

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 assess 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

Where PFMA was good...	Risk Analysis is better.....
Improved focus – failure modes, performance	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.
Improvement to the inspection process (and initial evaluation)	Significant improvement in the safety evaluation of dams: <ul style="list-style-type: none"> - Dam is evaluated as an integrated system - Failure modes viewed on a unique, balanced plane. - Relative importance of different initiators (floods, earthquakes, misoperation, etc.) can be measured. - Relative importance of events (floods) of different size is measured
Quantitative - ad hoc <ul style="list-style-type: none"> - no aggregate measure 	Quantitative – probabilistic <p>Provides a ‘unified’ measure of risk/safety:</p> <ul style="list-style-type: none"> - within the context of dam safety - with other risks (business, energy, etc.)

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

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**

PFMA

Integration Role of RA in Dam Safety & Owner's Business

EXISTING DAM SAFETY
INFORMATION
FLOWS

Engineering Inputs



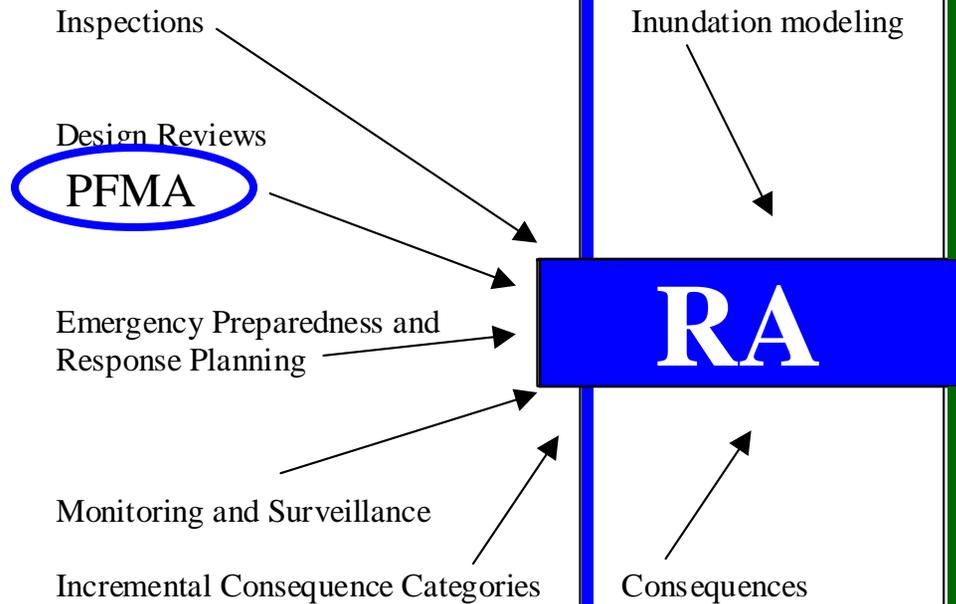
Integration Role of RA in Dam Safety & Owner's Business

EXISTING DAM SAFETY
INFORMATION
FLOWS

ADDITIONAL
INFORMATION
NEEDS

Engineering Inputs

Consequences Inputs



Integration Role of RA in Dam Safety & Owner's Business

EXISTING DAM SAFETY
INFORMATION
FLOWS

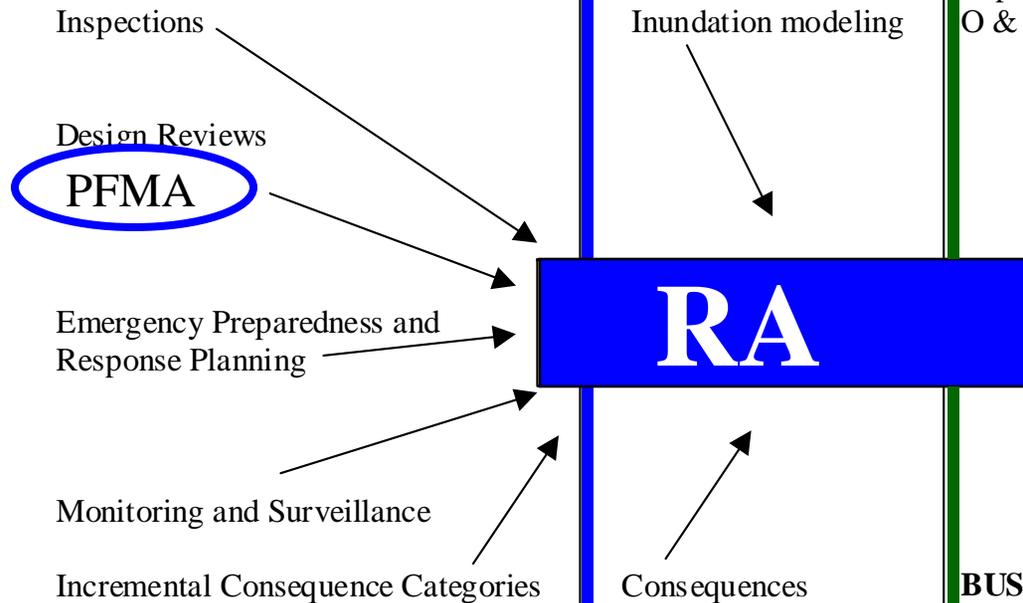
ADDITIONAL
INFORMATION
NEEDS

BUSINESS RISK
INFORMATION
NEEDS
(THE TARGET)

Engineering Inputs

Consequences Inputs

1) Dam Safety Program



DAM SAFETY:

Monitoring and surveillance,
EPRP,
Assessment Program
Improvement Program
O & M Program

Outcome Targeting

BUSINESS PROCESSES:

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

Integration Role of RA in Dam Safety & Owner's Business

EXISTING DAM SAFETY
INFORMATION
FLOWS

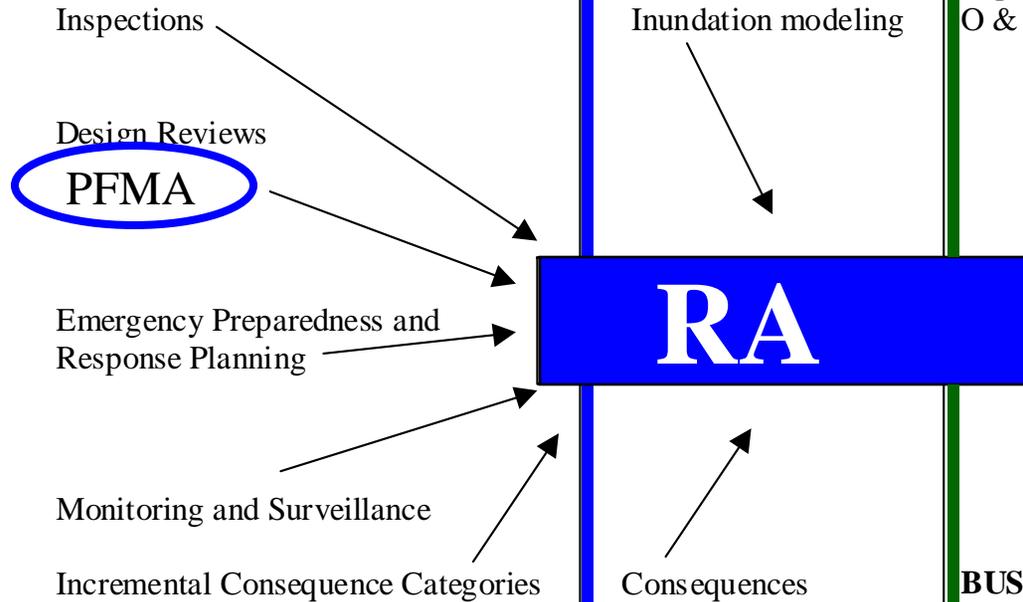
ADDITIONAL
INFORMATION
NEEDS

BUSINESS RISK
INFORMATION
NEEDS
(THE TARGET)

Engineering Inputs

Consequences Inputs

1) Dam Safety Program



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

Outcome Targeting

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 obligation,
Public relations and
consultation,
Etc.

2) Business Processes

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

E-mail:

David.Bowles@usu.edu

Home Page

(including links to selected papers):

**[http://www.engineering.usu.edu
/uwrl/www/faculty/bowles.html](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

PFMA and Risk Assessment

Panel Members: David Scott, BC Hydro
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