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THE AUTHORS RESPOND TO ALLAN BENJAMIN'S COMMENTS

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As the multiple references to it in our article attest, we have learned a great deal from the pioneering work of Allan Benjamin *et al, Spent Fuel Heatup Following Loss of Water During Storage* (NUREG/CR-0649; SAND77-1371 R-3, 1979). Indeed, many of our conclusions and recommendations essentially echo those made in that report 24 years ago, but never implemented because the probability of an accidental loss of water was estimated to be too low to justify action.

Benjamin argues that we should have estimated the probability that sabotage or terrorist attack might cause a loss of water. Indeed, he seems to suggest that the probability can be calculated with some precision with methods that his company offers. While we believe that systematic analysis is useful in identifying vulnerabilities, we are skeptical about the predictive value of probabilistic calculations—especially for malevolent acts.

We respond more briefly to Benjamin's other comments below:

Magnitude of the release of ^{137}Cs. We looked at 10 and 100 percent releases—not just 100%.

Sensitivity to the constant-wind assumption. An estimate of the sensitivity of the contamination area to wind wander can be obtained by varying the opening angle in the wedge model calculation. Increasing the opening angle from 0.11 to 1 radians, for example, results in the area contaminated above 100 Ci/km2 increasing by about 20% for the 100% release and decreasing by about a factor of 3 for the 10% release.

Feasibility of totally draining the pool through valves and gates. We make no claim that this is possible. Rather we cite NRC staff concerns that a number of pools could be drained below the top of the spent fuel. This would result in very high radiation levels in the spent-fuel-pool building. Pools should therefore be equipped with sources of makeup water that can be turned on from a remote location.

Probabilities that terrorist attacks would put dense-packed fuel into a more coolable configuration and open-racked fuel into a less coolable configuration. Benjamin makes both assertions. The first is far from obvious. With regard to the second, we point out that the assumption that the geometry of the spent fuel is not changed is a limitation of our analysis—as it is of all other analyses of which we are aware. The NRC should commission studies of the implications for coolability of potential changes in geometry.

Omission of 8-day halflife ^{131}I and 2-year halflife ^{134}Cs in the consequence calculations. Shorter-lived isotopes such as ^{131}I and one-year halflife ^{106}Ru could make significant contributions to short-term doses downwind from a spent-fuel-pool fire. However, our analysis was limited to the long-term consequences of such an accident where, as the consequences of the Chernobyl accident demonstrate, 30-year halflife ^{137}Cs is the principle concern because it can force the evacuation of huge areas for decades.

Effectiveness of dry casks over the long term. We propose on-site dry-cask storage for about 30 years of older spent fuel that would, according to current plans, remain in pools for that length of time. Spent-fuel casks have already been in use for about 20 years and there is no evidence that they cannot last decades longer without significant deterioration.

Risks during spent-fuel transfer. We urge in the paper that these risks be carefully examined and minimized before the transfer begins. However, the fuel will have to be moved sooner or later in any case.

Availability of space for dry-cask storage. Nuclear power plants are surrounded by exclusion areas that provide ample space for a few tens of additional casks.

Acceleration of Yucca Mtn. Project. It would probably be counterproductive at this stage to try to significantly accelerate the licensing process of the Yucca Mountain underground spent-fuel repository. It would be worth exploring whether the delivery rate for spent-fuel could be increased above the current design rate of 3000 tons per year. However, there are so many political uncertainties associated with the transport of spent fuel to Yucca Mountain and so many technical issues that still have to be decided in its design and licensing process that speculation about possible acceleration should not be used as an excuse to ignore the relatively straightforward interim on-site storage option recommended in our paper.