

**Summary of Presentations  
by the U.S. Nuclear Regulatory Commission**

**on the NRC's Power Reactor Decommissioning Process  
San Onofre Nuclear Power Plant**

**Carlsbad, California  
September 26, 2013**

**Larry Camper, Director, Division of Waste Management and Environmental  
Protection**

The NRC licenses and regulates the nation's civilian use of radioactive materials to protect public health and safety, promote the common defense and security, and protect the environment. Our primary mission during the decommissioning phase is health and safety.

**Decommissioning Requirements**

The NRC's decommissioning regulations are contained in Subpart E of 10 CFR Part 20. These state the goals of removing a facility safely from service and reducing radioactivity to a level that permits release of the property for unrestricted use, or under restricted conditions. In either event, the license to operate the plant is terminated or reduced to the footprint of the Independent Spent Fuel Storage Installation (ISFSI) when the property is released.

All decommissioned plants to date have achieved unrestricted release, based on reduction of radioactivity to the required level for this status.

**On-Site Decommissioning Team**

All areas of NRC decommissioning staff expertise will be used as needed on the San Onofre team, which may include: mechanical, civil, chemical, nuclear, geotechnical, and industrial engineers; health physicists, environmental scientists and engineers, hydro-geologists, mathematicians, biologist and chemists.

**Decommissioning Completions**

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Decommissioning is a process that includes a wide range of sites whose activities generate radioactivity. In the last 15 years, some 80 sites have been decommissioned. Of these, eleven were nuclear power plants:

Rancho Seco, 2009  
Big Rock Point, 2007  
Connecticut Yankee, 2007  
Pathfinder, 2007  
Yankee Rowe, 2007  
Trojan, 2005  
Maine Yankee, 2005  
Saxton, 2005  
For Saint Vrain, 1997  
Shoreham, 1995  
Shippingport, 1988

## **Decommissioning Milestones**

Key milestones in decommissioning are:

- Certification of permanent cessation of plant operations
- Certification of permanent removal of nuclear fuel from the reactor
- Post-shutdown decommissioning activities report ((PSDAR) – a major document
- Decommissioning and environmental remediation – activity on-site
- License termination plan
- Final status survey – activity on-site
- NRC confirmatory survey
- Termination or reduction of 10 CFR Part 50 license

## **Decommissioning Release Requirements**

There are two pathways to release: restricted and unrestricted, based on a maximum radiation dose standard of less than 25 mrem/yr (0.25 mSv/yr) and as low as reasonably achievable. This “total effective dose equivalent” (TEDE) is based on the average member of the critical group, in all pathways, for a 1000-year period of performance. The 0.25 mSv/yr standard is monitored by legally enforceable institutional controls. If these controls fail, doses must not exceed 1 – 5 mSv/yr in specified circumstances.

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During the decommissioning process of pathways to release, financial assurance of capability must be provided by an independent third party and the licensee and NRC must satisfy requirements for public input and outreach.

### **Agenda for this Public Meeting**

At this meeting, the NRC will provide an overview of NRC regulations, the reactor decommissioning process, the decommissioning inspection program, decommissioning funding, and spent fuel management. Waste confidence is an issue the NRC can speak to.

The NRC is very engaged in decommissioning. This public meeting is not part of the required process but it is important to us. An opportunity for hearing is offered once the utility submits its License Termination Plan (LTP) because approval of the LTP involves a license amendment. Other events that will result in meetings include filing the Post Shutdown Decommissioning Activities Report (PSDAR) and the License Termination Plan (LTP).

### **Bruce Watson, Chief, Reactor Decommissioning Branch, Office of Federal, State, Materials Safety and Environmental Protection**

NRC inspects the radiological level at all decommissioning sites. Four reactors were in active DECON (decontamination) in 2013. Humboldt Bay, LaCrosse and Zion 1 & 2 are now in active decommissioning. A resident inspector is typically on site during the first year of the process.

### **ISFSI**

10CFR Parts 50 and 20 contain the rules on power reactor licensing and license termination. Part 72 contains the Independent Spent Fuel Storage Installation (ISFSI) license requirements, which cover dry cask storage of the spent fuel during decommissioning.

### **Reactor Decommissioning Options**

DECON: Equipment and structures are removed or decontaminated to a radiological level that permits unrestricted release of the site.

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SAFSTOR: The plant is placed in a safe, stable condition and maintained in that state until it is subsequently decontaminated to a radiological level that permits release.

ENTOMB: The plant is encased in a structurally long-lived substance to allow decay until radiological levels permit unrestricted release. Note:  
The ENTOMB option has not been used and is not currently available under the NRC's regulations.

## **Reactor Decommissioning Process**

The process is required to be completed within 60 years. During the first 50 years the plant may be placed in SAFSTOR to achieve a 99% drop in radiation and a 90% drop in waste volume due to radioactive decay of cobalt 60 during that time. At the 50-year point, 7 – 10 years remain to complete actual decommissioning.

The amount of money in the Decommissioning Fund may increase during this time. The 60-year timeframe also corresponds to the 20-year cycle for life extensions at multi-unit sites.

## **Strategy Factors in Decommissioning**

- Multi-unit site safety
- Amount of decommissioning funds available
- Access to radioactive waste disposal capacity
- Future use of site
- Stakeholder concerns and priorities
- Special concerns
- New business model

Under the new business model, the utility transfers the license to a decommissioning company that does the job and returns the site – and the spent fuel waste - to the utility. This model is being used in the Zion decommissioning.

## **Power Reactor Decommissioning Process (PSDAR)**

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Within 30 days of permanently ceasing operations, the licensee must send a letter to the NRC notifying and certifying this operational status. A similar certification must be provided by the licensee when fuel has been permanently removed from the reactor vessel.

Within two years of the cessation of operations, the licensee must submit a Post-Shutdown Decommissioning Activities Report (PSDAR).

The PSDAR is a document from the licensee to the NRC. This document is received and reviewed, but not “approved” by the NRC.

The PSDAR must contain: a description and schedule for planned decommissioning activities, an estimate of expected costs, and a review of environmental impacts of decommissioning within the parameters of Environmental Impact Statements (EIS) applicable to the project.

Upon receipt of the PSDAR from the licensee, the NRC publishes a notice in the Federal Register, followed by a public meeting to discuss the PSDAR and solicit comments. As noted above, the NRC does not approve the PSDAR and the licensee may begin decommissioning 90 days after the NRC receives the PSDAR.

### **License Termination Plan (LTP)**

As the licensee performs site decommissioning, the NRC conducts site inspections on a continuous basis. At least two years prior to requesting license termination, the licensee must submit a license termination plan (LTP). At that point the NRC publishes a notice in the Federal Register and holds a public meeting to discuss the LTP.

The LTP must include information characterizing site radiology levels, remaining dismantlement activities, plans to complete remediation of the site, and detailed plans for the final radiation survey. An important part of the LTP is the licensee’s demonstration of how the final radiological inspection will meet NRC requirements.

In cases where restricted release is requested, the LTP will include a description of the end use of the site. In all cases, the LTP will include an updated site-specific estimate of remaining decommissioning costs. The LTP will also contain an updated environmental report if there have been significant changes in relevant conditions or information.

Upon receipt of the LTP, the NRC begins a detailed technical review that takes about one year. The NRC will request further information if needed. The LTP also provides the basis for public meetings and opportunity for a hearing.

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NRC approval of the LTP is in the form of an amendment to the license. The licensee performs the remaining decommissioning activities, which the NRC reviews using independent in-process and confirmatory surveys to verify the licensee's survey results.

The process concludes with a Final Status Survey Report (FSSR) submitted by the licensee. The FSSR contains final radiological reports, on which the NRC performs confirmatory surveys. If the findings are consistent with the FSSR, the NRC terminates the license by letter and provides notice of this action in the Federal Register.

### **San Onofre Decommissioning Schedule: Key Time Milestones**

June 7, 2013: SCE certified permanent cessation of operations for Units 2 and 3

June 28: SCE certified Unit 3 has been defueled

July 22: SCE certified Unit 2 has been defueled

2014 calendar year: SCE tells NRC it intends to submit the PSDAR in this timeframe.

June 7, 2015: Latest date for SCE to submit PSDAR

August 6, 2015: Latest date for public meeting on PSDAR

### **Blair Spitzberg, Chief, Fuels Safety and Decommissioning Branch, NRC Region IV**

#### **The NRC Inspection Program for Decommissioning Reactors**

The inspection program's role is to ensure compliance with requirements contained in NRC regulations, safety standards, license conditions and technical specifications. It performs this role through licensing reviews done by NRC national headquarters, with safety inspections, and enforcement actions where needed, by NRC Region IV staff.

Inspections of decommissioning activities are generally scheduled during periods of higher-risk activity. During and after remediation activities, the NRC conducts independent radiological measurements to confirm the accuracy of survey methodologies used by the licensee.

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Inspection of physical security is part of the process. A key area is inspection of spent fuel safety, including the Independent Spent Fuel Storage Installation (ISFSI).

The goal is objective verification of the safe conduct of licensee activities. The NRC verifies the adequacy of licensee controls to ensure that safety problems and violations are promptly identified and corrected, and effective actions taken to prevent recurrence. Licensees often bring in contractors. The NRC monitors their performance by monitoring trends in licensee safety performance.

### **Core Inspection Tasks**

- Review of decommissioning organization, management and cost controls
- Review of impact on safety of design changes and modifications
- Review of self-assessments, audits and corrective actions
- Occupational (workforce) radiation exposure
- Inspections to confirm final survey results
- Spent fuel safety
- Transportation of radioactive material
- Environmental monitoring of effluent and red-waste treatment
- Review of contingency response procedures

### **Inspection Procedures**

Routine inspection schedules are planned about a year in advance, with adjustments made as needed. The timing of inspections may be announced or unannounced. Exit meetings are held to review inspection findings. Post-exit, there is a 30-day goal for normal inspection reports and a 45-day goal for reports of team inspections.

Each inspection is followed promptly by an NRC debriefing for management, including any significant findings. Enforcement may include civil penalties for significant violations revealed through inspections. The final step is to track and follow up on any safety issues to the point of closure.

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## **Blair Spitzberg, Chief, Fuels Safety and Decommissioning Branch, NRC Region IV**

### **Spent Fuel Storage at San Onofre: Fuel Pools**

Spent fuel must have active heat removal in a pool for several years after leaving the operating reactor. After this period it can be passively cooled by air.

Spent fuel is being safely stored at San Onofre in fuel pools and in the on-site Independent Spent Fuel Storage Installation (ISFSI). Spent fuel pools are able to withstand the same degree of environmental hazard as the reactors, and will be operated by certified fuel handlers on shifts around the clock.

Each spent fuel pool has redundant and independent cooling systems, power supplies, pool water sources, and other safety and emergency equipment. Both spent fuel pools and the ISFSI are protected by the San Onofre physical security force and its associated security systems.

Inspections of fuel pool safety will continue semi-annually under the NRC spent fuel safety rules for permanently shut-down reactors.

### **Spent Fuel Storage at San Onofre: Dry Cask**

Due to the lack of a national repository, the ISFSI is a cask storage facility necessary as an alternative to spent fuel pools. The Nuclear Waste Policy Act of 1982 and 1987 amendments laid out a process for licensing a geologic repository, but that may be decades away.

Dry cask storage was developed to meet the need for expanded on-site spent fuel storage due to lack of a national repository. Casks are stored in ISFSIs at multiple locations around the U.S. because there is currently no place to ship the fuel after it cools in the spent fuel pools.

The ISFSI at San Onofre utilizes the Transnuclear Advanced NUHOMS Horizontal Modular Storage System. Its major components are the dry-shielded canister (DSC) and the horizontal storage module (HSM). Each DSC has a 5/8<sup>th</sup> inch stainless steel shell with steel internal spacer disks, a welded internal confinement boundary and a separate welded lid.

The DSC is placed horizontally inside each HSM module, into a steel reinforced concrete housing structure. The HSM has steel reinforced concrete walls more than 4 feet thick and roof slabs about five feet thick that provide additional structural protection and radiation shielding. The ISFSI pads are steel-reinforced concrete with a minimum 3-foot thickness.

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The ISFSI at San Onofre is designed for high-seismicity sites. The Design Basis Earthquake used for the ISFSI is 2.24 times more powerful than that used in licensing the San Onofre reactors.

The San Onofre ISFSI is 19.75 feet above sea level. A maximum flood condition of 29 feet was evaluated, which would put the ISFSI pad under 9 feet of water. The design basis of the pad is to withstand a submersion in 50 feet of water.

The maximum wave height under tsunami conditions is estimated at 27 feet – less than the maximum flood conditions evaluated for the site. If the ISFSI were temporarily flooded during a tsunami, no adverse thermal effects would occur. None of these calculations include any estimate of impact mitigation from the 28-foot seawall at San Onofre.

Inspections of the ISFSI are normally performed every two years under NRC regulations. Routine inspections are normally scheduled during ongoing cask loading operations. The NRC tries to time ISFSI inspections at times of active loading.

**Michael Dusaniwskyj, Economist, Financial Analysis & International Projects Branch, Office of Nuclear Reactor Regulation**

### **Funding Decommissioning: NRC Requirements and Expectations**

The process of funding decommissioning begins when a nuclear power plant license is issued. Decommissioning funding should be adequate when decommissioning begins. The NRC regulates safety, not commerce. Therefore, the NRC requirement to provide reasonable assurance of adequate funding for decommissioning is based on costs for protection of public health and safety. Methodologies deemed acceptable by the NRC are provided in 10 CFR 50.75(e).

Assurance of adequate funding for decommissioning is an obligation taken on by the licensee when the NRC issues a license. The NRC maintains a comprehensive, regulation-based program to provide reasonable assurance that sufficient funds will be available for radiological decontamination and other essential decommissioning functions for each U.S. commercial nuclear facility. The NRC monitors the amount and adequacy of funds to decommission each plant to the NRC standards on decontamination and waste management.

Note: Site restoration or “greenfield” is not under NRC jurisdiction, NRC requires radiological reduction to regulatory requirements. “Greenfield” levels of site restoration are under the jurisdiction of the California Public Utilities Commission.

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## **San Onofre Decommissioning Costs**

Decommissioning funds are kept in a dedicated trust account. The NRC monitors the amount and the purchasing power adequacy of these funds over time.

As of December 31, 2012, the San Onofre decommissioning account contained the following amounts:

\$1,666,100,000 for Unit 2

\$1,890,800,000 for Unit 3

\$295,700,000 for Unit 1 in remaining funds versus

\$206,500,000 for Unit 1 estimated remaining costs

(note: Unit 1 is mostly decommissioned but the reactor vessel remains on site)