



U.S. Department of Homeland Security

DAMS SECTOR ACTIVITIES

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Office of Infrastructure Protection

*Hydraulic Power Committee – National Hydropower Association
2009 Fall Meeting - October 14-16, 2009*

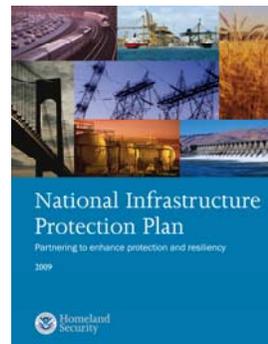


Critical Infrastructure: What is it?

- According to the *National Infrastructure Protection Plan (2009)*:

“Systems and assets, whether physical or virtual, so vital that the incapacity or destruction of such may have a debilitating impact on the security, economy, public health or safety, environment, or any combination of these matters, across any Federal, State, regional, territorial, or local jurisdiction.”

- Nation’s infrastructure categorized into 18 “Sectors”
- Homeland Security Presidential Directive 7 (HSPD-7) assigns responsibility for these sectors to Federal Sector-Specific Agencies (SSAs).





18 CIKR Sectors and Designated SSAs



Sector-Specific Agency	Critical Infrastructure/Key Resources Sector
Department of Agriculture ¹ Department of Health and Human Services ²	Agriculture and Food
Department of Defense ³	Defense Industrial Base
Department of Energy	Energy ⁴
Department of Health and Human Services	Public Health and Healthcare
Department of the Interior	National Monuments and Icons
Department of the Treasury	Banking and Finance
Environmental Protection Agency	Drinking Water and Water Treatment Systems

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18 CIKR Sectors and Designated SSAs

Sector-Specific Agency	Critical Infrastructure/Key Resources Sector
Department of Homeland Security <i>Office of Infrastructure Protection</i> <i>Sector-Specific Agency</i> <i>Executive Management Office</i>	Chemical Commercial Facilities Dams Emergency Services Commercial Nuclear Reactors, Materials, and Waste
<i>Office of Cyber Security and Telecommunications</i>	Information Technology Telecommunications
<i>Transportation Security Administration</i>	Postal and Shipping
<i>Transportation Security Administration, United States Coast Guard⁵</i>	Transportation Systems ⁶
<i>Immigration and Customs Enforcement, Federal Protective Service</i>	Government Facilities

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CIKR Partnership Framework

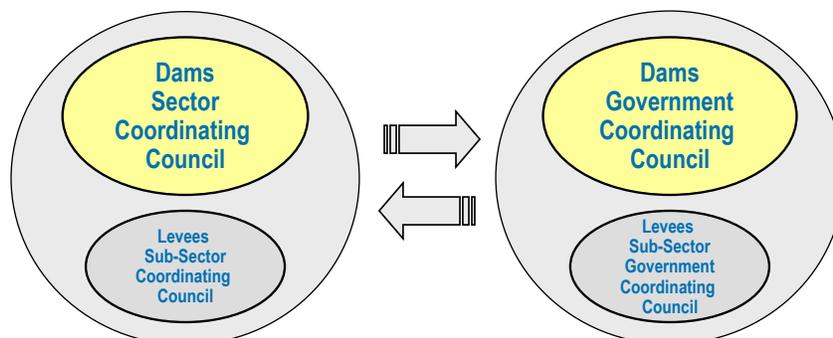
- DHS has supported self-organization of the CIKR sectors into Sector Coordinating Councils (SCCs), and their counterpart, the Government Coordinating Councils (GCCs).
- DHS established the Critical Infrastructure Partnership Advisory Council (CIPAC) to provide an overarching framework to this partnership structure.
- The activities of the CIPAC are exempt from the Federal Advisory Committee Act (FACA):
 - Section 871 of the Homeland Security Act of 2002.
- The CIPAC creates a “protected space” for effective collaboration.

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Dams Sector

- Dams Sector encompasses not only dams and navigation locks, but also levees, hurricane barriers, tailings and waste impoundments, etc.



- Non-Federal owners and operators (private, state, local, others)
- Professional organizations

- Federal owners and operators
- Federal & State regulatory agencies
- Other Federal agencies

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Dams Sector GCC Members

- Department of Homeland Security
 - Office of Infrastructure Protection (Dams SSA)
 - Federal Emergency Management Agency
 - U.S. Coast Guard
- International Boundary & Water Commission (Department of State)
- Mine Safety and Health Administration (Department of Labor)
- Natural Resources Conservation Service (Department of Agriculture)
- U.S. Army Corps of Engineers (Department of Defense)
- U.S. Bureau of Reclamation (Department of Interior)
- Department of Energy
- Federal Energy Regulatory Commission
- Tennessee Valley Authority
- Bonneville Power Administration
- Environmental Protection Agency
- National Weather Service
- State Dam Safety Offices:
 - California, Colorado, New Jersey, North Carolina, Ohio, Pennsylvania, Washington, and Nebraska



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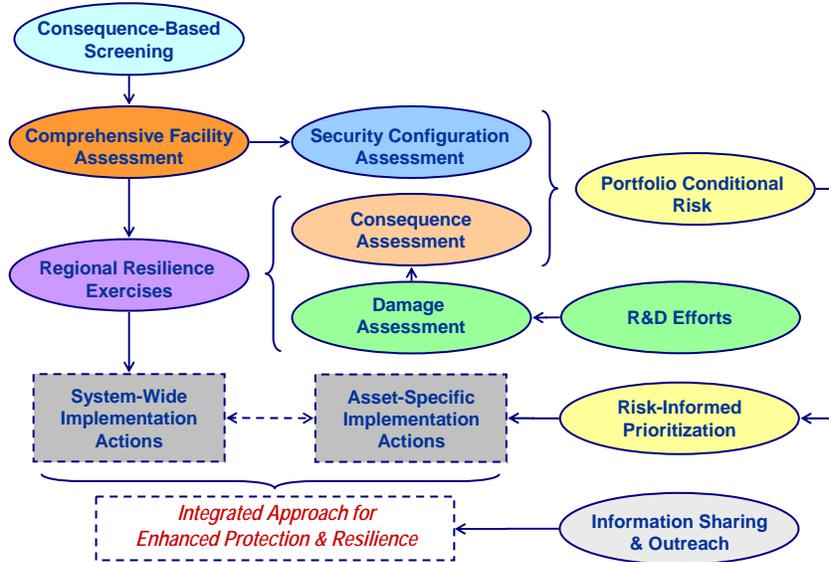
Dams Sector SCC Members

- Allegheny Energy
- Ameren Services Company
- American Electric Power
- AVISTA Utilities
- Consumers Energy
- Dominion Resources
- Duke Energy Corporation
- Exelon Corporation
- Hydro-Quebec
- New York Power Authority
- Ontario Power Generation
- Pacific Gas & Electric Company
- PPL Corporation
- Progress Energy
- Public Utility District #1 Chelan County
- SCANA Corporation
- Seattle City Light
- Santee Cooper
- Southern California Edison
- Southern Company Generation
- National Association of Flood & Stormwater Management Agencies
- Association of State Floodplain Managers
- Association of State Dam Safety Officials
- Colorado River Energy Distributors Association
- National Hydropower Association
- National Mining Association
- National Water Resources Association
- U.S. Society on Dams

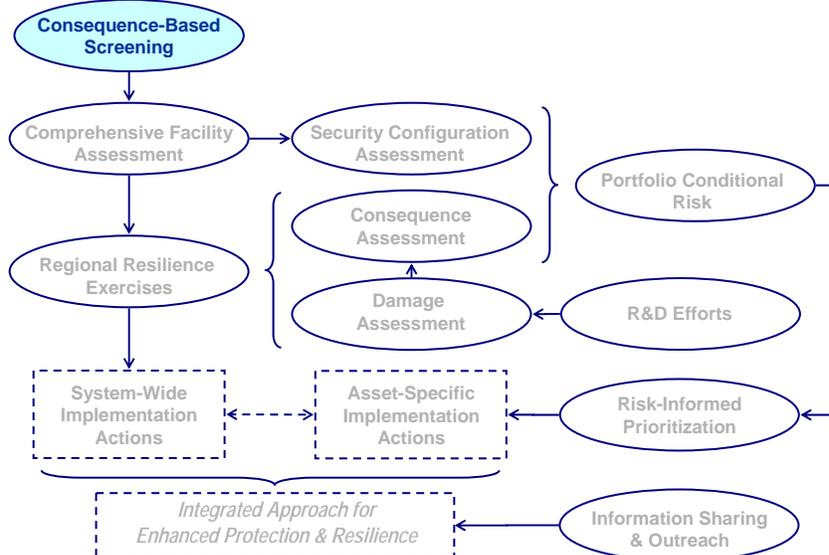
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Dams Sector Activities



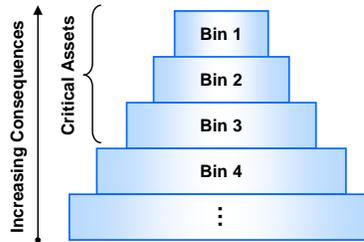
Consequence-Based Screening





Consequence-Based Screening

- Consequence-based prioritization constitute an essential element of the risk management process when dealing a target-rich environment and an intelligent and adaptive adversary.
- Characteristics of the facility (importance, recognition, perceived vulnerabilities and assumed consequences) and its surroundings could have direct influence on the likelihood of the event.
- Since it is impractical to conduct in-depth risk evaluations of every single facility, a consequence-based screening is necessary as the first step in the development of an effective risk mitigation strategy.



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Consequence Categories

- Approach based on criteria set forth in Homeland Security Presidential Directive 7 (*“Critical Infrastructure Identification, Prioritization, and Protection,”* 2003).
- As defined by the NIPP (2009):
 - **Public Health and Safety**
Fatalities, injuries, illness.
 - **Economic**
Direct and indirect economic losses such as cost to rebuild asset, cost to respond and recover, downstream damages, environmental damage.
 - **Governance/Mission Impact**
Effects on ability to deliver essential public services, ensure public health and safety, and carry out national security-related missions.
 - **Psychological**
Effects on public’s sense of safety and confidence in national economic and political institutions.

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Consequence Categories

- This approach does not consider structural condition, deficiencies, vulnerabilities, or likelihood of the consequence-triggering event.
- Procedure based on “indicators” of potential impacts associated with severe damage, failure, or mission disruption.
 - **Human Impacts:** Not represented by explicit consequence variables (such as fatalities).
 - **Mission Disruption Impacts:** “Capacity” parameters used as global indicators of potential indirect consequences, interdependencies, regional effects, impacts on public confidence, etc.

Consequence Categories
Potential Human Impacts
Total Population at Risk (PAR _T)
Population at Risk 0 ~ 3 Miles (PAR ₁)
Population at Risk 3 ~ 7 Miles (PAR ₂)
Population at Risk 7 ~ 15 Miles (PAR ₃)
Population at Risk 15 ~ 60 Miles (PAR ₄)
Potential Economic Impacts
Asset Replacement Value (E ₁)
Remediation Cost (E ₂)
Business Interruption (E ₃)
Potential Mission Disruption Impacts
Water Supply (M ₁)
Irrigation (M ₂)
Hydropower Generation (M ₃)
Flood Damage Reduction (M ₄)
Navigation (M ₅)
Recreation (M ₆)

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Worst Reasonable Case

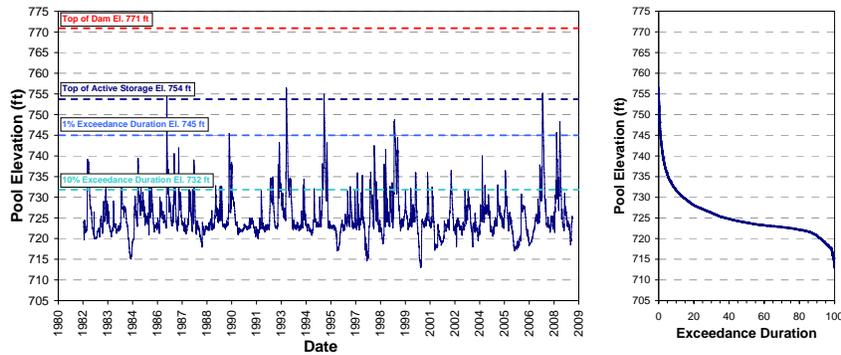
- Worst reasonable case scenario:
 - Total or extremely severe damage or disruption.
 - No simultaneous occurrence of multiple independent extreme events or human error.
 - Provides practical **upper bound** for total potential impacts associated with severe damage or disruption, regardless of the triggering event.
- A reasonably conservative pool elevation must be selected to represent an upper bound for the normal operating range.
 - **Top of active storage** provides, in most cases, a convenient condition for all-hazards screening.
 - This typically corresponds to the spillway crest elevation or an elevation at or near the top of the spillway gates.

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Worst Reasonable Case

Example A



	Pool Elevation	Population at Risk	Economic Consequences
Top of Dam →	771 ft	78,000	\$7.0B
Top of Active Storage →	754 ft	68,000	\$5.0B
10% Exceedance Duration →	732 ft	26,000	\$0.7B

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Consequence Severity Levels

• Consequence Severity Levels

Consequence Categories
Potential Human Impacts
Total Population at Risk (PAR_T)
Population at Risk 0 ~ 3 Miles (PAR_1)
Population at Risk 3 ~ 7 Miles (PAR_2)
Population at Risk 7 ~ 15 Miles (PAR_3)
Population at Risk 15 ~ 60 Miles (PAR_4)
Potential Economic Impacts
Asset Replacement Value (E_1)
Remediation Cost (E_2)
Business Interruption (E_3)
Potential Mission Disruption Impacts
Water Supply (M_1)
Irrigation (M_2)
Hydropower Generation (M_3)
Flood Damage Reduction (M_4)
Navigation (M_5)
Recreation (M_6)

Eight severity levels (l_i) for j^{th} consequence parameter (P_i)

Level	Consequence Parameter (P_i)
1	$P_i > 32\Delta_i$
2	$16\Delta_i < P_i \leq 32\Delta_i$
3	$8\Delta_i < P_i \leq 16\Delta_i$
4	$4\Delta_i < P_i \leq 8\Delta_i$
5	$2\Delta_i < P_i \leq 4\Delta_i$
6	$\Delta_i < P_i \leq 2\Delta_i$
7	$0 < P_i \leq \Delta_i$
8	$P_i = 0$

Where Δ_i represents the characteristic interval used to define severity ranges for the consequence parameter P_i

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Consequence Severity Levels

- Total Population At Risk:

Level	Total PAR (PAR _T)
1	PAR _T > 800,000
2	400,000 < PAR _T ≤ 800,000
3	200,000 < PAR _T ≤ 400,000
4	100,000 < PAR _T ≤ 200,000
5	50,000 < PAR _T ≤ 100,000
6	25,000 < PAR _T ≤ 50,000
7	0 < PAR _T ≤ 25,000
8	PAR _T = 0

- Since the approach is based on a worst reasonable case scenario, recreational visitors (day/night) should be considered, including times of high use such as on holidays or during special sporting or other types of events that attract large crowds.

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Consequence Severity Levels

- Close-Range Population At Risk:

Level	PAR 0-3 miles (PAR ₁)	PAR 3-7 miles (PAR ₂)	PAR 7-15 miles (PAR ₃)	PAR 15-60 miles (PAR ₄)
1	PAR ₁ > 4,000	PAR ₂ > 8,000	PAR ₃ > 16,000	PAR ₄ > 32,000
2	2,000 < PAR ₁ ≤ 4,000	4,000 < PAR ₂ ≤ 8,000	8,000 < PAR ₃ ≤ 16,000	16,000 < PAR ₄ ≤ 32,000
3	1,000 < PAR ₁ ≤ 2,000	2,000 < PAR ₂ ≤ 4,000	4,000 < PAR ₃ ≤ 8,000	8,000 < PAR ₄ ≤ 16,000
4	500 < PAR ₁ ≤ 1,000	1,000 < PAR ₂ ≤ 2,000	2,000 < PAR ₃ ≤ 4,000	4,000 < PAR ₄ ≤ 8,000
5	250 < PAR ₁ ≤ 500	500 < PAR ₂ ≤ 1,000	1,000 < PAR ₃ ≤ 2,000	2,000 < PAR ₄ ≤ 4,000
6	125 < PAR ₁ ≤ 250	250 < PAR ₂ ≤ 500	500 < PAR ₃ ≤ 1,000	1,000 < PAR ₄ ≤ 2,000
7	0 < PAR ₁ ≤ 125	0 < PAR ₂ ≤ 250	0 < PAR ₃ ≤ 500	0 < PAR ₄ ≤ 1,000
8	PAR ₁ = 0	PAR ₂ = 0	PAR ₃ = 0	PAR ₄ = 0

- Not meant to directly capture expected loss of life.
- Goal is to approximately estimate population that could be most severely affected (considering not only the possibility of fatalities but also disruption associated with emergency response activities, evacuation, and relocation).

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Consequence Severity Levels

- Economic Impacts (millions of dollars):

Level	Asset Replacement Cost (E_1)	Remediation Cost (E_2)	Business Interruption Cost (E_3)
1	$E_1 > 3,200$	$E_2 > 16,000$	$E_3 > 800$
2	$1,600 < E_1 \leq 3,200$	$8,000 < E_2 \leq 16,000$	$400 < E_3 \leq 800$
3	$800 < E_1 \leq 1,600$	$4,000 < E_2 \leq 8,000$	$200 < E_3 \leq 400$
4	$400 < E_1 \leq 800$	$2,000 < E_2 \leq 4,000$	$100 < E_3 \leq 200$
5	$200 < E_1 \leq 400$	$1,000 < E_2 \leq 2,000$	$50 < E_3 \leq 100$
6	$100 < E_1 \leq 200$	$500 < E_2 \leq 1,000$	$25 < E_3 \leq 50$
7	$0 < E_1 \leq 100$	$0 < E_2 \leq 500$	$0 < E_3 \leq 25$
8	$E_1 = 0$	$E_2 = 0$	$E_3 = 0$

Direct downstream impacts: property damage, environmental remediation, etc.

Estimated value of direct benefits not provided over the time period the facility is considered out of service, not to exceed 12-months after the event.

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Consequence Severity Levels

- Impacts on Critical Functions:

Water Supply

Level	Total Population Served (M_1)
1	$M_1 > 8,000,000$
2	$4,000,000 < M_1 \leq 8,000,000$
3	$2,000,000 < M_1 \leq 4,000,000$
4	$1,000,000 < M_1 \leq 2,000,000$
5	$500,000 < M_1 \leq 1,000,000$
6	$250,000 < M_1 \leq 500,000$
7	$0 < M_1 \leq 250,000$
8	$M_1 = 0$

Number of people

Hydropower Generation

Level	Installed Capacity (M_2)
1	$M_2 > 8,000$
2	$4,000 < M_2 \leq 8,000$
3	$2,000 < M_2 \leq 4,000$
4	$1,000 < M_2 \leq 2,000$
5	$500 < M_2 \leq 1,000$
6	$250 < M_2 \leq 500$
7	$0 < M_2 \leq 250$
8	$M_2 = 0$

Installed generating capacity (MW)

Navigation

Level	Navigation Tonnage (M_3)
1	$M_3 > 100,000$
2	$50,000 < M_3 \leq 100,000$
3	$25,000 < M_3 \leq 50,000$
4	$12,500 < M_3 \leq 25,000$
5	$6,250 < M_3 \leq 12,500$
6	$3,125 < M_3 \leq 6,250$
7	$0 < M_3 \leq 3,125$
8	$M_3 = 0$

Annual Tonnage (ktons)

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Consequence Severity Levels

- Impacts on Critical Functions:

Irrigation

Level	Annual Water Deliveries (M_2)
1	$M_2 > 800$
2	$400 < M_2 \leq 800$
3	$200 < M_2 \leq 400$
4	$100 < M_2 \leq 200$
5	$50 < M_2 \leq 100$
6	$25 < M_2 \leq 50$
7	$0 < M_2 \leq 25$
8	$M_2 = 0$

Annual Water Deliveries
(millions of dollars)

Flood Damage Reduction

Level	Flood Damages Prevented (M_4)
1	$M_4 > 800$
2	$400 < M_4 \leq 800$
3	$200 < M_4 \leq 400$
4	$100 < M_4 \leq 200$
5	$50 < M_4 \leq 100$
6	$25 < M_4 \leq 50$
7	$0 < M_4 \leq 25$
8	$M_4 = 0$

Annual Damages Prevented
(millions of dollars)

Recreation

Level	Annual Visitors (M_6)
1	$M_6 > 4,000,000$
2	$2,000,000 < M_6 \leq 4,000,000$
3	$1,000,000 < M_6 \leq 2,000,000$
4	$500,000 < M_6 \leq 1,000,000$
5	$250,000 < M_6 \leq 500,000$
6	$125,000 < M_6 \leq 250,000$
7	$0 < M_6 \leq 125,000$
8	$M_6 = 0$

Annual Visitors

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Criticality Screening

- The purpose of the screening is to identify facilities whose failure or disruption could be potentially associated to the highest possible impacts compared to other facilities across the sector
- A set of thresholds is defined to identify those facilities that are considered critical across the sector:
 1. Total population at risk $PAR_T > PAR_{CRIT}$ or
 2. Total first-year cost $E_T = E_1 + E_2 + E_3 > E_{CRIT}$ or
 3. Total population served $M_1 > M_{1CRIT}$ or
 4. Annual water deliveries $M_2 > M_{2CRIT}$ or
 5. Installed generating capacity $M_3 > M_{3CRIT}$ or
 6. Annual flood damages prevented $M_4 > M_{4CRIT}$ or
 7. Annual navigation tonnage $M_5 > M_{5CRIT}$ or
 8. Annual recreational visitors $M_6 > M_{6CRIT}$

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Web-Based Implementation

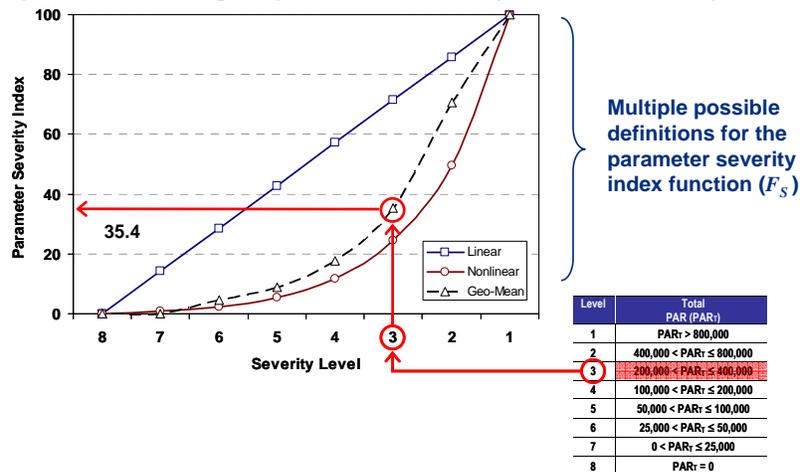
- Web-based CTS tool was launched on 4 February 2009 and remained open until 10 July 2009.
 - Data submittal statistics:
 - ❑ Total number of facilities submitted: 207
 - ❑ State regulated facilities: 76
 - ❑ Federally owned facilities: 123
 - ❑ FERC regulated facilities: 8
 - Participating Dam Safety offices:
 - ❑ California, Colorado, Kentucky, Montana, North Carolina, New Jersey, Ohio, Pennsylvania, and Washington
 - Criticality screening:
 - ❑ **149 facilities met at least one of the criteria.**

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Consequence-Based Prioritization

- Relative importance of consequence severity levels (1,2,...,8) is quantified through a parameter severity index function (0...100):



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Consequence-Based Prioritization

- Facility Potential Consequence Index (PCI):
 - An overall potential consequence index for the facility can be calculated as a weighted combination of the parameter severity index values associated with the 14 consequence parameters.
 - This potential consequence index can be obtained as the product of each parameter severity value multiplied by its corresponding relative weight:

$$P = \sum_{i=1..14} w_i F_S(l_i)$$

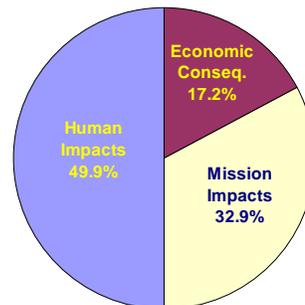
w_i : Relative weight for i^{th} consequence parameter.
 l_i : Severity level for i^{th} consequence parameter.
 F_S : Parameter severity index function.

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Determination of Relative Weights

Normalized Relative Weights (32 SME's)		
Consequence Category	Consequence Parameter	Average Value
Human Impacts	PAR 0-3	0.157
	PAR 3-7	0.122
	PAR 7-15	0.088
	PAR 15-60	0.056
	Total PAR	0.077
Economic Consequences	Replacement Cost	0.049
	Remediation Cost	0.078
	Business Losses	0.045
Mission Impacts	Water Supply	0.095
	Irrigation Deliveries	0.056
	Power Generation	0.063
	Flood Damage Reduction	0.055
	Navigation	0.041
	Recreation	0.019

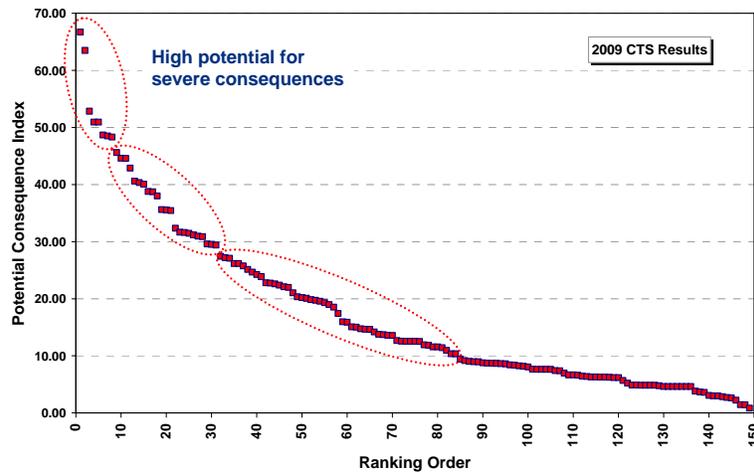


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Consequence-Based Prioritization

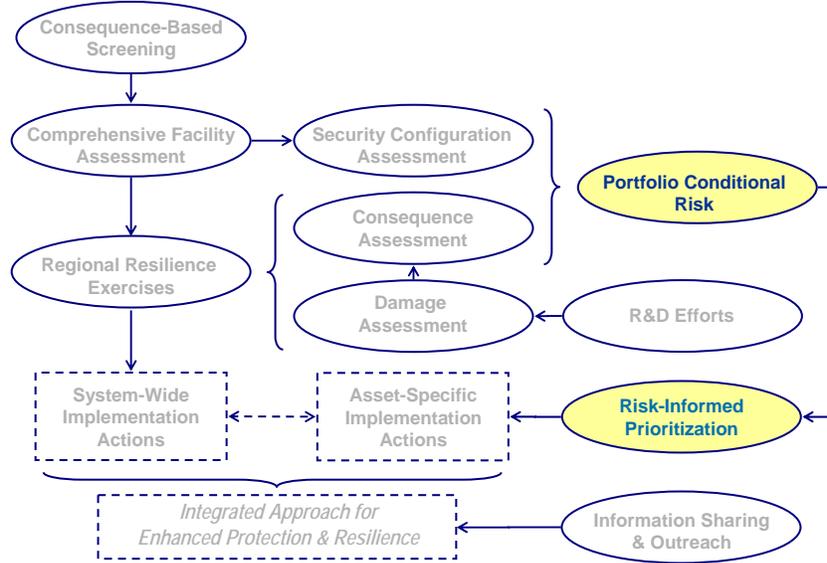
• 2009 Results



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Risk-Informed Prioritization



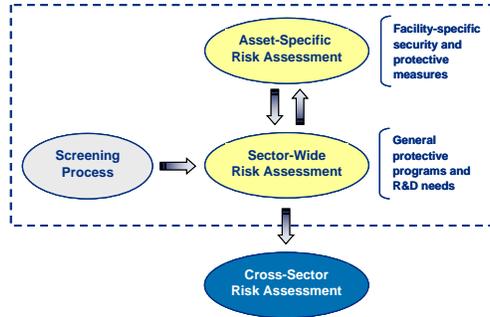
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Risk-Informed Prioritization

• Risk Assessment Methodology Comparison Study (2008):

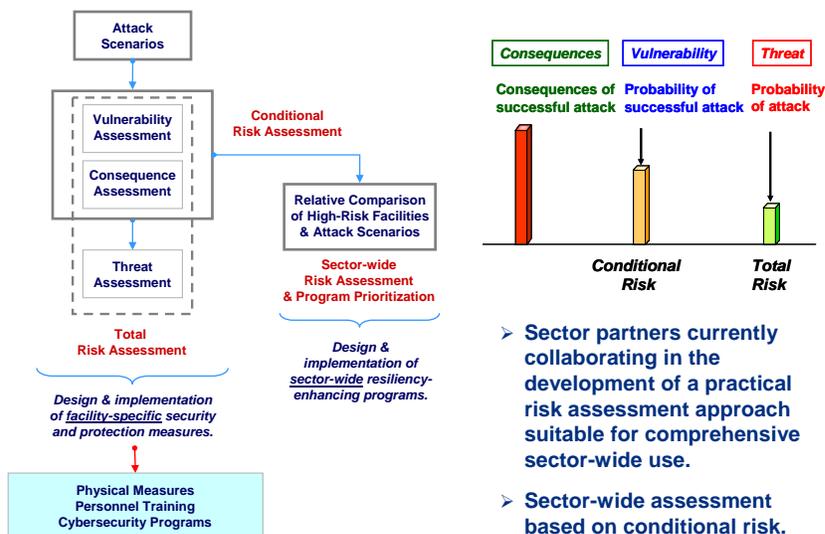
- Sector hindered by lack of common terminology and standards.
- Dissimilar data quality and availability limitations lead to unique approaches that are incompatible across the sector.
- Methodologies useful at the organizational level do not necessarily meet sector and National requirements.
- While each of the models reviewed has merit within their field of use, none of them satisfies the need for a practical approach suitable for sector-wide use.



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Risk-Informed Prioritization

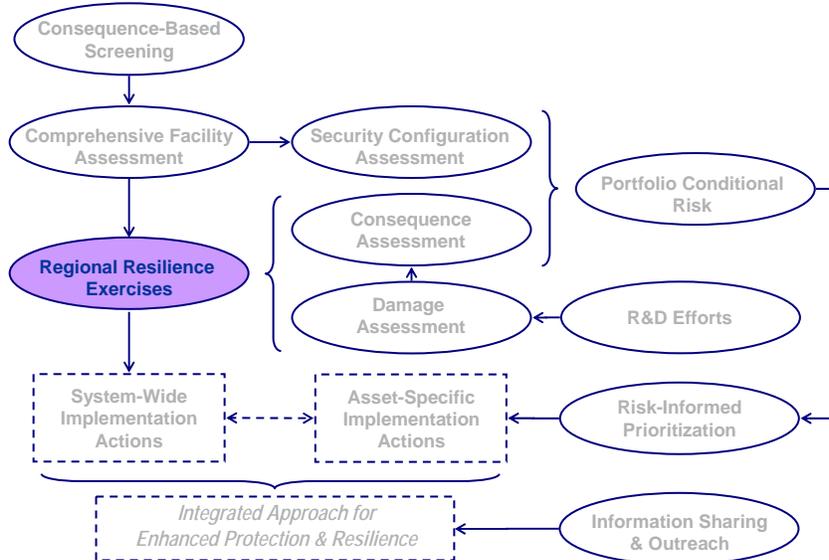


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- Sector partners currently collaborating in the development of a practical risk assessment approach suitable for comprehensive sector-wide use.
- Sector-wide assessment based on conditional risk.



Regional Resilience Exercises

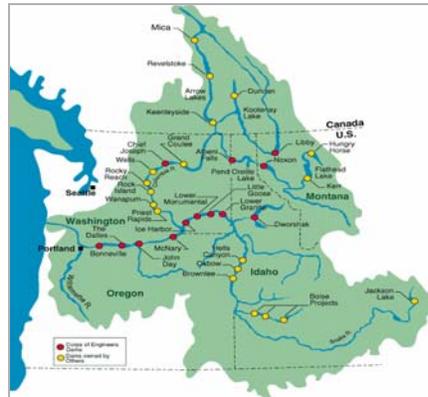


Regional Resilience Exercises

- 2009 Dams Sector Exercise Series – Columbia River Basin (DSES-09)



Tri-Cities:
 Richland, Pasco, Kennewick
 (WA)





Regional Resilience Exercises

- 2009 Dams Sector Exercise Series – Columbia River Basin (DSES-09)

Track 1: Inundation Modeling and Mapping

Track 2: Pre-Disaster Operation Response (TTX)

Track 3: State and Local Preparedness/
Emergency Response (TTX)

Track 4: Long-term Restoration/Economic
Resilience (TTX)

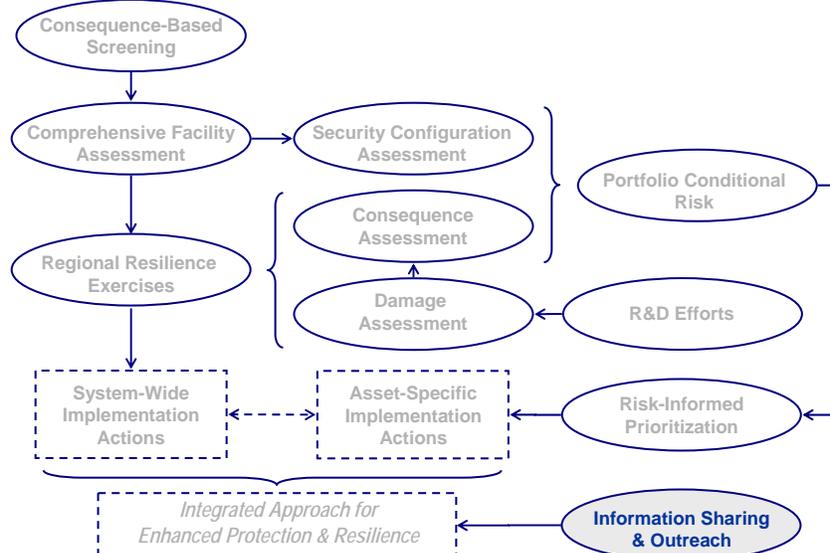
Track 5: Integrated Regional Strategy



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Information Sharing & Outreach



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Information Sharing & Outreach

Security Awareness Handbook (FOUO)

- Potential vulnerabilities of sector assets, indicators of possible surveillance activity, how to report suspicious incidents.

Security Awareness Guide

- Unlimited distribution version.

Security Awareness Guide: Levees

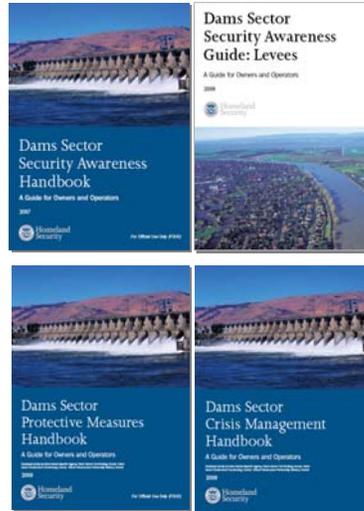
- Unlimited distribution version.

Protective Measures Handbook (FOUO)

- Measures related to deterrence, physical security, resilience, response, recovery, and mitigation; development of protective programs.

Crisis Management Handbook

- Crisis management as part of the overall risk management plan, emergency action plans, recovery plans, continuity plans, and exercises.



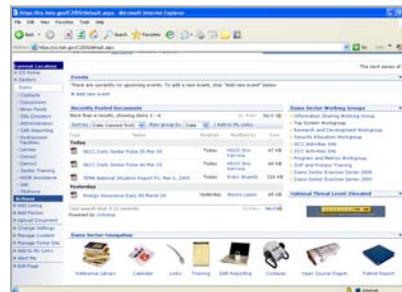
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Information Sharing & Outreach

• Homeland Security Information Network (HSIN):

- Internet-based system to disseminate information among Federal, State, local agencies, and the private sector; provide situational awareness; and facilitate collaboration with all critical infrastructure partners.



HSIN-Dams Portal

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Homeland Security

For Additional Information:
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