CEE Special Symposium

A Discussion on the Tolerability of Critical Infrastructure Risks

A Regulatory Perspective

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Federal Energy Regulatory Commission (FERC)

- Regulates the transmission and wholesale sales of electricity in interstate commerce;
- Reviews certain mergers and acquisitions and corporate transactions by electricity companies;
- Regulates the transmission and sale of natural gas for resale in interstate commerce;
- Regulates the transportation of oil by pipeline in interstate commerce;
- Approves the siting and abandonment of interstate natural gas pipelines and storage facilities;
- Reviews the siting application for electric transmission projects under limited circumstances;
- Ensures the safe operation and reliability of proposed and operating LNG terminals;
- Protects the reliability of the high voltage interstate transmission system through mandatory reliability standards;
- Monitors and investigates energy markets;
- Enforces FERC regulatory requirements through imposition of civil penalties and other means;
- Oversees environmental matters related to natural gas and hydroelectricity projects and other matters; and
- Administers accounting and financial reporting regulations and conduct of regulated companies.

Federal Energy Regulatory Commission (FERC)

Licenses and inspects private, municipal, and state hydroelectric projects;

Division of Dam Safety and Inspections (D2SI)

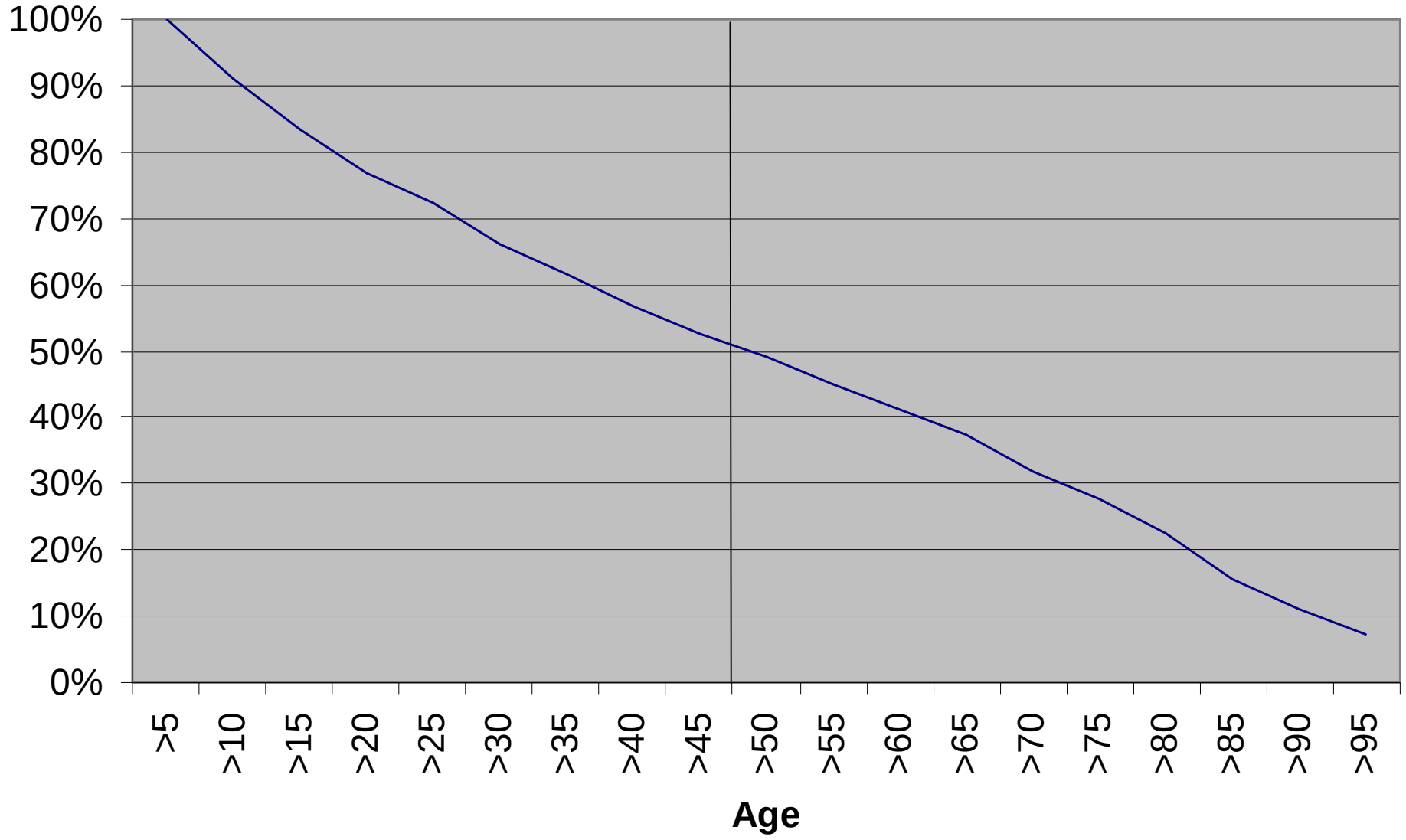
D2SI

In essence, D2SI's role is to be the voice of society in assuring that the people who live below dams are not exposed to intolerable levels of risk

Southfork 1889 - 2,200 deaths

Ka Loko 2010 - 7 deaths

% of Incidents that Occur at an Age Greater Than All Dams that Survive their 1st Five Years



Historical Methodology for Assessing the Safety of Dams

- Deterministic Guidelines (Factors of Safety)
- Three Loading Conditions
  - Static (Is the dam here today?)
  - Flood (Can the dam safely pass the “Probable Maximum Flood?”)
  - Seismic (Will the dam survive the “Maximum Credible Earthquake? ”)

Historical Methodology for Assessing the Safety of Dams

- High Hazard
  - Dams assigned the high hazard potential classification are those where failure or mis-operation will probably cause loss of human life.
- Significant Hazard
  - dams where failure or mis-operation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns.

Historical Methodology for Assessing the Safety of Dams

- Low Hazard
  - failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

Teton Dam
Idaho
1976

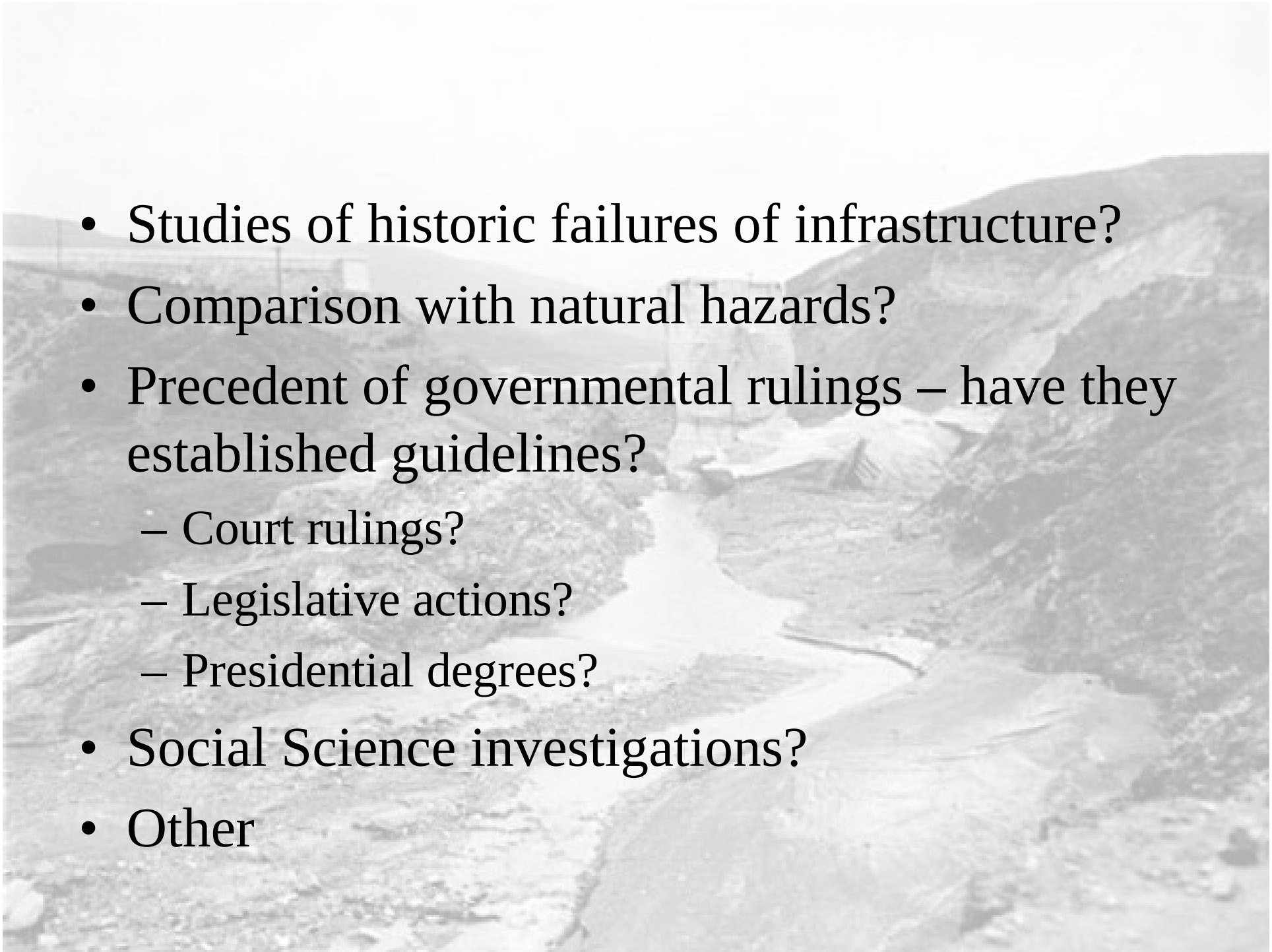
Risk Assessment of Dams

- Still 3 Basic Questions
  - What's the Probability of the Loading Condition?
  - What's the Probability the Dam will Fail Given the Loading Condition?
  - What are the Consequences (Lives, $, Environmental, etc) if the Dam Fails

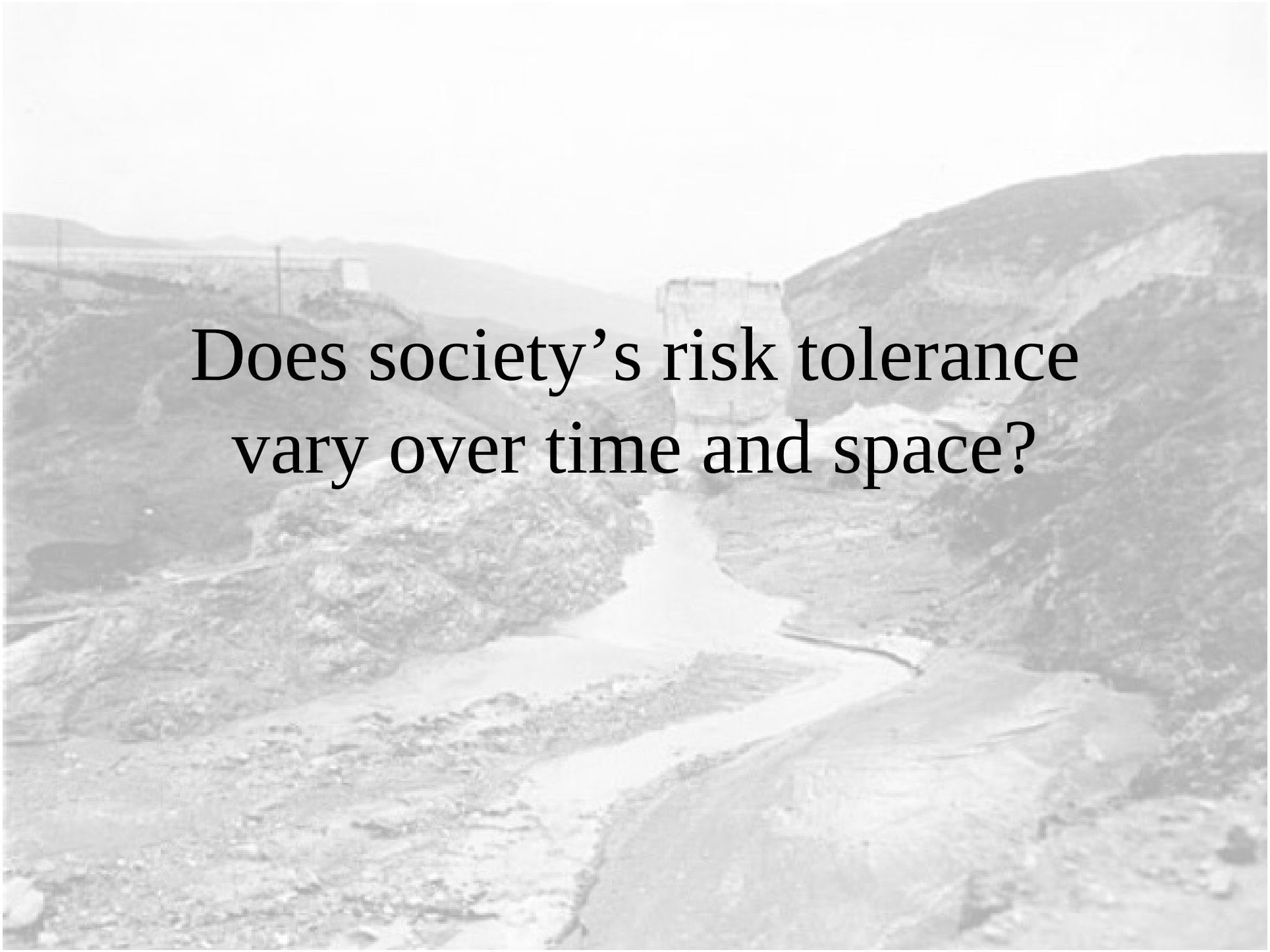

How Safe is Safe Enough?

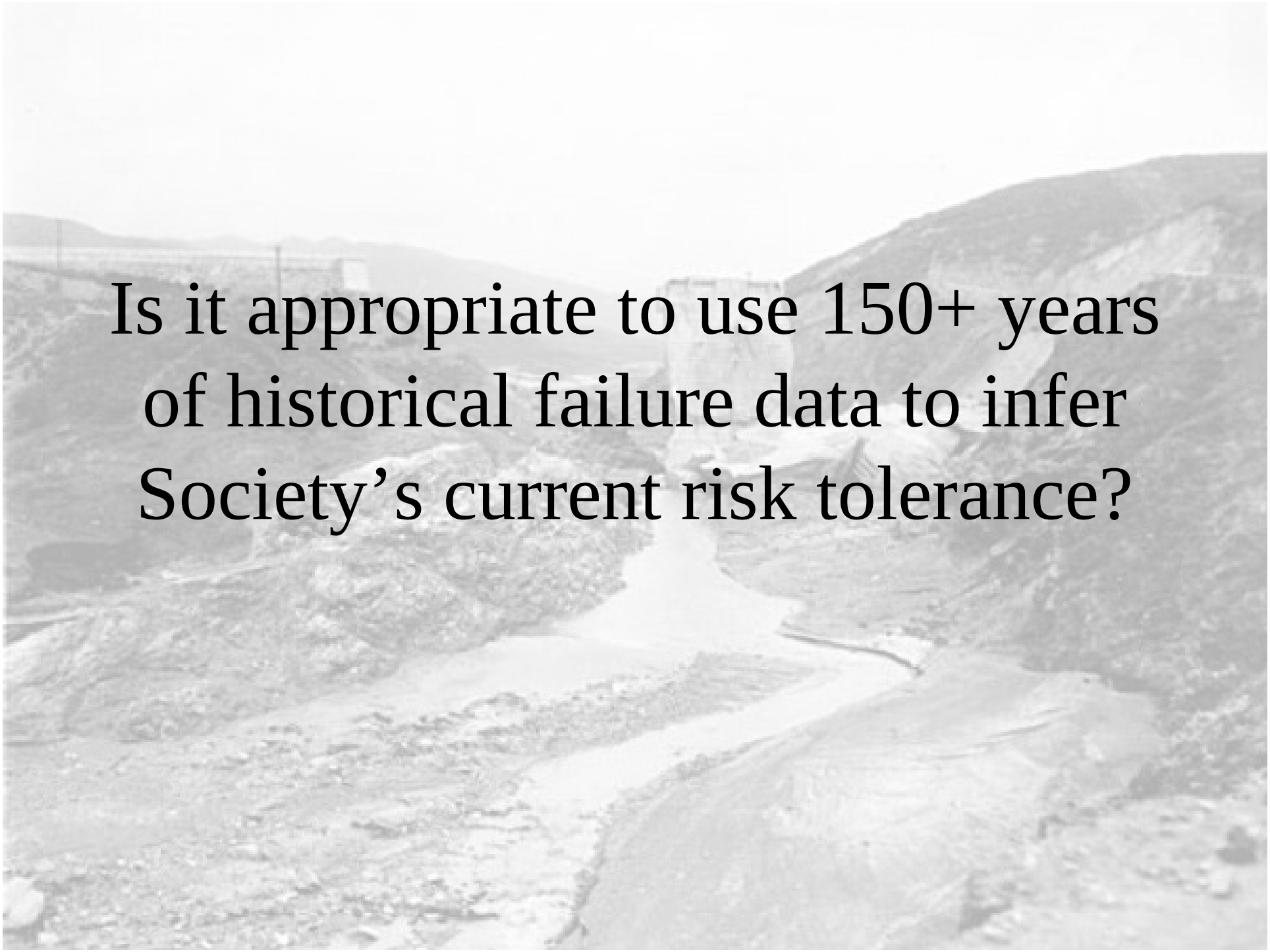

Questions We Are
Grappling With

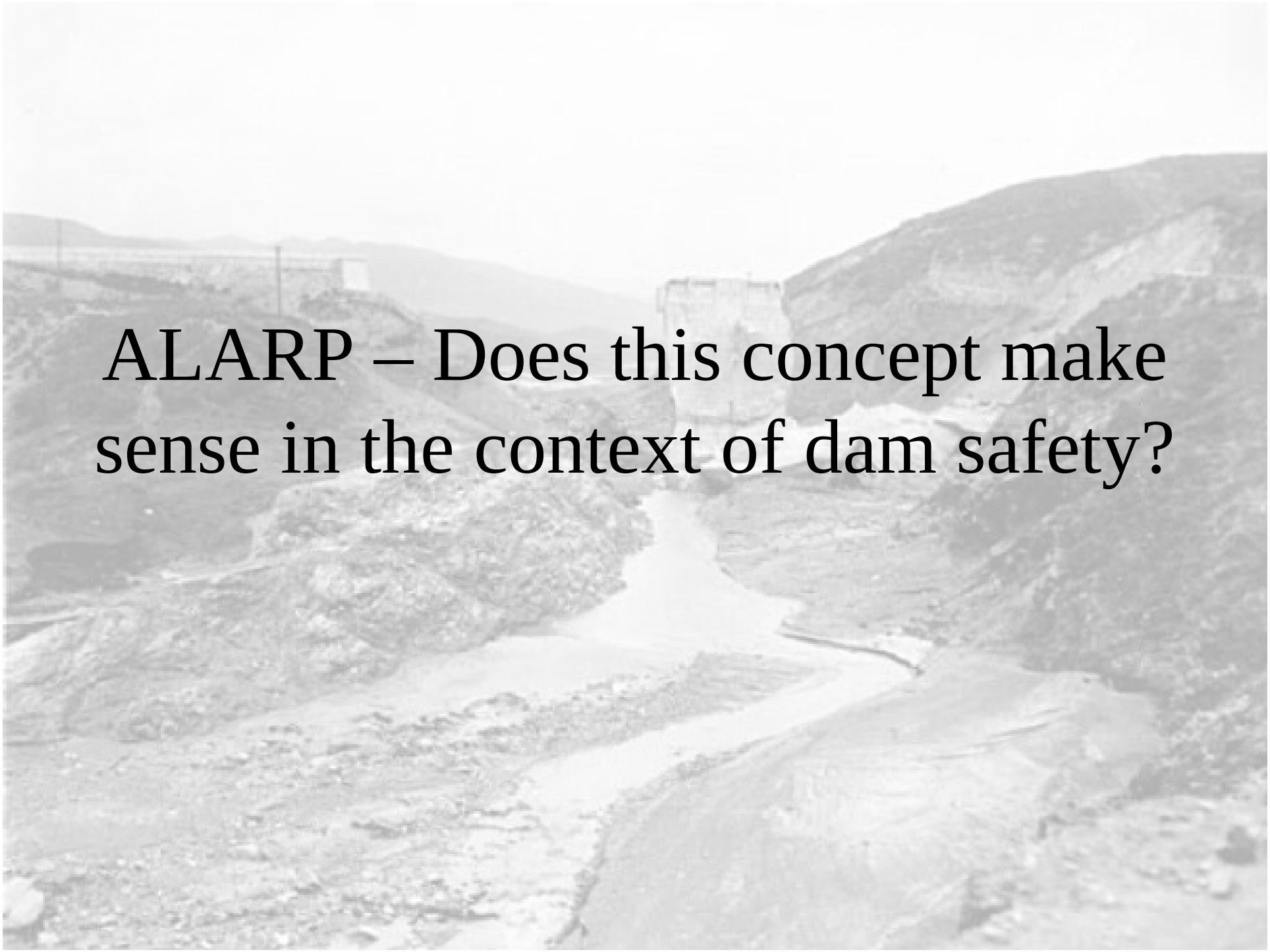

How can we gage society's
tolerance for risks associated with
critical infrastructure?



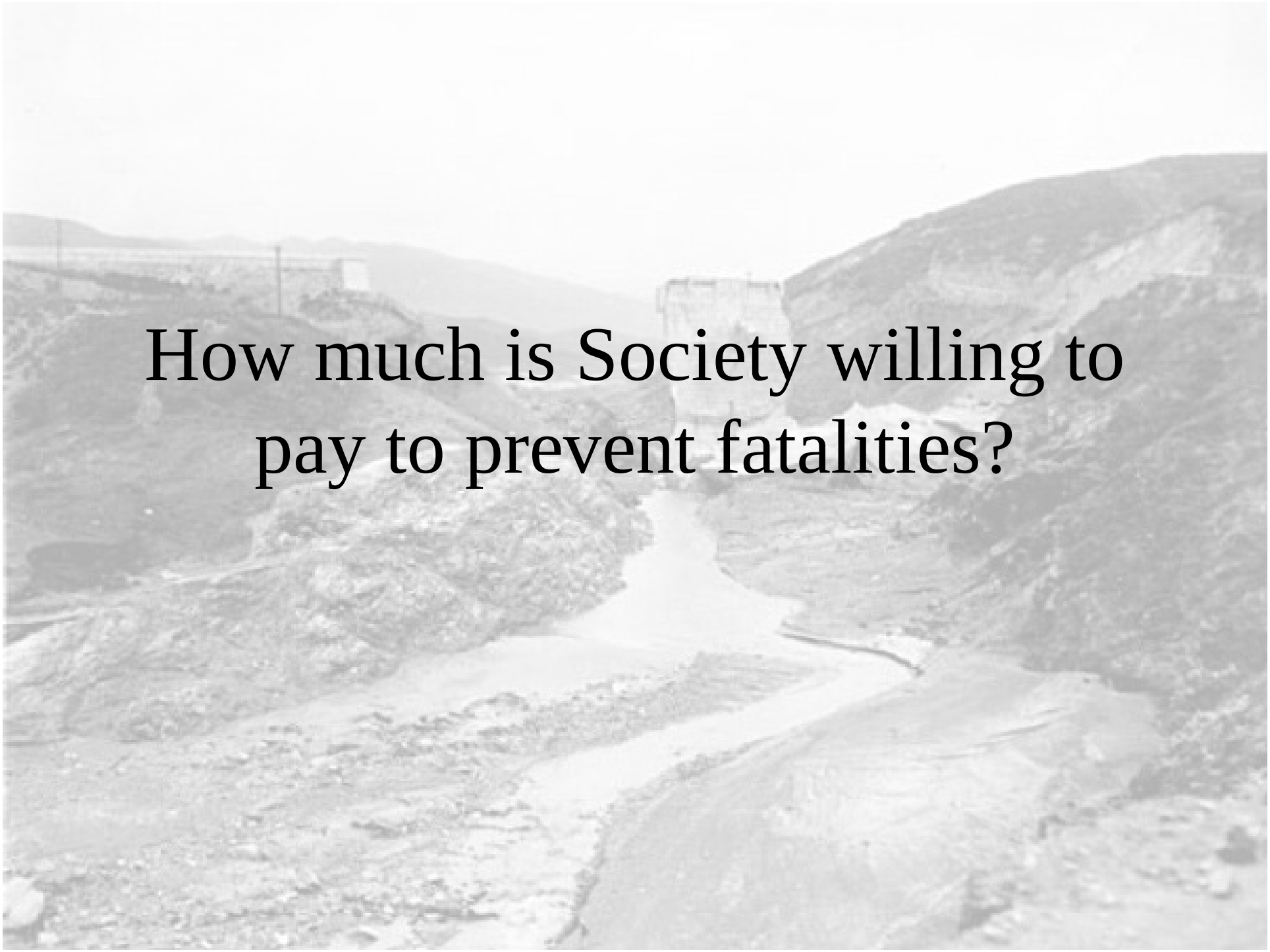
- Studies of historic failures of infrastructure?
- Comparison with natural hazards?
- Precedent of governmental rulings – have they established guidelines?
  - Court rulings?
  - Legislative actions?
  - Presidential degrees?
- Social Science investigations?
- Other

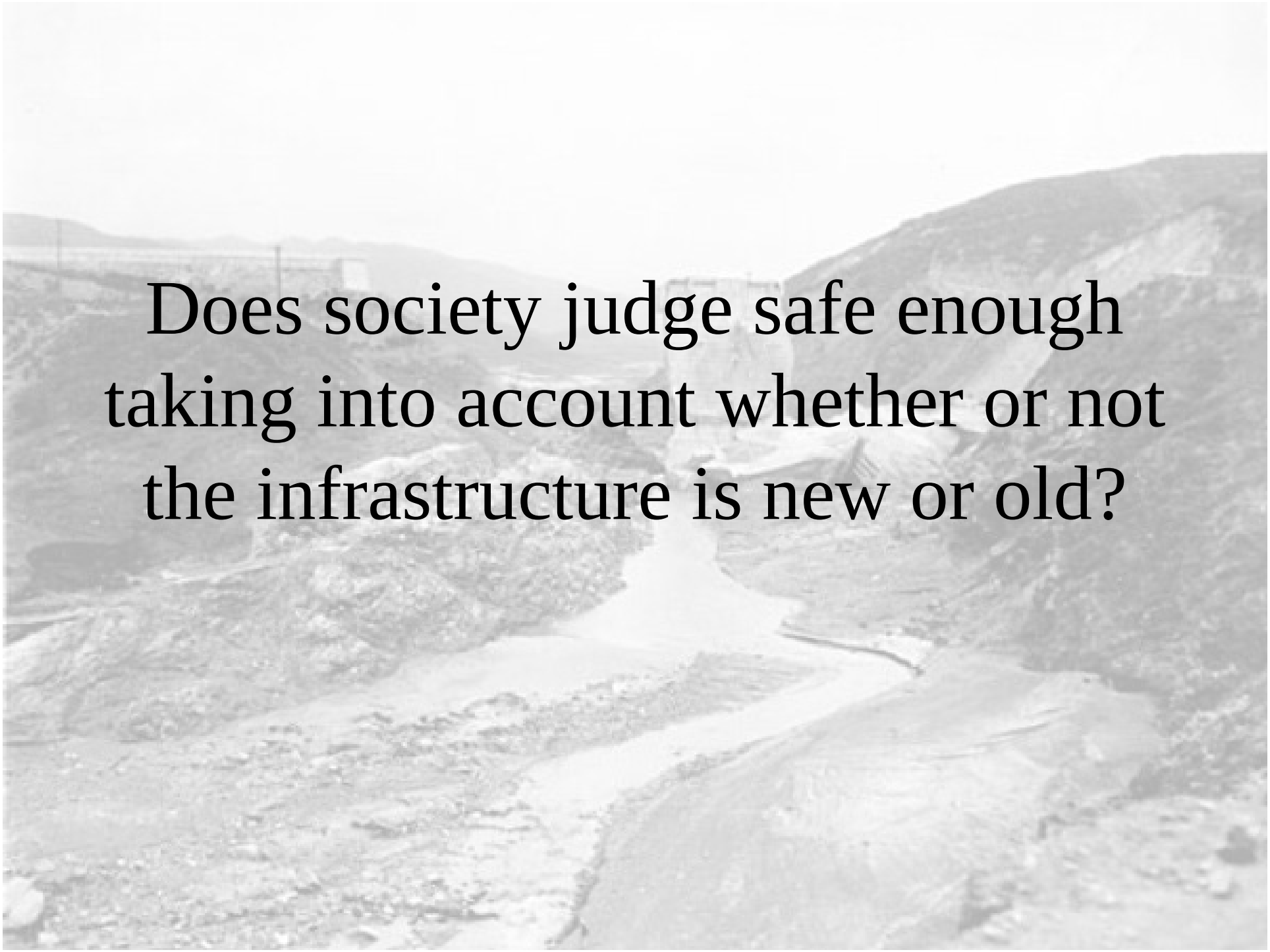

Does society’s risk tolerance
vary over time and space?


Is it appropriate to use 150+ years of historical failure data to infer Society's current risk tolerance?



ALARP – Does this concept make sense in the context of dam safety?


How much is Society willing to pay to prevent fatalities?


Does society judge safe enough taking into account whether or not the infrastructure is new or old?

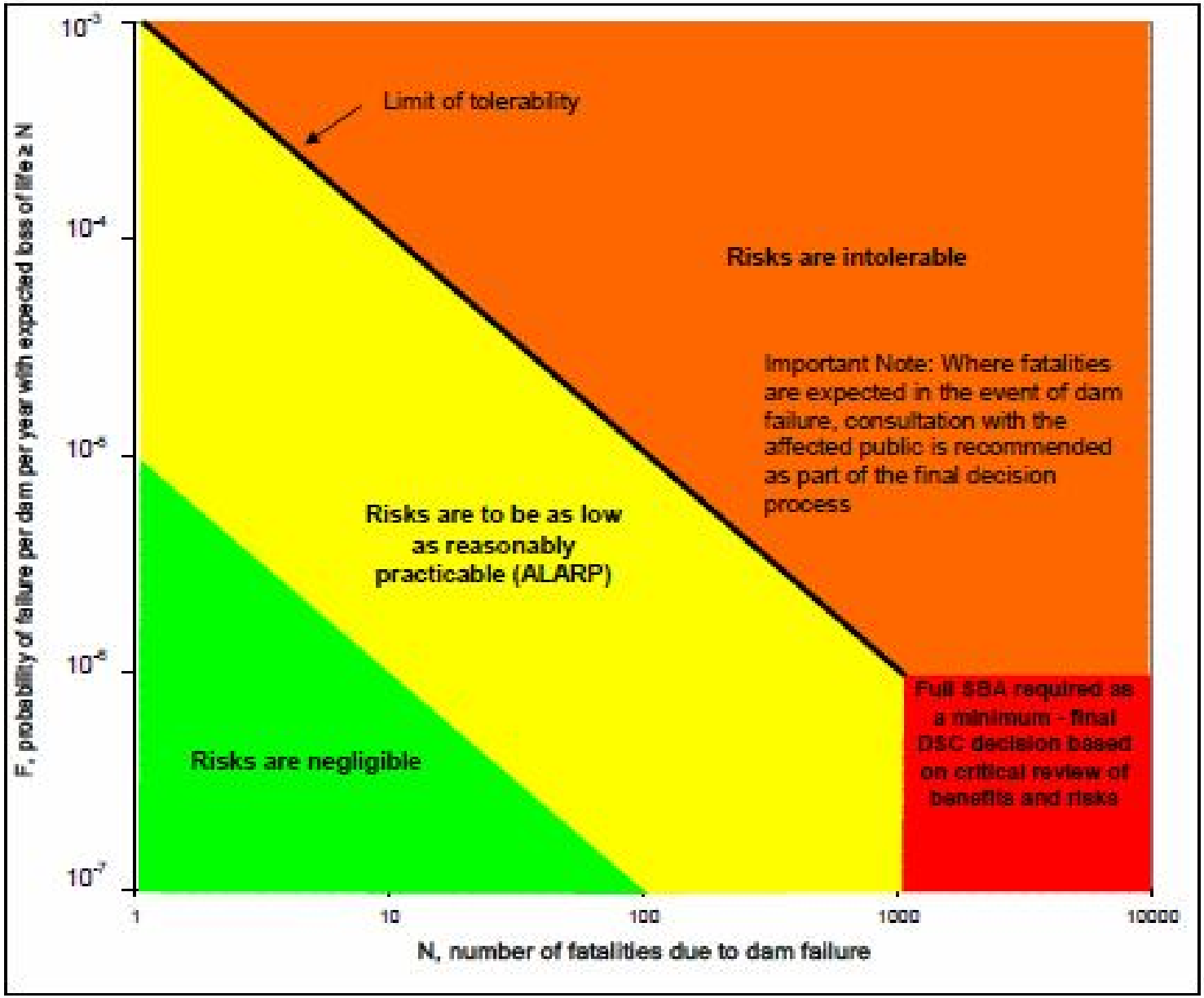


Figure 1 – Proposed DSC Societal Risk Requirements: Existing Dams

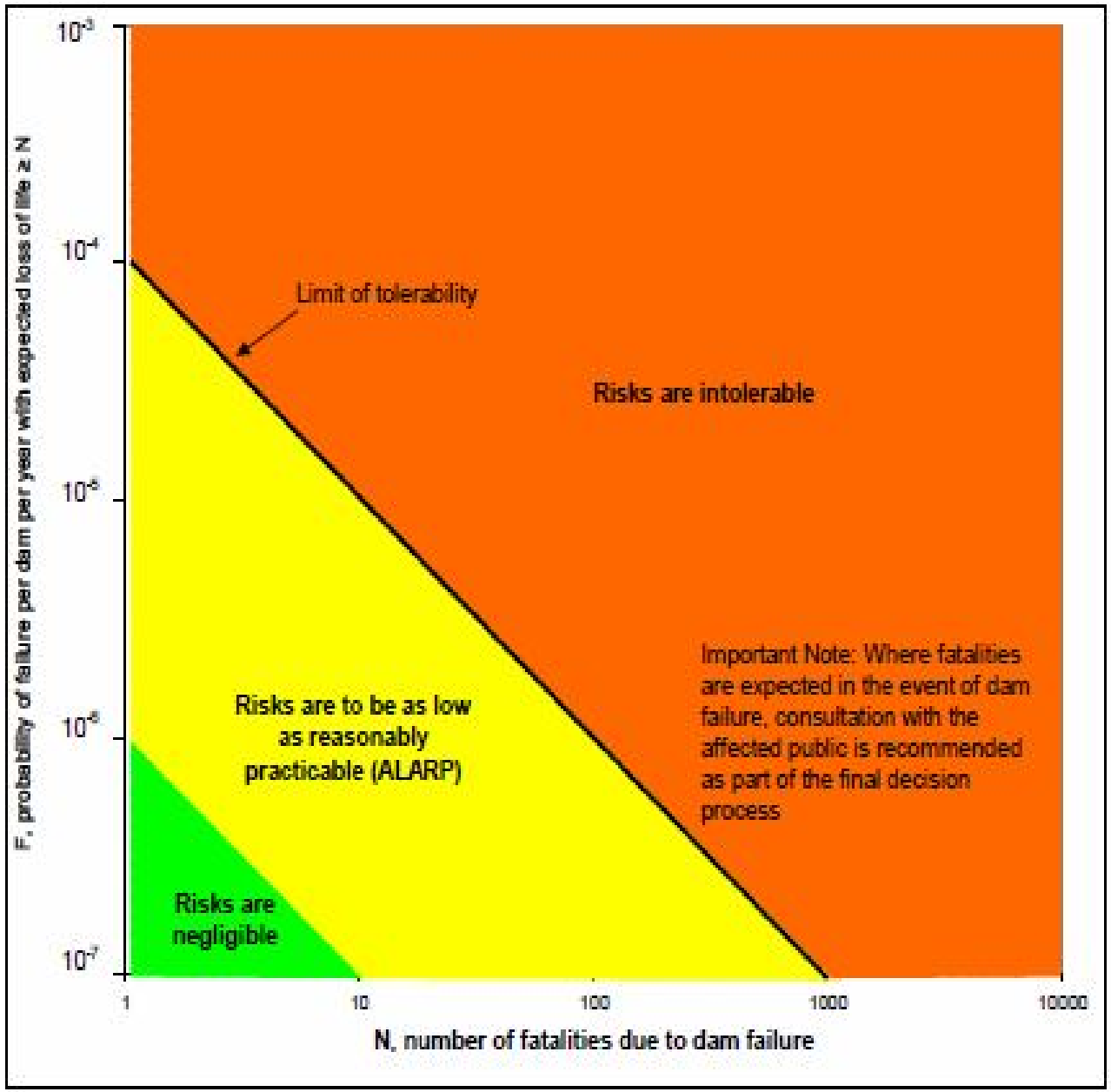
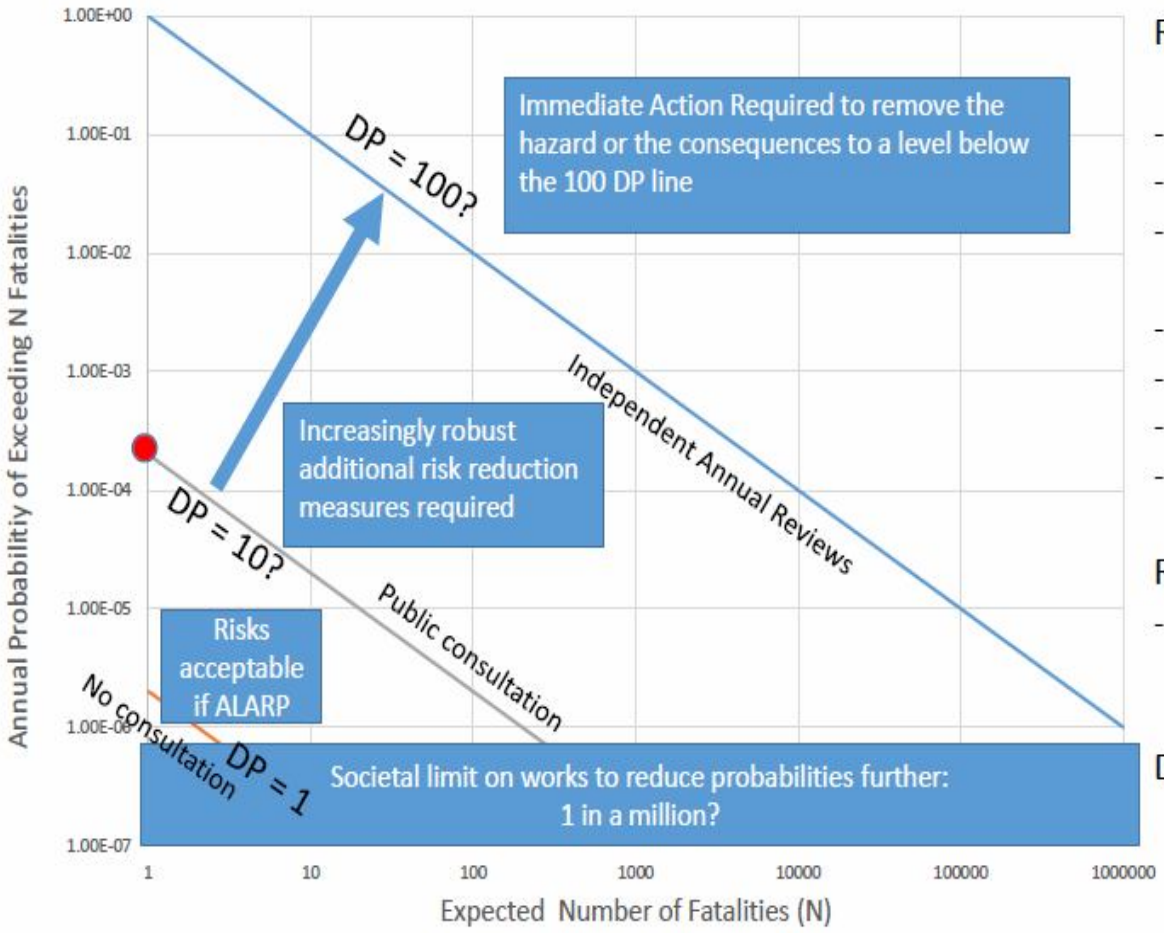


Figure 2 – Proposed DSC Societal Risk Requirements:
New Dams & Major Augmentations

April 28/14 Tolerable Risk Workshop
Toronto : OPG, FERC, BC Hydro
For Discussion



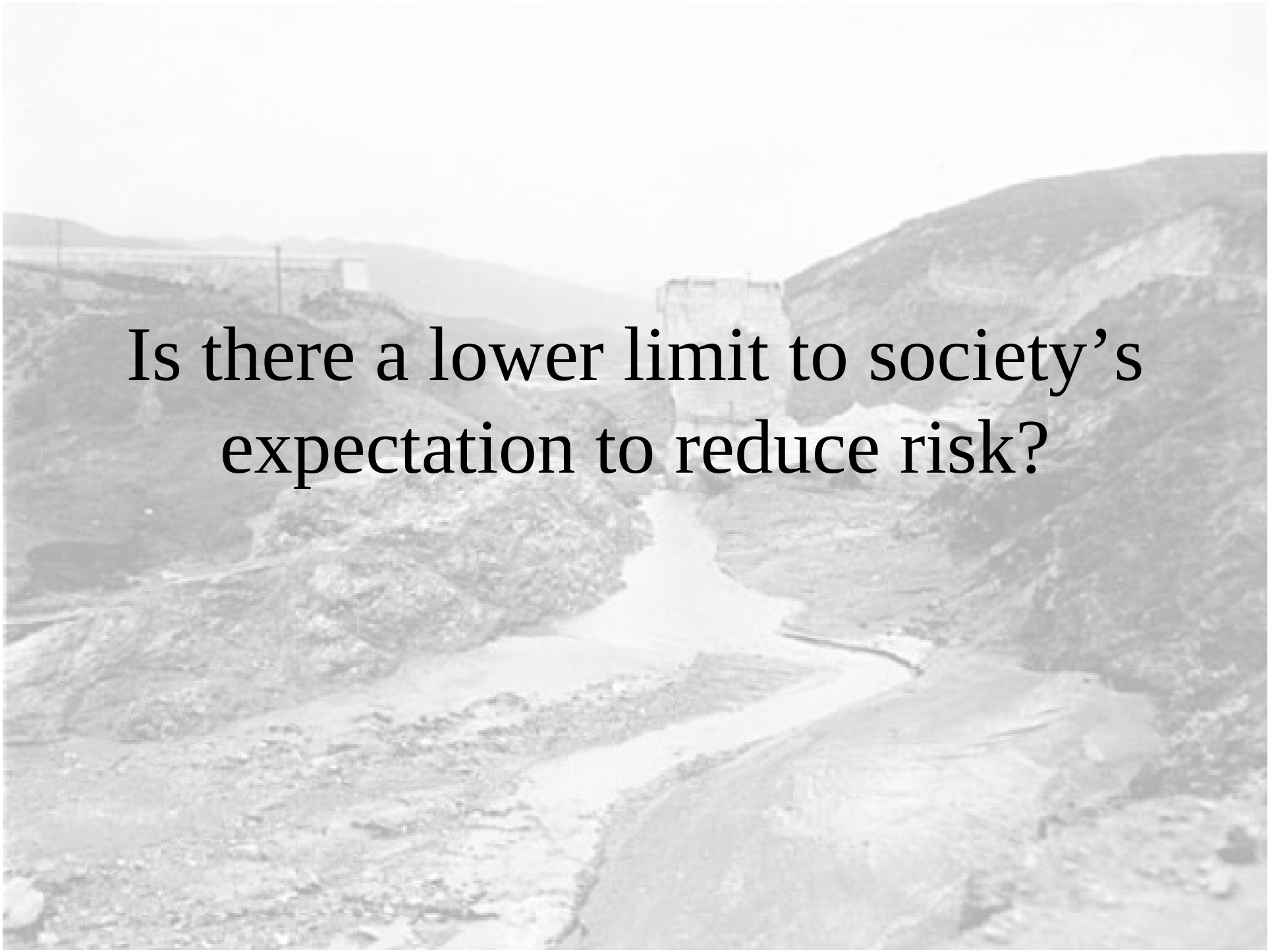
Required Justifications:

- Use of cumulative scale
- Slope of -1 line
- 1/10000 individual risk anchor point = 2x10-4
- 2 orders of magnitude lower for acceptable risk
- Immediate action line
- Values for disproportional lines
- Limit for probability reduction

Required Additions:

- Horizontal axes for financial and environmental

DP = disproportionality factor



Is there a lower limit to society's expectation to reduce risk?


Tolerable Risk for Whom?

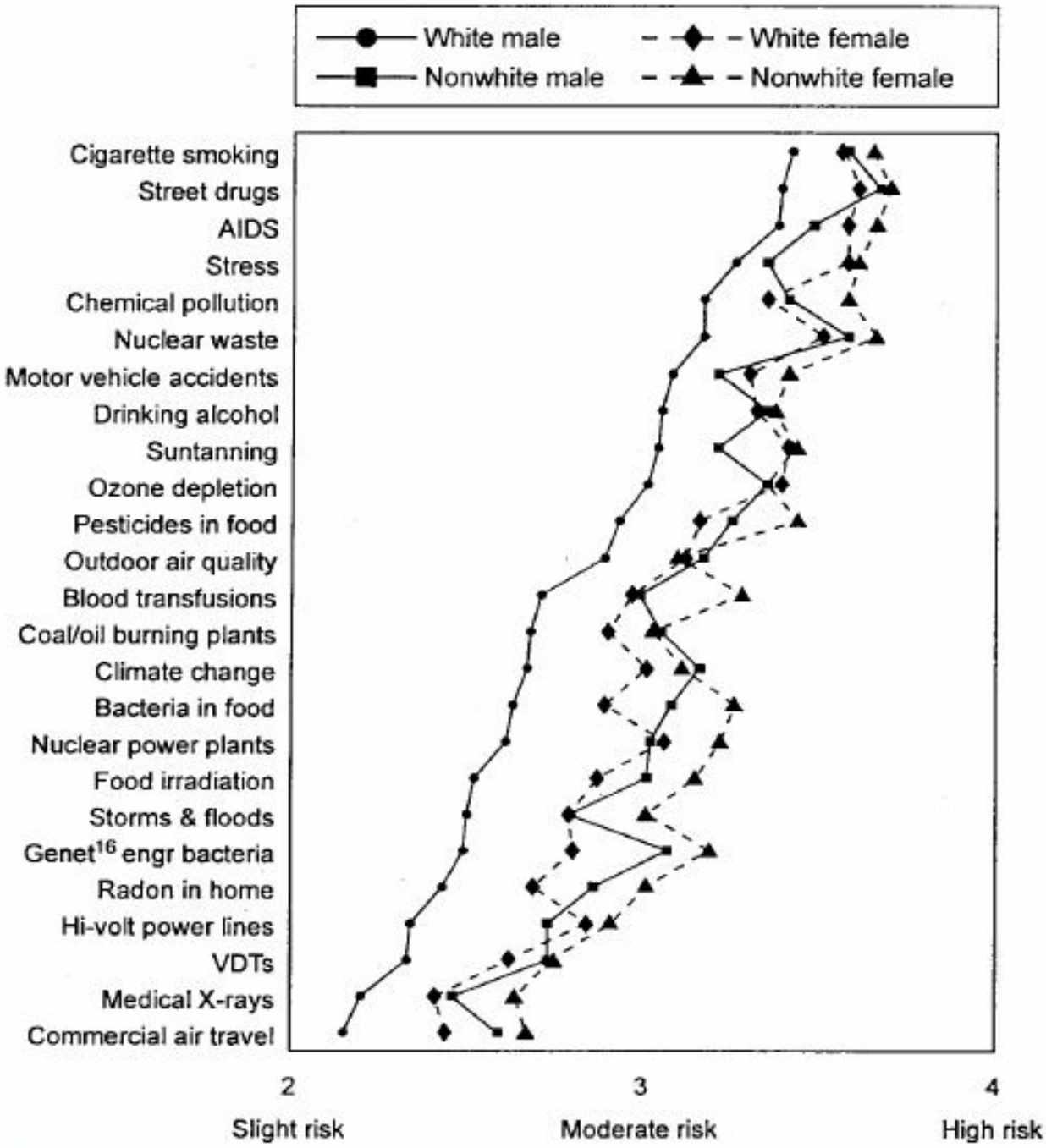
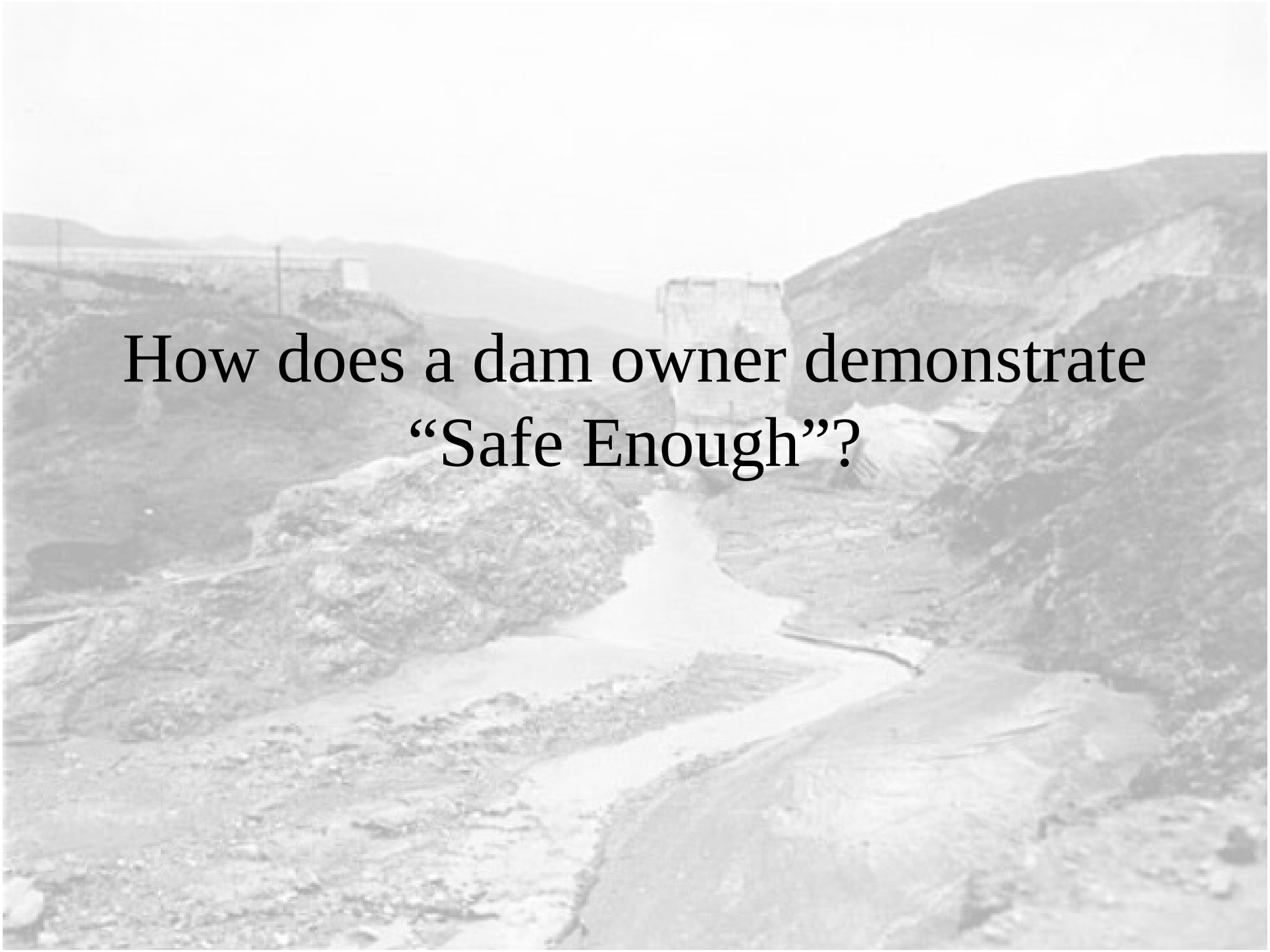


Figure 1. *Mean risk-perception ratings by race and gender. Source: Flynn et al. (1994). Reprinted with permission.*


My Crystal Ball



How does a dam owner demonstrate “Safe Enough”?