PFMA and Risk Assessment

Panel Members:  
David Scott, BC Hydro (Presentation unavailable)
Dr. Martin McCann, Stanford University
Dr. David Bowles, Utah State University and RAC Engineers & Economists
Daniel Johnson, MWH Global, Inc.

Moderator:  
Bruce Muller, Bureau of Reclamation
PFMA AND RISK ANALYSIS

Martin McCann
Director
National Performance of Dams Program
Stanford University

February 17, 2005
PFMA/Risk Analysis

• PFMA
  – Good engineering

• Risk Analysis
  – Better engineering
  – Better management
PFMA

- PFMA experience in the hydropower industry....
  - An alternative *process* for examining & evaluating the structural/operational integrity of dam systems
  - An improved level of understanding
What is a Risk Analysis?

• An analysis to access the likelihood and magnitude (severity) of adverse events (damage, downstream impacts) that can occur.

• It is a model that describes the physical & functional performance of a system – it is integrated information where a PFMA is disjointed.
**Good to Better**

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<th>Where PFMA was good…</th>
<th>Risk Analysis is better…</th>
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<td>Improved focus – failure modes, performance</td>
<td>PFMA results are a starting point; a risk analysis is explicit in its consideration of the combination of events that can lead to unsatisfactory performance.</td>
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<td>Improvement to the inspection process (and initial evaluation)</td>
<td>Significant improvement in the safety evaluation of dams:</td>
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<td>- Dam is evaluated as an integrated system</td>
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<td>- Failure modes viewed on a unique, balanced plane.</td>
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<td>- Relative importance of different initiators (floods, earthquakes, misoperation, etc.) can be measured.</td>
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<td>- Relative importance of events (floods) of different size is measured</td>
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<td>Quantitative - ad hoc</td>
<td>Quantitative – probabilistic</td>
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<td>- no aggregate measure</td>
<td>Provides a ‘unified’ measure of risk/safety:</td>
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<td>- within the context of dam safety</td>
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<td>- with other risks (business, energy, etc.)</td>
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What does it Offer?

- Multi-fold insight to the structural performance & operational integrity of a dam/hydropower system
- A safety and business context
- Regulatory & business balance
- Defensibility
  - Legal
  - Regulatory
  - Public
Linking Dam Safety and Security at the Corporate Level

David S. Bowles
Institute for Dam Safety Risk Management
Utah State University
and
RAC Engineers & Economists

February 17, 2005
• OF THE RISK ASSESSMENTS ON > 450 DAMS IN NORTH AMERICA, AUSTRALIA AND THE UK
  - 72% for Private Owners
  - 75% came under Safety Regulators
  - 13% were paid for by Regulators

• WHY HAVE THESE RISK ASSESSMENTS BEEN CONDUCTED?
  - 83% - To Justify Funding
    • Of those, 78% Regulated, 13% Self Regulated, and 9% Unregulated
  - 79% - To develop a Portfolio Approach to dam safety risk reduction, including staging of fixes
  - 59% - To provide input to “How Safe is Safe Enough?”
  - 1% - To Justify Operating Restrictions
    • Some very politically sensitive cases
  - 13% - Demonstration Projects
Integration Role of RA in Dam Safety & Owner’s Business
Integration Role of RA in Dam Safety & Owner’s Business

Engineering Inputs

- Inspections
- Design Reviews
- Emergency Preparedness and Response Planning
- Monitoring and Surveillance
- Incremental Consequence Categories

EXISTING DAM SAFETY INFORMATION FLOWS

BUSINESS PROCESSES:
- Capital budgeting/financing,
- Risk management/insurance,
- Due diligence and legal liability assessment,
- Contingency planning and contractual obligations,
- Public relations and consultation,
- Etc.

PORTFOLIO RISK ASSESSMENT

Int. Role of RA in Dam Safety & Owner's Business

Monitoring and Surveillance

PFMA

EPRP,
Assessment Program

Improvement Program

Design Reviews

Emergency Preparedness and Response Planning

Incremental Consequence Categories
EXISTING DAM SAFETY INFORMATION FLOWS

ADDITIONAL INFORMATION NEEDS

Engineering Inputs

Consequences Inputs

Inspections
Design Reviews
Emergency Preparedness and Response Planning
Monitoring and Surveillance
Incremental Consequence Categories
Inundation modeling

PFMA

RA

Integration Role of RA in Dam Safety & Owner’s Business
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Engineering Inputs

Consequences Inputs

1) Dam Safety Program

Outcome Targeting

EXISTING DAM SAFETY INFORMATION FLOWS

ADDITIONAL INFORMATION NEEDS

BUSINESS RISK INFORMATION NEEDS (THE TARGET)

DAM SAFETY: Monitoring and surveillance, EPRP, Assessment Program Improvement Program O & M Program

BUSINESS PROCESSES: Capital budgeting/financing, Risk management/insurance, Due diligence and legal liability assessment, Contingency planning and contractual obligations, Public relations and consultation, Etc.

Inspections

Design Reviews

Emergency Preparedness and Response Planning

Monitoring and Surveillance

Incremental Consequence Categories

Inundation modeling

RA

RA

Outcome Targeting

Outcome Targeting
**Engineering Inputs**

- Inspections
- Design Reviews
- Emergency Preparedness and Response Planning
- Monitoring and Surveillance
- Incremental Consequence Categories

**Consequences Inputs**

- Inundation modeling

**DAM SAFETY:**
- Monitoring and surveillance, EPRP, Assessment Program Improvement Program
- O & M Program

**BUSINESS RISK INFORMATION NEEDS (THE TARGET)**

**1) Dam Safety Program**

**2) Business Processes**

**Integration Role of RA in Dam Safety & Owner’s Business**

**BUSINESS PROCESSES:**
- Capital budgeting/financing
- Risk management/insurance
- Due diligence and legal liability assessment
- Contingency planning and contractual obligations
- Public relations and consultation
- Etc.
SOME BUSINESS USES OF DAM SAFETY RA

• Corporate Risk Management
  - Risk profile - many risks (security), prioritization

• Business criticality
  - Relating dam safety to key business results indicators

• Budgeting
  - Justification (deregulation)

• Business Contingency Planning
  - Dam failure & non-dam failure risks

• Community Emergency Planning
  - Improved understanding of failure modes & consequences

• Loss financing/insurance
  - Evaluate coverages and exposures

• Legal considerations
  - Due diligence, internal control, corporate governance, & legal defensibility for decisions

• Community consultation
• PFMA is identifying some unaddressed failure modes
  - How far to go in addressing these “new” failure modes?
• Some Dam Safety Regulators are using RA
• If FERC extends PFMA to RA:
  - Would licensees be interested in linking Dam Safety RA to Business RA processes?
• Dam owner is ultimately responsible for public safety
  - Dam safety and public safety are not always congruent
• Tendency in the US for owners to rely on safety regulator to determine appropriate level of safety
  - Compliance does not provide absolute defensibility
  - Safety regulator does not account for business risks
• Approach to RA should depend on desired outcome targets
• Beware of Index Approaches that do not conform to a risk metric:
  - Cannot make risk comparisons with other fields
  - Cannot justify risk reduction through cost effectiveness
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Home Page (including links to selected papers):
http://www.engineering.usu.edu/uwrl/www/faculty/bowles.html
Inspection, Maintenance, and Monitoring

Dan Johnson
Vice President
MWH Global, Inc.
Inspection

- Condition assessments
- Capability to meet current standards
- Changes with time
Maintenance

• Typically not frequent due to staff and other cost needs
• Components forgotten—emergency spillway
• Many times, needs are identified after an event
• Regular maintenance is effective
  – “You can pay me now, or pay me later.”
Monitoring

- Observe / Measure / Document
- Check data trends vs. time
- Reporting to interested parties
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