NE250 Summary 5 **Mitch Negus**
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Deep-Burn: making nuclear waste transmutation practical

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While last week's article discussed the potential for transmutation in various reactor types, this week's article presents a specific method for transmuting transuranic components of used LWR fuel in an advanced reactor. By using modular helium reactor (MHR) with a deep-burn procedure, the authors believe that they can effectively eliminate at least 90% of the transuranics present in spent nuclear fuel (SNF). The proposed process uses 2 fuels, a driver and a transmutation fuel, to accomplish the required burnup. Both fuels are encapsulated in TRISO particles, and after a fresh uranium driver is passed through one cycle (where it is expected that nearly 90% of transuranics will be destroyed), it is processed via a traditional UREX procedure to extract FPs before being mixed with used LWR fuel for transmutation. This transmuted fuel is expected to be a graphite enclosed ceramic, and nearly impervious to water. With this in mind, the final output transmutation fuel is a prime candidate for low-risk geologic disposal.

Though I thought in general the paper was both thorough and fairly readable, I do have two critiques of the authors methods. First, I believe that more transparency ought to have been provided on the results presented. I felt like often the authors would quote improvements that they were expecting for their design over conventional methods, without specifying their methods for making these assumptions. An example of this is on page 310 when the authors claim that after three irradiation periods "75% of the LWR waste transuranics and 99% of the Pu-239 being are destroyed." While this is an encouraging result, I don't believe the authors explained where this value came from. I believe that if it was found through simulation they should note the codes used, and if it was a calculation by hand, they should briefly explain their methods. Furthermore, while I appreciated their attempts to include beneficial graphics, I find flowcharts like figure 15 to be both messy and confusing. A simpler and more communicative flowchart is figure 16, which while very heavy on text, is easily comprehended and insightful.