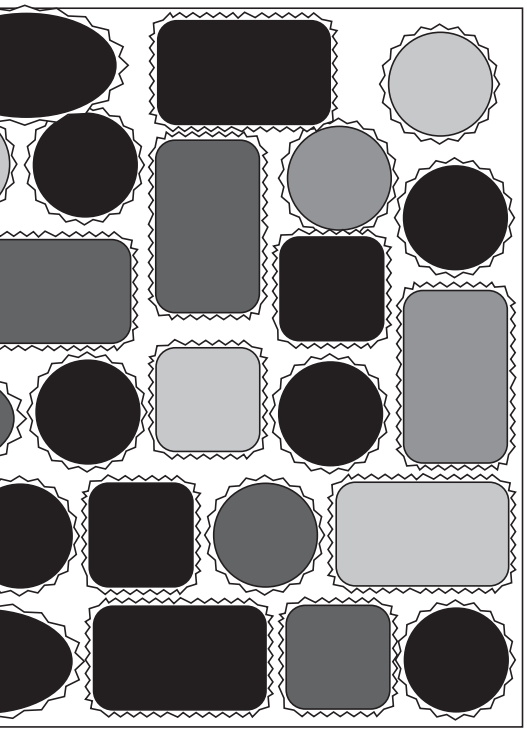

Like a Box of Chocolates?

At the Hanford Burial Grounds, You Never Know What You're Gonna Get

At Hanford, cleanup workers must be prepared to handle safely any material encountered without always knowing what they're going to find.

By Laurie Campbell and Ken Powers

To quote a line from the movie *Forrest Gump,* "Life is like a box of chocolates . . . you never know what you're gonna get." The same could be said of the burial grounds and waste sites on the Hanford Site in Washington State. Richland-based Federal Engineers & Constructors (FE&C) holds two subcontracts for related scopes of work with Bechtel Hanford to excavate and remove waste materials in the 100 B/C Area: one subcontract for the 100 B/C Reactor waste burial grounds and for the remaining waste sites—i.e., coal and burn pits, debris piles, a caisson site, and an electrical laydown area—and another subcontract for the B/C remaining pipelines and sewers (RPAS), as well as any remaining auxiliary structures related to the B and C Reactors. Bechtel realizes that working together harmoniously with subcontractors is essential to completing projects successfully.

Remediation of the 100 B/C burial grounds began February 18, 2004, headed up by FE&C Project Manager Ned

Craft workers start every morning with a Plan of the Day meeting.

Cleaning polychlorinated biphenyl–contaminated soil and poles.

Hutchins. FE&C's work is to excavate and repackage the waste. After excavation the crew will utilize better containers than the old ones for packaging wastes. The increased contamination cans have a plastic liner and are fitted with a moisture absorbing "sock" (a long, cloth cylinder put in place to absorb any free liquid). Rubber seals allow the container gate to be torqued for a tight seal. FE&C will clean up decades of accumulations of radiological and chemical wastes in the 100 B/C Area in less than three years from start to finish. (They are not involved with transportation and disposal.)

The RPAS Project began in September 2004, and the readiness assessment was performed November 9, 2004. The bulk of the job hazards are radiological and chemical wastes created by the production processes used. FE&C Project Manager Jim Mortimer says, "The analogy of a box of chocolates is right—we know it is possible to find unexpected material." Like the 100 B/C Burial Grounds Project, this project is scheduled to be completed by October 31, 2006.

The early Hanford workers should all be commended for the cutting-edge technologies that led the world into the burgeoning nuclear industry—setting standards for everyone else to follow.

What Boldly Went Before

To understand what was left behind, one must understand what work was under way at the height of production. B Reactor—the world's first large-scale plutonium production reactor, which rests on the south bank of the Columbia River at the northern tip of the Hanford Site—was completed in September 1944. Its size was such that it could be operated at 250 000 kilowatts—250 times more capacity than B Reactor's cousin, the X-10 Graphite Reactor at Oak Ridge in Tennessee.

The reactor was surrounded by support facilities such as a river pump house with huge pumps for delivering water for cooling purposes, settling basins, and a filtration plant. Whereas most of the auxiliary structures adjacent to the old Hanford reactors have already been demolished, there remains the buried piping and waste, which is being excavated as part of the Environmental Restoration Project managed by Bechtel.

In the 1940s, plutonium production was a brand new industry. B Reactor produced the plutonium for the Trinity device and the Nagasaki weapon, also known as "Fat Man," as part of the Manhattan Project. In support of the war effort, time was critical and project personnel constantly worked against the clock. Because of security and the protection of classified material, the crews were given enough information to perform their work and nothing more—everything they did was secret.

A "mountain" of contaminated buried reactor hardware and soil.

Where Is It and What's in It

There is considerable knowledge of the material in some of the sites; however, the complete content of other sites is not known. Bechtel did an excellent job conducting site characterizations to determine the contents at each location. They followed a precise and intricate pattern of potholing to extricate matter that was sampled to help determine contents of the burial grounds. Due to the very nature of the process, it is impossible to identify everything—especially when dealing with undocumented constituents in the burial grounds. The contents of "Pothole A" and "Pothole B" can be determined, but what lies buried in between could be something entirely different.

The site characterization process, as well as historical information, field investigations, and experience from other remedial action sites, allows Bechtel to include a description in the subcontract of "where is it" and "what's in it" for each of the 10 burial ground sites and eight remaining waste sites—some listed as high-activity, others as low-level.

Known Hazardous Materials at the Hanford Burial Grounds (Others May Also Be Encountered)

Hazards may appear in different forms from site to site—not necessarily detectable by sight or smell.

- ***elemental mercury***
- ***lead***
- ***barium***
- ***polychlorinated biphenyls (PCBs)***
- ***cadmium***
- ***lithium-aluminum alloy***
- ***aluminum cladding***
- ***palladium***
- ***cobalt***
- ***strontium***
- ***asbestos***
- ***tritium—both as a solid and as a high-activity liquid***
- ***process soils***

Reactor thimble found on the ground.

Bechtel also used ground-penetrating radar to determine the vicinity of the burial grounds. Although exact locations of two of the burial ground sites remain unknown, FE&C will perform additional exploratory "potholing" to discover the precise locations based on what has already been identified. They will then be able to proceed with remedial activities.

Among the long list of known hazardous wastes are elemental mercury, palladium, cobalt, strontium, and tritium. Also listed are process soils—those that come in contact with buried waste—which are certainly not the least of the items on the list. Each waste substance must be dispositioned in its own particular way, with some wastes requiring segregation and/or encapsulation. (See accompanying table for a comprehensive listing of known hazardous materials.)

In addition, some sites contain outwardly innocuous waste, such as green, clear, and bright blue glass; rusted paint cans; assorted scrap metal and auto parts; metal boxes as large as 10 feet long by 4 ft wide; railroad ties; and chunks of concrete and structural steel, as well as other miscellaneous construction/demolition debris. Much of these materials must be size reduced, which means cutting these waste products—for example, corrugated culvert piping—into smaller pieces to fit into containers prior to approval for shipment to the Environmental Restoration Disposal Facility.

Entering the Unknown

Loadout of contaminated soil.

But the listing in the subcontract is only as good as the characterization sampling and the record keeping for the time frame of 1943 through 1968—the length of B Reactor's production run. There are also undocumented constituents listed in the subcontract as "unknown media and waste forms," which might include radionuclide and other hazardous materials encountered in the bits and pieces being excavated and removed. Personnel can expect to come across drums filled with reactor hardware and unknown liquids that include solvents—but which one? Or containerized solids—but what are they? Or something categorized as uncontainerized unknown media—it's a mystery! And there is always the possibility of discovering discolored process soil—discolored by coming into contact with one of these unknown wastes. These soils should be considered seriously, because they may exceed cleanup standards for radionuclides. During remedial activities on the RPAS Project, employees may come upon undocumented pipelines, debris, and even structures, all of which becomes part of the excavation and removal job process. FE&C workers must be prepared to safely handle any material encountered without always knowing what they're going to find.

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118 B/C Burial Ground gas cylinders.

Now, back to that proverbial box of chocolates. Not only are there myriad diversified wastes involved, each burial ground is a world in itself. Some consist of concrete pipes measuring 18 ft long by 6 ft in diameter that were buried vertically, filled with waste material, and capped. Others are pits or vaults made from metal tanks or something as seemingly simple as a debris pile.

All these different materials and site configurations require different levels of personal protective equipment (PPE)—D, C, or B protection, mask or no mask, and so on. FE&C's work planning and processes must prepare for limitations intrinsic to a radiological/chemical setting. Results of early

Excavation of B/C Reactors' twin box sewer.

excavation and sampling activities determine the necessary level of PPE in accordance with Occupational Safety and Health Administration regulations. In anticipation of encountering toxic metals, lead bricks, asbestos, or drums containing liquids, the proactive approach taken by FE&C is to assume the worst possible scenario until proven "less than." While each site is discovered, the FE&C workers institute numerous personal protective procedures to safely complete the project scope of work.

During the active production days of B and C Reactors, the crews were working fast. Although there was strict accountability for intact and damaged fuel elements, some slipped through the system and made their way into the burial grounds. On the 100 B/C Burial Grounds Project, FE&C workers have encountered objects in two burial grounds with high exposure rates (100 Roentgens per hour), which were later confirmed to be pieces of nuclear fuel.

It's not to say the nuclear pioneers were careless—they simply didn't know the consequences of their work. It wasn't until the 1980s that the environmental impacts of unlined burial grounds and waste sites came to light. The early Hanford workers should all be commended for the cutting-edge technologies that led the world into the burgeoning nuclear industry—setting standards for everyone else to follow.

Safety Is Job 1

FE&C has never had a lost workday incident. To quote DeVerne Dunnum, FE&C vice president–Projects, "Our workers have an excellent reputation for putting safety first—not just talking about it, but actually walking the talk. It shows in everything they do."

Nuclear Legacy . . . Solutions for the Future

Today's crews are living and working with the legacy of early production work methods. They are carving out new solutions to the old ways armed with the knowledge of the past 60-plus years of experience. Earle Marvin, FE&C contracts manager, says of these jobs, "Just like Lewis and Clark, we're delving into the unknown—we have to press on." Together, Bechtel and FE&C are inaugurating positive measures to solve our nuclear legacy as they embrace the environmental cleanup activities of the 21st century. ■

"Just like Lewis and Clark, we're delving into the unknown—we have to press on." —Earle Marvin, FE&C contracts manager

Laurie Campbell is assistant to Ken Powers, nuclear strategist for FE&C.