Rulemaking1CEm Resource

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To: Rulemaking1CEm Resource
Subject: FW: NRC Regulatory Improvements for Decommissioning, Docket ID NRC-2015-0070
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From: garyheadrick@gmail.com [mailto:garyheadrick@gmail.com] **On Behalf Of** Gary Headrick
Sent: Friday, March 18, 2016 6:44 PM
To: RulemakingComments Resource <RulemakingComments.Resource@nrc.gov>
Subject: [External_Sender] NRC Regulatory Improvements for Decommissioning, Docket ID NRC-2015-0070

On behalf of San Clemente Green, representing nearly 5,000 concerned citizens living in close proximity to San Onofre, we wish to express our full support and agreement with all comments submitted to you in the attached document from the Sierra Club.

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March 18, 2016

TO: Secretary, U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
ATTN: Rulemakings and Adjudications Staff
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RE: Advanced Notice of Proposed Rulemaking (ANPR): Regulatory Improvements for Decommissioning Power Reactors, Docket ID NRC-2015-0070

It is now recognized by the NRC that highly irradiated spent nuclear fuel could remain at many reactor sites for the foreseeable future. As long as this highly radioactive material remains at a site, adequate precautions are needed to ensure safety and financial protection of both the public and the environment; whether the irradiated spent fuel is in pools or dry storage. The exemptions that have been granted to decommissioning sites do not ensure public or environmental safety and create an unnecessary financial burden. Stating there is less risk after reactor shutdown does not mean low risk and does not mean low consequences. On the contrary, risks and consequences are high.

Decommissioning, by definition, covers the entire process of dismantling and "cleaning up" a nuclear site. The NRC draft focuses mainly on irradiated spent fuel whereas it should cover the other aspects of site remediation, maintenance and release. Despite that glaring omission in the ANPR, we focus here on specific aspects of the high level waste/irradiated spent fuel issues.

RECOMMENDATIONS

Until nuclear irradiated spent fuel is removed from the site the following actions need to be taken:

- **Continue requirements for (and no exemptions from) on-site and off-site emergency planning**.
- **Require on-site and off-site continuous radiation monitoring and public reporting in real time**.
- **Retain experienced, trained and certified staff for all critical functions**.
- **Resolve current short-term aging management issues.** Existing dry storage used in the U.S. was not designed for even short-term storage (as defined by the NRC as up to 120 years). Canisters may start failing after 20 or 30 years from initial loading. We are close to the 30 year mark for some canisters, yet no solutions are in place. (See U.S. Nuclear Spent Fuel Storage Canisters/Casks loaded as of June 2013 *http://bit.ly/drycasks2013*). Both safety and funding need to be addressed, especially if the controversial use or misuse of decommissioning trust funds monies for irradiated spent fuel storage is allowed. Examples of critical issues:
  - **Thin-walled (1/2" to 5/8") stainless steel canisters used at most U.S. facilities cannot be inspected (even on the outside), repaired, maintained, or monitored prior to a radiation release, and are subject to cracking, with leaking occurring in as little as 16 years after crack initiation.**
  - **Thin canister interiors cannot be inspected, but may have short-term degradation.** Recent information from TEPCO in Japan shows the aluminum alloy baskets used in the casks may not last 60 years. Japan has discontinued using aluminum alloy baskets. This issue needs to be evaluated by the NRC to assess impact for U.S. storage. The majority of U.S. utilities use thin canisters with welded lids. NRC and the licensees must adequately address the condition of the baskets without destroying the canisters. How will this be accomplished? Are the U.S. aluminum alloy baskets subject to the same degradation? Where is the funding for replacement canisters and removal of the failed canisters and concrete overpacks?

- **Increase financial assurances**. Utilities should provide legally binding financial assurances that they can maintain and manage the irradiated spent fuel for as long as needed, including funding to recontainerize irradiated spent fuel assemblies as needed.
- **Require replacement plan and funding**. Current NRC exemptions have allowed trust fund money to be used without a plan in place for any replacement or repair needs for canisters or other mitigation.
- **Do not assume the DOE will pick up fuel by a certain date until an approved facility is built and approved for shipments.** There is no conservative basis to assume otherwise and the NRC's Continued Storage decision confirms this.
- **Retain irradiated spent fuel pool(s) even after emptied until an alternative means is identified to repair or replace dry storage canisters and failing fuel assemblies**. The alternative means should be specifically defined, funded, approved, and have provisions in place before pool(s) are destroyed. Currently, NRC requires pools for mitigation of canister or fuel failure for operating reactors, yet is allowing them to be destroyed without an adequate approved replacement plan in place or even funding for a plan at closed reactors. The option to repair thin canisters does not exist, so should not be considered a valid plan.
- **Meet transportation requirements.** NRC regulations prevent transport of canisters with even partial cracks. Without a pool there is no plan or funding in place that would address canisters that may be cracked or have some other condition that would prevent transport.
- **Meet DOE Standard Contract requirements.** DOE requires fuel retrievability at the fuel assembly level. This cannot be done without the pool and must be addressed in decommissioning and irradiated spent fuel management design and funding.
- **Increase state authority over the decommissioning process, irradiated spent fuel management and related funding.** Continuing to allow utilities to use large amounts of limited trust fund monies and make major decision without state oversight or even NRC oversight until after the fact is not regulating. It puts ratepayers and taxpayers at risk and limits or eliminates funds for potentially needed safety related items.

JUSTIFICATION

Explosion Risk

As stated by ACRS Chairman Dana A. Powers, in ACRS *Recommendations for Improvements to the NRC Staff's "Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants*," April 13, 2000, (*ML003704532*), p. 3, risk of an explosion exists with spent fuel assemblies exposed to air at any temperature:

> *Many metal hydrides are spontaneously combustible in air. Spontaneous combustion of zirconium-hydrides would render moot the issue of "ignition" temperature that is the focus of the [NRC] staff analysis of air interactions with exposed cladding. The staff has neglected the issue of hydrides and suggested that uncertainties in the critical decay heat times and the critical temperatures can be found by sensitivity analyses. Sensitivity analyses with models lacking essential physics and chemistry would be of little use in determining the real uncertainties...spent fuel exposed to air at any temperature, particularly high burn-up fuel may result in an explosion. The majority of nuclear power plants use higher burn-up fuel.*

The ACRS letter referenced spent fuel pools. This issue has not been adequately addressed by the NRC.

Irradiated spent fuel in dry storage exposed to air from through-wall cracks is of similar concern as the following references show.

> *Damaged Spent Nuclear Fuel at U.S. DOE Facilities*, *Experience and Lessons Learned*, INL, November 2005, INL/EXT-05-00760, page 4 & 5. *https://inldigitallibrary.inl.gov/sti/3396549.pdf*
>
> > *The generation of high surface area uranium metal SNF fragments and uranium hydride necessitates additional measures during SNF drying, dry storage, and transportation because of the pyrophoric nature of these materials when exposed to air.*
>
> *The Explosive Characteristics of Titanium, Zirconium, Thorium, Uranium, and their Hydrides*, Irving Hartman, et.al., U.S. Bureau of Mines, Report of Investigation 4835, U.S. Dept. of Interior, December 1951
> *https://sanonofresafety.files.wordpress.com/2014/12/4410914explosivezirconiumdivofmines.pdf*
>
> > *Even 5% oxygen in helium, can cause zirconium powder to ignite. Any mechanical or chemical process that reduces the [zirconium] cladding to turnings, chips, granules, or powders can generate a pyrophoric or flammability hazard.*

Dry Storage Safety Risks

The NRC justification to remove emergency planning and other critical resources after fuel is moved to dry storage is based on many assumptions that have proven to be wrong or have not been addressed. Key sources the NRC uses to support safe storage are disputed below.

Pilot Probability Risk Assessments (PRA's) in EPRI-1009691 and NUREG-1864 predict an extremely low risk of latent cancer fatalities to the public. Some of the critical PRA assumptions in these documents are invalid.

- **Invalid assumptions: Canisters will be fabricated and loaded correctly** as prescribed in the Holtec HI-STORM Final Safety Analysis Report.

  Canisters have been loaded incorrectly. For example, at Diablo Canyon, PG&E hired Holtec to perform loading over numerous loading periods. Over half of the canisters were loaded incorrectly (assemblies with longest cooling time were loaded on inner cask locations and those with shortest cooling times were loaded on outer cask locations). Since the canisters are welded shut, any degradation to the fuel cladding is unknown. This in spite of the Holtec's own technical specifications requiring triple checks at multiple points in the process (Event Number 51134 06/06/2015).

  Manufacturing problems have occurred. For example, at Monticello nuclear facility, numerous canister manufacturing issues were found by an NRC inspector. Xcel Energy was cited for this (*ML14156A023*). Canisters have not been remediated.

- **Invalid assumption: No materials degradation will occur.**

  Given that canisters will need to be stored on-site indefinitely and given there is evidence of even short-term risk of degradation and failure with materials and manufacturing, this is not a valid assumption.
  The existing thin wall (1/2" to 5/8" thick) stainless steel canister designs have been approved for an initial 20 years. In that approval, the NRC ignores aging issues, such as material degradation of the fuel cladding, concrete and metals, even though they know these are

short-term and long term aging issues. In the approval for the Holtec HI-STORM UMAX Canister Storage System the NRC states material degradation “is not an issue during the initial 20-year certification period, but instead, is an issue that would have to be addressed if a CoC holder requested renewal of the CoC for a period beyond the initial 20 years.”

List of Approved Spent Fuel Storage Casks: Holtec International HI-STORM UMAX Canister Storage System, Certificate of Compliance No. 1040, Amendment No. 1 Direct Final Rule, Federal Register Vol. 80, No. 173, pp 53691 – 53694, effective September 8, 2015 *http://www.gpo.gov/fdsys/pkg/FR-2015-09-08/pdf/2015-22053.pdf*

The NRC approved these canisters knowing they cannot be inspected for cracks or repaired, are subject to stress corrosion cracks, and once a crack initiates it can grow through the wall of the canister in as little as 16 years. The NRC has no approved plan in place to mitigate this and makes the problem worse by allowing empty irradiated spent fuel pools to be destroyed even though irradiated spent fuel is still stored on-site.

Public Meeting with Nuclear Energy Institute on Chloride Induced Stress Corrosion Cracking Regulatory Issue Resolution Protocol, August 5, 2014 (*ML14258A081* and *ML14258A082*)

Director of Spent Fuel Management Division statement at California Coastal Commission hearing, October 6, 2015, confirming inspecting these canisters is “not a now thing”. *https://youtu.be/QtFs9u5Z2CA*

Holtec canister President and CEO, Dr. Kris Singh, states even if you could find the crack, in the face of millions of curies of radiation being released, and find a way to robotically repair it, there is no adequate method to repair these canisters filled with spent nuclear fuel without introducing another area for cracking.

Dr. Kris Singh, Southern California Edison Community Engagement Panel, October 14, *2015 https://youtu.be/euaFZt0YPi4* and *https://sanonofresafety.files.wordpress.com/2015/09/attachment-14-declaration-of-donna-gilmore.pdf*

According to the NRC, the Koeberg nuclear plant in South Africa had a comparable component crack and leak in only 17 years. The largest crack (0.61”) was deeper than the thickness of most U.S. canisters (0.50”). It was located in a similar environment to San Onofre and Diablo Canyon, with on-shore winds, surf and frequent fog. These are some of the many known environmental factors for stress corrosion cracking.

Public Meeting with Nuclear Energy Institute on Chloride Induced Stress Corrosion Cracking Regulatory Issue Resolution Protocol, August 5, 2014 (ML14258A081 and ML14258A082)
A Diablo Canyon canister was found by the Electric Power Research Institute (EPRI) to have all the conditions for cracking in a canister that had only been loaded with irradiated spent fuel assemblies for two years. See details and references on this report:

Diablo Canyon: conditions for stress corrosion cracking in 2 years, Oct. 23, 2014 *https://sanonofresafety.files.wordpress.com/2011/11/diablocanyonscc-2014-10-23.pdf*

NUREG/CR-7017 is another source the NRC uses to substantiate safe dry storage. However, the document does not substantiate safe dry storage. It addresses **spent fuel handling (SFH) human failure events (HFE)** and uses the following four primary sources of information for the core for developing and investigating this. All of these sources, except “Subject Matter Expert (SME) interviews, are already disputed above.

1. Subject Matter Expert (SME) interviews
2. NUREG-1864 Pilot dry cask PRA developed by the NRC
3. EPRI-1009691 Bolted storage cask PRA conducted by EPRI
4. Final Safety Evaluation Report for the Holtec International HI-STORM 100

NUREG/CR-7017 *Preliminary, Qualitative Human Reliability Analysis for Spent Fuel Handling*, SAND2010-8464P, Sandia National Laboratories, Jeffrey D. Brewer et.al. *http://pbadupws.nrc.gov/docs/ML1105/ML110590883.pdf*

NUREG/CR-7017 actually challenges assumptions made in those previously discussed reports that the NRC uses to claim safe dry storage.

Page 3-3 Storage (comments on NUREG-1864)

No attempt was made to determine the frequency or manner in which fuel mis-loading might occur…Interestingly, with respect to the fuel assemblies themselves, if the expected age of spent fuel (5 years cooling in SFP) were loaded, simply blocking the vents on the cask is expected to cause 20% of the assemblies to exceed their long-term failure temperature level of 742 º Fahrenheit (i.e., they would likely fail due to creep rupture). This situation, although not expected to challenge the MPC, may pose serious problems during future movement and handling of the casks.

Page 3-4 (comments on NUREG-1864)

Additional evidence gathered later has cast doubts on the assertions of minuscule public and environmental risks from SFH activities. Given the vast number of human-performed SFH activities, increased doubts about the magnitude of risk greatly increase the importance of conducting more detailed HRAs.

Page 7-2 Visual Challenges

As mentioned above, visual cues are primary in performing fuel spent operations. In many cases, it is difficult to properly observe these cues because of the position of personnel in relation to the activities they are observing. Operations within the SFP can be particularly challenging; the refraction in the water and reflection from the water's surface can distort the view of operations that require precise positioning. Observing signs of damage to individual fuel pins within a cask or canister may be severely hampered by structural elements. Finally, in many cases, by its very nature and location, the action must be viewed from a distance. In such cases, personnel can miss small deviations that could possibly lead to significant problems simply because they do not have sufficient visual resolution to detect the error.

Page C-22 Subject Matter Expert (SME) interviews

***SME11** – fuel that's around 5kW would be at about 90 degrees Fahrenheit around 15kW – it would start burning hand; 33 MW/day (high-burn-up) you might see temps up around 300 degrees C; to date we haven't seen any really hot casks*.

***SME12** – related to mis-loading, temperature is not a good indicator for wrong fuel loading. [Temperature is the only continuous monitoring used for welded thin canisters]*

***SME11** – the utilities are good about capturing unusual things in their corrective action system; the inspectors can look into all the incidents that have happened with a crane. We*

> *could take a look when we are onsite at a plant. The plants don't like to let the Corrective Action Program documentation leave the plant site with NRC personnel, since it will then be accessible to others via the freedom of information act (FOIA).*

As long as the highly radioactive nuclear irradiated spent fuel remains at a site, the NRC should require adequate precautions to ensure safety and financial protection of both the public and the environment, whether in irradiated spent fuel pools or dry storage. The above issues should be addressed before moving forward with any new decommissioning regulations and before any further exemptions are granted that fail to adequately address these issues. Existing exemptions should be reevaluated to address the above issues. Too much is at risk to do otherwise. With each of these canisters and casks holding about as much Cesium-137 as was released at Chernobyl, we cannot afford to ignore these issues.

Sincerely,

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