

RANCHO SECO – PLANNING FOR LARGE COMPONENTS

Dennis E. Gardiner, Decommissioning Project Manager, SMUD
John M. Newey, CHP, President, NewRad, Inc.
Michael W. Snyder, Superintendent Radwaste Operations, SMUD

ABSTRACT

The Rancho Seco Nuclear Generating Station ceased operation in June of 1989 and entered an extended period of Safestor to allow funds to accumulate for dismantlement. Incremental dismantlement was begun in 1997 of steam systems and based on the successful work to date, 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 the Auxiliary Building and should be completed by mid 2003.

The Spent Fuel is currently being moved to dry storage in an onsite ISFSI, with completion scheduled for late 2002. The personnel resources on site are currently assigned to support both the dry fuel project and the dismantlement of the facility. Once fuel movement is complete more resources will be provided for dismantlement.

Characterization of major components other than the vessel is complete and planning for their removal is in progress with various cut-up and/or shipping options being evaluated. Planning for the vessel and internals removal is being performed. The relatively slow pace of the work allows careful evaluation of cost-effective options as they become available in the industry.

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 is in progress with 8 of 21 canisters filled and placed in the ISFSI as of January 10, 2002. The current schedule calls for fuel transfer to be complete by late 2002.

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 has been successfully completed leading to approval of full dismantlement in July of 1999.

The plant staff is being reorganized to support a focus on decommissioning rather than the maintenance and operation of the station. The personnel resources on site are currently assigned to support both the dry fuel project and the decommissioning of the facility. With significant physical work going on for the first time in ten years, of paramount importance is a safety culture that encourages watching out for one another, and accountability for infractions.

Once fuel movement is complete the staff will be reorganized to focus on completion of dismantlement. With fuel in storage and off the reactor site many licensing requirements will be removed and many surveillances and procedures can be eliminated.

Over the last year significant progress has been made on removal of systems in the Auxiliary Building and the Reactor Building. Reactor Coolant Pump motors were removed and sized for the most cost-effective disposal. Most Hot Spots in both buildings have been removed. Removal of four highly contaminated tanks was completed this year.

Planning for Auxiliary Building work in 2002 includes disposition of remaining liquid waste and seven waste tanks, and removal of remaining systems, including the ventilation systems. Reactor Building dismantlement will include main RCS piping, Reactor Coolant Pumps and other miscellaneous piping. Disposal of primary ion exchange resin in six HICs is also planned for 2002.

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 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 takes about a week and a half to two weeks to complete. Through January 10, 2002 eight canisters have been loaded and moved to the ISFSI. The schedule has been hampered by the delivery rate from the fabricator. Current delivery schedules call for all canisters to be on-site by May of 2002 with spent fuel loading and storage completed by late 2002.

Dose rates on the loaded transfer cask have been 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 quick decontamination process 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. The biggest unknown affecting this schedule is the completion of fuel movement, which continues to produce many challenges.

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 2002 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	Dec. 2002
Reactor Building Preparation	Jan. 2000	Dec. 2000
Reactor Building System Removal	Jan. 2001	Dec. 2003
Remove RCP Motors	Mar. 2001	Dec. 2001
Move Spent Fuel to ISFSI	April 2001	Sept. 2002
Spent Fuel Pool Dismantlement	Sept. 2002	Dec. 2003
Remove Reactor Coolant Piping	Mar. 2002	Aug. 2002
Remove Reactor Coolant Pumps	May 2002	Dec. 2002
Remove Steam Generators and Pressurizer	May 2003	July 2004
Remove Outside Tanks	Feb. 2003	Oct. 2003
Remove Underground Piping	Jan. 2003	Dec. 2004
License Termination Plan Preparation	Jan. 2002	Oct. 2003
Reactor Vessel Internals Removal	Jan. 2005	July 2006
Reactor Vessel Cut-up	July 2006	May 2007
Building Decontamination	July 2003	Feb. 2008
Perform Final Survey	Oct. 2006	Oct. 2008

2000/2001 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 will be performed when determined to be cost effective.

High-density waste is packaged for disposal at Envirocare of Utah. In 2001, approximately 18,000 cubic feet of metal waste in B-25 boxes and Seavans, as well as DAW in compacted drums was shipped there. Most low-density waste is shipped to processors for volume reduction and disposal or for decontamination and free release. Approximately 11,000 cubic feet was shipped for processing in 2001. Plant components, which never came into contact with radioactive systems or which can be easily cleaned by grit-blasting, are considered candidates for onsite free release. In 2001, over 200,000 pounds of metal was free released.

Some class B/C waste (<100 cubic feet) was generated and is stored pending SMUD management approval for disposal at Barnwell or disposal at Envirocare pending pursuance of legislative and gubernatorial approval for their B & C License. Prior to 2002, Rancho Seco had 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. Early work on low-activity tanks was done by washing the material to a sump, but this only causes the problem to be revisited when the sump is cleaned.

The first tank to be cleaned was the Miscellaneous Waste Tank, which received sump waste and had a significant quantity of sludge. The sludge was washed to a bag filter system by use of 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.

A method was developed for the next tank, the Reactor Coolant Drain Tank, to flush the sludge to a High Integrity Container (HIC) that contained previously discharged resin. This allowed for low exposure handling and activity averaging over the resin waste such that there was no increase in waste volume.

Other tanks cleaned in a similar manner during 2001 included the Spent Resin Storage Tank, Letdown Filter Back-flush Collection Tank and Reactor Coolant Drain Tank all of which presented ALARA issues. The subsequent removal of these tanks was a significant obstacle. 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.

Hot Spot Removal

A program to remove hot spots in the Auxiliary Building was completed during 2001. Mostly valves, these hot spots caused many rooms to be radiation or high radiation areas. Prior to major work in these rooms the valves were removed making work much simpler and significantly reducing exposure. A similar program is nearing completion in the reactor building.

Removal of Decay Heat System

Components of the Decay Heat System were removed from the Auxiliary Building during 2001. The tube bundles from the two heat exchangers were actually pulled from the carbon steel housings and then segmented into box-sized pieces. The housings were flame cut and also boxed. System piping was segmented into box lengths and then nested with other diameter piping. Internal dose rates were much lower than originally expected. This can be attributed to the twelve plus years of decay Rancho Seco has experienced.

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 system to ensure minimal radioactivity and boron in the effluent for discharge. Better quality water from DI water decontamination (and the eventual spent fuel pool drainage) is processed with a portable demineralizer system.

The liquid concentrates from various past radwaste processes (including RO) are being evaporated with a drum dryer system. This is a slow process so alternatives are being investigated. In testing, the use of a VSEP 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 our waste. The system is currently being installed to process the concentrates tank. This should cut drum-drying time in half, allowing the concentrates tank to be abandoned by the end of 2002.

Rx Building Work

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

The Reactor Building air cooler housings are being segmented, packaged into seawans and sent for offsite processing and also to direct disposal. This project has generated over 300,000 pounds of waste metal thus far and will be completed during the first quarter of 2002.

The Reactor Building Fuel Assembly Upenders were removed and packaged in September of 2001. The packaging consisted of two large B-type boxes. Segmentation was kept to a minimum in order to reduce worker exposure as hot spot dose rates in the cavity were up to 100 rem/hr. The Upenders were pressure washed, dried and then had a fixative applied. When packaged, smearable contamination levels were less than 80,000 dpm/100cm² and dose rates did not exceed 100 mrem/hr.

Reactor Coolant Pump Motors

In early 2001, evaluations were performed to determine the most cost effective solution to dispose of SMUD's four RCP motors. Each motor weighed approximately 88,000 pounds over a volume of 870 ft³. Options for disposition included direct disposal, offsite processing or onsite processing. It was determined that the most cost effective option to pursue was that of onsite processing. After removal of the motors from the pumps the metal coverings were removed, followed by upper bearing housing, rotor, and then the stator, leaving only the lower bearing housing. The stators and rotors were packaged for direct disposal, the metal coverings were shipped to a processor for further volume reductions and the bearing housings were segmented

onsite and subsequently packaged into B-25 boxes for disposal. SMUD realized a savings of over 30% over offsite disposal or vendor processing of the entire motor and also eliminated onsite and offsite logistical challenges due to size and weight. This work was completed in December of 2001.

Safety and ALARA

An active safety program has resulted in no lost-time accidents in 2001 and only 4 OSHA recordable injuries. The annual dose site recorded was approximately 20 Man-Rem, which was much less than the annual estimate of approximately 46 Man-Rem. Actual dose-rates from the fuel cask were well below the estimated values and the dismantlement work was done for about half of the estimate.

PLANNED WORK FOR 2002

Work planned for 2002 in the Auxiliary Building includes processing remaining wastewater in the liquid radwaste tanks, removal of the seven remaining tanks and the removal of the ventilation ducting. Once the fuel move is completed, much of the Spent Fuel Building is to be removed during the latter part of 2002 and into 2003. In the Reactor Building, all remaining piping systems except major components will be removed. The four Reactor Coolant Pumps are scheduled for removal and disposal. In-core detectors will be removed and work may begin on the pressurizer.

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 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 (Richland or DOE sites).

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 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 is being planned for 2002 in order to ascertain waste classification status for internal components and subsequent internals segmentation and removal plans.

A study is currently in progress to determine if whole vessel shipment is a viable possibility. 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.

Underground Tank Farm

Seven tanks 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. A section of – 20 level Auxiliary Building wall has been removed to permit access to the tanks.

Containerized Waste

SMUD has six High Integrity Containers with resin that have been in storage since 1999. This resin is Class B. It was anticipated that Envirocare of Utah would obtain a license to accept and dispose of class B & C waste. During the past summer Envirocare determined that it would not seek Legislative or Gubernatorial approval for its Class B & C low-level radioactive waste proposal.

The District had not disposed of any waste at the Barnwell Disposal Facility over its years of operation. An evaluation was performed to determine feasibility of shipping these HICs to Barnwell. This was a major obstacle, as the District did not have any allocation space at Barnwell. It was determined that 850 ft³ of disposal space would be required for disposal of the HICs. Processing options are being reviewed for volume reduction in order to minimize the allocation necessary for disposal. It is anticipated that the class B & C waste will go for volume reduction and disposal in 2002.

The District is also working with Envirocare of Utah to obtain certified generator status, which will allow disposal of containerized Class A waste. The certification involves a review of Rancho Seco's radwaste characterization, packaging and transportation procedures. Program and procedure revisions are required to address allowable container void space, removal and verification of free liquid volume and radiological surveys of containers.

Mixed Waste

SMUD has an inventory of mixed waste including mercury, both debris and elemental, freon filters and HEPA filters containing RCRA levels of hexavalent chromium. 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. Requests for proposals have been prepared in order to secure mixed waste treatment and disposal during 2002.

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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