

RESPONSE SHEET

TO: Annette Vietti-Cook, Secretary

FROM: Commissioner Baran

SUBJECT: SECY-18-0103: Proposed Rule: "Emergency Preparedness for Small Modular Reactors and Other New Technologies" (RIN3150-AJ68; NRC-2015-225)

Approved Disapproved Abstain Not Participating

COMMENTS: Below Attached None

Entered in "STARS"

Yes

No



SIGNATURE

11/14/19

DATE

**Commissioner Baran's Comments on SECY-18-0103, "Proposed Rule:
Emergency Preparedness for Small Modular Reactors and Other New Technologies"**

For the last 40 years, NRC has required emergency planning zones, or EPZs, around nuclear power plants "to assure that prompt and effective actions can be taken to protect the public in the event of an accident."¹ Every one of the 96 operating large light-water reactors in the country has a plume exposure pathway EPZ that extends about 10 miles around the site with dedicated offsite radiological emergency plans and protective actions in place to avoid or reduce radiation dose to the public during an accident. An ingestion exposure pathway EPZ with a radius of 50 miles around each of these sites is designed to avoid or reduce dose from consuming food and water contaminated by a radiological release. The EPZs and dedicated radiological emergency plans are meant to provide multiple layers of protection – or defense-in-depth – against potential radiological exposure. Other NRC requirements are focused on preventing or mitigating a radioactive release. The emergency planning regulations are there to provide another layer of defense in case a release occurs despite those safety requirements. In other words, EPZs and radiological emergency planning are designed to address low-probability, high-consequence events. The Federal Emergency Management Agency (FEMA) assesses the adequacy of the offsite emergency plans, and NRC regulations require licensees to hold offsite emergency preparedness drills at each plant at least once every 2 years to practice implementing the plans.²

Under this draft proposed rule, emergency planning for small modular reactors (SMRs) and non-light-water reactors would be flimsy by comparison. Instead of a 10-mile plume exposure pathway EPZ, these reactors would have EPZs that encompass only areas where the projected dose from "credible" accidents could exceed 1 rem. An EPZ extending only to the site boundary is explicitly permitted under this methodology. In the case of a site-boundary EPZ, NRC would not require dedicated offsite radiological emergency planning and FEMA would have no role in evaluating the adequacy of a site's emergency plans. In addition, the draft proposed rule would eliminate the requirement for an ingestion exposure pathway EPZ and no longer require a specific drill frequency for emergency planning exercises. Overall, this proposed rule represents a radical departure from more than 40 years of radiological emergency planning.

No new SMR or non-light-water reactor designs have yet been approved by NRC, and only one SMR design has been submitted for the staff's review. These new designs could potentially be safer than current large light-water-reactor designs. But that does not eliminate the need for EPZs and dedicated offsite emergency planning to provide defense-in-depth in case something goes wrong.

Since 1978, when the concept of an EPZ was first developed, the size of an EPZ has never been exclusively based on the likelihood of an accident occurring. The joint NRC-EPA task force that introduced the EPZ concept specifically stated: "Emergency planning is not based upon quantified probabilities of incidents or accidents."³ Its foundational task force report, referred to as NUREG-0396, explained that "[r]adiological emergency planning is not

¹ NUREG-0396, *Planning Basis for the Development of State and Local Government Radiological Emergency Response Plans in Support of Light Water Nuclear Power Plants* (1978) at 11.

² The regulations require a full set of emergency preparedness exercises to be conducted at each plant over an 8-year cycle.

³ *Id.* at 1-2.

based upon probabilities, but on public perceptions of the problem and what could be done to protect health and safety.”⁴ This was not an isolated statement. The task force found that EPZ size should be “derived from the characteristics of design basis and Class 9 accident consequences.”⁵ Class 9 accidents were defined as those “considered to be so low in probability as not to require specific additional provisions in the design of a reactor facility,” including total core melt scenarios “in which the containment catastrophically fails and releases large quantities of radioactive materials directly to the atmosphere.”⁶ Today, we refer to these as beyond-design-basis accidents. NRC and EPA understood that these kinds of extreme accidents were unlikely, but they also knew that EPZs should be in place to provide defense-in-depth because “the probability of an accident involving a significant release of radioactive material, although small, is not zero.”⁷ The task force further concluded that nuclear accidents were unique in important ways. The report explained: “the potential consequences of improbable but nevertheless severe power reactor accidents, while comparable in some sense to severe natural or man-made disasters which would trigger an ultimate protective measure such as evacuation, do require some specialized planning considerations.”⁸

NRC’s recognition of the important role emergency planning plays in providing defense-in-depth endured over the years. In the 1986 Safety Goals Policy Statement, even as the Commission focused on the quantitative risk of nuclear reactor accidents, the Commission recognized “emergency planning as [an] integral part[] of the defense-in-depth concept associated with its accident prevention and mitigation philosophy.”⁹ The Commission stated that “emergency response capabilities are mandated to provide additional defense-in-depth protection to the surrounding populations.”¹⁰ Similarly, when the agency was working through non-light-water reactor issues in 1993, the NRC staff proposed “no changes to the existing regulations governing EP for non-light-water reactor licensees,” explaining that it “views the inclusion of emergency preparedness by advanced reactor licensees as an essential element in NRC’s ‘defense-in-depth’ philosophy.”¹¹ Four years later, the staff emphasized the importance of getting the buy-in of federal, state, and local emergency response agencies for any emergency response changes relating to new, potentially safer reactor designs.¹²

But these considerations are sidelined with the draft proposed rule. Under the rule’s EPZ sizing methodology, the quantitative dose formula exclusively determines the size of the EPZ. It is a purely quantitative, risk-based determination rather than a risk-informed decision that accounts for expert judgment, defense-in-depth, and public confidence. With this draft proposed rule, no one is exercising any human judgment about how large an EPZ should be. It is simply a mathematical calculation.

The NRC staff acknowledges in the draft proposed rule that emergency planning is supposed to be “risk-informed rather than risk-based” and “independent of accident probability.”¹³ After all, an existing plant’s EPZ does not change every time a plant modification

⁴ *Id.*

⁵ *Id.* at 16.

⁶ *Id.* at 26, I-6.

⁷ *Id.* at II-1.

⁸ *Id.* at III-1, III-2.

⁹ 51 FR 28044 (1986).

¹⁰ *Id.*

¹¹ SECY-93-092 at 13.

¹² SECY-97-020.

¹³ Draft Proposed Rule at 30.

reduces the risk of an accident. A large light-water-reactor licensee does not (and should not) get a smaller EPZ because it installs an additional emergency diesel generator or stores FLEX equipment on site. But the draft proposed rule embodies just that sort of exclusively quantitative approach. Instead of risk being one important factor considered in setting emergency planning requirements, it would become the only factor that matters. For any SMR or non-light-water reactor that met the dose criteria for a site boundary EPZ, there would be no dedicated off-site radiological emergency planning. That element of defense-in-depth would be dropped completely.

FEMA has expressed major concerns about the draft proposed rule. It disagrees that quantitative dose criteria should completely determine the size of an EPZ. Consistent with NUREG-0396, FEMA has expressed its support for “a methodology for EPZ sizing that takes into account such ‘non-technical’ criteria” as public confidence.¹⁴

Moreover, “FEMA has consistently raised concerns about a methodology that allows for a site boundary EPZ for a commercial nuclear power plant.”¹⁵ In the absence of an EPZ and dedicated offsite radiological emergency planning, emergency responders would be left with all-hazards planning. FEMA does not believe that all-hazards planning would be adequate in the event of an actual nuclear power plant accident. According to FEMA, “Radiological [emergency planning] is not sufficiently addressed within the All Hazards framework – radiological [emergency planning] is unique. In a Worst-Case Scenario, our [offsite response organizations] could be challenged to effectively protect the health and safety of the public using an ad hoc [emergency planning] construct.”¹⁶ FEMA explains that “[a]dvanced planning – such as provided by an EPZ – reduces the complexity of the decision-making process during an incident.”¹⁷ And FEMA “stress[es] that the proven best way to ensure offsite readiness is to develop, exercise, and assess [offsite response organization] radiological capabilities, as is now done throughout the offsite EPZ.”¹⁸ While a radiological emergency plan could be “scaled up” to address a more severe accident than what was planned for, FEMA notes that it is “unrealistic” to scale up “non-existent plans” and that the resulting “lack of necessary equipment, and shortage of trained emergency personnel could have unfortunate consequences.”¹⁹

In short, all-hazards planning would not be as effective as dedicated radiological emergency planning in an actual radiological emergency. As a result, a site boundary EPZ with all-hazards planning would not provide the same level of protection for a community located near a reactor site as an offsite EPZ with dedicated radiological emergency planning. FEMA, therefore, “believes that the NRC staff conclusion that the proposed methodology of offsite emergency preparedness maintains the same level of protection as a ten-mile EPZ is unsupported.”²⁰

¹⁴ Letter from Michael S. Casey, Director, Technological Hazards Division, FEMA to NRC (Aug. 24, 2019) (ML19240A938).

¹⁵ *Id.*

¹⁶ Letter from Michael S. Casey, Director, Technological Hazards Division, FEMA to NRC (July 8, 2019) (ML19189A318).

¹⁷ *Id.*

¹⁸ *Id.*

¹⁹ Letter from Michael S. Casey, Director, Technological Hazards Division, FEMA to NRC (Aug. 24, 2019) (ML19240A938).

²⁰ *Id.*

We need to take FEMA's warnings seriously. FEMA has a key role in determining whether the emergency planning for a nuclear power plant site is adequate. Under NRC's regulations, a nuclear power plant license cannot be issued unless NRC makes a finding that the major features of the emergency plan meet the regulatory requirements. And NRC is supposed to base its finding on FEMA's determinations as to whether the offsite emergency plans are adequate and whether there is reasonable assurance that they can be implemented. In fact, under NRC's regulations, "in any NRC licensing proceeding, a FEMA finding will constitute a rebuttable presumption on questions of adequacy and implementation capability."²¹ FEMA has this prominent role in our licensing process because of its well-known expertise in this area. Yet, under the proposed rule, FEMA would have no role in assessing the adequacy of offsite emergency plans and capabilities for reactors with a site boundary EPZ.²²

In addition to the issues identified by FEMA, there are several other significant problems with the draft proposed rule.

First, the logic of the proposed EPZ sizing methodology could be applied to the existing fleet of large light-water reactors to weaken the current level of protection. As the Advisory Committee on Reactor Safeguards noted:

No technical basis is stated in the rule or the guidance for restricting the use of the new rule to SMRs and [other new technologies] with a limit on thermal power. The rule could apply to any reactor technology regardless of size. During our meetings, the staff acknowledged this point.²³

In fact, the draft proposed rule would explicitly seek comment on whether to apply this kind of approach to large light-water reactors.²⁴ This opens the door to smaller EPZs and reduced emergency planning for the existing fleet of power reactors. If the draft proposed rule's formulaic approach is adopted, a precedent will be established for applying a purely risk-based methodology to EPZ sizing.

Second, the draft proposed rule does not account for the possibility of accidents affecting more than one SMR module. Even though some SMR designs contemplate several reactors at one site, the EPZ sizing methodology addresses each reactor in isolation. This ignores a key lesson of the Fukushima accident – that severe natural disasters can simultaneously threaten multiple reactors at a site. Under the draft proposed rule, a SMR is defined as a power reactor that produces less than 1,000 megawatts-thermal. The combined heat energy produced by just two SMRs of this size could be larger than that of some existing large light-water reactors in the U.S. But, under the draft proposed rule, each module could individually qualify for a site boundary EPZ without consideration of the other.

Third, unlike the existing regulations for large light-water reactors, the draft proposed rule "would not define the required frequency of drills and exercises" for emergency

²¹ 10 CFR § 50.47.

²² See Draft Proposed Rule at 47 ("for SMRs and [other new technologies] within the scope of this proposed rule, FEMA findings and determinations regarding reasonable assurance ... would only be needed for a facility where the plume exposure pathway EPZ extends beyond the site boundary requiring dedicated offsite radiological EP plans for the facility.")

²³ Letter from Michael Corradini, Chairman, ACRS to NRC (Oct. 19, 2018) (ML18291B248).

²⁴ Draft Proposed Rule at 60.

preparedness.²⁵ As a result, SMR and non-light-water reactor licensees would not be required to conduct a full offsite emergency preparedness drill every 2 years. The NRC staff provides no basis for this weaker standard.

Finally, the draft proposed rule would eliminate the ingestion pathway EPZ for SMRs and non-light-water reactors. The NRC staff argues that prior quarantines of spinach and eggs in response to E. Coli and salmonella infections “demonstrate[] that a response to prevent ingestion of contaminated foods and water could be performed in an expeditious manner without a predetermined planning zone.”²⁶ No FEMA evaluation of this change is provided. Nor is there any discussion of the effectiveness of ad hoc responses to previous radiological releases. Moreover, if the staff’s unbounded rationale were adopted, it could ultimately lead to ingestion pathway EPZs being dropped for the existing fleet of large light-water reactors.

For these reasons, I disapprove the draft proposed rule in its current form. NRC needs a rule that provides regulatory certainty for potential applicants and recognizes that SMRs and non-light-water reactors will be different than traditional, large light-water reactors. It makes sense to have a graded approach that accounts for potential safety improvements in new designs. But the rule should not be purely risk-based, relying entirely on the results of a dose formula. Instead, the staff should re-draft the proposed rule to establish the following emergency planning requirements for three categories of nuclear power plants.

SMRs and non-light-water reactors with a thermal output of more than 20 megawatts would be eligible for a 2-mile EPZ, as long as they meet the dose standard at that distance. A 2-mile EPZ recognizes that these new technologies could be safer than large light-water reactors while ensuring that there will be dedicated offsite radiological emergency planning to provide defense-in-depth in the unlikely event of a severe accident. To account for future potential technological advances, an alternate EPZ smaller than 2 miles should be available if NRC, FEMA, and the host state all agree that the alternate EPZ would provide for an effective and adequate response in the event of a severe radiological emergency. The revised proposed rule should include an EPZ sizing methodology that accounts for the possibility of accidents affecting more than one SMR module, provide for an appropriately-sized ingestion pathway EPZ, and maintain the existing requirements to conduct an offsite emergency preparedness drill every 2 years and the full suite of emergency preparedness exercises over an 8-year cycle.

SMRs and non-light-water reactors with a thermal output of 20 megawatts or less would be eligible for a site boundary EPZ, as long as they meet the dose standard at that distance. Reactors of this size, essentially micro-reactors, would present accident consequences comparable to existing research and test reactors, which are not subject to offsite emergency planning requirements.²⁷

Large light-water reactors, as well as any SMRs or non-light-water reactors that do not meet the dose standard for a 2-mile EPZ, would continue to have a 10-mile EPZ.

In my view, this approach strikes the right balance. It recognizes the potential for improved designs with lower risks, while maintaining defense-in-depth to protect the public. It builds on 40 years of experience with emergency planning rather than discarding it. Of course, stakeholders will have an opportunity to offer their views on how this approach can be further

²⁵ Draft Proposed Rule at 39.

²⁶ Draft Proposed Rule at 55.

²⁷ The largest currently operating test reactor has a power level of 20 megawatts thermal.

refined during the public comment period. The staff should provide the Commission with the revised draft proposed rule within 6 months.