Eric Altenburg HST-415 November 14, 2020

Week 11: Nuclear Power — Video

Part 1

Nuclear Reactors

1. Basic Reactor Theory
   - Slow nuclear reaction
   - You can make reactors that are completely safe
     - Variable safety
   - Uses U-238 in it (lowers the probability and stops neutrons)
   - Moderator: bounces the neutrons around to make it likely to hit U-235
   - Control rod: absorbs neutrons so that it doesn't fission too fast
2. Reactor engineering example: TRIGA
   - ***Was this TRIGA reactor a part of the NPT treaty?***
   - As it gets hotter, it reduces the neutron probability of hitting fuel

The road to peaceful nuclear power

1. Postwar reactor research
   - In 1940 reactor research taken over by AEC
   - Mainly used for research and plutonium production
2. Atoms for peace
   - Promote peaceful international uses of atomic energy
   - Declassify peaceful tech, reactor work, basic science, some enrichment info, etc.
3. Atomic energy act 1954
   - Changes:
     - US can share info to allies
     - US can share reactor info with private industry
   - During this time, push for private reactor research
4. Naval Reactors
   - Hyman G. Rickover
     - AEC and Navy
   - Makes submarine nuclear reactor
5. Types of reactors
   - ***Does the pool of water get emptied in the BWR?***
   - ***Why do the cool down towers have that iconic shape to them?***
6. Nuclear concerns by the 1970s
   - Concerns about accidents:
     - loss of coolant
     - meltdown
     - risk = (probability of accident) $*$ (expected consequences)
     - high powered reactors have low prob of accident, but high consequences = "high risk" technology
   - Concerns about waste:
     - spent fuel very radioactive for a few decades—fission products
     - less radioactive for thousands of years
     - how to guarantee a structure will survive for millennium?
     - reprocessing possible—but expensive and raises security issues
   - Concerns about economics:
     - high capital costs
       $*$ licensing, development, maintenance
       $*$ expensive anywhere, but just US, but US legal system makes very expensive
       $*$ takes a long time to pay for itself—must run plant for 30-40 years

– never any “organic demand” for nuclear power (maybe today, with concern about environment/climate, there is)