

# Nuclear to Nuclei: Role of Sandia National Laboratories in Biosecurity and Biotechnology

Emerging Leaders in Biosecurity Initiative Research Symposium

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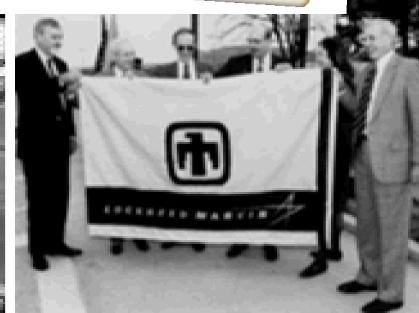
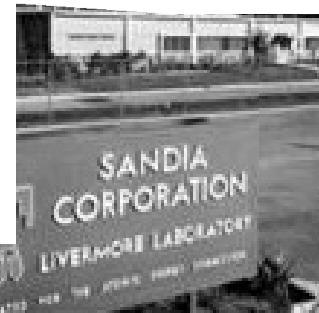
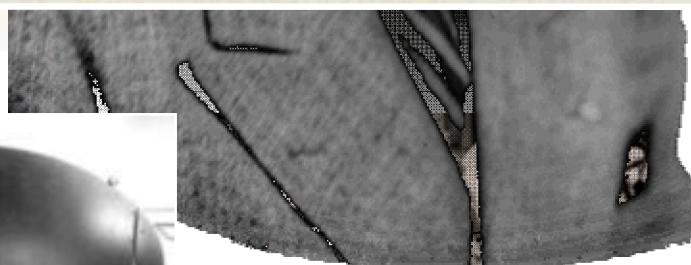
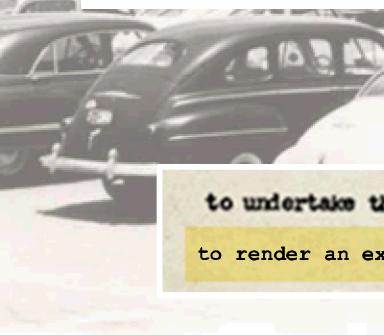
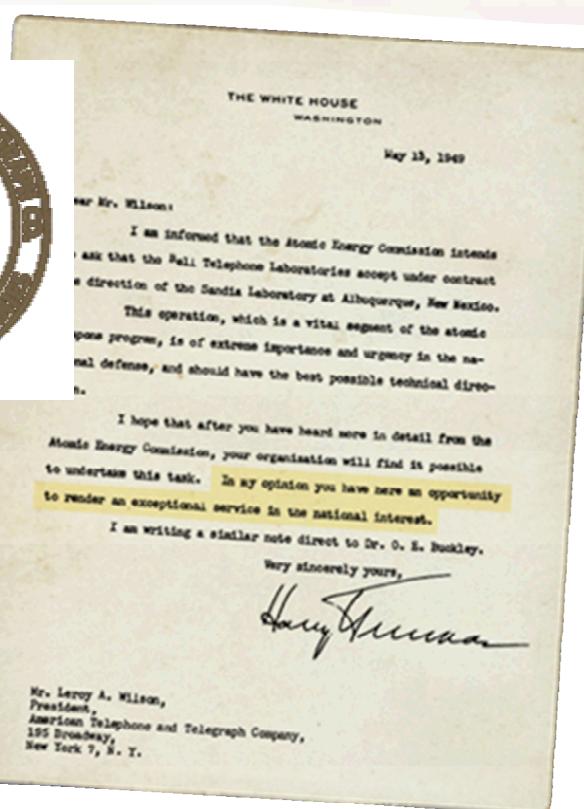
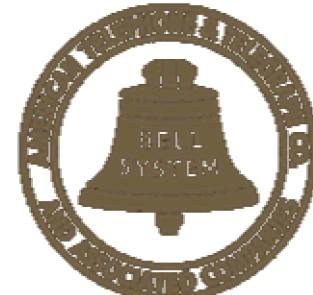
# Sandia's History

*Exceptional service in the national interest*

- July 1945: Los Alamos creates Z Division
- Nonnuclear components of engineering
- November 1, 1949, Sandia Laboratory established



to undertake this task. In my opinion you have here an opportunity to render an exceptional service in the national interest.



# Snapshot of Chemical & Biological Security at Sandia Overtime



1990

National  
and SNL



Berlin Wall Falls



Aum Shinrikyo



DOE  
CBNP

2000

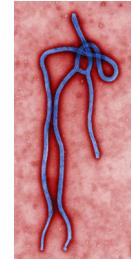


9/11



DHS  
BioWatch  
Anthrax  
Letters

2010



Ebola  
Outbreak

Terrorist Interest in WMD (supporting NW missions)

Defense of Cities

MicroChem Lab

Nanotechnology

Chem System Analysis and Deployments

Lab-on-a-Chip

Detection & Response Analysis

Responsive Studies

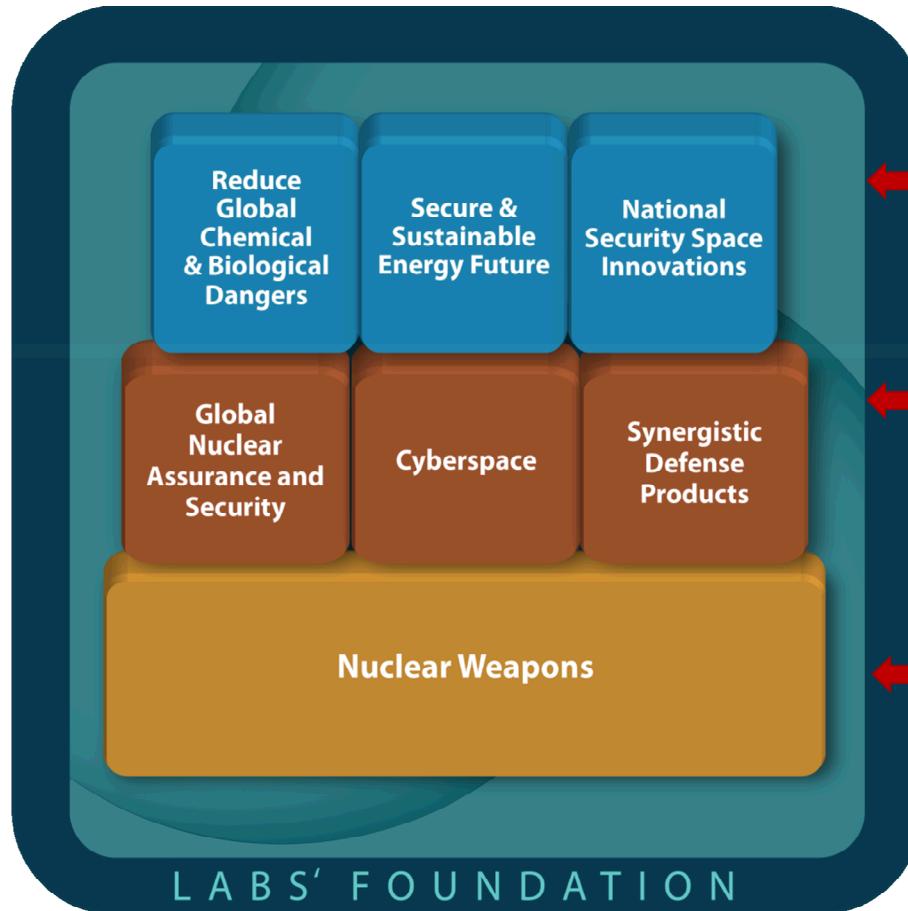
BioWatch Reachback and Support

Decision Support Tools

Training and Exercises

Risk Analysis

# National Security Mission Areas



- Top row: Critical to our national security, these three mission areas leverage, enhance, and advance our capabilities.
- Middle row: Strongly interdependent with NW, these three mission areas are essential to sustaining Sandia's ability to fulfill its NW core mission.
- Bottom row: Our core mission, nuclear weapons (NW), is enabled by a strong scientific and engineering foundation.

"Reduce Global Chemical & Biological Dangers" is a critical Mission Area that is key to the broader National Security Complex

# Sandia's Biotechnology Work

Interdisciplinary nature of the labs results in novel solutions to national security problems

## Sandia Protocells



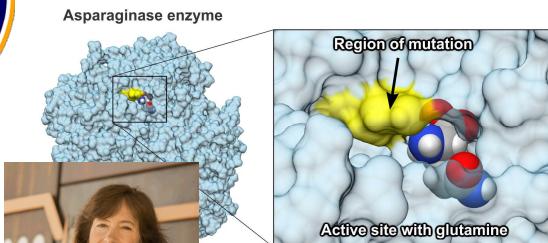
(Photo by Randy Montoya)

## Microneedle fluidic sensor



(Photo by Randy Montoya)

## Computational enzyme design



(Graphic by Juan Vanegas)



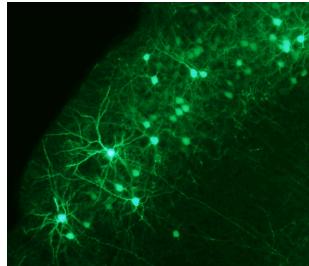
(Photo by Randy Montoya)

## Peripheral Nerve Interfaces



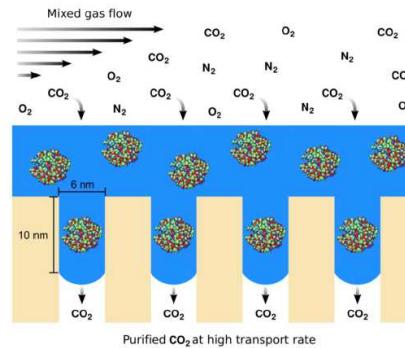
(Photo by Randy Montoya)

## Neural computing



(Photo by Frances Chance, courtesy of Janelia Farm Research Campus)

## CO<sub>2</sub> Memzyme



**jbei**

Joint BioEnergy Institute



(Photo by Dino Vournas)

## BaD<sub>x</sub>

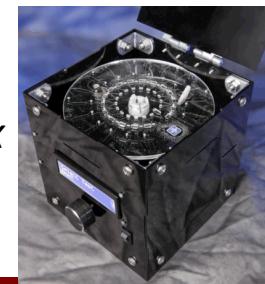


(Photo courtesy of Melissa Finley)

(Photo by Thayne Edwards)



## SpinDx



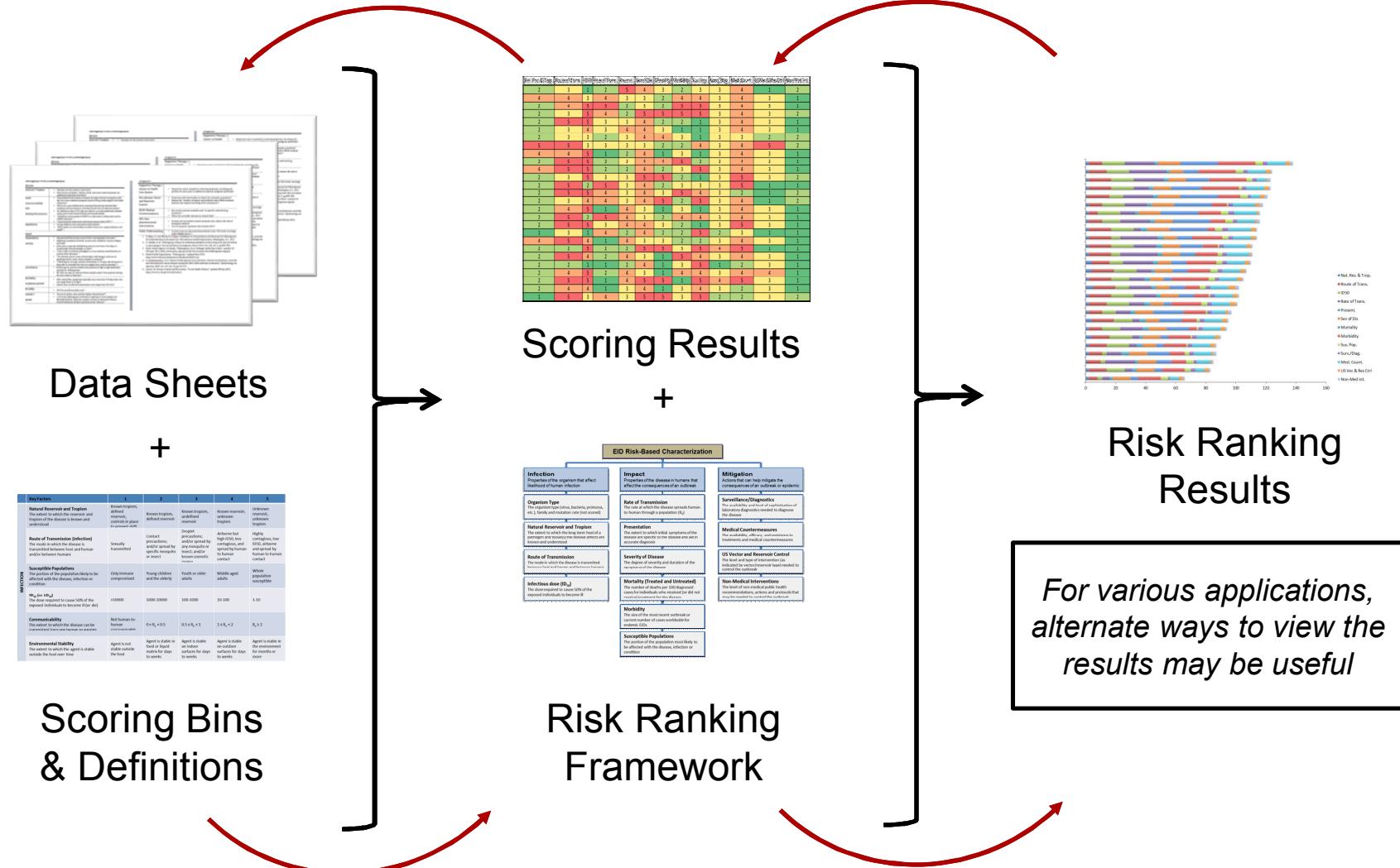
(Photo by Randy Wong)

# Example Chem/Bio Systems Analysis Projects



- Reachback and Responsive Studies
  - Ebola and Influenza: Effectiveness of airport passenger screening
    - *Should the US screen passengers on international flights for Influenza or Ebola?*
  - Anthrax Release Scenarios: Population Movement and Prophylaxis Distribution
    - *Where would potentially exposed people go in the first day(s) after an anthrax attack? What does this imply for prophylaxis distribution?*
  - BioWatch Performance Using Assays with a Range of Limits of Detection
    - *What is the impact of increased BioWatch LODs on overall system performance?*
- Topical Studies
  - ***Biological Agent Risk & Prioritization***  
*How should interagency ...prioritize newly emerging diseases?*
  - DTRA/CTR Prioritization:
    - *How should DTRA/CTR prioritize engagement opportunities within a country? (Bio, Chem, Rad, Nuc)*
    - *How should DTRA/CTR decide which countries to engage next?*
  - Bio Restoration and Response Tools
    - *Tools to inform key response decisions: e.g., How to decontaminate facilities after a biological release?*

# Prioritization Process for Emerging Infectious Diseases

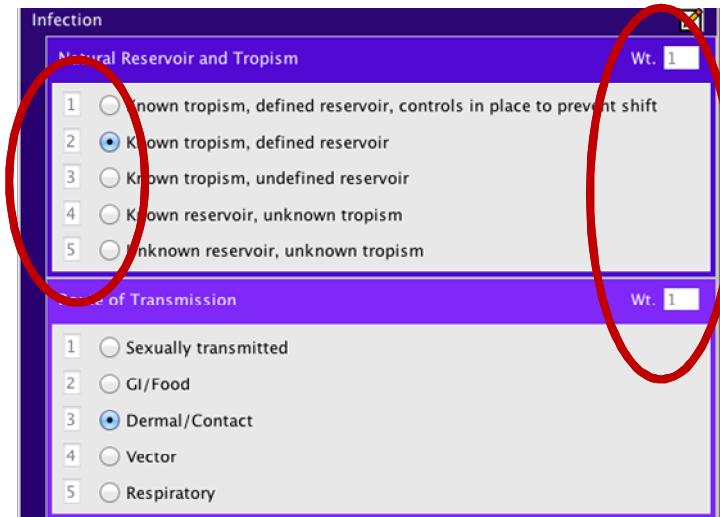


Vetting of the methodology and data is important at multiple steps in the process to ensure transparency and value to stakeholders

# Analytical framework uses defined scores and weights to assign values

- Scoring:
  - Factors are scored on a 1-5 scale
  - Each factor is assigned a weight
  - Higher-level scores are calculated by summing the weighted scores

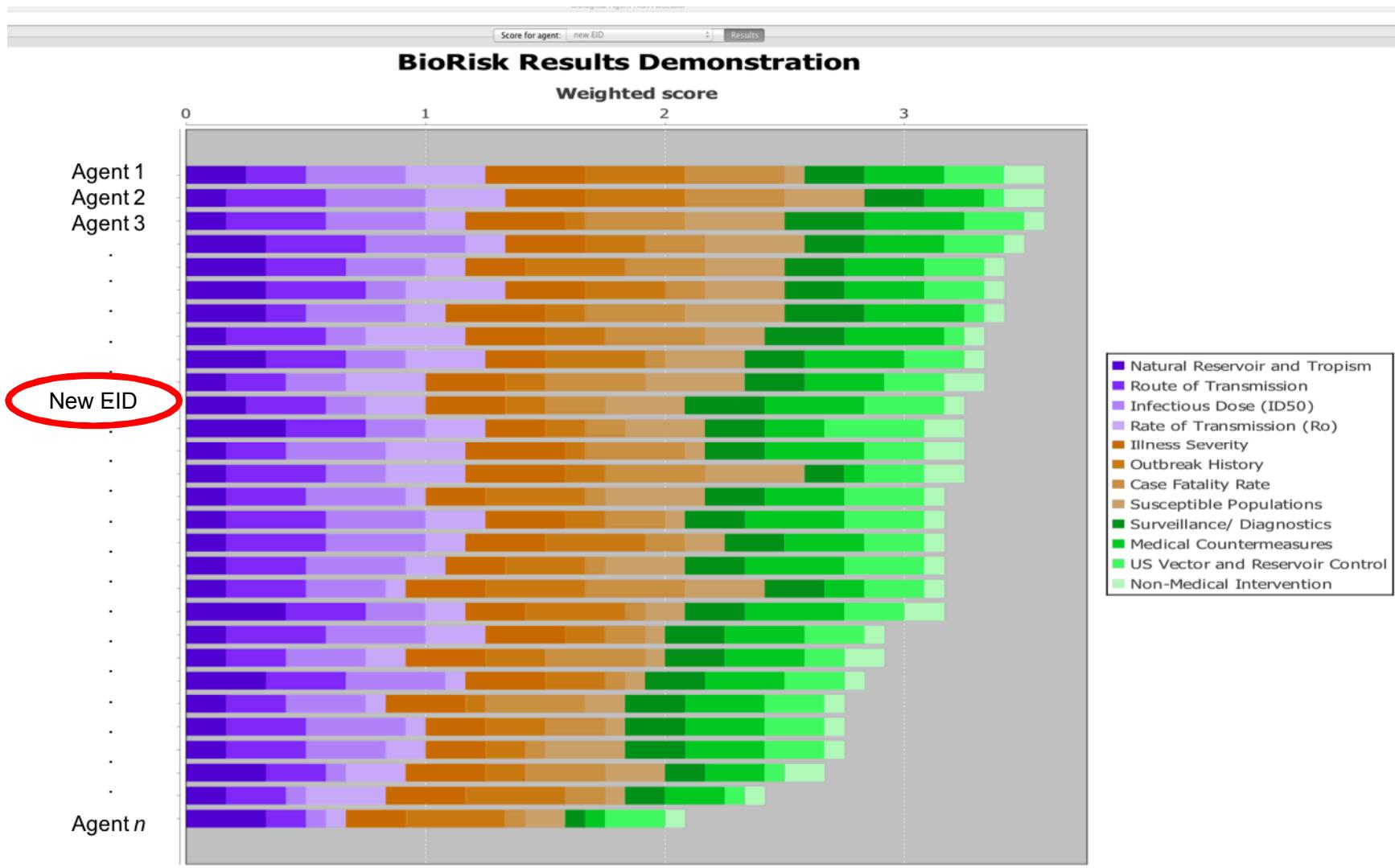
$$A = \sum_{j=1}^n a_{ij} w_j$$



Allowing users to change the weights and score amounts for a variable, including a non-linear scale, allows for sensitivity analysis

# Sample risk ranking view of EID agents

This view may suggest a cut-off or highlight certain trends in key variables



# Summary

- Biosecurity, a highly interdisciplinary space, is a key component of the broader national security complex and is therefore an important area within Sandia
- Risk analysis is a key tool for approaching complex biosecurity challenges
  - The process can be just as or more important than the solution
- The prioritization process, while not a risk analysis, uses principles of risk to structure the viewpoints of a diverse audience
- There are many challenges with such a diverse, interagency panel
  - Balance the priorities of different players
  - Keep focused on the goal and ultimate purpose
  - Be flexible to test new approaches and be ready to show different outcomes