

Prepared Comments of Christopher E. Paine
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SECY-11-0137, "Staff Assessment and Prioritization of Near-Term Task Force Recommendations."
October 11, 2011

2.1 and 2.3 Seismic and Flood Reevaluations and Walk-downs:

The Staff proposal on how to deal with these recommendations seems needlessly bureaucratic, time-consuming and cumbersome. It involves preparation of no less than four separate Request for Information documents (two separate letters covering reevaluation of site-specific seismic and flooding hazards and two to guide seismic and flooding walk-downs) followed by Staff review of this information that would result in four separate safety evaluations or NUREGs to document staff conclusions, followed by four draft orders, a total of 12 separate commission documents just to get to the starting line of implementing upgraded flood and seismic protections.

This laborious sequence seems unnecessarily complicated and lengthy. Given already extensive regulatory documentation of these issues, is this mountain of additional preliminary paperwork really necessary? Is the Staff expecting industry to invoke the "Backfit Rule," and thus intent on compiling a meticulous administrative record to fend off legal challenges? If this is the case, then in the interest of expediting improvements to public safety, the Commission should consider suspending application of the Backfit Rule to some or all of its regulatory responses to the Fukushima accident.

The NRC has been gnawing on the problem of reassessing seismic risks at existing plants for a very long time, essentially since *Unresolved Safety Issue (USI) A-46, 'Seismic Qualification of Mechanical and Electrical Equipment in Operating Nuclear Power Plants* was issued in December 1980. But all subsequent regulatory improvements have been confined to reactor license applications submitted after January 10, 1997, allowing existing reactors to duck a seismic vulnerability review for decades. In June 2005 the Commission finally initiated *Generic Issue (GI) 199, "Implications of Updated Probabilistic Seismic Hazard Estimates in Central and Eastern United States on Existing Plants."* That was *more than six years ago*, and GI 199 is just now getting to the stage of determining site-specific hazards and associated nuclear plant risks. A new Generic Letter to guide the site-specific process is in the works.

Meanwhile, to guide reviews of new reactors, since 2007 the Staff has established new interim staff guidance and regulatory guides on: *"Seismic Issues of High Frequency Ground Motion" (DC/COL-ISG-1); "Seismic Margin Analysis for New Reactors Based on Probabilistic Risk Assessment: (DC/COL-ISG-20) and RG 1.208, "A Performance-Based Approach to Define the Site-Specific Earthquake Ground Motion" (RG 1.208).*

An obvious and expediting solution would be to apply the criteria and methods for seismic evaluation of new reactor Early Site Permit (ESP) and Combined License (COL) applications to the existing reactors, and let the chips fall where they may. Because an existing unit may come up short under this approach does not automatically mean that it will be compelled to shut down. That judgment is a more complex regulatory determination, involving the totality of the safety improvements and accident mitigation strategies that are feasible for a given unit at a given site, and how much the licensee is willing to invest in order to keep the unit in operation with a credible margin of safety. But the public deserves to know where all these older units stand with respect to the seismic challenges they face in light of the seismic

resistance regulators deem essential to achieve in modern plants, and then we can proceed to evaluate the risks of continuing to operate the older units on that basis.

Improved knowledge is not the enemy, but the vague language employed by the Staff – “continue stakeholder interactions to discuss the technical basis and acceptance criteria for conducting a reevaluation of site specific seismic hazards,” including “implementation considerations of the hazard and risk methodologies described in a draft *Generic Letter 2011 – XX “Seismic Risk Evaluations for Operating Reactors”* -- suggests to us a possible effort to soften and tailor the criteria and methods so that existing plants will fall less short than they otherwise would, or better yet, even pass muster.

However, on the flooding issue the Staff does not hesitate to propose “application of present-day regulatory guidance and methodologies being used for early site permit and combined license reviews to the reevaluation of flooding hazards at operating reactors.” I am not in a position to judge whether this discrepancy in the source of seismic versus flooding regulatory guidance and methodologies is meaningful or not, but I commend it to the Commission’s attention.

Regardless of their source, it seems to me that consideration of the criteria and specific methodologies to guide the seismic evaluations and seismic walk-downs could be consolidated in a single document, since they are intimately related and the approved methods for reassessing seismic resistance must be established in advance before walking down a plant to gather relevant data on its seismic vulnerabilities.

Similar reasoning applies to the consideration of flooding hazards and walkdowns, where the threat is more familiar, arguably less complex, and where there are reams of historical flood data and now climate modeling data regarding projected precipitation patterns and future flood risk. This approach also has the virtue of eliminating potential conflicts and discrepancies between the separate “reevaluation” and “walk-down” chains of documents that could slow down or confuse the process of implementing upgrades.

Then skip the four separate Staff written safety evaluations (or NUREGs) and proceed directly to drafting two commission orders, one to guide the seismic reevaluations and walk-downs, and the other to guide the flooding reevaluations and walk-downs. This would reduce the stack of separate Commission documents from twelve to four. Then take the unusual step of issuing these as draft orders for a 30-day period of public notice and comment. Take another 30 days to consider these comments and then issue a final rule and begin the walk-downs. Aim to get all the paperwork done and begin the walk-down stage within six months.

3. Preventing or Mitigating Seismically-Induced Fires and Floods

The serious threat of seismically-induced fires and floods has been officially recognized by the Commission for several decades, but for just as long the Commission has done nothing about it. This is in line with the Commission’s continuing failure to decisively address and minimize nuclear plant fire risks in general. Current fire protection systems are not even required to be functional after a seismic event, and due to their inherent vulnerabilities, they can themselves be a source of pipe breaks and flooding that could cause safety system and component (SSC) functional failures. Indeed the July 2007 quake that struck the world largest nuclear power plant in Niigata, Japan demonstrated how serious these fire and

flooding effects can be. After an excellent, even disturbing summary evaluation of the problem, the Near Term Task Force report came to an incommensurate conclusion – “as part of the longer term review, ...evaluate potential enhancements to the capability to prevent or mitigate seismically induced fires and floods.”

We can see no valid reason for excluding seismically-induced fire and flood vulnerabilities from the seismic and flooding plant walk-downs called for under Recommendation 2, or from inclusion in any subsequent Commission orders issued to rectify the vulnerabilities noted. This is far too important an issue to punt into some vague and distant “long-term evaluation,” which is precisely where it has been for decades.

4.1 Station Blackout regulatory actions

After witnessing the most severe station blackout episode in history at Fukushima, with damages running into the hundreds of billions of dollars, the Staff rightly classifies SBO mitigation capability as a “Tier 1” issue, but then it proposes a leisurely four-and-a quarter year schedule just for developing and issuing a final rule that would amend 10 CFR 50.63. Even barring further elongation of this timetable, which given the NRC’s notorious penchant for procrastination seems likely, the staff proposal means that improved protections against SBO would not be in place until the first quarter of 2016 at the earliest, and probably much longer. NRDC finds this delay to be unacceptable, and indicative of a continuing Commission mindset that the worst case simply cannot happen in the United States.

During the long wait for this rulemaking, the only recommended “interim action” regarding SBO mitigation is recommendation 4.2, which would provide better protection of potentially dual-use mitigation equipment specifically designed to survive and cope with the consequences of terrorist induced fires and explosions. But the current version of this recommendation begs the question of protecting this equipment from severe natural events that are currently “beyond-design basis,” like those that overwhelmed Fukushima. The staff proposal even explicitly raises doubts about whether the proposed “reasonable protection” standard would actually require storing EDMG equipment in seismic Category I structures built to *present* design-basis limits for ground motion at a particular site.

Since design-basis parameters for the full range of severe natural events are also the object of Tier 1 review and revision under NTF Recommendations 2.1 and 2.3, via a process likewise destined to take years, any “interim protection” from SBO’s under 4.2 would appear to be based on the current insufficient design basis criteria. So in effect the Staff is proposing no significant increase in SBO mitigation capability for at least 4.25 years, and if past is prologue, probably much longer than that. As I noted, NRDC finds this situation intolerable, and we urge the Commission to act expeditiously to strengthen the staff recommendations on mitigating SBO’s with some meaningful near-term actions:

- *Promptly issue an order establishing a significantly longer minimum on-site SBO coping capability for critical emergency core cooling functions, utilizing a flexible combination of extended DC battery backup, portable power units, and self-powered alternatives using residual heat removal steam. The status-quo, ranging from as little as two to eight hours for maintaining DC emergency power to these functions at US units -- is simply not enough, and the American people shouldn’t have to wait over four years to begin gaining any meaningful improvement in coping capability.*

The price/performance ratio of battery bank energy storage has improved considerably in recent years and available to plant operators in the commercial marketplace, there are portable power technology options that can be ruggedized, seismically hardened, and survivably positioned within the plant site, and as I just noted, there are now reliable self-powering options.

All French PWR nuclear units, for example, already achieve some 20 hours of coping time by employing small emergency turbo-generators running on secondary loop steam from the steam generators. Within two minutes of emergency shut-down in response to an SBO, these units supply power to a primary system motor-driven test pump that ensures continued cooling of critical primary loop coolant pump seals, and ensures maintenance of a minimum of control valve and instrumentation functions for regulating pressure and temperature in primary and secondary cooling systems, primary system refill, speed control of the steam turbine-driven pump(s) for auxiliary supply of the steam generator, and control of the atmospheric steam relief valves.

In US PWRs, an extended self-powering option would seem to be readily available by attaching a modern low-maintenance generator, such as a permanent magnet generator, to the shaft end of the Auxiliary Feedwater Pump Turbine. This upgrade could simultaneously cure reliance on obsolete hydraulic speed control systems that frequent result in overspeed trips on startup, uncertain reliability, and high maintenance costs for this critical safety-related component.

In BWR's, there are numerous opportunities for extended self-powering options for speed and flow control of safety-related turbines, and for much longer than the minimum recommended eight hours of initial coping capability. These generators could be attached to the Reactor Core Injection Cooling (RCIC), High Pressure Safety Injection (HPSI), and Low Pressure Safety Injection (LPSI) turbines, providing AC power to critical instrumentation and control valves for emergency core-cooling as long as a supply of steam remains available. This could free the expanded battery bank for supplying power to other critical monitoring systems and controls, such as radiation monitors, emergency lighting, cameras in remote or radiation hazard locations, and upgraded spent fuel pool instrumentation.

Recommendation 5.1 – Require Reliable Hardened Vents in BWRs with Mark I and II containments

NRDC strongly supports prompt action on this issue, with the added caveat that we see no reason why these should not be hardened filtered vents. While the inherent flaws of the Mark I and II containments make them the priority targets for near-term Commission orders to install filtered vents, it should be noted, with some embarrassment to our pretensions as global nuclear safety leader, that on the order of 90 operating reactors *of all types* in Europe already have some type of Filtered Containment Vent System (FCVS) installed.

IMI Nuclear, a company headquartered in Switzerland, has recently completed development of a second-generation filtered vent system with a claimed tenfold improvement in the decontamination factor for active aerosols and elemental iodine (I_2) and the ability to capture volatile iodine species that previously went up the stack. These high-performance vents are already installed in Switzerland at the Liebstadt NPP, which is a GE-BWR Model 6 and at the Beznau NPP, which is a two-loop Westinghouse PWR. *The Commission should make it a high priority to get on top on these technological advances so they can be included in the orders implementing Recommendation 5.1.*

Recommendation 7.1 – Order Licensees to provide sufficient safety related instrumentation, able to withstand design-basis natural phenomena, to monitor key Spent Fuel Pool parameters (i.e. water level, temperature, and area radiation levels) from the control room.

The Staff prioritization paper (SECY-11-0137) introduces some subtle caveats that muddy the waters surrounding implementation of this important recommendation. The Staff wants to begin the process by engaging stakeholders on “what constitutes *potentially safety-related* SFP instrumentation” before it asks the Commission to issue orders providing only for “*reliable* SFP instrumentation,” whereas the Task Force called for the provision of “*sufficient safety-related instrumentation* able to withstand design basis natural phenomena.”

If the Commission is serious about this issue and not merely dabbling in it until the public concern fades away, it will direct that these SFP instrumentation upgrades be “safety-related,” and therefore subject to the Commission’s quality assurance requirements in 10 CFR Part 50 Appendix B, and also capable of maintaining performance in severe accident scenarios that are currently beyond a plant’s approved design basis.

Recommendations 7.2 – 7.5 (Tier 2) – Enhancing SFP makeup capability.

The Staff prioritization paper demotes the Task Force recommendations for ensuring spent fuel makeup capability from a *near-term priority for Commission orders* to a “*Tier 2*” *priority for eventual rulemaking*, “after consideration of insights” from the extended rulemaking processes that the Staff now calls for. Once again, this kicks out any resolution and implementing action on this important issue for at least 4 years. We therefore oppose this staff recommendation, and urge that the Commission, as a minimum revert to the original Task Force recommendation.

However, as good as Task Force Recommendation 7 was in its original form, we note that it entered the current Staff review process with two inherent weaknesses:

- (1) It ignores the safety advantages of off-loading densely packed spent fuel from vulnerable pools to better protected hardened dry cask storage, and
- (2) It artificially constrains the problem of ensuring spent fuel cooling to SFP makeup capability only.

With respect to the first issue, it is of long standing, and the Commission’s current position that the two methods of storing spent fuel are essentially equivalent in the risks they pose remains undocumented and untenable. We and others have already raised this issue in the context of this review and once again the Staff has failed to address these comments.

With respect to the second issue, a safety strategy for spent fuel pools that relies solely on supplying make-up water to a boiling pool can have a deleterious impact on overall safety when the pools are located within the secondary containment and above critical safety related equipment for the reactor, as is the case in BWR’s. In fact the Commission already has before it a 2.206 petition from our colleagues at the Union of Concerned Scientists on this very issue. A boiling spent fuel pool inside the secondary containment that is continuously supplied with make-up water would create a submergence threat via condensation that would threaten the operability of critical reactor safety systems located near the base of the reactor vessel in BWR’s. Even if submergence could somehow be avoided,

temperature and humidity conditions could compromise critical safety related electrical equipment, including critical control systems for the turbine driven emergency cooling pumps.

The Staff paper and recommendation fails to address this issue. For BWR's the right spent fuel pool safety strategy is more complex and demanding than that proposed by the Staff. The *first option should be ensuring a robust SBO supply of electric power and cooling water to the pool heat removal system*, and to hardening this system against the effects of severe natural events. Or, in the alternative, you could qualify all the safety-related electronic, electro-mechanical, and hydraulic control systems in BWR emergency core cooling and pressure relief systems to function in a saturated high-temperature environment. What you can't do is continue, as the Staff does in its current recommendation, to ignore this significant safety issue.

Recommendation 8: Strengthening and Integrating Onsite Emergency Response Capabilities

Unfortunately, neither the Task Force recommendation nor the Staff's subsequent evaluation of it clearly bites the bullet and brings *severe accident mitigation hardware features and operating procedures firmly within the ambit of NRC operating license requirements* subject to the NRC's continuing inspection and enforcement process. It would greatly simplify matters if the Commission took this step, thereby making it clear to industry and the public that the era of non-binding, unaccountable self-regulation was over in the critical matter of on-site emergency responses.

It never made sense in the first place to push these issues to the margins of the regulatory system, and it makes even less sense now in the wake of Fukushima. Given that unexpectedly severe natural or man-made events or multiple equipment failures could challenge one or more units in a population of 104 aging nuclear power plant *at any time*, the Staff's proposal, to engage in a yet another leisurely rulemaking that would put us at the starting line for implementation in 4.25 years, is unacceptable.

The Commission should revert to the original Task Force recommendation for issuance of a near-term order and strengthen it in the manner I've just indicated.

Recommendation 9: Require that facility emergency plans address prolonged Station Blackout and multiunit events.

Of the original four-part recommendation, the Staff prioritizes as "Tier One" only a part of sub-recommendation 9.3, and then proceeds to gut even that small part, converting it from being the object of a near-term Commission order to an extended group grope with industry that could take years.

- First, the staff wants to "engage stakeholders to inform development of a methodology to perform a staffing study to determine the required staff to fill all necessary positions to respond to a multiunit event;
- Then its wants to "discuss" with stakeholders "potential enhancements that could provide a means to power communications equipment...during a prolonged SBO event,"
- Then it wants to issue a request for information to licensees to "perform a staffing study to determine the required staff to fill all necessary positions to respond to a multiunit event" and "evaluate what enhancements would be needed to provide a means to power communications equipment necessary for licensee onsite and offsite communications;"

- Then it wants licensees to inform the NRC of the results of these studies and any actions taken or planned to “react to” the staffing study results or to enhance communications equipment;

Then the Staff would “evaluate licensee responses,” and prepare a written safety evaluation or NUREG to “document staff conclusions.”

- Then it would “develop a regulatory basis” and draft orders “if needed”

- If the Staff decides that orders are needed and the Commission decides to issue them, then staff will develop a “temporary instruction” for follow-up inspection activities, and then after an indeterminate period conduct inspections and document the results.

Most of these steps don’t even have a proposed schedule associated with them. This supposedly “Tier One” high priority recommendation would take years to implement. Is all this regulatory hocus-pocus really necessary just to answer the question, “how many additional emergency staff do we need to respond to a severe multi-unit event like Fukushima, and how will these people be provided with an assured means of radio communications?”

I have a simpler plan. Commissioner Ostendorff, I’m certain, would be willing to call one of his former colleagues in the Navy and pose a simple question, “what systems do you rely for shock resistant, radiation-hardened, enduring and survivable radio communications between personnel on a nuclear aircraft carrier. Others could call other government agencies and departments, such as DoD, the Army, Air Force and Marine Corps, FEMA, Homeland Security, and NNSA, having similar robust emergency communications requirements, and find out what they use. Then sit down and write a set of NRC requirements that several commercially-available robust portable power solutions can reasonably meet, and then issue an order to licensees to purchase this type of equipment. Then make the operational readiness of this equipment, and the ability to use it to achieve required safety goals, a matter for recurring inspection. This should take you no more than six months start-to-finish.

Having tossed the staffing and communication elements of the original 9.3 recommendation into a regulatory briar patch from which they may never emerge, the Staff then demotes the rest of the 9.3 recommended orders to “Tier 2” status and makes any further action contingent on the future availability of “sufficient staff with critical skill sets” to “engage stakeholders to inform the development of acceptance criteria for the licensee examination of planning standards elements related to the recommendations.” I have no idea what that last phrase means, and I suspect none of you do either, but whatever it means, the Staff memo states that a process for eventually generating the specific orders to implement Task Force recommendation 9.3 will not even *begin* until “mid-2012,” more than a year after the accident.

The Staff believes the remaining elements of Recommendation 9.3 – how to perform a multiunit dose assessment, training for multiunit and prolonged SBO scenarios, and ensuring a sufficient supply of equipment for dealing with those scenarios – pose “unique implementation challenges” because the Staff is already engaged in “a significant outreach effort” to licensees to ensure “consistent implementation” of emergency planning reforms developed *before* Fukushima.

Similarly, rulemakings under Recommendation 9 that would require facility emergency plans to address “prolonged multiunit events” and “prolonged station blackout” are punted into Tier 3 without even a schedule for “long-term evaluation.” While I can appreciate the Staff’s psychological and bureaucratic investments in the recently completed Emergency Planning rule, I find the substantive logic here hard

to fathom: something terrible happens in a highly experienced nuclear power nation that confirms the potential for more severe accident than we are currently prepared to protect the public against, but the most important priority for the Staff remains the implementation of a modest emergency planning reform that fails to take account of this new reality.

I would further note that these modest amendments to emergency planning requirements took the Commission five years just to *issue*, much less implement, so I merely pose the question, “*will you allow post-Fukushima emergency planning enhancements to coast along on the same leisurely track?*” Because that is the direction in which the Staff is pointing you.

Other Emergency Preparedness Issues (Recommendations 10 and 11)

The Staff’s prioritization of all remaining Task Force EP issues to an indeterminate “Third Tier’ is indicative of the difficulty the NRC and the industry have in facing up to the risk of catastrophic consequences from nuclear accidents and then doing something credible to reduce or mitigate their harm to the exposed population. NRDC believes there are serious emergency planning issues that the Task Force report and Staff review have completely overlooked:

- At what point, if ever, does the size of the surrounding population potentially at risk from a serious nuclear accident impose a limit on the practical, financial, or moral efficacy of engaging in the emergency preparedness portion of the “defense-in-depth” process. If there is such a limit, how should it find regulatory expression:
 - in a new operating license condition for existing reactors that would compel their closure when the population at risk exceeds a certain level within the maximum credible radius for a severe accident (e.g. the 17 million within 50 miles of Indian Point)?
 - in additional criteria for new reactors that would bar siting within an area of x radius from the plant that contains an aggregate population (or average population density) greater than y?
 - in a ceiling on the potential financial damages to real property and economic activity that could be incurred in the event of a serious accident?
 - in new fuel and reactor design requirements for reactors sited in urban areas that significantly raise the barriers to or even *preclude* the possibility of exposing the public to the radiological consequences of a nuclear accident?

Recommendation 12 – More fully include “defense-in-depth” activities in the Reactor Oversight Process (ROP) and enhance NRC staff training on Severe Accident Management Guidelines (SAMGs)

In opposition to the Staff prioritization memo, we see no justification or safety benefit to deferring either NRC staff training on the management of severe accidents, or the training of resident inspectors to monitor licensee implementation of the currently voluntary SAMGs. The sooner the NRC takes seriously the need to regulate preparations for severe accident management, the better. Including the current licensee activities within the ROP would create an inspection baseline with which to measure subsequent progress, or lack thereof, when and if stronger regulatory requirements are introduced.