UCS Perspectives on NRC and Industry Actions in Response to Fukushima

April 30, 2015

Dr. Edwin S. Lyman
Senior Scientist
Union of Concerned Scientists

General comment

- **UCS acknowledges the enormous effort on the part of the NRC and the industry to address safety vulnerabilities post-Fukushima**
- **However, the lack of a unifying framework (e.g. NTTF Recommendation 1) has led to an overly complex and confusing set of activities**
- **Consequently, it is hard to assess to what degree safety is being improved**
- **The NRC should keep a tight rein on "schedule relaxations" (e.g. Indian Point 3) to prevent a repeat of the decade-long time to fully implement post-9/11 modifications**

UCS view of mitigating strategies/FLEX

- **FLEX does not fulfill the original intent of the Near Term Task Force**
  - **Stakeholder input influenced the NRC staff to pursue a more performance-based approach [e.g. FLEX] to improve the safety of operating power reactors than envisioned in NTTF Recommendation 4.2 …" – boilerplate language in NRC Safety Evaluation Reports**
- **"Diverse and flexible" response is necessary, but perhaps not sufficient**
  - **French "hardened safety core" may also be needed**
- **FLEX boundary conditions are too narrow and represent an artificial, stylized event**
  - **Contributes to the confusion surrounding the flooding hazard reevaluations**

Industry position has shifted

"… the mitigation of Beyond-Design-Basis Event capabilities needs to address a spectrum of plant conditions that may be caused by the different initiating events and the resulting damage states … it basically requires that you assume the ELAP condition and the loss of the heat sink even when you're assessing the revised hazard response. We think that in many of those cases you should be able to use a alternate or targeted hazard mitigation strategy that takes into account the actual state of the plant."

– Bryan Ford, Entergy, ACRS Fukushima Subcommittee meeting, March 20, 2015.

FLEX inspections

- **Performance-based requirements need performance testing-based inspections**
- **UCS proposes that the effectiveness of mitigating strategies be inspected through a series of stress test scenarios, supplemented by performance testing where appropriate**
  - **To be modeled on force-on-force security inspections**
- **Goal: to assure that FLEX can provide plausible success paths for a sufficiently broad spectrum of beyond-design-basis events**

Westinghouse RCP seal problem

- **NSAL-15-2 released publicly on April 23**
- **UCS is still evaluating its significance but it appears that it could have an impact on FLEX timelines and cause further delays in compliance with EA-12-049**
- **This is in addition to the previously revealed problems in RCP seal leakage modeling (NSAL-14-1):**
  - **"At the present time, the NRC staff is unable to conclude that Westinghouse's analytical modeling of RCP seal leakage is acceptable on its own merits." – Watts Bar mitigating strategies SER, March 27, 2015.**

Flooding

- **NRC seems to be "at sea" at the moment regarding its response to flooding hazards**
- **UCS strongly supports SRM-COMSECY-14-0037, but is concerned that directing the staff to be "risk-informed" may only increase confusion, given the absence of credible flooding PRA methods**
- **In our view, reevaluated hazards (based on more accurate information and improved methods) constitute the *true* design basis; the original design basis was *wrong***

Defense-in-depth

- **DID should not be lumped in with other "qualitative" factors: it has a unique regulatory role**
- **DID is a crucial consideration in evaluating the benefits of regulatory requirements for post-core damage measures (e.g. SAMGs and CPRR)**
  - **Effectiveness of mitigating strategies for preventing core damage cannot be well-quantified (depends on uncertain operator actions)**

BDBE mitigation and CPRR rulemakings

- **UCS strongly supports the incorporation of SAMGs into the BDBE mitigation rulemaking as a regulatory requirement**
  - **SAMGs cannot otherwise be effectively integrated with other emergency procedures/guidelines**
  - **Severe accident water management is being proposed as a measure for compliance with EA-13-109 and as such would be a regulatory requirement**
  - **NRC should approve such a rule in its entirety on the basis of adequate protection**
- **UCS strongly recommends that the NRC follow through with its commitment to develop a CPRR draft rule for public comment (including a filter alternative)**

Benefits of SAMGs

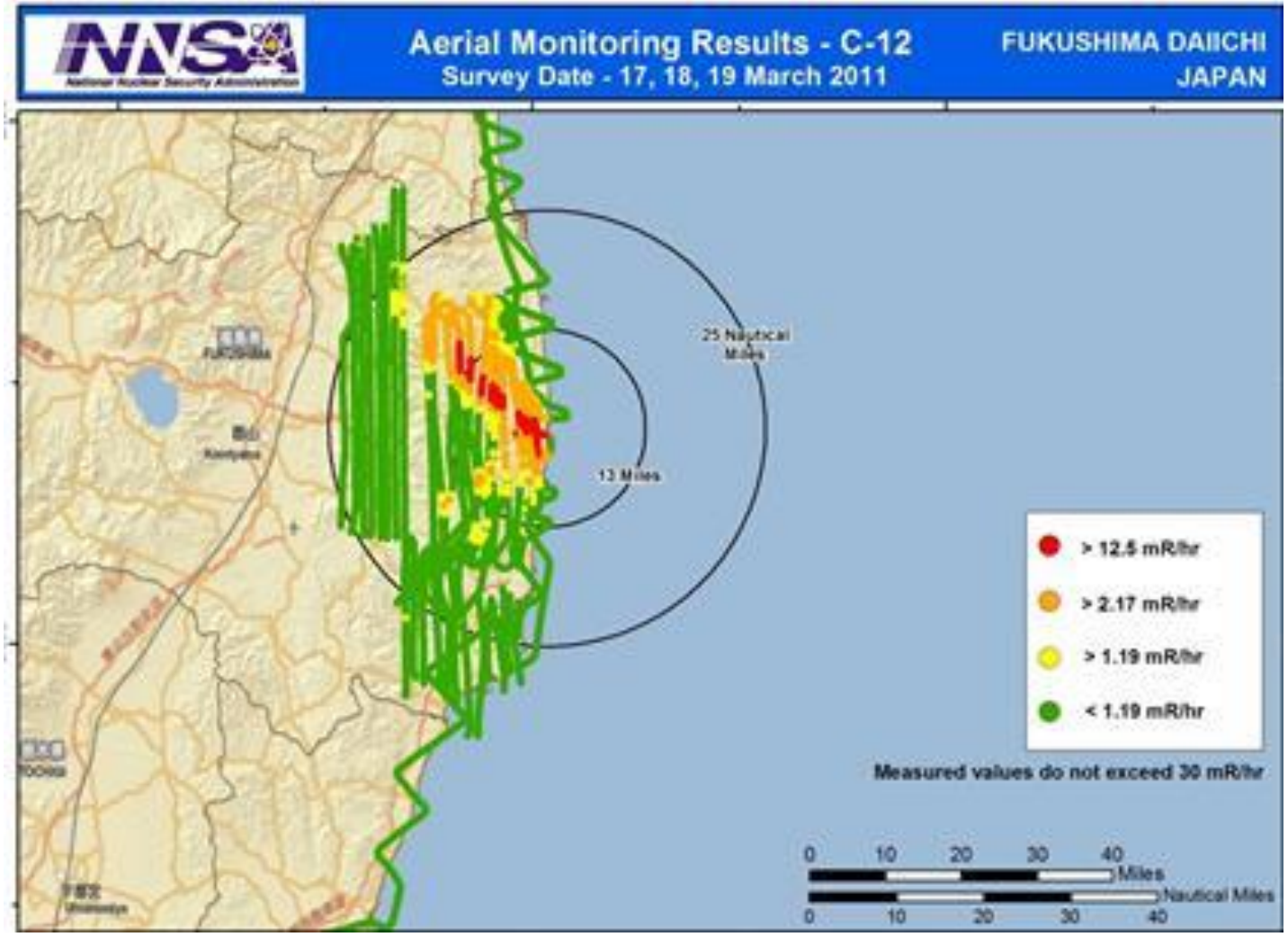
- **The staff's conclusion that SAMGs cannot be quantitatively justified has been questioned:**

"I've got real problems with the way you refer to those technical analyses for the CPRR as evidence that SAMGs don't improve risk… to point to that limited, and in my opinion very flawed technical analysis to say that that the NRC can draw a conclusion that SAMGs … do not improve risk … is misleading at best." **–** John Stetkar, ACRS, Fukushima Subcommittee Meeting, March 20, 2015.

- **The staff's long-overdue update of the value of a statistical life (to $9 million, or $5,100/person-rem) will have an impact on quantitative cost-benefit determinations**

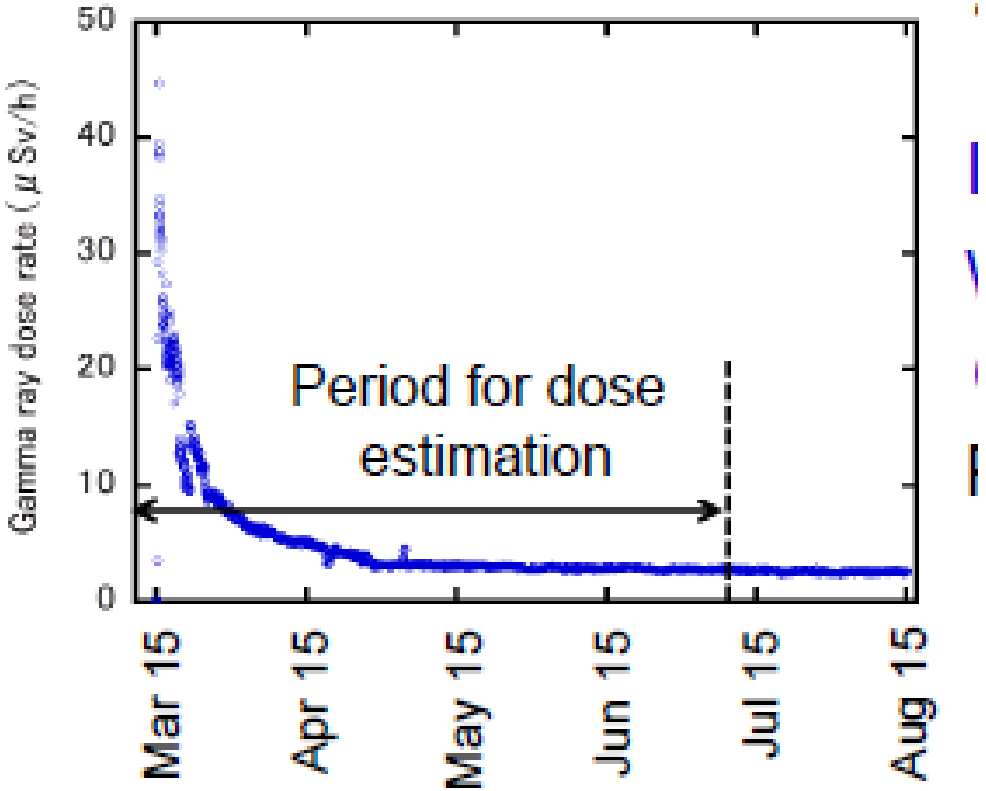
EPZ size and KI distribution

- **The NRC needs to seriously consider expansion of the plume exposure EPZ radius beyond 10 miles in light of Fukushima**
- **Environmental Protection Agency protective action guide for evacuation (1 rem in 4 days) likely exceeded at least 20 miles away from Fukushima Daiichi**
- **More severe releases were projected to exceed PAGs much further away**
- **Japan has expanded its evacuation planning zone to 30 km (18.6 miles)**
- **Assertion that larger areas can be effectively evacuated on an ad hoc basis after an accident occurs for any U.S. plant needs to be reassessed**


NNSA
National Nuclear Security Administration
Aerial Monitoring Results - C-12
Survey Date - 17, 18, 19 March 2011
FUKUSHIMA DAIICHI
JAPAN
25 Nautical Miles
13 Miles
> 12.5 mR/hr
> 2.17 mR/hr
> 1.19 mR/hr
< 1.19 mR/hr
Measured values do not exceed 30 mR/hr
0 10 20 30 40
Miles
Nautical Miles
0 10 20 30 40

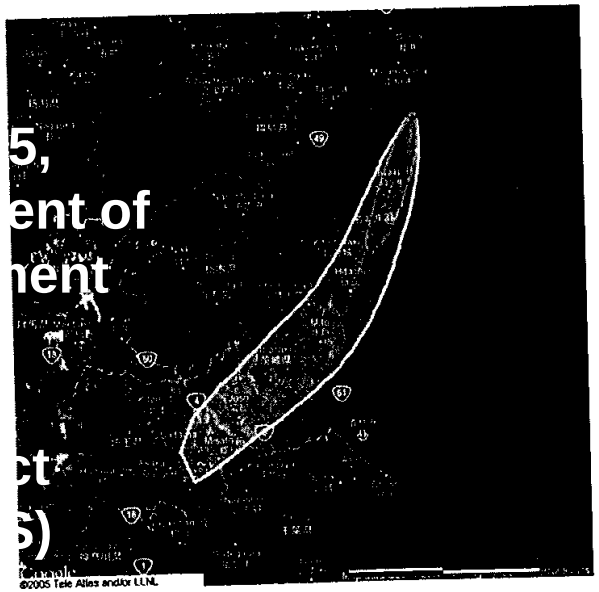
External dose rate: Iitate Village (25 miles from Fukushima Daiichi)

Approx.
300 mrem external dose in first 4 days; internal doses from plume exposure unknown



3. Plausible Severe Release

Release from 2 Spent Fuel Pools



The graphic indicates where the 96-hour total effective dose including plume passage exceeds 1 rem (yellow) and 5 rem (orange)

- In this hypothetical scenario, the US EPA Protective Action Guidelines for the total effective dose MAY be exceeded in Tokyo, as well as at locations closer to the release point.
- In this hypothetical scenario, the US EPA Protective Action Guidelines for both the adult and child thyroid dose will NOT be exceeded in Tokyo, but are exceeded at locations closer to the release point

U.S. worst case dose projections

		Summary					
	Distance (km)	96-hour Adult Dose (mrem)			Child Thyroid Dose (mrem)		
Cs-137/I-131 rel (CI)		low	median	high	low		high
Southern Alaska		0.05	0.30	80			
Hawaii	6200	0.01	0.12	3	0.4	700	1800
Midway	4100	0.003	0.29	10			
Wake	3200	0.002	0.06	1			
West Coast	8000	0.01	0.09	0.8	0.06	400	4500

Acronyms

- **CPRR: Containment Protection and Release Reduction**
- **DID: Defense-in-Depth**
- **EPZ: Emergency Planning Zone**
- **NTTF: Near-Term Task Force**
- **PAGs: Protective Action Guides**
- **PRA: Probabilistic Risk Assessment**
- **RCP: Reactor Coolant Pump**
- **SAMGs: Severe Accident Management Guidelines**

Acronyms

- **UCS: Union of Concerned Scientists**