

MANUAL

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INTEGRATED SAFETY MANAGEMENT SYSTEM MANUAL



U. S. DEPARTMENT OF ENERGY
Washington, DC

EXCERPTS ON SAFETY CULTURE

As Extracted by David Compton (December 2007)

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INITIATED BY:
Office of Health, Safety and Security

ISM PRINCIPLES AND ATTRIBUTES FOR EFFECTIVE ISM IMPLEMENTATION

1. BACKGROUND AND INTRODUCTION.

- a. In 1996, the Department defined the Integrated Safety Management (ISM) system as its programmatic framework for accomplishing work safely. Ten years of implementation experience have proven that ISM is a fundamentally sound safety management approach with broad applicability. The ISM concept is also well supported by Department personnel and contractors. The Department is committed to ISM as its enduring framework for performing work in a safe and environmentally sound manner. [Note: In ISM, the term “safety” is used synonymously with environment, safety, and health (ES&H) to encompass protection of the public, the workers, and the environment.]
- b. During 2004, the Department recognized and acknowledged the need to revitalize ISM implementation. This need to revitalize or reinvigorate ISM is due to two factors:
 - (1) incompleteness and inconsistencies in implementing ISM principles and functions in programs, sites, offices, and facilities throughout the complex, and
 - (2) a general waning of attention to and use of ISM as it was intended to create and sustain continuous, measurable improvement.
- c. In addition, the Department has recognized that ongoing maturation of ISM systems at some sites and facilities enables the associated organizations to shift focus and expected outcomes from primarily compliance to a balance of compliance and operational excellence.
- d. To address inconsistencies in implementation, the Department has targeted three long-recognized weaknesses for renewed attention:
 - (1) work planning and control,
 - (2) feedback and improvement processes, and
 - (3) ISM system description and implementation by DOE federal organizations.
- e. To help reinvigorate the use of ISM as the guiding framework for organizational performance improvement, this attachment seeks to describe the context or environment that ISM systems must create and within which ISM systems must function in order to be effective. With this

vision, leaders throughout the organization can direct efforts to create the necessary environment for effective ISM implementation and, ultimately, positive culture change that supports safe, environmentally sound and highly productive operations.

- f. This attachment seeks to clearly describe and articulate the attributes – expected, observable behaviors and organizational characteristics – typical of the total environment within which ISM must be implemented to be fully effective. Leaders need to implement appropriate change strategies to make these behaviors recognizable and typical in their work environments. In implementing the ISM principles, line managers may want to use the attributes for a given principle as performance indicators to determine how well the principle is being implemented and where additional attention is needed. Achieving these desired work behaviors will result in greater productivity as well as improved safety.

Within the ISM hierarchy, it is the ISM principles that describe the environment or context for work activities, in that most ISM principles apply to each and every ISM function. Experience and research with safety cultures and high-reliability organizations (HRO) over the past ten or more years have raised new insights and deeper understanding relevant to the desired work environment for effective safety management. Experience from the commercial nuclear industry, including the Institute for Nuclear Power Operations (INPO), has been reviewed for relevant lessons. An analysis of this experience and research over the past decade has identified four supplemental safety culture elements that may be helpful to focus attention and action in the right areas to create the desired ISM environments. These elements also promote a shift from compliance toward excellence. They emphasize continuous improvement and long-term performance, and are entirely consistent with the original intents of ISM. These elements are identified and described beginning on page 12 of this attachment.

2. GUIDING PRINCIPLES FOR INTEGRATED SAFETY MANAGEMENT.

The Department has established the following principles to guide implementation of Integrated Safety Management (ISM) systems, as defined in DOE P 450.4, *Safety Management System Policy*.

- **LINE MANAGEMENT RESPONSIBILITY FOR SAFETY.** *Line management is directly responsible for the protection of the public, the workers, and the environment.*
- **CLEAR ROLES AND RESPONSIBILITIES.** *Clear and unambiguous lines of authority and responsibility for ensuring safety shall be established and maintained at all organizational levels within the Department and its contractors.*
- **COMPETENCE COMMENSURATE WITH RESPONSIBILITIES.** *Personnel shall possess the experience, knowledge, skills, and abilities that are necessary to discharge their responsibilities.*
- **BALANCED PRIORITIES.** *Resources shall be effectively allocated to address safety, programmatic, and operational considerations. Protecting the public, the workers, and the environment shall be a priority whenever activities are planned and performed.*
- **IDENTIFICATION OF SAFETY STANDARDS AND REQUIREMENTS.** *Before work is performed, the associated hazards shall be evaluated and an agreed-upon set of safety standards and requirements shall be established which, if properly implemented, will provide adequate assurance that the public, the workers, and the environment are protected from adverse consequences.*
- **HAZARD CONTROLS TAILORED TO WORK BEING PERFORMED.** *Administrative and engineering controls to prevent and mitigate hazards shall be tailored to the work being performed and associated hazards.*
- **OPERATIONS AUTHORIZATION.** *The conditions and requirements to be satisfied for operations to be initiated and conducted shall be clearly established and agreed upon.*

Note: The ISM core functions (defined in DOE P 450.4, *Safety Management System Policy*) describe the specific work activities that must be accomplished, and these are not explicitly addressed by this attachment:

- (1) “Define the Scope of Work,”
- (2) “Analyze the Hazards,”

- (3) “Develop and Implement Hazard Controls,”
- (4) “Perform Work within Controls,” and
- (5) “Provide Feedback and Continuous Improvement.”

It is vitally important that each organizational element effectively implement these five core functions, beginning with defining its own work, to the extent necessary to support the safe conduct of operational work activities. The core functions are described in detail in DOE G 450.4-1B, *Integrated Safety Management System Guide*, and have received considerable attention. This attachment focuses on the ISM principles because these have received less attention than needed to achieve the requisite environment for effective ISM implementation. The emphasis in this attachment on ISM principles should not be interpreted as a slight in any way on the essential role of the ISM core functions. The current ISM Guide adequately addresses expectations for ISM core functions.

LINE MANAGEMENT RESPONSIBILITY FOR SAFETY

Line management is directly responsible for the protection of the public, the workers, and the environment.

Attributes

- Line managers (from the Secretary to the DOE cognizant Secretarial Officer to the DOE Field Office Manager to the Contractor Senior Manager to the front-line worker) understand and accept their safety responsibilities inherent in mission accomplishment. Line managers do not depend on supporting organizations to build safety into line management work activities.
- Line managers have a clear understanding of their work activities and their performance objectives, and how they will conduct their work activities safely and accomplish their performance objectives.
- Line managers demonstrate their commitment to safety. Top-level line managers are the leading advocates of safety and demonstrate their commitment in both word and action. Line managers periodically take steps to reinforce safety, including personal visits and walkthroughs to verify that their expectations are being met.
- Line managers spend time on the floor. Line managers practice visible leadership in the field by placing “eyes on the problem,” coaching, mentoring, and reinforcing standards and positive behaviors. Deviations from expectations are corrected promptly and, when appropriate, analyzed to understand why the behaviors occurred.
- Line managers maintain a strong focus on the safe conduct of work activities. Line managers maintain awareness of key performance indicators related to safe work accomplishment, watch carefully for adverse trends or indications, and take prompt action to understand adverse trends and anomalies.
- Line managers throughout the organization set an example for safety through their direct involvement in continuous learning by themselves and their followers on topics related to technical understanding and safety improvement.
- Line managers are skilled in responding to employee questions in an open, honest manner. They encourage and appreciate the reporting of safety issues and errors. They do not discipline employees for the reporting of errors. They encourage a vigorous questioning attitude toward safety, and constructive dialogues and discussions on safety matters.
- Credibility and trust are present and continuously nurtured. Line managers reinforce perishable values of trust, credibility, and attentiveness. The organization is just – that is, the line managers demonstrate an understanding that humans are fallible and when mistakes are made, the organization seeks first to learn as opposed to blame. The system of rewards and sanctions is aligned with strong safety policies and reinforces the desired behaviors and outcomes.

CLEAR ROLES AND RESPONSIBILITIES

Clear and unambiguous lines of authority and responsibility for ensuring safety shall be established and maintained at all organizational levels within the Department and its contractors.

Attributes

- Responsibility and authority for safety are well defined and clearly understood as an integral part of performing work.
- Organizational safety responsibilities are sufficiently comprehensive to address the work activities and hazards involved.
- The line of authority and responsibility for safety is defined from the Secretary to the individual contributor. Each of these positions has clearly defined roles, responsibilities, and authorities, designated in writing and understood by the incumbent.
- Ownership boundaries and authorities are clearly defined at the institutional, facility, and activity levels, and interface issues are actively managed.
- Organizational functions, responsibilities, and authorities documents are maintained current and accurate.
- Reporting relationships, positional authority, staffing levels and capability, organizational processes and infrastructure, and financial resources are commensurate with and support fulfillment of assigned or delegated safety responsibilities.
- All personnel understand the importance of adherence to standards.
- Line managers provide ongoing reviews of performance of assigned roles and responsibilities to reinforce expectations and ensure that key safety responsibilities and expectations are being met.
- Personnel at all levels of the organization are held accountable for shortfalls in meeting standards and expectations related to fulfilling safety responsibilities. Accountability is demonstrated both by recognition of excellent safety performers as well as identification of less-than-adequate performers. In holding people accountable, in the context of a just culture, managers consider individual intentions and the organizational factors that may have contributed.

COMPETENCE COMMENSURATE WITH RESPONSIBILITIES

Personnel shall possess the experience, knowledge, skills, and abilities that are necessary to discharge their responsibilities.

Attributes

- People and their professional capabilities, experiences, and values are regarded as the organization's most valuable assets. Organizational leaders place a high personal priority and time commitment on recruiting, selecting, and retaining an excellent technical staff.
- The organization maintains a highly knowledgeable workforce to support a broad spectrum of operational and technical decisions. Technical and safety expertise is embedded in the organization. Outside expertise is employed when necessary.
- Individuals have in-depth understanding of safety and technical aspects of their jobs. Technical qualification standards are defined and personnel are trained accordingly. Technical support personnel have expert-level technical understanding. Managers have strong technical backgrounds in their area of expertise.
- Assignments of safety responsibilities and delegations of associated authorities are made to individuals with the necessary technical experience and expertise. In rare cases, if this is not possible, corrective and compensatory actions are taken.
- The organization values and practices continuous learning, and requires employees to participate in recurrent and relevant training and encourages educational experiences to improve knowledge, skills, and abilities. Professional and technical growth is formally supported and tracked to build organizational capability.
- Training to broaden individual capabilities and to support organizational learning is available and encouraged – to appreciate the potential for unexpected conditions; to recognize and respond to a variety of problems and anomalies; to understand complex technologies and capabilities to respond to complex events; to develop flexibility at applying existing knowledge and skills in new situations; to improve communications; to learn from significant industry and DOE events.
- Mental models, practices, and procedures are updated and refreshed based on new information and new understanding.
- Training effectively upholds management's standards and expectations. Beyond teaching knowledge and skills, trainers are adept at reinforcing requisite safety values and beliefs.
- Managers set an example for safety through their personal commitment to continuous learning and by their direct involvement in high-quality training that consistently reinforces expected worker behaviors.
- Managers encourage informal opinion leaders in the organization to model safe behavior and influence peers to meet high standards.

BALANCED PRIORITIES

Resources shall be effectively allocated to address safety, programmatic, and operational considerations. Protecting the public, the workers, and the environment shall be a priority whenever activities are planned and performed.

Attributes

- Organization managers frequently and consistently communicate the safety message, both as an integral part of the mission and as a stand-alone theme.
- Managers recognize that aggressive mission and production goals can appear to send mixed signals on the importance of safety. Managers are sensitive to detect and avoid these misunderstandings, or to deal with them effectively if they arise.
- The organization demonstrates a strong sense of mission and operational goals, including a commitment to highly reliable operations, both in production and safety. Safety and productivity are both highly valued.
- Safety and productivity concerns both receive balanced consideration in funding allocations and schedule decisions. Resource allocations are adequate to address safety. If funding is not adequate to ensure safety, operations are discontinued.
- Staffing levels and capabilities are consistent with the expectation of maintaining safe and reliable operations.
- The organizational staffing provides sufficient depth and redundancy to ensure that all important safety functions are adequately performed.
- The organization is able to build and sustain a flexible, robust technical staff and staffing capacity. Pockets of resilience are established through redundant resources so that adequate resources exist to address emergent issues. The organization develops sufficient resources to rapidly cope and respond to unexpected changes.
- Key technical officials are assigned for long terms of service to provide institutional continuity and constancy regarding safety requirements and expectations. Organizational knowledge is valued and efforts are made to preserve it when key players move on.
- Systems of checks and balances are in place and effective at all levels of the organization to make sure that safety considerations are adequately weighed and prioritized.
- Safety and quality assurance positions have adequate organizational influence.
- Adequate resources are allocated for safety upgrades and repairs to aging infrastructure. Modern infrastructure and new facility construction are pursued to improve safety and performance over the long term.

IDENTIFICATION OF SAFETY STANDARDS AND REQUIREMENTS

Before work is performed, the associated hazards shall be evaluated and an agreed-upon set of safety standards and requirements shall be established which, if properly implemented, will provide adequate assurance that the public, the workers, and the environment are protected from adverse consequences.

Attributes

- Facilities are designed, constructed, operated, maintained, and decommissioned using consensus industry codes and standards, where available and applicable, to protect workers, the public, and the environment.
- Applicable requirements from laws, statutes, rules and regulations are identified and captured so that compliance can be planned, expected, demonstrated, and verified.
- Clear, concise technical safety directives are centrally developed, where necessary, and are based on sound engineering judgment and data. DOE directives and technical standards are actively maintained up to date and accurate.
- A clearly-defined set of safety requirements and standards is invoked in management contracts, or similar agreements. An accepted process is used for identification of the appropriate set of requirements and standards. This set of requirements is comprehensive and includes robust quality assurance, safety, and radiological and environmental protection requirements.
- Implementing plans, procedures and protocols are in place to translate requirements into action by the implementing organization.
- Technical and operational safety requirements clearly control the safe operating envelope. The safety envelope is clearly specified and communicated to individuals performing operational tasks.
- Exemptions from applicable technical safety requirements are both rare and specific, provide an equivalent level of safety, have a compelling technical basis, and are approved at an appropriate organizational level.
- Compliance with applicable safety and technical requirements is expected and verified.
- Willful violations of requirements are rare, and personnel and organizations are held strictly accountable in the context of a just culture. Unintended failures to follow requirements are promptly reported, and personnel and organizations are given credit for self-identification and reporting of errors.
- The organization actively seeks continuous improvement to safety standards and requirements through identification and sharing of effective practices, lessons learned, and applicable safety research. The organization is committed to continuously rising standards of excellence.

HAZARD CONTROLS TAILORED TO WORK BEING PERFORMED

Administrative and engineering controls to prevent and mitigate hazards shall be tailored to the work being performed and associated hazards.

Attributes

- Work hazards are identified and controlled to prevent or mitigate accidents, with particular attention to high consequence events with unacceptable consequences. Workers understand hazards and controls before beginning work activities.
- The selection of hazard controls considers the type of hazard, the magnitude of the hazard, the type of work being performed, and the life-cycle of the facility. Controls are designed and implemented commensurate with the inherent level and type of hazard.
- Safety analyses identifying work hazards are comprehensive and based on sound engineering judgment and data.
- Defense in depth is designed into highly-hazardous operations and activities, and includes independent, redundant, and diverse safety systems, which are not overly complex. Defense in depth controls include engineering controls, administrative processes, and personnel staffing and capabilities.
- Emphasis is placed on designing the work and/or controls to reduce or eliminate the hazards and to prevent accidents and unplanned releases and exposures.
- The following hierarchy of defense in depth is recognized and applied: (1) elimination or substitution of the hazards, (2) engineering controls, (3) work practices and administrative controls, and (4) personal protective equipment. Inherently safe designs are preferred over ones requiring engineering controls. Prevention is emphasized in design and operations to minimize the use of, and thereby possible exposure to, toxic or hazardous substances.
- Equipment is consistently maintained so that it meets design requirements.
- Safety margins are rigorously maintained. Design and operating margins are carefully guarded and changed only with great thought and care. Special attention is placed on maintaining defense-in-depth.
- Organizations implement hazard controls in a consistent and reliable manner. Safety is embedded in processes and procedures through a functioning formal integrated safety management system. Facility activities are governed by comprehensive, efficient, high-quality processes and procedures.
- Hazard controls are designed with an understanding of the potential for human error. Error-likely situations are identified, eliminated, or mitigated. Existence of known error-likely situations is communicated to workers prior to commencing work along with planned mechanisms to assure their safety.

OPERATIONS AUTHORIZATION

The conditions and requirements to be satisfied for operations to be initiated and conducted shall be clearly established.

Attributes

- Formal facility authorization agreements are in place and maintained between owner and operator.
- Readiness at the facility level is verified before hazardous operations commence. Pre-operational reviews confirm that controls are in place for known hazards.
- Facility operations personnel maintain awareness of all facility activities to ensure compliance with the established safety envelope.
- Work authorization is defined at the activity level. The work authorization process verifies that adequate preparations have been completed so that work can be performed safely. These preparations include verifying that work methods and requirements are understood; verifying that work conditions will be as expected and not introduce unexpected hazards; and verifying that necessary controls are implemented.
- The extent of documentation and level of authority for work authorization is based on the complexity and hazards associated with the work.

SUPPLEMENTAL SAFETY CULTURE ELEMENTS

Based on experience and learning over the past ten years since the inception of Integrated Safety Management, the Department has identified the following four supplemental safety culture elements to be used, along with the existing ISM guiding principles, to help develop the appropriate context or environment for effective implementation of Integrated Safety Management (ISM) systems within the Department of Energy and at its sites and facilities in the future:

- **INDIVIDUAL ATTITUDE AND RESPONSIBILITY FOR SAFETY.** *Every individual accepts responsibility for safe mission performance. Individuals demonstrate a questioning attitude by challenging assumptions, investigating anomalies, and considering potential adverse consequences of planned actions. All employees are mindful of work conditions that may impact safety, and assist each other in preventing unsafe acts or behaviors.*
- **OPERATIONAL EXCELLENCE.** *Organizations achieve sustained, high levels of operational performance, encompassing all DOE and contractor activities to meet mission, safety, productivity, quality, environmental, and other objectives. High-reliability is achieved through a focus on operations, conservative decision-making, open communications, deference to expertise, and systematic approaches to eliminate or mitigate error-likely situations.*
- **OVERSIGHT FOR PERFORMANCE ASSURANCE.** *Competent, robust, periodic and independent oversight is an essential source of feedback that verifies expectations are being met and identifies opportunities for improvement. Performance assurance activities verify whether standards and requirements are being met. Performance assurance through conscious, directed, independent reviews at all levels brings fresh insights and observations to be considered for safety and performance improvement.*
- **ORGANIZATIONAL LEARNING FOR PERFORMANCE IMPROVEMENT.** *The organization demonstrates excellence in performance monitoring, problem analysis, solution planning, and solution implementation. The organization encourages openness and trust, and cultivates a continuous learning environment.*

INDIVIDUAL ATTITUDE AND RESPONSIBILITY FOR SAFETY.

Every individual accepts responsibility for safe mission performance. Individuals demonstrate a questioning attitude by challenging assumptions, investigating anomalies, and considering potential adverse consequences of planned actions. All employees are mindful of work conditions that may impact safety, and assist each other in preventing unsafe acts or behaviors.

Attributes:

- Individuals understand and demonstrate responsibility for safety. Safety and its ownership are apparent in everyone's actions and deeds. Workers are actively involved in identification, planning, and improvement of work and work practices. Workers follow approved procedures. Workers at any level can stop unsafe work or work during unexpected conditions.
- Individuals promptly report errors and incidents. They feel safe from reprisal in reporting errors and incidents; they offer suggestions for improvements.
- Individuals are mindful of the potential impact of equipment and process failures; they are sensitive to the potential of faulty assumptions and errors, and demonstrate constructive skepticism. They appreciate that mindfulness requires effort.
- Individuals recognize that errors and imperfections are likely to happen. They recognize the limits of foresight and anticipation, and watch for things that have not been seen before. They appreciate that error-likely situations are predictable, manageable, and preventable, and seek to identify and eliminate latent conditions that give rise to human performance errors.
- Individuals cultivate a constructive, questioning attitude and healthy skepticism when it comes to safety. Individuals question deviations, and avoid complacency or arrogance based on past successes. Team members support one another through both awareness of each other's actions and constructive feedback when necessary.
- Individuals are aware of and counteract human tendencies to simplify assumptions, expectations, and analysis. Diversity of thought and opposing views are welcomed and considered. Intellectual curiosity is encouraged.
- Individuals are intolerant of conditions or behaviors that have the potential to reduce operating or design margins. Anomalies are thoroughly investigated, promptly mitigated, and periodically analyzed in the aggregate. The bias is set on proving work activities are safe before proceeding, rather than proving them unsafe before halting. Personnel do not proceed and do not allow others to proceed when safety is uncertain.
- Individuals outside of the organization (including subcontractors, temporary employees, visiting researchers, vendor representatives, etc.) understand their safety responsibilities.

OPERATIONAL EXCELLENCE

Organizations achieve sustained, high levels of operational performance, encompassing all DOE and contractor activities to meet mission, safety, productivity, quality, environmental, and other objectives. High-reliability is achieved through a focus on operations, conservative decision-making, open communications, deference to expertise, and systematic approaches to eliminate or mitigate error-likely situations.

Attributes

- Line managers are in close contact with the front-line; they pay attention to real-time operational information. Maintaining operational awareness is a priority. Line managers identify critical performance elements and monitor them closely.
- Operational anomalies, even small ones, get prompt attention and evaluation – this allows early detection of problems so necessary action is taken before problems grow.
- Individuals are systematic and rigorous in making informed decisions that support safe, reliable operations. Workers are expected and authorized to take conservative actions when faced with unexpected or uncertain conditions. Line managers support and reinforce conservative decisions based on available information and risks.
- Candid dialogue and debate and a healthy skepticism are encouraged when safety issues are being evaluated. Differing professional opinions are welcomed and respected. Robust discussion and constructive conflict are recognized as a natural result of diversity of expertise and experience.
- Line managers regularly and promptly communicate important operational decisions, their basis, expected outcomes, potential problems, and planned contingencies.
- Organizations know the expertise of their personnel. Line managers defer to qualified individuals with relevant expertise during operational upset conditions. Qualified and capable people closest to the operational upset are empowered to make important decisions, and are held accountable justly.
- Operations personnel are held to high standards of both technical understanding and detailed task-oriented performance. Operations personnel provide reliable and consistent responses to expected occurrences. Flexible responses to unexpected occurrences are based on continuous preparation and training. Formality and discipline in operations is valued.
- Organizational systems and processes are designed to provide layers of defenses, recognizing that people are fallible. Prevention and mitigation measures are used to preclude errors from occurring or propagating. Error-likely situations are sought out and corrected, and recurrent errors are carefully examined as indicators of latent organizational weaknesses. Managers aggressively correct latent organizational weaknesses and measure the effectiveness of actions taken to close the gaps.

OVERSIGHT FOR PERFORMANCE ASSURANCE

Competent, robust, periodic and independent oversight is an essential source of feedback that verifies expectations are being met and identifies opportunities for improvement. Performance assurance activities verify whether standards and requirements are being met. Performance assurance through conscious, directed, independent reviews at all levels brings fresh insights and observations to be considered for safety and performance improvement.

Attributes:

- Performance assurance consists of robust, frequent, and independent oversight, conducted at all levels of the organization. Performance assurance includes independent evaluation of performance indicators and trend analysis.
- Performance assurance programs are guided by plans that ensure a base level of relevant areas are reviewed. Assessments are performed against established requirements (such as those defined in Criteria and Review Approach Documents).
- Efficient redundancy in monitoring is valued; higher levels of redundancy are recognized as necessary for higher risk activities.
- Performance Assurance includes a diversity of independent “fresh looks” to ensure completeness and to avoid complacency. A mix of internal and external oversight reviews reflects an integrated and balanced approach. This balance is periodically reviewed and adjusted as needed.
- The insights and fresh perspectives provided by performance assurance personnel are valued. Organizational feedback is actively sought to make performance assurance activities more value-added.
- Complete, accurate, and forthright information is provided to performance assurance organizations.
- Results from performance assurance activities are effectively integrated into the performance improvement processes, such that they receive adequate and timely attention. Linkages with other performance monitoring inputs are examined, high-quality causal analyses are conducted, as needed, and corrective actions are tracked to closure with effectiveness verified to prevent future occurrences.
- Line managers throughout the organization set an example for safety through their direct involvement in oversight activities and associated performance improvement.
- Senior line managers are periodically briefed on results of oversight group activities to gain insight into organizational performance and to direct needed corrective actions.
- Periodic ISM reviews, assessments, and verifications are conducted and used as a basis for ISM program adjustments and implementation improvements.

ORGANIZATIONAL LEARNING FOR PERFORMANCE IMPROVEMENT

The organization demonstrates excellence in performance monitoring, problem analysis, solution planning, and solution implementation. The organization encourages openness and trust, and cultivates a continuous learning environment.

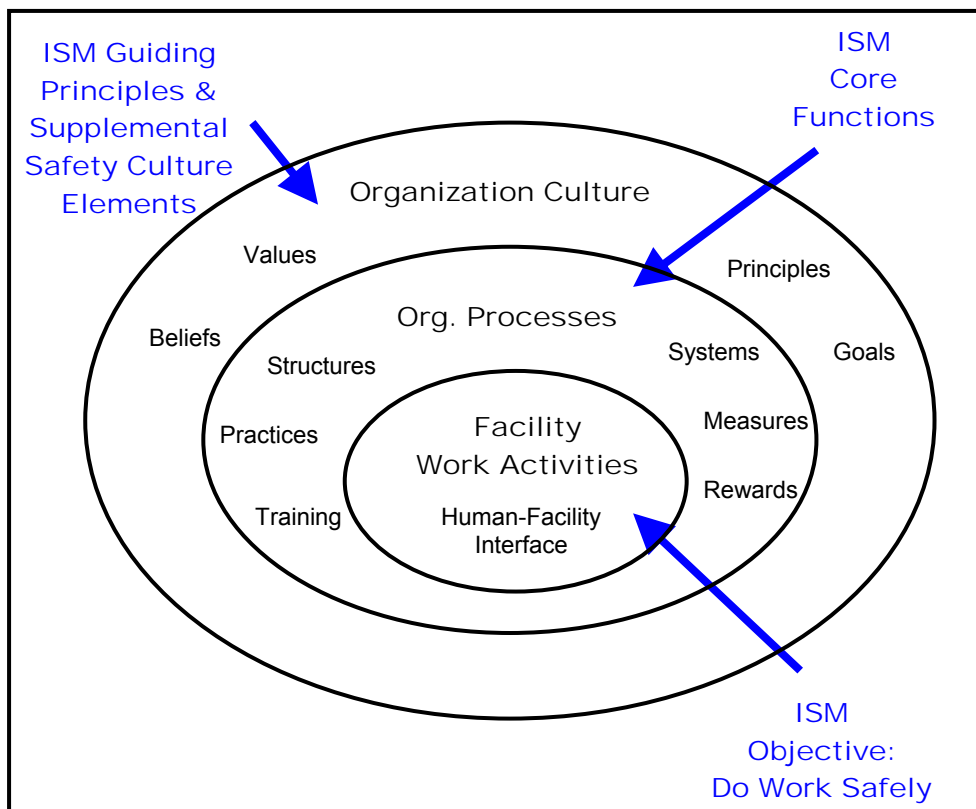
Attributes:

- The organization actively and systematically monitors performance through multiple means, including leader walk-arounds, issue reporting, performance indicators, trend analysis, benchmarking, industry experience reviews, self-assessments, and performance assessments. Feedback from various sources is integrated to create a full understanding.
- Processes are established to identify and resolve latent organizational weaknesses that can aggravate relatively minor events if not corrected. Linkages among problems and organizational issues are examined and communicated.
- Open communications and teamwork are the norm. People are comfortable raising and discussing questions or concerns. Good news and bad news are both valued and shared.
- A high level of trust is established in the organization. Reporting of individual errors is encouraged and valued. A variety of methods are available for personnel to raise safety issues, without fear of retribution.
- Organization members convene to swiftly uncover lessons and learn from mistakes. Frequent incident reviews are conducted promptly after an incident to ensure data quality to identify improvement opportunities.
- Operating experience is highly valued, and the capacity to learn from experience is well developed. The organization regularly examines and learns from operating experiences, both internal and in related industries.
- Expertise in causal analysis is applied effectively to examine events and improve safe work performance. High-quality causal analysis is the norm. Causal analysis is performed on a graded approach for major and minor incidents, and near-misses, to identify causes and follow-up actions. Even small failures are viewed as windows into the system that can spur learning.
- Performance improvement processes encourage workers to offer innovative ideas to improve performance and to solve problems.
- Line managers are actively involved in all phases of performance monitoring, problem analysis, solution planning, and solution implementation to resolve safety issues.
- Vigorous corrective and improvement action programs are in place and effective. Rapid response to problems and closeout of issues ensures that small issues do not become large ones. Managers are actively involved to balance priorities to achieve timely resolutions.

3. RELATIONSHIP BETWEEN ISM PRINCIPLES, FUNCTIONS, OPERATIONAL WORK, AND PERFORMANCE RESULTS.

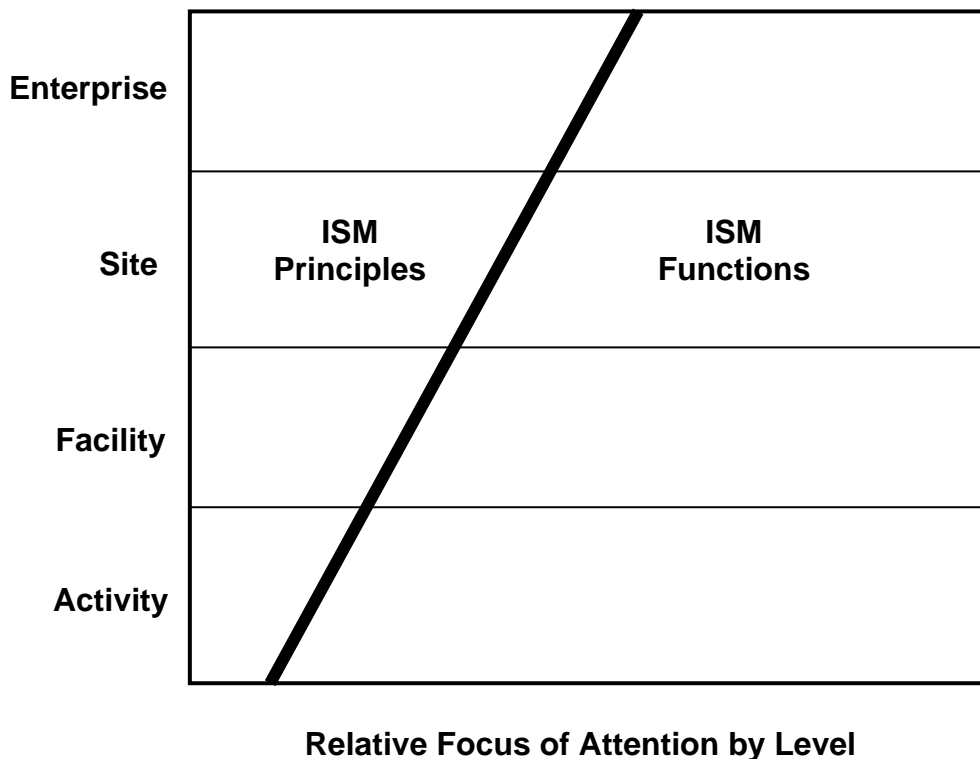
The figure below depicts various levels within the organizational culture. The outer level represents the environment within which the work must take place. The outer level is most influenced by the ISM Principles (and the supplemental safety culture elements). The next level is the process level, where management systems are defined to direct behaviors. This level is most influenced by the ISM Functions. The inner-most level is the activity-level work itself, where operational work is performed. This work is the direct interaction between people and physical facility, and is mostly performed by DOE contractors (except at GoGos). This is the level at which organizations can measure ultimate performance results and determine whether the ISM program objectives have been realized. Performance measures at other levels can show how effectively the process and culture support the desired safety objectives. Showing work at the inner-most level does not mean that work is not required at the other levels; indeed, work activities are required at the other levels to develop work processes and highly reliable, error tolerant work environments.

Organizations are systems and it is important that the organization be measured at all three levels, with their alignment routinely assessed. Understanding the performance and perceptions at each level is essential to the development of integrated organizational, process, and work activity improvements that are likely to be effective and sustaining.



4. RELATIVE FOCUS OF ATTENTION BY LEVEL.

Different levels of the organization (enterprise, site, facility, and activity) will provide different levels of attention to implementing the ISM principles and ISM functions. As the ISM principles relate more to establishing the desired environment and the desired culture, more attention to implementing the ISM principles is expected at higher levels of the organization (such as the enterprise and site level). At the lower levels, attention to the ISM principles will not need to be as focused, since many of the principles should be effectively built into work procedures and practices. Regarding ISM functions, this is the primary focus of the lower levels of the organization and will require the clear majority of its relative attention. For the higher levels of the organization, their involvement and attention will also be needed to facilitate accomplishment of the ISM functions, although in a lower percentage when compared to attention to ISM principles. The figure below illustrates this concept.



5. IMPLEMENTATION.

- a. Initially, DOE offices will be required by this Manual to prepare ISM system descriptions that address how the existing ISM principles will be implemented to create the desired behaviors for effective ISM implementation. DOE offices may also choose to use the supplemental safety culture elements and/or associated attributes to help them in developing their ISM system descriptions. Attempts to incorporate these elements in the DOE office ISM systems descriptions should not delay or detract from establishing the basic ISM framework described in DOE P 450.4, *Safety Management System Policy*. DOE contractors are not required to make any changes to their ISM Systems to address the supplemental safety culture elements.
- b. In 2007, the DOE and contractor community will engage in a dialogue about the ultimate role of the concepts in this Attachment. Based on the outcomes of that dialogue, the DOE ISM directives will be revised to capture the experience, lessons learned, successful implementation methods, and good practices related to implementation. At that time, it is expected that the seven ISM guiding principles and the four supplemental safety culture elements will be reviewed for possible integration into a single set. This process may include combining some of these items where appropriate. This process may also determine that some or all of the attributes of the four supplemental safety culture elements described in this Attachment can be adequately assigned to existing ISM principles and functions. Only after the associated DOE directives and ISM DEAR clause are revised will the contractors be required to address any potential changes or additions to the ISM program related to this Attachment.

6. ASSESSMENTS.

The material in this Attachment is provided to clarify expectations for implementation of the ISM guiding principles and to describe supplemental safety culture elements. The attributes are not intended for use as assessment criteria. The attributes are intended for use as a management tool to help clarify expectations of organizations and employees. The attributes may be used as performance indicators regarding how well an organization is implementing the ISM principles or supplementary safety culture elements. When used as performance indicators, reviews against the attributes should be used for diagnosis and improvement. In general, an organization's safety management system, as documented in its ISM system description, is the authoritative document against which implementation should be assessed.

7. CONCLUSION

Thorough and consistent implementation of the principles in this document will provide the necessary environment for DOE organizations to succeed and thrive. This Attachment provides the vision for DOE to achieve the essential attributes of a high-performing organization, and further improve the Department's safety record and productivity record. This vision captures the elements needed for DOE to move beyond a compliance-based approach to a performance-based approach, consistent with more mature high-reliability organizations.

For example, the International Atomic Energy Agency (IAEA) developed a capability maturity model that illustrates the stages that an organization goes through in achieving a mature safety culture. These stages are:

Stage I. The organization sees safety as an external requirement and not as an aspect of conduct 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 technical issue. Mere compliance with rules and regulations is considered adequate.

Stage II. An organization at Stage II has a management which 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.

Stage III. An organization at Stage III has adopted the idea of continuous improvement and applied the concept to safety performance. There is a strong emphasis on communications, training, management style, and improving efficiency and effectiveness. Everyone in the organization can contribute. Some behaviors are seen within the organization which enables improvements to take place and, on the other hand, there are behaviors which act as a barrier to further improvement. Consequently, people also understand the impact of behavioral issues on safety. The level of awareness of behavioral and attitudinal issues is high, and measures are being taken to improve behavior. Progress is made one step at a time and never stops. The organization asks how it might help other companies.

The environment described herein can take the Department to IAEA Stage III performance, a fully developed safety culture. On the path to achieving a fully developed safety culture, the culture in various parts of an organization is likely to be at different stages of development. As such, until the fully mature culture is achieved, organizations will likely be able to recognize the characteristics of more than one stage at any given time.

GUIDELINES FOR DEVELOPING DOE ISM SYSTEM DESCRIPTIONS (EXCERPTED)

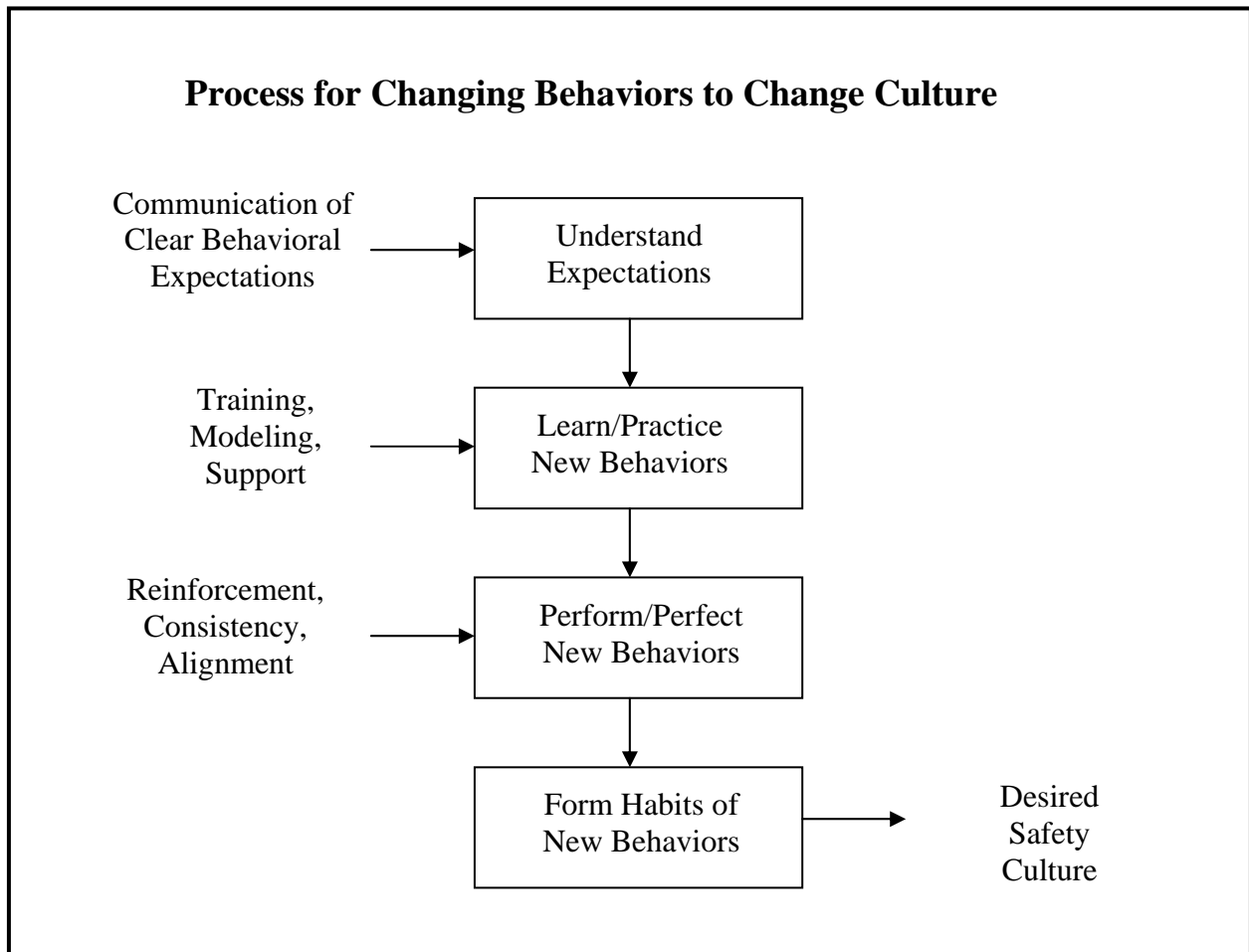
8. ON CHANGING VALUES AND BEHAVIORS.

In many cases, implementing organizations will find that the desired ISM system will require changes to existing employee values and behaviors. Desired ISM values and behaviors are driven by the ISM principles and functions. Changes in values can not be dictated and, if possible, can only be brought about by concerted effort directed toward changing behaviors. In some cases, changes in personnel or leaders may be required to achieve the desired changes. To the extent possible, leaders should involve worker in both formulation and implementation of the desired changes. To change behaviors, and ultimately values, it is necessary to do the following:

- Clearly define the desired behaviors in terms that the target audience can fully understand and appreciate.
- Establish consensus among the senior leadership regarding the desired behaviors and obtain their commitment to support the desired changes.
- Identify any actions or changes on the part of senior leadership to achieve the desired behaviors and obtain their buy-in to these actions.
- Identify existing organizational processes and behaviors that may be counter to the desired behaviors and develop actions to align existing processes and behaviors with new desired behaviors; take actions to eliminate or minimize the influence of forces that may be restraining achievement of the desired behaviors.
- Clearly communicate the desired behaviors to the target audience, and provide training as needed for the audience to master the desired behaviors.
- Encourage employees to ask questions to clarify intentions, and provide feedback and suggestions on achieving the desired behaviors. Be open to potential adjustments in expectations as a result of employee involvement and feedback.
- Working with members of the target audience, develop the necessary tools and supporting structures and processes, so that the desired behaviors can be consistently performed.
- Provide consistent, visible senior leadership attention and focus on new desired behaviors.
- Align rewards and incentives programs with desired behaviors.

- Provide positive reinforcement to employees performing desired behaviors, and not to employees who are not performing the desired behaviors.
- Monitor performance and continue to provide direct, timely and specific feedback to employees regarding their behaviors.
- Periodically evaluate progress toward institutionalizing the desired behaviors and take actions necessary to continue progress.
- Communicate and train all new members, especially new leaders, on the desired behaviors, their objectives and bases.
- Reiterate and repeat the steps above, as needed, for at least five to seven years until the newly desired behaviors are well ingrained and institutionalized.

The figure below depicts the process of changing behaviors to achieve the desired culture changes.



APPENDIX B GLOSSARY OF TERMS (EXCERPTED)

ACTIVE ERROR—Human action (behavior) that changes equipment, system, or plant state triggering immediate undesired consequences.

ADMINISTRATIVE CONTROLS—Provisions related to organization and management, procedures, record keeping, assessment, and reporting necessary to ensure safe operation of a facility. With respect to nuclear facilities, *administrative controls* means the section of the Technical Safety Requirements (TSRs) containing provisions for safe operation of a facility including (1) requirements for reporting violations of TSRs, (2) staffing requirements important to safe operations, and (3) commitment to the safety management programs and procedures identified in the Safety Analysis Report as necessary elements of the facility safety basis provisions.

ALIGNMENT—A measure or judgment of the extent to which the values, processes, management, and existing factors within an organization influence human performance in a complementary and non-contradictory way; facilitating organizational processes and values to support desired behavior.

BEHAVIOR—(1) Observable (movement, speech) and unobservable (perception, thought, decisions not to act or *inaction*, emotional response, and so forth) activity by an individual; (2) The mental and physical efforts to perform a task.

BEHAVIOR BASED SAFETY—A proactive approach to injury prevention that focuses on at-risk behaviors that can lead to an injury -or on safe behaviors that can contribute to injury prevention.

CONSERVATIVE DECISION MAKING—Reaching conclusions by placing value on facility safety above the production goals of the station. Facility results demonstrate recognition and avoidance of activities that unnecessarily reduce safety margins.

CONTROLS—Administrative and engineering mechanisms that can affect the chemical, physical, metallurgical or nuclear process of a nuclear facility in such a manner as to effect the protection of the health and safety of the public and workers, or the protection of the environment. Also, error-prevention techniques adopted to prevent error and to recover from or mitigate the effects of error; to make an activity or process go smoothly, properly, and according to high standards. Multiple layers of controls provide defense in depth.

CULTURE—An organization's system of commonly held values and beliefs that influence the attitudes, choices and behaviors of the individuals of the organization.

DEFENSE IN DEPTH - An approach to facility safety that builds in layers of defense against release of or exposure to hazardous materials so that no one layer by itself, no

matter how good, is completely relied upon. To compensate for potential human and mechanical failures, defense in depth is based on several layers of protection with successive barriers to prevent the release of or exposure to hazardous materials. This approach includes protection of the barriers to avert damage to the plant and to the barriers themselves. It includes further measures to protect the public, workers, and the environment from harm in case these barriers are not fully effective. Defense in depth controls include engineering controls, administrative processes, and personnel staffing and capabilities.

DEVIANCE—See NORMALIZATION OF DEVIANCE.

ENGINEERING CONTROLS—Physical controls, including set points and operating limits; as distinct from administrative controls.

ERROR—An action that unintentionally departs from an expected behavior.

ERROR-LIKELY SITUATION—A work situation in which there is greater opportunity for error when performing a specific action or task due to error precursors (also known as "error trap").

GUIDING PRINCIPLES (or ISM GUIDING PRINCIPLES)—Conditions for performance of work that an integrated safety management system must address. The guiding principles are defined in DOE P 450.4, *Safety Management System Policy*, to be: (1) Line management Responsibility for Safety, (2) Clear Roles and Responsibilities, (3) Competence Commensurate with Responsibilities, (4) Balanced Priorities, (5) Identification of Safety Standards and Requirements, (6) Hazard Controls Tailored to Work Being Performed, and (7) Operations Authorization. These principles are also identified in DEAR 48 CFR 970.5223-1(b).

HAZARD—A source of danger (i.e., material, energy source, or operation) with the potential to cause illness, injury, or death to personnel or damage to a facility or to the environment (without regard to the likelihood or credibility of accident scenarios or consequence mitigation).

HAZARD CONTROLS—Measures to eliminate, limit, or mitigate hazards to workers, the public, or the environment, including (1) physical, design, structural, and engineering features; (2) safety structures, systems, and components; (3) safety management programs; (4) technical safety requirements; and (5) other controls necessary to provide adequate protection from hazards.

HIERARCHY OF CONTROLS - The following hierarchy of defense in depth controls is recognized and applied: (1) elimination or substitution of the hazards, (2) engineering controls, (3) work practices and administrative controls, and (4) personal protective equipment. Inherently safe designs are preferred over ones requiring engineering controls. Prevention is emphasized in design and operations to minimize the use of, and thereby possible exposure to, toxic or hazardous substances.

HIGH-RELIABILITY ORGANIZATION—Organizations that consistently operate under trying and hazardous conditions, and manage to have relatively few accidents. These organizations operate in settings where the potential for error and disaster is very high. They have no choice but to function reliably because failure results in severe consequences. HRO theory holds that significant accidents can be prevented through proper management of prevention and mitigation activities. Examples of high-reliability organizations: nuclear aircraft carriers, nuclear power generating plants, power grid dispatching centers, air traffic control systems, aircraft operations, hospital emergency departments, hostage negotiating teams, firefighting crews, continuous processing firms. HRO characteristics include: (1) personal technical excellence and commitment to continuous training; (2) sustained, high levels of operational performance, encompassing both productivity and safety objectives; (3) robust technical systems and structures, and organizational processes that provide redundancy and flexibility; (4) decentralized authority patterns, including deference to capable individuals with the most technical expertise and individuals closest to the problem; (5) a committed workforce where every individual understands and accepts their roles and responsibilities for safe mission performance; (6) a deep commitment to continuous performance improvement, openness and trust, and cultivation of a continuous learning environment; and (7) the use of systems of checks and audits to build reliability.

HUMAN ERROR—A phrase that generally means the slips and mistakes of humankind. See also active error and latent error.

HUMAN PERFORMANCE—(1) Individual sense: A series of behaviors executed to accomplish specific task objectives (results); (2) Organizational sense: The sum of what people (individuals, leaders, managers) are doing and what people have done; the aggregate system of processes, influences, behaviors, and their ultimate results that eventually become manifest in the physical plant.

HUMAN PERFORMANCE IMPROVEMENT—Human Performance Improvement is fundamentally about reducing errors and managing defenses. Striving for excellence in human performance is an ongoing effort to reduce events caused by human error. Human error is caused by a variety of conditions related to individual behavior, management and leadership practices, and organizational processes and values. Behaviors at all levels need alignment to improve individual performance, reduce errors and prevent events. Alignment involves facilitating organizational processes and values to support desired behaviors.

INTEGRATED SAFETY MANAGEMENT—The DOE approach for systematically integrating safety into management and work practices at all levels so that missions are accomplished while protecting the public, the worker, and the environment.

INTEGRATED SAFETY MANAGEMENT SYSTEM—A safety management system that provides a formal, organized process whereby people plan, perform, assess, and improve the safe conduct of work efficiently and in a manner that ensures protection of workers, the public, and the environment. This management system is used to implement ISM to systematically integrate safety into management and work practices

at all levels so that missions are accomplished while protecting the public, the worker, and the environment.

JUST CULTURE—A culture that understands and values the distinction between blame-free and culpable actions, and does not seek to punish errors that are unintentional and reasonable given the context. In a just culture, line managers demonstrate an understanding that humans are fallible and when mistakes are made, the organization seeks first to learn as opposed to blame. In a just culture, employees are more likely to report errors, near-misses, and error-likely situations, which help the organization to learn and improve.

LAGGING INDICATOR (or OUTCOME INDICATOR)—A parameter or measure, changes in which provide information about previous performance as reflected in events, observations, problem reports, and similar occurrences.

LATENT ERROR—An error, act, or decision that results in organization-related weaknesses or equipment flaws that lie dormant until revealed either by human error, testing, or self-assessment.

LATENT ORGANIZATIONAL WEAKNESSES—Loopholes in the system's defenses, barriers, and safeguards whose potential existed for some time prior to the onset of the accident sequence, though usually without any obvious bad effect. These loopholes consist of imperfections in features such as leadership/supervision, training and qualification, report of defects, engineered safety features, safety procedures, and hazard identification and evaluation. Most accidents originate from or are propagated by latent weaknesses.

LEADING INDICATOR (or Process Indicator)—A parameter or measure, changes in which are frequently followed by a correlated change in one or more other performance measures some time later; provides information about developing or changing conditions upstream in the organization that tend to influence future human performance at the job site.

LEARNING ORGANIZATION—One that values continuous learning. An organization that is deeply committed to continuous performance improvement and develops and sustains organizational processes, such as incident critiques, that facilitate continuous improvement; encourage openness and trust so that problems are reported; cultivate an environment that encourages and rewards ongoing efforts to learn from experience, learn from others, and from self-directed studies; aggressively seek to know what it doesn't know; demonstrate excellence in performance monitoring, problem analysis, solution planning, and solution implementation; systematically eliminate or mitigate error-likely situations; and remain obsessed with the liabilities of success.

MENTAL MODEL—Structured organization of knowledge a person has about how something works (usually in terms of generalizations, assumptions, pictures, or key words). Mental models may be deeply ingrained and even unconscious.

MINDFULNESS—The combination of ongoing scrutiny of existing expectations, continuous refinement and differentiation of expectations based on newer experiences, willingness and capability to invent new expectations that make sense of unprecedented events, a more nuanced appreciation of context and ways to deal with it, and identification of new dimensions of context that improve foresight and current functioning. Mindfulness is a pre-occupation with updating. Mindful people accept the reality of ignorance and work hard to smoke it out, knowing full well that each new answer uncovers a host of new questions. Mindfulness is exhibited by high reliability organizations through the following five hallmarks of reliability: (1) preoccupation with failure, (2) reluctance to simplify interpretations, (3) sensitivity to operations, (4) commitment to resilience, and (5) deference to expertise. [Reference: Weick & Sutcliffe]

NORMALIZATION OF DEVIANCE—The tendency to redefine and accept previously-unexpected anomalies over time as expected events and ultimately as acceptable risks. Diane Vaughan developed this term based on her study of the O-ring failures in the Challenger accident. In this accident, “the range of expected error enlarged from the judgment that it was normal to have heat on the primary O-ring, to normal to have erosion on the primary O-ring, to normal to have gas blowby, to normal to have blowby reaching the secondary O-ring, and finally to the judgment that it was normal to have erosion on the secondary O-ring.”

PERFORMANCE INDICATOR—Operational information indicative of the performance or condition of a facility, group of facilities, site, or process. (See also leading and lagging indicator.)

QUESTIONING ATTITUDE—An attitude that encourages a person's foresight to precede his or her action such that planning, judgment, and decision-making are appropriate for the situation.

SAFETY—In ISM, the term “safety” is used synonymously with environment, safety, and health (ES&H) to encompass protection of the public, the workers, and the environment [DOE P 450.4]. Safety is a dynamic non-event; a stable outcome produced by constant adjustments to system parameters. To achieve stability, change in one system parameter must be compensated for by changes in other parameters, through a process of continuous mutual adjustment [Reference: Weick & Sutcliffe].

SAFETY CULTURE—The safety culture of an organization is the product of individual and group values, attitudes, competencies, and patterns of behavior that determine the commitment to, and the style and proficiency of, an organization's health and safety programs. Organizations with a positive safety culture are characterized by communications founded on mutual trust, by shared perceptions of the importance of safety, and by confidence in the efficacy of preventive measures. The term safety culture entered public awareness through the vocabulary of nuclear safety after the Chernobyl nuclear power plant explosion.

SAFETY PERFORMANCE OBJECTIVES, MEASURES, AND COMMITMENT—Safety performance objectives are long-term management system goals. Safety performance

commitments are specific actions that will be taken during a specific year to further achievement of long-term performance objectives. Performance commitments would be expected to address significant identified weaknesses or areas for improvement. These may include either major corrective actions or major improvement actions. Safety performance measures are used to monitor achievement of performance objectives and commitments.

SAFETY PROGRAMS—Programs, required by DOE or other regulatory authority or committed to in the contractor's ISM description, that will be adhered to for a scope of work by a facility or site in support of the work.

SELF-ASSESSMENT—A review, analysis or evaluation, that can be informal or formal and structured, of a program or management system performed by the organization responsible for the program or system to determine whether its implementation is in conformance with established requirements and/or defined expectations.

SITUATIONAL AWARENESS—The mental activity of developing and maintaining an accurate mental model of the facility state and the work situation based on knowledge of critical parameters, observations of system or equipment condition, work environment, team members, and recall of fundamental knowledge of the facility.

SUPPLEMENTAL SAFETY CULTURE ELEMENTS—Four elements, to supplement the original seven ISM guiding principles, to help organizations to develop the appropriate context or environment for effective implementation of ISM systems: (1) Individual Attitude and Responsibility for Safety, (2) Operational Excellence, (3) Oversight for Performance Assurance, and (4) Organizational Learning for Performance Improvement.

VIOLATION—Deliberate, intentional acts to evade a known policy or procedure requirement for personal advantage usually adopted for fun, comfort, expedience, or convenience.