

First Hour Exam
NEEP-423
Oct. 5, 1998

Points

Question

- 12 1.) List the most commonly used materials in today's fission power plants for the following components;
- a.) Fuel
b.) Cladding
c.) Control Rods
d.) Pressure Vessel Structural Material
- 16 2.) a.) What is the single largest drawback of unalloyed metallic U fuel for power reactors and why is it a problem?
- b.) Give 3 other reasons why reactor vendors switched from metallic U to other fuels for light water reactors in the 60's and 70's
- 15 3.) What were the 3 events in the 1980's that caused the public to reassess fission power? How did the IFR propose to address those problems?
- 16 4.) a.) What is the difference between Zircalloy-2 and Zircalloy-4? In what kind of reactors do we use these alloys?
- b.) Why don't we use Zircalloy in Fast Breeder Reactors?
- 21 5.) Country X is suspected of making weapons grade ^{235}U (i. e., $>90\%$ ^{235}U) You are part of an IAEA observation team and your intelligence network tells you that 25 canisters of UF_6 (each container has 100 kg of natural UF_6) were seen going into the plant. Furthermore the plant has a 2 MW_e electrical line going into it which is used 24 hr's a day. Exactly 1 year later you see them removing the tails which now contain 0.3% ^{235}U . Could they have made enough weapons grade ^{235}U (10 kg of $>90\%$ ^{235}U) for a bomb?

- Note : • At. Wt. of F is 19.
• They used a gaseous diffusion process which requires 3 MWh/SWU

$$V(x_i) = (2x_i - 1) \ln \frac{x_i}{1 - x_i}$$
$$S = V(x_p) + \frac{W}{P} V(x_w) - \frac{F}{P} V(x_p)$$

20 6.) a.) In the early 1970's, what was the major cause of fuel element failure in BWR's? In PWR's ? Explain, qualitatively, each mechanism.

b.) What is the major cause of fuel element failure in PWR's today? Explain.