

Safety as a Foundation for Project Success

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ABSTRACT

This paper describes the importance of safety as a foundation for success on the largest and most complex cleanup project in the DOE complex. It describes the breadth of safety considerations ranging from design of systems to prevent low probability large consequence events to the day-to-day work hazard analysis and accident prevention. We are developing many first of a kind systems for handling, treating and disposing of the nation's largest volume of stored radioactive and hazardous waste. It is stored in aging underground tanks distributed across nearly 100 square miles. The project includes the development of retrieval and transfer systems, treatment and product handling, storage and disposal. When considering safety for a project of this magnitude it is necessary to include knowledge from almost every discipline as the breadth of hazard is large. Line ownership, worker involvement, and open communication are keys to safety success.

INTRODUCTION

There are basic safety tenants that apply to all projects and it begins and ends with the minds and hearts of people. Safety must be part of everything we think and do. Engineering of safety features does not make things safe. It gives us the opportunity to achieve safety but it is people thinking and acting responsibly that protects ourselves and each other. A combination of attitude and knowledge are the keys that make things work. I can know the physical systems like the back of my hand or I can be very safety conscious but I can only expect to succeed if I have both going for me. Its kind of like opening a safe deposit box, you must have both keys to get where you want to be.

There are many types of hazards that face any endeavor. In the nuclear and chemical industries of course an important focus is on the low probability/high consequence accidents. Such events are not very likely to happen, but if they do there are unacceptable results. These are often a critical part of the design of a facility. These are accidents where future events are prevented by engineered features and operating technique. The other extreme is incidents in which the performance of an individual person or piece of equipment places people in immediate danger.

Sometimes referred to as “slips, trips and falls”. To achieve the goal of protecting against the full range of accidents or exposure to hazard, it is necessary to capture the hearts and minds of people. Thinking and properly motivated people at every step are essential to safety and project success.

LOW PROBABILITY HIGH CONSEQUENCE EVENTS

These are events that help make our industry unique and a source of public anxiety and concern. They do not happen very often but when they do there can be large environmental or human harm or property damage. In the chemical and nuclear industries these are the ones that have household names like Chernobyl, Bopal, Challenger, Columbia. There are thankfully very few of this magnitude and there is a reason. Our society values the premise that the authorities who build, operate and oversee the facilities that could create such events are highly motivated to prevent such loss. This is a valid premise and prevention starts at the very beginnings of projects or can be planned into the operation of existing facilities. For many facilities this starts with safety analyses in which the sources of hazard are postulated and prevention is designed in. This is a highly disciplined approach in which smart people think real hard about all the things that can go wrong. This is normally done through a sophisticated hazard analysis. Early in the design this can lead to design features that keep the energy sources or physical hazards under control. This is the process used by the Office of River Protection in the design of the WTP and new construction within the tank farms.

If a project is already operating and has the potential to produce high consequence concerns then the hazard analysis might lead to physical modification or operating practices to reduce risk.

The processes used at Hanford during the Cold War years to separate and refine plutonium and uranium involved the use of hundreds of different chemicals. Recent analyses have identified approximately 1,500 chemicals that are present on the site, stored in 177 aging underground storage tanks. Tank farm contractors are in the process of retrieving nuclear and chemical waste from 149 of the older single-shell tanks and transferring it into 28 newer double-shell tanks while awaiting ultimate disposal. During the waste retrieval process, tank farm workers are potentially exposed to fugitive chemical vapors that can escape from tank headspaces. Exposure assessments are underway to characterize the hazards from these chemical vapors. Uncontrolled vapor exposures could cause serious injury, illness, or even death.

The Office of River Protection and its contractors manage both existing and new facilities. Many of the hundreds of facilities operating and under construction have the capability of producing a low probability high consequence event. With over 50 million gallons of radioactive and chemically hazardous waste stored in aging facilities covering multiple square miles there are many day to day hazards to deal with. We have upgraded the safety analysis to the modern standard of a Documented Safety Analysis. This document postulates the range of things that could lead to an event and establishes Technical Safety Requirements to specify equipment and how it is to be operated to maintain safe operations. The process of preparing such an analysis is intense and requires a motivated multi-disciplined team. For the tank farms this team included safety analysis experts, engineers, scientists and operating staff with leadership from senior management dedicated to achieving efficient operations with an exceptional standard of safety.

This process is never done as the systems continue to age and safety system knowledge continues to develop. An added feature for the tank system is the fact that for several years construction has been underway inside and between the farms to develop the delivery system for Waste Treatment Plant. This new activity has resulted in unprecedented construction of new features in a radiologically contaminated area. It is relatively easy in this case to design modern, well-engineered features. However the construction activity is challenging and has led to a new level of cooperation among people to get the work done with an exceptional safety record. Construction activities in these facilities also expose workers to chemical and airborne vapor hazards that have contributed to the complexity of work.

LOWER CONSEQUENCE EVENTS

Lower consequence is only in the context of how many people or how much property is involved. If you are the one hurt or killed, the consequence may be very high. Generally industrial in nature this is the type of hazard that must be considered in virtually every job. The right mental attitude and process works both on the job and when you are doing your own thing. At issue here is physical or chemical hazard and the fragile human body. Energy may be in the form of electricity, a mechanical tool, gravity, heat, or almost anything with momentum. Chemical hazards can be toxic fumes, or any of a tremendous variety of materials that are harmful when not properly handled.

A tremendous industry has grown around the protection of people and the environment from such hazards. This has grown in complexity to the point where as an individual it can be difficult to know enough to be safe. Enter the concepts of team work and looking out for each other. Techniques have evolved for maximizing the safety of jobs where conscious attention is required. One of the most effective is the Job Hazard Analysis in which the people preparing to do a piece of work discuss the work to be done and techniques to maintain safe practice during conduct. An added feature on many jobs now is the work pause in which if a person sees something that does not seem right they can call a pause to make sure proper safety practices are being followed. This requires a culture in which any worker feels free and in fact is required to speak up knowing there will be no adverse management reaction. In fact there needs to be a positive reaction when workers alert management or each other to a potentially unsafe situation. The advanced work environment in which such practices are followed is the result of evolution in industrial practices in general and DOE in particular over the last few decades. Both cultural and programmatic concepts will be discussed in some detail.

SOME CULTURAL CONSIDERATIONS

If you have been around for a while you will remember the days when safety was not the first consideration on jobs. If you were on a logging job 50 years ago and you got hurt they would patch you up and leave you under a tree till someone was going to town. If you needed an extension cord to reach a long way you just rounded up all the cords you could find and wrap a little tape if there was some bare wire. If the cord had a three pronged ground and the receptacle did not you might have broken off the ground prong or used an adapter designed to over-ride the safety feature. If you were running a machine that had one of the early tool guards you might

take the guard off or wire it out of the way. Safety glasses may or may not have been provided or even available. Using a chemical you might not have a clue what it could do to you and you might just breathe the fumes and get it on your hands or clothes and not give it a thought. This is not unique to DOE or any other organization. There are innumerable examples throughout our history of the cultural acceptability of human and environmental harm. Most of the great achievements of man have with them a fascinating array of culturally acceptable incidents. During the first survey of India it was expected that tigers would kill some of the workers and the leader died of a disease that can now be prevented. Many of the great dams and bridges in our country have the legacy of fatalities from accidents and work environment maladies.

We have come a long way. But as with all advanced concepts, we have a way to go and must nurture constant improvement. How many of you use the same advanced safety concepts at home as you do at work. Know anybody who chopped off a toe with a power mower or got a chip in the eye or a toxic effect from a garden chemical? Cultural concepts should apply all the time. Do you consider it to be an invasion of your privacy to think this way? Have you ever talked to someone who considered it to be a challenge to their skill to require safety practices either at work or home? How do you score on this question?

Some cultural concepts have evolved to get at the core of this question. All still focused on the fundamental premise of capturing the hearts and minds of people. Culture is to the organization as personality and character are to the individual. It is important to realize that leaders can affect change to the culture, but do not define it. Leaders can show what elements of the culture are important to them by their words and actions, but it takes individuals to define the context. Organizational Culture is the sum total of the people in an organization. It is the additive effect of the group's learning and a reflection of the personnel at the individual level. Each person whether hourly or salaried, operators, technicians, engineers, designers, union represented workers, and executives all have a hand in defining the actual organizational culture.

Safety Culture is a component of an organization's values and behaviors. The leaders of the organization set the example and the personnel live by the attitude that safety is an overriding priority. In this context leaders can be senior management who have the position of authority or individuals at any level who mentor and lead by example.

A mature Safety Culture should lead to a Safety Conscious Work Environment in which there is a willingness among the workers to identify safety issues without fear of reprisal. This is a challenging level to achieve for many reasons, some of which relate to human dynamics and some related to the realities of business pressure and getting work done. It is necessary to rise above the "us and them" concepts that arise so easily in human endeavors. The DOE places a lot of emphasis in this area and specific actions within ORP will be discussed.

Achievement of a mature safety culture requires a tremendous investment of management and worker energy as it often is seen as distracting from the primary productive activity of the organization. There are a number of obstacles that must be overcome and constant vigilance is required to stay focused. There are a number of bad habits that must be overcome and constantly considered as organizations advance and backslide.

BAD HABITS AND TROUBLE SIGNS

Finger pointing is a lousy loop of lousy practice that can stifle the most advanced intentions. If this is at all accepted by the leadership, or worse, if the organization leadership engages in this or overlooks the practice it can be very difficult to achieve a higher culture of safety awareness.

Assumption rather than verification is a form of organizational laziness. Managers and supervisors should be where the work is being done so that verification becomes an ingrained element of the day to day practice. This is of course difficult when often every hour in the field adds to an already overburdened management schedule. DOE has adopted and ORP follows the practice of augmenting the time of management in the field by the application of Facility Representatives who can act as the eyes and ears of the organization. Facility Representatives are highly trained specialists who each understand specific facilities in detail. They are trained in the processes of the facilities in which they participate, with a particular emphasis on the safety features as they relate to day to day operations and the mission of the facility. This has proven to be a highly effective means of verification. Another form of verification and a major tool of a successful organization is the Design Basis. This includes the drawings, calculations, and safety analysis. If it is maintained up to date and easily retrieved the organizations ability to verify rather than assume is greatly enhanced. Of course this requires an initial and continual investment.

Does management always want to hear the truth? Can they deal with the news? Are we being overly optimistic instead of facing facts? Is the burden of proof inverted? That is if an issue is raised, is it up to the organization responsible for the work to show adequate safety margin remains or is it up to the individual to prove that the problem creates an undue risk. Facing the news and dealing with it is by far the more acceptable practice for total success. It has been proven to not be a sign of a healthy organization if workers have a perception that managers only want to hear positive reports. Managing the news can lead to disaster. It takes courage at all levels to make factual management a reality. This creates a heavy responsibility for managers to create an open environment and not punish or intimidate people for speaking out;l

It is a lot of work to continually strive for a higher level of performance. Satisfaction with the status quo is running on dangerous ground. Organizations must drop the overconfidence and strive for constant improvement. If the numbers look good, figure out why and do more of what made it happen correctly. If the numbers look bad you better get on it now. Complacency is like entropy, it is a form of dissipated energy. Don't be satisfied, but don't push so hard that you loose credibility. Striving for change requires knowing the culture and individuals of an organization.

As a parent what happens when you send mixed signals. If you speak one thing and act another you are sending mixed signals. "Walk The Talk" as it is so aptly stated. If schedule adherence is more important than doing it right, you are in mixed signal space. If workers are unsure if they will be rewarded or criticized for raising an issue you are responsible as management for a bad habit. A worker should know instinctively where they stand. Indecisiveness on the part of the guy on the front line is a bad situation looking for the wrong moment. A particularly challenging moment is when a worker is confronted with the perceived need to confront a coworker if a practice is observed that is either outside rules or standards or simply appears to be unsafe.

It must be clear to the organization that there is sincerity in the actions of top management. Bad practice cannot be fixed with whatever program is on the “Flavor of the Month” list for this period. Get everyone scheduled and trained up and everything will be just fine because I won't get those calls from Senior Management. This attitude by management is so transparent that very good techniques can be rendered unfit for causing or inspiring quality change. The people you are trying to reach can tell if you are for real or just checking a box. When applying programs to organizations it is very important to remember that management can set the stage for the right culture but they must capture the hearts and minds of smart people if change is going to happen. You don't even have to reach everyone. If the opinion leaders believe you then the path to success is open.

If issues with safety related equipment are accepted as a normal part of business and it is ok for things to not perform as designed the path to an incident is assured. Operators must have the expectation that equipment will operate as designed and if an alarm is on there is a reason. Maintenance backlogs are to be expected but the meaning of a delay must be understood and not accepted as a normal part of operations. It is abnormal and needs to be understood as such. Operating limits and safety limits are for real and entering into technically constrained operation should not be viewed as normal. This is a time when management response establishes the culture of the organization.

SOME TECHNIQUES THAT WORK

The DOE has maintained an excellent safety record for many years, due in large part to the fact that constant improvement has been a driving force. Numerous processes have been utilized and some have been sufficiently effective to be maintained and upgraded over time. The term Integrated Safety Management has become a mantra of the Department. It is a technique for imbedding safety into the way work is done and it provides ownership for correct practices in the organization responsible for the work. Safety is not the responsibility of a separate “Safety Group”. It is part of the way work is done. **NEED TO LOOK AT THE WHEEL AND ITS UPGRADE**

Both DOE and its contractors are responsible for assuring that ISM is practiced by all organizations. This is an important conceptual evolution as the safety organization is not “Watching” the work. The workers and the line organization are the owners of safety just as they are of the project itself.

This principle was borne out in the evaluation of chemical vapors. In the late 1990's the work scope in the tank farms progressed from simple caretaking and maintenance to active retrieval and remediation of the tank wastes. Early in the transition, workers began to notice an increase in chemical vapor odors, and some complained of health concerns. Workers and management worked together to craft a plan for evaluating vapors, assessing health effects, and designing ways to control vapor exposures. Key to this process was line ownership of the problem, and worker involvement in the solution.

DOE does provide significant oversight as the owner of the facilities and projects. This is accomplished by several techniques that have proven to be highly effective. Facility

Representatives are specially trained Federal staff that reside in specific facilities or projects. They understand the configuration of the facility, the work being done, safety hazards and features, and are aware of any incident or near miss. Every day they report to Senior DOE management on the status of their facility or project. Contractors are schooled in the importance of the Facility Representative and keep them well informed. This has proven to be one of the most effective oversight techniques ever instituted by DOE.

Within the past several years DOE has increased emphasis on the quality of safety oversight by developing specific safety oversight programs. This is an augment to the Facility Representative program. A key element of ORP's mission success is the utilization of expert staff that understands safety systems and Safety Management Programs necessary for the accomplishment of the mission while protecting the public, the environment and workers. Within ORP the Safety Oversight Program establishes qualification requirements and qualifies federal staff assigned these duties. The principal is to have Federal staff members that are expert on particular physical systems that are critical to the safe conduct of work and operations. Personnel assigned to oversee safety systems are highly qualified to perform assessments and investigations to confirm performance to established safety and mission requirements. ORP has determined that Safety System Oversight personnel are required for the following systems:

Tank Farm Facilities:

- Instrument and Control
- Process
- Ventilation

Waste Treatment Plant:

- Chemical Processes
- Electrical
- Fire Protection
- Instrument and Control
- Mechanical
- Nuclear Safety
- Confinement and Structural
- Ventilation

Safety System Oversight personnel augment the Facility Representatives by focusing on very specific physical and administrative features at a greater level of detail. Where the FR is responsible for a specific facility, the SSO is responsible for oversight of a specific system that may exist in multiple facilities.

SOME LEGAL CONSIDERATIONS

Key to a safety culture that works is a staff that feels compelled to participate without any fear of reprisal or intimidation. This is recognized in both Federal and state laws in case it is not adequately a part of the culture created by an organization. The DOE has instituted formal

employee concerns programs that can be utilized in many ways by people if they feel their management is not responding properly. The entire intent is to create an environment where issues are expected to be raised as they are perceived. If that environment is not thought to exist an employee can go around the management chain to higher authority without fear.

CONCLUSIONS

In order to protect ourselves from both the big and small events or accidents we need to consider how they happen and keep our focus in a manner to prevent them. Of course this can be done at many levels and the principal common factor is the action or inaction of people. In order to get people to act appropriately they need to understand the importance of protecting themselves and others.