EFCOG/DOE ISMS Safety Culture Task Team Final Report

Approved by:

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EXECUTIVE SUMMARY

In 2007, the Department of Energy (DOE) Office of Health, Safety and Security (HSS) and the DOE Integrated Safety Management (ISM) Champion Council identified safety culture as one of its top Integrated Safety Management System (ISMS)-related priorities. Through the Energy Facility Contractors Group (EFCOG) ISMS/Quality Assurance (QA) Working Group, a joint DOE/EFCOG-sponsored ISMS Safety Culture Task Team (the Team) was formed to address this issue. The Team was to identify a consensus set of safety culture principles, along with implementation practices that could be used by DOE, the National Nuclear Security Administration (NNSA), and their contractors. The Team consisted of a diverse group of senior leaders representing major DOE and NNSA contractors, subject matter expert advisors, and DOE and NNSA personnel. (Reference to DOE further in this document is intended to include DOE, NNSA, and their contractors.) The goal of this effort was to achieve an improved safety culture through ISMS continuous improvement, building on operating experience from similar industries, such as the domestic and international commercial nuclear and chemical industries.

DOE's ISMS has had a positive impact on overall performance improvement within the DOE complex since inception. However, periodic revitalization is necessary to account for new industry information and lessons learned; it is a never-ending journey. Based on extensive operating experience, certain cultural elements have been shown to have significant influence on overall operational and safety performance in various industries. These events prompted the development and refinement of various safety culture models considered by the Team. Lessons learned from related industries and organizations, such as the Institute of Nuclear Power Operations (INPO), Nuclear Regulatory Commission (NRC), National Aeronautics and Space Administration (NASA), Occupational Safety and Health Administration (OSHA), and International Atomic Energy Agency (IAEA) were evaluated by the Team, including relevant information on cultural issues from oversight and enforcement.

The primary result of the Team effort was the identification of three ISMS Safety Culture Focus Areas and Associated Attributes that are considered by the Team to offer the most impact on improving ISMS, safety, and production performance within the DOE complex. ISMS Safety Culture Focus Areas and Associated Attributes identified by the Team were:

- Leadership
  - Clear expectations and accountability
  - Management engagement and time in field
  - Risk-informed, conservative decision making
  - Open communication and fostering an environment free from retribution
  - Demonstrated safety leadership
  - Staff recruitment, selection, retention, and development

- Employee/Worker Engagement

    - Personal commitment to everyone's safety
    - Teamwork and mutual respect
    - Participation in work planning and improvement
    - Mindful of hazards and controls

- Organizational Learning
    - Performance monitoring through multiple means
    - Use of operational experience
    - Trust
    - Questioning attitude
    - Reporting errors and problems
    - Effective resolution of reported problems

The following basic process is suggested by the Team for each organization that embarks on the process of improving its safety culture:

1. Review the Safety Culture Focus Areas and Attributes.
2. Assess these Safety Culture Focus Areas and Attributes to identify specific improvement targets and associated behavior expectations.
3. Apply selected tools to address improvement opportunities and develop competence in desired behaviors through training, coaching, and practicing.
4. Reinforce the new behaviors and underlying values resulting in improved performance.

The Team developed documents for use in assessing and improving safety culture assessment, which are available on the EFCOG ISMS/QA Working Group Web page. The products of the Team are intended for elective use by DOE contractors. A 1-year evaluation period provided an opportunity to collect field experience, share information, and collect success stories and lessons learned. All comments and feedback collected over the evaluation period were evaluated for inclusion in the final set of recommendations.

A key recommendation of the Team is to continue complex focus on this effort through a new EFCOG safety culture subgroup. This group should be able to provide a forum to share lessons learned, interface with DOE, and generate new activities and documents to proactively improve safety culture.

TEAM REPORT

Background - Building on ISMS Continuous Improvement

ISMS has had a positive impact on overall improvement within the DOE complex. However, periodic revitalization is necessary to account for new industry information and lessons learned; it is a never-ending journey. When an organization with a strong safety culture implements ISM, one can expect a significant, additional reduction in important organizational events, providing an added margin of safety to the workers, the public, and the environment.

Several years ago, a number of industry events resulted in the issuance of the Defense Nuclear Facilities Safety Board (DNFSB) Recommendation 2004-1. In response to this recommendation, DOE issued an ISMS Manual, which included new supplemental safety culture elements. These safety culture elements were intended to capture lessons learned from various industry events and experience. Initially, DOE only held itself to the new principles with the intent of reviewing that effort and potentially extending them to the contractors as well. Based on review of external operating experience and internal DOE complex performance data, as well as the supplemental safety culture elements, a compelling case exists for applying these new safety culture characteristics across the complex in order to provide a significant positive impact to overall effectiveness of ISMS.

Team Purpose

The goal of the Team was for DOE to achieve an improved safety culture through continuous ISM system improvements, building on operating experience from similar industries, such as the domestic and international commercial nuclear and chemical industry. The Team's objective was to identify a consensus set of safety culture principles, along with effective implementation practices that could be used by DOE and its contractors.

Implementation practices identified by the Team are intended to proactively enhance leadership, employee/worker engagement, and organizational learning consistent with ISM Guiding Principles and the latest safety improvements in the commercial nuclear industry (INPO), IAEA, high reliability organizations, and DNFSB Recommendation 2004-1. These enhancements are intended to apply to DOE, as well as contractor personnel.

The Team

The team consisted of a representative group of senior contractor and DOE and NNSA personnel. The team was co-chaired by DOE and contractor personnel. Team members were:

Executive Sponsors:	**Department of Energy Participants:**
Glenn Podonsky, DOE/HSS	Earl Carnes, DOE/HSS
EFCOG Executive Sponsor	Dae Chung, DOE/EM
Dave Amerine/Parsons;	David Compton, DOE/HSS

Al Konetzni/Energy Solutions	
Project Co-Chairs	Ali Ghovanlou, DOE/HSS
John McDonald, WRPS	Frank Russo, NNSA
Pat Worthington, DOE/HSS	Jim McConnell, NNSA
	Todd Lapointe, DOE/CNS
Contractors Participants:	Bill Roege, DOE/HSS
Norm Barker, EnergySolutions	Steve Krahn, DOE/EM
Todd Conklin, LANL	**Outside Observers:**
Frank McCoy, WGI	George Mortensen, INPO
Joe Midgett, Bechtel	Douglas Minnema, DNFSB
Jim Tarpinian, Battelle	Wayne Frazier, NASA
Gail Walden, Fluor	
David Zeff, B&W	**Additional Support Personnel:**
Bob Brandhuber, Sandia Lab	Bill Rigot, Fluor/SRNS
Roy Schepens, Parsons	Rick Hartley, B & W
	Wyman Nettles, EnergySolutions
	Kent Fortenberry, Parsons

Vision Statement

In order to guide its efforts, the Team developed a vision of what its end-state goal was for the DOE complex. The Team goal was:

> *DOE and its contractors are leaders in achieving ISM excellence including safe, reliable performance and a strong safety culture. Through ISM, the principles and attributes of a strong safety culture are communicated, understood, embraced, and continually reinforced. As a result, mission critical parameters show continuous improvement.*

Safety Culture Definition

The Team noted that there are multiple definitions of safety culture although most of those definitions capture similar fundamental concepts. The Team adopted the following definition:

> *An organization's values and behaviors modeled by its leaders and internalized by its members, which serve to make safe performance of work the overriding priority to protect the workers, public, and the environment.*

Case for Improvement

Recent industry experiences have clearly demonstrated that the safety culture is an important element in overall performance improvement. As a result, DOE contractors should proactively improve safety culture in performing the mission work. Such proactive response by contractors provides an excellent opportunity for stronger ownership of improvements and potentially reduces the need for stringent regulations. The Team believes that voluntary, proactive pursuit of excellence is preferable to regulatory approaches to address safety culture because it is difficult to regulate values

and behaviors. DOE is not currently considering regulation or requirements relative to safety culture. DOE remains committed to using ISM as its safety framework for assessing and improving safety culture. EFCOG provides an effective forum for contractors to collaborate and strengthen the overall safety culture within the Department.

To provide common themes for DOE and contractors to use in their efforts to improve safety culture, the following drivers were identified by the Team:

- Weaknesses in safety culture have led to major industry events.
- There is a correlation between cultural maturity and organizational performance.
- There is a strong positive correlation between mission and safety performance.
- DOE data identifies culture elements as significant aspects of recent operational incidents.
- Some major events occurred following a prolonged period of "improved" safety performance similar to what has been experienced across the DOE complex.
- Safety culture activities are closely aligned with the existing ISMS.
- Safety culture improvement is a DOE ISM priority.
- ISM is working and has had a positive impact on improving performance. This effort should take ISM to the next level by learning from the experience of others.
- This is a proactive initiative that captures operating experience, both within DOE and outside of DOE, since ISM was first developed.
- DOE is not seeing the consistent level of safety performance across the complex. There is a desire for the DOE complex to be best in class.
- DOE complex events include cultural issues and support the case for improvement.
- A compelling case exists for adopting safety culture characteristics within the DOE complex, which would have a significant positive impact on mission performance and safety.
- Recognized and existing safety culture models, such as those used by IAEA and INPO, heavily influenced the final product. The supplemental safety culture elements recently added to the DOE ISM Manual also were a significant source document for the team.
- The products are expected to apply to DOE, as well as contractors.
- The focus of this effort is on leadership, employee/worker engagement, and organizational learning because those characteristics seemed to address most of the gaps between the current ISMS implementation and a mature, fully developed safety culture.
- Tangible versus abstract deliverables are the desired products with observable and/or measurable characteristics.
- Culture improvements take time, often 3-5 years, to achieve lasting changes in behaviors and underlying values. Culture improvement is a never-ending journey, not a project with a start and end point. Sustaining a strong safety culture requires ongoing attention and investment.

Safety Culture Focus Areas and Associated Attributes

The following focus areas and attributes were identified by the Team within the existing ISMS framework. They attempt to define clear behaviors and visible actions as opposed to attitudes or philosophies that would be difficult to observe, measure, and assess. Each of them will be tied to existing ISMS guiding principles and safety culture elements. The Team did not attempt to provide new formulation for these attributes, instead decided to use what already existed. A crosswalk between these focus areas and attributes and ISMS attributes contained in the ISM manual is included in the associated EFCOG documents. Safety Culture Focus Areas and Associated Attributes identified by the Team are:

- Leadership
  - Clear expectations and accountability
  - Management engagement and time in field
  - Risk-informed, conservative decision making
  - Open communication and fostering an environment free from retribution
  - Demonstrated safety leadership
  - Staff recruitment, selection, retention, and development
- Employee/Worker Engagement
  - Personal commitment to everyone's safety
  - Teamwork and mutual respect
  - Participation in work planning and improvement
  - Mindful of hazards and controls
- Organizational Learning
  - Performance monitoring through multiple means
  - Use of operational experience
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  - Questioning attitude
  - Reporting errors and problems
  - Effective resolution of reported problems

ISMS Related Safety Culture Improvement Activities

Contractors and DOE line managers are responsible for establishing and maintaining an effective ISMS. A safety culture will not improve without additional efforts by management. Therefore, management has responsibility and discretion in the way they manage a safety culture at a particular facility. As with processes for problem identification and resolution, the choice of tools and its usefulness will depend on several factors, including the size of the organization and the complexity and hazards of work activities.

It is important to periodically assess organizations to identify enhancements or adjustments that could improve the safety culture. Various activities can be used to assess an organization's safety culture. These include assessments, interviews, surveys, and leading/lagging performance indicators. These assessment methods can be used together or individually. Some of the practices to improve safety culture may not be practicable or appropriate for every contractor or DOE organization, depending on the existing work environment and/or the size, complexity, and hazards. For example, some

of the practices may not be applicable for organizations that have only a few employees or a very simple management structure. In such organizations, more informal practices may be appropriate. In addition, other practices not included in this document may be more effective and should be considered.

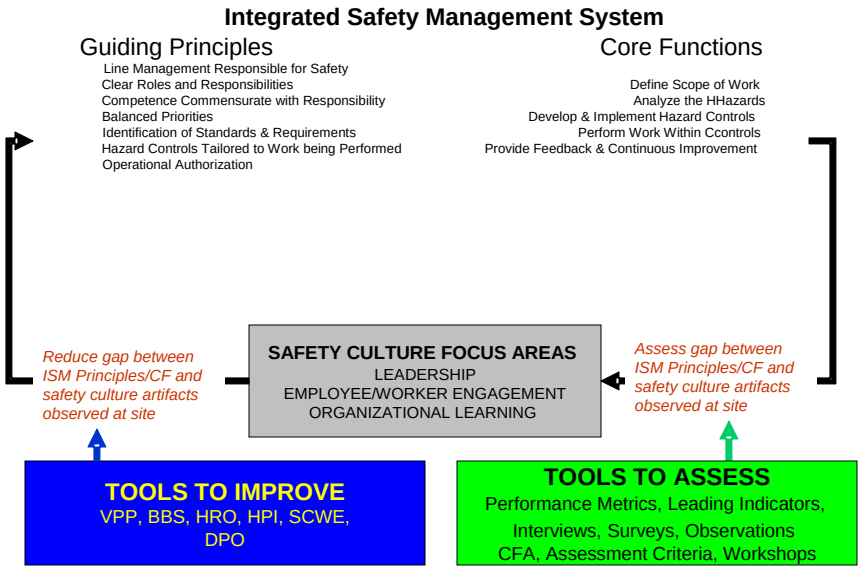
The Team identified three focus areas that were judged to have the most impact on improving safety and production performance within the DOE complex: Leadership, Employee/Worker Engagement, and Organizational Learning. For each of these three focus areas, the Team identified related attributes. The following process is suggested by the Task Team for each organization to assess its safety culture:

1. Review the Safety Culture Focus Areas and Attributes in the EFCOG documents described below.
2. Review the ISM Guiding Principles and Supplemental Safety Culture Elements identified in attachment 2 of the ISM Manual (DOE M 450.4-1).
3. Assess the Safety Culture Focus Areas and Attributes. An assessment of safety culture, using methods such as those discussed in the EFCOG documents, would likely involve a combination of direct observations, review/assessment of key safety culture-related processes, performance indicator monitoring and trending, surveys and/or interviews, and facilitated safety culture workshops.

Several EFCOG documents were prepared to provide guidance on assessing and improving safety culture. The first document provided guidance on assessing safety culture. A second document addressing implementation of this initiative was also developed. Typical implementation activities included in this implementation document are use of existing safety programs, such as VPP, senior management communications, culture-related training, and use of behavior change to change culture. These documents are available on the EFCOG ISMS/QA Web site.

The figure below illustrates the general approach of assessing safety culture and deploying various tools to improve that safety culture.

Continuous ISMS Improvement Through Strengthening Safety Culture



DOE/EFCOG Illustration of the Mechanics of Improving/Maintaining Safety Culture

Figure Description:

- The upper part shows the ISM Guiding Principles and core functions. These principles and their related attributes suitably describe a healthy safety culture.
- The gray box shows the three safety culture focus areas identified by the Team. These are not meant to be a new representation or definition of ISMS, but rather three areas in which to focus additional attention within ISMS specifically regarding safety culture.
- The green box shows examples of tools for assessing safety culture. The assessment of safety culture is not well established throughout the DOE complex, so areas needing improvement in achieving a healthy safety culture are not known. To address this, the DOE/EFCOG Task Team developed a suggested model for assessing safety culture.
- The dark blue box shows examples of tools for improving safety culture. These tools are well known throughout the DOE complex, and ample guidance, references, and best practices are available for implementing these tools.
- Completing the description of the Figure, the cycle continues with the idea that routine assessment (green box) followed by corresponding adjustments or corrections using the tools (dark blue box) should result in continuing improvement in safety culture and ISMS.

Implementation Activities

Implementation activities were intended to maximize line management ownership, both with contractors and DOE, and key stakeholder involvement. Implementation of this task required regular communication with key stakeholders and inclusion by those who will implement the products of the Team. Key stakeholders included the EFCOG Executive Council, contractors, DNFSB, and senior DOE management. The Team was also selected from a cross section of senior DOE contractors and DOE personnel who also regularly communicated progress to their respective organizations, as well as built increased ownership.

Lessons learned from other organizations, such as INPO, NRC, NASA, and IAEA were identified, including relevant information from oversight and enforcement around culture issues. A similar effort to implement safety culture elements conducted by INPO was introduced over a 1-year comment period with later issuance of a final document. A similar approach was adopted by the Team. A 1-year pilot was employed with multiple volunteer DOE contractors to gain insight and lessons learned before final recommendations were made.

Pilot Summary Results

The implementation practices identified by the Team were used voluntarily in a 1-year pilot by multiple DOE contractors. Comments and feedback were collected over the pilot period and factored into the final recommendations. This effort also included input from contractors, DOE, union organizations, and experienced external organizations to provide the best possible product.

Feedback from the pilot facilities includes the following comments:

- Culture change starts at the top; management change at the beginning is probably most important.
- This is a long journey, there is no easy fix; but it is a worthwhile journey with potential high payback.
- There is a need to share lessons learned and provide an ongoing discussion forum.
- One size does not fit all; smorgasbord approach is good; difficult to write an exact cookbook for improving culture.
- Lots of employee and management involvement and engagement is needed.
- This pilot was used by multiple facilities to attempt to reach breakout performance
- If possible, it is good to build culture activities into existing processes.

The Team has made considerable progress within the last 2 years in understanding issues involving these activities, but additional time is needed to communicate these issues to others involved.

- **Final Team Recommendations**

While there is much yet to be done, the Team recommends ending the Team based on accomplishing its mission and objectives and then charter a new EFCOG ISMS/QA subgroup to continue the work started by the task Team. DOE would be able to easily participate in this forum. The original charter of the Team was met. Safety culture

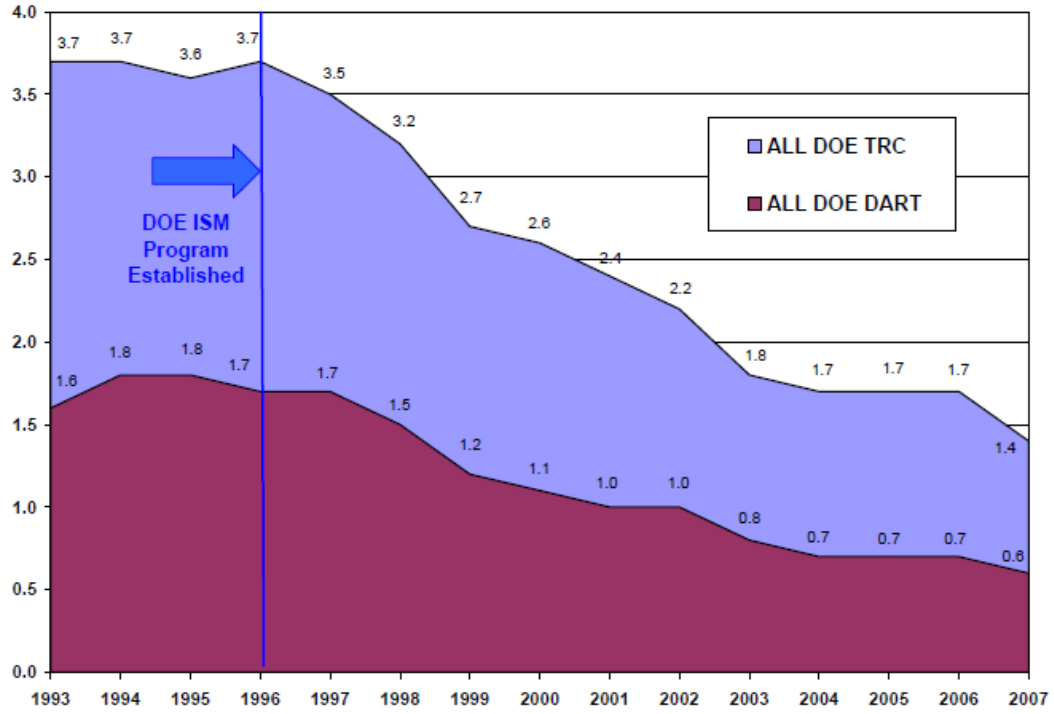
attributes have been developed and EFCOG guidance documents created. The material was piloted by a number of facilities for 1 year. Much more effort will be necessary to continue to move the DOE complex towards a mature safety culture. The purpose of such effort is to develop an environment where DOE can encourage excellence in operations (integrated with ISMS) and strive for excellence versus compliance.

As part of this effort, EFCOG should consider some type of culture assessments with peer evaluators at major facilities. A communication plan should also be developed to make sure the DOE complex is aware of the results of this effort. .

SUPPORTING MATERIAL

Positive Impact of ISMS

As illustrated below with industrial safety rates, there is a positive correlation between ISMS and DOE complex-wide industrial safety performance since it was introduced in the mid 1990s. Similar indicators exist for nuclear and chemical safety and environmental protection. The ISMS has proven that it is a comprehensive and effective program to ensure work is conducted safely. It has been endorsed and embraced by every DOE Secretary since originally established and is widely accepted throughout the DOE community as the foundation for performing work safely. (At the present time, DOE indicators focus on industrial safety and health. We do not yet have measures of overall system safety; however, this is an objective of the current DOE safety goals.)



Positive Impact of ISMS

Weaknesses in Safety Culture have Led to Major Industry Events

Based on extensive, external operating experience, certain culture elements have been shown to have a significant influence on overall operational and safety performance in various industries. Formal reviews of every major event going back to the Three Mile Island (TMI) accident have identified safety culture elements as significant factors in the events. Examples of events with major cultural aspects include the TMI accident, Chernobyl accident, Davis Besse head corrosion, *Challenger* and *Columbia* space shuttle events, and the British Petroleum Texas City explosion. These and other events prompted the development of various safety culture models considered by the Team.

On February 1, 2003, the Space Shuttle *Columbia* burned up on atmospheric re-entry killing all seven members of its crew. The physical cause of the loss of *Columbia* and its crew was a breach in the Thermal Protection System on the leading edge of the left wing caused by a piece of insulating foam that separated from the left bipod ramp of the External Tank after launch. During re-entry this breach caused failure of the wing and breakup of the Orbiter.

On March 5, 2002, a cavity with a surface area of approximately 20- to 30-square inches was found in the reactor pressure vessel (RPV) head at the Davis-Besse Nuclear Power Station. This cavity was caused by cracking of an RPV head penetration nozzle, leakage of primary coolant water through the cracks, and subsequent corrosion of the carbon steel RPV head by boric acid in the water. Had the cavity not been found by chance while repairing the cracks in the nozzle, subsequent operation of the reactor would likely have resulted in a loss-of-coolant accident.

Major investigations were conducted following both events, which concluded that beyond the material failures which directly caused these events significant organizational, process, and personnel contributors existed. Sample safety culture issues from these events that have applicability to DOE include:

- Operating Experience: People and organizations need to learn valuable lessons from internal and external operating experience to avoid repeating mistakes and to improve operations.
- Mission and External Influences: Budget and schedule pressures must not override safety considerations to prevent unsound program decisions.
- Normalizing Deviations: Routine deviations from an established standard can desensitize awareness to prescribed operating requirements and allow a low-probability event to occur.
- Technical Inquisitiveness: To ensure safety, managers need to encourage employees to freely communicate safety concerns and differing professional opinions.
- Focus on Planning and Prevention: Safety efforts should focus more on planning and preventive actions rather than investigations and corrective actions resulting from accidents or events.
- Self-Assessment and Oversight: Successful operations require critical self-assessment and oversight to find problems.
- Organization Staffing and Qualification: Robust technical capability, enhanced through ongoing technical and leadership training, is essential for complex operations.
- Corrective Action Programs: Corrective actions that address the underlying causes of problems must be managed to resolution and verified to be effective.
- Complacency: Management must guard against complacency brought on by good performance metrics and past successes.

Similarly, safety culture played a role in an event at the Tooele Chemical Agent Disposal Facility, an incinerator that destroys chemical agents. During a GB (Sarin) nerve agent campaign on July 15, 2002, maintenance workers, wearing insufficient personal protective equipment (PPE), received an unplanned exposure to GB. One worker exhibited 25 percent reduction in blood cholinesterase levels and several symptoms of exposure. Five hours elapsed until site personnel were able to remove agent contamination. The individuals survived but symptoms persisted for more than a week. Subsequent investigation identified:

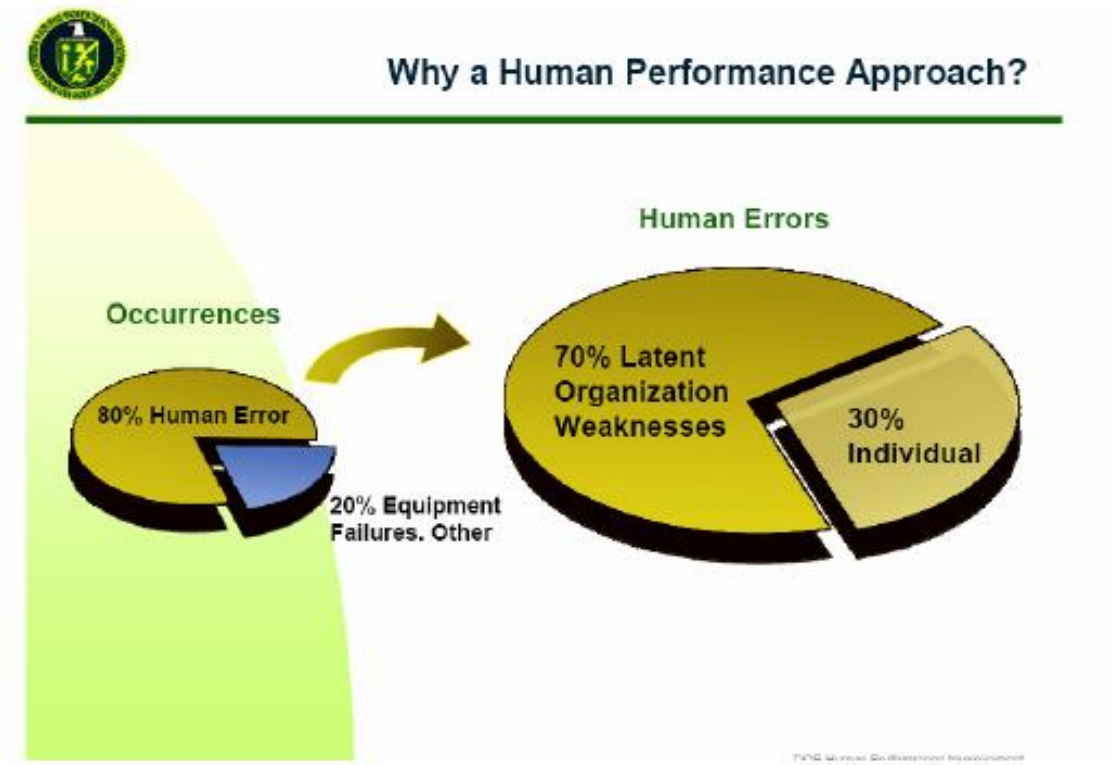
- A poor safety "culture;" the mindset of workforce favored safety shortcuts; exposure to nerve agent was considered a badge of honor.
- Poor work planning; nonexistent lessons-learned program; few policies and procedures existed, and those that did were weak and not enforced.
- Compliance with permit requirements was the main driver, even when it caused entry into contaminated demilitarization cells.

It behooves the DOE community to learn from low-probability, potentially high-consequence events in hazardous technology industries. The above events were all examples of highly visible, major events where safety culture weaknesses have been identified as fundamental contributors. Failure to take notice and learn from these relevant events in other industries would be a failure of leadership and an invitation to similar major events in the DOE community.

Complacency and Events

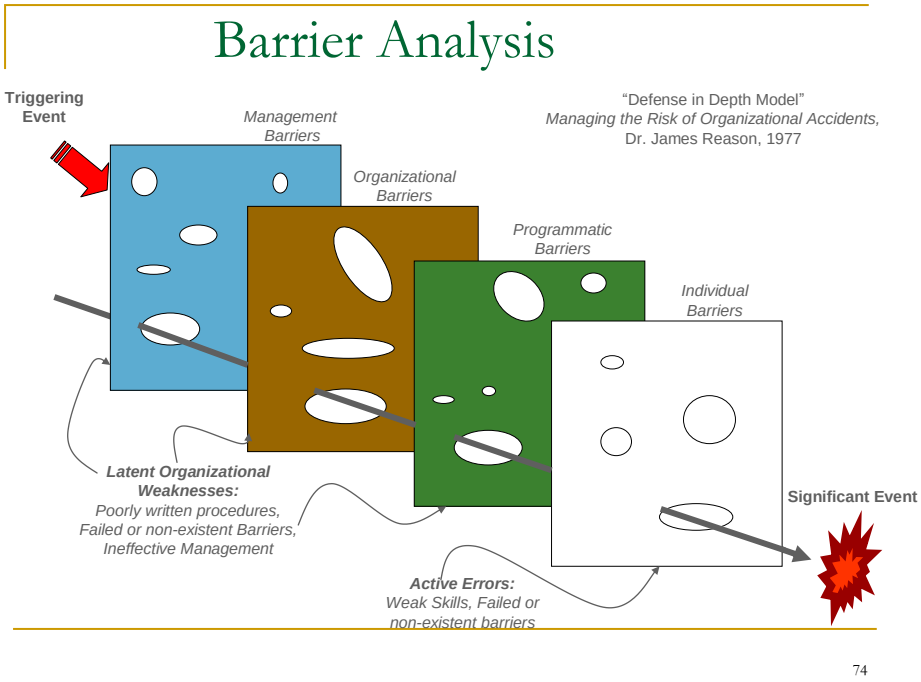
On March 23, 2005, the British Petroleum (BP) Texas City Refinery suffered one of the worst industrial disasters in recent U.S. history. Explosions and fires killed 15 people and injured another 180, alarmed the community, and resulted in financial losses exceeding $1.5 billion. Industrial safety performance was improving prior to this event. This event shows that past industrial safety performance is not an adequate indicator of current process safety performance. Although actions or errors by operations personnel at the BP Texas City site were the direct causes of the accident, numerous latent conditions and safety system deficiencies at the refinery influenced its actions and contributed to the accident. These safety system deficiencies created a workplace ripe for human error to occur. Examples of cultural issues that were factors in this event include:

- Ineffective safety culture leadership and oversight.
- Safety implications of major organizational, personnel, and policy changes were ineffectively evaluated.
- Inadequate resources; budget cuts impaired process safety performance.
- Ineffective reporting and learning culture; reporting bad news was not encouraged. Incidents were often ineffectively investigated and appropriate corrective actions not taken.
- Management did not model or enforce the use of up-to-date plant policies and procedures.
- Operators were inadequately supervised and not supported by experienced, technically trained personnel during unit startup, an especially hazardous phase of operation.



This figure depicts results from commercial nuclear power events (which are similar to DOE event data) that reveal that 80 percent of events involved human errors. Of this, 70percent (or 56 percent of all events) were attributed to latent organizational weaknesses and 30 percent (or 24 percent of all events) to individual error. This figure shows that management and leadership practices and weaknesses in an organization can affect the occurrence of events. Management and leadership practices frequently have cultural aspects to them.

Events typically do not have a single cause, but many. They frequently involve the breakdown of many defenses. In addition to common defenses one might think of, such as adherence to procedures and equipment design, organizational and management defenses must fail as well. Many, or most, of the defenses have cultural aspects to them, such as organizational emphasis on production over safety or influence of external pressures on internal decisionmaking. The concept of multiple defenses with corresponding influence of cultural elements has been developed in high risk industries for years with academic research to support the concept.



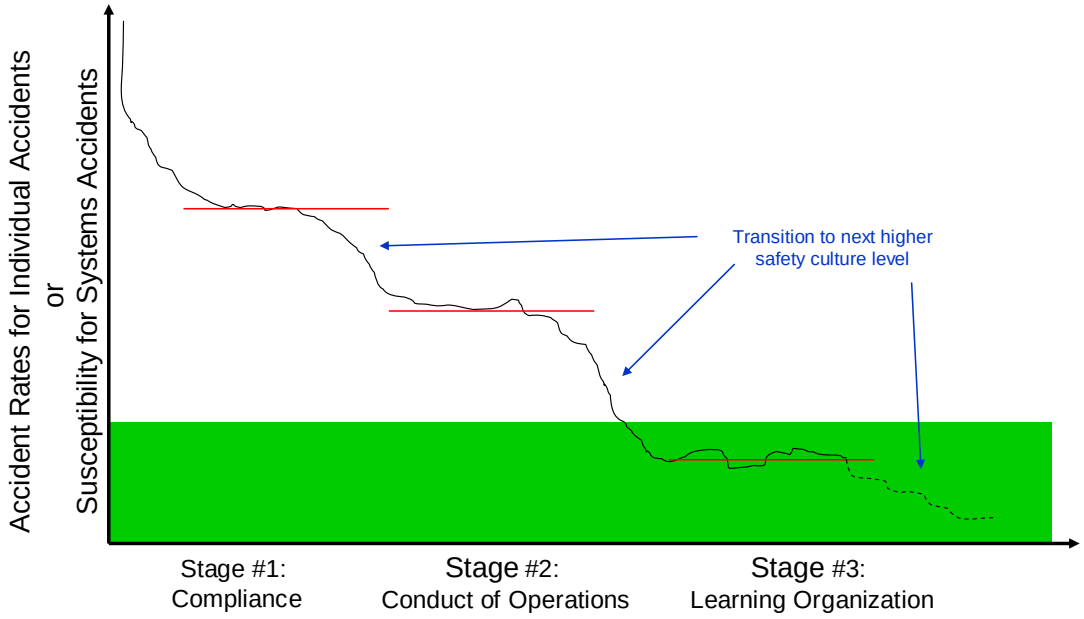
This figure shows how the failure of multiple defenses in particular circumstances must align at the same time when events occur. Breakdowns of major defenses frequently have cultural elements to them, which lead to, or cause, the events.

A chief benefit of safety culture improvement is the greatly increased leverage on an organization's ability to find and fix latent organizational weaknesses, flaws in defense systems, and error traps through the creation of a true learning organization.

Cultural Maturity and Organizational Performance

The IAEA developed a conceptual model that illustrates the stages an organization goes through in achieving a mature safety culture. These stages are important to this effort, because the goal is to achieve mission excellence. Stage 3 attributes are the intended product of the Team. In Stage 3, the organization has adopted the idea of continuous improvement and applied the concept to its safety performance. As the safety culture matures, the accident rates for individual accidents or the susceptibility for the system accident decreases with corresponding improvement in mission performance. Each of the three stages are shown in the following graph, which attempts to figuratively demonstrate that as the safety culture matures (goes to a higher stage), the accident rates for individual accidents or the susceptibility for the system accident decreases.

Improvements in Safety for Each Stage of Safety Culture Maturity



Moving through different stages of safety culture development to Stage 3 will help the DOE complex achieve ISMS excellence.

After an organization is successful at a particular stage of safety culture maturation, it may observe a leveling off of safety improvement; thus, requiring additional effort to transition to the next highest level. Organizations will likely be able to recognize the characteristics of more than one stage at any given time. Organizations can also lapse in their efforts and degrade their safety culture to a lower level if concerted effort is not maintained every day. These stages are:
Stage 1. Compliance. The organization sees safety as an external requirement and not as an attribute that will help the organization to succeed. The external requirements are those of national governments, regional authorities, or regulatory bodies. There is little awareness of behavioral and attitudinal aspects of safety performance, and no willingness to consider such issues. Safety is seen very much as a "necessary evil" and as a hindrance to production. Mere compliance with rules and regulations is considered adequate.

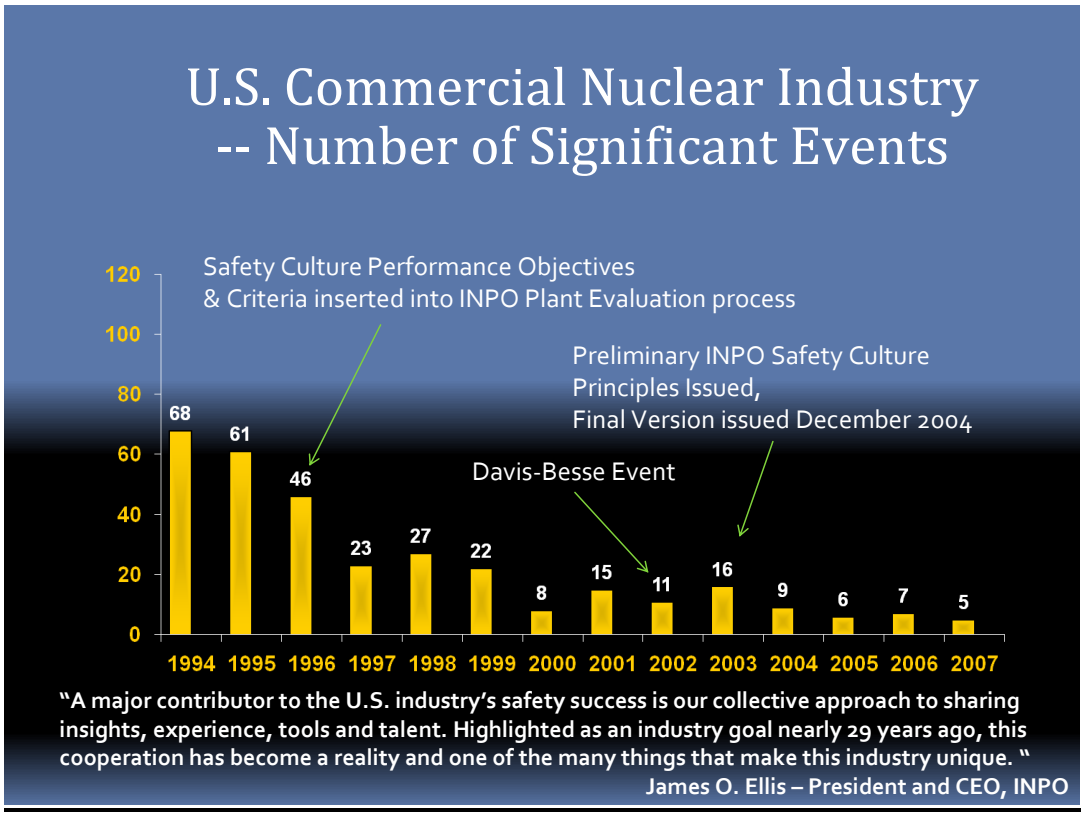
Stage 2. Conduct of Operations. An organization at Stage 2 has a management that perceives safety performance as important even in the absence of regulatory pressure. Although there is growing awareness of behavioral issues, this aspect is largely missing from safety management methods, which comprise technical and procedural solutions. Safety performance is dealt with, along with other aspects of the business, in terms of targets or goals. The organization begins to look at the reasons why safety performance reaches a plateau and is willing to seek the

advice of other organizations. At this stage, the focus is on "how to" best practices, such as "conduct of operations" best practices.

Stage 3. Learning Organization. An organization at Stage 3 has adopted the idea of continuous improvement and applied the concept to safety performance. There is a strong institutional value placed on communications, training, management style, and improving efficiency and effectiveness. At this stage, strong safety leadership is evident, along with a personal commitment to safety, by each individual in the organization. At this stage, the organization seeks full participation of managers and workers in pursuit of continuous improvement in both safety and reliability; it is a learning organization. Stage 3 is similar to the stage envisioned by the Team where the DOE complex should aspire to be.

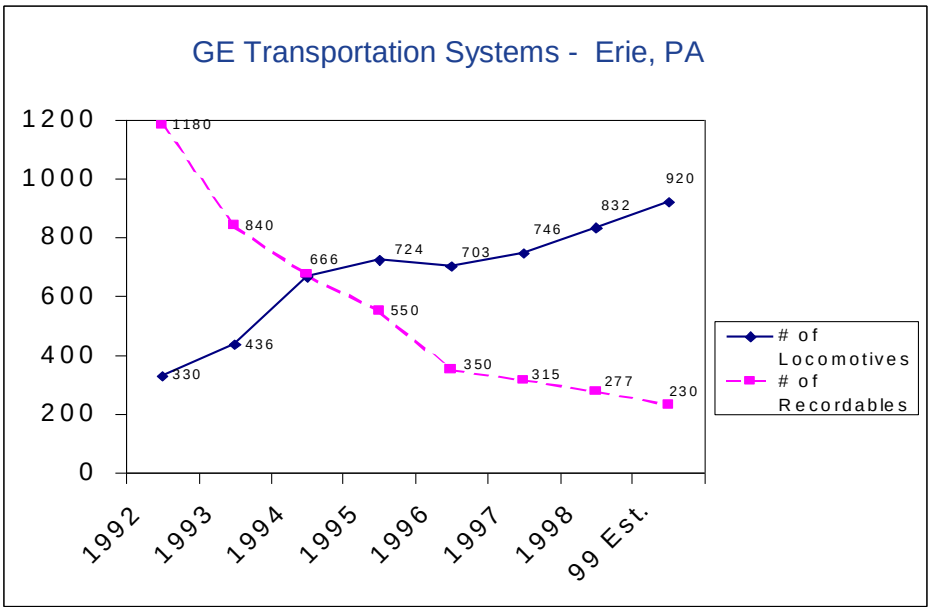
Strong Positive Correlation Between Mission and Safety Performance

Safety culture has a significant impact on organizational issues, which influence individual behavior in the organization. INPO has concluded that safety culture has a significant impact on improving safety. In turn, safety performance has had a direct impact on mission or operational performance in the commercial nuclear industry. As an example, INPO has developed safety culture attributes for use in the commercial nuclear power industry with impressive results, which can be seen in the figure below. Corresponding improvement in safety directly correlates with across the board improvement in various indicators of plant operational performance. INPO recognized the need for safety culture principles that included emphasis on leadership and continuous improvement. An example is recognition of fairness related to the identification and resolution of human performance problems and distinction between honest mistakes and intentional shortcuts with respect to discipline. This approach can result in positive benefits such as free flow of information across all levels of an organization and high level of self-reporting at lower thresholds in the organization. Open communication and reporting helps assure that events with minor consequences are being evaluated and addressed before events with more significant consequences occur. The IAEA has used a similar approach.



The above figure shows that a focused emphasis on safety culture principles did not occur until after the Davis-Besse event in 2002 in the domestic commercial nuclear industry. Performance improvement was noteworthy prior to Davis-Besse as INPO began assessing plants using safety culture performance objectives. After the Davis Besse event, they concluded that to take performance to the next level and avoid events like this they needed to focus on safety culture improvement. Continuing improvement is noted since 2003 as INPO safety culture principles were issued.

Productivity vs Recordable Injuries



imagination at work

The figure above shows the relationship between improved safety performance and improved production at a General Electric locomotive facility. This graph is a typical relationship that has been observed by various industries. (Used with permission of GE.)

The strong correlation between good safety performance with good mission performance (or productivity or reliability) has been observed in many different contexts, including industrial, chemical, and nuclear operations. The reasons behind this strong correlation are many and include the following: (1) an organization that excels at attention to, and satisfaction of, work-related requirements can do so regardless of whether the requirements relate to safety, quality, schedule, or mission; (2) strong safety performance can preclude facility shutdowns as a result of accidents or safety concerns and, thereby, avoid associated negative impacts on mission performance; (3) demonstration of leadership and organizational core values for worker health and safety, as well as public health and safety, can garner increased worker commitment and efforts toward mission accomplishment for the organization; and (4) the same human principles related to learning and continuous improvement of safety performance (such as communications, trust, questioning attitude, modeling, worker engagement, learning from experience, etc.) also apply to learning and continuous improvement of mission performance.

Impact of Culture on DOE Events

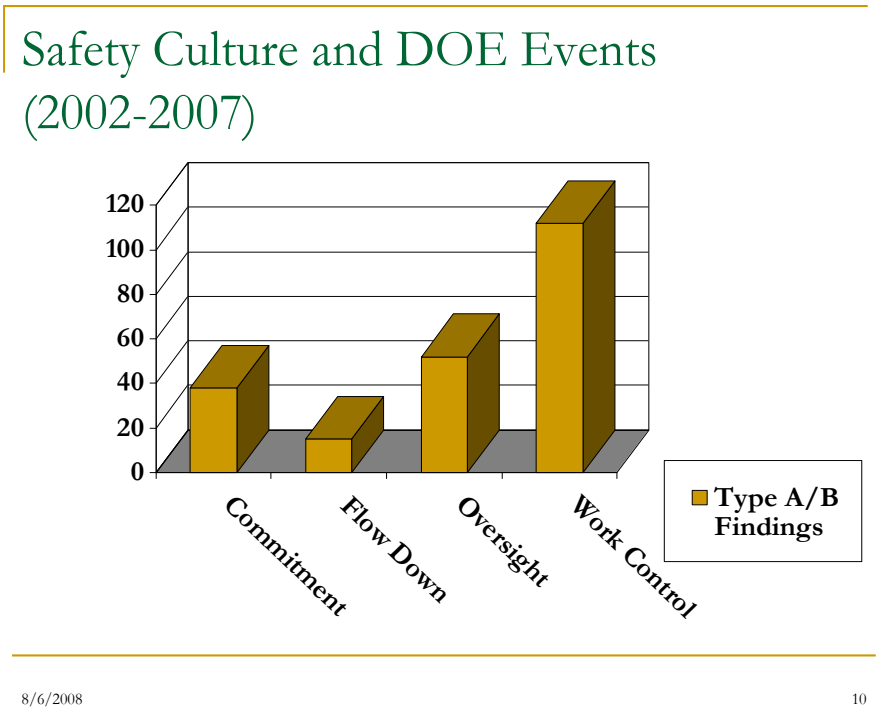
Within DOE, the Team reviewed DOE occurrence reports for the last several years, specifically Categories 1, 2, and R reports. The cause codes were examined for causes relevant to the forces that either shape (Management) or define (Human Performance) culture in the organization. The task group concluded that:

- Management and Human Performance issues make up the majority of the primary causes of Categories 1, 2, and R Occurrence Reporting and Processing System (ORPS) events
- Almost every Category 1 and R ORPS events has a cause tied to Management or Human Performance
- A "Strong Safety Culture" should lead to a reduction in ORPS Categories 1, 2, and R events

The Team also reviewed the causes of the events leading to Type A and Type B investigations for the years 2002–2007. There were 22 investigations issued during this time period that were available for review, and each the root and contributing causes were evaluated that the affected process areas (e.g., work management, hazards analysis) were determined. On this basis it was found that there was a:

- Low correlation between ISM contractual commitments and accidents
- High correlation between less than adequate (LTA) commitment to ISM and accidents
- High correlation between LTA oversight and accidents
- High correlation between LTA hazard analysis, training, work procedures, and implementation of work procedures and accidents

The common theme for the areas that are highly correlated with accidents is a lack of a learning organization. Less than adequate commitment to ISM, implementation of ISM core functions, and oversight are the primary areas that require focus for culture change to occur. Review of number, type, and causes of significant events within the DOE complex indicates DOE and contractors need to focus on safety culture as a common way to improve overall performance. Safety culture-related issues have been present in significant DOE events.



Safety culture-related issues have been present in significant DOE events.

The number, type, and causes of significant events indicate DOE and contractors need to focus on safety culture as a key common cause to reduce the number and significance of events. By improving safety culture, DOE and its contractors will:

- Improve the safety and work environment for their employees
- Reduce the number of safety-related events
- Increase operational performance
- Reduce the cost of operating the facilities

Given that it takes years to develop and change safety culture, a common set of principles that all DOE organizations can agree to and focus on will improve consistent complex-wide performance and prevent backsliding when management changes occur.

Communication with Stakeholders

Key stakeholders were identified, which were DOE ISM Champions, DNFSB and staff, EFCOG member management/Executive Council, and EFCOG ISMS Working Group participants. A DOE executive steering committee was established, which ensured high-level buy-in by DOE prior to issuance of the final documents. The EFCOG Executive Council provided contractor oversight. The EFCOG Executive Council was updated at each meeting during Team deliberations on the status of the task team and to bring back any feedback to the Team. This ensured high-level contractor buy-in.

Certain forums were targeted to update stakeholders to provide an efficient means to communicate status, such as:

- DOE ISM Champions workshops
- EFCOG Executive Council meetings
- ISMS Program Management and Integration Subgroup meetings
- DNFSB and DNFSB staff
- DOE senior leaders

Building Commitment

Building "concentric" commitment was determined to be the most efficient way to approach this effort with greater certainty of success and sustainable change. This approach is based on gaining commitment from key decision makers first. Commitment is then gained in stages as a function of stakeholder influence within the complex. This is being accomplished by:

- Socializing the objectives and approach at ISM Champions' workshop
- Gaining EFCOG Leadership commitment
- Obtaining the DOE Secretary's support through Glenn Podonsky, HSS
- Identifying and educating the change agents in our organizations
- Identifying and influencing the detractors
- Informing contractors and industry change agents.

Building "Concentric Commitment"

1-Year Pilot Activity

For facilities and organizations participating in the 1-year pilot, participation expectations were:

1. Management commitment to assess and improve safety culture, using EFCOG/DOE methodology as a guide.

2. Performance of some assessments of safety culture during upcoming year to identify safety culture improvement targets.

3. Identification and initiation of some improvement activities based on targets identified by assessments.

4. Willingness to provide feedback to EFCOG/DOE on the safety culture assessment/improvement approach.

Pilot facilities were to review, understand, and implement these proposed activities within their facilities and organizations, as appropriate. The following organizations volunteered to participate in this effort:

- Washington River Protection Solutions, LLC
- Argonne National Laboratory
- Idaho National Laboratory
- B & W Pantex
- Oak Ridge Transuranic Waste Processing Center
- Washington Closure Hanford
- Pacific Northwest National Laboratory

Implementation Plan

A number of activities occurred over the life of the task Team. The table below summarizes what was accomplished by the Team. All activities have been completed.

Action	Responsibility	Date/Status
Task plan developed	McDonald/Worthington	Complete
Establish Task Team	McDonald/Worthington	Complete
Kickoff Meeting	McDonald/Worthington	Complete
Brief EFCOG Board	Amerine	Complete
Brief DNFSB Staff	McDonald	Complete
Brief DNSFB	McDonald/Worthington	Complete
March Task Team Meeting	McDonald/Worthington	Complete
June Task Team Meeting	McDonald/Worthington	Complete
July Task Team Meeting	McDonald/Worthington	Complete
Conduct Contractor Workshop	McDonald	Complete
Present Status in Idaho DOE ISMS	McDonald	Complete
Draft Implementation Document	McDonald	Complete
Task Team Meeting	McDonald/Worthington	Complete
Brief EFCOG Executive Council	Amerine	Complete
Contractor Meeting at EFCOG ISM WG	McDonald	Complete
Brief DNFSB	McDonald/Worthington	Complete
Team Approve Meeting Material	McDonald/Worthington	Complete

EFCOG Board Update	Amerine	Complete
Brief HSS	Worthington	Complete
Issue Final Meeting Handout Documents	McDonald/Worthington	Complete
Resolve/Consolidate Comments	McDonald/Worthington	Complete
Task Team Meeting	McDonald/Worthington	Complete
Periodic EFCOG ISM WG Meetings	McDonald	Complete
Feedback collected from trial	McDonald	Complete
Final Team Recommendations	McDonald/Worthington	Complete