# A Few Perspectives on Risk…

David S. Kosson and Charles C. Powers

VANDERBILT
SCHOOL OF ENGINEERING

March 5, 2014

**Waste Management**
Phoenix, Arizona

# Acknowledgements

Important contributions to this perspective have been made by many CRESP team members, including

Craig Benson[6], Lisa Bliss[1], Kevin Brown[1], Joanna Burger[2], James Clarke[1], Michael Gochfeld[2], Michael Greenberg[2], Kathryn Higley[3], Steve Krahn[1], Shlomo Neuman[5], Jennifer Salisbury, Jane Stewart[4] and Richard Stewart[4]

[1]Vanderbilt University, [2]Rutgers, The State University of New Jersey,
[3]Oregon State University, [4]New York University,
[5]University of Arizona, [6]University of Wisconsin- Madison

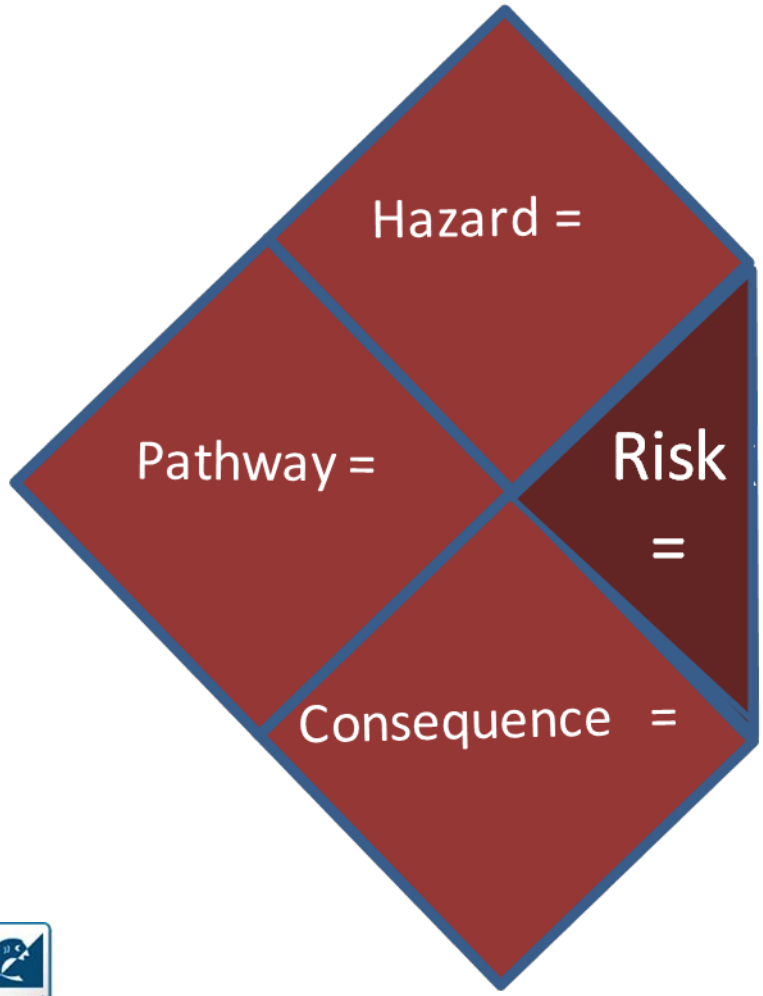
And many folks from multiple agencies, organizations, Tribal Nations and others.

# What is Risk?

- **Risk** is an estimate for probability and magnitude of consequences, considering a range of factors, events and uncertainties.
- **Human Health Risk** considers exposure, dose, toxicity and likelihood, applied to either individuals or populations
- **Risk perception** is complex integration of factual information, personal experience and trust.
- **Risk Management** is the set of actions (or inaction) taken to address risk and risk perception.


Chemical & Radiological
Physical Disruption
Biological Disruption
Sources (Hazard)
Initiating Events/ Processes & Pathways
= Risk Ratings
Consequence
Risks to Human Health & Impacts to Resources
Rated severity of risks to each set of receptors & resources
From Source to Receptor
factors affecting completion
(eg., blockage)
Adverse Receptor Effects
& Transfers – human, ecological,
cultural & economic

# Evaluating Risk to Human Health & Environment




## Hazards

- Relative severity (e.g., toxicity, rad.)
- Magnitude (e.g., quantity)
- Facility configuration, physical/chemical form

## Pathway & Barriers

- Routes to exposure (e.g., water, air, biota)
- Primary and secondary barriers (e.g., engineered and natural systems)
- Initiating Events – Chronic degradation, Accident scenarios, Episodic events (e.g., earthquakes)

## Consequences

- Human health (worker, general population)
- Environmental resources & ecosystems
- Cultural resources
- Economic resources

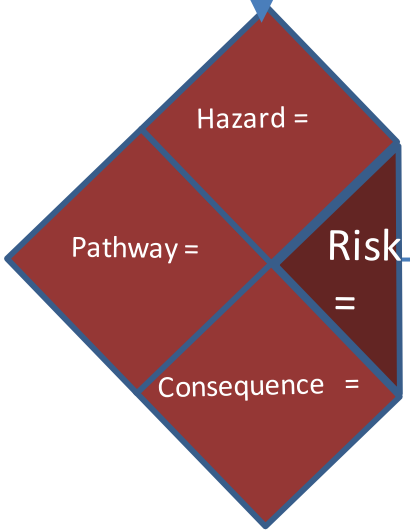
CRESP

# Risk Rating (one approach)

CRESP

Waste Management Area / Project Definition(s)

Template/ Narrative Summary




| Consequence / Hazard & Pathway | Low (L) | Medium (M) | High (H) | Very High (VH) |
|---|---|---|---|---|
| Very High (VH) | M | H | VH | VH |
| High (H) | L | M | H/VH | VH |
| Medium (M) | L | M | M | M/H |
| Low (L) | L | L | L | L |

| Low (L) | Medium (M) | High (H) | Very High (VH) |
|---|---|---|---|

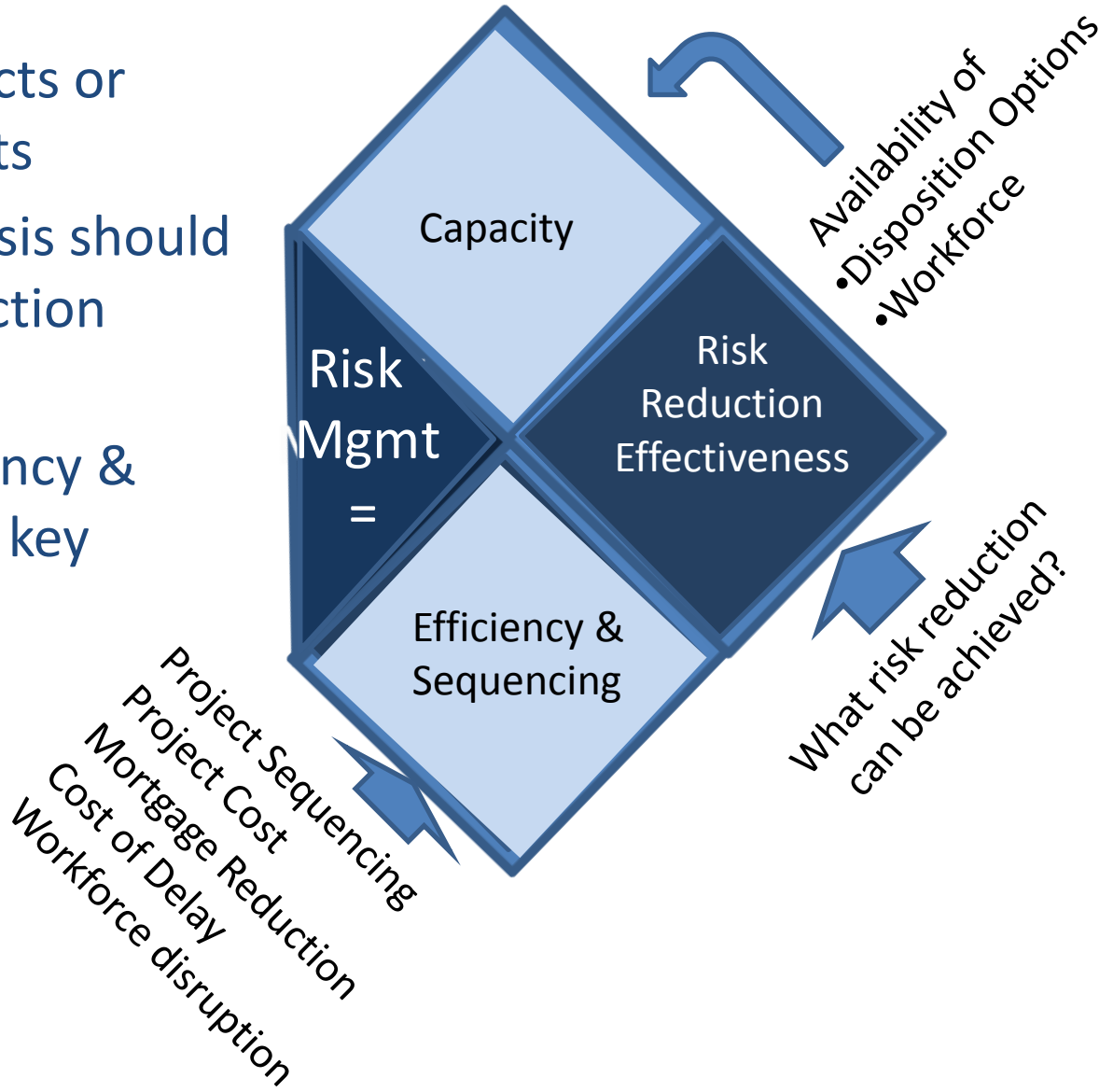
Risk Rating Bins

# Time, Land Use and Risk

- Multiple time frames can provide different basis for risk estimates and perceptions (i.e., during cleanup period, post-cleanup, including period of assumed institutional control effectiveness).
- Actual (current) or planned future land use provides a key basis for exposure scenarios that contribute to risk estimates, as well as uncertainties.
- Distinguishing between current risks, impaired or precluded land use, and risks forecast under planned future land use is important.

# Risk Management Evaluation

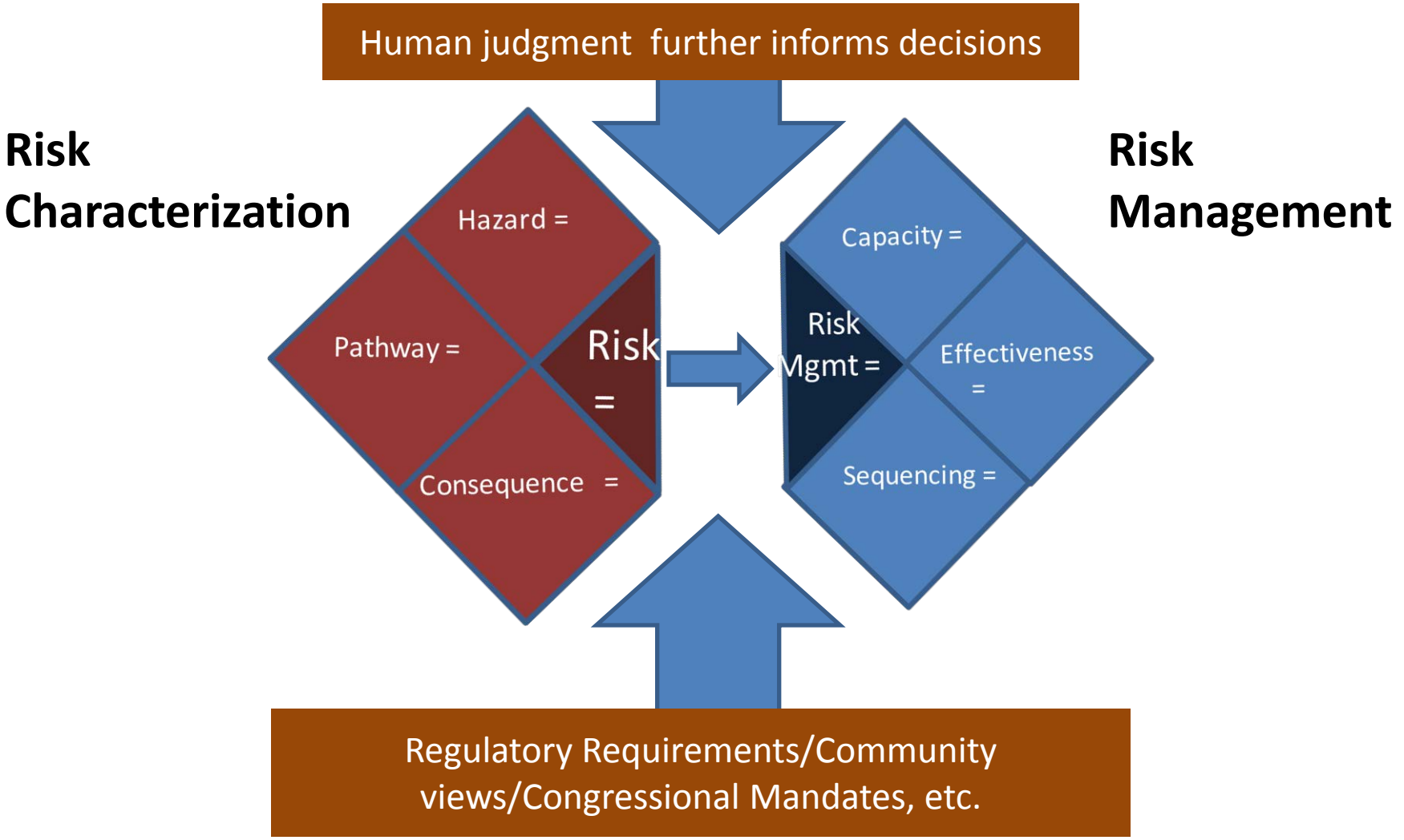
- Evaluates projects or project elements
- Primary emphasis should be on risk reduction effectiveness
- Capacity, Efficiency & Sequencing are key considerations




CRESP

# Risk Characterization and Risk-Informed Management Decisions

CRESP



# Important Lessons Learned

- Risk is one of many inputs to decisions, therefore concept should be *Risk-Informed* **not** *Risk-Based*
- Every DOE Site (i.e., Hanford, Savannah River, Idaho, Oak Ridge, Amchitka, etc.) has distinctive risk-creating characteristics and considerations.
- Broad input and feedback – on methodology, data and perceptions - from the full range of relevant agencies, tribal nations, organizations, officials and individuals is important.

**One size does not fit all!**

**Nuclear Waste Management Policy and Strategy**

**Stakeholder Engagement and Communication**

# A Sampling of CRESP Literature On Nuclear Waste Law, Policy and Public Perception

# Hanford Site-wide Risk Review

CRESP

"…to request the conduct [by CRESP] of a Hanford site-wide evaluation of human health, nuclear safety, environmental and cultural resource risks (Risk Review Project).

The goal of the Risk Review Project is to identify and characterize potential risks and impacts to the public, workers, and the environment at the Hanford Site and to inform the efficient use of Department of Energy (DOE) Environmental Management (EM) resources…"

David M. Klaus, Deputy Under Secretary for Management and Performance, January 16, 2014.

*Risk characterization only, not risk management*

# Acknowledgement and Disclaimer


- The Consortium for Risk Evaluation with Stakeholder Participation (CRESP) is supported by the U. S. Department of Energy, Office of Environmental Management under Cooperative Agreement DE-FC01-06EW07053 awarded to Vanderbilt University.

- The opinions, findings, conclusions, or recommendations expressed herein are those of the authors and do not necessarily represent the views of the Department of Energy or Vanderbilt University.