Changing the Safety Culture in Hanford Tank Farms – 9211

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ABSTRACT

In 2000 the Hanford Tank Farms had one of the worst safety records in the Department of Energy Complex. By the end of FY08 the safety performance of the workforce had turned completely around, resulting in one of the best safety records in the DOE complex for operations of its kind. This paper describes the variety of programs and changes that were put in place to accomplish such a dramatic turn-around.

INTRODUCTION

The U.S. Department of Energy's 586-square-mile Hanford Site in Washington State was established during World War II as part of the Manhattan Project to develop nuclear materials to end the war. For the next several decades it continued to produce plutonium for the nation's defense, leaving behind vast quantities of radioactive and chemical waste. Much of this waste, 53,000,000 gallons, remains stored in 149 aging single-shell tanks and 28 newer double-shell tanks. One of the primary objectives at Hanford is to safely manage this waste until it can be prepared for disposal, but this has not always been easy. These giant underground tanks, many of which date back to the beginning of the Manhattan Project, range in size from 55,000 gallons up to 1.1 million gallons, and are buried beneath 10 feet of soil near the center of the site. Up to 67 of the older single-shell tanks have leaked as much as one million gallons into the surrounding soil.

Liquids from the single-shell tanks were removed by 2003 but solids remain in the form of saltcake, sludges and a hardened heel at the bottom of some tanks. The Department of Energy's Office of River Protection was established to safely manage this waste until it could be prepared for disposal. For most of the last seven years the focus has been on safely retrieving waste from the 149 aging single-shell and moving it to the newer double-shell tanks.

Removing waste from the tanks is a difficult and complex task. The tanks were made to put waste in, not take it out. Because of the toxic nature of the waste, both chemically as well as radiologically, all retrieval operations must be performed using remote-controlled equipment which has to be installed in each tank, then removed when retrieval is completed. This process involves a variety of potentially hazardous construction activities including crane and rigging, excavation, electrical and piping work. It also requires strong attention to safety to avoid injuries to personnel and contamination of the environment.

Safety Performance Needed Improvement

The safety performance at Hanford's tank farms in 2000 was among the worst in the Department of Energy complex. The Days Away, Restricted or Transferred (DART) case rate was 1.23 against a contract limit of 2.1; the Total Recordable Case Rate was 3.25 which exceeded the DOE limit of 3.2, and the Lost Workday Case Rate was 0.52 which approached the contract limit of 0.64. Clearly, something needed to be done.

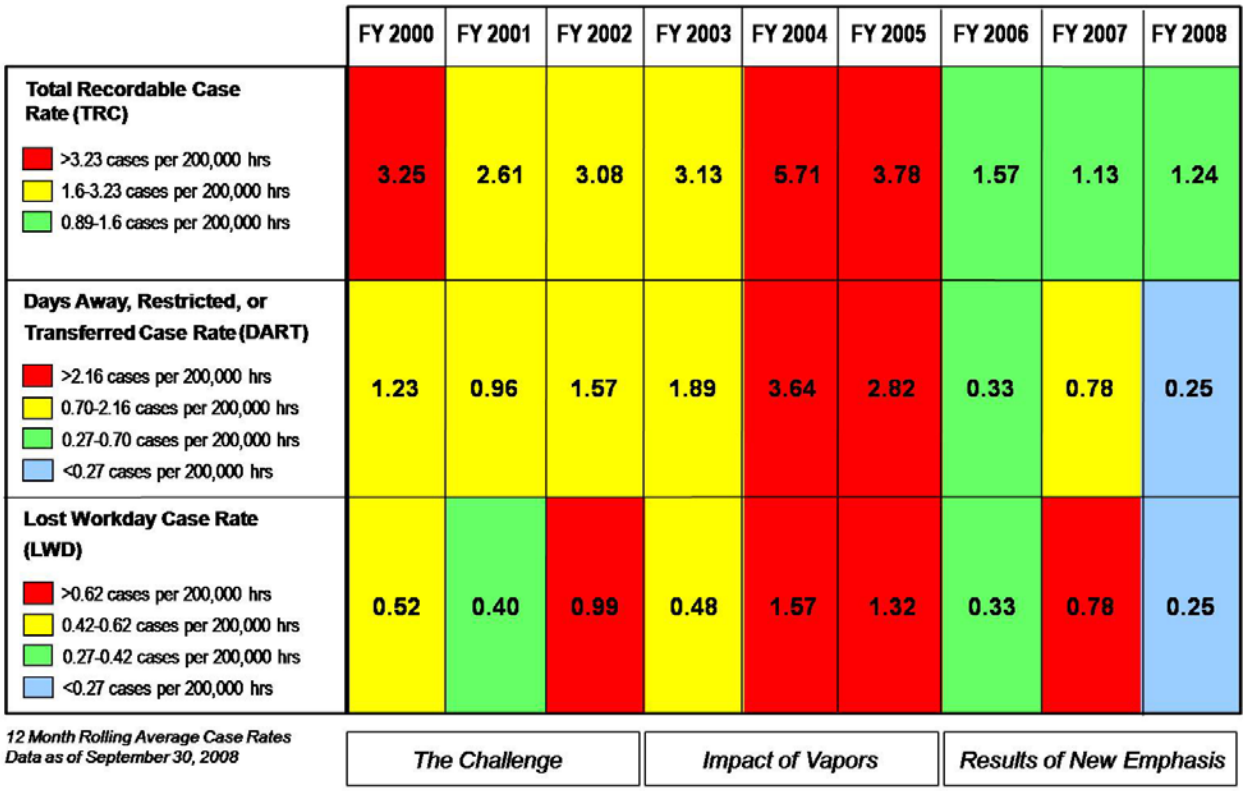

Fig. 1. 2000 – 2008 Fiscal Year Hanford Tank Farm Safety Rate Summary

While a turnaround was recognized as achievable, it was going to take time and that there was no "magic bullet" that would fix all the problems.

Taking the First Step

The first step began with the contractor management team demonstrating an overall leadership commitment. Management had to "buy-in" to the idea of establishing a new safety culture, and shake off the notion that the old culture was so deeply entrenched that it couldn't be changed.

Once management was on board and began to "walk the talk," a series of programs and campaigns were launched to effect needed change. Some of the changes were simple, such as improving the company's lessons learned program so that information shared from other organizations and even other DOE sites that have faced similar challenges were integrated into daily work planning.

Next came a plan based on solid safety principles, with a focus on zero events. Lastly, it was recognized that nothing would succeed without the involvement of the workforce. Once combined, these efforts created a formula for positive safety culture change.

Management understood that it would be a long and sometimes difficult journey, but experience showed that when workers were given the opportunity to make a difference, it could be done. The initiative also demonstrated that safety and productivity go hand-in-hand. By early 2006 not only were the safety numbers improving but productivity was improving.

A Steep and Rocky Path

In spite of, or as a result of a contractor change in late 1999 the workforce was frustrated and skeptical. They had seen contractors come and go, safety programs come and go, yet people were still getting hurt on the job. Compounding the problem was a growing number of legacy issues including aging equipment and a relatively high number of facility events that needed to be addressed in a timely manner.

The Hanford tank farm workforce repeatedly demonstrated that it was talented as well as capable, but budget realignments, mission acceleration, and reorganizations exacerbated latent organizational problems which contributed to the poor safety performance. In addition, workers were once again raising concerns over the long-standing issue of tank waste vapors. The underground tanks periodically release vapors into the work space through filtered stacks. These vapors have strong and unpleasant odors, and workers were concerned about the impact of these vapors on their health. Previous contractors had made efforts to deal with the vapors concerns, but these efforts were seen as minimal and failed to resolve the issue. Only after the Government Accountability Project issued its *Knowing Endangerment* report [1] accusing DOE and its contractor of ignoring the issue did they recognize the depth of employee concerns about this issue. In response the decision was made to attack the problem head-on and put it to rest once and for all. Resolving the vapors issue, however, would take time. To ensure worker safety while gathering needed data to support future decisions, workers were required to use supplied air respirators for all work taking place inside the tank farms. While placing workers on supplied air was regarded as the right decision for protection against potential harmful effects of tank waste vapors, wearing such equipment took its toll on workers and injuries in the field increased.

Due in part to wearing heavy respiratory equipment in the field such as carrying 40-pound air bottles on their backs, and wearing face masks resulting in limited visibility, the workforce recordable injury rate peaked in 2004, at 5.71 injuries per 200,000 hours worked. This compared to the DOE average among all of its sites of 1.7. Further, the tank farm Days Away and Restricted Time (DART) case rate peaked at 3.64 in 2004, compared to the DOE average of 0.70.

In spite of what these numbers would indicate, workers were performing the high hazard work, such as crane and rigging activities, safely. It was the slips, trips and falls where they were being hurt. They suffered bumps, bruises, cuts, muscle strains and injuries from ergonomic issues, plus repetitive motion injuries.

Senior Management Commitment

To ensure that all managers were on the same page, and on the same page with their workforce, a single set of clear, Integrated Safety Management System (ISMS) expectations was developed. These expectations applied to the senior leadership team, managers and all other employees, and were based on proven safety culture principles. The ISMS expectations were based on safety principles rooted in the commercial nuclear power industry, which has experienced significant performance improvement using these principles over the last twenty years.

Expectations were then established for management to spend more time in the field to help build trust and improve communications with the workforce. Managers were directed to spend 25-50% percent of their time in the field, depending on their management level. It was viewed as essential that leadership spoke the language of the field, and that they experience what workers experience on a daily basis in the field so they can understand worker issues first-hand. As a result, it became a common site to see managers in change rooms donning protective clothing, supplied air respirators, and going into the field to stand along-side engineers, industrial hygiene technicians and operators as they perform their work.

A new policy was established, requiring senior management to be notified within 30 minutes when an injury occurs. This policy required managers to closely follow each injury case, work with the injured employee to make sure his or her needs were being met, including helping the individual obtain new job assignments, when necessary, to prevent injury aggravation. Additionally, an Executive Safety Review Board was chartered, requiring managers to review safety program performance, assess results, and approve all root cause analyses and associated corrective action plans once a month, or more.

A Safety Assessment Center was created to provide a forum for managers who are physically located miles apart to review noteworthy events of the previous 24 hours and discuss work accomplishments during a daily morning conference call. The call keeps managers connected and aware of what is happening in other parts of the company and allows for a dialogue that otherwise may not take place. The executive management team and their staff members are expected to be on the call.

The work environment also came into focus. Industrial work spaces have a tendency to become cluttered if vigilance is not maintained, and Hanford is no exception. To deal with this, management increased its attention to removing unneeded or outdated equipment from the field. Time was also spent identifying and removing hazards and correcting unsafe conditions. Improving tank farm housekeeping has significantly reduced accidents associated with slips, trips and falls.

Quarterly all-employee meetings were also instituted. Topics discussed include the company safety performance, as well as potential workforce distractions such as budget issues. Employees were recognized for their accomplishments and they were updated on overall company business performance. There was also time for a look ahead to acquaint workers with company performance commitments. Time was also allowed for employees to ask questions directly to any of the senior management team.

Expectations were also established among management to recognize employees for their safe behavior. An aggressive employee recognition program was instituted to make sure that employees were rewarded for the behavior that management sought. This included creation of a discretionary fund that managers could use in a variety of ways to recognize safe behavior. Recognition could be in many forms, such as a certificate of appreciation, a gift card to a local shopping mall, or an organizational feed.

Building a Safe Work Environment Emphasizing Problem Identification and Resolution

The backbone of the safety culture improvement strategy focused on establishing expectations regarding lessons learned and effective problem identification and resolution. Changes were regularly made to the problem identification process to increase its usability and effectiveness.

Another major initiative was establishment of an organization focused on a “Safe Work Environment,” similar to the Nuclear Power industry’s Safety Conscious Work Environment, whereby individuals from the workforce can identify problems and raise safety issues without fear of retaliation. Numerous management and employee training sessions were provided and annual employee surveys were used to evaluate worker satisfaction and identify where improvements could be made. Managers were held accountable to correct any problems that are identified. As a result, significant progress was made in improved trust and respect between workers and management. Open communications and a questioning attitude were encouraged.

Any form of retaliation, or perceived retaliation is addressed immediately to prevent any chilling effect on raising issues or concerns. Two separate surveys showed an “excellent” level of trust of first line managers by the workforce and that this level of trust continued to improve as first line managers

demonstrated that they listen to worker concerns, respond effectively, and report back to them. Hand-in-hand with improved trust and communications has been a significant reduction in employees using other alternatives available to them for raising concerns.

A robust assessment process for evaluating program opportunities for improvement and applying lessons learned was also put in place. Assessment improvement areas were captured in the company's problem identification and resolution process and tracked to completion. This prevented issues from falling through the crack and ensured continued management emphasis was placed on those areas where safety could be enhanced.

Ergonomics

The importance of ergonomics in the workplace was another issue that had to be addressed. Ergonomics issues are well understood in just about every industry, but at Hanford, it is doubly important. Because employees are working in a hazardous environment, differing tasks require differing ergonomics considerations. One factor, for example, is the use of personal protective equipment such as wearing multiple layers of protective clothing. Compound this by having to work in confined spaces, or under hazardous conditions, then add in the wearing a self-contained breathing apparatus. All of these conditions create an environment rich with opportunities to slip, trip, fall, and twist, or otherwise become injured.

Many of the recordable accidents seen in Hanford tank farms were associated with the use of self-contained breathing apparatus (SCBA). To help deal with these issues, a buddy system was put in place so workers could help each other in the field. This included assisting each other to make sure they put on and take off their respiratory protection equipment safely. The eventual elimination of the need for respirator use by most workers on a daily basis had a significant, positive impact on the injury rate. However, the buddy system approach has been maintained when SCBA equipment is used.

Another example of an ergonomic challenge had to do with workers lifting heavy laundry bags…a problem that had been an ongoing issue for many years. The bags were held in place in change rooms by a framework requiring workers to lift them vertically when changing them out. Through employee involvement, an idea surfaced to redesign the holders, allowing workers to remove the bags horizontally, eliminating the awkward lifting that was resulting in frequent back strains. The new design for the holders was simple and inexpensive, but greatly reduced the number of back strain injuries the workers had been experiencing.

Emphasizing Employee Involvement

Employee involvement in safety had been going on at various levels at Hanford for many years. However, it was realized that safety performance would only improve with a substantial increase in employee involvement and a top-to-bottom buy-in of the various programs and processes being put in place. It has long been shown that organizations which use the Voluntary Protection Program (VPP) supported by the Occupational Safety and Health Administration and the Department of Energy have exhibited lower injury rates and better employee morale than industry averages. VPP is a continuous improvement process with a heavy emphasis on worker involvement. The VPP program was aggressively embraced within Hanford tank farms, resulting in the prestigious VPP STAR certification being presented to two of the tank farm operating divisions.

The improved safety results in the field organizations that achieved STAR recognition makes the program an "easy sell" to other organizations within the company. Because the benefits of the VPP program are

clearly demonstrated, employees want to get involved because it clearly improves the accident and injury rate.

As part of the VPP process, one-day safety jamborees were held periodically to involve all employees and solicit their feedback. Instead of a safety stand-down which often follows a serious incident, safety jamborees were held to focus on preventing injuries in the future, solicit ideas for improvement and get everyone on the same page when it comes to safety. The jamborees included a number of breakout sessions focused on specific topics. Other sessions were held to allow brainstorming of innovative ideas. These ideas were captured, prioritized and presented to management for action. Workers also routinely met with management and their VPP Champions. Time was also allowed for workers to meet with senior management in small groups to ask questions and discuss concerns. The jamboree brought everyone closer together on the issue of safety and helped continue to improve safety performance.

Another element of worker involvement was the appointment of safety representatives from the ranks of Hanford's 10 bargaining units. These individuals were appointed by the leadership of the Hanford Atomic Metals Trade Council (HAMTC), which is the overarching union leadership for Hanford site work. Safety Reps, as they are called assist in resolving employee concerns related to environment, safety and health. They are the point of contact for stop-work actions, work pauses, fact finding, event investigations, and much more. They are actively engaged on all fronts when it comes to safety, and the position is credited with strengthening the trust between management and the workforce. The number of safety representatives was recently increased from five to seven. This action alone was responsible for a significant decrease in the number of issues raised by workers.

As was discussed before, one of the most serious issues facing Hanford tank farms in recent years had to do with chemical vapors emanating from the underground radioactive and chemical storage tanks. Many of the 177 tanks periodically vent vapors to the work space through filtered breather stacks, exposing workers to strong odors and potentially to harmful concentrations of a variety of chemicals. Workers were concerned about the potential for adverse health effects and began to raise the issue in a variety of forums.

In response, a document referred to as the Industrial Hygiene Technical Basis [2] was prepared which became the foundation for the tank farms industrial hygiene program. Unique in the DOE complex, it defined the hazards in the tank farms and has been used as a basis for setting appropriate workplace monitoring, controls and action levels to protect workers on a daily basis.

In addition, the Chemical Vapor Solutions Team (CVST) was formed, made up of interested union employees, engineers and managers from across the company. When employees joined the team attendance at meetings and participation in team activities became part of their routine work assignment. They attended regular meetings, participated in brainstorming, conducted research, made recommendations, and served as a sounding board for development of programs to address vapors-related concerns.

Working together, employees and management agreed that existing tank vapor data was inadequate for basing safety decisions, leaving unanswered questions about the potential health effects from vapor exposure. Until definitive data could be obtained however, use of supplied breathing air respirators was required for everyone working inside the tank farm boundaries. To many of the workers, this seemed like a drastic action because self-contained breathing apparatus (SCBA) equipment is heavy, cumbersome and very uncomfortable, especially during the heat of the summer and the cold of the winter. Further, the farm boundaries were an artificial and seemingly arbitrary demarcation because distances between tanks and the fences were not uniform across the site. In some instances workers outside the fence were closer

to tanks than workers in some locations inside the fence. In spite of this, it was the only way to assure workers that workers were not breathing harmful vapors.

Once everyone inside the fence was on supplied air an extensive vapor sampling and monitoring campaign was launched to determine the makeup of chemicals in the tanks that produced the vapors. The campaign was developed working with the CVST. It also included development of new policies and procedures to protect workers. It took nearly two years to complete, but because of this level of employee involvement, workers had confidence in the changes that were put in place.

Additionally, some of the best minds available in the scientific community were engaged in an advisory role to help solve the issue.

Event Prevention

Following through on expectations a goal of zero accidents was aggressively pursued in Hanford tank farms. Once again, using a commercial nuclear industry tool endorsed by the DOE, Human Performance Improvement was instituted to drive home "event prevention" using proven tools developed by Institute of Nuclear Power Operations.

The program recognizes human performance limitations. It puts an emphasis on recognizing precursors to errors and accidents so they can be headed off during work planning before an event occurs or someone is injured. Work packages put more up-front focus on critical steps where errors can occur and what we can do to mitigate those errors. Workers and supervisors were trained to recognize error-likely situations and what can be done to minimize the chance of an event. Deeper looks were also taken at the cause of events to see what an organization may have done to set up an error-likely situation without fixing blame.

As changes were made to improve safety, management expectation of personnel safety had to be established as the overriding priority. One of the first steps was to communicate the message of working at a comfortable pace where accidents or events would not occur, and to stop when uncertain of plant conditions. It meant moving at a productive pace, but not so fast as to become unsafe or make mistakes. The company also institutionalized the practice of proactively identifying plant conditions in the work package that required stopping ahead of time.

The Employee Accident Prevention Councils were also reinvigorated. Five councils were established, with members drawn from across the various organizations. Councils included representation from all levels in the company. Councils were empowered to set safety goals for the employees they represent, were allowed to pursue initiatives to reduce injuries, oversee VPP activities in their area of responsibility, recognize and reward employees for safety, and were provided with tools and funding to implement safety initiatives within their own organizations.

Further, a President's Accident Prevention Council was established, made up of Employee Accident Prevention Council's executive sponsors and leadership, was co-chaired by the lead HAMTC Safety Representative and the company president. The council reviews safety statistics monthly, and focuses resources where they are the most needed to proactively solve both short- and long-term safety issues. It also worked to stay ahead of seasonal issues such as those created by winter ice and snow, or summer heat and insect bites. In addition to focusing on problems, the council focuses on rewarding safe behavior by singling out workers for exemplary safety performance. Awards would range from long-term safety leadership to one-time situations, such as prompt attention to a given issue or even saving the life of a fellow worker.

In addition to normal management expectations to ensure workers are following safety rules, a behavior-based peer safety observer program was established so employees could do on-the-spot observations of their co-workers in a “no name no blame” format. The whole purpose of this program was to get more people looking out for behaviors that can lead to accidents. When found to be doing things right, individuals were equally rewarded on the spot. If observers saw something that was not being done right, however, they identified the behavior, but not the person, so coaching could be done without embarrassing an individual. Examples of positive behaviors included use of seat belts, use of a hand rails along stairs, proper use of safety glasses and hard hats, or proper and appropriate use of hand tools. This process was benchmarked at another facility and modified for use in the tank farm. Team members were trained by the Industrial Safety organization in safety observation in coaching techniques that would be the most effective in the field.

While bad weather cannot be prevented, it can be factored into job planning. Hanford weather conditions can be harsh. While winter temperatures rarely drop to zero, they can remain below freezing for long periods. Combined with snow, ice and the ever present-wind, conditions become ripe for cold weather accidents. To help deal with these issues a Winter Safety Team was created and empowered to identify problems and develop and implement controls before they were needed. The result was a significant reduction in winter accidents. Some of the improvements made in this area included hazard communications, the use of warming tents to allow workers to take warm-up breaks without leaving the work area, and implementation of a proactive approach to keep parking lots and walking paths clear of slipping hazards by applying de-icer ahead of time and calling out overtime support to clear areas prior to normal dayshift arrival.

In extreme contrast, summer temperatures soar to over 90º F for weeks at a time and often reach above 100º F, creating special hazards. For a long time, the simple solution to the heat problem was to shift our work schedules to early morning hours or at night when temperatures are more moderate. It beat the heat, but workers were opposed to night work. As an alternative, a switch was made to lighter, cooler protective clothing. Cool-down tents were set up and fitted with air conditioning, and work areas were outfitted with water misters. Work-rest regimens were applied, based on temperature and work activities being performed. The result has been a happier and more productive workforce.

In yet another example of event prevention, a voluntary stretching program was implemented so workers can stretch out prior to every shift to help prevent injuries and minimize the severity if they do occur. The Hanford workforce is not different than other industries across the US, with a large population of the workforce over 40. These daily “Stretch for Life” classes are quick, painless, and result in fewer injuries. General feedback from the workforce has been extremely positive.

The net effect of all of the various actions and improvements has been that the event rate has dropped dramatically to near zero; the number of employee concerns not addressed by their direct management has plummeted; workers are actively involved in problem identification and resolution; and other companies began using Hanford tank farms as their benchmark for safety improvements and best practices.

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