September 13th, 2012

Dear Editor,

First, I would like to express my sincerest gratitude for granting me the excess time required to make the edits suggested by the reviewers. The majority of the comments given in the review were highly pertinent and the changes made in light of them result in a stronger overall document. Bulleted below are the changes made to the paper from the reviewer comments:

1. Added discussion about why surrogate models are insufficient in this study as the second to last paragraph of the introduction.
2. Added clarifying text that directly states that we adjust the non-leakage probability, the initial enrichment, and the cycle length to achieve the desired burnups.
3. Added text declaring that min and max bounds were chosen for each parameter to create a sufficiently large domain.
4. Made all editorial changes suggested:
    a. many rewordings of possibly awkward phrasings
    b. burned uranium (BU) terminology changed to used uranium (UU),
    c. and updated Figure 2 for terminology changes
5. Added two paragraphs in §5.1 discussing why normal Monte Carlo statistics are insufficient for the sort of analysis here.
6. Added sentence in final paragraph about boolean probability distribution functions.

However, there were two suggestions which were not implemented. The first one was to "*discuss what new insights have been gained that was not commonly known to the fuel cycle expert community.*" In fact, I believe that this document already demonstrates non-intuitive results which may be gained from entropy-based metrics. The first example is in §6.2 where it is shown that 90% partitioning of Cs and Sr is enough to mitigate the repository effects of these species. The second is §6.4.2 where the repository capacity decreases with increasing transuranic conversion ratio.

Still, the primary purpose of this paper was not to demonstrate specific, non-intuitive fuel cycle results. Instead, it is intended as primarily a methods paper describing the mechanism and value of entropy-based measures. That this was the purpose was explicitly mentioned in §4.1:

> "*The statistical techniques discussed below could be applied to any type of fuel cycle; in this study, the LWR and Na-cooled FR technologies were chosen for the fuel cycle simulation model in order to strike a reasonable balance between input space richness, complexity, and familiarity to readers.*"

In essence, the fuel cycle FR-LWR hybrid scenario examined here was chosen because it serves as a well known and well understood benchmark for a fundamentally new analysis technique applied to the nuclear fuel cycle. Performing such a benchmark study, as done here, is necessary due diligence to have trust in this method. Furthermore, it is expected that future work using this methodology which will include more specific insights about the cycle at hand in such studies.

The second suggestion that was not implemented was that a standard deviation column was not added to the rankings in Table 5. Instead, this was addressed in the two paragraphs added in point #5 above. In short, such a column would be trivial because all of the entries would have identical values. This is because the marginal sums over all input parameters is the

same for a given response for each input. Since we only examine repository capacity, all fuel cycle contingency tables in the paper demonstrate this result. This is mentioned in the two paragraphs included as part of point #5.

Finally, given the changes that have been made and the justifications for the edits undone, I feel that this paper is now the strongest it could possibly be without expanding its scope beyond any reasonable means. Therefore, it is now ready to publication. Once again, thank you for your understanding with regard to the delay.

Be Well,
Dr. Anthony Scopatz
The University of Chicago