

RISK MANAGEMENT GUIDELINES, PRIORITIZATION, AND PROCESS

Modified Extract of a Presentation by –

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Event –

DRBC WCAC Meeting

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US Army Corps of Engineers
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**Unacceptable
Region**

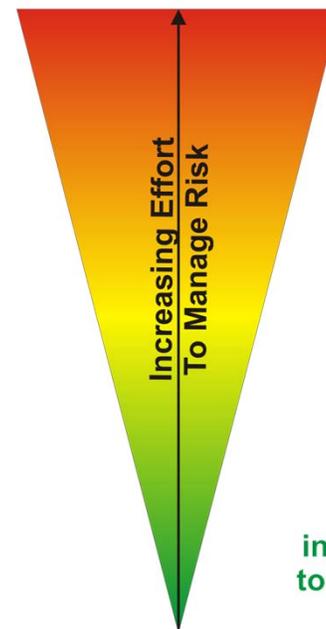
**Risks cannot be
justified except in
extraordinary
circumstances**

**Tolerable/
Intolerable
Region**

**People and society are
prepared to accept risk
in order to secure
benefits**

**Broadly
Acceptable
Region**

**Risk regarded as
insignificant, further effort
to reduce risk not required
unless easily achieved**



PHILOSOPHY AND GUIDING PRINCIPLES



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Dam Safety Risk Management

Decision-Making

Risk Assessment

Decision Recommendation

Risk Analysis

Failure Modes
Identification
(PFMA)

Risk
Estimation

Risk
Evaluation

Risk Control

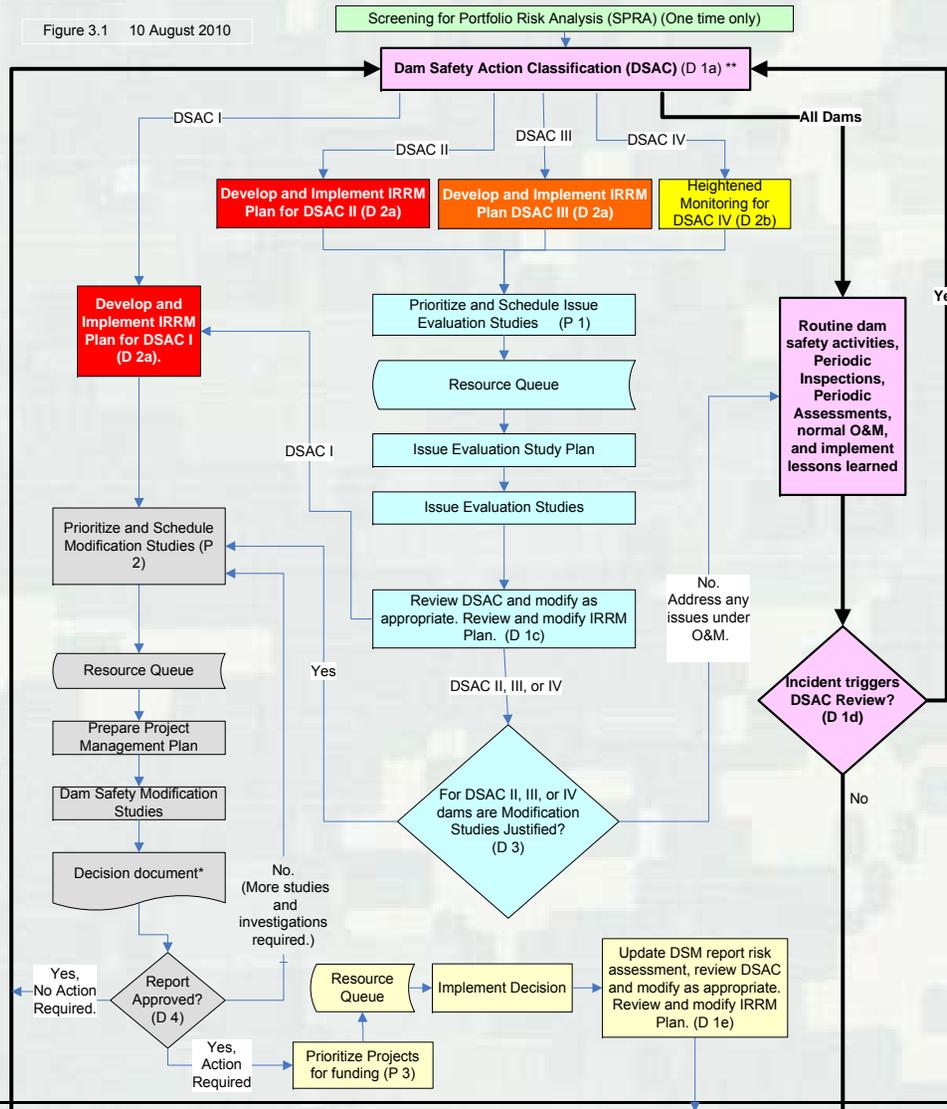
Risk
Reduction
Measures

Recurring
Activities

Periodic
Re-Assessment

USACE Dam Safety Risk Assessment Process

Figure 3.1 10 August 2010



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Tolerable Risk Framework

Unacceptable
Region

Risks cannot be
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circumstances

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Intolerable
Region

People and society are
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Broadly
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to reduce risk not required
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Increasing Effort
To Manage Risk



DEFINITIONS



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Definitions

- Individual Risk
- Societal Risk



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Individual Risk

Individual risk is the probability of harm to individuals and the things they value. This risk is associated with the most exposed individual who is placed in some fixed relation to a hazard such as a dam. Individual risk is the sum of the risks from all failure modes associated with the hazards that affect that person. These risks are often assessed in relation to a hypothetical person. There will often be more than one hypothetical person created for a particular hazard to ensure that all population exposed to risk are included in assessments and to account for transient population at risk. (HSE and ANCOLD)



Societal Risk

Societal risks are the probability of adverse consequences from hazards that impact on society as a whole and create a socio-political response because multiple fatalities occur in one event. Society is increasingly averse to hazards as the scale of the consequences increase. This is commonly shown on an F-N diagram as a line with a negative slope in relation to the frequency of the event or cumulative frequency of events.

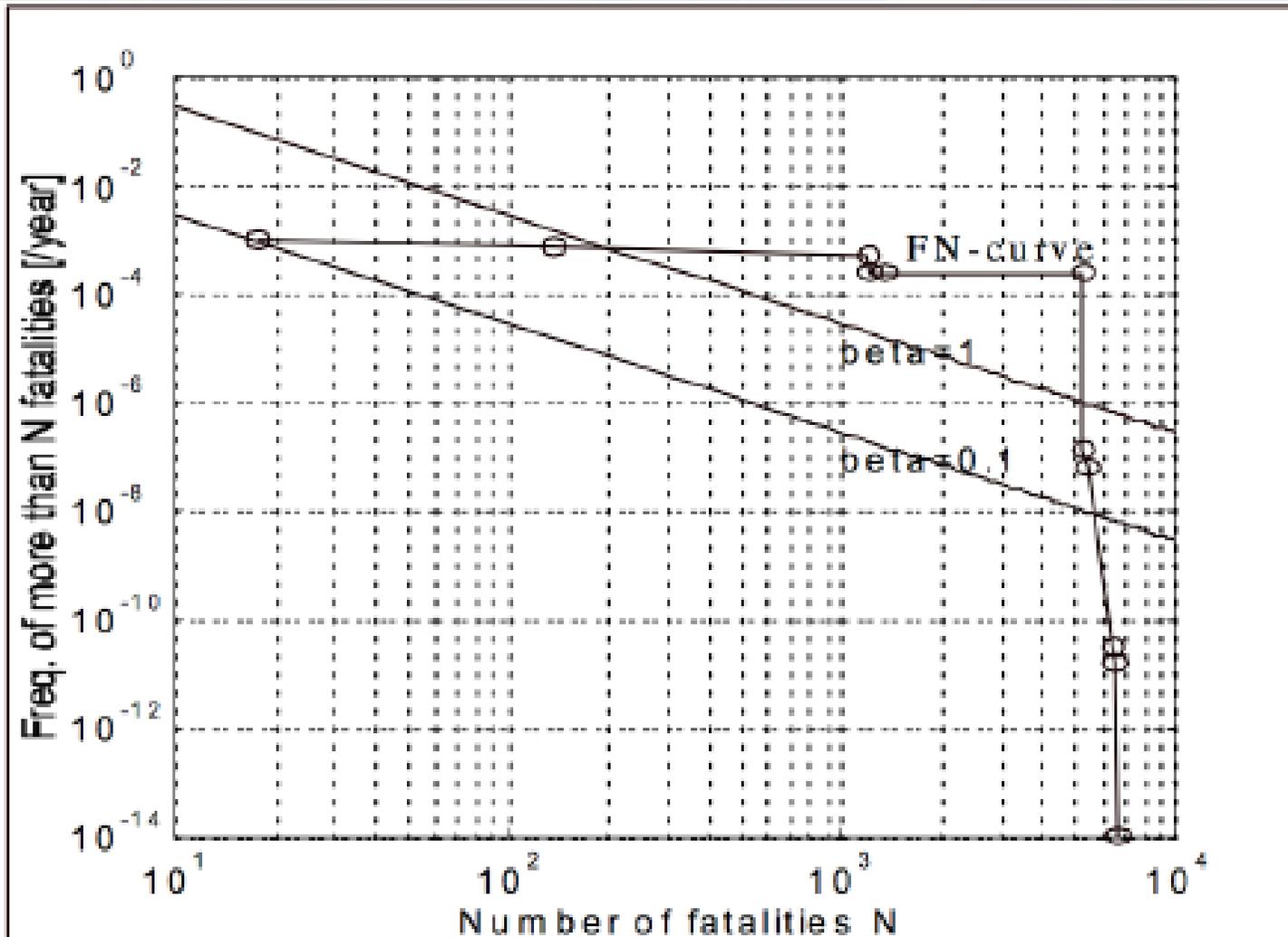


Societal Risk (continued)

- Attributes of hazards that give rise to societal concerns (ANCOLD):
 - ▶ Severity not controllable
 - ▶ Catastrophic
 - ▶ Difficult to control
 - ▶ Certain to be fatal
 - ▶ Risks and benefits inequitable
 - ▶ Threatens future generations
 - ▶ Not easily reduced
 - ▶ Involuntary
 - ▶ Affects them personally
 - ▶ Risk getting worse



F-N Chart



Why Tolerable Risk?

- Support risk informed dam safety program
- Identify, justify, and prioritize decisions
- Communicate risk to stakeholders
- Understand risk in an environment of shared flood risk management responsibilities
- Make better decisions

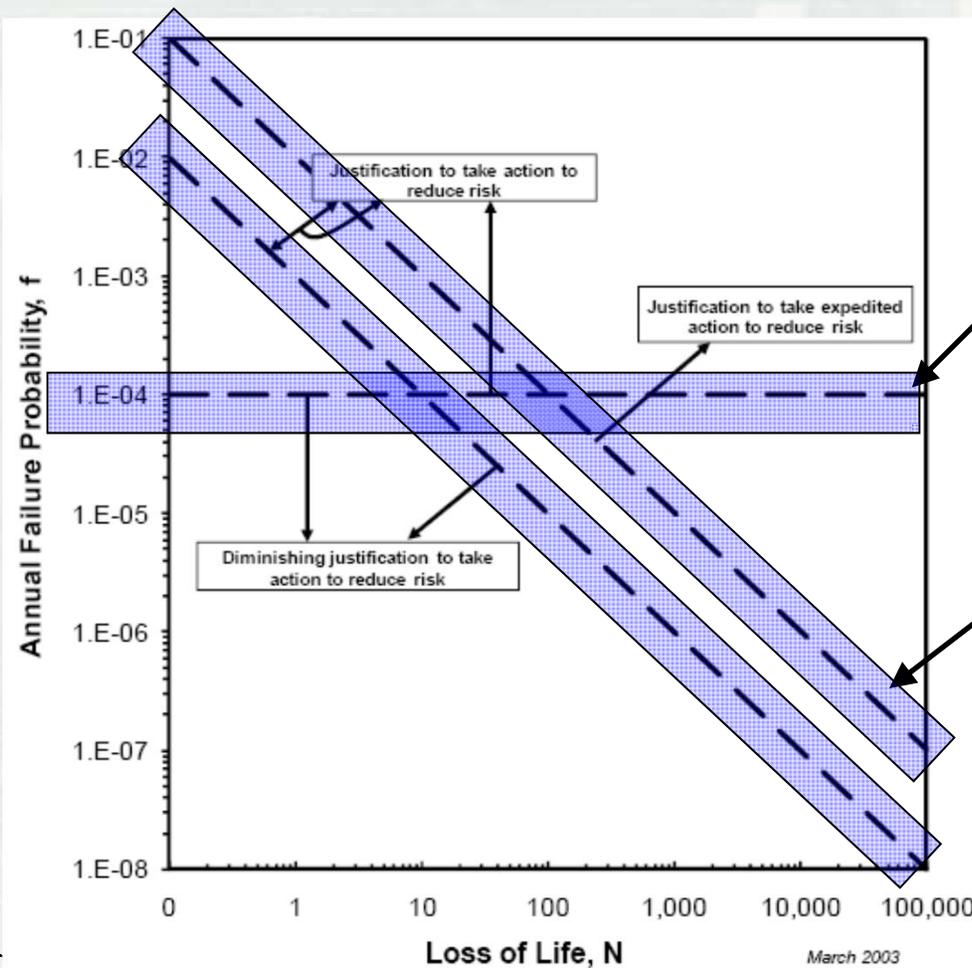


TOLERABLE RISK GUIDELINES



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Tolerable Risk Guidelines



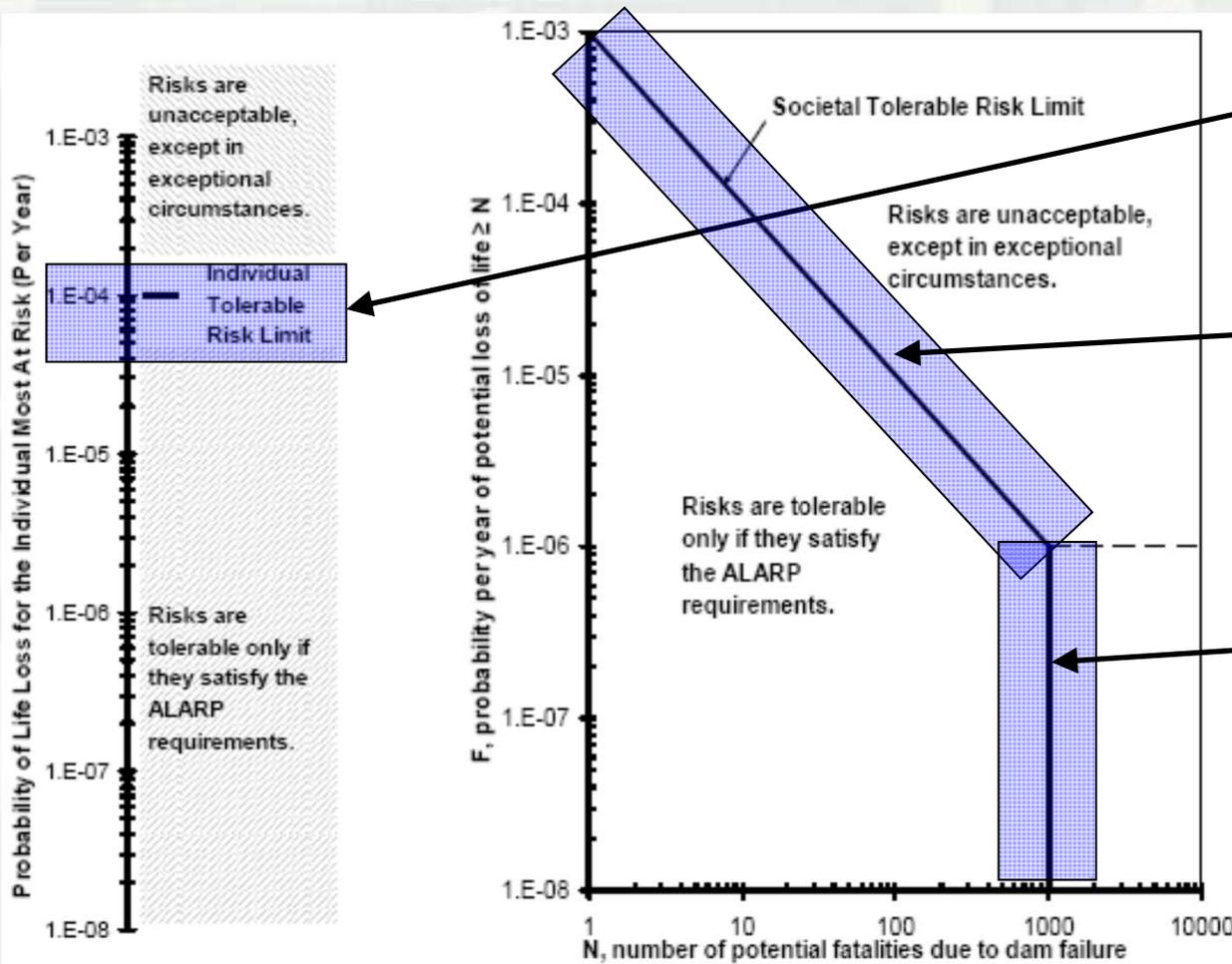
Performance (Annual Probability of Failure) and Individual Life Safety

Societal Life Safety (Annual Life Loss)



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Tolerable Risk Guidelines



**Individual Life Safety
(Probability of Life Loss)**

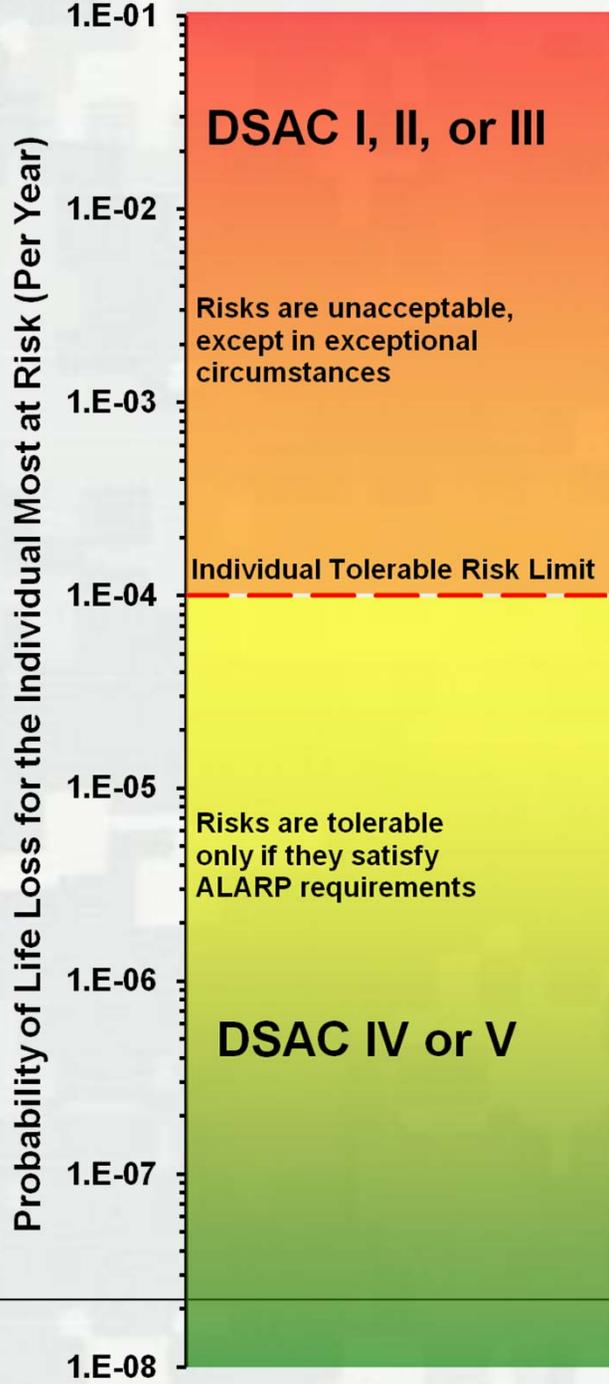
**Societal Life Safety
(Probability Distribution
of Life Loss)**

**Special Consideration
for High Consequence
Projects (Life Loss >
1000)**



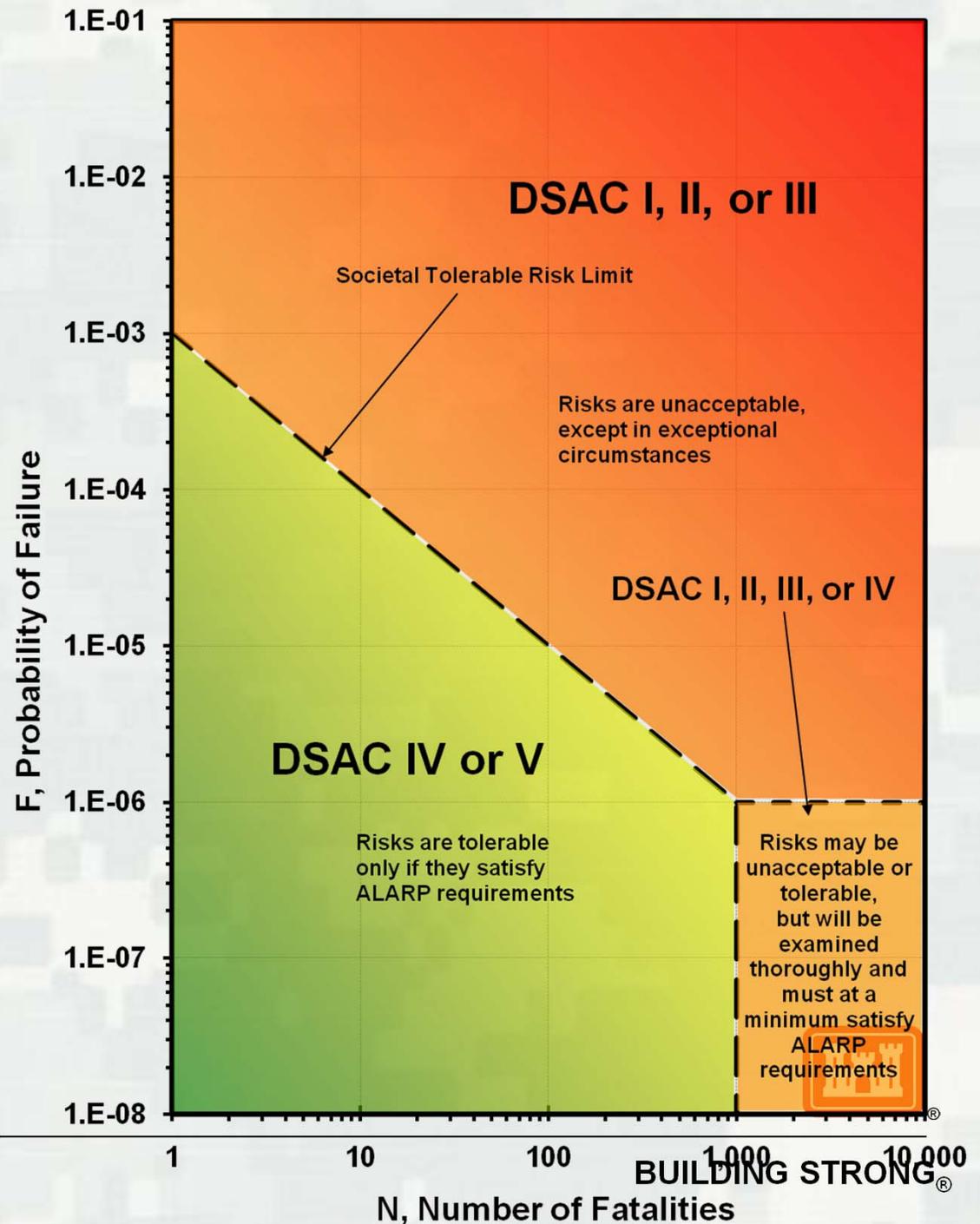
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Individual Risk Chart



Societal Tolerable Risk Chart

- Origin of the sloped tolerable risk threshold – Nuclear Power Industry (risk aversion)
- Origin of the horizontal “hook” – ANCOLD / NSW
- Origin of the vertical limit – NSW
- Origin of the urgency – Reclamation
- Extensive use in other field and countries



Tolerable Risk Guidelines

- The present guidelines have been kept as simple as possible and so exceptions should be identified and handled appropriately.
- Neither societal risk nor individual risk are more important, both must be calculated, **either** can be used to justify a DSAC rating, **both** will be used to prioritize activities



Snorteland Version

DSAC CHART AND TOLERABLE RISK GUIDELINE INTERPRETATION



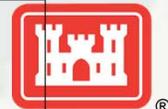
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DSAC Chart Interpretation

Table 2.1 USACE Dam Safety Action Classification Table*

Dam Safety Action Class	Characteristics of this class	Actions for dams in this class
I URGENT AND COMPELLING (Unsafe)	<p>CRITICALLY NEAR FAILURE Progression toward failure is confirmed to be taking place under normal operations. Almost certain to fail under normal operations from immediately to within a few years without intervention.</p> <p>OR EXTREMELY HIGH RISK Combination of life or economic consequences with probability of failure is extremely high.</p>	<p>Take immediate action to avoid failure. Validate classification through an external peer review. Implement interim risk reduction measures, including operational restrictions, and ensure that emergency action plan is current and functionally tested for initiating event. Conduct heightened monitoring and evaluation. Expedite investigations to support justification for remediation using all resources and funding necessary. Initiate intensive management and situation reports.</p>
II URGENT (Unsafe or Potentially Unsafe)	<p>FAILURE INITIATION FORESEEN For confirmed (unsafe) and unconfirmed (potentially unsafe) dam safety issues, failure could begin during normal operations or be initiated as the consequence of an event. The likelihood of failure from one of these occurrences, prior to remediation, is too high to assure public safety.</p> <p>OR VERY HIGH RISK The combination of life or economic consequences with probability of failure is very high.</p>	<p>Implement interim risk reduction measures, including operational restrictions as justified, and ensure that emergency action plan is current, and functionally tested for initiating event. Conduct heightened monitoring and evaluation. Expedite confirmation of classification. Give very high priority for investigations to support justification for remediation.</p>
III HIGH PRIORITY (Conditionally Unsafe)	<p>SIGNIFICANTLY INADEQUATE OR MODERATE TO HIGH RISK For confirmed and unconfirmed dam safety issues, the combination of life or economic consequences with probability of failure is moderate to high.</p>	<p>Implement interim risk reduction measures, including operational restrictions as justified, and ensure that emergency action plan is current and functionally tested for initiating event. Conduct heightened monitoring and evaluation. Prioritize for investigations to support justification for remediation considering consequences and other factors.</p>
IV PRIORITY (Marginally Safe)	<p>INADEQUATE WITH LOW RISK For confirmed and unconfirmed dam safety issues, the combination of life or economic consequences with probability of failure is low and may not meet all essential USACE guidelines.</p>	<p>Conduct elevated monitoring and evaluation. Give normal priority to investigations to validate classification, but no plan for risk reduction measures at this time.</p>
V NORMAL (Safe)	<p>ADEQUATELY SAFE Dam is considered safe, meeting all essential USACE guidelines with no unconfirmed dam safety issues.</p> <p>AND RESIDUAL RISK IS CONSIDERED TOLERABLE.</p>	<p>Continue routine dam safety activities, normal operation, and maintenance.</p>

* At any time for specific events a dam, from any action class, can become an emergency requiring activation of the emergency plan



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DSAC Chart Interpretation

Table 2.1 USACE Dam Safety Action Classification Table*

Dam Safety Action Class	Characteristics of this class	Actions for dams in this class
I URGENT AND COMPELLING (Unsafe)	CRITICALLY NEAR FAILURE Progression toward failure is confirmed to be taking place under normal operations. Almost certain to fail under probability of failure is extremely high.	Take immediate action to avoid failure. Validate classification through an external peer review. Implement interim risk reduction measures, Expedite investigations to support justification for remediation using all resources and funding necessary. Initiate intensive management and situation reports.
II URGENT (Unsafe or Potentially Unsafe)	FAILURE INITIATION FORESEEN For confirmed (unsafe) and unconfirmed (potentially unsafe) dam safety issues, failure could begin during	Implement interim risk reduction measures, including operational restrictions as justified, and ensure that emergency action plan is current,
III HIGH PRIORITY (Conditionally Unsafe)	OR VERY HIGH RISK The combination of life or economic consequences with probability of failure is very high. SIGNIFICANTLY INADEQUATE OR MODERATE TO HIGH RISK For confirmed and unconfirmed dam safety issues, the combination of life or economic consequences and probability of failure is moderate to high.	for remediation. Implement interim risk reduction measures, including operational restrictions as justified, and ensure that emergency action plan is current and tested for initiating event. Continue monitoring and evaluation.
IV PRIORITY (Marginally Safe)	INADEQUATE WITH LOW RISK The combination of life or economic consequences and probability of failure is low.	Prioritize for investigations to support justification for remediation considering consequences and other factors. Conduct elevated monitoring and evaluation.
V NORMAL (Safe)	ADEQUATELY SAFE AND RESIDUAL RISK TOLERABLE. Dam is considered safe, in accordance with USACE guidelines with no uncorrected deficiencies.	Continue to conduct dam safety activities, including monitoring, operation, and maintenance.

Holy Cow! Will this dam be here next year?

Very, Very serious issues to be addressed ASAP

Everything else

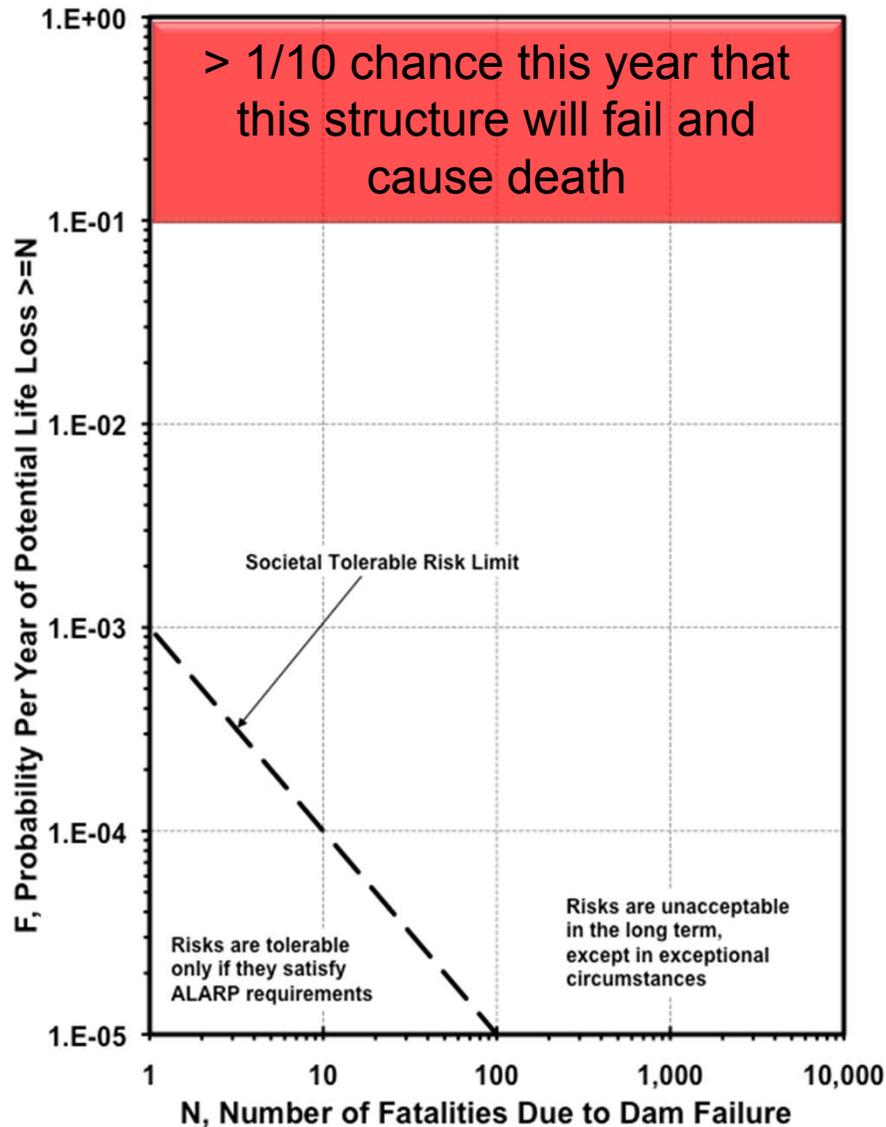
This dam is pretty good, not perfect, but good

Is this a dam?



* At any time for specific events a dam, from any action class, can become an emergency requiring activation of the emergency plan

Translating Societal Risks

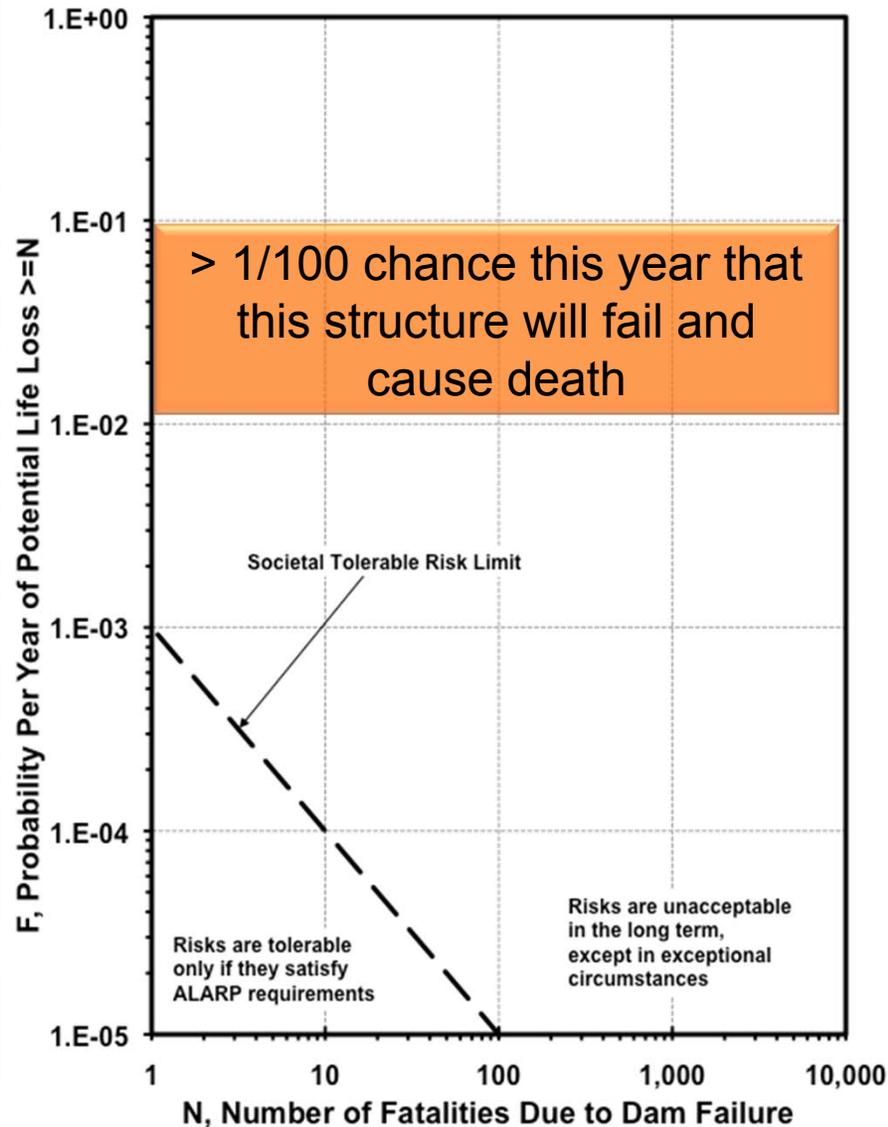


Very Strong Statement!
Allowing for uncertainty, failure is virtually certain **THIS YEAR** unless intervention is taken immediately.



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Translating Societal Risks

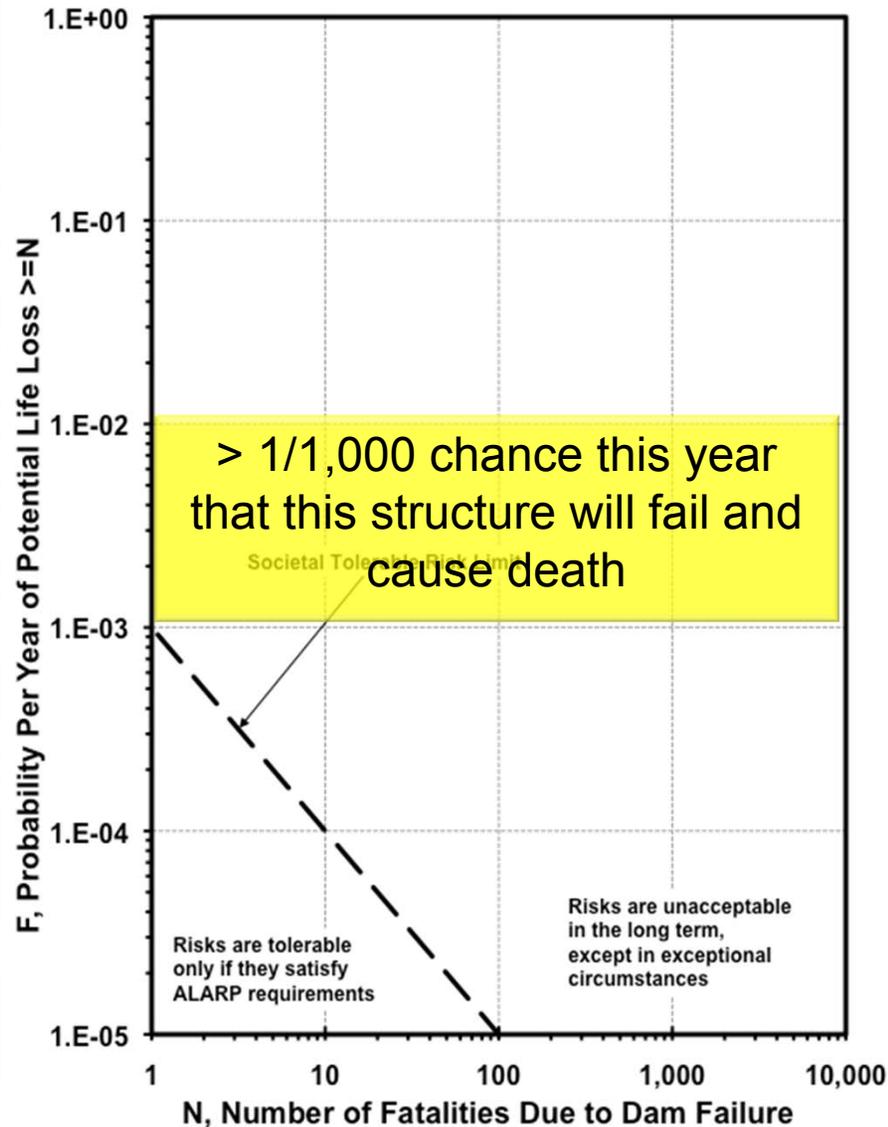


Strong Statement. If the structure is a flood control facility, this means it is providing zero benefits for the 1% event, and may in fact be increasing consequences for that event – difficult to make the case for risk tradeoffs (severe reservoir restriction)



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Translating Societal Risks



Likelihood of failure is more than 10 times higher than the average dam in the U.S. This includes all of the high, significant and low hazard structures built by everyone.



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What in the world do we do with all that?

DECISION MAKING



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Decisions

- Four Basic Pieces of Information
 - ▶ Risk Estimate
 - ▶ Estimated Range of Uncertainty
 - ▶ Case to Support Risk Estimate
 - ▶ Recommended Course of Action
- Strategy
 - ▶ Use the risk estimate in relation to the tolerable risk guidelines and the safety case to support rational consistent decisions



PRIORITIZATION



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Goal of Prioritization

Allocate limited resources on a national basis to reduce overall portfolio risk as quickly and efficiently as possible.



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Questions?



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