



# **Flooding Hazards**

**January 6, 2014**

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**Director, Nuclear Safety Project**

**Union of Concerned Scientists**

**[www.ucsusa.org](http://www.ucsusa.org)**

# Issues

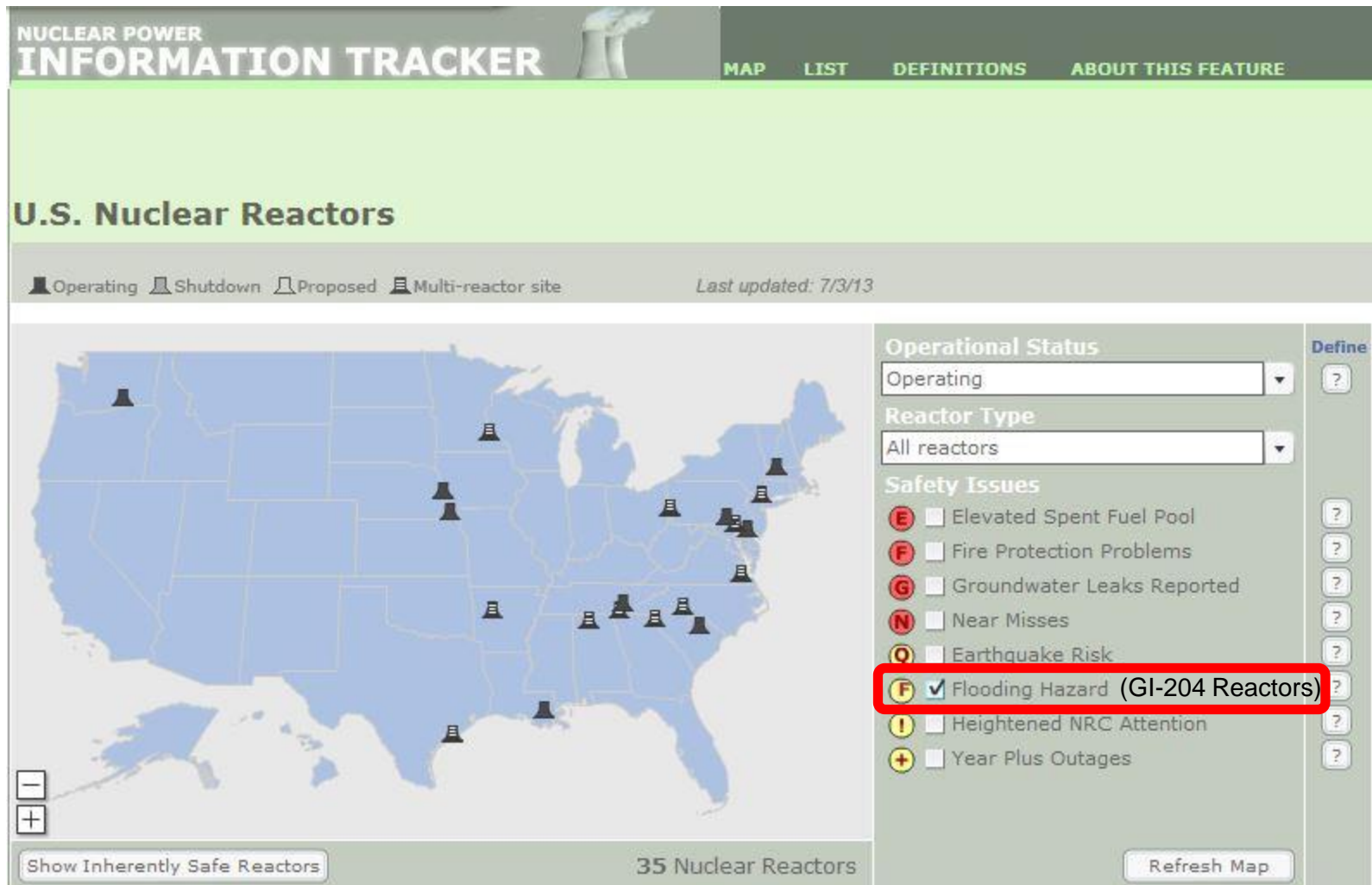
- **Risk integration vs. isolation**
- **Cart before the horse**
- **Inconsistent oversight**

# Stellar Regulatory Performance



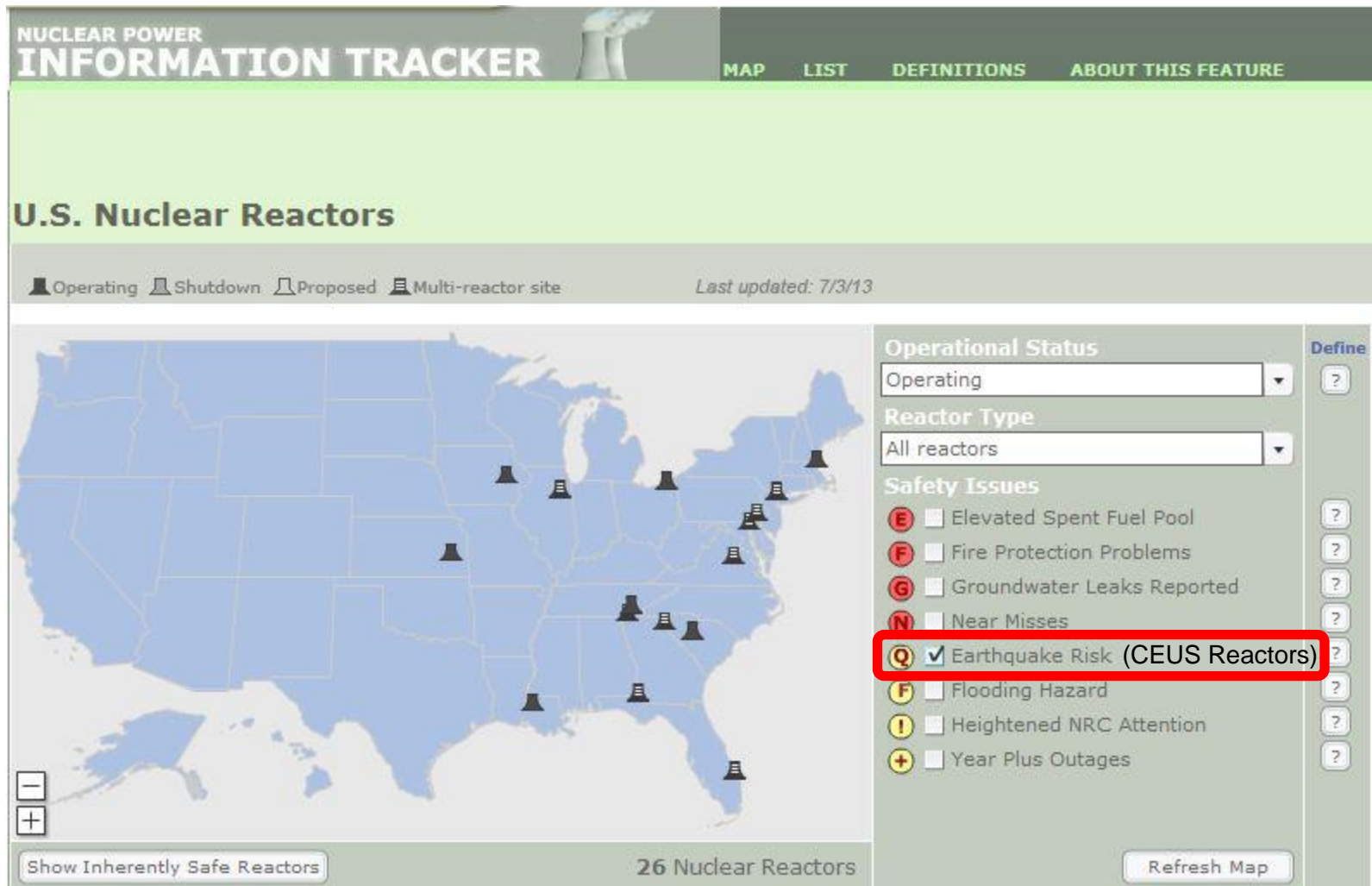
**Source: ML120400493**

# Flood of Known Safety Issues

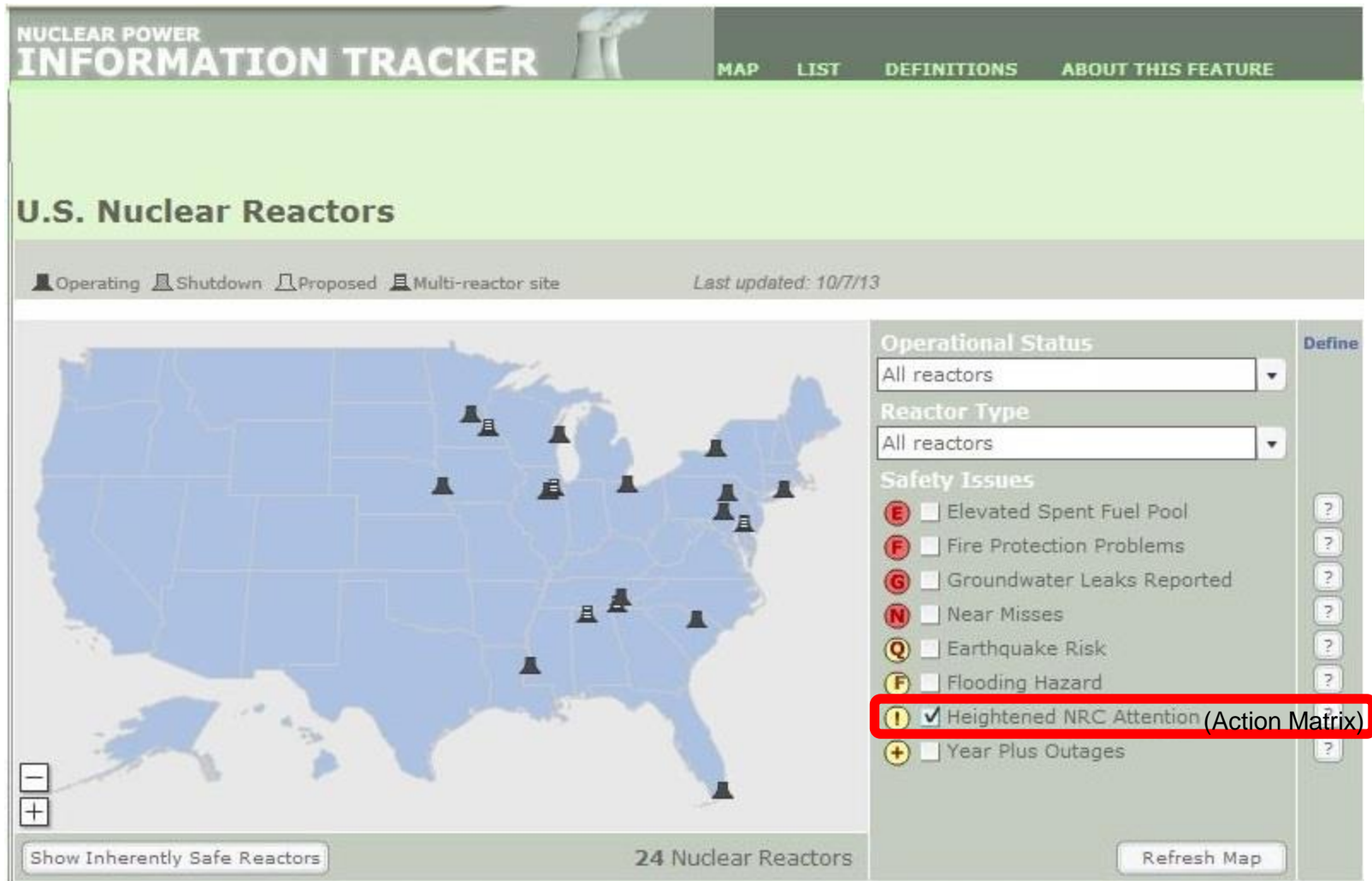


Source: [http://www.ucsusa.org/nuclear\\_power/reactor-map/embedded-flash-map.html](http://www.ucsusa.org/nuclear_power/reactor-map/embedded-flash-map.html)

# Another Drop in the Flood

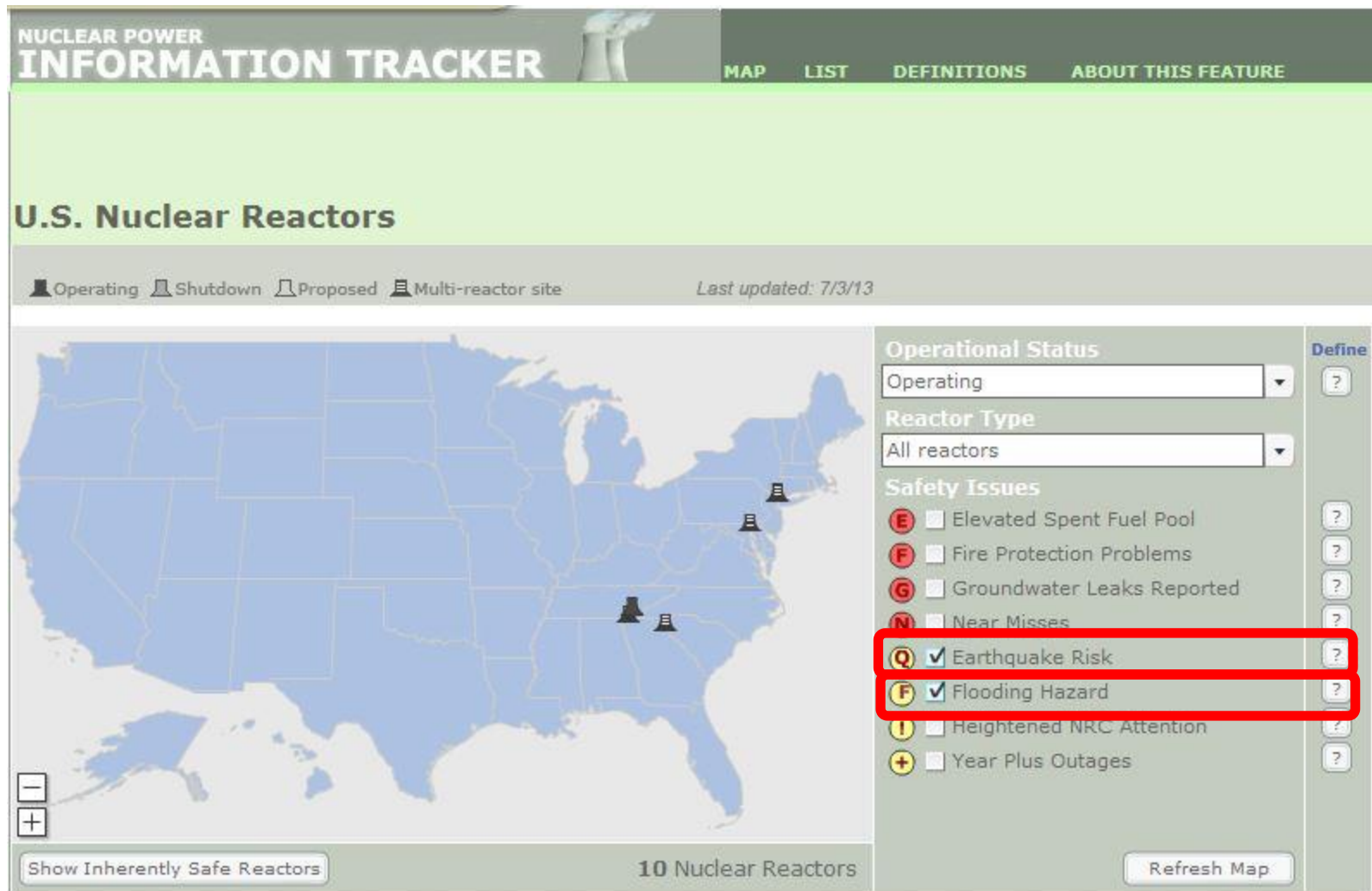


# Another Drop in the Flood





# Flood is More Than One Drop



# But NRC Only Sees a Drop

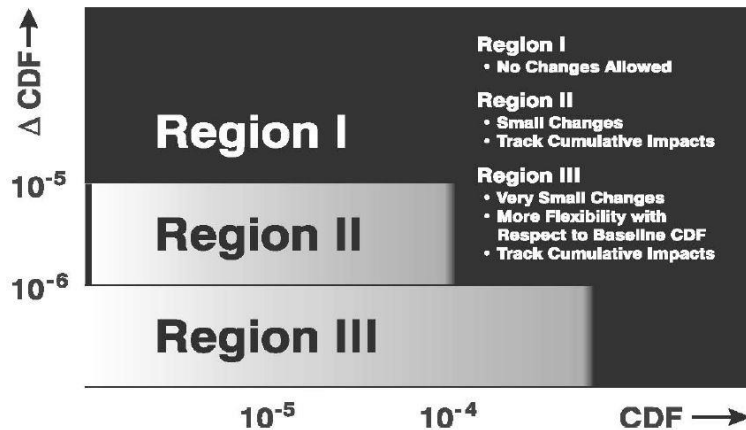


Figure 4 Acceptance guidelines\* for core damage frequency

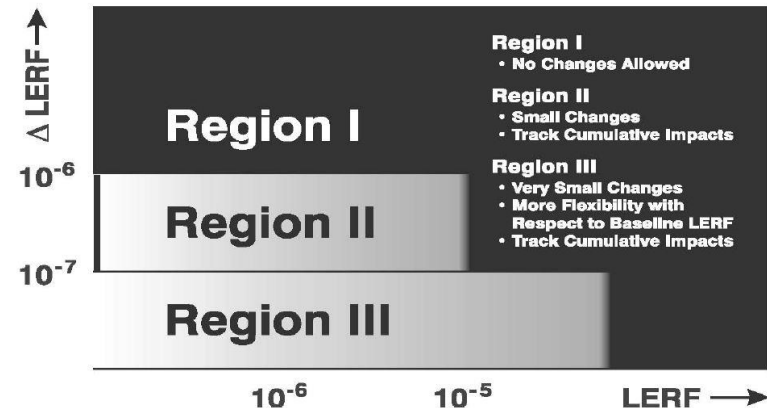


Figure 5 Acceptance guidelines\* for large early release frequency

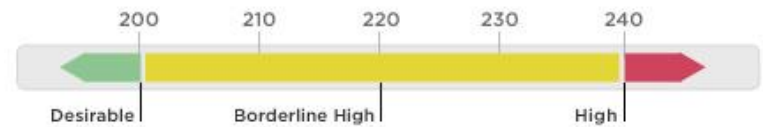
**NRC's decision-making processes, such as this one from RG 1.174, are largely made without formally considering other known risks.**



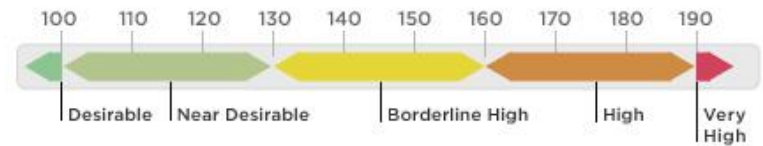
# Connect-the-Dot?



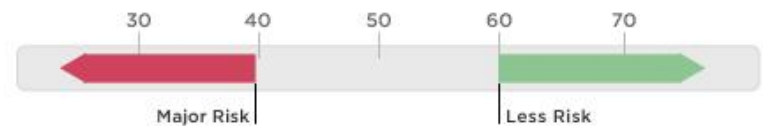
TOTAL CHOLESTEROL LEVEL (in mg/dl)



LDL CHOLESTEROL LEVEL (in mg/dl)



HDL CHOLESTEROL LEVEL (in mg/dl)



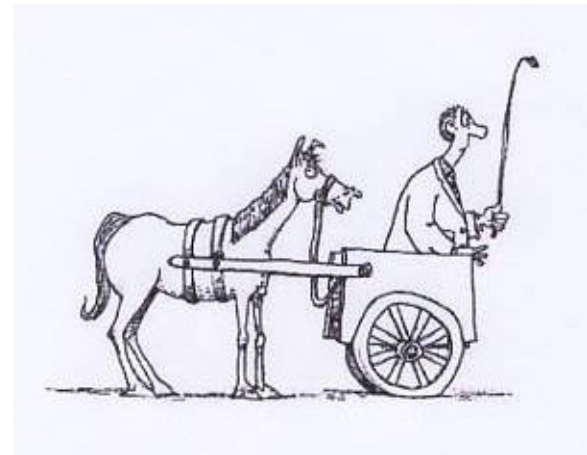
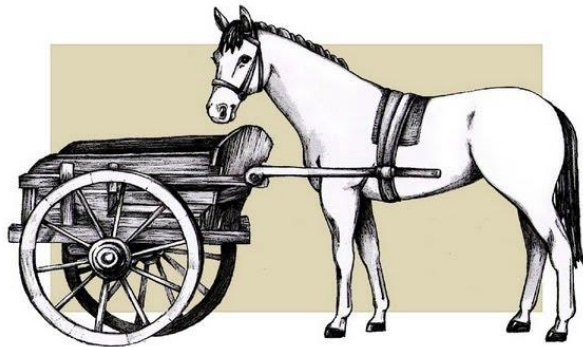
# **Connect-the-Dot?**

**If Reactors A and B each had flooding protection issues, NRC's processes would treat each equally in terms of urgency, etc.**

**But what if Reactor B also had seismic and fire issues and was in Action Matrix column 4 while Reactor A had no other issues and was in column 1?**

# Cart Before Horse

**The NRC mandated that walkdowns and assessments be performed BEFORE it clearly articulated its expectations and appropriate standards.**



# **Cart Before Horse**

- 08-09-2010:** NRC accepted upstream dam failure issue in its generic issue program
- 03-11-2011:** Fukushima Daiichi experienced earthquake and tsunami
- 03-23-2011:** NRC began walkdowns per Temporary Inspection 2515/183
- 07-12-2011:** Near-Term Task Force issued report and recommends external flooding walkdowns

# **Cart Before Horse**

- 02-29-2012: NRC approved upstream dam failure issue as Generic Issue 204**
- 03-12-2012: NRC mandated walkdowns and reevaluations of flooding hazards**
- 05-31-2012: NRC endorsed NEI flooding walkdown guidance**
- 11-30-2012: NRC issues flooding assessment guidance**
- 01-04-2013: NRC issues tsunami, surge, seiche hazard assessment guidance**

# Cart Before Horse

Draft 18; January 17, 2013

*Program*

Workshop on  
Probabilistic Flood Hazard Assessment  
(PFHA)

January 29 - 31, 2013, 8:30 a.m. – 6:00 p.m. (EST)  
U.S. NRC Headquarters Auditorium  
11555 Rockville Pike, Rockville, MD 20852

*Federal Agency Partners*



**More than 10 months AFTER the walkdown directive, NRC hosted a flooding assessment workshop.**



# Cart Before Horse

## Extreme Flood Frequency Analysis: Concepts, Philosophy and Strategies

Jery R. Stedinger

Cornell University and USGS

Member HFAWG

sabbaticals USGS, US ACE

with V. Griffis, A. Veilleux, E. Martins, T. Cohn

**More than two  
years later,  
federal  
government is  
playing catch-up.**

### Bulletin 17B

- Uniform flood frequency techniques used by US Federal agencies
- **Bulletin not updated in 20+ years**
  - despite significant amount of research
  - additional 30 years of data for skew map
  - better statistical procedures for censored data

### Bulletin 17C

- **Revision on the way**
- Provides a tune up addressing
  - Use of historical information
  - Potentially Influential Low Floods (PILFs)
  - Censored & interval data
  - **Confidence intervals & uncertainty analyses**
- Also developing better regional skew

# **Cart Before Horse**

## **Some unanswered questions:**

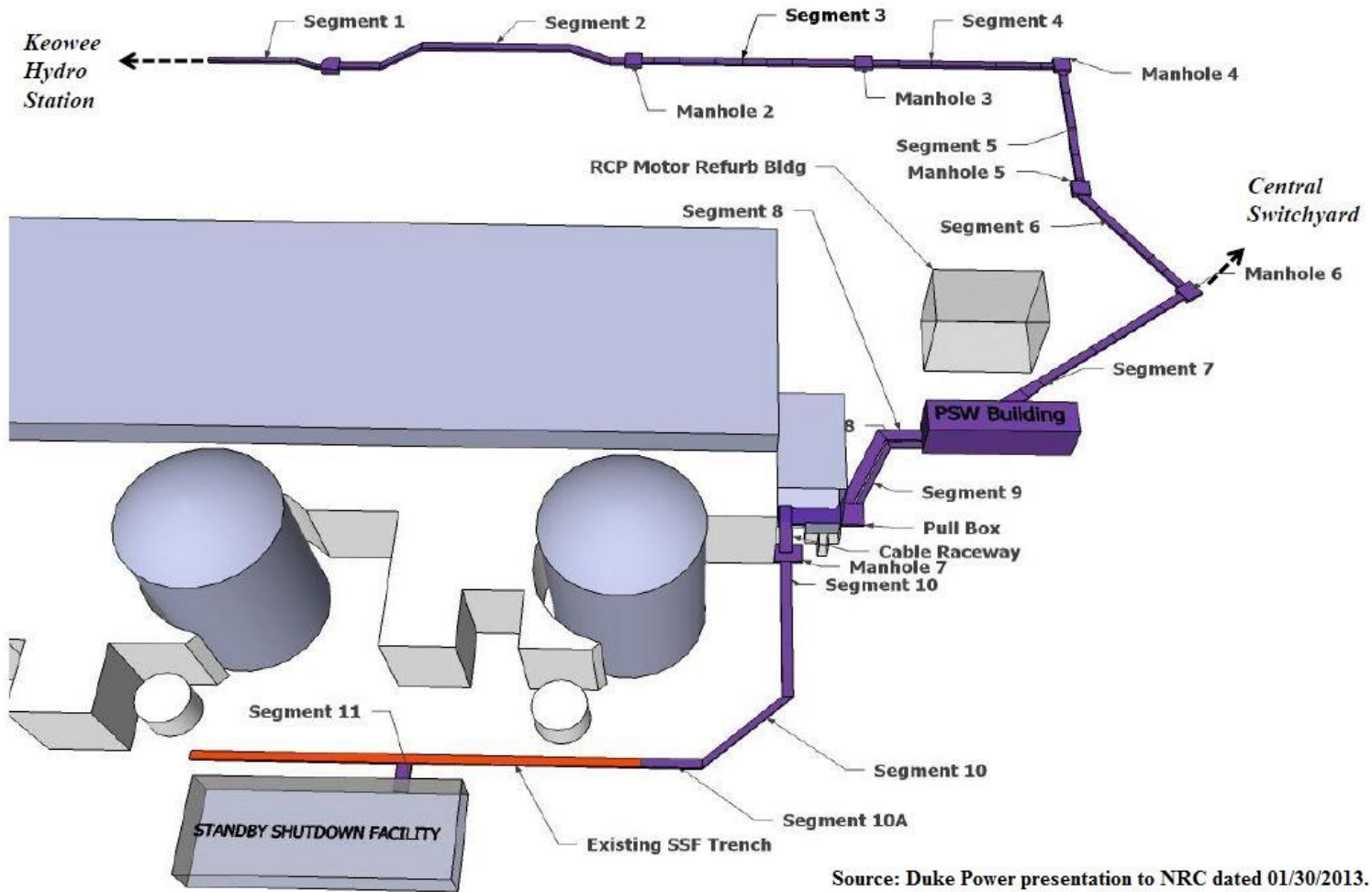
- 1) Should dam failures be postulated concurrent with heavy rainfall, or should the current “sunny day” practice continue?**

# **Cart Before Horse**

**Some unanswered questions:**

**2) When assessing flooding above design basis levels, should factors like weight of water affecting structures be considered, or totally ignored as is the current practice?**

# Cart Before Horse



# **Cart Before Horse**

## **Some unanswered questions:**

**3) When assessing flooding below design basis levels, should manual actions being impaired by flood water be considered, or totally ignored as is the current practice?**

# **Cart Before Horse**

**Had they been completed at Fukushima Daiichi before March 10, 2011, would the NRC-mandated flooding walkdowns and assessments have prevented the three reactor meltdowns?**



# **Cart Before Horse**

## **Near Term Task Force recommendation 2.2:**

**Initiate rulemaking to require licensees to confirm seismic hazards and flooding hazards every 10 years and address any new and significant information. If necessary, update the design basis for SSCs important to protect against the updated hazards.**

# Flood Hazard Reevaluations: Categories

Category 1 Due 03/12/2013		Category 2 Due 03/12/2014		Category 3 Due 03/12/2015	
Callaway	Quad Cities	Arkansas Nuclear One	Fort Calhoun	<del>Bellefonte</del>	Perry
Calvert Cliffs	Salem 03/2014	Beaver Valley	Robinson	Brunswick	Pilgrim
Comanche Peak	Sequoyah 03/2015	Braidwood	Farley	Crystal River	Point Beach
Dresden 05/2013	Shearon Harris	Browns Ferry	<del>Kewaunee</del>	Diablo Canyon	Ginna
Fermi	South Texas	Byron	LaSalle	DC Cook	<del>San Onofre</del>
Grand Gulf	Three Mile Island	Catawba	Monticello	FitzPatrick	Seabrook
Hope Creek 03/2014	Turkey Point	Clinton	Palo Verde	Limerick	St. Lucie
Indian Point 12/2013	Vermont Yankee	Columbia	Peach Bottom	Millstone	Surry
Nine Mile Point	Summer	Cooper	Prairie Island	Oyster Creek	Susquehanna
North Anna	Vogtle	Davis-Besse	River Bend	Palisades	Waterford
Oconee	Watts Bar 03/2015	Duane Arnold	McGuire		
delayed		Hatch	Wolf Creek		
COUNT= <del>22</del> 18		COUNT= <del>24</del> 26		COUNT= <del>20</del> 22	

Source: NRC slides 11/12/2013 (ML13311A268)

# Observations from Walkdown Reports

- Approximately 90% of licensees entered an issue into its Corrective Actions Program
- Common issues identified include:
  - Inadequate procedures
  - Flood protection features that may not perform as planned
  - Degraded or missing seals

Source: NRC slides 11/12/2013 (ML13311A268)

# **Duck and Uncover**

**06/22/2010 – Secret confirmatory action letter for Oconee flood protection shortcoming**

**10/08/2010 – Public yellow finding for Fort Calhoun flood protection shortcoming**

**06/18/2013 – Public yellow finding for Point Beach flood protection shortcoming**

**08/28/2013 – Public yellow finding for Monticello flood protection problem**

# Issues

- **Risk integration vs. isolation**
- **Cart before the horse**
- **[redacted] oversight**

# **Acronym List**

**CEUS – Central and Eastern  
United States**

**GI – Generic issue**

**NEI – Nuclear Energy Institute**

**NRC – Nuclear Regulatory  
Commission**

**RG – Regulatory Guide**

**SSC – Systems, structures, and  
components**

**USGS – United States Geological  
Survey**