Fact Sheet
Used Nuclear Fuel Storage at the Fukushima Daiichi Nuclear Power Plant

(Last updated 3/16/11)

Key Facts

- Used nuclear fuel at the Fukushima-Daiichi plant is stored in seven pools (one at each reactor and a shared pool) and in a dry container storage facility (containing nine casks.)
- Sixty percent of the used fuel on site is stored in the shared pool, in a building separated from the reactor buildings; 34 percent of the used fuel is distributed between the six reactor fuel storage pools, and the remaining 6 percent is stored in the nine dry storage containers.
- Used fuel pools are robust concrete and steel structures designed to protect the fuel from even the most severe events. Pools are designed with systems to maintain the temperature and level of the water sufficient to provide cooling and radiation shielding.
- The water level in a used fuel pool typically is 16 feet or more above the top of the fuel assemblies.
- The used fuel pools at the Fukushima Daiichi reactors are located at the top of the reactor building for ease of handling during refueling operations.
- The used fuel pools are designed so that the water in the pool cannot drain down as a result of damage to the piping or cooling systems. The pools do not have drains in the sides or the floor of the pool structure. The only way to rapidly drain down the pool is to have structural damage of the walls or the floor. As of mid-day March 15, there is no evidence to date that this has occurred.

What Could Happen During an Accident?

- The systems that cool and maintain water levels in the pools are designed to withstand severe events. If these systems are unable to function, the heat generated by the used fuel would result in a slow increase in the temperature of the spent fuel pool water. The operating temperature of the pools is typically around 40 degrees C or 100 degrees F (the boiling point for water is 100 C or 212 F). This slow increase in temperature will result in an increased evaporation rate. Rapid evaporation of the water will not occur.
- Exact evaporation rates would depend on the amount of used fuel in the pool and how long it has cooled. The rate at which the pool water level would decrease (due to evaporation or mild boiling) in the absence of cooling system function would not be expected to lower water levels by more than a few percent per day. Given that there is approximately 16 feet of water above the used fuel assemblies, operators would have a few weeks to find another way to add

water to the pools before the fuel would become exposed. For example, water could easily be added using a fire hose.

- If the water level decreases below the top of the fuel assembly, oxidation of the zirconium cladding could occur. This oxidation could result in some hydrogen generation. The rate of hydrogen generation depends on the temperature of the fuel assembly, with hotter temperatures leading to higher hydrogen generation rates. However, only the fuel assemblies with the least cooling time would be susceptible to this oxidation and the temperature of the fuel assemblies decreases exponentially with cooling time.
- Even if the water level in the pools was to decrease sufficiently so that the fuel were exposed to air, the same level of overheating that can occur in a reactor accident would not occur in the used fuel pool because the used fuel assemblies in the pool are cooler than the assemblies in the reactor. It is highly unlikely that used fuel temperatures could reach the point where melting could occur, although some damage to the cladding cannot be ruled out. The likelihood of cladding damage, as with hydrogen generation, decreases substantially with temperature and cooling time.
- There has been some speculation that, if the used fuel pool were completely drained, the zirconium cladding might ignite and a “zirconium fire” might occur. At the surface of the used fuel pool, the gamma dose rate from radiation emanating off the used fuel assemblies typically is less than 2 millirem per hour. If the water level decreases, the gamma radiation level would increase substantially. This increase would be noticed at the radiation monitors near the reactor buildings.