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Safety At Fluor Hanford (A) Case Study

Prepared by Thunderbird School of Global Management

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Project Hanford Management Contractor for the
U.S. Department of Energy under Contract DE-AC06-96RL13200

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Prepared by Thunderbird School of Global Management

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SAFETY AT FLUOR HANFORD (A)

It was clear from the first day we arrived on site that the safety system was broken.
Fluor Hanford Staff Member

By November of 1997, Fluor Hanford (Fluor) had been the site manager of the Hanford nuclear reservation for a year. The Hanford site had been established as part of the Manhattan Project in the 1940s that gave birth to the atomic bomb. Hanford produced two thirds of U.S. plutonium during the Cold War period. The Hanford site was half the size of Rhode Island and occupied 586 square miles in southeastern Washington State. The production of plutonium for more than 40 years left a huge legacy of chemical and radiological contamination: 80 square miles of contaminated groundwater; 2,300 tons of spent nuclear fuel stored in underwater basins; 20 tons of plutonium-laced contaminated materials; and 500 contaminated facilities. The cleanup involved a challenging combination of radioactive material handling within an infrastructure constructed in the 1940s and 1950s. The cleanup that began in 1988 was expected to take 30 years or more.

Improving safety at Hanford had already proven to be a significant challenge. As the new site manager at Hanford, Fluor Hanford inherited lower- and mid-level managers and thousands of unionized employees, many of whom were second or third generation Hanford employees. These employees had seen many contractors come and go over the years. Some of the managers who had worked with the previous contractor saw Fluor's emphasis on safety as getting in the way of operations. Union-management relations were fractious. Hanford's culture was described as "production driven—management told everyone what to do, and, if you didn't do it, there were consequences." Worker involvement in designing and implementing safety programs was negligible. Fluor Hanford also was having trouble satisfying its client, the Department of Energy (DOE). The DOE did not see a clear path forward for performance improvements at Hanford. Clearly, major change was necessary, but how and where should it be implemented?

Fluor Corporation

Fluor's roots extended back to the turn of the 20th century when a family of Swiss immigrants set up a construction business in the western United States. Over the decades, Fluor expanded its expertise across industries and around the world. Fluor was among the world's largest engineering, construction, maintenance, and diversified services companies. Fluor provided design, engineering, procurement, construction, maintenance, and other diversified services to clients in a broad range of industrial and geographic markets on a worldwide basis. In 1996, Fluor had $11 billion in total revenue, net income of $268 million, and more than 50,000 employees worldwide.

Safety is the first word in Fluor's business values statement—Safety, Integrity, Teamwork and Excellence (SITE)—and a core component in its approach to doing business. The company began every meeting around the world with a safety topic. As one employee put it, "Safety is in our DNA." Every proposal that Fluor made for new contracts incorporated a strong safety element around the notion that "We are going to make your site safer, and we will protect the workforce." Fluor viewed safety as good business because safe operations saved money and contributed to higher quality output.

Fluor had been awarded the Hanford contract partly on the basis of its safety accomplishments and its implicit promise that "we will improve Hanford safety." Within Fluor Hanford, the special-purpose entity established to execute the contract, there was acknowledgment that "the Hanford safety system is broken." The data were clear: Hanford's safety record was one of the worst in the DOE complex, and was much worse than Fluor's other sites. Too many people were getting injured.

The Hanford Nuclear Site

The Hanford Engineer Works (HEW) began in January 1943. HEW was designed and developed to produce plutonium, the man-made element used in nuclear weapons. Beginning with three nuclear reactors and a series of chemical-processing plants, the complex had grown and evolved over time. The first reactor, B reactor, was completed in September 1944, and was the first full-scale atomic reactor ever constructed. It was followed by the D reactor, completed in December 1944, and the F reactor in February 1945.[1]

> *During World War II, three reactors (called piles) were built along the Columbia River at HEW. Strung along sixteen miles of the waterway's west bank, reactors B, D, and F composed the "100 Areas" at Hanford. Each reactor core consisted of a cube of graphite bars bored to receive approximately two thousand narrow, aluminum-clad, uranium fuel rods (slugs). Concrete and steel walls many feet thick surrounded the core as radiation shields. River pump houses, each containing facilities large enough to supply water to a city of four thousand people, provided cooling water to the reactors... At the rear of each reactor sat large retention basins designed to hold effluent (cooling water exiting the piles) long enough for the short-lived radionuclides to "decay," or stabilize.*
>
> *After the uranium fuel slugs were irradiated, they were "pushed" out the rear of the HEW reactors and dropped into thickly shielded casks filled with twenty feet of water. Here and at special "cooling" areas about five miles away, the rods sat while their radioactivity partially decayed. After a variable cooling period, the irradiated slugs were transported by rail to Hanford's "200 Areas," two chemical separations complexes located near the center of the vast reservation. The huge separations buildings, officially termed cell buildings but dubbed canyons or Queen Marys by Hanford workers, were eight hundred feet long, sixty-five feet wide, and eighty feet high. Each contained a row of forty thickly shielded concrete cells. Each separation area, 200 East and 200 West, also contained plutonium bulk reduction or concentration buildings, as well as a network of underground tanks (tank farms) and test wells for the storage and monitoring of high-level atomic wastes. Sixty-four such tanks were built during World War II. Less concentrated liquid wastes were at first poured directly on low spots on the ground, and later entered the ground through open-bottomed structures called cribs. At 200 West, one plutonium finishing building refined the final HEW product, a wet plutonium nitrate paste, for shipment to Los Alamos.*

The Hanford complex in the mid-1990s (see Exhibit 1) included a series of "hundred areas": the 100 Areas (nuclear reactors positioned along the Columbia River); the 200 Areas (chemical-processing and storage areas for high-level radioactive waste); the 300 Area (nuclear fuel processing and research and development facilities); and the 400 Area (built in the 1970s to house the Fast Flux Test Facility, designed to test nuclear materials and fuel).

The problem from the beginning, both in construction and operation, was the need for haste and the need for size. The United States was at war, and it was hoped that the creation of an atomic bomb could shorten the war. Massive scale was also needed: a reactor the size of B might produce less than a thimble-full of plutonium in a 24-hour period.

Hanford's role and purpose evolved over time. During the early construction and operation years of World War II, Hanford was essentially invisible and impenetrable. Operating under heavy secrecy, little was known about the activities under way at Hanford by either the outside world or its own workers during the 1944 to 1945 period.[2] Within weeks of the bombing of Nagasaki, the U.S. government released a brief statement describing Hanford's role as the producer of the bomb material.

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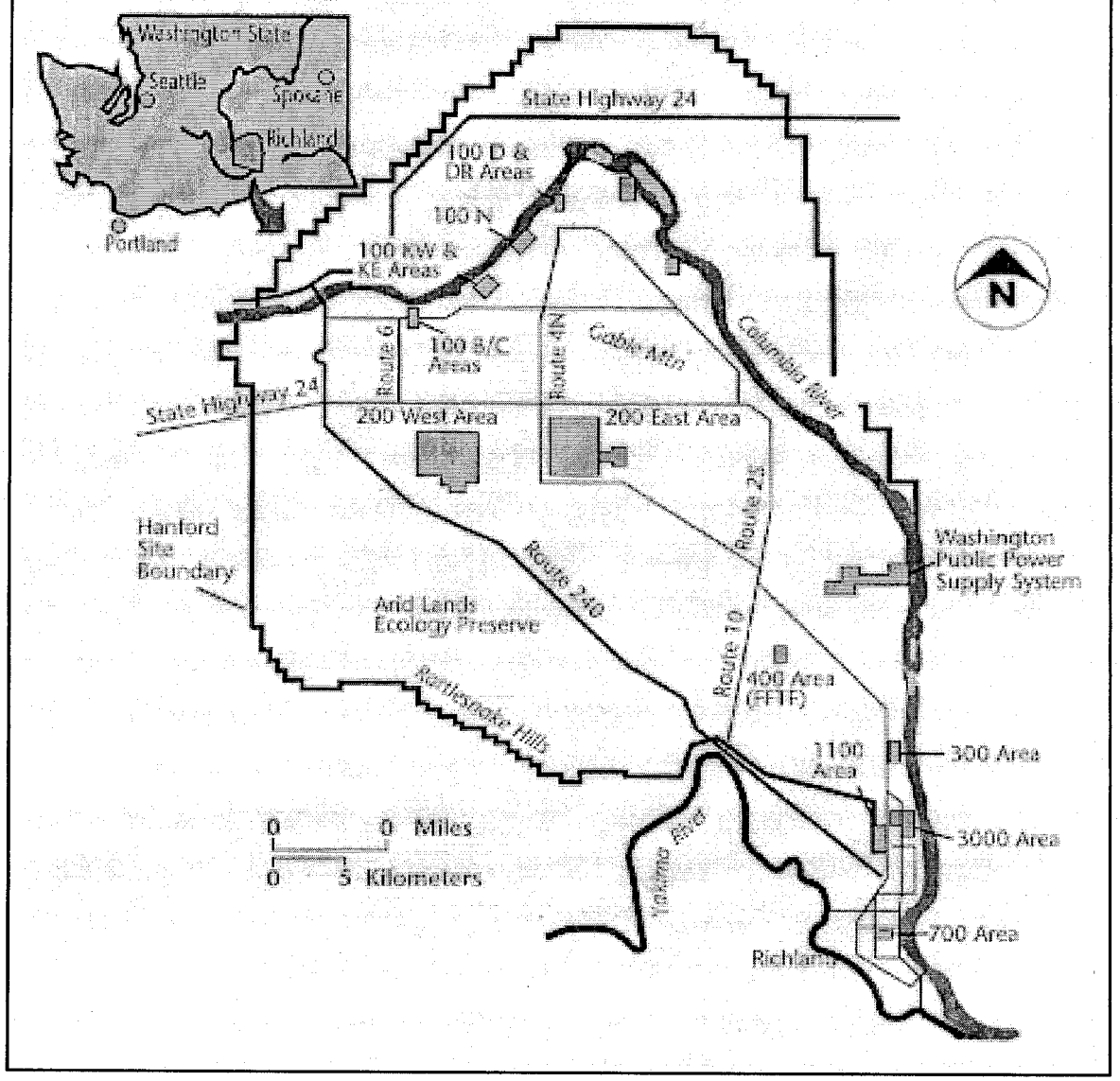
[1] This section quotes directly from *On the Home Front*, Third Edition, by Michele Stenehjem Gerber, University of Nebraska Press, 1997, pp. 33-34.

[2] In one of the more engaging video clips of the war era, a worker relates the story of a colleague's son who said: "I know what they do at Hanford, they make toilet tissue. My dad brings home two rolls in his lunch box every day."

Exhibit 1. The Hanford Site



The following years saw Hanford go through a series of three separate building and expansion booms during the Korean War and Cold War. Although there was growing knowledge and some public disclosure of activity at Hanford, the focus of the project continued to be production of weapons-grade material for national security, with its requisite secrecy. By 1956, there were eight operational nuclear reactors and five separation facilities. In 1963, the N reactor was brought online, completing the buildup of reactor capabilities. The N reactor manufactured plutonium and also provided electrical power to the regional power grid.

The Shutdown

The end of the Cold War coincided with increasing concern for the potential environmental legacy of Hanford's 40 years of atomic research and production. In 1986, the DOE released 19,000 pages of documents detailing the potential environmental damage and continuing threats associated with Hanford. Two years later, the N reactor was put into cold standby. Active plutonium production for weapons or fuel use was shut down in 1987.[3] In

[3] The nearly instantaneous shutdown of plutonium production would prove a major problem in the cleanup effort in future years. Irradiated uranium rods were left in the cooling basins attached to several of the nuclear reactors. These rods and basins would prove to be an enormous remediation challenge 10 to 15 years later.

May 1989, the DOE, the Environmental Protection Agency (EPA), and Washington State signed a Tri-Party Agreement for a 30-year cleanup plan for the Hanford site, a site with many challenges.

The following month saw the DOE publicly announce a "fundamental change in priorities" at Hanford with greatly expanded focus on health, safety, and the environment. Weapons production at Hanford was coming to an end. U.S. Secretary of Energy James Watkins spoke publicly of Hanford moving from weapons production to a "center for research and development, especially in waste-remediation technologies." The Fast Flux Test Facility (FFTF), the last operating (test) reactor at Hanford, was shut down in 1992.[4] Hanford's critical mission and national security role ended.

Hanford now found itself at the center of growing controversy and criticism. Many of the organizations that had supported the "mission critical" role of Hanford now appeared to have second thoughts. Even in the local communities around Hanford (the tri-cities of Richland, Pasco, and Kennewick), those who had long defended the reservation now wondered if they had misplaced their loyalties. The cleanup of the Hanford site would be an enormous undertaking.

From Production to Environmental Remediation

During the Cold War years at Hanford, the focus was on plutonium production. "*There was a kind of cowboy pride. Get it out. Nothing gets in the way of getting the work done.*" For management, it meant planning the work process, writing it up, and sending it to the field for implementation. For the workers, it meant doing what they were told. Any hint of dissent, whether it was concerns over pay, safety, or process, was akin to subversiveness. According to a longtime Hanford engineer:

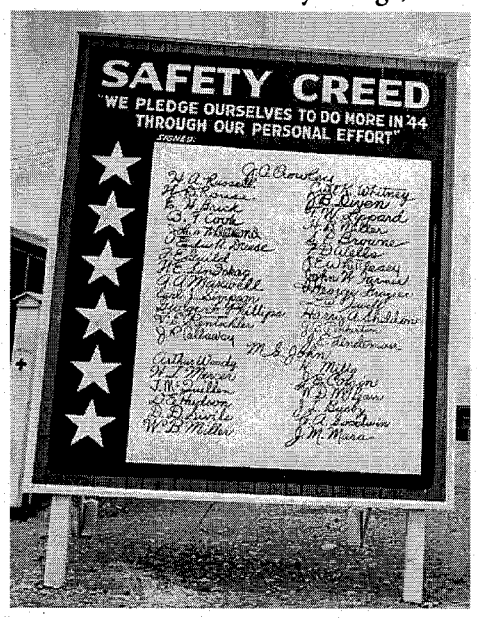
> *Until the late 1980s, it was a military mission. Everybody had secret clearances and you did not talk about what you did. It was a critical mission that needed to be done to defend our country. If we needed to get a certain amount of plutonium produced, the emphasis was getting that plutonium produced at the expense of any other missions. Industrial safety rules existed but were not valued. What was valued was the production of weaponry material. There was a hierarchy of people. The chemical-processing people who dissolved fuel rods and separated plutonium looked down on the tank farm people as "you guys just handle the waste, and we are the guys who are doing the real work." There was a conscious effort to put the best nuclear chemical operators into the production mission and not into the waste areas. Production was king, and the rest was support.*
>
> *When the mission became remediation, everything changed. I remember when our company president came and explained that environment was now king. We were in a room with the production guys on one side and the environment guys on the other side. You got cheers on one side of the room and glum faces on the other.*
>
> *We were no longer in the super-secret production era. A number of federal regulations became more important to people. After production stopped, the emphasis was on cleaning up the site. They did not put as much emphasis on industrial safety as they did on site cleanup. They did not want to miss any of the DOE milestones. Industrial safety and procedure compliance was mandated, but the cleanup mission was the focus.*
>
> *Once production stopped, there was a major shift in openness. In the early 1990s, a Russian group visited Hanford. Talk about a shock to a workforce! The whole mission had been to make plutonium for the bomb because those nasty Russians were going to get us. Now the DOE is letting them into our facility to see how we do things.*

[4] FFTF was a sodium-cooled fast-neutron test reactor used primarily for research in commercial reactor design and operation. It was completed in 1978 and was operational until 1992.

Safety Concerns before Fluor

During the Cold War, nuclear and radiation safety were aggressively managed at Hanford (see Exhibit 2). However, because of the emphasis on production, industrial safety procedures were not as well developed.

Exhibit 2. Hanford Safety Pledge, 1944



> *Part of the problem was the secrecy that existed during the production years. You would have guys running chemical processes that did not know what they were producing. They would not know the strategy; just get the buttons [plutonium] out the door. The rules were options and guidelines.*

Industrial safety deals with preventing and investigating occupationally related injuries and health matters. Using the terminology of the Occupational Safety and Health Administration (OSHA), a safe workplace is "free from recognized hazards that are causing, or are likely to cause, death or serious physical harm to employees." Nuclear safety involves the actions taken to prevent nuclear and radiation accidents or to limit their consequences. Hanford had always maintained a very effective nuclear safety program. But in industrial safety, a former manager commented:

> *We always had a feeling that industrial safety was somehow second-rate—a lower priority to nuclear at Hanford.*

Hanford's shifting labor demands over time added to its safety challenges. Beyond the initial demands for original construction, ongoing operational needs required high levels of skills and trades not easily found in a relatively isolated, low-population area, such as southeastern Washington State. As a result, training in the Cold War years was often very quick and very loose. The following worker's story about the pre-1988 period bordered on the unbelievable:

> *I just got tired of coaching at the high school one Wednesday. I called up a friend in HR at Hanford on Thursday. I interviewed on Friday and got hired on Friday. Saturday I did a double-shift training. By Monday, I was walking out on a berm at the back of the reactor, a berm about 14 inches wide, built around the pool of water holding the spent fuel. There was no railing for protection, and I was using a long pole tool to knock the spent-fuel rods off the trampoline netting that was under water. The spent-fuel rods were hung up on the netting and needed to be knocked loose to fall into the fast cart system for spent-fuel handling.*

In the years following the end of production, industrial safety at Hanford became a growing concern. The DOE, particularly in its field offices, was changing as the organization became less political in its leadership. The DOE was hiring more managers from the field operations it was overseeing, and was under increasing pressure to achieve the safety standards now being seen in non-DOE facilities.[5] This requirement was formalized in 1995 with Recommendation 95-2 to the Secretary of Energy that required a "system view of a standards-based safety management system."

[5] The Atomic Energy Commission (AEC), created in 1947, historically had regulated all nuclear activity in the private sector. Those facilities were also held accountable to OSHA standards. Nuclear facilities run by DOE, however, were "self-regulating" in all aspects of nuclear and industrial safety.

Union-Management Relations and Safety

Despite the increased emphasis on safety, Hanford had one of the worst injury rates within the entire DOE complex. On-site managers in the late 1980s and early 1990s noted a variety of reasons for the safety issues:

> *The previous contractor did a poor job of case management. That is one of the reasons why Hanford had such a poor record in the DOE complex. When a worker got hurt, they would go home. The company was focused on so many other things they were not interested in rehabilitating that worker. DOE started saying, "This is not right. You need to get better at case management."*
>
> *Safety was important, but they did it through conduct of operations.[6]. It was more of a compliance mindset. The workers were on the back end. We have work planners and a group of safety people who approve the work package, and then we hand it over to the workers. We expect the workers to comply with the work package. Workers would get the package and would say, "We can't do it this way, it's not safe, it's not compliant, it's the wrong way to do the work."*
>
> *Under the various contractors, Hanford was not part of the contractor business families. We were a self-contained unit. We did not share anything with other parts of the company. The previous site manager was very production-oriented, and DOE had a run-the-plant mentality. The DOE field managers were bureaucrats and politicians; they were watching the dollars. They rarely went on-site.*

One of the failed initiatives was *behavior-based safety (BBS)*. Behavior-based safety originated with the work of Herbert William Heinrich, an employee of Traveler's Insurance, in the 1930s. The original BBS program studies typically found that between 75 and 85 percent of all workplace accidents and injuries were the result of unsafe actions by workers, or, as they were sometimes labeled—*man-failures*. In strong labor environments like that at Hanford, this was synonymous with blaming the worker; accidents were construed consistently as "human error." BBS event studies sometimes resulted in finger-pointing; management pointed at the errors made by workers, and workers countered that they were doing what they had been told, so the work process was wrong. An associated criticism was that BBS had a tendency to treat safety as a standalone concept and not integral to other workplace activities.

> *In the 1990s, senior management said you shall do behavior-based safety, and you shall do it with us. It had no employee buy-in and it became a bad word. Management forced it on us instead of getting our buy-in. Senior management would set directions and we would follow.*

There were, however, a number of Hanford safety initiatives that were successful. The Hanford Guard, the security force on the reservation, had achieved an excellent safety record in the mid-1990s using a bottom-up safety program. Leadership at the Guard had engaged the unionized workforce by working directly with them in the development of the safety program.

In 1996, Hanford management began to champion division-level safety councils. This was the total quality-control era, and there was a push to get employees more involved. Unfortunately, safety councils with union involvement were not very successful, as a manager indicated:

> *The previous site manager had union people on the safety committees. One of the committees formed in the late 1980s was referred to as the "Yellow Leg Committee." This was a group of people who went to meetings, and all they accomplished was pissing on each other. The problem was the union did not buy into the people at the table. Management was picking people that agreed with their philosophies.*

Union workers saw senior management as disconnected from the work site. The safety experts in the management group did not expect workers in the field to understand the reasons or regulations behind safety instructions issued. They did not need to know; their job was to execute. According to one union worker:

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[6] The term *conduct of operations* means the deliberate application of controls and methods to ensure safe, compliant, and productive operation of the facility or activity. Conduct of Operations programs are required for all DOE facilities, and the requirements of a compliant Conduct of Operations program can be found in DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities.*

Safety was a department, not a responsibility. Management was downtown, off-site, inaccessible. Management never came out to the site, and DOE was never there. The heavy security restrictions prevented any one of us from voicing our concerns. The only way was through grievance procedures. With those, you submitted the grievance and waited a month or two for an answer. If you didn't like the answer you got, you met with an officer of the company, and, if you were still unhappy, it went to arbitration. In short, nothing got done.

As a construction worker coming to Hanford, this was the safest place I ever worked. You were never asked if you needed additional tools or equipment. But things did go wrong, and when they did, we always pointed fingers at the guy who initiated the event. We would give the guy time off or fire him.

You just didn't bring safety up. I almost got fired for bringing safety up. I was told that "if you keep talking, we will shut it down and you are out of a job." So I filled out a concern and sent it to Washington, and they sent it back to DOE in Hanford. DOE finally comes back in with money to fix it. That was the only way to get something done. Not long after that, a guy fell through the roof of a building and died. People woke up. Old facilities need new ideas.

They were always coming up with something new. My kids thought I worked for a coffee cup company. Every 3 or 4 months I would get another coffee cup for safety. Here's the cup, but none of it ever worked.

In the mid-1990s, labor became more and more frustrated with management's distance. Increasing public scrutiny over environmental risks associated with Hanford heightened their anxieties. When workers attempted to raise awareness, they were told, *"We pay you well for that risk. We don't have budgets for what you are asking. Just do your job."* Relations continued to deteriorate. The unions periodically quit working overtime to try and get management's attention, but senior executives rarely came on-site and workers had almost no access to senior management.

The relationship with the workers and contractors was not good. We were just people they needed to have because they got the contract. Why was safety not as important as it should have been? Everything we did with safety took away from getting the work done. Because of the secrecy, contractors could do this and get away with it. I believe it was about contractors making money and managers getting big bonuses.

Senior managers in the company cared about their workers. The company inherited a middle- and lower-level management culture, and that was the problem.

The DOE told the site to implement a "lock and tag system"—a safety procedure to ensure that dangerous machines are properly shut off and not started up again prior to completion of maintenance or servicing work. It sat there for about a year, and we kept doing lockouts the way we did in the past. I gathered up some documentation about it and sent a package to the DOE in Washington. Management was livid. They wanted me gone. The DOE hired a consultant to see what was happening, and the hammer came down on the contractor. Two weeks later, I was told that the company wanted to fire me.[7]

The relationship between the contractors, the unions, and the DOE was knock-down drag-out on safety. If you wanted to bring up a safety issue, senior- and mid-level management were downtown off the site. The only way to bring up safety concerns was to write up grievances. If you did not like the answer, you took it to the next step. Then it could go to arbitration, and it would get tied up in red tape, and pretty much nothing ever got done.

The last couple of years, the company did not want to meet with us on safety issues. Nobody felt safe here. If something was a bad hazard, we might stop working overtime. We were working with old decrepit equipment. If I brought this up to management on the site, they would say, "Just do your job;, nothing is going to happen." We might see the director of safety a few times a year. They would tell us, "We don't have the budget; you don't know what you are talking about."

[7] This individual had been fired a few years earlier, and then quickly rehired. According to union officials, this tactic was used often; firing was a threat, but a fired worker could talk to the press, so the individual would be hired back.

Fluor Arrives at Hanford

The management of Hanford involved a complex combination of a governmental client (DOE), a rotating prime contractor as site manager, and a permanent workforce. The DOE was the governmental body responsible for the production of plutonium and other chemical products, and was now charged with the execution and completion of the reservation cleanup. During the production phase, and now for cleanup, the DOE selected a contractor to manage the site and a contractor for nuclear-reactor management. Every decade or so, the DOE put the project out for bid. The original site management for Hanford operations was E. I. DuPont de Nemours and Company (1942-1946), followed by General Electric (1946-1965). Starting in 1965, however, different Hanford activities and services were contracted to a variety of different companies. Fifty years of governance and management change at Hanford is summarized in Appendix 1.

Fluor and Management Change

Unlike their predecessors, who were manufacturing companies heavily steeped in the Navy-Nuclear world, Fluor was an engineering, procurement, and construction management firm. When the DOE put the Hanford contract out for bid in 1995, it was looking for new ideas. Fluor's contract was for an initial five-year term with a potential five-year extension. Fluor was awarded the contract on the basis of three core elements:

1. **Integration**. Fluor, with its project management and construction management background, was expected to recruit, organize, and manage a variety of best-in-class companies in a variety of functions.

2. **Safety**. Safety had long been a core value at Fluor, and the DOE was under increasing pressure to improve the safety performance of the Hanford project.

3. **Economic diversification**. The DOE wanted Fluor as an integrator to help foster economic and business activity by subcontractors both on- and off-site at Hanford.

There was one last added feature of Fluor's contract with the DOE that was both significant and unusual: the conditional payment-of-fee clause. Traditionally, most of the DOE's contracts were "cost plus an award fee," essentially a cost plus contract with a large portion of the contract fee guaranteed regardless of contract fulfillment. In the mid-1990s, the DOE decided to introduce a more demanding contract structure with the subjective quality of contract fulfillment as part of the arrangement. When the DOE put the Hanford management contract out for bid, it had requested that all bidders accept a conditional payment-of-fee clause in their contracts. The clause made it very clear that a variety of fulfillment failures, including environment, safety, and health (ES&H) requirements of the contract, would result in a significant fee reduction.

> *The degrees of performance failure under which reductions of earned or fixed fee, profit, or share of cost savings will be determined are...*

The clause itself was very specific, detailing safety and health failures and under what conditions fees would be forfeited. The first stated performance failure was a failure to comply with the accepted Integrated Safety Management System (ISMS) that the contractor and the DOE had established. Additional reductions were specified for noncompliance with ISMS standards leading to actual or near-miss accidents resulting in "injury, exposure, and excedence" of contract stipulations. The conditional payment clause was extremely controversial at the time, and was opposed by all DOE contractors. Fluor was—in the end—the only bidder for the Hanford contract that accepted the imposition of the conditional fee clause.

Although Fluor had been awarded the management contract, it now faced the daunting task of managing multiple specialty company partners for a challenging customer with an intransigent workforce. The integrator role requiring Fluor to manage a set of partners was new to Fluor and the DOE. Fluor won the contract with a 1+6+6 structure: Fluor (1) would provide overall site management to a consortium of best-in-class subcontractors (6), in addition to fostering the development of selected (6) enterprise companies. Fluor had experience managing subcontractors on construction projects, but the Hanford cleanup was very different. The rationale for the integrator model was that best-in-class experts would be selected for the various remediation tasks.

Managing the Hanford Workforce

In addition to the challenges of the integrator model, Fluor also had to manage the Hanford workforce. With every new site manager came new senior management. Although senior management changed, middle-to-lower-level management and the unionized workforce stayed largely intact. A manager explained the "we-be" culture: *"We be here before you came, we be here after you go."*

> *I interviewed with Arco [Atlantic Richfield] in 1977, and a few months after I started, Rockwell took over. I asked what was going to happen and was told "nothing—the transition only affects the higher-level people." You just move from what you are doing with one company to doing what you are doing with another company. At the higher levels, you may drop a management level and have to prove yourself again. People here have been transitioned many times and view it as a normal part of business. You keep doing what you were doing. The job you have and the people you work with are the same people. We know that there will be change and new approaches, but we will survive because they do not have people to replace us.*
>
> *When the new contractors come in, they bring something different. They each have their own culture, and they want to bring something new. Rockwell brought an aerospace model on cost scheduling. It took years to get us cost-oriented because we were focused on production. Westinghouse was much more scientific and technical. Fluor is an engineering and construction company.*
>
> *Initially, there is always a huge lack of trust. The workers would see new managers with new initiatives and dismiss them as flavor of the month. They have heard all that before.*

Hanford's union labor was apprehensive about Fluor. Fluor was awarded the first nuclear environmental remediation contract in 1992 at the Fernald, Ohio, DOE facility. Fernald had been one of the DOE's primary uranium-processing facilities and had experienced significant labor strife. As a union worker commented:

> *I don't get attached to contractors. Contractors come and go. The only people that stay are the unions and the DOE. When we heard Fluor was coming in, we thought they would be the worst contractor that ever set foot in this area. We heard they were a union buster back there in Ohio at the Fernald facility. They came in here like we were a bunch of stupid idiots and they were going to bust our chops. We thought they were here to break the union.*

Hanford's Safety Performance

When Fluor arrived in late 1996, Hanford's safety performance was a focal point of concern. The *Total Recordable Case Rate (TRCR)* at Hanford, the number of reported injuries and accidents per 100 workers per year, was 5.37. *Total Recordable Case Rate* (TRCR), or *Incident Rate*, is the most widely used measure of safety in industry today. Used by the U.S. government's Occupational Health and Safety Administration (OSHA) as its primary measure, it is calculated as follows:

$$\text{Incident Rate} = \frac{\text{Total number of injuries x 200,000}}{\text{Total hours worked by all workers}}$$

where the 200,000 numerical adjustment is the total hours worked by 100 employees in a single year, assuming a 40-hour week and a 50-week work-year (100 x 40 x 50). At 5.37, Hanford was far above the DOE complex averages—and expectations.

Fluor's First Year

Prior to coming on site, Fluor management had seen some Hanford safety data, but did not know the specifics of the safety environment.

> *We didn't worry much about what the former contractor had done. We focused on what our new client needed. We knew there were some problems with safety, and we had a few statistics, but that's all.*

An early visit by Fluor was not encouraging. Under the previous site manager, senior management rarely ventured into the field. The company offices, located on the northern edge of Richland a few miles south of the southern border of the Hanford site, were relatively isolated. As a Fluor manager commented:

> *We visited the safety people prior to the transition. After the visit, my boss said, "You could brick up the building for two weeks and the people inside the building wouldn't know they had been cut off." The safety program never left the building. They never let a program get communicated to the shop floor and actually get people to own it, understand it, believe it, and ingrain themselves into doing it.*

During the management transition to Fluor, the safety challenges became more apparent. Some early observations by the Hanford transition team:

> *At our other sites, we were not struggling with technical safety issues; we were struggling with people issues. At Hanford we saw a safety program totally divorced from the people side. If there was a problem, they tried to fix the people, not the process.*
>
> *We inherited a multitude of initiatives. The previous contractor and the DOE were on the latest fad for safety. They were trying to do all the acronyms of safety at the same time. Radiological control was done very well. What was missing was industrial safety.*
>
> *Traditional "how you do safety" was not going to work here. This workforce is very intelligent, very motivated, and very much wants to own their own work processes. At Fluor, we were used to hiring people with the attitude of "tell me what to do, boss, and I will go do it." This workforce wanted to know why.*
>
> *We came in and said, "This is a horrible injury rate." There was a staggering number of injuries. Hanford had 400 recordable injuries the previous year. Fluor had 60 recordable injuries globally the previous year.*
>
> *Previous management told workers to "go home and get better," rather than evaluate what was contributing to safety events. Safety was doing a lot of things, but it was not affecting people on the shop floor. The contractor was more worried that the worker would call the client [DOE] to say they were being harassed than they were about managing their people.*

Fluor immediately began putting in place new programs and procedures around safety, linking compensation to safety, something Fluor did on all its projects. This was a departure from the ways things had been done, and not all middle managers accepted the changes. According to a Hanford manager:

> *It bothered me that conduct of operations was being downplayed by Fluor. Hanford was held up against safety standards for the rest of Fluor Corporation. Bingo! We were not there. The problem is that there are apples and oranges. We get driven to do things by our client that Fluor does not have to do on the construction site in Indonesia. Nevertheless, the standard was there and we were given a goal. Fluor told us that if you did not meet your safety goal and your production goal, you would just get base salary. You were going to get paid for good safety performance.*

Hanford's workforce peaked at more than 50,000 workers during the rapid construction phase in the 1940s. During the Cold War, employment at Hanford scaled up and down during expansions, lulls, and finally retirement. Now, in 1997, Fluor was managing 9,000 workers in a variety of activities over the site. Most of the workers were over 50 years old and members of various unions. The Hanford Atomic Metal Trades Council (HAMTC) represented 15 unions; the Building Trades Council, 13 unions; and the Hanford Guards Union represented security workers. Relations between workers and management varied year-to-year.

The gulf between labor and management resulted in more and more safety "Stop Work" actions. All Hanford employees had the right to declare a "Stop Work" if the worker believed they were in imminent danger. This meant that all work ceased until the source of the danger was evaluated and rectified if found to be a legitimate threat. A growing problem was that a number of workers were using "Stop Work" as a way to get attention for safety concerns. In some cases, work stoppages occurred because workers wanted more overtime. Some units were suffering as many as six to eight "Stop Works" a day.

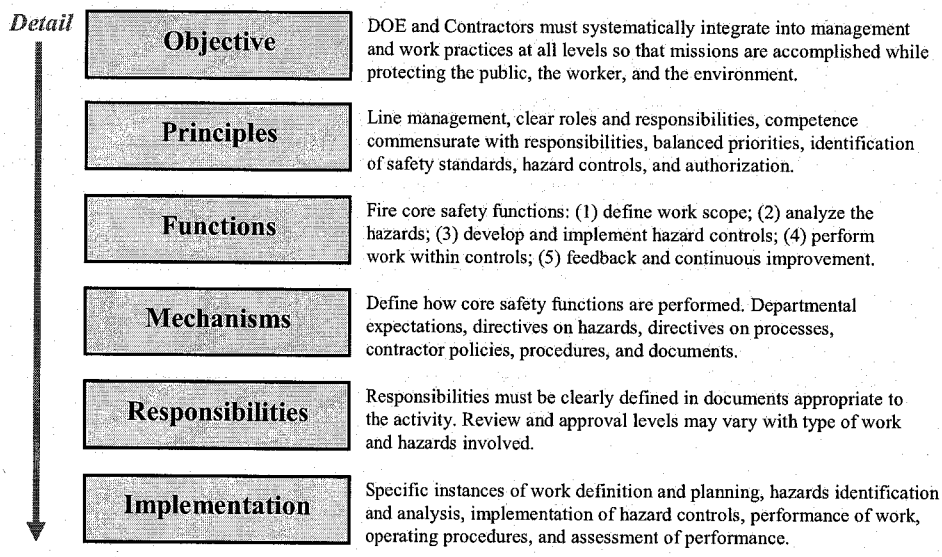
Fluor management saw safety grievances as not only costly, but inherently inconsistent with their core corporate safety values:

> *In a true safety culture, safety is not collectively bargained. Safety is a right and an obligation for the employer. If there are safety grievances, that means safety is being negotiated. It means you are actively at the table negotiating where the safety margins are. Nobody wins because you are gambling with safety.*

DOE Expectations

The Defense Nuclear Facilities Safety Board (DFNSB) was chartered by Congress in 1988 as an independent oversight organization within the Executive Branch. It was charged with providing advice and recommendations to the Secretary of Energy to ensure adequate protection of public health and safety at DOE's nuclear facilities. In 1995, the DFNSB introduced its *Integrated Safety Management System* (outlined in Exhibit 3), and the DOE accepted this approach for the whole Hanford site.

Exhibit 3. DOE's Safety Management System



Source: U.S. Department of Energy, Safety Management System Policy, 10-15-96, p. 450.4.

In January 1997, just months after the contract was signed, Fluor submitted its Safety Management Plan to the DOE. The DOE rejected the plan for two reasons: it was not specific enough, and it did not integrate differing safety systems, policies, and bodies into a singular master plan. With the difficulties of coordination and integration Fluor was experiencing with the multiple subcontractors, Fluor Hanford was not performing to the client's expectations.

In May 1997, an explosion occurred in a plutonium finishing facility. Ten workers were exposed to chemical fumes as a result of the accident.

> *At approximately 8:00 p.m. on May 14, 1997, an explosion occurred in Room 40 (the chemical makeup room) on the fourth floor of the Plutonium Reclamation Facility (PRF). The explosion destroyed a tank containing hydroxylamine nitrate and nitric acid, causing a breach in the roof of the building, and sending a visible cloud of gases out the main stack of the Plutonium Finishing Plant (PFP). Although the room where the explosion occurred was not used for the storage of plutonium, past contamination incidents had occurred there, leaving unknown levels of fixed plutonium contamination.*[8]

[8] "Regulatory Investigation of the Potential Airborne Release of Radionuclides during the May 14, 1997, Explosion in the Plutonium Reclamation Facility at Hanford," Washington State Department of Health.

There were a number of different perceptions on the severity of, and the organization's emergency and safety response to, the explosion, as seen in the following *Los Angeles Times* report:

> *A chemical explosion at the Hanford Nuclear Reservation that released plutonium and other hazardous chemicals was followed by a near-complete breakdown in emergency response, exposing workers to a toxic plume and leaving outside authorities unaware of the danger until hours after the event, a government report concluded Friday. In a series of extraordinary admissions, the Department of Energy and Fluor Daniel Hanford Inc., manager of the huge nuclear site in central Washington State, detailed a series of failures in almost every link of the emergency-response chain at Hanford's Plutonium Reclamation Facility.*[9]

The Road Ahead

After only one year, Fluor was at a crossroads on the Hanford contract. As summarized in Exhibit 4, several key safety performance statistics had definitely improved. However, Hanford safety was not at a level that was consistent with Fluor's overall corporate performance and expectations.

Exhibit 4. Safety at Hanford One Year into the Contract

- Accidents requiring more than first aid dropped from 5.1 per 200,000 hours worked in 1996 to 3.09 in 1997. The DOE complex average for 1996 was 4.1.
- The number of cases resulting in people staying at home or returning to work in a limited capacity dropped from 1.59 per 200,000 hours worked in 1996 to 1.09 in 1997. The DOE average was 3.9.
- The year prior to Fluor's contract, Hanford averaged 6.1 cases per month of people picking up radioactive contamination. In Fluor's first 11 months on the job, the rate had dropped to 4.6 cases per month.
- Chemical accident rates were, however, fluctuating. Monthly rates under both the previous contractor and Fluor varied between one and five, with no clear trends or distinctions.
- Hanford workers suffered seven electrical shocks (or came close) in 1996, while Hanford had already recorded nine such incidents in the first 11 months of Fluor's management term.

Source: "Statistics Tell of Improvements, Troubles," by John Stang, *Tri-City Herald*, October 7, 1997.

Early discussions between Fluor Hanford management and Hanford's unions made one thing very clear: labor wanted a greater voice in safety. But they did not know what, exactly, they wanted. The difficult labor-management relations were lacking trust. A Fluor manager described the situation:

> *One of the most difficult things is that we inherited the workforce. In a traditional Fluor project, we hire the workforce and have the ability to cull the herd to get the culture you want. We inherited x-thousand people. The culture is the culture you got. We had no roadmap for the massive cultural change that had to occur. We had to get people aligned to the values of Fluor, with safety as the lead one.*

Much of the dilemma was summarized by a *Tri-City Herald* article deliberating Fluor's performance after one year on the job:

> *"I think the jury is still out on safety. Fluor has talked big, and has done so from day one. But I don't see it yet," said Dick Belsey, chairman of the advisory board's health and safety committee. Madeline Brown, who represents nonunion Hanford employees on the advisory board agreed. "We're having more near-misses. I think we could have a fatality. That scares me," she said.*

[9] "Nuclear Plant Blast Sparked Chaos, U.S. Says," Kim Murphy, *Los Angeles Times*, July 26, 1997, p. A-1.

Appendix 1. Changing Management at Hanford

Time	Government Agency Overseeing Hanford Site	
1943-1949	Manhattan Engineer District (MED) U.S. Army	
1947-1974	Atomic Energy Commission (AEC)	
1975-1977	Energy Research and Development Administration (ERDA)	
1977-today	Department of Energy (DOE)	
	Private Industry Contractors	**Services**
1942-1946	E.I. DuPont de Nemours and Company	All site functions
1946-1965/66	General Electric Company (Hanford Atomic Products Operation, HAPO)	All site functions
	Private Industry Contractors	**Services**
1965-present	Battelle Memorial Institute (BNWL) (later Pacific NW National Lab, PNL)	Environmental monitoring
1965-1990	U.S. Testing (January 1965-1990)	Bioassay and environmental sampling
1965-1975	Computer Sciences Co. (CSC)	Data management
1965-2004	Hanford Occupational Health Foundation (HOHF) (later Hanford Environmental Health Foundation, HEHF)	Medical services
1965-1973	Douglas United Nuclear (DUN) (joint venture of Douglas Aircraft Co. and United Nuclear Corp.)	Reactors operations and fuel fabrication
1973-1977	United Nuclear Industries (UNI)	Reactor operations and fuel fabrication
1966-1967	Isochem (joint venture of U.S. Rubber Co. and Martin Marietta Corp.)	Chemical processing operations
1967-1977	Atlantic Richfield Hanford Co. (ARHCO)	Chemical processing operations
1966-1975	ITT Federal Support Services, Inc.	Administration and data management
1970-1996	Westinghouse Hanford Company (Hanford Engineering Development Laboratory, HEDL)	FFTF development
1975-present	Boeing Computer Services Richland (BCSR)	Administration and data management
1977-1987	Rockwell Hanford Operations (RHO)	Chemical processing and reactor operations
Consolidation (partial)		
1987-1996	Westinghouse Hanford Co. (WHC)	All site functions except those performed by PNL, HEHF, and BCSR
1994-present	Bechtel Hanford, Inc. (BHI) Environmental restoration and decontamination and decommissioning of 100 area inactive facilities; soil and groundwater remediation (1998-2002)	
1996-present	Fluor Daniel Hanford, Inc. (Project Hanford Management Contract—PHMC; name changed to Fluor Hanford, Inc. in 1999)	All site functions except PNL, medical and informational technology
1996-present	Lockheed Martin Services, Inc. (LMSI)	Information technology

*This does not represent a complete listing of the contractors at the Hanford site.