From:	Ryan Bodolay
To:	RulemakingComments Resource
Subject:	[External_Sender] Comment Re: NRC-2015-0225 Emergency Preparedness Requirements for Small Modular Reactors and Other New Technologies
Date:	Sunday, November 01, 2020 5:12:36 PM
Attachments:	Ryan_Bodolay_Comment_Re_NRC-2015-0225-0071.docx

Hello –

I understand that this comment is beyond the deadline, but I would like to submit it regardless. I strongly support this regulatory change but believe it has one area which could be improved upon.

Thank you.

Ryan Bodolay
Stetson University College of Law
Candidate for Juris Doctor, Class of 2022
Stetson Law Review, Associate Member
Cell: (863) 738.3546

Re: Docket NRC-2015-0225: I support NRC's movement towards performance based emergence preparedness guidelines for SMRs and Advanced Reactors with a recommendation to incorporate mandatory processes to continuously update emergency preparedness plans based on new information as such information becomes available.

I. Introduction

As the need for clean, non-carbon-based energy sources continues to become more and more critical to prevent the worst effects of climate change, as well as other damaging effects of burning fossil fuels, the evaluation of viable alternative sources of energy must be one the central areas of focus for academic, industry, and governmental actors. Due to overall safety records, associated carbon emissions, and ecological foot-print, nuclear energy should be included in the discussions about alternatives to burning fossil fuels. As with any source of energy[1], there are drawbacks and serious concerns associated with nuclear energy.[2] There is, however, a growing global population that continues to require more and more electricity and a need to stop adding carbon dioxide as well as other pollutants associated with burning various fossil fuels to the atmosphere.

Nuclear power must be a part of the effort to slow the effects of climate change, and the progress required for enabling nuclear energy to be a safe, clean, abundant, and inexpensive form of energy appear to be achievable in the timelines required to prevent the

---

[1] *See e.g.* https://energycentral.com/c/ec/how-much-land-does-solar-wind-and-nuclear-energy-require; https://www.audubon.org/news/will-wind-turbines-ever-be-safe-birds; https://www.forbes.com/sites/michaelshellenberger/2018/05/17/if-renewables-are-so-great-for-the-environment-why-do-they-keep-destroying-it/?sh=6e1319f33a1c; *https://www.nrdc.org/stories/columbia-snake-river-basin-salmon-are-losing-their-way*

[2] http://large.stanford.edu/courses/2018/ph241/kuet2/

worst effects of climate change. The Nuclear Regulatory Commission ("NRC") has a critical role to play in this effort. I believe that the proposed regulatory changes in Docket NRC-2015-0225 are excellent first steps by the NRC to balance the potential consequences associated with nuclear energy against the need to promote improved nuclear technologies that have the potential to play a significant role in the fight against climate change.

In support of this claim, this comment will first outline the current understanding of the safety record and real impacts associated with nuclear power. Second, this comment will argue that a performance-based approach to evaluating Emergency Preparedness as proposed in Docket NRC-2015-0225 is a superior approach to existing blanket emergency preparedness guidelines and begins to utilize techniques applied in other rapidly advancing technology fields. Third, this comment will argue that Docket NRC-2015-0225 is deficient because it lacks a mechanism to ensure that new learnings, improved processes, and changes in designs are adequately fed back into emergency preparedness plans to ensure that nuclear reactors remain as safe as possible.

II. Nuclear Power Safety and Environmental Impacts

Despite bad press from various sources, it is widely acknowledged by many in the scientific communities (and beyond) that nuclear power is one of the safest forms of electricity production currently available to the human race.[3] Since its inception, there have been three major accidents associated with nuclear power: Chernobyl, Three-Mile Island, and Fukushima. However, based on the latest estimates, the total deaths and lasting injuries associated with

[3] http://sitn.hms.harvard.edu/flash/2016/reconsidering-risks-nuclear-power/; https://www.wired.com/2016/04/nuclear-power-safe-save-world-climate-change/

the accidents are likely very low[4] when compared to other forms of power generation such as processing fossil fuels and even hydroelectric generation.[5]

Similarly, the real effects of nuclear power on the environment should be compared to the impacts from other potential sources of energy. Nuclear energy has by far the land use footprint required to generate the same amount of power.[6] Also, wind, solar, and hydroelectric are not without their ecological drawbacks such as the mass killings of various flying animals that are associated with wind and solar[7] and the damaging effects that many hydroelectric projects can have on migrating fish populations[8].

Nuclear energy, like all other sources of energy, has its environmental and safety drawbacks. There are the obvious effects of meltdowns that have been seen in history, and then there are issues associated with nuclear proliferation and the storage of nuclear waste. There are also more subtle effects such as the impact associated to the aquatic ecosystems

---

[4] The Chernobyl disaster is currently believed to have directly caused 50 deaths and the WHO estimates that it could eventually cause 4000 total deaths. https://www.who.int/news/item/05-09-2005-chernobyl-the-true-scale-of-the-accident. There are no known health impacts that resulted from the Three-Mile Island accident as acknowledged by the NRC. https://www.nrc.gov/reading-rm/doc-collections/fact-sheets/3mile-isle.html Similarly, it not currently believed that Fukushima directly caused any deaths https://www.world-nuclear.org/information-library/safety-and-security/safety-of-plants/fukushima-daiichi-accident.aspx although there were thousands of death associated to the evacuation procedures in regards to Fukushima.

[5] "To name only two: Bhopal, in India, where at least 3,800 people died immediately and many thousands more were sickened when 40 tons of methyl isocyanate gas leaked from a pesticide plant; and Henan Province, in China, where at least 26,000 people drowned following the failure of a major hydroelectric dam in a typhoon." https://e360.yale.edu/features/why-nuclear-power-must-be-part-of-the-energy-solution-environmentalists-climate. Similarly the construction of other renewables are often not very safe: *see* https://usbr.gov/lc/hooverdam/history/essays/fat1932.html; *see also* *https://www.forbes.com/sites/jamesconca/2013/09/29/forget-eagle-deaths-wind-turbines-kill-humans/?sh=14cbedd75467*

[6] https://energycentral.com/c/ec/how-much-land-does-solar-wind-and-nuclear-energy-require

[7] https://www.audubon.org/news/will-wind-turbines-ever-be-safe-birds; https://www.forbes.com/sites/michaelshellenberger/2018/05/17/if-renewables-are-so-great-for-the-environment-why-do-they-keep-destroying-it/?sh=6e1319f33a1c

[8] *See https://www.nrdc.org/stories/columbia-snake-river-basin-salmon-are-losing-their-way*

around nuclear power plants that have their base water temperatures raised by the plants due the need for vast amounts of water to cool the reactors.[9]

However, in both the cases of mainstream renewables and nuclear energy many organizations and individuals are working hard to alleviate many of these environmental concerns. Some of the nuclear energy technologies currently being developed have the potentially to drastically improve the safety of nuclear power production through features like passive safety devices, reduced half-lives and quantity of resulting nuclear waste, and improved designs allowing for more consistent production processes.[10] It should be argued that it is the role of regulatory agencies such as the NRC to balance the regulatory burden on these technologies to ensure that the public and environment are adequately protected while, at the same time, ensuring that benefits of innovations (such as improving safety, reducing environmental impacts, and improving economics) are enjoyed by the public.

Nuclear power, like all energy sources, has its drawbacks, but these should be weighed in the larger balance of climate change and the impacts from other energy sources. NRC-2015-0225 is a step in the right direction for the NRC to give the nuclear power industry the regulatory framework needed to balance technological advancement with a continuing expectation of safety for both people and the environment.

III. Support of Performance Based Emergency Preparedness Guidelines

As in many other rapidly advancing industries, regulations for nuclear energy should and can be both robust and agile. If allowed, the nuclear energy industry could make large

[9] http://large.stanford.edu/courses/2019/ph241/clark1/

[10] https://www.technologyreview.com/2019/02/27/136920/the-new-safer-nuclear-reactors-that-might-help-stop-climate-change/

technological leaps in the coming years that could greatly improve the safety, efficiency, environmental footprint, and cost of energy generation.

Creating a performance and results based regulatory scheme for nuclear power will allow the NRC to evaluate technologies on a case by case basis and will create incentives for those technologies that can show the lowest risks of environmental accidents and those technologies with reduced impacts when accidents do occur. Similarly, the new regulatory scheme would slowly facilitate the removal of older, less robust nuclear energy systems.

It is also important that well-reasoned analysis of emergency preparedness procedures occur on a case-by-case basis as each technology and site has its own unique concerns. For example, it is currently believed that more people actually died from the evacuation of Fukushima than from radiological exposure.[11] This appears to be a failing in the understanding of the science of the reactor and its surrounding environment as well as a failing in the understanding the logistic associated to the emergency plans. These types of issues can be avoided if emergency plans are better tailored and are practiced and evaluated regularly.

Finally, agility may become critical in the coming years if the issue of global warming becomes even more pressing. Having a forward-looking regulatory scheme that appropriately weighs the benefits against the risks is critical and should be re-evaluated against the current state of the planet periodically.

Despite these potential benefits of a performance based regulatory scheme, there are several arguments levied against modernizing regulations for the nuclear energy industry. First,

[11] https://www.world-nuclear.org/information-library/safety-and-security/safety-of-plants/fukushima-daiichi-accident.aspx

some argue that promoting nuclear energy through improved regulations will soak up needed research and development funding from other renewable energy technologies such as wind, solar, and improved battery technologies.[12] Second, others argue that these guidelines are delegating too much regulatory control to the nuclear industry itself.[13]

The first argument, which states that the planet should go all in on a couple technologies and leave others behind, inherently puts far too much faith into technologies that have known drawbacks and no guaranteed correct path forward that account for all of the issues. To take solar panels as an example, there are the issues of the environmental impacts from the manufacturing processes, from the mining processes needed to make the panels, from the toxic waste that results from old solar panels that are no longer able to generate sufficient output, from the land use required to create enough power, etc.[14] Wind and battery technologies also have similar environmental challenges.[15]

None of this is to say that nuclear energy does not have its own set of environmental challenges that need to be overcome. There are similar issues related to mining impacts as well as nuclear waste. However, nuclear energy has the potential to be one of the cleanest energy sources out of the currently available technologies and should not be hamstrung by regulations that are overly restrictive based on the real risks. Creating performance-based safety

---

[12] https://www.americanprogress.org/issues/green/news/2008/07/08/4735/10-reasons-not-to-invest-in-nuclear-energy/

[13] See comments from Docket NRC-2015-0225: https://beta.regulations.gov/document/NRC-2015-0225-0071/comment

[14] https://www.nationalgeographic.com/news/energy/2014/11/141111-solar-panel-manufacturing-sustainability-ranking/#:~:text=Yet%20manufacturing%20all%20those%20solar,shows%2C%20can%20have%20environmental%20downsides.&text=Fabricating%20the%20panels%20requires%20caustic,It%20also%20creates%20waste.

[15] https://scitechdaily.com/wind-farms-cause-more-environmental-impact-than-previously-thought/; https://sciencing.com/environmental-problems-batteries-cause-7584347.html .

regulations, if done properly, will maintain (or ideally improve as technologies are allowed to improve) the safety margins associated with nuclear power. The result could be that abundant clean and safe energy is quickly brought online thus reducing the need to continue burning fossil fuels. If this ultimately results in nuclear energy becoming the dominant form of energy production based on its merits of safety, environmental impact, and cost then it ultimately should be considered the right technology. If solar and wind make significant breakthroughs and become the cleanest forms of energy production then they will naturally weed nuclear energy out. The point is that the planet must hedge its bets.

The second argument regarding seeding control to private industry, while valid, can be alleviated if the performance based regulatory scheme is appropriately implemented. Generally speaking, the NRC should have the expertise required to determine the validity of the projections, estimates, and emergency plans created by the nuclear industry. However, in order to ensure that private industries keep up their end of the bargain, the NRC should implement a reliable mechanism to ensure continuous improvements in emergency preparedness as circumstances and information change.

IV. Proposed Improvements to NRC-2015-0225

As currently drafted, the updated NRC Emergency Preparedness guidelines are lacking a mechanism to ensure that previously approved Emergency Preparedness plans are updated as new information becomes available and as environmental circumstances change. Several of the existing comments on the regulation cite rising sea levels, changing weather patterns, and ongoing terrorism threats as reasons why the proposed performance-based regulations open the door to undue risk. These concerns are not without grounds. For example, the Fukushima

incident was preventable based on new information that became available after the original construction. When the Fukushima facility was originally built, the facility was originally only planned to withstand a 10-12m tsunami, which at the time was considered sufficient. Later studies revealed that a >15m tsunami was possible. The failing was that this information, which was available over 15 years prior to the Fukushima meltdown, was never acted upon.

There are many similar stories of accidents or issues across various industries where relevant information that would have prevented negative outcomes was available but not acted upon. In newer industries (especially in software and manufacturing sectors) the idea of continuous improvement has become a staple part of general operations. A "baked-in" culture of continuous improvement helps to ensure that the latest and greatest techniques are integrated into existing processes and to avoid complacency.

The NRC should attempt to weave a continuous improvement mechanism into the performance-based emergency planning that ensures processes are continuously updated and improved thus ensuring protection against today's vulnerabilities as well as tomorrow's. Such a process should also alleviate some of the dynamic concerns raised by commentors about rising sea levels, ever changing terrorism tactics, and changing weather patterns. Similarly, improvements to emergency preparedness should be promoted and not stifled by stagnant regulatory requirements.

There are several well-known techniques that can be implemented to ensure that continuous improvement occurs. Chaos engineering and testing, improved automation, required retrospective sessions, etc. are a few examples of such procedures that are utilized effectively in software engineering and which could also be implemented in the nuclear

industry to avoid complacency in safety procedures. Similarly, there should be required budgets for uplifting old systems, for ongoing environmental analysis, and for the incorporation of the latest research and techniques into emergency preparedness. While such programs do cost money, they should be seen as ongoing operational expenses and should be offset by the tailored emergency preparedness plans that are core to the proposed regulations.

In order to prevent another Fukushima, Three-Mile Island, or Chernobyl, the NRC should create a regulatory framework that can keep up with technological advancements, ensure complacency is not the cause of another disaster, and keep our nuclear energy sources are as safe as possible. This can be accomplished through a performance and results oriented framework that also requires energy providers to be the driving force behind ever improving safety measures.

V. Conclusion

Based on the discussion above, I believe that the nuclear industry requires a regulatory uplift to current technological standards in support of the growing need for clean and safe energy. Performance Based Emergency Preparedness Guidelines appear to be the correct choice to create the appropriate balance between safety and progress. I would like to request that the NRC consider adding additional regulatory provisions to ensure that future learnings, updated reactor designs, and improved safety practices can be reliably incorporated into existing emergency preparedness plans thus continually decreasing the chances of a major domestic nuclear energy related disaster.