OMEGA WEST REACTOR PROGRAM MANAGEMENT & COMMUNICATION KEY TO SUCCESSFUL D&D

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ABSTRACT

This paper describes what differentiates the Omega West Reactor (OWR) Decommissioning and Decontamination (D&D) Project from other projects with similar scope and how the project was successfully completed ahead of schedule. With less than 26 months to scope, schedule, advertise, select a contractor and complete the actual D&D, Los Alamos National Laboratory (LANL) needed a new approach to form the foundation for the project’s success and ensure the project was completed on time and within the original contract value. This paper describes the three key elements of this new approach – including team building, strong project management and technical innovation.

Team building was identified early on as a key element for successful project completion. It was agreed upon that the DOE would become an integral part of the project team. This meant that the DOE client would be fully involved and aware on a daily basis of what was taking place at the OWR D&D site. Contractors were informed that this project was to be done as a team. The project would succeed as a team or would fail as a team. Laboratory personnel and contractor personnel worked side-by-side to identify and solve problems before they could impact work schedule. True teamwork saved the project significant time and costs.

The Laboratory issued a performance-based contract that allowed the contractor the flexibility to meet all contract requirements, while minimizing costs. The Laboratory selected WD3 (a joint venture of Framatome ANP Inc. and Washington Group Inc.) to perform the fixed-price, best value contract. While the Laboratory Project Manager is ultimately responsible for the project, he must also have confidence in the contractors. If that confidence exists, as it did on this project, the Laboratory Project Manager can manage the contract, not the contractor. This means that the Project Manager ensured that WD3 met or exceeded all contract requirements, while allowing WD3 the flexibility to meet the requirements in the most efficient way.

A creative and innovative approach to demolition of the building and the reactor itself resulted in saving at least two months on the schedule. The first step in this creative approach was to take down the building, leaving the reactor in place. Then a large tent was put in its place. This enabled the Team to use much heavier equipment that was capable of demolishing the reactor

much faster. The tent provided a secondary containment in which to perform the work more safely and avoid any adverse impact on the environment.

INTRODUCTION

LANL and WD3, a joint venture between Framatome ANP, Inc. and Washington Group Inc., teamed through a fixed price best value contract to perform the D&D of the OWR. The project was initiated in an effort to reduce the risk to LANL facilities identified in the aftermath of the Cerro Grande fires.

Between May 4 and June 10, 2000, a devastating wildfire swept across the Bandelier National Monument in the Jemez Mountains of northern New Mexico and onto the Department of Energy's (DOE's) LANL. The Cerro Grande fire burned about 43,000 acres, including 7,500 acres of LANL property. Large areas of vegetation in the Jemez Mountains surrounding LANL were destroyed. The DOE, LANL, other federal agencies, and the State of New Mexico initiated prompt actions to identify and mitigate the risks from the fire aftermath. Assessments conducted after the fire determined that serious environmental and safety problems associated with flash floods, erosion, and contaminant run-off would persist at LANL for a number of years. Since the OWR was located in a potential flash flood area it was decided to accelerate the D&D of the facility.

The Cerro Grande Rehabilitation Project (CGRP) was put in place to guide, direct and fund the restoration of LANL and the surrounding communities to their pre-fire state, in addition to helping the Lab and the community to reduce their vulnerabilities to future disasters. The Omega West Reactor D&D was one of many projects conducted under the overall umbrella of the CGRP. The CGRP is unique in that its scheduled completion must accommodate not only the technical challenges of the decommissioning of Manhattan Project era facilities but also a firm date as to the availability of funding. The nature of the project made it essential that both the Laboratory and the Contractor establish an effective project management team and close working relationship to ensure project success.

The development and maintenance of common expectations regarding safety, scope, schedule, and change control were critical factors in this process. The mutual recognition of the fluidity of the technical challenges and conditions, and the standards for success established a recipe for success from the project's inception.

The project was completed in early July 2003, approximately two months ahead of the original schedule. All buildings have been demolished. The reactor building was decontaminated, and all radioactive material was removed and transported to approved waste disposal sites. The high-density concrete reactor biological shield was demolished in 27 days (33 days ahead of schedule). The overall project was completed within the approved budget. There were no significant radiological or safety violations.

The building, reactor, all associated piping and utilities, the concrete slab and all asphalt surrounding the building were removed and disposed at an approved offsite location. Safe work hours for the project were 72,723; this was for a combined work force in excess of 70 individuals working for 10 different firms.

The following factors played a key role in the success of the overall project:

- Performance Based "Best Value Contracting Strategy;"
- Team Work from the Project Team and Stakeholders;
- Project/Contract Management;
- Technical and Operational Innovations; and
- Project Timeline: 24 months from conception to completion

ENVIRONMENTAL ASSESSMENT AT OMEGA WEST REACTOR

Beginning in September 2001, LANL initiated an aggressive campaign in conjunction with the client, the U.S. National Nuclear Security Administration (NNSA), to facilitate the Environmental Assessment (EA) needed for the D&D of the Omega West Reactor at LANL. This accelerated schedule was driven by widely changing funding variables and the fact that the program tasked with managing this particular project was mandated by the U. S. Congress to be completed no later than September 30, 2003.

Daily coordination between LANL, and the EA contractor enabled the project to move from initial planning to signed document in only seven months. Concurrent with EA preparation LANL D&D staff prepared supporting documentation, while planning and compiling the bid package to support the award of the D&D contract. Given the volume of information required, ranging from ecological impact to historical reviews and public input, this was an incredibly rapid time frame to successfully complete an EA on a former Category II nuclear facility.

The successful partnership between project management and the client set the foundation for safe removal of the OWR and its associated structures in less than 15 months.

DESCRIPTION OF THE REACTOR AND PROJECT OVERVIEW

Building Description and History

The Omega West Reactor was located in Technical Area 2 (TA-2) at LANL. Building 1 was the main reactor building at TA-2. Building 1 was constructed in 1943 and housed five separate nuclear reactors between 1944 and 1995. The first reactor was a water boiler type and used enriched uranium (U-235) as a fuel source. The final version of these water reactors was completely shutdown in 1974, and the last of the early reactors was dismantled in 1989. The fifth and final reactor used at this facility was the OWR.

Fig. 1

Building 1 was approximately 21,300 sq ft and, in most areas two stories tall with some three-story areas as well. In addition to the OWR, the building itself contains offices, experimental areas where the reactors were located, and a variety of laboratories. Building 1 was constructed of wood, cinder block, glass, and concrete with asbestos roofing material and siding. A brick stack, used in association with the boiler room, and a small sub-basement completed the general construction of the building.

The OWR initially went critical in 1956. In 1992, an OWR safety mechanism triggered a reactor scram due to high power. An investigation showed that the scram was due to a leak in the cooling system. The OWR was shutdown and never again operated. In 1994, the fuel and all control blades were removed and shipped off site to place the reactor in a safe shutdown mode. During de-fueling operations, the fuel elements were inspected and found to be undamaged. The reactor was then drained of all coolant and the site was placed into long term storage.
Contaminates within Building 1 included lead (dust, paints, shielding), beryllium, asbestos, U-235, Cs-137, plutonium, cobalt 60 in Beryllium reflector assembly, various activation products, bismuth, mercury, PCBs, and the possibility of uranyl nitrate and other chemicals.

OMEGA WEST REACTOR DESCRIPTION

GENERAL

The OWR was a thermal, heterogeneous, closed tank-type test and research reactor that was light water moderated and cooled. The OWR used an assembly of Material Testing Reactor (MTR) type fuel elements, which were supported inside a stainless steel vessel. The core assembly consisted of an aluminum pedestal and grid assembly.

REACTOR CORE

The reactor core was comprised of a rectangular array of four rows (numbered 2 through 5) by nine columns (designated A through I) supported vertically in an aluminum grid plate. The reactor was controlled by eight borated (1.2 wt% natural boron) stainless steel control blades, which moved in the slots between the fuel elements. Row 1 was comprised of a lead gamma-ray shield on the east side of the reactor. Row 6 was comprised of a beryllium reflector on the west side of the reactor. The north and south faces of the reactor were water reflected.

Normal operations were conducted at a steady state power of 8 MW utilizing either 31 or 33 fuel elements allowing for up to five in-core sample positions. The beryllium reflector was comprised of 21 beryllium blocks (4 x 4 x 8 in). A 5.7-cm thick lead plate and a 12.7-cm thick bismuth shield were located on the opposite side of the core and allowed for experiments with a minimum of gamma-ray or fast-neutron interference. The gamma rays and fast neutrons were conducted in a "thermal column" that was made up of stacked graphite within a shield.

FUEL ELEMENTS

Note: Fuel elements were removed in 1994

MTR (Materials Testing Reactor)-type fuel elements were utilized in the OWR core. Each element was comprised of 18 or 19 aluminum-clad, curved fuel plates that were 60 mils thick, and mounted 117 mils apart in heavy aluminum side plates. Each fuel plate consisted of a sheet of uranium-aluminum alloy sandwiched and hot-rolled between two 20-mil thick sheets of pure aluminum. The U235 section (active portion) of the element was 24 in. long, with the overall length of each element being 43 in. Each element contained various loadings of U235, up to 232 grams.

REACTOR TANK

The reactor vessel was a cylindrical tank 8-ft diameter tank, approximately 24-ft high; with 1/4-in. walls and a 3/8-in. bottom plate. The tank was constructed with 304 stainless steel. The cooling water outlet line penetrated the tank bottom, with the core base casting resting over the outlet. A circumferential rack around the inside of the tank wall provided storage space for up to 53 fuel elements, experiment holders, and sample holders. A 14 x 17 x 96-in. deep storage well welded to and extending below the bottom of the tank provided storage space for 32 elements loaded in two boron-stainless baskets.

BIOSHIELD

A biological shield constructed of high-density concrete in an irregular octagonal shape surrounded the tank and thermal column. The high-density concrete was comprised of steel hockey puck size aggregate and 4000 psi concrete. The irregular octagonal shape was chosen to maximize the number of experiment ports available for research. The design allowed for irradiation from nine 6-inch beam ports; five in-core sample positions, 16 pneumatic or hydraulic rabbit ports; and 15 thermal column ports.

Fig. 2

From the floor level to a height of 11-ft, the bioshield has a minimum thickness of 5-ft and a specific gravity of about 4.5. Above the 11-ft mark, the shield has a minimum thickness of 3-ft and a specific gravity of about 3.5.

OMEGA WEST REACTOR PROJECT OVERVIEW

PERFORMANCE BASED "BEST VALUE CONTRACTING STRATEGY"

The winning contractor was selected based on providing best value to the Laboratory and the NNSA. The Laboratory Source Selection Team (six individuals from LANL and NNSA) reviewed each contractor's proposed approach in detail. The findings were discussed to confirm that all involved parties thoroughly understood the contractor's proposed approach. The Team then selected the winning contractor based upon a best value assessment. The Team selected WD3, a joint venture between Framatome ANP Inc. and Washington Group Inc. as the winning contractor proposal.

TEAM WORK FROM THE PROJECT TEAM AND STAKEHOLDERS

Team building was identified from the beginning of the project as an absolute necessity for success. The NNSA client agreed to become an integral part of the Team, meaning NNSA would be very much involved and fully aware of daily activities. Other groups within the Laboratory became a supportive part of the Team. WD3 embraced the team approach throughout the project. Laboratory and contract personnel worked side-by-side to identify and solve problems before they could impact the work schedule. With all personnel speaking in "one voice," it clearly saved the project a significant amount of time and expense.

Throughout, the Project Manager remained very cognizant of core responsibilities and strived to keep the entire project team, the client, all stakeholders and the public completely informed as to the status and progress of the project. The project management team embraced a common understanding of the project status and direction. To ensure this common understanding was established, an integrated project management team was put in place. The integrated team included representatives from the Laboratory, the contractor, and NNSA. The integrated team approach ensured frequent, comprehensive communications and resolution of any issues, as well as development of a common view of the project goals, status and direction. Keeping the team small, with individuals performing multiple tasks, ultimately improved efficiency and overall effectiveness.

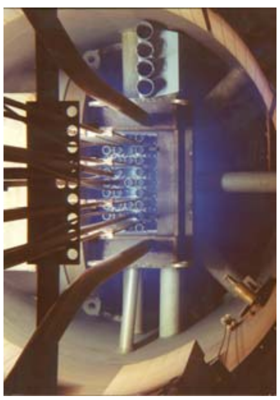

Fig. 3

PROJECT / CONTRACT MANAGEMENT

LANL issued a performance-based contract to WD3 that allowed the contractor the flexibility to meet all contract requirements, while minimizing costs. While the Laboratory Project Manager is ultimately responsible for the project, he must also have confidence in the contractor. If that confidence exists, as it did on this project, the Laboratory Project Manager can manage the contract, not the contractor. Meaning, the Project Manager ensured that WD3's performance met or exceeded all contract requirements, while allowing WD3 the flexibility to meet the requirements in the most efficient way.

The Laboratory required the contractor to have a rigorous safety program with daily oversight by LANL ES&H professionals. There were no significant safety incidents during the life of the contract.

The Project Management team also required the contractor to maintain weekly updates to the project schedule to clearly communicate the project's progress, problems and future plans to all concerned stakeholders. Weekly status meetings were conducted on site conducted by the contractor Project Manager. Project metrics were reviewed each week and key issues were discussed and a team approach to resolution identified. These meeting proved to be invaluable in maintaining complete and open communications between all team members.

TECHNICAL AND OPERATIONAL CHALLENGES AND INNOVATIONS

The original plan for the reactor D&D required overcoming two distinct challenges, the first being the funding expiration date of September 30, 2003. This required evaluating options to speed the removal of the massive high-density bio shield. Normal methods in such a confined room (50feet X 40 feet) would be to use a small, remote operated machine with a 1000 ft-lb. Hammer in conjunction with diamond wire sawing and conventional torches required to remove rebar and steel core barrel. Previous experience and physical calculations indicated the need for 76 total workdays with this method (including external steel mezzanines) or approximately 3 ½ months of critical path. Removal of one wall and extension of the work area to allow larger machinery to remove the bio-shield was considered but rejected due to restricted overhead clearance and a remaining lack of floor mobility.

The actual method selected was to seal the dry reactor, dismantle the reactor building on three sides and build an 80 X 50 sprung structure with the fourth side remaining as a shield wall to attach the tent structure. HEPA ventilation was installed to allow five air changes per hour and an excavator (CAT 245) with a 10,000 ft-lb MPK hammer used to dismantle the bio-shield. The use of this large hammer, with chisel point, enabled the entire bio-shield, core barrel, rebar, steel decks, et al to be removed, size reduced and packaged as waste in 21 days, which included four days of unexpected down time during hammer repairs. The net effect was a reduction of schedule by approximately 2 ½ months. In actuality, the core could have been removed even faster had the method of moving, packaging and surveying the waste boxes been faster, since the excavator averaged less than four hours per day, waiting on waste removal.

The second challenge related to the method of core component removal. The reactor was shutdown because of a coolant leak in the supply or return lines, below the concrete reactor foundation, which precluded filling the core with water to safely remove components for shielding from the top. This led to a unique design for personnel protection while size reducing and component removal. A moveable shield was built in two pieces to replace the core lid. This shield allowed additional steel plates to be added for personnel protection and was closed when work for the day ceased. Additionally, a 4-foot vertical plate was attached to one side to allow worker protection from scatter.

HEPA ventilation was designed and installed to support all evolutions in the tent and specifically the core itself. One of the 15,000 cfm, (cubic foot per minute) units was attached to the 30 inch cooling water return line and provided a significant downdraft through the core, protecting workers, especially through plasma cutting operations.

During core component removal (after all test devices and bioshield were removed from the test ports), a unique phenomenon occurred. Each time a highly irradiated component was removed, reducing the total curie content of the core, the general core area radiation levels increased! There was a six-foot diameter stainless steel ring, five inches deep and six inches thick, encasing a five-inch deep bismuth shield. This stainless steel ring read 200 R/hr on contact and the bismuth surface was only 50 R/hr. However, when it finally became available in the removal sequence, the bismuth shield was pulled free and it was discovered to have a one-inch steel ring that had been shielded by the stainless ring. The one-inch steel ring read over 500 R/hr, causing the general area dose rates to increase. Extended ALARA planning and segmentation of the ring was required in the successful removal finally reducing the remaining bioshield.

By selecting pre-qualified subcontractors with reactor dismantlement experience and prior LANL abatement and demolition experience, WD3 was able to mobilize, develop, and get procedures approved in short order. By having LANL, DOE, and WD3 as "team members," specific detailed procedures and ALARA reviews were done at team meetings, corrections and additions were usually made on the spot, approval signatures obtained, and in some cases, work crew pre-job briefings on the procedure conducted in the same day. Administrative delays were virtually non-existent as each group was well aware of expectations and aggressive schedule.

The total dose for the project was 39.95 rem.
The total radioactive waste volume shipped was 47,084 ft3.
The total curies removed was 1.31 E04 Ci.

PROJECT SUCCESS

Communication, responsibility and teamwork equal success!

During the initial planning stages of the project, the project management team decided that the project would have to be managed differently if the project goals and schedule were to be met. Key to success included the following:

- First, it was agreed that the client would serve as an integral part of the project team, meaning the client would attend most of the team meetings, and be fully aware of the project status, approach, major decisions and future plans.

- Secondly, all contractors were informed that this project was going to be managed as integrated team; there would be no "Lone Rangers." All project participants would succeed or fail as a team. It was further agreed that the Laboratory's project management staff would work very closely with both the NNSA and the contractor staffs to solve problems together. There would be no letter writing or finger pointing campaigns. When a problem needed to be solved the appropriate individuals from each of the organizations would meet, evaluate possible solutions, decide on a solution and then go back to work to implement the agreed upon solution. The process that evolved from this approach allowed the team to solve most problems in 1 to 8 hours, depending on the complexity of the problem. On other projects solving problems of a similar magnitude typically takes from 1 to 4 weeks, if not much longer.

The focus on teamwork and problem solving was a major factor in the demolition phase of the project being completed in 13 months, in comparison to similar projects that have been underway for more than 3 years and are expected to take an additional 4 to 5 years to complete.

On the Omega West Reactor D&D Project, effective project management was the clear key to project success. By identifying, documenting and championing sound project management approaches, the Project Manager facilitated an improved methodology for completing the work at hand. Tasked with making important decisions and actions associated with the project, the Project Manager demonstrated fair and knowledgeable leadership skills. Throughout the project, there was an understanding that mistakes would occasionally be made and a team approach was needed to help find the right answers. The team was also cognizant that flexibility was a key to project success; on occasion it was necessary to modify actions or change earlier decisions. Ultimately, through consistently applied project management standards, the Project Manager managed the contract, **NOT the contractor**.

Fig. 4

GLOSSARY OF TERMS

OWR: Omega West Reactor
LANL: Los Alamos National Laboratory
D&D: Decontamination and decommissioning
WD3: Joint venture between Framatome ANP Inc. and the Washington Group Inc.
Cerro Grande fire: Large wildfire that burned 47,000 acres of land in northern New Mexico in May and June of 2000
CGRP: Cerro Grande Rehabilitation Project
NNSA: National Nuclear Security Administration
EA: Environmental Assessment