**EAS 375**

**Spring 2011**

**Lecture questions - Nuclear Energy**

**What are the major roles that nuclear energy play in our day-to-day lives?**

Generating electricity, medical application (X-ray, MRI), industrial application (X-ray), home use (smoke alarms), food preparation (gamma radiation), transportation (submarines)

**What are some of the challenges questions facing the nuclear industry?**

Public perception, economic viability, improved operating safety, efficient waste management, resource utilization, nuclear weapons proliferation

**What is nuclear fission?**

It occurs when the nucleus of an atom splits into smaller parts, often producing free neutrons and lighter nuclei

**What is fissionable material?**

It undergoes fission from being struck by a neutron.

**What is meant by critical mass?**

Amount of fissile material needed to sustain a chain reaction.

**What is the difference between weapons grade and reactor grade enrichment?**

Enrichment of U-235 is about 96% for weapons vs. 3% in a nuclear reactor.

Nuclear weapons are designed to produce a reaction that is so fast and intense that it cannot be controlled once it’s started.

Power plants: precise control of the rate at which nuclear reaction occurs and low level of enrichment which makes impossible a nuclear explosion to occur.

**What is the difference between neutron moderators and absorbers?**

Moderators slow neutrons to increase the reactivity of a nuclear reactor.

Absorbers stops neutrons and decreases the reactivity of a nuclear reactor.

**What is the differences between open and closed fuel cycles?**

Closed fuel cycles allow reprocessing of the waste to be reused to produce energy. Reuse waste before disposing it.

**What is the basic difference in protection required in handling a fresh fuel rod and a spent fuel rod?**

Fresh fuel rod has negligible radiation level and no shielding is required.

Spent fuel rod have high radiation level and requires special handling and shielding.

**Why are spent fuel rods so dangerous?**

Number of transuranic elements generated in reactor core – highly radioactive and often thermally hot.

**What is a light water reactor and how it differ from a heavy water reactor?**

It has 2 to 3 loops. Loop 1 is boiling water from reactor to turbine. Loop 2 is cooling water to cool and condense steam.

Heavy water reactor does not need enrich U-235 and does not absorb neutrons as readily as light water reactor. More expensive to build and obtain water.

**What is a fast breeder reactor and how do they affect the production of nuclear waste?**

Use fast neutrons to cause fission of their fuel. Produces plutonium that can either be used for weapons or fuel for reactors. Can be used to destroy high level nuclear waste.

**Why are spent fuel rods stored in a fuel pond of about 10 years?**

It provides shielding from radiation and cools the fuel.