Like many other nuclear plants across the U.S., the San Onofre Nuclear Generating Station (SONGS) has designed and constructed an Independent Spent Fuel Storage Installation (ISFSI)—a dry storage facility—for the spent nuclear fuel that once was used in the reactors at SONGS. Nuclear power plants throughout the country have been safely storing used nuclear fuel in dry storage canisters since 1986. Southern California Edison (SCE)—decommissioning agent for SONGS—has been safely storing spent fuel in dry storage since 2003.

**The need for on-site storage of spent fuel**

By law, the federal government is required to take possession of spent fuel from commercial nuclear power plants in the U.S., including SONGS. Specifically, the U.S. Department of Energy (DOE) was required to provide a national disposal facility and begin accepting used fuel by 1998. To date, DOE has not delivered on its mandate. In the meantime, used fuel is stored at both operating and shut down nuclear power plants across the U.S.

**Purpose of the ISFSI**

Dry storage systems for spent nuclear fuel protect people and the environment from radiation, using thick concrete for shielding and physical protection for the storage canisters. The concept of defense-in-depth applies here as radioactive material is contained in several layers of physical protection. First, ceramic pellets that are sealed within fuel rods. The fuel rods are organized into assemblies that are housed in seal-welded stainless steel canisters. The canisters are stored in thick concrete overpacks that provide radiation shielding and physical protection against mechanical contact and precipitation. Collectively, the canisters and overpacks provide shielding, containment, physical protection, and passive cooling. SONGS chose designs that provide more radiation shielding than above-ground cask designs that are widely in use at other sites in the U.S.

**Safe and passive functionality**

Dry storage systems including those at SONGS employ natural convection air flow to cool and maintain spent fuel in a safe condition.
Dry storage systems do not use water or fans for cooling, have no moving parts, and require no electric power for cooling.

**Common characteristics of the dry storage systems at SONGS**

There are two dry storage systems deployed at SONGS, an original AREVA Transnuclear (TN) NUHOMS system and a more recently constructed Holtec UMAX system. To minimize the risk of chloride induced stress corrosion cracking in the coastal environment, all canisters in both systems at SONGS are fabricated from Type 316L stainless steel, which is highly corrosion resistant. Canister shells are 5/8-inches thick as compared to the industry standard of 1/2-inch thick stainless steel. When filled with spent fuel assemblies, canisters weigh up to approximately 50 tons.

Both the NUHOMS and UMAX systems at SONGS are designed to withstand a lateral peak ground acceleration of 1.5g, which is more than twice as robust as the design for the other plant structures at San Onofre and four times the California Building Code requirements for commercial buildings. The design protects against hazards such as water, fire or tsunamis.

Both dry storage systems at SONGS are designed to withstand submersion by a transient tsunami event. The NUHOMS system is designed to be submerged under 50 feet of water and the UMAX system by 125 feet of water.

**Design characteristics that are unique to each of the two dry storage systems**

For the NUHOMS system, each of the 50 canisters is stored horizontally in its own massive, 400,000-pound module, which is constructed of thick reinforced concrete for shielding and protection. Each module is closed with a massive concrete plug that weighs more than 14,000 pounds.

The UMAX system at SONGS is built as a monolith that accommodates 73 canisters in vertical cavity enclosure containers. It was constructed with a foundation and top pad that used more than 900 tons of No. 11 rebar (measuring 1-3/8-inches in diameter) as well as high-strength 5,000-PSI concrete. Each of the 73 storage cavities is capped with a 35,000-pound steel and concrete closure lid.

**Secure and protected location**

The dry storage systems at SONGS are in a protected area and monitored 24/7 by a security force to protect the spent fuel from sabotage. In addition, the ISFSI is protected by a 28-foot-tall tsunami wall.

**Defense-in-depth for continued dry storage**

Spent fuel and ISFSIs are regulated by the U.S. Nuclear Regulatory Commission (NRC). The initial NRC licensing period is for 20 years, after which an Aging Management Program (AMP) is required. The known degradation mechanism for canisters is chloride induced stress corrosion cracking (CISCC) which is a very long-term phenomenon. AMPs are designed, in part, to provide for the early detection and mitigation of degradation. Here, defense-in-depth applies to the inspection and remediation or “repair” of canisters.
The NUHOMS system at SONGS has an initial license that requires renewal in 2023. In May 2019, TN Americas LLC (TN) submitted a request for a 40-year extension of the license—specifically, the Certificate of Compliance—for the NUHOMS system at SONGS. The extended license will include requirements for visual inspections of selected canisters in the NUHOMS system, using the best available technology. In the unlikely event a canister did become degraded, SCE has demonstrated the ability to mitigate (repair) a canister.

The UMAX system at SONGS has an initial license that requires renewal by the NRC in 2035. An AMP is not required until after 2035 although SCE will implement an Inspection & Maintenance (I&M) program much earlier, in 2020. That is because in 2015 as part of the permitting process to expand the ISFSI to accommodate the UMAX system, SCE made a commitment to the California Coastal Commission to develop an I&M program to inspect, monitor, and maintain the system. Here again, SCE already has demonstrated a “metallic overlay” repair method and a video of that method is available here.

**Dry fuel storage radiation monitoring**

Two radiation monitoring systems are deployed at SONGS in the interest of safety and to provide information to the public.

One system uses thermoluminescent dosimeters (TLDs sometimes referred to as “badges”) that are placed in an array along the perimeter of the plant site. These small devices absorb radiation and are read periodically by trained specialists in order to quantify the amount of radiation in the immediate vicinity of SONGS. SCE submits annual reports to the NRC that summarize the readings from the TLDs and that report is available here.

SCE also deployed a second radiation monitoring system specifically for the SONGS ISFSI, which goes above and beyond NRC requirements. This gamma-sensitive ISFSI Radiation Monitoring System produces an ongoing stream of data to three independent partners that have the ability to monitor radiation dose readings. These partners are the California Department of Public Health Radiologic Health Branch, California State Parks and the City of San Juan Capistrano. The Radiological Health Branch also produces a monthly report for the public and those reports are available here.