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Comment On: NRC-2015-0225-0171

Emergency Preparedness for Small Modular Reactors and Other New Technologies;
Extension of Comment Period

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General Comment

On behalf of the Union of Concerned Scientists, I am pleased to submit comments on the proposed rule and guidance. Please note the letter from Mr. Jay Tilden, which UCS is attaching to our own comments for your full consideration.

Sincerely,

Edwin Lyman, PhD

Director of Nuclear Power Safety

Union of Concerned Scientists

Washington, DC

Attachments

UCS comments EPZ proposed rule 9 25 20

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**Comments on the Nuclear Regulatory Commission’s Proposed Rule and Guidance,
“Emergency Preparedness for Small Modular Reactors and Other New Technologies”
Docket ID: NRC-2015-0225**

Edwin S. Lyman, PhD
Director of Nuclear Power Safety
Union of Concerned Scientists
Washington, DC
September 25, 2020

The Union of Concerned Scientists (UCS) strongly opposes this fundamentally flawed and technically unsound proposed rule, and urges that the NRC withdraw it. This proposal sinks to a new low in the NRC’s ongoing effort to dismantle its current nuclear power plant licensing framework and replace it with a house of cards with a rotten foundation. This foundation is the unproven and absolutely false assumption that any application for a new power reactor that falls within the scope of the proposed rule—that is, any small modular reactor (SMR) or non-light-water reactor (of any size)—and potentially even conventional large light-water reactors—is automatically qualified to apply for broad exemptions from current safety requirements. This draft rule, together with other ongoing efforts by the NRC to greatly weaken safety, security, and emergency preparedness requirements, only serves to further undermine the NRC’s credibility as an independent regulator that makes decisions in the public interest based on sound science, instead of misleading industry public relations sloganeering and undue political influence.

In requesting that the NRC terminate the rulemaking, UCS does not think the current rules that specify emergency planning zone (EPZ) sizes themselves are technically sound and should be set in stone. In fact, the technical basis for the current 10-mile plume exposure EPZ is dated, vague, and has been demonstrated to be insufficiently protective by the 2011 Fukushima Daiichi accident. We support a technically sound approach for determining EPZ size that can be informed by mechanistic source term information, assuming that sufficient safety margin will be provided to fully account for the large uncertainties associated with such analyses. As the NRC knows, the RASCAL code calculations performed by its staff following the Fukushima Daiichi accident found that the Environmental Protection Agency (EPA) early phase protective action guide (PAG)—1 rem total effective dose equivalent (TEDE) in 96 hours— would have been exceeded at least 20 miles away from the site, even assuming only a single reactor experienced core damage.¹ Aerial monitoring results days after the accident also indicated dose rates high enough to exceed the EPA PAG well beyond ten miles. Similar results were found by the National Atmospheric Release Monitoring Center (NARAC) in its modeling of the accident.² NARAC also found that the thyroid dose to a 1-year-old child could have exceeded the 5 rem PAG for potassium iodide (KI) prophylaxis as far as 150 km (over 90 miles) from Fukushima, depending on the chemical composition of the release. Thus the current plume EPZ size for large light-water reactors is most likely too small to comply with this proposed rule. This also

¹ <https://www.nrc.gov/docs/ML1211/ML12111A247.pdf>

² <https://narc.llnl.gov/content/mods/publications/op-model-description-evaluation/LLNL-PRES-650086.pdf>

challenges the presumption that a mechanistic source term approach for determining EPZ size for SMRs would necessarily result in EPZ radii smaller than ten miles. The NRC needs to start with a clean slate and not assume a priori that a mechanistic source term evaluation, with full accounting for uncertainties to provide sufficient defense-in-depth, would result in smaller EPZ sizes for SMRs and non-LWRs—or, for that matter, for large LWRs, if the scope is expanded to include them.

UCS largely concurs with the thoughtful and cogent comments on the proposed rule submitted by Jay Tilden, Deputy Under Secretary for Counterterrorism and Counterproliferation at the Department of Energy's National Nuclear Security Administration (NNSA). We acknowledge the highly irregular and disturbing request made the following day by the NNSA Administrator, Lisa Gordon-Hagerty, that the NRC disregard the Deputy Under Secretary's comments. As Mr. Tilden is a seasoned bureaucrat who presumably knew exactly what he was doing, we assume that his comments were meant as a signal to the NRC and the public that there is internal disagreement between the DOE Office of Nuclear Energy and some NNSA officials regarding the risks that the proposed rule would pose to domestic national security—a disagreement that the NRC must fully take into account. We think that the NRC should give Mr. Tilden's recommendations on security and emergency preparedness matters as an individual far more weight than those of the DOE Office of Nuclear Energy, whose views are tainted by its promotional mission. We are attaching Mr. Tilden's comments and request that the NRC consider them in full as part of our submittal.

Specific concerns with the proposed rule are below.

1. The proposed rule would require that applicants consider doses from “a spectrum of credible accidents” and determine the size of the plume exposure EPZ boundary as the distance beyond which exposures exceeding the EPZ early phase PAG would not be expected. However, the term “spectrum of credible accidents” is not defined in the proposed rule text, or elsewhere in the NRC's rules, guidance, or previous planning standards for emergency preparedness for power reactors. The term is only defined parenthetically in the Statement of Considerations (SOC) of the proposed rule at 85 FR 28445 as “design-basis accidents, less severe accidents, and less probable but more severe accidents.”

This vague and subjective term is extremely problematic because it allows for applicants to cherry-pick a “spectrum of credible accidents” that would enable them to meet the dose criterion for a reduced (or no) off-site EPZ. This would likely lead to negotiations between applicants and the NRC staff as to whether all “credible” accidents were considered, but without a clear standard upon which to base decisions--opening the door for arbitrary and inconsistent implementation of the rule. Applicants would have a strong incentive to fudge their analyses to ensure the plume exposure EPZ would remain at the or within the site boundary, because the proposed rule would then exempt them from a large number of regulatory requirements. The NRC staff would then have the undue burden of searching for accident sequences that could exceed the PAGs off-site and then determining whether or not they were “credible.”

The proposed rule states that this process “would afford the same level of protection of the public health and safety as the current regulatory framework,” implying this is the same definition that is used in the current EP planning basis. However, the definition in the SOC is not equivalent to the “full spectrum of accidents” referred to in NUREG-0396 or the “spectrum of radiological incidents” referred to in NUREG-0654, Revision 2. Thus the relationship between the level of protection defined in the proposed rule and the current level of protection in the planning basis for emergency preparedness is unclear.

Compare this to the first three criteria in NUREG-0654, Revision 2:

- “a. Projected doses from the traditional design basis accidents would not exceed Federal PAG levels outside the EPZ.
- b. Projected doses from most core melt sequences would not exceed Federal PAG levels outside the EPZ.
- c. For the worst core melt sequences, immediate life threatening doses would generally not occur outside the EPZ.”

Presumably, the “spectrum of credible accidents” referred to in the proposed rule would correspond to categories (a) and all or a subset of (b), but not (c), since only (a) and (b) reference the PAG standard. One cannot draw a straightforward correspondence between the definitions because it is unclear whether “most” core melt sequences is equivalent to the “less severe” accident category described in the proposed rule.

What is clear is that the current protection level for accidents in the (c) category—that is, the “worst” core melt sequences that must be accounted for in the current EP planning basis—is not included in the proposed rule. This appears to be an oversight. On page 7 of the Regulatory Analysis for the proposed rule, the description of the alternative proposed by the staff includes a requirement that “applicants would also need to show a substantial reduction in risk to public health and safety at the chosen plume exposure pathway EPZ outer boundary for very severe accidents similar to the evaluation in NUREG-0396.” However, this requirement does not appear in the proposed rule itself. Thus the proposed rule is not only inconsistent with the current planning basis but also with the Regulatory Analysis developed to support it. This technical error alone is serious enough for the NRC to withdraw the proposed rule.

We note that the original division in NUREG-0396 between “less severe” and “more severe” beyond-design-basis accidents was based on a distinction between basemat melt-through accidents, which would result in relatively small atmospheric releases, and accidents resulting in containment failure or bypass causing relatively large atmospheric releases. It is not obvious that this distinction makes much sense today for non-LWRs or even for today’s LWRs. However, the Fukushima meltdowns—which involved both basemat melt-through and some degree of containment failure but only an intermediate level of atmospheric release—were by definition “credible” accidents because they actually occurred.

The task of defining a valid and conservative “spectrum of credible accidents” for any reactor design is non-trivial. The NRC should do its homework and develop a solid technical basis for such a term, supported by robust independent peer review and extensive public engagement, before incorporating it into its regulations.

2. The term “spectrum of credible accidents,” as defined, excludes core melt and large radiological release sequences induced by hostile action. This is not consistent with NUREG-0654, which refers to “radiological incidents” that clearly could be caused by sabotage as well as accidents. Moreover, hostile action could result in very severe radiological consequences to the public that might not be considered “credible” if accidents alone are considered. Thus the proposed rule should also require that a spectrum of sabotage attacks resulting in core melt and containment breach be considered in determining EP requirements and the EPZ size.

3. The EPA early phase PAGs include a separate standard for limiting thyroid doses due to inhalation of radioactive iodine by administration of potassium iodide (KI), especially for children (EPA-400/R-17/001, 2017). Specifically, the EPA recommends KI administration when the thyroid dose to a 1-year-old child is projected to exceed 5 rem. This recommendation is absent from the proposed rule and should be included as a separate criterion for determining EPZ size. The aforementioned NARAC Fukushima analyses show that a 5 rem thyroid dose to children from plume exposure could be exceeded at greater distances than a 1 rem whole-body dose, so the whole-body dose criterion for determining EPZ size is not necessarily limiting. The rule should ensure that children and other sensitive subpopulations will receive a level of protection commensurate with their increased vulnerability.

4. The NRC also needs to ensure that its rules do not cause disproportionate impacts on communities of color and economically less-advantaged groups. The proposed rule fails this test because it exempts applicants who are able to meet the proposed rule criteria for a site boundary EPZ from all requirements for off-site emergency planning, thereby putting the entire burden on protecting the public from off-site radiological releases on public entities such as State, local and Tribal authorities. Jurisdictions with fewer resources and weaker infrastructure will be in a worse position to cope with a radiological emergency than more affluent communities. For this reason alone, the NRC should not authorize any option that would relieve licensees from all responsibilities for off-site emergency planning.

Also, using a single dose-based criterion as a surrogate for radiological harm does not take into account disparities in health care and other factors that could make a significant difference not only for cancer survival rates, but also for a range of other harms resulting from cancer morbidity, such as the ability to keep one’s job and to provide child care. These issues are not currently addressed anywhere in the NRC’s entire regulatory safety framework, but this is a good place to start.

5. We believe that the proposed rule should not eliminate the requirement for an ingestion planning zone, which is an essential component of timely and effective post-accident emergency response. In addition, the proposed rule should include a new provision requiring that licensees define a long-term relocation planning zone, which would include areas where the EPA’s

intermediate phase PAG of 2 rem in the first year would be exceeded following a “credible” accident or terrorist attack. Such accidents would likely result in substantial off-site areas that would exceed this criterion even if they would not cause the early phase PAG to be exceeded off-site. Licensees, working together with Federal, Tribal, State, and local authorities, should then develop contingency plans to help ensure that timely and safe long-term relocations of the public within these zones can be carried out.

6. The rule itself, and not only supporting guidance, should specify the parameters that must be used in conducting the radiological assessments in sufficient detail to ensure consistency, clarity, and a sufficient level of conservatism with regard to source term composition, release, atmospheric dispersion, and deposition. As noted in the references on dose assessment methodology cited in the Federal Register notice, assumptions that may be conservative with regard to one exposure pathway may be non-conservative with respect to others. Thus it is critical that a wide distribution of site-specific atmospheric conditions be analyzed and that the peak individual dose value over this distribution be used to determine EPZ size. Alternatively, a safety factor could be applied to the criterion itself to ensure uncertainties are accounted for—say, a 0.1 rem value instead of 1.0 rem.

Below we respond to certain additional issues on which the NRC requested comment in Section IV of the Federal Register notice.

1. Terminology: Since the proposed rule would fundamentally base EP requirements on dose, it would be misleading to remove the phrase “dose-based” from the description.
2. The scope of any new rule for a technically defensible EPZ should include large LWRs. However, in order to ensure that the level of public protection for operating and future large LWRs does not decrease, the minimum plume exposure EPZ radius should remain at 10 miles. As explained above, it is likely that applying a technically valid methodology to large LWRs would result in a plume exposure EPZ greater than 10 miles.

From: [Boyd, Dallas](#)
To: [RulemakingComments Resource](#)
Cc: [NRCExecSec Resource](#); [Bookless, William](#); [Park, Brent](#); [Baranwal, Rita](#); [Van Dyke, Henry](#); [Schrader, Eric](#); [Beall, Bob](#); [Heinrich, Ann](#); [Smith, Christopher L](#); [Crocker, Jackson](#); [Tilden, Jay](#); [Hoagland, David](#); [Christensen, Rick](#); [Knapp, David](#); [Bravo, Normita \(CONTR\)](#); [Bauer, Amy \(LAB\)](#); [Scheuer, Mark](#); [Reyes, Bryan \(CONTR\)](#); [Black, Thomas](#)
Subject: [External_Sender] NNSA Response to NRC Rulemaking on Emergency Preparedness for SMR / ONT
Date: Wednesday, July 22, 2020 8:17:33 AM
Attachments: [NNSA Response to NRC Rulemaking July 22, 2020 Final.pdf](#)
Importance: High

Colleagues,

On behalf of Deputy Under Secretary Jay A. Tilden, please see the attached memo containing the National Nuclear Security Administration's (NNSA) comments on the Nuclear Regulatory Commission's proposed rulemaking on 10 CFR Parts 50 and 52, *Emergency Preparedness for Small Modular Reactors and Other New Technologies*, dated May 12, 2020.

Please direct any questions concerning this memo to myself, Rick Christensen, Deputy Director of the NNSA Office of Nuclear Incident Response (NA-84), at rick.christensen@nnsa.doe.gov / (202) 586-0997, or Col. David Knapp, Program Manager, NA-84, at david.knapp@nnsa.doe.gov / (202) 586-6619.

Best,
Dallas

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July 22, 2020

TO: ANNETTE VIETTI-COOK
SECRETARY OF THE NUCLEAR REGULATORY COMMISSION
ATTN: RULEMAKINGS AND ADJUDICATIONS STAFF

A handwritten signature in blue ink that reads "Jay A. Tilden".

FROM: JAY A. TILDEN
DEPUTY UNDER SECRETARY FOR
COUNTERTERRORISM AND COUNTERPROLIFERATION
DEPARTMENT OF ENERGY

SUBJECT: Response to NRC Rulemaking on Emergency Preparedness for Small Modular Reactors (SMR) and Other New Technologies (ONT)

The purpose of this memorandum is to provide Department of Energy / National Nuclear Security Administration (DOE/NNSA) comments on the Nuclear Regulatory Commission's (NRC) proposed rulemaking on 10 CFR Parts 50 and 52, *Emergency Preparedness for Small Modular Reactors and Other New Technologies*, dated May 12, 2020. This rulemaking provides an alternative to existing emergency preparedness requirements for nuclear facilities as promulgated in 10 CFR Part 50 Appendix E recognizing improvements in SMR and ONT design and other safety advances.

In addition to the letter to NRC Chairman Svinicki from DOE Assistant Secretary for Nuclear Energy Dr. Rita Baranwal in support of this rulemaking, NNSA offers comments below to clarify and strengthen emergency preparedness requirements for SMRs and ONTs. NNSA is committed to emergency preparedness and will continue to support this important aspect of public health and safety through its supporting role codified in 44 CFR 351.24.

Response to NRC Topic 7 Question #2: Emergency Planning Zone Size

The new NRC approach to emergency preparedness for SMRs and ONTs represents a significant departure from the successful 42-year-old practice of using a 10-mile plume exposure emergency planning zone (EPZ) and 50-mile ingestion pathway EPZ. This traditional approach is documented in NUREG-0396, "Planning Basis for the Development of State and Local Emergency Plans in Support of Light Water Nuclear Power Plants."

The current EPZ and emergency planning framework provides the last layer of a defense-in-depth for low-probability, high-consequence accidents. It is both cost effective and beneficial to communities around nuclear power plants and to the nuclear utilities. However, the proposed EPZ strategy may not provide the same defense-in-depth against the full spectrum of nuclear accident scenarios. Specifically, the proposal could greatly reduce the plume EPZ from 10 miles to a much smaller footprint, possibly down to the site boundary. NNSA recommends that NRC consider alternatives to the proposed approach in 10 CFR 50 Appendix E. One option is to develop smaller plume and ingestion pathway EPZs applicable to all SMR and ONT facilities to

help validate NRC's approach. A reduced EPZ would acknowledge the safety improvements in SMRs yet provide a reasonable safety margin should unforeseen engineering issues arise or the new SMR and ONT designs do not operate as expected. Given the lack of operational history for SMR technologies, the source term determination and evaluation of credible accident scenarios are purely theoretical. This circumstance should lead the NRC, nuclear utilities, and emergency planners to be more conservative with emergency preparedness rules and determinations of EPZ size.

Response to NRC Topic 7 Question #3: Ingestion Pathway EPZ Size

Under the proposed rulemaking, current 50-mile ingestion pathway EPZ (IPZ) requirements would be dramatically weakened or eliminated altogether. NRC Draft Regulatory Guide DG-1350 Page 7, Paragraph 3, removes the requirement for an IPZ not because of limited potential impact but because of the availability of food contamination tracing and the capabilities of the Federal Radiological Monitoring and Assessment Center and the Interagency Advisory Team for Environment, Food, and Health. DG-1350 Page 9, Section 3, sets a requirement for federal, state, local, and tribal authorities to maintain capabilities and deploy them to keep doses under Protective Action Guide requirements. The rulemaking also suggests that merely describing these existing federal, state, local, and tribal capabilities for contamination interdiction is sufficient for a licensee to adequately address emergency preparedness in the event environmental contamination occurs. On-site and off-site environmental contamination concerns are within the spectrum of credible consequences that will need to be managed within the first four (4) days of a response. Furthermore, nuclear utilities and counties cannot be prepared to properly manage contamination within an IPZ if they do not plan for such a contingency. The proposed rulemaking should require off-site emergency response coordination in the on-site emergency plan regardless of the EPZ boundary.

Response to NRC Topic 7 Questions #2, 3: Hazard Analysis for EPZ Determination

Historically, reactor accidents have been the result of or complicated by unforeseen risks or hazards and/or the inability to respond accordingly. Similar phenomena should be expected from SMR and ONT technologies, and as such a suitable safety margin should be imposed. NRC should advocate for approaches that take into account unknowns and uncertainties with SMRs that exist only as designs, have not been built or tested, and have no operational history. Hazard analyses should include low-probability events, security considerations, combined emergency scenarios, and other beyond-design-basis events.

Response to NRC Topic 6 Questions #2, 3: Mixed Mode or Multi-module SMRs

As the Fukushima disaster demonstrated, a natural disaster can cause accidents at more than one reactor on a site. The proposed rulemaking should require hazard analysis and emergency planning for multi-unit SMR sites or mixed facilities consisting of any combination of SMRs, light water reactors, decommissioned reactors, and interim spent nuclear fuel storage sites. The NRC design and safety justifications regarding individual modules are not technically compelling arguments for ignoring the need for multi-module planning.

Response to NRC Topic 6 Question #3: Transparent EPZ Determination Process

The rulemaking does not offer a clear description of the process for making the EPZ determination. The rulemaking relies on the licensee to provide an estimate of the source term, the full spectrum of credible accidents, and the hazard analysis. Further, the Federal Emergency Management Agency would have no role in assessing the adequacy of off-site emergency plans and capabilities for reactors with a site boundary EPZ. The NRC should reassure the public and interagency partners by publishing a description of the process that is in place for the review of source term determination and hazard analysis that includes technical experts outside NRC to evaluate the technical basis (e.g., source term, spectrum of credible accidents, and beyond-design-basis scenarios) for EPZ determination. Coupled with the fact that no operational history exists for SMRs and ONTs, stringent review practices for EPZ determination by the NRC should be promulgated.

Response to NRC Topic 4 Questions #1, 2: Off-site Radiological Emergency Preparedness Planning Activities; Topic 5 Question #1: Drills and Exercises

To maintain a reliable emergency preparedness plan and emergency response skill set, the proposed rulemaking should require a drill and exercise cadence for SMR and ONT operators that reflects the expected turnover of key personnel involved in emergency response both at the utility site and at state, local, and tribal authorities. Once an operational history is established with online SMRs and ONTs, lessons learned can be incorporated for these technologies at a suitable rate. NNSA supports explicit language in the NRC rulemaking that maintains the existing requirements for conducting an off-site emergency preparedness drill every two (2) years and the full suite of emergency preparedness exercises over an eight (8) year cycle. In addition, drills must exercise the interactions at the interface between on-site operating staff and off-site authorities, including notification, emergency response coordination, evacuation orders, and public affairs coordination. This coordination is even more critical if an EPZ is determined to be at the site boundary.

Please contact Rick Christensen, Deputy Director of the NNSA Office of Nuclear Incident Response (NA-84), at rick.christensen@nnsa.doe.gov / (202) 586-0997 or Col. David Knapp, Program Manager, NA-84, at david.knapp@nnsa.doe.gov / (202) 586-6619 with any questions.

Cc:

Dr. William Bookless, Principal Deputy Administrator, NNSA
Dr. Brent Park, Deputy Administrator for Defense Nuclear Nonproliferation
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