Talking Points: Spent Fuel Pool Fires

The following comments address the 2013 Waste Confidence Generic Environmental Impact Statement, Draft NUREG-2157, Pages F-1, F-6, F-9, F-10, F-12, F-13; Essentially all of appendix F.

Citations following each point are linked / listed at the end of this document.

NRC Staff dismiss **ALL** of the following points (one way or another) on the basis that it finds the probability of a fuel pool fire to be **so low** that it concludes that such an event is "inconsequential." The odds cited are about 1 in 60,000...but that is for any one year, at only one reactor. Meanwhile there are still 99 reactors operational in the USA, and each will continue operating for more than one year. The odds rise to 1 a few thousand. NRC dismissing an enormous hazard solely because it is a "low-probability" event does not constitute **protection** of the public health and safety as it is charged by law to provide. The following factors MUST be considered:

A. As of 2012, spent fuel pools are overcrowded, packed beyond their originally engineered capacity by as much as 9 times. (Union of Concerned Scientists), (Lochbaum).

B. **Water loss in the spent fuel pool could lead to a catastrophic spent fuel pool fire**. "Water could be lost from a spent-fuel pool through leakage, boiling, siphoning, pumping, displacement by objects falling into the pool, or overturning of the pool. These modes of

water loss could arise from events, alone or in combination, that include: (i) acts of malice by persons within or outside the plant boundary; (ii) an accidental aircraft impact; (iii) an earthquake; (iv) dropping of a fuel cask; (v) accidental fires or explosions; and (vi) a severe accident at an adjacent reactor that, through the spread of radioactive material and other influences, precludes the ongoing provision of cooling and/or water makeup to the pool."(Thompson).

C. **NRC downplays the risks of pool fires by assuming that surrounding populations will be successfully evacuated**. But nuclear utilities are allowed to store HLRW in pools for many decades after reactors permanently shutdown, in order to defer the costs of dry cask storage as far off into the future as possible, despite the inherent risks. At the same time, NRC allows utilities, via exemptions from regulations, to do away with 10-mile radius emergency planning zones (EPZs) as soon as 12-18 months post-reactor shutdown despite the lingering risk of storing HLRW in pools at such shutdown reactor sites. How can populations be evacuated if EPZs have been dismantled?!

D. **NRC also downplays the risks of pool fires by assuming that a pool drain down accident (or attack) involves the complete drain down of the pool**. As Dr. Gordon Thompson of the Institute for Resource and Security Studies (IRSS) has pointed out, any technically competent person paying attention to the issue should have known since 1979 that a *partial* drain down of the pool is actually a worse-case scenario, for the leftover water in the bottom of the pool would block convection current air flow which would help cool the irradiated nuclear fuel, leading to faster heat up to the ignition point.

E. **The evaluation of the spent fuel pool fire risk in the GEIS relies on the spent fuel pools having only 3.5 spent fuel cores.** Currently, spent fuel pools contain as many as 9 cores. (Lochbaum). The NRC estimates the spent fuel pool capacity for some reactors to be as high as 16.7 cores. (DGEIS G-4).The ACTUAL over-loading of the fuel pools renders the probabilistic risk assessment invalid.

F. **The health risk assessment for a spent fuel fire was done using only three different nuclear power plants (Ginna, Surry and Zion**), ignoring the idiosyncratic nature of each reactor in the US. Reactor sites all have different amounts of irradiated fuel that gives off different amounts of radioactivity. The surrounding human populations are not equal nor are they distributed in the same way-- the dose calculations couldn't possibly be the same for all reactors.

G. **The seismic risks for the spent fuel pools in highly earthquake-prone areas are ignored.** The seismic risk for Diablo Canyon, San Onofre and Columbia fuel pools were deliberately glossed over, by the NRC's own admission, since the one reactor used in the NRC's "Consequences Study" is in Pennsylvania (Peach Bottom).

H. **The risk and consequences of a collapse of a spent fuel pool was explicitly ignored in the GEIS**. No attempt was made to incorporate this type of possible accident into the risk assessment for spent fuel pool fires. The current, ongoing situation at Fukushima Dai-ichi unit #4 tells us that this particular hypothetical scenario is a very real possibility.

I. **The 2013 GEIS references a seriously out-dated spent fuel pool study: "Regulatory Analysis for the Resolution of Generic Issue 82, 'Beyond Design Basis Accidents in Spent**

Fuel Pools'" (NRC 1989). The information in this report is at least 24 years old. A new regulatory analysis should be done, with the inclusion of the experience from Fukushima, and should include a risk analysis of spent fuel pools containing irradiated MOX fuel rods.

J. The NRC's Office of Nuclear Security and Incidence Response uses a predictive tool to aid emergency responders during nuclear accidents which indicates that **the radiological release from a pool fire following an earthquake could dwarf that of a reactor meltdown**. It also indicates that the consequence of the breach of a dry cask is thousands of times less severe. (U.S. Nuclear Regulatory Commission, Office of Nuclear Security and Incidence Response, RASCAL 3.0.05 Workbook, NUREG-1889, September 2007). (Curran).

K. **The Draft Consequence Study lacks scientific integrity because it examines only complete drainage of a pool and ignores the more severe case of partial drainage.** Based on the canard that complete drainage is the worst case, the NRC ignored spent fuel pool accident risks for decades. Then in 2001, in NUREG-1738, the NRC admitted that the most severe accident risk is posed by prolonged disruption of air or water circulation over the spent fuel assemblies. The point was confirmed by a panel of the National Academy of Science in 2004. By reverting to the discredited assumption that complete pool drainage is the worst case, the NRC fatally undermines the integrity and credibility of the Study. (Curran), (NAS).

L. **The Study is too narrow because it significantly underestimates risk by considering only one type of initiating event–an earthquake–and ignoring other credible initiating events that are at least as probable**. For instance, the Study ignores the impacts of aging and the potential for an attack on a pool and/or adjacent reactor to initiate a pool fire. Vulnerability of spent fuel storage pools to terrorist attack is perhaps the greatest risk of all. Further, the Study does not analyze the potential for a core melt accident to cause or contribute to a pool fire. For instance, radiation released during a core melt accident could preclude access to the pool to supply emergency cooling. (Curran)

M. **The Study is misleading and biased because it only pretends to consider the relative merits of low-density storage**. The Study purports to evaluate whether low-density pool storage of irradiated fuel would be cost-effective and safer than high-density storage. But NRC misleadingly uses the phrase "low-density" to refer to closed high-density racks that contain fewer fuel assemblies, not true low-density fuel storage in open-frame racks. The NRC decided not to consider true open-rack low-density storage because it was assumed to be too expensive (see page 23). The Draft Consequence Study shows an appalling lack of scientific integrity by including the result of the study as an assumption: the question of whether a return to open-frame low-density storage is justified is the very question the NRC set out to answer in the Study. (Curran).

N. **Ignoring real world multiple risk factors.** The draft NRC study has been done in a vacuum that excludes the hazards of a concurrent reactor accident that are known to impact the safety of spent fuel pool systems. Dr. Thompson correctly points out, *"the physical proximity of spent-fuel pools to operating reactors, and their sharing of safety systems, means that the use of high-density racks creates strong linkages between reactor risk and pool risk."* This fact is underscored in a 1990 NRC-sponsored study that points out that a long-term station blackout at the Peach Bottom nuclear station would cause "*deflagrations to occur in*

the reactor building and refueling bay.." This is exactly what occurred at the Fukushima reactors, which caused significant damage to the spent fuel pools. (Thompson, 2013)

O. **Aging and deterioration of Spent Fuel Pool Systems.** The NRC staff dismisses this problem by ignoring a 2011 NRC-sponsored study that concludes, "*as nuclear plants age, degradations of spent fuel pools (SFPs), reactor refueling cavities…are occurring at an increasing rate, primarily due to environment-related factors. During the last decade, a number of NPPs have experienced water leakage from the SFPs [spent fuel pools] and reactor refueling cavities."* Instead the NRC staff points to a study done 25 years ago, before aging effects were being observed. (NRC, 2011).

P. **Failure to meet the NRC's Technical Safety Information Standard for Final Safety Analysis Reports (10 CFR 52.157).** The draft study does not comport with the NRC's own technical information safety analysis standard for reactor operators. According to this regulation, safety analyses must incorporate all key reactor station components including the reactor operations and spent fuel handling and storage functions.

Q. **Failure to compare the risks of high density versus open rack configurations.** The draft study examines a reduction of spent fuel assemblies while allowing racking configurations that allow for high density storage to remain. Specifically, the study does not address the removal of neutron-absorbing panels that allow for closer spacing. It's been noted in a previous study that these panels can interfere with air convection during a pool drainage event and thus can enhance the heat-up of the nuclear fuel. In effect, they could become *de facto* "thermos bottles." Open rack storage would allow for free convection cooling and thus reduce the risk of ignition. (Alvarez)

R. **Failure to compare relative hazards of high-density pool storage with dry cask storage.** Instead the authors pick a scenario which may not even reflect real world situations relative to the different storage configurations at U.S. nuclear power stations. According to estimates developed in 2007 for the Nuclear Regulatory Commission's Emergency Operation Center, for purposes of emergency planning and response, a major earthquake near the San Onofre Nuclear Generating Station in California might cause a spent fuel cladding fire releasing approximately 40 million curies of Cs-137 and causing life-threatening radiation doses to people within a 10-mile radius. By contrast, according to the same NRC document, a cask rupture would result in the release of 2,500 times less radioactivity. This is underscored by real world experience at the Fukushima Daiichi site where all the nine dry spent fuel casks were unscathed by the earthquake and tsunami. (NRC, 2007), (Talbot).

S. **What should be done?** The draft study should be withdrawn and efforts to incorporate it into the NRCs regulatory framework should be halted. NRC should start with a clean slate and sponsor a proper investigation of the physics and chemistry of pool fires. Given that NRC lacks the in-house credibility to do this work, the agency should reach out to a broader pool of expertise and follow scientific principles.

CITATIONS:

1. “Safer Storage of Spent Nuclear Fuel”, Union of Concerned Scientists, 2012. http://www.ucsusa.org/nuclear_power/nuclear_power_risk/safety/safer-storage-of-spent-fuel.html

2. Thompson, Gordon. “Risk-Related Impacts from Continued Operation of the Indian Point Nuclear Power Plants”, INSTITUTE FOR RESOURCE AND SECURITY STUDIES, Cambridge, Mass, 2007. http://www.riverkeeper.org/wp-content/uploads/2011/05/Risk-related-to-impacts-from-Continued-operations-of-IndianPoint.pdf

3. Lochbaum, David, Director, Nuclear Safety Project, testimony Before the Senate Committee on Energy and Natural Resources, July 20, 2013.http://www.energy.senate.gov/public/index.cfm/files/serve?File_id=89dbc888-171c-4f77-8ecf-83a0055fcfb9

4. Curran, Diane.” Mothers for Peace Attorney Diane Curran urges public participation in Sept. 18 NRC meeting”, San Luis Obispo Mothers for Peace, http://mothersforpeace.org/data/mothers-for-peace-attorney-diane-curran-urges-public-participation-in-sept.-18-nrc-meeting

5. National Academy of Sciences (NAS), “Safety and Security of Commercial Spent Nuclear Fuel Storage: Public Report” (2006). http://www.nap.edu/download.php?record_id=11263

6. Thompson, Gordon. Comments on the US Nuclear Regulatory Commission’s Draft Consequence Study of a Beyond-Design-Basis Earthquake Affecting the Spent Fuel Pool for a US Mark I Boiling Water Reactor, August 2013.

7. U.S. Nuclear regulatory Commission (NRC), A summary of Aging Effects and Their Management in Reactor Spent Fuel Pools, Refueling Cavities, TORI and Safety-Related Concrete Structures, NUREG/CR-7111 (2011). P. vxiii.http://pbadupws.nrc.gov/docs/ML1204/ML12047A184.pdf

8. U.S. Nuclear Regulatory Commission, Office of Nuclear Security and Incidence Response, RASCAL 3.0.5 Descriptions of Models and Methods, NUREG-1887, August 2007

9. Talbot, David, “The Case for Moving U.S. Nuclear Fuel to Dry Storage”, MIT Technology Review, April 14, 2011.

10. Robert Alvarez, Jan Beyea, Klaus Janberg, Jungmin Kang, Ed Lyman, Allison Macfarlane, Gordon Thompson, and Frank N. von Hippel, Reducing the Hazards from Stored Spent Power-Reactor Fuel in the United States,*Science and Global Security, 11:1–51, 2003*

NRC Documents are posted here:
http://www.nrc.gov/waste/spent-fuel-storage/wcd/documents.html

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