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RANCHO SECO – DECOMMISSIONING UPDATE

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ABSTRACT

The Rancho Seco Nuclear Generating Station ceased operation in June of 1989 and entered an extended period of SAFSTOR to allow funds to accumulate for dismantlement. Incremental dismantlement was begun in 1997 of steam systems and based on the successful completion of work, the Sacramento Municipal Utility District (SMUD) board of directors approved full decommissioning in July 1999.

A schedule has been developed for completion of decommissioning by 2008, allowing decommissioning funds to accumulate until they are needed. Systems removal began in the Auxiliary Building in October of 1999 and in the Reactor Building in January of 2000. Systems dismantlement continues in the Reactor Building and should be completed by the end of 2003. System removal is near completion in the Auxiliary Building with removal of the final liquid waste tanks in progress.

The spent fuel has been moved to dry storage in an onsite ISFSI, with completion on August 21, 2002. The spent fuel racks are currently being removed from the pool, packaged and shipped, and then the pool will be cleaned. Also in the last year the reactor coolant pumps and primary piping were removed and shipped. Characterization and planning work for the reactor vessel and internals is also in progress with various cut-up and/or disposal options being evaluated.

In the year ahead the remaining systems in the Reactor Building will be removed, packaged and sent for disposal, including the pressurizer. Work will be started on embedded and underground piping and the large outdoor tanks. Building survey and decontamination will begin.

RFP's for removal of the vessel and internals and the steam generators are planned to fix the cost of those components. If the costs are consistent with current estimates the work will go forward. If they are not, hardened SAFSTOR/entombment may be considered.

INTRODUCTION

Rancho Seco is a 913-megawatt B&W designed nuclear power plant owned by the Sacramento Municipal Utility District that began commercial operation in 1975. It was shut down in June of 1989 as the result of a voter referendum. Due to a minimal decommissioning fund balance, the decision was made to enter an extended period of SAFSTOR to allow the activity to decay and the fund to build to a level that would allow dismantlement, projected to begin in 2008.

In 1991, the decision was made to place the spent fuel into dry storage, allowing the plant to enter a "hardened" SAFSTOR condition and cutting the required staff significantly. An ISFSI was built and contracts for casks and fuel storage liners were put in place, but numerous delays have continued to postpone fuel transfer. Fuel transfer was finally completed in August of this past year as 21 canisters have been filled and placed in the ISFSI.

With the staff waiting for fuel movement and the possibility for significant cost savings by using the Envirocare disposal site, a three-year incremental decommissioning project was proposed to dismantle the Turbine Building systems and a portion of the Tank Farm systems (1). The project was approved for a 1997 start, with annual renewals based on performance. This work was successfully completed leading to approval of full dismantlement in July of 1999.

The plant staff has been reorganized to support the focus on decommissioning rather than the maintenance and operation of the station. The personnel resources on site were assigned to support both the dry fuel project and the decommissioning of the facility until the fuel movement was complete in August of 2002. Now that fuel movement is complete the staff has been reorganized to focus on completion of dismantlement. With fuel in storage and off the reactor site many licensing requirements have been removed and many surveillances and procedures are being eliminated.

Over the last year significant progress has been made on removal of systems in the Auxiliary Building and the Reactor Building. The four Reactor Coolant Pumps were removed and shipped in two rail cars. Most highly radioactive components in both buildings have been removed. Removal of four highly contaminated tanks was also completed this year.

Planning for Auxiliary Building work in 2003 includes disposition of the three remaining underground liquid waste tanks, and removal of remaining systems, including the ventilation systems. The removal of the outside liquid waste tanks is also planned for 2003. Reactor Building dismantlement will include all remaining piping and systems and preparation of the pressurizer and reactor head for disposal in late 2003 or early 2004. Work in the spent fuel pool will continue with removal of the racks, followed by pool clean up and removal of the liner plate. Processing of primary ion exchange resin in five HICs is also planned for 2003.

Planning for major component removal is in progress with major decisions to be made to allow the work to go forward within the scheduled timeframe.

DRY FUEL PROJECT

The decision to move the fuel to dry storage was originally made to allow the plant to go to a hardened SAFSTOR condition that would allow the utility to minimize the staff and therefore the cost. SMUD decided that a transportable dry cask system was needed to allow the fuel to be transported to the DOE without replacing it in a fuel pool for repackaging. No such system existed at the time that would accommodate Rancho Seco's fuel. SMUD decided to develop and purchase a "first ever" large-scale canister based transportable spent fuel storage system.

SMUD signed the contract in 1992 for the design, licensing and fabrication of a transportable storage system. In 1995 the ISFSI was constructed and fabrication of the cask and associated equipment began. However, in 1996, quality issues throughout the dry storage industry and vendor bankruptcy forced work to be stopped. In 1997, a new supplier resumed the design and license work.

The transportable storage system consists of a transportation cask, twenty-one dry storage canisters, twenty-two modular horizontal storage modules and a multi-axle trailer. The cask serves for on-site transfer and off-site transportation overpack for the canisters. The canisters hold the spent fuel in a structural array and are then seal-welded at both ends. The horizontal storage modules are thick reinforced concrete storage bunkers used to store the canisters. The twenty-second module is expected to provide storage for greater-than-class-C waste from reactor vessel internals.

Fuel movement began in May of 2001. Loading a single canister took about a week and a half to two weeks to complete. The schedule was hampered by the delivery rate from the fabricator, however all canisters were finally on-site in May of 2002 with spent fuel loading and storage completed by August 21, 2002.

Dose rates on the loaded transfer cask were significantly below the projected dose rates bringing the annual site exposure well under the ALARA goals. The cask was electro-polished prior to the first time it was placed in the fuel pool providing a surface that could be quickly (and easily) decontaminated after removal from the pool further lowering the total exposure.

PAST DISMANTLEMENT WORK

Beginning in 1997 a small team was formed to begin selective dismantlement. This work was successful and grew into the current decommissioning project. From 1997 through 1999, the majority of the potentially contaminated components in the Turbine Building and outside areas were removed. Most of the asbestos, lead and other hazardous material remediation has also been completed. Work began in the Auxiliary Building in September 1999.

PLANNING

Until 2000 job planning was barely ahead of ongoing work. Once the entire decommissioning project was approved it became a priority to develop the planning process to support a detailed schedule for the entire project. A high-level schedule was developed for an eight-year duration

to provide a framework. Then, the detailed schedule was slowly extended to include the next two years. Allowing the planning to develop over an extended period of time permits the evaluation of many alternative methods for dismantlement and the incorporation of lessons learned from other projects that are further along.

Detailed planning for work in 2003 has been completed. Table I lists the current long-term schedule.

Table I
Major Item Schedule

Activity Description	Start	Finish
Auxiliary Building System Removal	Sept. 1999	June 2003
Reactor Building Preparation	Jan. 2000	Complete Dec. 2000
Reactor Building System Removal	Jan. 2001	Dec. 2003
Remove RCP Motors	Mar. 2001	Complete Dec. 2001
Move Spent Fuel to ISFSI	April 2001	Complete Aug. 2002
Spent Fuel Pool Dismantlement	Sept. 2002	Dec. 2003
Remove Reactor Coolant Piping	Mar. 2002	Complete Aug. 2002
Remove Reactor Coolant Pumps	May 2002	Complete Sept. 2002
Remove Pressurizer	May 2003	July 2004
Remove Steam Generators	July 2005	July 2006
Remove Outside Tanks	Feb. 2003	Oct. 2003
Remove Underground Piping	Jan. 2003	Dec. 2004
License Termination Plan Preparation	Jan. 2003	Oct. 2004
Reactor Vessel Internals Removal	July 2004	June 2005
Reactor Vessel Removal	July 2005	May 2006
Building Decontamination	July 2003	Feb. 2008
Perform Final Survey	Oct. 2006	Oct. 2008

2002 DISMANTLEMENT WORK

Flow of Radioactive Waste

Most waste from Rancho Seco goes to one of three paths; 1) disposal at a burial site, 2) offsite processing for free release or volume reduction or 3) onsite free release. In addition, onsite segmentation is performed when determined to be cost effective.

High-density waste is packaged for disposal at Envirocare of Utah. In 2002, approximately 42,000 cubic feet of waste was shipped there, mainly metal waste in B-25 boxes and Seavans, as well as compacted DAW in drums. Most low-density waste is shipped to processors for volume reduction and disposal or for decontamination and free release. Approximately 10,000 cubic feet was shipped for processing in 2002.

Plant components, that never came into contact with radioactive systems or which can be easily cleaned by grit blasting, are considered candidates for onsite free release. In 2002, approximately 150,000 pounds of metal was free released.

The District also obtained certified generator status at Envirocare of Utah in order to dispose of containerized Class A waste. The certification involved a review of Rancho Seco's radwaste characterization, packaging and transportation procedures. Program and procedure revisions were required to address allowable container void space, removal and verification of free liquid volume and radiological surveys of containers. One high integrity container (HIC) containing dewatered resin was disposed of once certification was achieved.

One shipment of mixed waste was sent to Permafix. This included elemental mercury, mercury debris and freon contaminated filters. More mixed waste shipments are planned for 2003.

Some class B/C waste (<100 cubic feet) was generated and is stored pending SMUD management approval for disposal at Barnwell (Rancho Seco has never utilized the Barnwell disposal site).

Tank Cleaning and Disposal

Tank cleaning is a high exposure, but necessary, activity that allows the removal of radwaste tanks. Some tanks have a thin layer of activated oxide material, while some have significant sludge from sumps and others have gravel-like activated sediment. Each presents its own set of problems for removal and waste handling.

A variety of methods have been used to clean the tanks prior to segmentation. Contamination inside the lower activity tanks was just washed to plant sumps, but this only caused the problem to be revisited when the sump is cleaned. Another method to clean the tanks was the use of a sock filter system that removed the contaminants after tank cleaning with a high-pressure water lance and pump. Bag handling caused more dose than anticipated and left many filters to process. This would not be acceptable on higher activity tanks.

One tank contained dried sludge and resin fines. It was determined that the best course of action was to leave the waste dry and vacuum the material from the inside of the tank. This avoided creation of a wet waste, difficult to dewater and dispose of. Dose rate criteria were established for the vacuum to satisfy ALARA concerns and to assure a class A waste.

Segmentation and removal of these tanks created additional obstacles. Some of the smaller, lower dose rate tanks were removed whole, packaged and sent for disposal. Larger tanks, such as those cleaned, were sized for removal from rooms and cubicles. Tanks were either stainless steel or carbon steel with lead paint and an interior coating. For coated tanks the lead paint and coating was manually removed along lines to be cut and the tank was subsequently cut by torch in pieces then packaged into B-25 sized boxes. For stainless tanks a variety of methods were used, including saws, machining and plasma torch. Plasma torch was the most efficient, but created smoke that clogged filters and required tenting the local area to control fumes. In addition, torching stainless tanks created quantifiable industrial hygiene and RCRA concerns

with hexavalent chromium. Each tank-segmentation was evaluated to determine the best method.

Water Processing

To stay ahead of dismantlement stored wastewater from system drainage and decontamination must be processed and the installed liquid radwaste systems must be abandoned to allow their removal. The large quantities of poor quality water were processed with a reverse osmosis (RO) system to ensure minimal radioactivity and boron in the effluent for discharge. Better quality water from DI water decontamination and the spent fuel pool draining is processed with a portable demineralizer system.

By mid 2003 most all of the radioactive wastewater onsite should have been processed and released. The remaining processing tanks and components will then be removed.

The liquid concentrates from various past radwaste processes (including RO) were evaporated with a drum dryer system. This is a slow process so alternatives were investigated. In testing during 2002, the use of a VSEP (vibratory separation enhanced processing) system allowed greater than 50% volume reduction of the concentrates while producing permeate water that could be processed with the demineralizer system. The VSEP system was tested under an EPRI program and consists of a set of vibrating reverse osmosis membranes. The vibration allows high solids loading and the ability to handle the high silica levels discovered in Rancho Seco waste. The system was installed to process the concentrates tank, cutting drum-drying time in half, allowing the concentrates tank to be abandoned by September of 2002.

Rx Building Work

Reactor Building work began with removal of asbestos and mirror insulation in previous years. Removal of cabling, ventilation systems and dome spray systems was next. A high-pressure wash-down of the entire building was completed in 2001. With the hot spot removal program complete, the building is far more accessible from a radiological standpoint.

The Reactor Building air cooler housings have been segmented, packaged into seavans and sent for offsite processing or to direct disposal. Most all system components and piping outside of the steam generator shields have been removed and shipped for disposal.

Reactor Coolant Pumps

All main reactor coolant piping and the reactor coolant pumps were removed and shipped in 2002. Primary piping was cut with machine tooling into short sections that could be filled with other piping and placed into standard boxes. The four reactor coolant pumps were removed and packaged for shipment in two rail cars to Envirocare. Packaging included welded covers on piping connections and stuffing box, paint for contamination control, and heavy bags for final packaging. The pumps were blocked and braced in the rail cars with heavy cables and steel cradles.

Spent Fuel Building

Once the fuel was removed work began draining the spent fuel pool and removing the 11 racks. Each rack was vacuumed and moved to a shelf area of the pool above the water level. Here the racks were pressure washed and surveyed before being moved out of the pool for packaging. Each rack was wrapped in plastic then placed into specially designed metal shipping boxes.

Electrical Generator Move

The last major item in the turbine building, the electrical generator, was sold to Westinghouse and began its journey to be refurbished and resold. As one of the largest loads ever on California highways it was moved to the port of Stockton for shipment east via the Panama Canal.

Safety and ALARA

An active safety program has resulted in no lost-time accidents in 2002 and only 1 OSHA record able injury under the decommissioning program. The annual dose the site recorded was approximately 28 Man-Rem, which was less than the annual estimate of approximately 32 Man-Rem.

PLANNED WORK FOR 2003

Work planned for 2003 in the Auxiliary Building includes processing the remaining wastewater in a liquid radwaste tank, removal of the tanks and the removal of the ventilation ducting. Work may begin on embedded pipe and sump decontamination. In the Reactor Building, all remaining piping systems except major components will be removed. This will include the Core Flood Tanks and the Pressurizer Relief Tank. Work will also begin for removal of the pressurizer and the reactor head. Much of the structural steel and grating will also be removed.

Planning for Large Components

Prior to 2001 no significant planning on the major components had been done. Due to the scheduled time frame when it is expected that these components will be removed, 2003 to 2007, the ultimate destination is still somewhat unknown. It may be possible to send all of the components to Envirocare, with some sizing for transportation, but their recent pronouncement to delay or abandon their Class B and C waste license makes this option questionable. Barnwell may still be an option or other sites may open to Rancho Seco waste.

Within the next two years SMUD will have to decide on the ultimate disposition of the Reactor Vessel to allow final planning and work to begin on its removal. The only currently available disposal option is the Barnwell site. Shipping to Barnwell must be complete prior to its closure to out-of-compact waste in 2008. As 2008 approaches waste allocations will decrease so final disposal may be necessary by 2005 or 2006. Decisions will be made on vessel cutup (as described in the cost estimate) or the possibility of whole vessel shipment. Whole vessel shipment will require removal and storage of greater-than-Class C internals. A final waste characterization of the Vessel and Internals is in progress in order to ascertain waste

classification status for internal components and subsequent internals segmentation and removal plans.

Difficulties in shipping the entire Vessel via rail include physical size, weight and public perception. The vessel possibly could be transported via barge, however the Rancho Seco site is landlocked with the nearest navigable water over 30 miles away. In addition, the barge would be required to travel through the Panama Canal.

Based on the current NRC Notice of Proposed Rulemaking for Reactor Entombment SMUD may decide to stop dismantlement prior to removal of the large components, do a partial site release, and go to a plan of long-term SAFSTOR or entombment. This option would probably be the lowest cost option for the near term and would at least allow storage until other disposal options for the vessel appear.

It has been determined that the Rancho Seco steam generators can be shipped to Envirocare of Utah via rail transport. This would involve a southerly route in order to skirt the Sierra Nevada mountain range. It is not clear however, if the generators should be removed intact from the Reactor Building due to their size and building interferences. The removal of the intact steam generators as well as the possibility of wire-sawing the steam generators to allow easy removal and shipment to Envirocare is being investigated. The generators have been characterized as Waste Class A, with DOT subtype greater than Type A.

Reactor Head

The Reactor Head is expected to be removed this year. Currently control rod drives are being removed to be followed by the upper shroud. Then the head will be placed in the head-stand. Planning is in progress to determine the best packaging and shipping option. It may be necessary to cut the head to meet a package size for rail shipment to Envirocare.

Pressurizer

The Pressurizer will be removed in late 2003 or early 2004. It is expected to be shipped intact by rail to Envirocare. Some concrete may have to be removed from the reactor building to allow its movement.

Spent Fuel Building

Once the remaining fuel racks are removed the pool bottom will be vacuumed and the remaining water drained. The pool cooling and cleanup systems are being currently being removed. The liner will then be removed and the concrete walls cleaned or scabled as necessary.

Outside Tanks

Two large stainless-steel outdoor tanks (about 450,000 gallons, each) once used for reactor coolant are expected to be removed in 2003. The tanks will be cut into box-size pieces with a large shear, heavy-duty nibblers, machine tooling or plasma torches.

Underground Tank Farm

Three of the seven tanks remain that comprise the tank farm that is located twenty-three feet below grade level under an outside access road. It was first thought that the road over these tanks would be removed and the tanks would be lifted to grade level. However, based on past success with tank cleaning and subsequent cutup it was decided that tank segmentation and packaging into B-25 boxes would be the most efficient method for removal.

Class B and C Waste

SMUD has five High Integrity Containers (HICs) with resin that have been in storage since 1999. This resin is Class B and C. It was originally anticipated that Envirocare of Utah would obtain a license to accept and dispose of class B & C waste. Envirocare has determined that it will not seek Legislative or Gubernatorial approval for its Class B & C low-level radioactive waste proposal at this time so other options are being investigated.

The District has not disposed of any waste at the Barnwell Disposal Facility over its years of operation. At the present time SMUD management has decided that the liability of putting waste in the Barnwell site is not justified. Processing options are being reviewed for volume reduction in order to minimize the storage space necessary and to improve the stability while waiting for disposal. It is anticipated that the class B & C waste will go for volume reduction in 2003.

Mixed Waste

SMUD has an inventory of mixed waste, including HEPA filters containing RCRA levels of total chromium resulting from the segmentation of stainless steel tanks. In addition, a large amount of radioactively contaminated lead shot, blankets, sheets and bricks remain onsite. The District is reviewing options for lead disposition including cleaning for recycling, or encapsulation and disposal for that lead which cannot be reused.

CONCLUSION

The slow ramp-up of decommissioning activities from an incremental project to a full decommissioning has allowed time for innovation and trial and error in the process. The last year has finally brought success for fuel movement to dry storage. The dismantlement work has been accomplished under budget and ahead of schedule in a safe manner with low worker exposures. While the approval for full decommissioning required catching up in the planning process, much of that planning has been completed. The goal is to have three years of planning completed ahead of the ongoing work. A further goal is to determine the ultimate disposition of the major components that will allow the detailed planning to begin.

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