



Union of Concerned Scientists

Citizens and Scientists for Environmental Solutions

Union of Concerned Scientists
Response to the NRC Near-Term Task Force Report
Recommendations for Enhancing Reactor Safety in the 21st Century
August 1, 2011

The Union of Concerned Scientists (UCS) supports the recommendations for improving the safety of U.S. nuclear reactors made by the Nuclear Regulatory Commission (NRC) Near-Term Task Force in its July 12, 2011 report *Recommendations for Enhancing Reactor Safety in the 21st Century*.¹ They provide a solid starting point for improving U.S. nuclear power safety, and the Commission should move expeditiously to adopt them.

We therefore urge the Commissioners to provide the NRC staff with the resources and direction necessary to begin to fully implement these recommendations within the next few months. That will provide adequate time for the Commission to receive input from public interest organizations, the nuclear industry, and other stakeholders. Moreover, the NRC and industry should fully implement the recommendations within a period of several years—not a decade as it has taken to implement the recommendations made after 9/11. Americans are unnecessarily at elevated risk until the NRC successfully implements these recommendations.

If the Commissioners delay action on the grounds that they do not yet have enough information about what happened at Fukushima to move forward with the recommendations, then it means the NRC also does not have enough information to move forward with relicensing existing reactors or licensing new reactors. In this case, the NRC should institute a moratorium on such business dealings until enough information about Fukushima is available to move ahead on both safety and business issues.

The NRC Task Force identified several important steps necessary to address unresolved safety problems. However, because the Task Force was charged only with reviewing the insights from the Fukushima Dai-ichi accident and did not consider nuclear safety and security problems that were apparent prior to the accident, the scope of the NRC review was too narrow to fully address the outstanding nuclear safety problems in the United States. Moreover, some of its recommendations are inadequate to address the problems the review identified.

UCS has taken a broader look at U.S. nuclear power following the Fukushima accident. On July 13 we released *U.S. Nuclear Power after Fukushima: Common Sense Recommendations for Safety and Security*,² which considers both the lessons from Fukushima and the safety and security shortcomings that have been evident for years. It outlines 23 steps the NRC must take to ensure nuclear power in this country is adequately safe from accidents and secure against

¹ <http://pbadupws.nrc.gov/docs/ML1118/ML111861807.pdf>

² http://www.ucsusa.org/assets/documents/nuclear_power/ucs-rpt-nuclear-safety-recs.pdf

terrorist attacks. We urge the NRC to move expeditiously to implement these recommendations as well.

Below, we assess the key recommendations of the NRC Task Force; a more detailed discussion is provided in the appendix.

Protection against Severe Accidents

One of the top UCS recommendations (UCS #1) is that the NRC extend the scope of its regulations to include the prevention and mitigation of severe accidents—those beyond the “design-basis” accidents that reactors are currently designed to handle. We are pleased that the NRC Task Force made a similar recommendation (NRC #1). In its report, the Task Force states that the NRC should apply the principle of defense-in-depth to accidents that are low-probability but high-consequence (termed “beyond-design-basis” or “severe” accidents), and should redefine the level of protection that is considered “adequate.”

As the Task Force notes:

... after the attacks of September 11, 2001, the Commission established new security requirements on the basis of adequate protection. These new requirements did not result from any immediate or imminent threat to NRC-licensed facilities, but rather from new insights regarding potential security events. The Task Force concluded that the Fukushima Dai-ichi accident similarly provides new insights regarding low-likelihood, high-consequence events that warrant enhancements to defense-in-depth on the basis of redefining the level of protection that is regarded as adequate. (viii)

If the NRC adopts this recommendation—to redefine the “adequate” level of protection—it appears that reactor owners will not be able to appeal to the back-fit rule to avoid complying with these new regulations. Under the back-fit rule, reactor owners are only required to comply with new regulations if a cost-benefit analysis finds that the costs of the back-fits are balanced by the value of the lives potentially saved. However, the rule does not apply to back-fits required to maintain the minimum allowable level of protection—namely, those required for “adequate protection” of the public. However, the devil is in the details and we will be watching closely to see that the NRC carries out this recommendation in full.

Earthquakes and Flooding

The NRC Task Force recommended that reactor owners reevaluate and, if necessary, upgrade their protection against earthquakes and flooding (NRC #2). Because the scientific understanding of seismic and flooding risks may have evolved since the reactors were built, this is an important step to ensure that nuclear plants are able to withstand known hazards. The Task Force also recommended that reactor owners confirm every decade that their assumptions about seismic and flooding threats are consistent with the current scientific understanding of these hazards and to update their protection if necessary (NRC #2.2). This is a prudent step to ensure that such fundamental protection is not based on outdated information.

The Task Force only addressed potential protection shortcomings for seismic and flooding hazards. Similar shortcomings are likely also present in other areas. It is imperative that the

NRC's license renewal process include a formal review of a reactor's existing design and licensing basis to compare it against current standards to prevent safety shortcomings from threatening the reactor for another 20 years (UCS #14).

Station Blackout

The underlying problem at Fukushima was a prolonged station blackout, in which no onsite or off-site AC power was available for an extended period of time, and which in the Japanese case was caused by an earthquake and tsunami. The Task Force recommended that the NRC require reactor owners to strengthen the capability to mitigate extended station blackouts (NRC #4), as did UCS (UCS #2). Because station blackouts can result from a wide variety of events, this is an important recommendation.

Spent Fuel

Both UCS and the NRC Task Force recommend emergency procedures for spent fuel pool accidents (UCS #6; NRC #7). However, we are concerned that some of the detailed Task Force recommendations would not provide adequate protection for boiling water reactors (BWRs) during a station blackout. For BWRs, the spent fuel pools are located in the same building as the reactor, and it is important to prevent the water in the spent fuel pool from boiling off and re-condensing at the bottom of the reactor building where it would disable all the back-up systems for cooling the reactor core. Thus, the Task Force recommendation that the pool water simply be replenished is not viable for BWRs.

More importantly, the Task Force does not address the key step to making spent fuel pools less vulnerable to accidents in the first place: moving spent fuel to dry casks once the fuel has cooled enough to do so (UCS #4). The Task Force incorrectly concludes that the current situation—in which spent fuel pools are loaded to maximum capacity—is safe enough.

Emergency Preparedness

The NRC Task Force recommended several common-sense changes to strengthen on-site preparedness for emergencies involving a station blackout and/or multiple reactors (NRC #9). It also discussed augmenting off-site emergency plans for a severe accident, but its recommendation fell far short of what is needed (NRC #11). Current U.S. plans entail a 10-mile planning zone for evacuation and potassium-iodide distribution). While the Task Force noted that it was necessary to evacuate Japanese residents up to and beyond a 20-kilometer (16 mile) area around Fukushima, and stated that insights from Fukushima might make it easier for the United States to expand its emergency response zone beyond 10 miles during an emergency, it failed to take the obvious step and recommend that the NRC require reactor owners to plan in advance for an emergency response in a zone that extends beyond 10 miles.

UCS recommends that the NRC modify the current emergency planning requirements to ensure that everyone at significant risk from a severe accident—not just people within the arbitrary 10-mile planning zone—is protected (UCS #3). The U.S. government advised Americans within 50 miles of Fukushima to evacuate—a decision validated by the high contamination levels recorded well beyond 10 miles from the plant. We urge the NRC to adopt this recommendation as part of its longer term review.

New Reactors

The Task Force did not sufficiently consider the lessons of Fukushima for new reactor licensing. Incorporating additional safety features in new reactors will be far simpler and less costly than if the reactors have to be back-fitted after construction. It would therefore be sensible for the NRC to vet all new reactor designs for potential modifications to address severe accidents before it certifies them.³

While passive designs like the AP1000 may have some advantages for dealing with severe accidents, passive design features like 72-hour station blackout coping have only been analyzed for design-basis events and not beyond-design-basis natural phenomena. Moreover, the lack of safety-related active systems in these passive designs is contrary to the defense-in-depth principle that the Task Force emphasizes in other parts of its report. The United States is fortunate in that construction has not yet begun on any next-generation reactor; the NRC should take advantage of this window of opportunity to lock in design features that could provide robust protection against Fukushima-scale events.

Other Issues

UCS's recommendations address many other safety and security problems that the Task Force did not consider. We urge the longer term review to address these issues, which include: NRC enforcement of its fire protection regulations at over three dozen reactors; establishment of timeliness goals for NRC resolution of safety issues; improved risk assessment for generic safety issues; enhanced inspection techniques and procedures; restrictions on the use of high-burnup fuels; a prohibition on the use of mixed-oxide (MOX) fuel; improved security of existing reactors against terrorist attacks; a requirement that new reactors be safer than existing reactors; improved NRC cost-benefit and risk-informed analyses; and public participation in NRC hearings.

³ This evaluation should include a reevaluation of the Severe Accident Design Mitigation Alternatives analyses in each design certification application, using the revised Regulatory Analysis Guidelines that the Task Force recommends.

Appendix: UCS Comments on NRC’s Near-Term Task Force Recommendations

No.	Task Force Recommendation and UCS Comment (We have only listed those recommendations for which we have comments.)
1.1	<p><i>Draft a Commission policy statement that articulates a risk-informed defense-in-depth framework that includes extended design-basis requirements in the NRC’s regulations as essential elements for ensuring adequate protection.</i></p> <p>This step seems unnecessary and would merely delay implementation of the desired improvements. NRC undertakes rulemaking (Recommendation 1.2) frequently without first drafting policy statements. In fact, very few if any rulemakings are preceded by policy statements. If rulemaking is needed for the NRC to obtain “a logical, systematic, and coherent regulatory framework for adequate protection,” then it can and should proceed without the front-end delay that drafting a policy statement would entail.</p>
1.3	<p><i>Modify the Regulatory Analysis Guidelines to more effectively implement the defense-in-depth philosophy in balance with the current emphasis on risk-based guidelines.</i></p> <p>Since defense-in-depth is a qualitative concept, it is unclear how quantitative analyses, such as the cost-benefit calculations that support backfit rule evaluations and severe accident mitigation alternatives (SAMA), can be modified in this way. This objective could be met by taking uncertainties into account directly in regulatory analyses. For example, the guidance allows the use of average values for inputs such as population dose-risk in cost-benefit analyses. Using other statistical values instead, such as those for the 95th or 99th percentile, would provide an additional safety margin to compensate for uncertainties.</p> <p>Also, the Regulatory Analysis Guidelines should be modified to increase the value it assigns to a human life in its cost-benefit analyses so the value is consistent with other government agencies. U.S. agencies other than the NRC place a value on a human life of between \$5 million and \$9 million. The NRC—despite the Office of Management and Budget’s recent warning that it would be difficult to justify a value below \$5 million—has continued to value a human life at \$3 million since 1995.</p> <p>Bringing the NRC’s calculations in line with other agencies and taking uncertainties into account would have a major effect on nuclear plant license renewals and new reactor approvals: plant owners would have to consider the addition of safety features that are now judged too expensive under the existing guidelines.</p>
1.4	<p><i>Evaluate the insights from the IPE and IPEEE efforts as summarized in NUREG-1560, “Individual Plant Examination Program: Perspectives on Reactor Safety and Plant Performance,” issued December 1997, and NUREG-1742, “Perspectives Gained from the Individual Plant Examination of External Events (IPEEE) Program,” issued April 2002, to identify potential generic regulations or plant-specific regulatory requirements.</i></p> <p>The Severe Accident Mitigation Alternatives (SAMAs) developed by each licensee seeking renewal of reactor operating licenses should also be included within the scope of</p>

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	<p>this evaluation.</p> <p>For such an evaluation to be constructive, the NRC must develop objective criteria in advance and then use them to inform decisions on which insights and SAMAs to implement. Absent such criteria, any evaluations would likely become exercises in futility. Proper evaluation of the potential benefit and cost-effectiveness of each SAMA would be contingent on modification of the Regulatory Analysis Guidelines, as discussed above.</p>
2.1	<p><i>Order licensees to reevaluate the seismic and flooding hazards at their sites against current NRC requirements and guidance, and if necessary, update the design basis and SSCs important to safety to protect against the updated hazards.</i></p> <p>This Order would not be required if NRC’s deliberate inactions had not allowed the reactors to maintain outdated protection against known seismic and flooding hazards. For example, on page 26, the Task Force noted:</p> <p style="padding-left: 40px;">In 1996, the NRC established two new seismic regulations for applications submitted on or after January 10, 1997. <i>These regulations were not applied to existing reactors.</i> (emphasis added)</p> <p>On page 27, it stated:</p> <p style="padding-left: 40px;">In 1996, the staff also established a new requirement in 10 CFR 100.20, “Factors To Be Considered When Evaluating Sites,” for the evaluation of the nature and proximity of man-related hazards, such as dams, for applications submitted on or after January 10, 1997. <i>This regulation was not applied to existing reactors.</i> (emphasis added)</p> <p>Also on page 27, the task force continued:</p> <p style="padding-left: 40px;">Since the last SRP update in 2007, the staff has established interim staff guidance (ISG) in three areas related to protection from natural phenomena: (1) DC/COL-ISG-1, “Interim Staff Guidance on Seismic Issues of High Frequency Ground Motion,” (2) DC/COLISG7, “Assessment of Normal and Extreme Winter Precipitation Loads on the Roofs of Seismic Category I Structures,” and (3) DC/COL-ISG-20, “Seismic Margin Analysis for New Reactors Based on Probabilistic Risk Assessment.” <i>This interim guidance has been applied only to new reactor reviews.</i> (emphasis added)</p> <p>An application to renew the license of an existing reactor for 20 more years should entail a formal review of that reactor’s design and licensing bases against “current NRC requirements and guidance.” That review would have two possible outcomes: (1) in some places, the review could identify shortcomings in the existing design and licensing bases that require upgrades to current standards, and (2) in other places, the review could verify</p>

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	<p>that the existing design and licensing bases, while differing from current standards, provide equivalent protection and thus do not require updating.</p> <p>The task force only addressed potential shortcomings in protection from seismic and flooding hazards. Similar shortcomings are likely also present in other areas. It is imperative that the NRC’s license renewal process include a formal review of a reactor’s existing design and licensing bases to compare it against current standards to prevent safety shortcomings from being sustained for another 20 years.</p>
2.2	<p><i>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 safety to protect against the updated hazards.</i></p> <p>As explained above for Recommendation 1.4, for such a periodic assessment to be constructive, the NRC must develop objective criteria and then use them to inform decisions about whether new information warrants updates to the design basis. Absent such criteria, any evaluations would likely become exercises in futility.</p>
2.3	<p><i>Order licensees to perform seismic and flood protection walkdowns to identify and address plant-specific vulnerabilities and verify the adequacy of monitoring and maintenance for protection features such as watertight barriers and seals in the interim period until longer term actions are completed to update the design basis for external events.</i></p> <p>The need for walkdowns strongly suggests that the existing inspection and testing regimes for seismic and flood protection measures are inadequate. Thus, in addition to these one-time walkdowns, the NRC must also redress the deficiencies in the inspection and testing regimes that enabled these vulnerabilities to go undetected to date.</p>
4.1	<p><i>Initiate rulemaking to revise 10 CFR 50.63 to require each operating and new reactor licensee to (1) establish a minimum coping time of 8 hours for a loss of all ac power, (2) establish the equipment, procedures, and training necessary to implement an “extended loss of all ac” coping time of 72 hours for core and spent fuel pool cooling and for reactor coolant system and primary containment integrity as needed, and (3) preplan and prestage offsite resources to support uninterrupted core and spent fuel pool cooling, and reactor coolant system and containment integrity as needed, including the ability to deliver the equipment to the site in the time period allowed for extended coping, under conditions involving significant degradation of offsite transportation infrastructure associated with significant natural disasters.</i></p> <p>Overall, the 8-hour, 72-hour, and 72-plus-hour approaches to the loss of AC power problem is a sound framework for managing this risk, with the caveats described below.</p> <p>The 72-hour coping time for an extended loss of all AC power permits reliance on non-safety-related equipment for reactor core and spent fuel cooling. Unless this equipment is specifically included under the Maintenance Rule (10 CFR 50.65), the availability and reliability of this equipment cannot be assured. For example, if a coping plan relies on a</p>

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	<p>non-safety-related widget not covered by the technical specifications, updated final safety analysis report, and maintenance rule program, then a licensee could ship the widget offsite for repairs for an indefinite period without any compensatory measures being taken. The use of non-safety-related equipment increases the likelihood that a single failure or sub-standard part prevents reactor core and/or spent fuel cooling from being successfully achieved during this 72-hour coping period.</p> <p>The provisions for offsite resources assuring reactor core and spent fuel cooling involve some details to be addressed. For example, resources at an offsite location would require periodic testing and inspection to verify their continued functionality. In addition, if these resources are needed to support a site stricken by a severe natural disaster, there may be competing needs for them (e.g., to provide temporary power to a local hospital or to a local emergency response center).</p>
6	<p><i>The Task Force recommends, as part of the longer term review, that the NRC identify insights about hydrogen control and mitigation inside containment or in other buildings as additional information is revealed through further study of the Fukushima Dai-ichi accident.</i></p> <p>The NRC already has enough information to address a glaring vulnerability in combustible gas control: the lack of reliable backup power to the hydrogen igniters in ice-condenser PWRs and Mark III BWRs. Even though NRC determined through GSI-189 that a new requirement that these plants install backup power for the hydrogen igniters was cost beneficial, it never followed through with a rulemaking (violating its own procedures). As a result, the non-safety-related backup power for these systems has been installed only on a voluntary basis outside of NRC regulatory control, and therefore cannot be assumed to be any more reliable than the SAMGs that the Task Force criticizes. NRC should act immediately to convert these voluntary initiatives into regulatory requirements.</p>
7.1	<p><i>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.</i></p> <p>The qualifier “able to withstand design-basis natural phenomena” seems unduly restrictive. The instrumentation should withstand <i>all</i> design-basis phenomena, not just that of the natural variety.</p>
7.2	<p><i>Order licensees to provide safety-related ac electrical power for the spent fuel pool makeup system.</i></p> <p>This recommendation, along with the rest of the recommendations in the task force’s report, would not provide sufficient protection for boiling water reactors (BWRs) with Mark I and Mark II containment designs.</p>

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If the spent fuel pool at a BWR Mark I/II plant was allowed to boil and its irradiated fuel was protected from damage by providing makeup flow to compensate for the water inventory lost via boil-off, the irradiated fuel in the reactor core may be sacrificed. The NRC must not force the operators to make a choice between catastrophic damage to the spent fuel and catastrophic damage to the reactor core. Both catastrophes should be avoided.

The spent fuel pool in a BWR Mark I/II plant is located inside the reactor building, or secondary containment. All of the emergency core cooling system pumps (high pressure coolant injection, core spray, and residual heat removal) and the reactor core isolation cooling system pump are also located inside the reactor building, typically at its lowest elevation.

The water evaporating from a boiling spent fuel pool at a BWR Mark I/Mark II containment would eventually condense back into water. Much of that condensed water would drain down into the lower elevations of the reactor building. The rising water level would eventually submerge and disable the emergency core cooling systems.

Therefore, this task force recommendation of a panacea for spent fuel pools would be a pandemic for reactor cores at BWR Mark I/II plants.

The NRC must ensure that BWR Mark I/II plants comply with existing regulations applicable to this situation. As the task force stated on page 17 of its report:

... the current NRC regulatory approach includes (1) requirements for design-basis events with features controlled through specific regulations or the general design criteria (GDC) (10 CFR Part 50, Appendix A, "General Design Criteria for Nuclear Power Plants") ...

General Design Criterion 44 in Appendix A to 10 CFR Part 50 states:

A system to transfer heat from structures, systems, and components important to safety, to an ultimate heat sink shall be provided. The system safety function shall be to transfer the combined heat load of these structures, systems, and components under normal operating and accident conditions.

BWR Mark I/II plants do not comply with this requirement if their cooling water systems cannot transfer the "combined heat load," including the heat load from the spent fuel pool, from the reactor building to the ultimate heat sink. Note that this requirement is for design basis events.

Merely assuring makeup flow to a boiling spent fuel pool at a BWR Mark I/II plant is also inconsistent with the defense-in-depth philosophy expressed on page 25 of the task force's report:

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	<p>The key to a defense-in-depth approach is creating multiple independent and redundant layers of defense to compensate for potential failures and external hazards so that no single layer is exclusively relied on to protect the public and the environment.</p> <p>Moreover, the environmental conditions inside a BWR reactor building when its spent fuel pool is boiling are very likely to disable the standby gas treatment system. The standby gas treatment system is a safety system normally in standby. In event of a design basis accident, the reactor building’s normal ventilation system is shut down and the standby gas treatment system started. The standby gas treatment system draws air from the refueling floor and lower elevations of the reactor building and passes it through a series of HEPA and charcoal filters before discharging it from an elevated release point. The filters are designed to reduce the radioactivity levels by a factor of 100. The elevated discharge further protects plant workers and the public by diluting radioactively contaminated air with clean air.</p>
7.3	<p><i>Order licensees to revise their technical specifications to address requirements to have one train of onsite emergency electrical power operable for spent fuel pool makeup and spent fuel pool instrumentation when there is irradiated fuel in the spent fuel pool, regardless of the operational mode of the reactor.</i></p> <p>This recommendation lacks sufficient scope. As stated on page 43 of the task force’s report:</p> <p style="padding-left: 40px;">When the reactor is shut down and defueled for maintenance work and all of the fuel is placed in the spent fuel pool, the LCOs [limiting conditions for operation specified in the technical specifications, an implicit part of a reactor’s operating license] do not require any electrical power systems to be operable.</p> <p>This is true. It is also true that when a reactor is defueled, there are no applicable technical specification requirements for containment integrity and even water level in the spent fuel pool. These shortcomings in the technical specification requirements must also be addressed.</p>
7.4	<p><i>Order licensees to have an installed seismically qualified means to spray water into the spent fuel pools, including an easily accessible connection to supply the water (e.g., using a portable pump or pumper truck) at grade outside the building.</i></p> <p>For plants other than BWR Mark I/II plants, this recommendation has value with few downsides. For BWR Mark I/II plants, this recommendation has the same potential adverse consequences as articulated in the comments for Recommendation 7.4 above.</p>