-based training modules (CBTs) focused on dam safety, surveillance, and monitoring
- ◆ Facilities Safety-related standards and procedures
  - Surveillance & Monitoring
  - Maintenance
  - Incident Reporting
  - Emergency Preparation and Response



**Basic Components of Most Dams**

