National Nuclear Security Administration

Senior Technical Safety Manager
Qualification Standard

DOE-STD-1175-2013

October 2013 | Reference Guide

The Functional Area Qualification Standard References Guides are developed to assist operators, maintenance personnel, and the technical staff in the acquisition of technical competence and qualification within the Technical Qualification Program (TQP).

Please direct your questions or comments related to this document to the Office of Leadership and Career Management, TQP Manager, NNSA Albuquerque Complex.

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ACRONYMS	
AC	administrative control
ACMP	Acquisition Career Management Program
AEA	Atomic Energy Act
ACWP	actual cost of work
ALARA	as low as reasonably achievable
ANSI	American National Standards Institute
APEGGA	Association of Professional Engineers, Geologists, and Geophysicists of Alberta
BAT	best available technology
BCWP	budgeted cost of work performed
BCWS	budgeted cost of work scheduled
BIO	basis for interim operation
Bq	becquerels
CAIB	Columbia Accident Investigation Board
CAS	cost accounting standard
CCEs	continuing core expectations
CDP	critical detection point
CDs	critical decisions
CEQ	Council of Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CM	configuration management
CO	contracting officer
COOP	continuity of operations program
CRB	corporate review budget
CRD	contractor requirements document
CSE	cognizant system engineer
CSO	cognizant secretarial officer
CTA	central technical authority
CWA	Clean Water Act
DBT	design basis threat
DEAR	Department of Energy acquisition regulation
DNFSB	Defense Nuclear Facility Safety Board
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOE-ORO	U.S. Department of Energy-Oak Ridge Field Office
DOT	U.S. Department of Transportation
DPC	directives point of contact
DPO	differing professional opinion
DRB	directives review board
DSA	documented safety analysis
DSC	department standards committee
EA	environmental assessment
E&CF	event & causal factor

ECP	Employee Concerns Program
EFCOG	Energy Facility Contractors Group
EH	environmental health
EIS	environmental impact statement
EM	Office of Environmental Management
EMS	environmental management system
EO	executive orders
EOC	emergency operations center
EPCRA	Emergency Planning and Community Right-to-Know Act
EPHA	emergency planning hazards assessments
EPI	emergency public information
ER	environmental restoration
ERAP	emergency readiness assurance plan
ES&H	environment, safety, and health
ESE	energy, science, and environment
EV	earned value
EVMS	earned value management system
FACA	Federal Advisory Committee Act
FACTS	foreign access central tracking system
FAQS	functional area qualification standard
FDO	fee determining official
FEM	field element manager
FEMA	Federal Emergency Management Administration
FEMP	Federal energy management program
FFCA	Federal Facility Compliance Act
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FLP	Future Leaders Program
FONSI	finding of no significant impact
FPC	Federal preparedness circular
FPD	Federal project director
FR	facility representative
FRA	functions, responsibilities, and authorities
FTCP	Federal Technical Capability Panel
G&A	general and administrative
GCEP	gas centrifuge enrichment plant
GDP	gaseous diffusion plant
GHG	greenhouse gas
GHS	globally harmonized system
GOCO	government-owned, contractor-operated
GOGO	government-owned, government-operated
GS	general service
GSA	General Services Administration
GSP	graded security protection
HFE	human factors engineering
HLW	high-level mixed waste

HPI	human performance initiative
HQ	headquarters
HSS	Office of Health Safety and Security
HSWA	hazardous and solid waste amendments
IAG	interagency agreement
ICRP	International Commission on Radiological Protection
IDAS	intrusion detection and assessment systems
IDP	individual development plan
IDS	intrusion detection system
INPO	Institute of Nuclear Power Operations
IPT	integrated project team
ISM	integrated safety management
ISMS	integrated safety management system
ISO	International Organization for Standardization
JIC	joint information center
KSA	knowledge, skill, and ability
LCO	limiting condition for operation
LCS	limiting control setting
LLMW	low-level mixed waste
LLRW	low-level radioactive waste
LMES	Lockheed Martin Energy Systems
LOTO	lockout/tagout
MAA	material access area
MC&A	material control and accountability
MEI	maximally exposed individual
MEL	master equipment list
M&O	management and operating
MOA	memorandum of agreement
MOU	memorandum of understanding
mrem	millirem
MTRU	mixed transuranic waste
NASA	National Aeronautics and Space Administration
NCP	national contingency plan
NDAA	National Defense Authorization Act
NEI	Nuclear Energy Institute
NEO	nuclear explosive operation
NEPA	National Environmental Policy Act
NES	nuclear explosive safety
NEST	Nuclear emergency support team
NEWS	nuclear explosive and weapons surety
NGP	NNSA Graduate Program
NMMP	nuclear maintenance management programs
NNSA	National Nuclear Security Administration
NPH	natural phenomena hazard
NPL	national priorities list

NRC	Nuclear Regulatory Commission
NTS	noncompliance tracking system
ODFSA	officially designated Federal security authority
ODSA	officially designated security authority
OE	operating experience
OMB	Office of Management and Budget
OPI	Office of Primary Interest
OPM	Office of Personnel Management
ORPS	occurrence reporting and processing system
ORR	operational readiness review
OSHA	Occupational Safety and Health Administration
OST	Office of Secure Transportation
P2	pollution prevention
PA	protected area
PAAA	Price-Anderson Amendments Act
PBI	performance-based incentive
PDSA	preliminary documented safety analysis
P_E	system effectiveness
PEP	performance evaluation plan
PER	performance evaluation report
PESTLE	Political, economic, sociological, technological, legal, and environmental
PF	protective force
PIDAS	perimeter intrusion detection and assessment system
PISA	potential inadequacies of the safety analysis
PNNL	Pacific Northwest National Laboratory
PO	performance objective
PPE	personal protective equipment
PRA	probabilistic risk assessment
PSO	program secretarial officer
PV	planned value
QA	quality assurance
QAP	quality assurance program
RA	readiness assessment
RCA	root cause analysis
RCRA	Resource Conservation and Recovery Act
RCS	radiological control standard
RD	restricted data
RER	radiological emergency response
ROA	Regulatory Oversight Agreement
RPP	radiation protection program
SAC	specific administrative control
SC	safety class
S/CI	suspect/counterfeit item
SECON	security threat conditions
SES	senior executive service

SL	safety limit
SLSM	strategic leadership succession management
SME	subject matter expert
SMS	safety management system
SNM	special nuclear material
SNR	startup notification report
SO	secretarial officer
SP	security plan
SQA	software quality assurance
S/RID	standards/requirements identification document
S&S	safeguards and security
SS	safety significant
SSC	structures, systems, and components
SSP	site sustainability plan
SSPP	strategic sustainability performance plan
SSSP	site safeguards and security plan
STSM	senior technical safety manager
SV	schedule variance
SWOT	strength, weakness, opportunities, and threats
TED	total effective dose
TEDE	total effective dose equivalent
TPCDP	technical professional career development path
TQP	Technical Qualification Program
TRU	transuranic
TSCA	Toxic Substance Control Act
TSDF	transporters, and treatment, storage and disposal facilities
TSR	technical safety requirement
UFVA	unclassified foreign visits and assignments
USEC	United States Enrichment Corporation
USQ	unreviewed safety question
USQD	unreviewed safety question determination
VA	vulnerability assessment
WS&H	worker safety and health

PURPOSE

The purpose of this reference guide is to provide a document that contains the information required for a Department of Energy (DOE)/National Nuclear Security Administration (NNSA) technical employee to successfully complete the Senior Technical Safety Manager Functional Area Qualification Standard (FAQS). Information essential to meeting the qualification requirements is provided; however, some competency statements require extensive knowledge or skill development. Reproducing all the required information for those statements in this document is not practical. In those instances, references are included to guide the candidate to additional resources.

SCOPE

This reference guide has been developed to address the competency statements in the March 2013 edition of DOE-Standard (STD)-1175-2013, *Senior Technical Safety Manager Functional Area Qualification Standard*. The qualification standard for Senior Technical Safety Manager contains 16 competency statements.

PREFACE

Competency statements and supporting knowledge and/or skill statements from the qualification standard are shown in contrasting bold type, while the corresponding information associated with each statement is provided below it.

A comprehensive list of acronyms, abbreviations, and symbols is provided at the beginning of this document. It is recommended that the candidate review the list prior to proceeding with the competencies, as the acronyms, abbreviations, and symbols may not be further defined within the text unless special emphasis is required.

The competencies and supporting knowledge, skill, and ability (KSA) statements are taken directly from the FAQS. Most corrections to spelling, punctuation, and grammar have been made without remark. Only significant corrections to errors in the technical content of the discussion text source material are identified. Editorial changes that do not affect the technical content (e.g., grammatical or spelling corrections, and changes to style) appear without remark. When they are needed for clarification, explanations are enclosed in brackets.

Every effort has been made to provide the most current information and references available as of October 2013. However, the candidate is advised to verify the applicability of the information provided. It is recognized that some personnel may oversee facilities that utilize predecessor documents to those identified. In those cases, such documents should be included in local qualification standards via the TQP.

In the cases where information about an FAQS topic in a competency or KSA statement is not available in the newest edition of a standard (consensus or industry), an older version is referenced. These references are noted in the text and in the bibliography.

This reference guide includes streaming videos to help bring the learning experience alive. To activate the video, click on any hyperlink under the video title. Note: Hyperlinks to video are shown in entirety, due to current limitations of eReaders.

1. **An STSM must demonstrate the ability to effectively communicate technical safety expectations and issues.**

   a. **Discuss the means of developing and/or enhancing alliances with external groups (e.g., other agencies and governments, U.S. Congress, and clientele groups).**

   This is a site-specific KSA. The Qualifying Official will evaluate its completion.

   b. **Represent and speak for the organizational unit on safety management issues (e.g., presenting, explaining, selling, defending, and negotiating) to those inside and outside the Department.**

   This is a performance-based KSA. The Qualifying Official will evaluate its completion.

   c. **Discuss the benefits to safety management of promoting effective communication and exchange across the Department including**
      - **Focused sharing of information;**
      - **Interaction and resolution of issues; and**
      - **Use of lessons learned.**

   The following is taken from DOE-STD-7501-99.

   The application of lessons learned plays a key role in maintaining integrated safety management systems (ISMSs) and in improving DOE and contractor programs, processes, and practices integral to ISMSs.

   At the local level, contractor managers are expected to describe lessons learned programs as part of their safety management system (SMS) descriptions. These descriptions should express the local management expectations for the development, communication, and use of lessons learned. They should also describe, in whole or by reference, the infrastructure mechanisms that support development, sharing, and use of lessons learned.

   The Department established integrated safety management (ISM) as a Department-wide approach for managing and performing work safely. ISM defines five work-cycle functions: identifying the work, analyzing the hazards, defining the controls, performing the work, and feedback and continuous improvement. It also describes three basic levels of work within which these functions are performed: the institutional, site, and activity levels. It is expected that lessons learned will be identified, shared, and used within each function, for inter-relationships among functions, and within and among the three organizational levels of work planning and performance.

   The use of lessons learned is a principal component of an organizational culture committed to continuous improvement. The methods used to instill lessons learned as part of the culture vary, as do the mechanisms for identifying, sharing, and using lessons learned.

   The nature of the work and the complexity of the organization are prime determinants of cultural and infrastructure support for lessons learned. Cultural methods often include setting expectations, providing support and incentives, conducting monitoring and providing feedback, and continuous improvement. Infrastructure mechanisms typically include the

clear definition of resources, processes, and procedures by which personnel are supported to identify, share, and use lessons learned. The infrastructure mechanisms are often referred to as lessons learned programs.

Lessons learned programs include two basic processes. The first is a development process that includes identification, documentation, validation, and dissemination of a lesson learned. The second is a utilization and incorporation process that includes identification of applicable lessons learned, distribution to appropriate personnel, identification of actions that will be taken as a result of the lessons learned, and follow-up to ensure that appropriate actions were taken. In addition to these elements, lessons learned programs contain processes to measure operational performance improvement and program effectiveness.

Video 1. Effective communication within the organization
http://www.youtube.com/watch?v=e5oXygLGMuY

d. Describe how the following expectations are effectively communicated within an organization to build a continuous improvement culture:
- **Development and exploration of new ideas are encouraged.**
- **Process quality and safety responsibilities within the organization are understood.**
- **Individuals know how their work contributes to safety objectives and strategic goals.**
- **Unsafe practices, nonconforming items, and potential areas for improvement are readily identified.**
- **Enhanced product and process safety and reliability are emphasized.**

The following is taken from DOE G 450.4-1C.

Integrated safety management (ISM) core function 5 is to "provide feedback and continuous improvement." Feedback information on the adequacy of controls is gathered; opportunities for improving the definition and planning of work are identified and implemented.

The concept of continuous improvement implies that line management establishes formalized mechanisms and processes for identifying and capturing environment, safety, and health (ES&H)-related deficiencies, as well as for tracking the implementation and effectiveness of associated corrective actions. The process of ensuring that corrective actions are timely, complete, and effective is founded on firm technical basis and clearly identified responsibility for timely implementation. To avoid recurrence of events having environment, safety, and health (ES&H) implications, line management establishes a process for disseminating lessons learned to affected personnel, internally and across the DOE complex. The basic attributes of ISM core function 5 are as follows:
- Feedback on the effectiveness of the ISM and the adequacy of controls is gathered.
- Extent-of-condition reviews are conducted using a graded approach.
- Opportunities for improving work execution and planning are identified and implemented.
- If necessary, regulatory enforcement actions occur.
- Line and independent oversight or assessment is conducted at all levels by DOE and the contractor.

- Oversight and assessment activities verify that work is performed within adequate and agreed upon controls.
- Performance measures or indicators and performance objectives are developed in coordination with DOE.
- Line managers use performance measures and indicators as part of the self-assessment process.
- Feedback, including worker input and lessons learned, is managed to improve safety and work performance.
- Oversight or assessment results are managed to ensure that lessons are learned and applied throughout the site.
- Issues, including worker input, are identified and managed to resolution.
- Fundamental causes are determined, and effective corrective action plans are developed and implemented.
- Corrective action effectiveness reviews are conducted using a graded approach.
- Regulatory compliance and enforcement as required by rules, laws, and permits, such as the Price-Anderson Amendments Act (PAAA), National Environmental Policy Act (NEPA), Resource Conservation and Recovery Act (RCRA), the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the Federal Facility Compliance Act (FFCA), and 10 CFR 851 "Worker Safety and Health Program," are ensured.

e. Prepare and present a briefing to senior management or stakeholders on the state of safety for a given facility or site.

This is a performance-based KSA. The Qualifying Official will evaluate its completion.

2. An STSM must have a working level knowledge of the policies and procedures used to recruit, select, and qualify employees to establish and maintain technical competency.

a. Discuss planning, recruitment, and selection processes that can be used to acquire a technically competent workforce with the necessary knowledge, skills, abilities, and/or potential to accomplish the goals of the organization.

The following is taken from DOE O 426.1, chg. 1.

The purpose of DOE O 426.1, *Federal Technical Capability*, is to define requirements and responsibilities for meeting the DOE commitment to recruiting, deploying, developing, and retaining a technically competent workforce that will accomplish DOE missions in a safe and efficient manner through the Federal technical capability program.

NNSA Graduates Program

NNSA offers an exceptional opportunity for recent college graduates who have the ability and drive to take on challenging jobs that help safeguard our nation's security.

The NNSA Graduates Program (NGP) recruits talented men and women who have recently obtained, or are pursuing, a master's or Ph.D. degree in a wide variety of disciplines, including engineering, nuclear nonproliferation, science, international affairs, security,

emergency operations, and other related fields. Over the course of the full-time, year-long program, Fellows are provided specialized training to introduce them to NNSA's varied operations and help to develop their technical and leadership skills.

The NGP, created in 2012, combines the best features of NNSA's two premier developmental programs: the Future Leaders Program and the Nonproliferation Graduate Fellowship Program. Like its predecessors, NGP seeks outstanding applicants who can obtain and maintain a security clearance.

The NGP is funded by the NNSA and is administered by the Pacific Northwest National Laboratory (PNNL). While NGP Fellows work in NNSA offices in the Washington metropolitan area, they are PNNL employees.

DOE Scholar's Program

The Department's Corporate Outreach and Recruitment Council have created a corporate "umbrella" intern program called the "DOE Scholars Program." This program is designed as a comprehensive pipeline program to attract a new generation of employees into DOE and quickly prepare them for vital mid- to senior-level positions. The DOE Scholars Program offers flexibility to meet varied mission needs and mobility for candidates to move throughout the Complex. The program also provides a strategic approach to help the Department achieve a highly skilled, diverse workforce capable of carrying out vital mission areas.

b. Discuss the parameters of the Excepted Service Authority (ies), the circumstances which would dictate use of an Excepted Service Authority, and the process and procedures for using an Excepted Service Authority to recruit and hire.

The following is taken from the *DOE Administrative Flexibilities Guide*.

DOE has three excepted service appointment authorities available as important tools to recruit and retain high-quality staff. Use of the excepted service authorities can expedite the hiring process and provide pay flexibilities to enhance recruitment and retention of key technical and other critical staff. They also support the Department's commitment to achieve the highest standards of scientific, engineering, technical, and professional excellence in its workforce.

Applicability

Authority to fill scientific, engineering, and technical positions performing activities relating to the safety of the Department's defense nuclear facilities and operations was initially included in the National Defense Authorization Act (NDAA) for 1995. This authority can only be used for scientific, engineering, or technical defense nuclear facilities safety-related positions. The excepted service appointment authority found in Section 621(d) of the DOE Act may also be used in hiring up to 200 high-quality individuals, who may otherwise be difficult to attract and retain under current competitive service rules. The NNSA also has an excepted service authority that may be used to facilitate the hiring of exceptionally qualified employees.

Considerations

The excepted service authorities may be particularly useful to organizations needing to attract exceptionally well-qualified employees in hard-to-fill positions or when offers must be made quickly to ensure competitive consideration by highly qualified candidates. Also, excepted service flexibilities can be useful to organizations undergoing restructuring and associated skills mix concerns.

Payment

Pay, under the excepted service personnel authorities, may be established up to an amount provided for by executive level III. In contrast to setting pay under the more traditional general schedule/senior level/senior executive service systems (SES), broad salary bands govern pay administration in the excepted service.

Authorization

Further guidance on the appropriate use of excepted service authorities may be obtained from the Human Resources Office or the Executive & Technical Resources Division (ME-531) at Headquarters. Actions to fill positions under these authorities are subject to review and approval by the Department's Executive Resources Board if pay levels meet or exceed salary levels for SES positions.

c. Discuss ways to motivate, reward, recognize, and retain excellent employees or recognize a major contribution to the organization using local rewards programs or programs described in the Departmental *Administrative Flexibilities Guide*.

The following is taken from the NNSA *Demonstration Project* website.

On March 16, 2008, NNSA implemented its pay banding and performance-based pay adjustments demonstration project. This project modifies the general schedule (GS) classification and pay system by identifying several broad career paths, establishing pay bands which may cover more than one grade in each career path, eliminating longevity-based step progression, and providing for annual pay adjustments based on performance. The proposed project will test

- the effectiveness of multi-grade pay bands in recruiting, advancing, and retaining employees, and in reducing the processing time and paperwork traditionally associated with classifying positions at multiple grade levels; and
- the application of meaningful distinctions in levels of performance to the allocation of annual pay increases.

The following is taken from the DOE *Administrative Flexibilities Guide*.

There are a variety of monetary and non-monetary awards that can be used as tools to motivate, reward, or recognize technically excellent employees. These should be used in a progressive manner commensurate with the nature of the contribution or continuous contributions to increase employee responsiveness and mission accomplishment. Following is a brief summary of some of the major awards:

Monetary Awards

SPECIAL ACT OR SERVICE AWARD
This is a monetary award granted to an employee or group of employees for a contribution or accomplishment in the public interest that is a nonrecurring contribution either inside or outside of established job responsibilities, a scientific achievement, or an act of heroism. Awards of up to 7,500 dollars per person may be approved by the head of the departmental element.

ON-THE-SPOT MONETARY RECOGNITION AWARD
This is a monetary award granted to an employee or group of employees for performing, usually short-term, tasks or assignments with exceptional and unanticipated speed and quality under difficult or unusual circumstances. Award amounts range from 25 dollars to 300 dollars for an individual and 25 dollars to 2,500 dollars for a group (maximum of 300 dollars for an individual in the group).

PERFORMANCE MANAGEMENT SYSTEM AWARD
This award recognizes and rewards high-level performance based on an employee's current appraisal period rating of record for one full year. (Awards granted for a lesser period maybe prorated.) Each departmental element establishes an award/scale method to be used for these awards. Scale/methods may be uniform or variable, and may be expressed as a percentage of salary or as dollar amounts.

QUALITY STEP INCREASE
This award may be granted to general schedule employees with a current rating at the highest level for continuing high-quality performance, usually extending over more than one rating period.

Non-Monetary Awards

TIME-OFF AWARD
Additional time off may be granted, without loss of pay or charge to leave, in recognition of superior accomplishment or other personal effort that contributes to the quality, efficiency, or economy of government operations. Full-time employees may be granted up to 40 hours of time off from duty for any single contribution, and receive a maximum of 80 hours of time off per year.

EXCEPTIONAL SERVICE AWARD
This bronze medal, rosette, and plaque may be granted for outstanding service or an established record of achievement in the conduct or improvement of departmental programs or operations; accomplishment of assigned responsibilities in an exemplary manner; the demonstration of unusual initiative in contributing to efficiency or improved management; outstanding executive or technical ability; unusual devotion to duty under adverse conditions; or for any other equally notable achievement deemed worthy of this level of recognition.

NON-MONETARY SUPERIOR ACCOMPLISHMENT AWARDS
Other non-monetary awards may be granted for superior accomplishment of assigned tasks to provide recognition for more exceptional accomplishments and creative endeavors that may result in significant benefits to the Department or the parent organization. These awards

include the superior achievement award, award for achievement in equal employment opportunity, and certificates of appreciation.

The following is taken from the DOE *Administrative Flexibilities Guide*.

Technical Professional Career Development Path (TPCDP)

The Department has established a Technical Professional Career Development Path (TPCDP) for safety professionals, senior managers, and decision makers responsible for nuclear safety, including those responsible for nuclear safety oversight. These technical professionals are primarily employees classified as scientists, engineers, or managers working in the safety, health, environmental, security, and management functions associated with the safe operation of defense nuclear facilities.

The TPCDP gives technical professionals the education and experience necessary to develop the technical and managerial skills needed for their positions and helps ensure that DOE recruits, continuously develops, and retains the employees it needs for critical oversight and management jobs. In addition, technical professionals can develop technical and professional skills, obtain professional credentials, and perform challenging technical assignments so they can advance to higher-graded positions—all through a structured program.

Technical Base

The technical base encompasses the training and qualification for a new technical professional. New technical professionals can be interns hired directly from college for entry-level positions, or they can be more experienced professionals hired for nonsupervisory positions.

Qualifications to enter the technical base phase are the knowledge and skills acquired through college education, combined with activities, such as completion of internships, on-the-job training, and prior work experience within DOE or external to DOE. New technical professionals in the technical base are expected to demonstrate effective performance by formal qualification in the Department's TQP, as defined in this Order. Technical professionals complete the technical base phase when they achieve formal qualification in the general technical base qualification standard, a specific FAQS, and a site-specific or office-specific qualification standard. Most employees will take 18 months to complete the training and qualification activities in the technical base. This is accomplished in conjunction with their normal job assignments. When employees complete the technical base training and qualification, they are considered to be competent to perform all the duties and assignments associated with that functional area.

Professional Base

Technical professionals in the professional base phase of their careers develop further expertise within their assigned functions. This phase of an employee's development program includes a balance of technical skills with professional and personal development. Although there is a training curriculum associated with this phase, there is more emphasis on expanding the experience base of the employee.

Employees that complete the professional base are recognized as very well qualified in their functions. They typically hold positions in one of the five general technical- or safety-related organizations: quality assurance/oversight/safety, site/facility operations, engineering/authorization basis, project/program, and headquarters technical position.

Expert Base

Some employees may choose to complete the professional base and continue working in that capacity for their entire career. Other employees may want to continue advancing their career, and, at this point, may choose one of two tracks. Those employees who want to progress into supervisory and management positions may pursue the management base. Other employees may want to practice their technical profession at a higher level without moving into a supervisory or management position. These employees may pursue the expert base.

The expert base phase of the TPCDP is directed toward a limited number of select employees who wish to continue to excel within their chosen profession. These employees are typically GS-14/15 or pay band IV, and in select cases, they may become SES employees. The training and development program for these personnel is typically individually based and focused on achieving technical excellence within a specific discipline, such as fire protection, criticality safety, structural engineering, or similar discipline. Employees in the expert base may continue to pursue advanced education to obtain a PhD in their technical discipline; in select cases, the Department will strive to support their choice through educational reimbursement or fellowship programs. Employees should also continue to pursue advanced training provided by professional organizations, educational institutions, other agencies, or commercial providers.

Employees in the expert base should also pursue other experiential opportunities in their technical discipline. At a minimum, these experiential opportunities would involve short- and mid-term assignments within the Department in areas that allow for growth within their technical discipline. Such opportunities may include assignments on operational readiness review teams, accident investigation teams, assessment teams, or assisting other offices with a particular technical issue or project. Employees in the expert base should also pursue temporary assignments with other agencies or industry organizations to broaden their base of knowledge in their specific technical disciplines.

Retention Allowances

Retention allowances of up to 25 percent of basic pay may be paid to high-quality employees who are likely to leave the Federal government and whose services the Department considers essential.

APPLICABILITY

Positions covered include those in the general schedule, and for senior level, scientific or professional, SES, excepted service, executive schedule, and presidential appointees. Retention allowances may not be offered to employees who have not yet fulfilled obligations pursuant to service agreements established in connection with relocation and/or recruitment bonuses.

CONSIDERATIONS
Managers can demonstrate the need for a retention allowance by determining first that a particular employee is likely to leave Federal service; the manager must then determine if the employee's leaving would adversely affect the organization's ability to conduct essential activities/functions. Also, the manager should consider data on the difficulty of replacing the employee: offer acceptance rates, proportion of positions filled, length of time required to fill the position, and availability in the labor market of other suitable candidates. Retention allowances are established on an annual basis, and must be reviewed at least annually.

BASIS FOR AUTHORIZATION
The amount of the allowance is based on whether a special need exists within the manager's organization, whether the allowance is cost effective, whether funds are available, and whether the allowance makes sense in terms of overall organizational goals and staffing allocations. The allowance cannot exceed 25 percent of the employee's basic pay (NOT base pay plus locality pay).

COMBINED USE
The retention allowance may be used in combination with dual compensation restriction waivers, recruitment and relocation bonuses (provided there are no service agreements in effect), and special salary rates.

PAYMENT
The allowance is calculated as a percentage of base pay and paid in the same manner and at the same time as basic pay. The allowance is not considered part of basic pay for any purpose.

AUTHORIZATION
The Executive Resources Board for Senior Executive Service, Senior Level, Scientific and Professional positions; for all other positions, Heads of Departmental Elements.

d. Discuss the roles and responsibilities of the FTCP panel and panel agents in the recruitment, selection, training, and retention of technical personnel.

The following is taken from DOE O 426.1 chg. 1.

Federal Technical Capability Program (FTCP) Panel Responsibilities

The FTCP panel must

- review and approve FAQS;
- develop and maintain an annual operational plan that clearly identifies major issues related to needed technical competencies and the Department's TQPs and activities necessary to resolve these issues in a timely manner;
- prepare periodic reports to the Secretary of Energy, based in part on the summary workforce analysis and staffing plans described in DOE O 426.1 chg. 1. The report will summarize actions taken to address the Department's hiring and deployment needs and identify future actions to preserve critical technical capabilities to ensure safe operations of defense nuclear facilities. The report must be submitted at least on a biennial basis;

- assess the effectiveness of its functions at least every four years. These assessments must be conducted according to the requirements of DOE O 226.1B, *Implementation of Department of Energy Oversight Policy*, and the current objectives and criteria approved by the FTCP chair and posted on the FTCP website.

Federal Technical Capability Program Agent Responsibilities

The FTCP agents

- coordinate development of the annual workforce analysis and staffing plans for their organizations;
- oversee implementation of the TQP for their organizations, and ensure that the qualification process is relevant, and aligned with mission priorities;
- assist field element managers (FEMs), program secretarial officers (PSOs)/lead PSOs in establishing or maintaining formal STSM programs for their organizations;
- facilitate recruitment to fill open STSM positions with technically competent individuals;
- concur with STSM vacancy announcements to ensure the inclusion of adequate selection criteria;
- concur with competitive selections for STSM positions where the individual has not previously qualified as an STSM;
- lead, participate in, or oversee FTCP assessments and TQP assessments within their organizations;
- solicit information and feedback from people in their organizations regarding the improvement of technical capability of the Department's workforce;
- keep people in their organizations informed of the progress/problems associated with execution of the FTCP, and seek support from senior officials regarding successful implementation; and
- assist with the development of the FTCP action plans.

e. Describe methods used to assess an employee's unique developmental needs and why providing developmental opportunities to employees could contribute to the achievement of organizational goals.

The following is taken from DOE O 360.1C.

All DOE employees must have individual development plans (IDPs) in place within 60 days of joining DOE, changing positions (reassignments, promotions, and/or details), or the beginning of a new performance cycle, except when supervisors and employees jointly determine and record that individual development planning would result in little or no benefit to DOE due to an employee's position, expertise, career status, performance level, or personal circumstances.

Managers and supervisors must

- ensure that employees comply with applicable workforce training requirements and agreements;
- participate in performance and training needs assessments to identify training opportunities for themselves and their employees;

- participate in the development and maintenance of IDPs for themselves and their employees; and
- ensure that selected training and development is mission-oriented, appropriate, and cost-effective.

Employees must

- assume responsibility to collaborate with their supervisors in planning for their continued professional development;
- maintain their IDP; and
- attend and complete required/assigned training.

f. Describe in general the training and qualification requirements for contractors specified in DOE Order 426.2, *Personnel Selection, Qualification, and Training Requirements for DOE Nuclear Facilities*.

The following is taken from DOE O 426.2, attachment 1.

Training

The operating contractor must establish one or more organization(s) to be responsible for the training of all applicable personnel. The organization(s) must be held accountable for providing the support necessary to ensure that personnel are qualified to safely and effectively meet job requirements. The responsibilities, qualifications, and authority of training organization personnel must be documented, and managerial roles, responsibilities, authority, and accountability clearly defined.

INITIAL TRAINING

A training program must be established for operations, maintenance, and technical staff personnel utilizing the systematic approach to training process. The basic elements of a systematic approach to training include the following:

- A systematic analysis of the jobs to be performed
- Learning objectives derived from the analysis of the job that describe desired performance after training
- Training design, development, and implementation based on the learning objectives
- Evaluation of trainee mastery of the objectives during training
- Evaluation and revision of the training based on the performance of trained personnel in the job setting

GENERAL TRAINING

General employee training: All persons employed either full- or part-time in DOE hazard category 1, 2, and 3 nuclear facilities must be trained commensurate with their job duties. General employee training programs must include training in the following areas as they relate to individual jobs:

- General description of facilities
- Job related policies, procedures, and instructions
- Radiological health and safety program
- Facility emergency plans
- Industrial safety/hygiene program
- Fire protection program

- Security program
- Quality assurance program (QAP)
- Criticality safety (training program content according to American National Standards Institute (ANSI)/American Nuclear Society (ANS) 8.20-2005, Criticality Safety Training)

Probabilistic risk assessment (PRA) training: At those nuclear facilities for which a PRA has been performed and is applicable, initial and continuing training programs for operations and technical staff personnel must include training on the principal results of the PRA.

Technician and maintenance personnel training: All technicians and maintenance personnel must be qualified to perform the tasks associated with their specialty, or work under the direct supervision of personnel qualified to perform the activity or task.

Technical staff training: Technical staff personnel are typically involved in surveillance, testing, analysis of facility data, planning modifications, program review, and technical problem resolution in their area of expertise.

Management and supervisory training: Supervisory skills and management training need not be subject to examination as part of initial training, nor is it necessary to include training on these topics in the continuing training program. It may, however, be appropriate to include additional topics such as these as part of the ongoing professional development program for managers and supervisors.

CONTINUING TRAINING

Continuing training programs must be established to maintain and enhance the knowledge and skills of operating contractor personnel who perform functions associated with engineered safety features as identified in the facility documented safety analysis (DSA). The guidance in DOE-HDBK-1118-99, *Guide to Good Practices for Continuing Training*, should be used to develop continuing training programs.

Qualification

Qualification is defined in terms of education, experience, training, examination, and any special requirements necessary for performance of assigned responsibilities. The requirements in this CRD are intended to provide reasonable assurance that personnel at DOE hazard category 1, 2, and 3 nuclear facilities possess qualifications to operate and maintain the facilities safely and reliably under all conditions.

GENERAL

The program leading to qualification must be governed by written procedures that include requirements for documented assessment of the person’s qualifications through examinations and performance demonstrations. The contractor must define qualification requirements for personnel in each functional level or area based on the criteria contained in this CRD. The contractor must have a method for formally indicating that a person is qualified and when the qualifications expire.

SUBCONTRACTOR PERSONNEL

Subcontractor personnel must meet the qualification requirements for the job function to be performed. In addition, the operating contractor must ensure that subcontractor and temporary personnel who perform specialized activities are qualified to perform their assigned tasks.

MANAGERS AND TECHNICAL STAFF

Even though applied broadly to personnel in the operating organization, the term qualification has a different application for managers and technical staff personnel. These personnel may be considered qualified by virtue of meeting the education and experience requirements associated with the position and by completing applicable position-specific training. A comprehensive examination need not be administered to determine qualification. Continuing training and professional development programs should be established to meet the needs of the individual and the position. Satisfactory performance of assigned duties and assessment of individual performance, like that which is typically included in personal performance appraisals, may be used to document continued satisfactory performance.

TECHNICIANS AND MAINTENANCE PERSONNEL

Technician and maintenance personnel qualification must include demonstrated performance capabilities to ascertain the ability to adequately perform assigned tasks. Written examinations should be administered to personnel in these positions as applicable. However, a comprehensive final examination need not be administered to ascertain formal qualification of technicians and maintenance personnel.

Satisfactory completion of the continuing training program, performance of assigned duties, and assessment of individual performance such as that which is typically included in personal performance appraisals may be used to document continued satisfactory performance.

OPERATORS AND SUPERVISORS

Qualification of operators and their immediate supervisors must include examinations as applicable to the position.

REQUALIFICATION

Personnel may be requalified by contractor management on completion of the continuing training program, including requisite examinations. Personnel and their immediate supervisors must not be allowed to continue to function in qualified or certified positions if they have not completed all of the requalification or recertification program elements within the two-year continuing training cycle. The contractor must indicate by signature that the person has successfully completed the requalification program and is formally requalified.

g. Discuss the responsibilities of DOE elements in meeting the requirements for the Technical Qualification Program as described in DOE O 360.1C, *Federal Employee Training*.

[Note: DOE O 360.1C does not mention the Technical Qualification Program.]

The following is taken from DOE O 426.1 chg. 1.

Each HQ and field element with defense nuclear facilities responsibility must establish a TQP for its organization. Although the programs may be designed to meet the unique needs and responsibilities of each organization, the following principles must be used as the basis for all TQPs:

- Demonstration of competence. The program must clearly identify and document the process used to demonstrate employee technical competence (e.g., professional certifications, qualification cards, background, and experience).
- Competency levels. The competency levels within the program must be clearly defined and consistent with applicable industry standards for similar occupations.
- Plans and procedures. Plans and procedures must be developed and implemented to govern the administration of the program.
- Qualification tailored to work activities. The program must clearly identify unique Department and position-specific work activities and the knowledge and skills necessary to accomplish the work. A process must be developed to determine needed additional office/site/facility-specific technical competencies for the individual positions.
- Credit for existing TQPs. The program must be structured to allow credit, where appropriate, for other TQP accomplishments to date.
- Transportable. Competency requirements identified as having Department-wide applicability must be transferable. For ease of transportability of qualifications between DOE elements, the DOE General Technical Base Qualification Standard and the various DOE FAQSs must be used without modification or additions. Each DOE HQ, field or organizational element determines whether office/site/facility-specific qualification standards technical competencies are needed for TQP participants.
- Measurable. The program must contain sufficient rigor to demonstrate compliance with the TQP.

Each organization must document its TQP requirements in a TQP plan. Organizations across the Department must use the FAQS as written in developing their TQP plans. The plans must be approved by the head of the element and include processes and requirements for the following:

- Identifying employees and/or positions required to participate in the TQP.
- Identifying employees and/or positions participating in the TQP responsible for oversight of safety management programs as identified in the respective facility DSA.
- Identifying employees and/or positions who can serve as qualifying officials to verify and certify qualifications.
- Identifying, developing, approving, revising, and updating individual qualification requirements, as appropriate.

- Establishing and/or updating IDPs, training plans, or qualification-related records; for example, qualification plans, qualification cards, supporting documentation, and other records needed to support how the qualification was attained. The TQP plans must reference the TQP in IDPs and performance standards.
- Evaluating employees against FAQS, determining when to use oral review boards (protocol, questioning procedures, pass/not pass criteria, quorum requirements, reexamination requirements, etc.), and documenting the approval of equivalencies for required competencies.
- Determining final qualification requirements, such as comprehensive written examination, oral examination, site/facility walkthrough, or some combination thereof.
- Addressing oral or written examination failures or other qualification failures, establishing reexamination requirements, and making work area or position reassignments.
- Establishing interim limitations or compensatory measures to support field office or program requirements for candidates who have not achieved full qualification or requalification, as applicable.
- Implementing continuing professional development and requalification programs.
- Maintaining training and qualification records. Personnel records/official personnel files are maintained separately by each HQ, field, and organizational element.
- Granting of equivalencies and criteria for extensions.
- Involving the FTCP agent in TQP vacancy announcements to ensure that qualification requirements of TQP are incorporated into the selection criteria for covered positions.

Each organizational element must use FAQS or other appropriate means to document technical qualification requirements for the position. These requirements must be established using the systematic approach to training methodology and include the following:

- Basic technical knowledge about topics such as radiation protection, occupational safety, chemical safety, nuclear safety, and environmental regulations. This area is covered through completion of the DOE general technical base qualification.
- Technical discipline competency, which can be demonstrated by education, professional certification, or examination. In addition to meeting Office of Personnel Management requirements for the position, current expertise and DOE-specific competencies are demonstrated through completion of the respective FAQS.
- Position knowledge, skills, and abilities specific to the position, facility, program, and/or office.

h. Describe the FTCP as defined in DOE O 426.1, Chg. 1, *Federal Technical Capability*, and discuss that application of the program in your organization.

The following is taken is taken from DOE O 426.1 chg. 1.

The purpose of the FTCP is to define requirements and responsibilities for meeting the DOE commitment to recruiting, deploying, developing, and retaining a technically competent workforce that will accomplish DOE missions in a safe and efficient manner through the FTCP. The Department will strive to recruit and hire technically capable people;

continuously develop the technical expertise of its existing workforce; and, within the limitations of executive policy and Federal law, retain critical technical capabilities within the Department at all times.

The FTCP principles are as follows:

- As described in the Department's ISM guiding principles, Federal personnel possess the experience, knowledge, skills, and abilities that are necessary to discharge their safety responsibilities.
- Line managers are accountable and have the responsibility, authority, and flexibility to achieve and maintain organizational technical excellence.
- Supporting organizations (personnel, training, contracts, finance, etc.) recognize line managers as customers and effectively support them in achieving and maintaining technical capabilities.
- An integrated corporate approach is required to ensure that necessary technical capabilities and resources are available to meet the overall needs of the Department's defense nuclear facility missions.

The second half of this KSA is performance-based and organization specific. The Qualifying Official will evaluate its completion.

i. Describe the following three types of mentoring relationships and discuss the types of goals that an organizationally sponsored mentoring program is intended to meet

- **supervisor**
- **informal**
- **structured-facilitated**

Supervisor

The following is taken from the National Aeronautics and Space Administration (NASA) *Mentoring Program Handbook, A Guide for Human Resources Professionals at NASA.*

Supervisory mentors share valuable information about the organization and provide meaningful work and developmental learning opportunities. They expose employees to the values of the organization (i.e., who and what gets rewarded or punished) and they help employees position themselves with the skills necessary for success.

Informal

The information for informal and structured-facilitated mentoring relationships is taken from the Association of Professional Engineers, Geologists, and Geophysicists of Alberta (APEGGA), *Strategies for Success in Mentoring, A Handbook for Mentors and Protégés.*

Informal mentoring relationships are unplanned relationships. These mentoring relationships grow out of a chance connection between two people and are further built into a relationship in which there is transference of skills and knowledge. There is no contract or list of goals. The relationship may move from professional to personal and may last a lifetime. These mentoring relationships are unquestionably valuable, but "just happen" as opposed to being actively developed.

Informal mentoring can be enhanced if the participants in the relationship take the time to have formal discussions and establish specific goals for the transference of certain skills and knowledge within set time periods.

Structured-Facilitated

Facilitated mentoring is a structured program that involves a coordinator who assigns mentoring pairs based on character, skills, need, and other criteria. The matching process is time-consuming and requires considerable human and capital resources. Facilitated mentoring also helps design contracts, creates reasonable lists of goals, and tracks the mentoring pairs to see if the relationship is working; and if not, helps facilitate the relationship. Although this may be the best kind of mentoring program, the cost is often prohibitive.

DOE offers structured programs that are designed to train and develop employees in specific disciplines. Two examples are the NNSA future leaders program and the facility representative (FR) mentoring program.

j. Discuss the benefits to the Department and individual organizational units which could be realized through use of the following:
- **Mentoring Program**
- **Special assignment/detail**

Mentoring Program

The following is taken from DOE Oak Ridge Operations Office, *Mentoring Program Description*.

The mentoring program is a one-year program designed to foster career and leadership development, expand employees' knowledge, skills, and abilities, and broaden understanding of DOE and its programs. It also aims to develop a workforce that is capable of adapting to the rapidly changing workplace environment. The program features employees at the senior executive service, as well as GS-13 to GS-15 level employees, serving as mentors to all DOE Federal employees who have strong leadership potential.

The mentoring relationship is the result of a deliberate pairing of a more skilled and/or experienced person with a lesser skilled and/or experienced person who has demonstrated potential. The benefits to the Department include
- cost-effective leadership development;
- improved recruitment and retention of a talented and diverse workforce;
- increased organizational communication and understanding;
- improved succession planning;
- increased employee motivation; and
- increased management ownership and engagement.

NNSA Graduate Program

The following is taken from the *NNSA Graduate Program* website.

NNSA offers an exceptional opportunity for recent college graduates who have the ability and drive to take on challenging jobs that help safeguard our nation's security. Those who are

selected for the highly competitive NNSA Graduate Program (NGP) will fill positions in NNSA's offices. They will gain experience addressing real-world challenges on the job and will participate in a rigorous learning and development program that can prepare them for potential leadership in the field of national security.

The NGP recruits talented men and women who have recently obtained, or are pursuing, a master's or Ph.D. degree in a wide variety of disciplines, including engineering, nuclear nonproliferation, science, international affairs, security, emergency operations and other related disciplines. Over the course of the full-time, year-long program, Fellows are provided specialized training to introduce them to NNSA's varied operations and help develop their technical and leadership skills.

The NGP, created in 2012, combines the best features of NNSA's two premier developmental programs: the Future Leaders Program and the Nonproliferation Graduate Fellowship Program. Like its predecessors, NGP seeks outstanding applicants who can obtain and maintain a security clearance.

Special Assignment/Detail

Special assignments or details provide employees with opportunities to diversify their skills, increase their knowledge, and enhance their abilities.

k. Describe the process for obtaining departmental technical assistance.

Although there are currently no directives that drive the process for obtaining technical assistance, information for nonnuclear operations is available from the Office of Worker Safety and Health Assistance. Nuclear facilities may secure assistance through the Office of Nuclear Safety and Environmental Assistance. Assets include subject matter experts (SMEs), other technical staff, and resources such as the DOE website. The departmental issues management process is one vehicle that may be utilized to ensure the proper assistance is directed to the request.

l. Describe the process for obtaining the technical assistance of an individual from another office on a temporary or detail basis.

Refer to KSA k for information on how to obtain technical assistance.

m. Describe other Departmental capabilities/resources that could be utilized to solve short-term technical safety issues.

Refer to KSA k for information on how to obtain technical assistance. Other STSM personnel may also be contacted for assistance, and depending on the nature of the issue, personnel referrals to other facilities with the expertise needed to resolve technical safety issues may be provided.

n. Conduct a workforce analysis to determine the gap in needed critical technical competencies for a given facility or site.

This is a performance-based KSA. The Qualifying Official will evaluate its completion. However, the following information may be helpful.

The following information provides guidance to be considered by program offices in developing workforce plans. It should be noted that with respect to integrating diversity into plans, organizations need to create a performance culture that respects diversity, and that can be reinforced through the performance system by incorporating a diversity element for supervisors and monitored by the use of survey results.

Workforce Analysis

The following is taken from the *Guide to Workforce Planning at the Department of Energy*, from which a large amount of additional information is available.

Four information sources provide key workforce information needs. They are (1) organization direction, (2) environmental factors (demand analysis), (3) internal, and (4) external labor (supply analysis). Suggested methods of collecting this information are listed in the guide. Analyze the supply (current workforce profile) against the demand (future workforce profile), and identify the discrepancies between supply and demand analyses.

Forecasting is considering the future needs of the organization. One of the most useful outcomes of this effort is the identification of potential problems or issues facing the organization. This analysis will be based on the data collected from the information sources in the analysis effort. The results of this effort will help develop gap analysis and emergent strategies to manage the future. It involves the identification of any predicted changes and/or developments that may result from the demand/supply analysis. Business elements may have varying issues identified based on needs of their organizations. The aim is to create necessary resources/strategies to optimize the future position of the organization. There are four steps in the forecasting process: identifying key workforce assumptions; validating assumptions; utilizing assumptions for scenario building; and performing gap analysis. There are three questions that need to be addressed in the forecasting process. They are as follows:

1. Where does the business element want to be? (utilizing assumptions information to suggest future demand)
2. Where is the organization now? (based on the workforce analysis)
3. What are the gaps in meeting this demand? (demand versus supply analysis)

The first step is to identify key workforce assumptions/issues for the elements, based on the data/information collected from the information sources during the analyzing effort. Ensure that all of these forecasting assumptions describe the potential impact on the business element, any inherent risks, and any likelihood of occurrence based on element culture.

The second step is to validate these assumptions by utilizing focus groups or administering questionnaires/interviews to various leaders in the organization. The feedback provided will ensure that gathered assumptions are valid and based on the best data available. Additionally, feedback should provide insight into the reasoning behind the assumptions.

The third step is utilizing these assumptions in scenario building. Scenarios are a way to develop alternative futures based on different combinations of assumptions, facts, and trends that will help in meeting the forecasting goals. Scenarios are generally a descriptive statement, presenting a particular picture of the future that includes comments on the probability of certain events occurring. Moreover, scenarios are usually accompanied by qualitative or quantitative information. Scenario building may clarify options. The following scenarios should be outlined based on the assumptions:

- Best-case scenario—any warning indicators (metrics) in the narrative description
- Worst-case-scenario—any warning indicators (metrics) in the narrative description
- Most likely-scenario—any warning indicators (metrics) in the narrative description

The next step after outlining best, worst, and most likely scenarios is to create a preferred scenario detailing what the organization wants as an outcome, taking into account the assumptions previously identified. Additionally, include the information from any warning indicators above which should be used to monitor changes consistent with the preferred outcome.

It is useful to apply a strength, weakness, opportunities, and threats (SWOT) analysis: a simple technique that uses four perspectives for decision-making and summarization. Strengths and weaknesses are internal factors. Opportunities and threats are external factors. Identify the strengths, weaknesses, opportunities, and potential threats for each scenario suggesting the best, worst, and most likely outcomes. A PESTLE (political, economic, sociological, technological, legal, and environmental) analysis applies essentially the same technique but is useful for examining the external factors affecting a problem.

SWOT and PESTLE are useful for handling qualitative data. Either tool will help to organize and promote thinking about issues or problems that are facing business elements. It will help to clarify/identify future trends and to apply those trends to the organization to help explicitly identify any underlying assumptions and to set priorities. For example, in using the SWOT analysis, step one is to identify the assumption(s) and employ a matrix using the demands and supply information obtained in the analysis effort. Step two is to identify assumptions/key workforce issues from step 1 and to take into account the potential impact on business elements, potential impact of the assumption, risk inherent in the assumption, and the likelihood of its occurrence.

The final phase of forecasting is performing gap analysis. After completing the preferred scenario, look back at the current workforce and future demands to identify any gaps in skills, people needed to meet preferred scenarios, etc. Demand is based on the preferred scenario and competencies/skills needed to meet demand requirements. The gap analysis should indicate the skills gap, surplus, any recruitment issues, and retention issues to meet the demand, etc. This would continue until suggested strategies, initiatives, and/or actions to deal with the preferred outcomes to meet the organization's needs are developed. To help in the gap analysis, these questions must be addressed:

- What will be the potential sources of new staff that will be required?
- What attrition and retirement can be expected over the next five years?
- Will attrition make it easier or harder to achieve workforce objectives?
- What kind of positions will need to be filled?

- How can training/re-training help?
- What are the succession planning implications?
- What are the competitive sourcing solutions?
- What is the impact of budget decisions on any mission-critical occupations?
- Are there any redeployment concerns or issues with current staff?
- Are new hires going to be required, and if so are they going to replace current employees or go into newly established positions?

o. Participate as member of an oral examination board for qualification in a TQP functional area.

This is a performance-based KSA. The Qualifying Official will evaluate its completion. However, the following information is provided to assist a candidate participating in a TQP functional area oral examination board.

DOE-HDBK-1080-97, *Guide to Good Practices for Oral Examinations*, defines "oral board" as an oral examination covering a broad area of knowledge (at the job level vs. task or duty area) involving the questioning of one trainee/job candidate by one or more examiners. Its purpose is to determine if a trainee has achieved the level of knowledge required for qualification as a facility operator, supervisor, etc. An oral board may be used as the final check of qualification, or it may be combined with an operational evaluation/plant walkthrough. Oral boards usually cover all facets of facility or process operation. This includes

- facility components;
- system interrelationships; and
- normal/abnormal situations involving systems and interrelated systems and components.

Oral examinations should probe the trainee's understanding of fundamental principles and his or her ability to apply these principles to practical situations, equipment and system operation, and normal and abnormal operating procedures. Examinations should be based on knowledge of information within the scope of the learning objectives. Special emphasis should be placed on the trainee's ability to apply this knowledge to facility operations.

To prepare for the board, each board member should prepare questions (with answers) to be asked during the board. Questions should represent a cross section of the material contained in the learning objectives. Follow-up questions (with answers) should also be prepared prior to the board.

Board members should bring copies of their prepared questions and answers to share with the other board members. This practice helps prevent grading differences between board members.

Each board member should independently grade each question that the board member is qualified to grade. The grades should be recorded on a standard form by each board member, and the board chair should assign the overall board grade. These forms, completed and signed by each board member, should become a part of the trainee's training record.

p. Review and evaluate the succession plan for a given facility or site.

This is a performance-based KSA. The Qualifying Official will evaluate its completion. However, the following information may be helpful.

The following is taken from the Office of Personnel Management (OPM), *A Guide to the Strategic Leadership Succession Management (SLSM) Model*, which was developed to assist agencies in planning, designing, implementing, and evaluating succession management programs. The SLSM model is a part of implementing the human capital assessment and accountability framework, and provides guidance for human capital practitioners, supervisors, managers, and senior leaders who play a leadership role in identifying and addressing potential gaps in effective leadership.

Succession management is a systematic approach for

- shaping the leadership culture;
- building a leadership pipeline/talent pool to ensure leadership continuity;
- developing potential successors whose strengths will best fit with the agency's needs;
- identifying the best candidates for categories of positions; and
- concentrating resources on the talent development process, yielding a greater return on investment.

Succession management identifies those jobs considered to be the organization's lifeblood and too critical to be left vacant, or filled by any but the best qualified persons. Succession management is critical to mission success and creates an effective process for recognizing, developing, and retaining top leadership talent.

Figure 1 is a graphical depiction of the SLSM model showing the five phases in the succession management process and related activities. Consult the OPM guide for a detailed explanation of each phase.

Source: Office of Personnel Management, A Guide to the Strategic Leadership Succession Management (SLSM) Model

Figure 1. The five phases of the succession management process

q. Lead or participate in a self-assessment of the implementation of an organization's technical qualification program in accordance with DOE O 426.1 chg.1.

This is a performance-based KSA. The Qualifying Official will evaluate its completion. However, the following information may be helpful.

The following is taken from DOE O 426.1 chg. 1.

Headquarters and field elements must conduct self-assessments of TQP and FTCP implementation within their organization at least every four years. These assessments must be conducted in accordance with the requirements of DOE O 226.1B, and the current objectives and criteria approved by the FTCP chair and posted on the FTCP website.

Briefly, the seven TQP objectives are as follows:

1. TQP-1, Demonstration of Competence 羊the program clearly identifies and documents the process used to demonstrate employee technical competence.
2. TQP-2, Competency Levels 羊competency requirements are clearly defined and consistent with applicable industry standards for similar occupations.
3. TQP-3, Plans and Procedures 羊plans and/or procedures are developed and implemented to govern administration of the program.
4. TQP-4, Qualification Tailored to Work Activities 羊the program identifies unique Department- and position-specific work activities, and specifies the knowledge and skills necessary to accomplish that work.
5. TQP-5, Credit for Existing TQPs 羊the program is structured to allow credit, where appropriate, for other TQP accomplishments.
6. TQP-6, Transportability 羊competency requirements identified as applying throughout the Department are transferable.
7. TQP-7, Measurable 羊the program contains sufficient rigor to demonstrate compliance with the principles.

3. An STSM must have a working level of knowledge of the mechanisms used to develop, approve, implement, and improve Integrated Safety Management (ISM) systems including Nuclear Safety Culture elements such as the DOE Principles of Human Performance Improvement described in the Human Performance Fundamentals Course (National Academy for Nuclear Training), High Reliability Organization (HRO) and Human Factor Engineering (HFE), Differing Professional Opinion (DPO), and Employee Concerns Program.

a. Compare, contrast, and describe organizational culture, safety culture, and safety conscious work environment as they relate to nuclear missions in DOE.

The following definitions are taken from The Institute of Nuclear Power Operations (INPO), *Principles for a Strong Nuclear Safety Culture.*

Organizational culture: the shared basic assumptions that are developed in an organization as it learns and copes with problems. The basic assumptions that have worked well enough to be considered valid are taught to new members of the organization as the correct way to perceive, think, and feel. Culture is the sum total of a group's learning. Culture is for the group what character and personality are for the individual.

Safety culture: an organization's values and behaviors—modeled by its leaders and internalized by its members—that serve to make nuclear safety the overriding priority.

Safety-conscious work environment: a work environment with freedom to raise concerns without fear of retribution.

The following is taken from DOE G 450.4-1C.

A positive safety culture is an integral aspect of an effective ISMS. DOE's commitment to a positive safety culture is expressed in DOE P 450.4A, *Integrated Safety Management Policy*, which states "…the Department expects all organizations to embrace a strong safety culture

where safe performance of work and involvement of workers in all aspects of work performance are core values of managers and workers. The Department encourages a questioning attitude by all employees and a work environment that fosters such attitude."

In addition, DOE O 450.2, *Integrated Safety Management*, assigns to DOE line management, including the ISM Champions Council, the responsibilities for evaluating and developing strategies for improving DOE's safety culture.

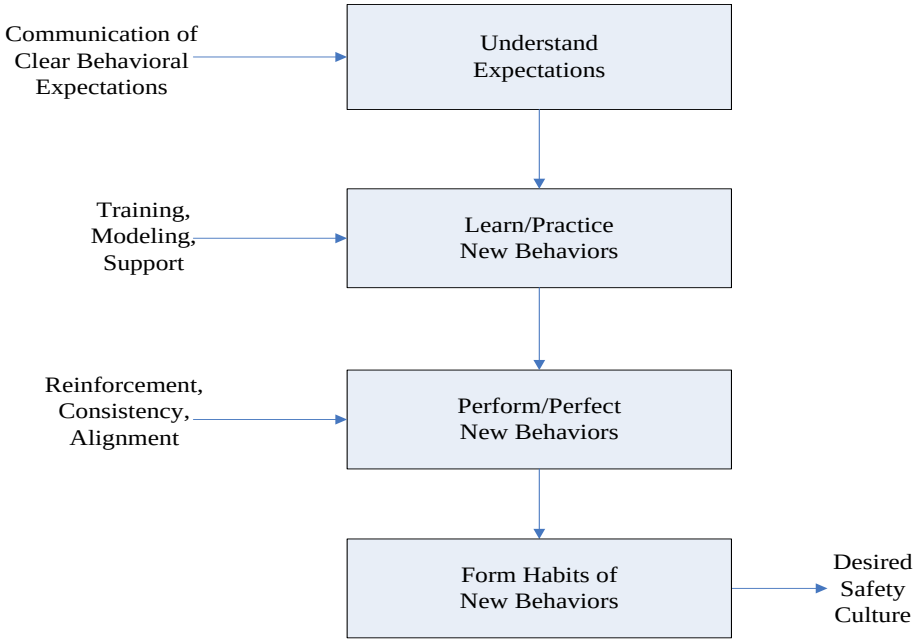
DOE and the Energy Facility Contractors Group (EFCOG) have collaborated to develop guidance for achieving a strong safety culture.

That guidance also includes the following three key safety culture focus areas and their associated attributes:

- leadership
- employee/worker engagement
- organizational learning

These safety culture focus areas and associated attributes are elaborated on in attachment 10 of DOE G 450.4-1C, *Safety Culture Focus Areas and Associated Attributes*. This attachment discusses the three safety culture focus areas presented above, and several attributes associated with each one that are useful for attaining a strong safety culture that supports achieving excellence in safety and mission performance.

DOE G 450.4-1C, attachment 12, "Changing Behaviors and Values", provides an overview of ways to effect change in values and behavior within an organization. Figure 2 depicts the process of changing behaviors to achieve the desired culture changes.



Source: DOE G 450.4.1C

Figure 2. Process for changing behaviors to change culture

b. Identify and discuss the safety culture lessons learned from the Fukushima, Challenger, and Columbia Space Shuttle accidents and their applicability to DOE.

Fukushima

The following is taken from Barnhart, *INPO Updates Report on Lessons Learned From Fukushima Daiichi Accident*.

The Institute of Nuclear Power Operations (INPO) has conducted an independent review of Japan's Fukushima Daiichi and Daini nuclear power plants, at the request of Tokyo Electric Power Co., to examine and share lessons learned from the 2011 accident in which an earthquake and tsunami damaged the nuclear energy facilities. The nine-person team—composed of INPO, World Association of Nuclear Operators and U.S. nuclear industry experts—provides lessons learned that nuclear energy facility operating organizations should consider implementing, in conjunction with action plans already established as a result of the Fukushima event. The report is an addendum to a 2011 INPO report describing what happened during the event. The lessons learned in the new addendum have broad applicability to all nuclear energy operations organizations.

Headquartered in Atlanta, INPO is a sister organization to the Nuclear Energy Institute (NEI). It was established by the U.S. nuclear energy industry in 1979 to promote excellence in safety and operating performance above and beyond federal regulatory requirements.

"For the U.S. nuclear industry, our first priority is and always will be safety. INPO's findings are aligned with steps already being taken to enhance safety across our industry," said Tony Pietrangelo, NEI's senior vice president and chief nuclear officer.

Principal lessons learned include the following:

- Reactor cooling is the top safety priority during any unusual event. Resources and training should be allocated to emphasize this fundamental priority.
- Emergency response capability must include the staff and resources necessary to respond effectively to a severe condition at each reactor at a facility.
- Continually strengthen the industry's safety culture using the lessons from Fukushima to drive continuous learning from operating experience, a questioning attitude among reactor operators, and awareness of the unique aspects of nuclear energy technology.

The events at Fukushima Daiichi and Daini reinforce the need for U.S. industry programs to be prepared for unexpected circumstances. NEI works with INPO, its member companies, and the Nuclear Regulatory Commission (NRC) to ensure that lessons learned are applied in an effective manner to improve the safety and reliability of U.S plants, operating in 31 states, that generate 20 percent of U.S. electricity supplies.

Challenger

The following is taken from National Aeronautics and Space Administration, *Lessons Learned from the Challenger*.

Section 3 of *Lessons Learned from the Challenger* lists 67 individual lessons learned. The following is a sample of that information. Please refer to the document for a complete list of the lessons learned.

- Safety considerations were de-emphasized and resources were reduced unrealistically. Prior to the Challenger, the NASA safety, reliability, and quality assurance (SR&QA) organizations, both at Headquarters and at the field centers, had atrophied to a level that seriously limited their capability to perform effectively.
- Commitment was needed for safety emphasis. A firm commitment must be maintained to emphasize the need for safety during periods of success as well as adversity. The resources to maintain this commitment must not be diminished without justification to assure that safety risks will not be unknowingly increased. There should also be certain tangible evidence of the commitment.
- There was a lack of independence in assurance reviews. The joint-seal problem was not reviewed independently by NASA SR&QA organizations and no action was taken to identify the safety risks inherent with the program-identified solutions to the problem.
- Lines of authority and responsibility and interfaces between SR&QA, programs, center support offices and contractors were poorly and sometimes improperly defined.
- Neither NASA nor its contractor organizations had sufficient resources to perform their SRM&QA assurance functions properly.
- Safety risk must not be diminished by decree. Decisions relating to SRM&QA resource allocations at any phase of a program (including skills, staffing, and systems) must be made based on objective, factual assessments of the degree of safety risk and must not be skewed by schedule or operational expediency. Consideration should be given to the number and severity of safety related problems, the status of adverse trends, the effectiveness of controls of known hazards, and the residual and aggregate risk assessments.
- Deviation and waiver management, including the review and decision process and associated risk assessments at all levels, were inadequate for flight critical components. The joint seal waiver violated existing management requirements and pointed to some serious deficiencies in the deviation and waiver system.
- Policies, criteria, requirements, and management systems were inadequate to assure complete review and assessment of safety risks. There were inconsistencies in all of these areas between NASA Headquarters, field centers, prime contractors, and support contractors.

Columbia

In July 2005, DOE issued a combined action plan for lessons learned from the Columbia Space Shuttle Accident and the Davis-Besse reactor vessel head corrosion incident. Details are in KSA c of this competency statement.

Video 2. Safety Culture and the Columbia Space Shuttle Accident
http://www.c-spanvideo.org/program/SACu&showFullAbstract=1

c. Identify and discuss the safety culture lessons learned from the Davis-Besse Reactor Vessel Head Degradation Incident and their applicability to DOE.

The following is taken from the Department of Energy Action Plan, *Lessons Learned from the Columbia Space Shuttle Accident and Davis-Besse Reactor Pressure-Vessel Head Corrosion Event.*

Ten lessons learned identified from these events have applicability to DOE:

1. Operating experience (OE). People and organizations need to learn valuable lessons from internal and external OE to avoid repeating mistakes and to improve operations.
2. Mission and external influences. To prevent unsound program decisions, budget and schedule pressures must not override safety considerations.
3. Normalizing deviations. Routine deviations from an established standard can desensitize awareness of prescribed operating requirements and allow a low-probability event to occur.
4. Technical inquisitiveness. To ensure safety, managers need to encourage employees to freely communicate safety concerns and DPOs (differing professional opinions).
5. Focus on planning and prevention. Safety efforts should focus more on planning and preventive actions rather than on investigations and corrective actions resulting from accidents or events.
6. Organizational structure. An effective organizational structure with clear roles and responsibilities and appropriate checks and balances is essential.
7. Self-assessment and oversight. Successful operations require critical self-assessment and oversight to find problems.
8. Organization staffing and qualification. Robust technical capability, enhanced through ongoing technical and leadership training, is essential for complex operations.
9. Corrective action programs. Corrective actions that address the underlying causes of problems must be managed to resolution and verified to be effective.
10. Complacency. Management must guard against complacency brought on by good performance metrics and past successes.

The following discussion describes how each of these issues applies to DOE.

Operating Experience

DOE uses many standard program requirements across the complex, such as the radiological control and QAPs prescribed in DOE directives, that lead to common causes, practices, and lessons learned. However, DOE must also deal with a myriad of operations that involve differing technologies and unique organizations applicable to that project or technology. A problem may manifest itself in one site or plant (e.g., mixed oxide fuel production), but it is not readily apparent how the problem and its solution apply to other DOE activities (e.g., cleanout of K-Basin or operation of a Defense Waste Processing Facility). Accordingly, DOE needs to implement a stronger OE program that is able to examine underlying technical,

organizational, or safety culture issues to enhance feedback and continuous improvement for all DOE operations.

DOE must pay attention to its own "weak signals" (e.g., near misses, equipment failures, minor conduct of operations problems) that can be precursors to more significant events if the underlying causes are not identified and corrected. Benchmarking should be encouraged as a way to evaluate the lessons of good work practices from other organizations so that these practices can be applied to improve operations.

Mission and External Influences

The Department, like other government agencies, has extensive program activities in support of national requirements and desires. It is also bound to a congressional budget process that attempts to balance funds across broad priorities. Efforts to improve the productivity of operations must be carefully weighed against changes to the infrastructure and processes that have prevented a high-consequence event in the complex for decades. This is not to say that enhancements are not possible, but that safety must be the top priority. DOE has long recognized the potential for cost and schedule pressures to have an undesirable impact on the safe conduct of work. Line organizations have the responsibility for ensuring there are adequate resources to conduct work safely.

The language in two of the Department of Energy Acquisition Regulation (DEAR) contract clauses—48 CFR 970.5223-1, "Integration of Environment, Safety, and Health (ES&H) into Work Planning and Execution," and 48 CFR 970.5215-3, "Conditional Payment of Fee, Profit, and Other Incentives"—was drafted to ensure that all contractors are applying the appropriate resources to accomplish work safely with adequate ES&H funding. However, all DOE contracting officers may not have effectively used the budget-related provisions of the annual update process, or the conditional payment of fee, profit, and other incentives clause, in levying award fee penalties.

Many line programs have established processes to manage ES&H funding requirements in their budgets and work plans. Some of these processes are formalized, like the Office of Environmental Management's integrated planning and budgeting system. However, not all programs are equally effective in managing ES&H resource requirements.

Even where there is effective DOE management of resources necessary to conduct work safely, organizational pressures to meet performance deadlines (e.g., qualify for award fee) can result in workers using shortcuts or performing unsafe acts to complete work faster. Management must be aware that their actions speak louder than words; if they are stressing the schedule rather than safety and reliability, the work force will deliver on-time no matter the cost in terms of safety.

Normalizing Deviations

Appendix 3 to the *NNSA Columbia Accident Investigation Board (CAIB) Lessons Learned Report (2004), Minority Opinion*, states in part, "We have at least one major contractor who does not have an approved Quality Assurance Plan to comply with a nuclear safety rule (10 CFR 830) promulgated in 1994." Other discrete examples exist of facilities within the DOE complex where requirements are not fully implemented or routinely followed. Effort is

needed to identify these noncompliances and resolve them. The working group is not certain to what extent "normalization of deviations" is an issue for other DOE operations. However, an action to establish a safety exemption baseline is included in this plan.

Technical Inquisitiveness

In organizations as large as the DOE complex, voices can be missed. Efforts must be made to encourage personnel to speak out and ensure that paths are readily available to communicate safety issues. Managers must take any safety concerns seriously and, if necessary, take action to address them prior to allowing operations to continue. In addition, DOE has no formal DPO process; one is required.

When NNSA reviewed the CAIB report, it found situations in DOE where some line managers presume operations are safe unless proven otherwise. As such, the onus is frequently placed on safety professionals to prove that operations are unsafe, rather than requiring line managers to demonstrate that they are safe. Early identification of evolving problems is necessary not only to resolve issues as soon as possible, but also to re-establish a stable and safe nuclear configuration.

Focus on Planning and Prevention

The Department is an organization that performs complex, high-hazard operations. The prevention of high-consequence events in this type of organization, known as a high-reliability organization, has been an area of much research over the past fifteen years. INPO has been a key participant in this effort and has developed several relevant publications. For the past year, the Office of Environment, Safety and Health has offered voluntary training on INPO's Excellence in Human Performance. This human performance improvement (HPI) is intended to promote behaviors that support safe and reliable operation throughout an organization. Progress toward excellent human performance requires a work environment in which individuals and leaders routinely exhibit desired behaviors. Such behaviors must be clearly described, communicated, and—most importantly—reinforced. Peer pressure, open communication, and positive reinforcement can establish a culture in which individuals, leaders, and organizational processes eliminate obstacles to excellent human performance. This culture will reduce or even eliminate events due to human error.

Organizational Structure

It is the Department's policy that work be conducted safely and efficiently and in a manner that ensures protection of workers, the public, and the environment. To achieve this policy, effective safety requirements and goals are established; applicable national and international consensus standards are adopted; and where necessary to address unique conditions, additional standards are developed and effectively implemented. Integrated Safety Management (ISM) requirements for Federal organizations are established through directives, and for contractor organizations through contract clauses.

The Department's ultimate safety goal is zero accidents, work-related injuries and illnesses, regulatory violations, and reportable environmental releases. The Department expects that for all activities and phases in the lifecycle of missions, appropriate mechanisms are in place to ensure that exposures of workers, the public, and the environment to radiological and

nonradiological hazards are maintained below regulatory limits. Furthermore, DOE expects deliberate efforts to be made to keep exposures to radiation as low as reasonably achievable.

The Department will implement integrated safety management systems to systematically integrate safety into management and work practices at all levels in the planning and execution of work. All organizations will develop, maintain, and implement ISM systems for their operations and work practices, based on the ISM guiding principles and core functions. To improve effectiveness and efficiency, organizations are expected to tailor their safety management systems to the hazards and risks associated with the work activities supporting the mission; including using established mechanisms to tailor requirements. Further, decisions impacting safety are made by technically qualified managers with knowledge of the operations and after consideration of hazards, risks, and performance history. To complement these systems and mechanisms, the Department expects all organizations to embrace a strong safety culture where safe performance of work and involvement of workers in all aspects of work performance are core values that are deeply, strongly, and consistently held by managers and workers. The Department encourages a questioning attitude by all employees and a work environment that fosters such an attitude.

The ultimate responsibility and accountability for ensuring adequate protection of the workers, the public, and the environment from the operation of DOE facilities rests with DOE line management. The Department will meet this responsibility by

- establishing functions and clear lines of responsibilities, authorities, and appropriate accountabilities;
- measuring safety management performance, with special emphasis on work related to high consequence activities;
- evaluating incident reports;
- using environment, safety, and health performance measures;
- assessing performance; and
- holding itself and its contractors accountable at all organizational levels for safety performance through codified safety regulations, contract clauses, DOE directives, and the use of contractual and regulatory enforcement tools.

Self-Assessment and Oversight

Like NASA, DOE contracts for its operations. Like the NRC, DOE establishes the standards and regulates these operations. DOE's oversight guidance must establish clear guidelines and an unambiguous framework (i.e., frequency, technical focus and bases, reporting, synthesizing findings, and communications) for oversight of ES&H topics. The DOE nuclear safety rule, 10 CFR 830, "Nuclear Safety Management," identifies management processes required for nuclear safety. These processes include configuration control, maintenance (including system surveillances), lessons-learned programs, and use of lessons learned in training and qualification. These programs are not uniformly implemented and should be monitored in an operations environment.

Organization Staffing and Qualification

DOE has undergone a number of organizational changes, most notably the creation of NNSA and their stand-up of the NNSA Service Center (NNSA Albuquerque Complex). A significant percentage of DOE personnel are eligible for retirement in the next few years.

Ensuring the proper number and qualification of DOE staff is essential to fulfill the complete spectrum of Department responsibilities. DOE operates complex and hazardous facilities. DOE personnel responsible for monitoring contractor performance and observing work in progress are required to have, at a minimum, a level of technical competency that reflects a working knowledge of engineering and scientific fundamentals. Managers, supervisors, and field personnel must be technically competent, be technically aware of plant conditions, and possess sufficient practical experience and skills to demonstrate requisite technical inquisitiveness to oversee operations and pursue anomalous conditions.

Corrective Action Programs

Organizations at every level within the DOE complex have one or more systems for tracking corrective actions, yet internal and independent assessments routinely report recurring deficiencies that have been ineffectively addressed. The ISM function of feedback and improvement is not uniformly and effectively implemented throughout the Department.

Complacency

Since the Rocky Flats fire in 1969, the Department has not experienced a catastrophic accident near the magnitude of the Columbia incident. This decades-long success record might lead one to a level of comfort with DOE operations. The Department must actively work to enhance safety to prevent a degradation of acceptable safety performance and an unacceptable high-consequence event.

The language in the contract clause, 48 CFR 970.5223-1, establishes the contractual requirement for ISM and the governing requirements for contractor programs. In addition, the DEAR clause, 48 CFR 970.5215-3, provides DOE contracting officers with a tool to avoid complacency. The clause requires the DOE contracting officer to reduce a contractor's fee payment should the contractor not meet their agreed upon annual ES&H program requirements, established as a result of the annual update process of 48 CFR 970.5223-1 (e), or if the contractor experiences significant adverse events.

Video 3. Davis-Besse Reactor Vessel
http://fox8.com/2012/08/23/davis-besse-safety-concerns-a-look-inside/

d. Given a scenario, analyze, identify, and describe potential signs of a strong or weak safety culture within an organization.

This is a performance-based KSA. The Qualifying Official will evaluate its completion. However, the following information may be helpful.

The following is taken from International Atomic Energy Agency, IAEA-TECDOC-1329, *Safety Culture in Nuclear Installations, Guidance for Use in the Enhancement of Safety Culture.*

For a nuclear organization, safety culture is the dominant aspect of the organizational culture.

Three stages of development seem to occur. Each stage involves a different awareness of the effect on safety of human behavior and attitude. The characteristics of each stage are

described below. These characteristics may be used by an organization to diagnose which stage reflects its current state most accurately.

Stage 1—Safety Is Based On Rules and Regulations

At this stage an organization sees safety as an external requirement; not as an aspect of conduct that will allow it to succeed. The external requirements are those of government, the legal framework, and the regulatory bodies. There is little awareness of the behavioral and attitudinal aspects of safety. Safety is seen as a technical issue, to be achieved by compliance with rules and regulations. Some characteristics of an organization in stage 1 include the following:

- Problems are not anticipated, and the organization reacts to each one as it occurs.
- Communication between departments and functions is poor.
- Collaboration and shared decision-making is limited.
- People who make mistakes are blamed for their failure to comply with the rules.
- The role of management is seen as enforcing the rules.
- There is not much listening or learning inside or outside the organization, which generally adopts a defensive position when criticized.
- People are viewed as components of the system—the mechanistic view.
- There is an adversarial relationship between managers and other employees.

Stage 2—Safety Becomes an Organizational Goal

An organization at this stage considers safety to be an important organizational goal, even in the absence of external requirements. Although there is growing awareness of behavioral issues, this aspect is largely missing from safety management, which generally concentrates on technical and procedural solutions. Safety is dealt with in terms of targets or goals, with accountabilities for achieving the goals specified. Organizations at this stage often discover that after a period of time, when safety trends have improved, a plateau is reached. Some characteristics of an organization in stage 2 include the following:

- There is growing awareness of the impact of cultural issues in the workplace, although it is not understood why added controls and training have not yielded the expected safety improvements.
- Management encourages interdepartmental and inter-functional communications.
- Management's response to mistakes is to introduce more controls and procedures, and to provide more retraining.
- The role of management is to make sure that goals are achieved and that work objectives are clear to employees.
- The organization is willing to learn from external groups, especially new techniques and best practices.
- The relationship between employees and management is adversarial, although there may be more opportunities to discuss common goals.
- People are rewarded for exceeding goals regardless of long-term consequences.
- The interaction of people and technology is considered, but more from the viewpoint of increasing the efficiency of the technology.
- There is more teamwork.
- The organization remains reactive in relation to problems, although there may be more anticipation of potential problems in planning.

Stage 3—Safety Can Always Be Improved

An organization in this stage has adopted the idea of continuous improvement and applied the concept to safety. There is a strong emphasis on communications, training, management style, and improving efficiency and effectiveness. People within the organization understand the impact of cultural issues on safety. Some characteristics of an organization in stage 3 include the following:

- Problems are anticipated and dealt with before they occur.
- Collaboration between departments and functions is good.
- There is no goal conflict between safety and production.
- Almost all mistakes are viewed in terms of process variability with the emphasis placed on understanding what has happened, rather than finding someone to blame.
- Management's role is seen as coaching people to improve performance.
- Learning from others, inside and outside the organization, is valued.
- People are respected and valued for their contribution.
- The relationship between management and employees is mutually supportive.
- People are aware of the impact of cultural issues, and these are considered in decision-making.
- People are rewarded for improving processes, as well as results.
- People are considered to be an important part of organizational systems with attention given to satisfying their needs, and not just to achieve technical efficiency.

The time scale required to pass through the various stages cannot be predicted. Much will depend on the circumstances of an individual organization, and the commitment and effort that it is prepared to make in order to bring about change. Sufficient time must be taken at each stage to allow the benefits from changed practices to be realized and to mature. It should be remembered that an organization might possess characteristics associated with each of the three stages. Change in an organization is rarely simultaneous or uniform. A rule-based approach should not be viewed negatively. There will be activities or circumstances in organizational life where strict compliance with rules is essential.

e. Explain how the Institute for Nuclear Power Operations (INPO) Safety Culture Principles are applied for a given organization and its associated mission in DOE.

This is a site-specific KSA. The Qualifying Official will evaluate its completion. However, the following information may be helpful.

The INPO document, *Principles for a Strong Nuclear Safety Culture*, describes the following safety culture principles:

- Nuclear safety is everyone's responsibility.
- Leaders demonstrate commitment to safety.
- Trust permeates the organization.
- Decision-making reflects safety first.
- Nuclear technology is recognized as different.
- A questioning approach is cultivated.
- Organizational learning is embraced.
- Nuclear safety undergoes constant examination.

Nuclear Safety is Everyone's Responsibility

Responsibility and authority for nuclear safety are well defined and clearly understood. Reporting relationships, positional authority, staffing, and financial resources are commensurate with and support nuclear safety responsibilities. Corporate policies emphasize the overriding importance of nuclear safety.

The attributes of this principle are as follows:

- The line of authority and responsibility for nuclear safety is defined from the board of directors to the individual contributor. Each of these positions has clearly defined roles, responsibilities, and authorities, designated in writing and understood by the staff.
- People and their professional capabilities, values, and experiences are regarded as the nuclear organization's most valuable assets. Staffing levels are consistent with the demands related to maintaining safety and reliability.
- Board members and corporate officers periodically take steps to reinforce nuclear safety, including conducting site visits to assess management effectiveness first-hand.
- The line organization is the primary source of information and the only source of direction. Other parties, such as oversight organizations and committees, review boards, or outside advisors that provide management information essential to effective self-evaluation, are not allowed to dilute or undermine line authority and accountability.
- Relationships among utilities, operating companies, and owners are not allowed to obscure or diminish the line of responsibility for nuclear safety.
- The system of rewards and sanctions is aligned with strong nuclear safety policies and reinforces the desired behaviors and outcomes.
- All personnel understand the importance of adherence to nuclear safety standards. Healthy accountability is exercised at all levels of the organization for shortfalls in meeting standards.

Leaders Demonstrate Commitment to Safety

Executive and senior managers are the leading advocates of nuclear safety and demonstrate their commitment in word and action. The nuclear safety message is communicated frequently and consistently, occasionally as a stand-alone theme. Leaders throughout the plant organization set an example for safety through their direct involvement in training and field oversight of important plant activities.

The attributes of this principle are as follows:

- Managers and supervisors practice visible leadership in the field by placing "eyes on the problem," coaching, mentoring, and reinforcing standards. Deviations from station expectations are corrected promptly.
- Continuous oversight is provided during safety-significant tests or evolutions.
- Managers and supervisors are personally involved in high-quality training that consistently reinforces expected worker behaviors.
- Leaders recognize that challenging production goals can appear to send mixed signals on the importance of nuclear safety. Managers are sensitive to detecting and avoiding these misunderstandings.

- The bases, expected outcomes, potential problems, planned contingencies, and abort criteria for important operational decisions are communicated promptly to workers.
- Informal opinion leaders in the organization are encouraged to model safe behavior and influence peers to meet high standards.

Trust Permeates the Organization

A high level of trust is established in the organization. There is a free flow of information in which issues are raised and addressed. Employees are informed of steps taken in response to their concerns.

The attributes of this principle are as follows:

- A variety of methods are available by which personnel can raise nuclear safety concerns without fear of retribution.
- Employees are expected and encouraged to offer innovative ideas to help solve problems.
- Differing opinions are welcomed and respected. When needed, fair and objective methods are used to resolve conflict and unsettled DPOs.
- Supervisors are skilled in responding to employee questions in an open, honest manner. They are recognized as an important part of the management team, crucial to translating safety culture into practical terms.
- Impacts of impending organizational changes (such as those caused by sale or acquisition, bargaining unit contract renegotiations, and economic restructuring) are anticipated and managed so that trust in the organization is maintained.
- Complete, accurate, and forthright information is provided to oversight, audit, and regulatory organizations.

Decision-Making Reflects Safety First

Plant personnel are systematic and rigorous in making decisions that support safe, reliable plant operation. Operators are vested with the authority and understand the expectation, when faced with unexpected or uncertain conditions, to place the plant in a safe condition. Senior leaders support and reinforce conservative decisions.

The attributes of this principle are as follows:

- The organization maintains a knowledgeable workforce to support a broad spectrum of operational and technical decisions. Outside expertise is employed when necessary.
- Plant personnel apply a rigorous approach to problem solving. Conservative actions are taken when understanding is incomplete.
- Single-point accountability is maintained for important safety decisions, allowing for ongoing assessment and feedback as circumstances unfold.
- Managers regularly communicate important decisions and their bases to the workforce as a way of demonstrating and reinforcing a healthy safety culture.
- Candid dialogue and debate are encouraged when safety issues are being evaluated. Robust discussion and healthy conflict are recognized as a natural result of diversity of expertise and experience.
- Decision-making practices reflect the ability to distinguish between “allowable” choices and prudent choices.

Nuclear Technology is Recognized as Different

The special characteristics of nuclear technology are taken into account in all decisions and actions. Reactivity control, continuity of core cooling, and safety margin management are valued as essential, distinguishing attributes of the nuclear station work environment.

The attributes of this principle are as follows:

- Activities that could affect core reactivity are conducted with particular care and caution.
- Features designed to maintain critical safety functions, such as core cooling, are recognized as particularly important.
- Design and operating margins are carefully guarded and changed only with great thought and care. Special attention is placed on maintaining defense-in-depth.
- Equipment is meticulously maintained, well within design requirements.
- Insights from probabilistic risk analyses are considered in daily plant activities and plant change processes.
- Plant activities are governed by comprehensive, high-quality processes and procedures.
- Employee mastery of reactor and power plant fundamentals, as appropriate to the job position, establishes a solid foundation to support sound decisions and behaviors.

A Questioning Approach is Cultivated

Individuals demonstrate a questioning attitude by challenging assumptions, investigating anomalies, and considering potential adverse consequences of planned actions. All employees are watchful for conditions or activities that can have an undesirable effect on plant safety.

The attributes of this principle are as follows:

- While individuals expect successful outcomes of daily activities, they recognize the possibility for mistakes and worst-case scenarios. Contingencies are developed to deal with these possibilities.
- Anomalies are thoroughly investigated, promptly mitigated, and periodically analyzed in the aggregate. Personnel do not proceed in the face of uncertainty.
- Workers do not live with conditions or behaviors that have the potential to reduce operating or design margins. These circumstances are promptly identified and corrected.
- Group-think is avoided through diversity of thought and intellectual curiosity. Opposing views are encouraged and considered.

Organizational Learning is Embraced

Operating experience is highly valued, and the capacity to learn from experience is well developed. Training, benchmarking, and self-assessments are used to stimulate learning and improve performance.

The attributes of this principle are as follows:

- The organization avoids complacency and cultivates a continuous learning environment. The attitude that “it can’t happen here” is not allowed in the organization.

- Training effectively upholds management's standards and expectations. Beyond teaching knowledge and skills, trainers are adept at instilling nuclear safety values and beliefs.
- Individuals are well informed of the underlying lessons learned from significant industry and station events, and they are committed to not repeating these mistakes.
- Expertise in root cause analysis is applied effectively to examine events and improve safety focus.
- Processes are established to identify and resolve latent organizational weaknesses that can aggravate relatively minor events if not corrected.

Nuclear Safety Undergoes Constant Examination

Oversight is used constructively to strengthen safety and improve performance. Nuclear safety is kept under constant scrutiny through a variety of monitoring techniques, some of which provide an independent "fresh look."

The attributes of this principle are as follows:

- A mix of self-assessment and independent oversight reflects an integrated and balanced approach. This balance is periodically reviewed and adjusted as needed.
- Periodic safety culture assessments are conducted and used as a basis for improvement.
- The pitfalls of over-focusing on a narrow set of performance indicators are recognized. The organization is alert; detecting and responding to indicators that may signal declining performance.
- The insights and fresh perspectives provided by quality assurance (QA), assessment, and independent oversight personnel are valued.
- Senior executives and board members are periodically briefed on results of oversight group activities to gain insights into station safety performance.

f. Describe the overall objective of DOE 450.2, *Integrated Safety Management* and the associated lower-tier organization-level directives developed by Headquarters Offices and Field elements.

DOE O 450.2

The overall objective of DOE O 450.2 is to ensure that DOE systematically integrates safety into management and work practices at all levels, so that missions are accomplished efficiently while protecting the workers, the public, and the environment.

NNSA-10-3.04, Construction Safety and Health Process

The objective of NNSA-10-3.04 is to establish a process and provide guidance for the protection of the NNSA-Albuquerque Complex Federal and contractor employees engaged in construction activities, protection of the general public from hazards in connection with construction activities, protection from property damage, and prevention of delay or interruption of NNSA-SC programs caused by accidents or fires.

NNSA-10-3.06, FEOSH Injury, Illness Reporting, and Investigation Process

The objective of NNSA-10-3.06 is to ensure that NNSA Albuquerque Complex Federal and support services contractor employees who have a work related illness, or who are involved

in a work related injury, vehicle accident, or property damage understand the proper reporting procedures.

NNSA-10-3.07, Reporting Employee Concerns and Hazards Process

The objective of NNSA-10-3.07 is to provide specific guidelines, time frames, responsibilities, rights, and information to facilitate the reporting of unsafe or unhealthful conditions at the Albuquerque Complex. This process has been developed according to the NNSA Worker Safety and Health (WS&H) Program and 29 CFR 1960, "Basic Program Elements for Federal Employee Occupational Safety and Health Programs and Related Matters."

Video 4. Tom D'Agostino's speech on ISM and human error
http://www.youtube.com/watch?v=XXmPBla3mcc

g. Give an example of a circumstance that might make it necessary or reasonable to deviate from the responsibilities and authorities identified in an organization's Functions, Responsibilities, and Authorities Document and describe the exemption process in DOE O 251.1C, *Departmental Directives Program*.

The first part of this KSA is performance-based. The Qualifying Official will evaluate its completion.

Exemption Process

LEGACY EXEMPTION PROCESS
The following is a summary of appendix E of DOE O 251.1C.

This appendix is taken from chapter X of DOE M 251.1-1B, *Departmental Directives Program Manual*, and will be used for directives published prior to DOE O 251.1C and requiring central technical authority (CTA) concurrence. However, as these same directives are revised according to DOE O 251.1C, the new process outlined in DOE O 251.1C will be used. Note: the terms EH (environmental health) or ES&H used in this appendix refer to the Office of Health Safety and Security (HSS) and ESE refers to energy, science and environment.

General provisions are as follows:

- An exemption under the directives program is a release from one or more requirements in a DOE Order, notice, or manual that has been granted to a DOE element or a contractor.
- If the Order, notice, or manual includes specific provisions for exemptions, equivalencies, or other forms of relief from the requirements in the document, then those provisions must be applied.
- If the document does not include specific provisions for relief, the process in this chapter applies to granting permanent or temporary relief from the applicable requirements in those documents.
- This exemption process does not apply to requirements in regulations.
- An approved exemption must be submitted to the Office of Information Resources.

The exemption review and approval process for NNSA facilities and activities is as follows:

- The approval authority must provide copies of the exemption request, appropriate supporting documentation, and the draft exemption, and with respect to each exemption, request views from the following parties before granting an exemption:
  - The cognizant secretarial officer (CSO)
  - The Office of Primary Interest (OPI)
  - HSS
  - The NNSA CTA for requirements listed on the NNSA index of baseline nuclear safety requirements
- The approval authority may not grant the exemption until
  - the parties have indicated that there is no objection; or
  - thirty calendar days have passed without objection after providing the parties the draft exemption and associated documentation.
- If one of the parties objects, the approval authority must proceed as follows or deny the exemption:
  - Work with the objecting party to resolve any issues and withdraw the objection.
  - For unresolved objections from NNSA personnel, raise the issue to the NNSA administrator or designee for resolution.
  - For unresolved objections from parties outside of NNSA, raise the matter through the NNSA administrator or designee to the deputy secretary for resolution.
- Unless otherwise stated in the directive, approval is as follows:
  - Heads of departmental NNSA elements approve exemptions to requirements in DOE Orders, notices, and manuals for activities and facilities under their direction except as provided in paragraph 2.a.(2)(b).
  - For ES&H requirements in Orders, notices, and manuals for hazard category 1 nuclear facilities, the under secretary for nuclear security approves exemptions. This authority may be delegated to other heads of departmental NNSA elements.

The exemption concurrence and approval process for ESE facilities and activities is as follows:

- The approval authority must provide copies of the exemption request, appropriate supporting documentation, and the draft exemption, and request concurrence on each exemption from the following parties before granting an exemption:
  - The CSO
  - The OPI
  - HSS
  - The ESE CTA for requirements listed on the ESE index of baseline nuclear safety requirements
- The approval authority may not grant the exemption until
  - the parties have concurred; or
  - thirty (30) calendar days have passed without non-concurrence after providing the parties the draft exemption and associated documentation.

- If one of the parties submits non-concurrence, the approval authority must proceed as follows or deny the exemption:
  - Work with the nonconcurring party to resolve any issues and withdraw the non-concurrence.
  - For non-concurrences from DOE personnel, raise the issue to the under secretary for energy or the under secretary for science, as appropriate for resolution.
  - For non-concurrences from parties outside of ESE, raise the matter to the deputy secretary for resolution.
- Unless otherwise stated in the directive, approval is as follows:
  - Heads of departmental elements (which include operations and field office managers) approve exemptions from requirements from DOE Orders, notices, and manuals for activities and facilities under their direction.
  - For ES&H requirements in Orders, notices, and manuals for hazard category 1 nuclear facilities, the under secretary for energy, science and environment approves exemptions to requirements in DOE Orders, notices, and manuals. This authority may be delegated to other heads of departmental elements.

Exemption concurrence and approval process for other than NNSA or ESE facilities and activities is as follows:

- The approval authority must provide copies of the exemption request, appropriate supporting documentation, and the draft exemption and request concurrence on each exemption from the following parties before granting an exemption:
  - The CSO
  - The OPI
  - HSS
  - The Office of the General Counsel
- The approval authority may not grant the exemption until
  - the parties have concurred; or
  - thirty calendar days have passed without non-concurrence after providing the parties the draft exemption and associated documentation.
- If one of the parties submits non-concurrence, the approval authority must proceed as follows or deny the exemption:
  - Work with the nonconcurring party to resolve any issues and withdraw the non-concurrence.
  - Raise the matter to the Deputy Secretary for resolution.
- Unless otherwise stated in the directive, heads of departmental elements approve exemptions from DOE Orders, notices, and manuals for activities and facilities under their direction.

Exemption requests must include the following information:

- Site or facility for which an exemption is being requested
- Reference to the requirements for which exemption is sought
- Identification and justification of the acceptance of any additional risks that will be incurred if the exemption is granted
- Benefits to be realized by providing the exemption

- Whether the exemption being requested is temporary or permanent, and for temporary exemptions, indication of when compliance will be achieved
- Identification of other pertinent data or information used as a basis for obtaining an exemption

Requests for exemptions to ES&H requirements must also address the following:

- A description of any special circumstances that warrant the granting of an exemption, including whether
  - application of the requirement in the particular circumstances would conflict with another requirement;
  - application of the requirement in the particular circumstances would not achieve, or is not necessary to achieve, its underlying purpose;
  - application of the requirement in the particular circumstances would not be justified by any safety and health benefit;
  - the exemption would result in a health and safety benefit that compensates for any detriment that would result from granting the exemption; or
  - other material circumstances that exist were not considered when the requirement was adopted for which it is in the public interest to grant an exemption.
- Steps to be taken to provide adequate protection of health, safety, and the environment, and a statement that adequate protection will be provided.
- A description of any alternative or mitigating actions that have been or will be taken to ensure adequate safety and health and protection of the public, the workers, and the environment for the period the exemption will be effective.

The approval criteria for all exemption decisions are as follows:

- The basis for approving the exemption must be documented in the approval and the approving authority may grant an exemption only if the exemption
  - is not prohibited by law;
  - would not present an undue risk to public health and safety, the environment, facility workers, or security; and
  - is warranted under the circumstances.

Following is the new DOE O 251.1C, paragraph 6.a.(3)(c) exemption process:

- Equivalencies are alternatives to how a requirement in a directive is fulfilled in cases where the “how” is specified. These represent an alternative approach to achieving the goal of the directive. Unless specified otherwise in the directive, equivalencies are granted, in consultation with the OPI, by the PSO or their designee, or in the case of the NNSA, by the administrator or designee, and documented for the OPI in a memorandum.
- Exemptions are the release from one or more requirements in a directive. Unless specified otherwise in the directive, exemptions are granted, in consultation with the OPI, by the PSO or their designee, or in the case of the NNSA, by the administrator or designee, and documented for the OPI in a memorandum. For those directives listed in attachment 1 of DOE O 410.1, *Central Technical Authority Responsibilities Regarding Nuclear Safety Requirements*, CTA concurrences are required prior to the granting of exemptions.

- The basis for approving exemptions and equivalency requests must be documented in the approval memorandum. Any increase in risk to public health and safety, the environment, workers, or security must be justified.

h. Discuss in detail the requirements contained in Department of Energy Acquisition Regulations (DEAR) Clauses 970.5223-1, "Integration of Environment, Safety and Health into Work Planning and Execution," DEAR 970.5204-2, "Laws, Regulations and DOE Directives," and DEAR 970.5215-3, "Conditional Payment of Fee."

48 CFR 970.5223-1

Following is 48 CFR 970.5223-1 in its entirety.

"Integration of Environment, Safety, and Health into Work Planning and Execution" (DEC 2000).

(a) For the purposes of this clause

- safety encompasses environment, safety, and health, including pollution prevention and waste minimization; and
- employees include subcontractor employees.

(b) In performing work under this contract, the contractor should perform work safely, in a manner that ensures adequate protection for employees, the public, and the environment, and should be accountable for the safe performance of work. The contractor should exercise a degree of care commensurate with the work and the associated hazards. The contractor should ensure that management of ES&H functions and activities becomes an integral but visible part of the contractor's work planning and execution processes. The contractor should, in the performance of work, ensure the following:

- Line management is responsible for the protection of employees, the public, and the environment. Line management includes those contractor and subcontractor employees managing or supervising employees performing work.
- Clear and unambiguous lines of authority and responsibility for ensuring ES&H are established and maintained at all organizational levels.
- Personnel possess the experience, knowledge, skills, and abilities that are necessary to discharge their responsibilities.
- Resources are effectively allocated to address ES&H, programmatic, and operational considerations. Protecting employees, the public, and the environment is a priority whenever activities are planned and performed.
- Before work is performed, the associated hazards are evaluated and an agreed upon set of ES&H standards and requirements are established which, if properly implemented, provide adequate assurance that employees, the public, and the environment are protected from adverse consequences.
- Administrative and engineering controls to prevent and mitigate hazards are tailored to the work being performed and associated hazards. Emphasis should be on designing the work and/or controls to reduce or eliminate the hazards and to prevent accidents and unplanned releases and exposures.
- The conditions and requirements to be satisfied for operations to be initiated and conducted are established and agreed upon by DOE and the contractor. These agreed upon conditions and requirements are requirements of the contract and binding

on the contractor. The extent of documentation and level of authority for agreement should be tailored to the complexity and hazards associated with the work and should be established in a safety management system.

(c) The contractor should manage and perform work according to a documented safety management system (system) that fulfills all conditions in paragraph (b) of this clause at a minimum. Documentation of the system shall describe how the contractor will

- define the scope of work;
- identify and analyze hazards associated with the work;
- develop and implement hazard controls;
- perform work within controls; and
- provide feedback on adequacy of controls and continue to improve safety management.

(d) The system shall describe how the contractor will establish, document, and implement safety performance objectives, performance measures, and commitments in response to DOE program and budget execution guidance while maintaining the integrity of the system. The system should also describe how the contractor will measure system effectiveness.

(e) The contractor shall submit to the contracting officer documentation of its system for review and approval. Dates for submittal, discussions, and revisions to the system will be established by the contracting officer. Guidance on the preparation, content, review, and approval of the system will be provided by the contracting officer. On an annual basis, the contractor should review and update, for DOE approval, its safety performance objectives, performance measures, and commitments consistent with and in response to DOE's program and budget execution guidance and direction. Resources shall be identified and allocated to meet the safety objectives and performance commitments as well as maintain the integrity of the entire system. Accordingly, the system shall be integrated with the contractor's business processes for work planning, budgeting, authorization, execution, and change control.

(f) The contractor shall comply with, and assist DOE in complying with, ES&H requirements of all applicable laws and regulations, and applicable directives identified in the clause of this contract entitled "Laws, Regulations, and DOE Directives." The contractor should cooperate with Federal and non-Federal agencies having jurisdiction over ES&H matters under this contract.

(g) The contractor should promptly evaluate and resolve any noncompliance with applicable ES&H requirements and the system. If the contractor fails to provide resolution or if, at any time, the contractor's acts or failure to act causes substantial harm or an imminent danger to the environment or health and safety of employees or the public, the contracting officer may issue an order stopping work in whole or in part. Any stop work order issued by a contracting officer under this clause (or issued by the contractor to a subcontractor according to paragraph (i) of this clause) shall be without prejudice to any other legal or contractual rights of the Government. In the event that the contracting officer issues a stop work order, an order authorizing the resumption of the work may be issued at the discretion of the contracting officer. The contractor shall not be entitled to an extension of time or additional fee or damages by reason of, or in connection with, any work stoppage ordered according to this clause.

(h) Regardless of the performer of the work, the contractor is responsible for compliance with the ES&H requirements applicable to this contract. The contractor is responsible for flowing down the ES&H requirements applicable to this contract to subcontracts at any tier to the extent necessary to ensure the contractor's compliance with the requirements.

(i) The contractor shall include a clause substantially the same as this clause in subcontracts involving complex or hazardous work on site at a DOE-owned or -leased facility. Such subcontracts shall provide for the right to stop work under the conditions described in paragraph (g) of this clause. Depending on the complexity and hazards associated with the work, the contractor may choose not to require the subcontractor to submit an SMS for the contractor's review and approval.

48 CFR 970.5204-2

Following is 48 CFR 970.5204-2 in its entirety.

"Laws, Regulations, and DOE Directives" (DEC 2000).

(a) In performing work under the contract, the contractor shall comply with the requirements of applicable Federal, State, and local laws and regulations (including DOE regulations), unless relief has been granted in writing by the appropriate regulatory agency. The List of Applicable Laws and regulations (List A) may be appended to this contract for information purposes. Omission of any applicable law or regulation from List A does not affect the obligation of the contractor to comply with such law or regulation pursuant to this paragraph.

(b) In performing work under this contract, the contractor should comply with the requirements of those Department of Energy directives, or parts thereof, identified in the List of Applicable Directives (List B) appended to this contract. Except as otherwise provided for in paragraph (d) of this clause, the contracting officer may, from time to time and at any time, revise List B by unilateral modification to the contract to add, modify, or delete specific requirements. Prior to revising List B, the contracting officer shall notify the contractor in writing of the Department's intent to revise List B and provide the contractor with the opportunity to assess the effect of the contractor's compliance with the revised list on contract cost and funding, technical performance, and schedule; and identify any potential inconsistencies between the revised list and the other terms and conditions of the contract. Within 30 days after receipt of the contracting officer's notice, the contractor shall advise the contracting officer in writing of the potential impact of the contractor's compliance with the revised list. Based on the information provided by the contractor and any other information available, the contracting officer shall decide whether to revise List B and so advise the contractor not later than 30 days prior to the effective date of the revision of List B. The contractor and the contracting officer shall identify and, if appropriate, agree to any changes to other contract terms and conditions, including cost and schedule, associated with the revision of List B pursuant to the clause of the contract entitled, "Changes."

(c) Environment, Safety, and Health requirements appropriate for work conducted under this contract may be determined by a DOE approved process to evaluate the work and the associated hazards and identify an appropriately tailored set of standards, practices, and controls, such as a tailoring process included in a DOE approved system implemented under

the clause entitled "Integration of Environment, Safety, and Health into Work Planning and Execution." When such a process is used, the set of tailored ES&H requirements, as approved by DOE pursuant to the process, should be incorporated into List B as contract requirements with full force and effect. These requirements shall supersede, in whole or in part, the contractual environmental, safety, and health requirements previously made applicable to the contract by List B. If the tailored set of requirements identifies an alternative requirement varying from an ES&H requirement of an applicable law or regulation, the contractor shall request an exemption or other appropriate regulatory relief specified in the regulation.

(d) Except as otherwise directed by the contracting officer, the contractor shall procure all necessary permits or licenses required for the performance of work under this contract.

(e) Regardless of the performer of the work, the contractor is responsible for compliance with the requirements of this clause. The contractor is responsible for flowing down the requirements of this clause to subcontracts at any tier to the extent necessary to ensure the contractor's compliance with the requirements.

48 CFR 970.5215-3

The following is an excerpt from 48 CFR 970.5215-3, which identifies contract requirements and the types of requirements associated with that contract.

GENERAL

The payment of earned fee, fixed fee, profit, or share of cost savings under the contract is dependent on

- the contractor's or contractor employees' compliance with the terms and conditions of the contract relating to ES&H that includes WS&H, including performance under an approved ISMS; and
- the contractor's or contractor employees' compliance with the terms and conditions of this contract relating to the safeguarding of restricted data (RD) and other classified information.

The ES&H performance requirements of this contract are set forth in its ES&H terms and conditions, including the DOE approved contractor ISMS or similar document. Financial incentives for timely mission accomplishment or cost effectiveness shall never compromise or impede full and effective implementation of the ISMS and full ES&H compliance.
The performance requirements of this contract relating to the safeguarding of RD and other classified information are set forth in the clauses of this contract entitled, "Security," and "Laws, Regulations, and DOE Directives," as well as in other terms and conditions.

If the contractor does not meet the performance requirements of the contract relating to ES&H or to the safeguarding of RD and other classified information during any performance evaluation period established under the contract pursuant to the clause of the contract entitled, "Total Available Fee: Base Fee Amount and Performance Fee Amount," otherwise earned fee, fixed fee, profit or share of cost savings may be unilaterally reduced by the contracting officer.

The potential for significant negative monetary consequences, at the discretion of the contracting officer, is used as an incentive to ensure and promote mission performance.

i. Discuss in detail the process used to review and/or approve contractor ISM System Descriptions. Discuss the process used to monitor the status of Field Element and Field Element contractors' ISM systems and to monitor Field Elements' establishment and implementation of safety goals and objectives.

ISM System Descriptions

Because attachment 7 of DOE G 450.4-1C provides guidance for development of ISM system descriptions, it is suggested that it be used as a template against which contractor-submitted ISM system descriptions may be compared in the review and approval process.

DOE G 450.4-1C, attachment 7, outlines important considerations and suggested approaches for development of ISM system descriptions intended to meet the applicable requirements of DOE O 450.2 and the DEAR ISM clause.

In developing these system descriptions, the following should be considered:

- How each organization defines its work activities related to achieving the ISM objective of safe mission accomplishment
- The implementing mechanisms, processes, and methods by which each organization implements the ISM guiding principles to create an effective environment for ISM implementation
- The implementing mechanisms, processes, and methods by which each office implements the ISM core functions
- How environmental management systems, QAPs, and other management processes and systems are integrated with the ISM system
- How each organization will measure ISM effectiveness, perform ISM effectiveness reviews, prepare ISM declarations, and continuously improve the effectiveness of the ISM system
- How each organization will establish, document, and implement relevant safety goals, performance objectives, measures, and commitments in response to secretarial and DOE office direction and budget execution guidance while maintaining the integrity of the system
- How each organization will maintain its ISM system description so that it is accurate and up-to-date, and demonstrates continuous ISM improvement in its performance of safe work activities

Each ISM system description is a primary management system description for the particular office for accomplishing work in a safe and environmentally sound manner, and should be integrated with other relevant safety and management systems, such as QA, and environments management systems. ISM systems are most effective when integrated with office business processes for work definition and planning, budgeting, authorization, execution, financial management and control, change control, performance measurement and evaluation, incorporation of lessons learned, and continuous improvement. For example, ISM accountabilities and performance should be reflected in personnel performance objectives

and evaluations. ISM system descriptions may be combined into a single document or a set of documents.

ISM system descriptions should be reviewed at an appropriate frequency to determine whether updates are needed. A statement to this effect should be included in a periodic ISM declaration.

Organizations with safety management responsibilities should establish and maintain implementing mechanisms, including processes, policies, protocols, procedures, documentation, and training, to translate ISM system expectations into implementation activities and desired human behaviors. These mechanisms need to consider all active and applicable program and facility life-cycle phases, including design, construction, operation, maintenance, research and development, and deactivation and decommissioning.

The level of rigor in the ISM system descriptions should be consistent with the hazards and complexity of the applicable facilities and activities.

Field Element and Field Element Contractor ISM Systems

The following is taken from DOE G 450.4-1C.

An ISM effectiveness review is a review conducted by an organization for determining whether its ISM system is in full conformance with the requirements and expectations for effective implementation. The ISM effectiveness review is a qualitative review that encompasses multiple elements, including review of self-assessments; oversight review results; integrated reviews across multiple reporting elements; performance against established performance objectives, measures, and commitments; and other feedback and performance information.

The following guidance outlines a suggested approach to performing ISM effectiveness reviews.

ISM effectiveness reviews are an important tool of ISM implementation that allow for evaluating implementation and making necessary adjustments. Elements of this review should be ongoing and culminate in a review report that contributes to a summary evaluation. The purposes of an ISM effectiveness review are to

- determine the effectiveness of the implementation of the ISM system in integrating safety into work performance, in supporting the safe performance of work, and in improving safety performance;
- identify strengths of ISM system implementation for sharing with other DOE elements to aid improvements at other locations;
- identify weaknesses of ISM system implementation to focus attention on corrective and improvement actions; and
- identify opportunities for improvement in the efficiency or effectiveness of the ISM system, and identify actions for continuous improvement.

The following steps are recommended for ISM effectiveness reviews:

- Review contractor performance and ISM system effectiveness.
  - Review ISM review(s) and summary evaluation(s) if performed by the contractor(s).
  - Review the safety performance of the contractor(s) against recent safety performance objectives, measures, and commitments.
  - Review the overall safety performance of the contractor(s), including results from various streams of feedback and improvement information. Attachment 13 to DOE G 450.4-1C provides safety performance objectives, measures, and commitments that are useful for reviewing safety performance.
  - Review results of line oversight of the contractor(s).
  - Review the completeness and accuracy of the ISM system description for the contractor(s) and the flow down of the site ISM system description to the site and facility procedures.
  - Determine whether a full ISM verification of the contractor(s) is needed.
  - Perform a full ISM verification when needed.
  - If a full ISM verification is not needed, document the review and conclusions regarding effectiveness of the ISM system implementation by the contractor(s), basis for conclusions, strengths and weaknesses, and areas for improvement.
  - If there is more than one contractor, look at ISM system performance across all the contractors to identify and document any generic or broad-based strengths or weaknesses or areas for improvement.
- Review DOE field office performance and ISM system effectiveness.
  - Review self-assessment results regarding DOE ISM performance.
  - Review DOE field office performance against recent safety performance objectives, measures, and commitments.
  - Review the completeness and accuracy of the ISM system description for the DOE field office, and make necessary changes. Determine whether an update is necessary. If an update is made, prepare a summary of changes.
  - Review integrated DOE/contractor safety performance; include results from various sources of feedback and improvement information, including external and independent oversight findings.
- Determine ISM effectiveness and prepare summary report.
  - Reach an overall conclusion regarding the state of ISM effectiveness that is based on all the prior reviews.
  - Prepare a summary evaluation report that documents the overall review process and conclusions regarding the effectiveness of the ISM system for the DOE office, basis for conclusions, strengths and weaknesses, areas for improvement, and corrective and improvement actions, with schedules for completion.

In judging effectiveness, both process measures and outcome measures should be considered. Examples of process measures include the following:

- Implementation of each ISM function and each ISM principle
- Integration of ISM with other management systems
- Completion of ISM commitments

- Identification of weaknesses and improvement activities
- Satisfactory performance on process-based performance measures
- Feedback from oversight reviews

Examples of outcome measures include satisfactory performance on outcome-based performance measures, including those related to safe performance of work activities.

In approaching ISM effectiveness reviews, DOE offices need to guard against complacency and "by rote" compliance. For the ISM effectiveness reviews to add value, DOE offices should periodically take a fresh approach or use different personnel to perform the review. DOE offices may want to periodically focus more intensely on a specific area within ISM in their review and declaration.

It is recommended that DOE field offices determine and provide the criteria they will use to judge effectiveness to their contractors as early as possible, and preferably well in advance, so that contractors can effectively focus their resources and efforts to meet expectations. Similarly, DOE field offices would benefit from early identification of effectiveness criteria in planning self-assessments and line oversight reviews. The criteria for determining effectiveness should be included in the ISM system description and updated as needed, if changes are made. Attachment 9 of DOE G 450.4-1C describes criteria that can be used to judge effective implementation of ISM year after year.

DOE-HDBK-3027-99, *Integrated Safety Management Systems Verification Team Leader's Handbook*, provides additional information relevant to DOE ISM verifications.

Field Elements' Establishment and Implementation of Safety Goals and Objectives

The following is taken from DOE G 450.4-1C.

DOE O 450.2 establishes requirements that safety goals for DOE offices and contractors will be established and monitored by DOE offices to drive performance improvement or maintain excellent performance. DEAR 970.5223-1states, "On an annual basis, the contractor shall review and update, for DOE approval, its safety performance objectives, performance measures, and commitments consistent with and in response to DOE's program and budget execution guidance and direction." Continuing core expectation CCE-2 in DOE G 450.4-1C addresses continuing safety performance objectives, measures, and commitments.

The purpose of safety performance objectives, measures, and commitments is to drive improvement in safety performance and ISM system effectiveness.

Performance objectives, measures, and commitments are developed based on numerous considerations, including the budget process. This approach to continuous improvement recognizes the need for investment in improvement. The ISM guiding principle of balanced priorities should be considered in developing appropriate performance objectives, measures, and commitments. One of the most effective methods to drive DOE contractor safety performance is to tie incentive fees to safety performance.

The following are sample performance objectives:

- Achieve zero organizational accidents.
- Perform work so that personnel hazards are anticipated, identified, evaluated, and controlled.
- Perform work in a manner that does not present a threat of harm to the public or the environment and that will identify, control, and respond to environmental hazards.
- Be recognized for operational excellence.
- Be recognized for excellent personnel.
- Be recognized for excellent safety culture.
- Be recognized for sound environmental management practices.
- Establish a senior leadership whose commitment to safety is clear and visible.
- Establish and sustain a robust safety culture, consistent with ISM principles.
- Fully integrate HPI initiatives into ISM systems.
- Demonstrate sound stewardship of the site through safe and effective hazardous and radioactive waste minimization and management through restoration of the site where degradation has occurred.

The following are sample performance measures:

- Exposures of personnel to chemical, physical, and biological hazards are adequately controlled.
- Accident and injury rates, lost workday case rates, and the DOE injury cost index are adequately controlled. Performance is better than comparable industry statistics and exhibits a downward trend.
- Exposures of personnel to ionizing radiation are adequately controlled.
- Reportable occurrences are managed with effective corrective actions and are minimized.
- Radioactive material is adequately controlled.
- The fire department response time and the rate of completion of required fire protection actions are adequately controlled and accomplished.
- Environmental violations and releases are adequately controlled.
- The amount of waste generated and the amount of pollutants emitted are reduced.
- Hazardous and radioactive wastes are managed in a manner that meets regulatory requirements and that is cost effective.
- Error-likely situations are identified and controlled.
- Corrective actions are timely.
- Corrective actions are effective at resolving originally identified causes.
- The number of repeat occurrences is minimized through effective corrective actions.
- Employee concerns are tracked and resolved in a timely manner.
- Employee concerns are effectively addressed to resolve the identified concerns.
- Self-assessments effectively identify issues raised by independent organizations when systemic issues are identified.
- The quality of safety basis documents, as measured by defects identified by assessments or occurrences, is excellent.
- The assessment and oversight schedule is issued by September 30th.
- At least 95 percent of annually planned assessments are completed.
- At least 90 percent of identified employee qualifications are completed on time.

- A line manager walk-around program is implemented such that line managers spend at least 100 hours individually in the field each year.
- Work scope priorities are defined and communicated to contractors by July 31st of each year to guide annual work planning.
- Corrective actions are reviewed monthly with the contractor for any cost or schedule variance that is greater than a negative ten percent.
- Monthly all-employees meetings are conducted, with an emphasis on safety.
- A DPO procedure is implemented, and employees are trained on it.
- Performance improvement is evident in environmental compliance and pollution prevention (P2).

Performance measures can also be developed to address various parameters such as

- behavioral and process measures such as the number of near-misses, the number of error reports, the number of behavioral observations, the number of safe acts, etc.;
- events—number of first aid cases, occurrences, near misses;
- Safety inspections—number and score;
- employee input—safety concerns and survey responses;
- management assessment results;
- housekeeping inspection results;
- safety-related work package cycle time; and
- procedure compliance rates.

The following are sample performance commitments:

- Develop performance evaluation standards to ensure greater line management responsibility and accountability for safety.
- Develop and implement processes for work planning and control that fulfill the attributes of best practice processes.
- Develop a robust and comprehensive line organization self-assessment program to assess overall safety performance and ISM effectiveness.
- Achieve P2 and sustainable environmental stewardship goals.
- Implement DOE ISM supplemental safety culture elements.
- Initiate two HPI projects.
- Achieve P2 and sustainable environmental stewardship goals.
- Train employees on ISM system revisions.
- Conduct two safety system assessments.
- Maintain voluntary protection program Star status.
- Improve total recordable case rate by implementing DuPont “STOP” program.
- Achieve P2 and sustainable environmental stewardship goals.

j. Discuss the implementing mechanisms, including work planning and control, contained in the contractor’s approved ISM System Description.

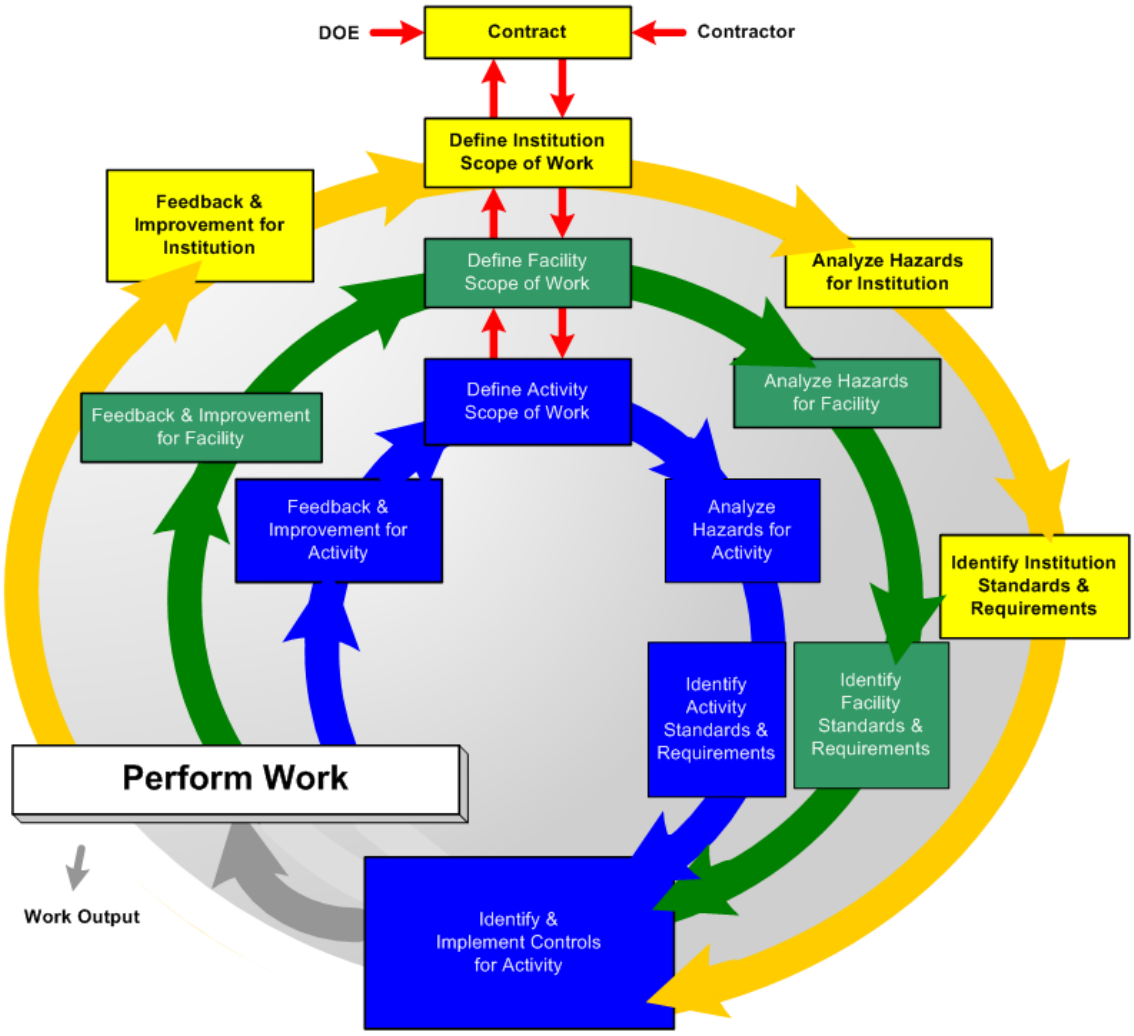
The following is taken from DOE G 450.4-1C.

All safety control measures, programs, and processes, regardless of the level at which they are specified, and regardless of whether they are mandatory or voluntary, flow down and should be implemented at the appropriate work level to achieve adequate safety. DOE and

the operating organization should review existing processes and programs to ensure they are integrated, flow down to the task/activity work level, and adequately address ISM system requirements. For these reasons, an ISM system should include processes for selecting and applying site and facility processes or procedures to use in developing work-specific control measures.

Figure 3 illustrates the layered structure that characterizes an ISM system. Each circle represents a single organizational level; that is, the institution or site level, the facility level, and the activity level. Individuals at each level of the organization play a role in work and safety planning. As illustrated in figure 3, the core safety functions are integrated at each level:

- The institutional level—the DOE regulatory and program organizations. This level has responsibility for setting standards and expectations, as well as overseeing the implementation of ISM by contractors. The institutional level also encompasses contractor management of the laboratories and production sites. The seven guiding principles of ISM are basically management requirements for its implementation at the facility and institutional levels.
- The facility level—the safe and compliant operation of facilities that house hazardous activities. The primary goal of implementing ISM at the facility level is to provide an approved safety basis for production and research activities. Properly applied at the facility level, ISM is designed to protect workers from system-level accidents (a facility fire, for example) and the public from the release of hazardous materials and chemicals (plutonium, for example). The five core functions of ISM provide the fundamental logic for developing a compliant facility safety basis; the details are embodied in DOE directives.
- The activity level—the safe execution of hazardous work needed to accomplish DOE's national security, environmental cleanup, energy, and science missions. The five core functions of ISM provide the fundamental logic for developing procedures and work controls that protect the technologists, scientists, and engineers working with hazardous materials and energetic processes.



Source: DOE G 450.4-1C

Figure 3. Major interactions between organizational levels for the five ISM core functions

k. Discuss in detail the DOE mechanisms used to oversee implementation of the contractor's ISM System Description.

The following is taken from DOE G 450.4-1C.

DOE O 450.2 requires DOE line management to determine the need for, and frequency of, contractors' ISM declarations for facilities and activities based on hazards, risks, and contractor performance history, and document their decisions concerning high-consequence activities, such as high-hazard nuclear operations. Configurations of facilities and activities vary considerably within DOE. Some large, multi-purpose facilities contain several discrete activities and some large, complex activities take place in multiple facilities.

In making such decisions, DOE line management should consider various factors, including the following:

- Appropriate groupings of facilities and activities that optimize the effort expended to prepare the declarations and the continuous improvement benefits derived therein
- Risks and hazards presented by the facilities/activities covered by the ISM system
- Safety performance, including consideration of past events and accidents and results of past appraisals by the contractor, DOE line management, independent oversight organizations, external reviewers and DOE's regulatory enforcement office
- Effectiveness of the contractor assurance system and issues management processes
- Significant changes in operations for the facilities/activities covered by the ISM system, such as new facilities, new mission/operational activities, major modifications to facilities or activities, changes in level of activity (e.g., significant increase in production or workload), or major changes in procedures controlling potentially hazardous work
- Significant changes in management and organizations for the facilities/activities covered by the ISM system, such as a new contractor or major subcontractor, reorganizations or multiple new personnel in key management positions, or large influxes of new personnel
- Significant changes in safety management programs and processes for the facilities/activities covered by the ISM system, such as a new or significantly revised contractor ISM system, a major revision to the contractor assurance system, major revisions to safety bases for nuclear facilities, or other major changes to work planning and control processes

I. Discuss the process used to maintain and update the contractor's approved ISM System Description.

The following is taken from DOE G 450.4-1C.

DOE's continuing core expectations (CCEs) have proven useful in maintaining ISM systems and in developing an evaluation of the effectiveness of the ISM system. They can be used to guide effectiveness reviews or ISM verification reviews.

- CCE-1: Organizations update their safety performance goals, objectives, performance measures, and commitments, in response to DOE senior level direction and guidance, so that they reflect and promote continual improvement and address major mission changes, as required. Contractors update their safety performance objectives, performance measures, and commitments annually as required by the DEAR ISM clause. The ISM system description is updated and submitted for approval as scheduled by the contracting officer.
- CCE-2: System effectiveness, evaluated as described in the contractor's ISM system description, is satisfactory. Safety performance objectives, measures, and commitments are met or exceeded, and they are revised as appropriate for the next year.
- CCE-3: Work activities reflect effective implementation of the functions of ISM system. Work scope is clearly defined. Hazards are identified and analyzed. Actions to prevent or eliminate the hazards are taken. Controls are developed and effectively translated into work instructions or procedures and implemented. Work is properly

authorized. Work is accomplished within controls. Appropriate worker involvement is a priority.

- CCE-4: Organizational implementing mechanisms are established and implemented to provide an effective environment for ISM implementation, as embodied in the ISM guiding principles and supplemental safety culture elements. Roles and responsibilities are clear. Line management is responsible for safety. Required competence is commensurate with responsibilities, and the technical and safety system knowledge of managers and staff continues to improve.
- CCE-5: Contractor and DOE budget processes ensure that priorities are balanced. Budget development and change control processes ensure that safety is balanced with production. Facility procedures ensure that production is balanced with safety.
- CCE-6: An effective feedback and improvement process, using progressively more demanding criteria, is functioning at each level of the organization from the worker and individual activities through the facilities and the site, including the ISM feedback and improvement process used by and within DOE. The requirements of DOE O 226.1B are implemented. Issues management is effective so that issues are identified, evaluated, and closed. Issues identified during ISM effectiveness reviews and ISM system verifications are effectively addressed.
- CCE-7: List A/List B in contracts is reviewed and updated, as necessary, and concurrent with the budget cycle. The process for effecting changes to the standards and requirements identified in the contract per DEAR list A and list B is used and is effective. Authorization agreements and authorization basis documents are kept current. Changes in agreed upon standards and requirements are included to reflect mission changes. An effective, dynamic process to keep standards and requirements current is apparent.
- CCE-8: Relevant performance records reflect an improving ISM system. Records include routine DOE and contractor self-assessment reports, independent and focused assessment reports, incident investigations, occurrence reports, DOE enforcement action reports, reports of enforcement activity conducted by external state and Federal safety agencies, and other relevant documentation that provides evidence on the status of implementation, integration, and effectiveness of the ISM system. Feedback, improvement, and change control processes cited in the contractor ISM system description are in place and effective.
- CCE-9: DOE ISM system procedures and mechanisms are in place to ensure that work is formally and appropriately authorized and performed safely in a manner that protects the public, workers, and the environment. DOE line managers are involved in the review of safety issues and concerns and have an active role in authorizing operations.
- CCE-10: DOE ISM system procedures and mechanisms are in place to ensure that hazards are analyzed, actions to prevent or eliminate the hazards are taken, controls are developed, and feedback and improvement programs are in place and effective. DOE line managers use these processes effectively, in a manner consistent with the DOE field office functions, responsibilities, and authorities (FRA and DOE FRA) requirements. DOE ISM system procedures and mechanisms integrate ISM with QA, environmental management system, and other management systems.

m. Describe the approach used to assess the effectiveness of the contractor's approved ISM System.

ISM effectiveness review is a review conducted by an organization for determining whether its ISM system is in full conformance with the requirements and expectations for effective implementation. The ISM effectiveness review is a qualitative review that encompasses multiple elements, including review of self-assessments; oversight review results; integrated reviews across multiple reporting elements; performance against established performance objectives, measures, and commitments; and other feedback and performance information.

The following guidance outlines a suggested approach to performing ISM effectiveness reviews.

ISM effectiveness reviews are an important tool of ISM implementation that allow for evaluating implementation and making necessary adjustments. Elements of this review should be ongoing and culminate in a review report that contributes to a summary evaluation. The purposes of an ISM effectiveness review are to

- determine the effectiveness of the implementation of the ISM system in integrating safety into work performance, in supporting the safe performance of work, and in improving safety performance;
- identify strengths of ISM system implementation for sharing with other DOE elements to aid improvements at other locations;
- identify weaknesses of ISM system implementation to focus attention on corrective and improvement actions; and
- identify opportunities for improvement in the efficiency or effectiveness of the ISM system, and identify actions for continuous improvement.

The following three steps are recommended for ISM effectiveness reviews:

1. Review contractor performance and ISM system effectiveness.
    - Review ISM review(s) and summary evaluation(s) if performed by the contractor(s).
    - Review the safety performance of the contractor(s) against recent safety performance objectives, measures, and commitments.
    - Review the overall safety performance of the contractor(s), including results from various streams of feedback and improvement information. Attachment 13 to DOE G 450.4-1C provides safety performance objectives, measures, and commitments that are useful for reviewing safety performance.
    - Review results of line oversight of the contractor(s).
    - Review the completeness and accuracy of the ISM system description for the contractor(s) and the flow down of the site ISM system description to the site and facility procedures.
    - Determine whether a full ISM verification of the contractor(s) is needed
    - Perform a full ISM verification when needed.
    - If a full ISM verification is not needed, document the review and conclusions regarding effectiveness of the ISM system implementation by the contractor(s), basis for conclusions, strengths and weaknesses, and areas for improvement.

- If there is more than one contractor, look at ISM system performance across all the contractors to identify and document any generic or broad-based strengths or weaknesses or areas for improvement.

2. Review DOE field office performance and ISM system effectiveness.
   - Review self-assessment results regarding DOE ISM performance.
   - Review DOE field office performance against recent safety performance objectives, measures, and commitments.
   - Review the completeness and accuracy of the ISM system description for the DOE field office, and make necessary changes. Determine whether an update is necessary. If an update is made, prepare a summary of changes.
   - Review integrated DOE/contractor safety performance; include results from various sources of feedback and improvement information, including external and independent oversight findings.
3. Determine ISM effectiveness and prepare summary report.
   - Reach an overall conclusion regarding the state of ISM effectiveness that is based on all the prior reviews.
   - Prepare a summary evaluation report that documents the overall review process and conclusions regarding the effectiveness of the ISM system for the DOE office, basis for conclusions, strengths and weaknesses, areas for improvement, and corrective and improvement actions, with schedules for completion.

In judging effectiveness, process measures and outcome measures should be considered. Examples of process measures include the following:

- Implementation of each ISM function and each ISM principle
- Integration of ISM with other management systems
- Completion of ISM commitments
- Identification of weaknesses and improvement activities
- Satisfactory performance on process-based performance measures
- Feedback from oversight reviews

Examples of outcome measures include satisfactory performance on outcome-based performance measures, including those related to safe performance of work activities.

In approaching ISM effectiveness reviews, DOE offices need to guard against complacency and “by rote” compliance. For the ISM effectiveness reviews to add value, DOE offices should periodically take a fresh approach or use different personnel to perform the review. DOE offices may want to periodically focus more intensely on a specific area within ISM in their review and declaration.

It is recommended that DOE field offices determine and provide the criteria they will use to judge effectiveness to their contractors as early as possible, and preferably well in advance, so that contractors can effectively focus their resources and efforts to meet expectations. Similarly, DOE field offices would benefit from early identification of effectiveness criteria in planning self-assessments and line oversight reviews. The criteria for determining effectiveness should be included in the ISM system description and updated as needed, if

changes are made. Attachment 9 of DOE G 450.4-1C describes criteria that can be used to judge effective implementation of ISM year after year.

DOE-HDBK-3027-99, *Integrated Safety Management Systems Verification Team Leader's Handbook*, provides additional information relevant to DOE ISM verifications.

n. Discuss the process used to develop and approve contractor annual ISM performance objective, measures, and commitments.

The following is taken from DOE G 450.4-1C.

DOE O 450.2 requires that safety goals for DOE offices and contractors will be established and monitored by DOE offices to drive performance improvement or maintain excellent performance. DEAR 970.5223-1 states, "On an annual basis, the contractor shall review and update, for DOE approval, its safety performance objectives, performance measures, and commitments consistent with and in response to DOE's program and budget execution guidance and direction." Continuing core expectation CCE-2 in DOE G 450.4-1C addresses continuing safety performance objectives, measures, and commitments.

The purpose of safety performance objectives, measures, and commitments is to drive improvement in safety performance and ISM system effectiveness.

Performance objectives, measures, and commitments are developed based on numerous considerations, including the budget process. This approach to continuous improvement recognizes the need for investment in improvement. The ISM guiding principle of balanced priorities should be considered in developing appropriate performance objectives, measures, and commitments. One of the most effective methods to drive DOE contractor safety performance is to tie incentive fees to safety performance.

The following are sample performance objectives:

- Achieve zero organizational accidents.
- Perform work so that personnel hazards are anticipated, identified, evaluated, and controlled.
- Perform work in a manner that does not present a threat of harm to the public or the environment and that will identify, control, and respond to environmental hazards.
- Be recognized for operational excellence.
- Be recognized for excellent personnel.
- Be recognized for excellent safety culture.
- Be recognized for sound environmental management practices.
- Establish a senior leadership whose commitment to safety is clear and visible.
- Establish and sustain a robust safety culture, consistent with ISM principles.
- Fully integrate HPI initiatives into ISM systems.
- Demonstrate sound stewardship of the site through safe and effective hazardous and radioactive waste minimization and management through restoration of the site where degradation has occurred.

The following are sample performance measures:

- Exposures of personnel to chemical, physical, and biological hazards are adequately controlled.
- Accident and injury rates, lost workday case rates, and the DOE injury cost index are adequately controlled. Performance is better than comparable industry statistics and exhibits a downward trend.
- Exposures of personnel to ionizing radiation are adequately controlled.
- Reportable occurrences are managed with effective corrective actions and are minimized.
- Radioactive material is adequately controlled.
- The fire department response time and the rate of completion of required fire protection actions are adequately controlled and accomplished.
- Environmental violations and releases are adequately controlled.
- The amount of waste generated and the amount of pollutants emitted are reduced.
- Hazardous and radioactive wastes are managed in a manner that meets regulatory requirements and that is cost effective.
- Error-likely situations are identified and controlled.
- Corrective actions are timely.
- Corrective actions are effective at resolving originally identified causes.
- The number of repeat occurrences is minimized through effective corrective actions.
- Employee concerns are tracked and resolved in a timely manner.
- Employee concerns are effectively addressed to resolve the identified concerns.
- Self-assessments effectively identify issues raised by independent organizations when systemic issues are identified.
- The quality of safety basis documents, as measured by defects identified by assessments or occurrences, is excellent.
- The assessment and oversight schedule is issued by September 30th.
- At least 95 percent of annually planned assessments are completed.
- At least 90 percent of identified employee qualifications are completed on time.
- A line manager walk-around program is implemented such that line managers spend at least 100 hours individually in the field each year.
- Work scope priorities are defined and communicated to contractors by July 31st of each year to guide annual work planning.
- Corrective actions are reviewed monthly with the contractor for any cost or schedule variance that is greater than a negative ten percent.
- Monthly all-employees meetings are conducted, with an emphasis on safety.
- A DPO procedure is implemented, and employees are trained on it.
- Performance improvement is evident in environmental compliance and pollution prevention (P2).

Performance measures can also be developed to address various parameters such as

- behavioral and process measures such as the number of near-misses, the number of error reports, the number of behavioral observations, the number of safe acts, etc.;
- events—number of first aid cases, occurrences, near misses;
- safety inspections—number and score;
- employee input—safety concerns and survey responses;
- management assessment results;

- housekeeping inspection results;
- safety-related work package cycle time; and
- procedure compliance rates.

The following are sample performance commitments:

- Develop performance evaluation standards to ensure greater line management responsibility and accountability for safety.
- Develop and implement processes for work planning and control that fulfill the attributes of best practice processes.
- Develop a robust and comprehensive line organization self-assessment program to assess overall safety performance and ISM effectiveness.
- Achieve P2 and sustainable environmental stewardship goals.
- Implement DOE ISM supplemental safety culture elements.
- Initiate two HPI projects.
- Achieve P2 and sustainable environmental stewardship goals.
- Train employees on ISM system revisions.
- Conduct two safety system assessments.
- Maintain voluntary protection program Star status.
- Improve total recordable case rate by implementing DuPont "STOP" program.
- Achieve P2 and sustainable environmental stewardship goals.

o. Explain the significance of human error in the incidences of occurrences and events.

The following is taken from DOE-HDBK-1028-2009.

About 80 percent of all events are attributed to human error. In some industries, this number is closer to 90 percent. Roughly 20 percent of events involve equipment failures. When the 80 percent human error is broken down further, it reveals that the majority of errors associated with events stem from latent organizational weaknesses (caused by previous human errors lying dormant in the system), whereas about 30 percent are caused by the individual worker touching the equipment and systems in the facility. Clearly, focusing efforts on reducing human error will reduce the likelihood of events.

An analysis of significant events in the commercial nuclear power industry between 1995 and 1999 indicated that 3 of every 4 events were attributed to human error, as reported by INPO. Additionally, an NRC review of events in which fuel was damaged while in the reactor showed that human error was a common factor in 21 of 26 (81 percent) events. The report disclosed that "the risk is in the people—the way they are trained, their level of professionalism and performance, and the way they are managed." Human error leading to adverse consequences can be very costly: it jeopardizes an organization's ability to protect its workforce, its physical facility, the public, and the environment from calamity. Human error also affects the economic bottom line. Very few organizations can sustain the costs associated with a major accident (such as product, material, and facility damage; tool and equipment damage; legal costs; emergency supplies; clearing the site; production delays; overtime work; investigation time; supervisors' time diverted; and cost of panels of inquiry). It should be noted that costs to operations are also incurred from errors by those performing

security, work control, cost and schedule, procurement, QA, and other essential but non-safety-related tasks. Human performance remains a significant factor for management attention, not only from a safety perspective, but also from a financial one.

A traditional belief is that human performance is a worker-focused phenomenon. This belief promotes the notion that failures are introduced to the system only through the inherent unreliability of people—once we can rid ourselves of a few bad performers, everything will be fine. There is nothing wrong with the system. However, experience indicates that weaknesses in organizational processes and cultural values are involved in the majority of facility events. Accidents result from a combination of factors, many of which are beyond the control of the worker. Therefore, the organizational context of human performance is an important consideration. Event-free performance requires an integrated view of human performance from those who attempt to achieve it; that is, how well management, staff, supervisors, and workers function as a team, and the degree of alignment of processes and values in achieving the facility's economic and safety missions.

p. Name three of the five principles of human performance and provide a workplace example of each principle in action.

The following is taken from DOE-HDBK-1028-2009.

Five simple statements, listed below, are referred to as the principles or underlying truths of human performance. Excellence in human performance can only be realized when individuals at all levels of the organization accept these principles and embrace concepts and practices that support them. These principles are the foundation blocks for the behaviors described and promoted in this handbook:

1. People are fallible, and even the best people make mistakes.
2. Error-likely situations are predictable, manageable, and preventable.
3. Individual behavior is influenced by organizational processes and values.
4. People achieve high levels of performance because of the encouragement and reinforcement received from leaders, peers, and subordinates.
5. Events can be avoided through an understanding of the reasons mistakes occur and application of the lessons learned from past events (or errors).

Specific workplace examples will be evaluated based on merit by the Qualifying Official.

q. Explain how individual behavior affects the frequency and severity of an occurrence or an event.

The following is taken from DOE-HDBK-1028-2009.

The following unsafe attitudes create danger in the workplace. Awareness of these unsafe, detrimental attitudes among the workforce is a first step toward applying error-prevention methods:

- Pride—an excessively high opinion of one's ability; arrogance. Being self-focused, pride tends to blind people to the value of what others can provide, hindering teamwork.

- Heroism—an exaggerated sense of courage and boldness, like that of General George Armstrong Custer.
- Invulnerability—a sense of immunity to error, failure, or injury. Most people do not believe they will err in the next few moments: “That can’t happen to me.” Error is always a surprise when it happens.
- Fatalism—a defeatist belief that all events are predetermined and inevitable and that nothing can be done to avert fate: “que será, será” (what will be will be) or “let the chips fall as they may.”
- “Bald tire”—a belief that past performance is justification for not changing (improving) existing practices or conditions: “I’ve got 60,000 miles on this set of tires and haven’t had a flat yet.” A history of success can promote complacency and overconfidence.

The following is taken from DOE-STD-1045-93 CN-1.

Minimizing human performance errors is essential to reducing the frequency and severity of events. To progress toward excellent human performance, a work environment must exist in which workers, leaders, and the organization routinely exhibit behaviors that promote event-free operations. Management establishes and reinforces operational practices to promote event-free performance. The INPO document, *Excellence in Human Performance*, describes individual, leadership, and organizational behavior characteristics that have proven successful in promoting excellence in human performance. Examples of practices that may be beneficial in enhancing operations include the following:

- Convey an attitude of trust and an approach that supports teamwork at all levels. Actively solicit, listen to, and (if acceptable) act on workers’ ideas for improving individual and organizational performance.
- Encourage communication and teamwork among groups that operate, maintain, and support the facility.
- Establish administrative practices that reinforce desired behaviors.
- Clearly communicate to all personnel the expectations for conducting work and reporting errors.

r. Given an accident scenario, explain how latent errors in the organization affect the active errors and mistakes that lead to an accident.

This is a performance-based KSA. The Qualifying Official will evaluate its completion. However, the following information taken from DOE G 450.4-1C and NUREG/CR-6751, may be helpful.

The INPO document, *Anatomy of an Event*, defines latent organizational weakness as hidden deficiencies in management control processes or values creating workplace conditions that can provoke error and/or degrade the integrity of defenses.

Process weakness examples are work control, training, accountability policy, reviews and approval, equipment design, procedure development, and human resources. Value weakness examples are priorities, measures and controls, critical incidents, coaching and teamwork, rewards and sanctions, reinforcement, and promotions and terminations.

DOE G 450.4-1C, in attachment 10, "Safety Culture Focus Areas and Associated Attributes," requires processes to be put in place that identify, examine and communicate latent organizational weaknesses that can aggravate relatively minor events if not corrected. It also requires that

- organizational systems and processes are designed to provide layers of defenses, recognizing that people are fallible;
- lessons learned are shared frequently and prevention and mitigation measures are used to preclude errors from occurring or propagating; and
- error-likely situations are sought out and corrected, and recurrent errors are carefully examined as indicators of latent organizational weaknesses.

NUREG/CR-6751, *The Human Performance Evaluation Process: A Resource for Reviewing the Identification and Resolution of Human Performance Problems*, states that the root cause of an error is often found in programmatic weaknesses. Programs comprise policies (formal and informal), organizational processes, and procedures that define management expectations for how work is to be performed. If there is a flaw in one of the programs responsible for maintaining safe operations, that flaw will create conditions that may result in a vulnerability to events caused by the programmatic flaw. Programmatic weaknesses are often found to be the cause of negative human performance trends. Programmatic weaknesses are synonymous with organizational weaknesses.

s. Describe the differing professional opinions process for issues involving nuclear safety.

The following is taken from DOE O 442.2.

DOE regulations, policies, requirements, and processes exist to ensure that ES&H technical concerns are considered and addressed in the performance of its mission. These requirements and procedures promote identification and resolution of issues at the lowest possible level, using day-to-day routine work processes to reduce the cost and the time needed to address issues. Employees are encouraged to report concerns to their immediate supervisor, to any level of management, or to offices responsible for dealing with the particular subject matter of the concern. DOE seeks to promote resolution of concerns at the lowest possible level. In rare cases, an employee may decide that the routine work process did not adequately resolve a concern. The differing professional opinion (DPO) process exists for use in these cases; however, before initiating the DPO process, the employee must first attempt to resolve the issue through his/her organization's routine work processes.

The seven steps in the DPO process are as follows: (A detailed description of each step is available in DOE O 442.2.)

1. Prepare and submit a DPO.
2. Perform an acceptance review of the DPO (screening).
3. Initiate the DPO process.
4. Appoint an Ad Hoc panel.
5. Review the DPO.
6. Issue final decision.
7. Track and follow up actions.

t. Describe the purpose, scope, and importance of the Department's Employee Concerns Program.

The following is taken from DOE O 442.1A.

The purpose of the Department's Employee Concerns Program (ECP) is to ensure employee concerns related to such issues as the ES&H, and management of DOE programs and facilities are addressed through

- prompt identification, reporting, and resolution of employee concerns regarding DOE facilities or operations in a manner that provides the highest degree of safe operations;
- free and open expression of employee concerns that results in an independent, objective evaluation; and
- supplementation of existing processes with an independent avenue for reporting concerns.

The policy applies to all DOE elements and the contractors of DOE-owned or -leased facilities.

The following is taken from the NNSA Administrator's Statement regarding the DOE ECP.

"One of our highest priorities within the National Nuclear Security Administration (NNSA) is to ensure the protection of all our employees. I would like to express my strong support for open communication and a workplace that fosters free and open expression of employee concerns, without fear of reprisal, which is essential to the safe and efficient accomplishment of NNSA's mission.

NNSA's Federal and contractor employees are the principal means for the discovery and reporting of conditions that could negatively affect the quality or safety of operations. As such, all NNSA Federal and contractor employees have the right—and the responsibility—to identify and report concerns, without fear of reprisal, that are associated with environment, safety, and health issues; ensuring compliance with applicable laws, rules, and regulations; identifying inefficiencies and other workplace issues; and, preventing fraud, waste, abuse, or mismanagement. NNSA Federal and contractor employees are encouraged to discuss concerns with their immediate supervisor, or any level of management. In turn, NNSA Federal and contractor managers are expected to respond respectfully to these concerns in a prompt and effective manner to ensure the efficient operation of programs under their jurisdiction.

In cases where employees are unable to raise issues to management, or are uncomfortable in doing so, the ECP provides an alternative mechanism to report concerns so that they can be elevated and addressed. The ECP is available to informally address any concerns. The ECP offices within NNSA are structured to ensure that employee concerns are addressed in a thorough, fair, and timely manner. I expect managers and supervisors to actively promote and support ECP to ensure that these concerns raised are adequately, effectively, and timely addressed.

If we are to ensure the protection of NNSA employees and the American public, a key feature of our system is open and free communication without the fear of reprisal. I ask each of you to commit to this important goal and to work together to accomplish it."

u. Describe the responsibilities of the following in implementing DOE O 442.1A, *Department of Energy Employee Concerns Program*:
- **Headquarters and Field Office Managers**
- **Employee Concerns Manager.**

The following is taken from DOE O 442.1A.

Secretarial Officers and Field Element Manager /NNSA Deputy Administrators

- Designate the management position or positions responsible for developing and implementing the ECP.
- Direct the ECP and provide adequate resources and training for effective implementation.
- Ensure implementation of ECPs required by contract for contractors under their jurisdiction.
- Use management assessment results to verify the adequacy and implementation of the ECP and improve performance.

Employee Concerns Manager

- Develop and submit ECP program implementation documentation to the secretarial officer or field element manager, as appropriate, for approval.
- Implement the approved ECP and ensure concerns are processed as required by DOE O 442.1A.
- Publicize ECP processes, employee rights and responsibilities to report concerns through these processes, and management's intolerance for reprisals against employees who have reported concerns.
- Maintain an employee concerns tracking system and a secure filing system.
- Decide which concerns that are brought to the attention of the ECP the ECP office should seek to resolve, which warrant referral or transfer to another office for further review, or which warrant no further action.
- Assist in evaluation and resolution of employee concerns.
- Transfer concerns to other programs or processes if the concern is deemed to be outside the scope of the ECP. Review and evaluate responses from other organizations to which concerns were referred, request further action when necessary, and provide feedback to those organizations that have a need to know about the outcome of the ECP process.
- Document that an individual, office, or organization has accepted responsibility for minimizing, correcting, and preventing recurrence of concerns that have been substantiated through the ECP process.
- Prepare quarterly and annual reports and review them for lessons learned and possible adverse trends.
- Use self-assessment or outside review to conduct management assessments of their ECPs. Assess the results with the HQ or field element manager, and take any necessary actions to improve program operations.

- Coordinate with DOE contracting officers to determine the existence of contract requirements for the establishment of contractor ECPs and the means and criteria by which such contractor ECPs will be evaluated.
- Advise appropriate levels of management when actions are either ineffective or not timely in resolving concerns or correcting identified deficiencies.

v. Describe how employee concerns are reported, processed, and documented as stated in DOE O 442.1A and the DOE G 442.1-1, *Department of Energy Employee Concerns Program Guide.*

The following is taken from DOE O 442.1A.

Concerns must be processed in one of the following manners:

- Investigated or otherwise evaluated through the ECP, in coordination with DOE, including NNSA or external offices when required
- Referred to other offices or programs and tracked by the ECP until they are resolved (referral of a concern)
- Transferred to another DOE or contractor organization with jurisdiction over the issues, when those issues are outside the scope of the ECP (transfer of a concern)
- Closed

ECP personnel must document employee concerns in sufficient detail to permit investigation or other appropriate levels of review. Concerns must be tracked until closure.

Unless otherwise agreed to by the employee, an organization other than that of the employee's immediate supervisor must conduct the investigation. Similarly, individuals or organizations outside the concerned employee's organization should not be selected to conduct the investigation where their involvement presents a conflict of interest.

If the concerned employee requests confidentiality, his or her identity must not be disclosed during the investigation or other process used to evaluate the concern. However, ECP personnel should advise employees of the limitations of its ability to protect confidentiality under certain circumstances. For example, the concern may involve action taken against the employee for whom relief is sought, or the employee may be closely associated with the concerns.

ECP personnel must evaluate and attempt to resolve employee concerns in a manner that protects the health and safety of employees and the public, ensures effective and efficient operation of programs, and uses alternative dispute resolution techniques whenever appropriate.

ECP personnel must immediately report to an appropriate line manager and/or the ES&H program office those concerns that involve an imminent danger or condition or a serious condition.

Appropriate offices must determine whether DOE, including NNSA or its contractors, has taken action to minimize, correct, or prevent recurrence of program, process, or management weaknesses identified and substantiated through the ECP.

Reports of concerns must be reviewed for classified information and, if classified, sanitized by an authorized classifier.

w. Define whistleblower.

The following is taken from Wikipedia, *Whistleblower*.

A whistleblower is a person who tells the public or someone in authority about alleged dishonest or illegal activities occurring in a government department, a public or private organization, or a company. The alleged misconduct may be classified in many ways; for example, a violation of a law, rule, regulation and/or a direct threat to public interest, such as fraud, health/safety violations, and corruption. Whistleblowers may make their allegations to internal or external authorities.

Video 5. The rights of the whistleblower
http://www.youtube.com/watch?v=G799vjiZphs

x. Identify the benefits of the Employee Concerns program.

The following is taken from DOE G 442.1-1.

The ECP is designed to

- encourage open communication
- inform employees of the proper forum for consideration of their concerns
- ensure employees can raise issues without fearing reprisal
- address employee concerns in a timely and objective manner
- provide employees an avenue for consideration of concerns that fall outside existing systems

y. Demonstrate techniques to mitigate employees' concerns/whistleblower concerns given a specific scenario.

This is a performance-based KSA. The Qualifying Official will evaluate its completion.

z. Describe the applicability of Human Factors Engineering (HFE) to DOE facilities and operations, including where in the life cycle and functional areas it may be used.

The following is taken from DOE-HDBK-1028-2009.

Human factors is a branch of the engineering profession that focuses on how people interact with tasks, machines, or computers, and the environment, taking into consideration that humans have limitations and capabilities. Often, human factors will study the human within the system to ensure that they understand the limitations of the human within the current structure, product, or process. Human factors engineers will evaluate human-to-human, human-to-group, or human-to-organization interactions to better understand the phenomena associated with these interactions and to develop a framework for evaluation. Human factors involves working to make the environment function in a way that seems natural to people and attempts to optimize the accomplishment of tasks, with regard to machine design and the

environment. The purpose of human factors research and practice is to maximize the safety and "healthiness" of work environments and work practices and to ensure the usability of tools, machines, and devices in general. A priority in human factors is consideration of users' physical, behavioral, and information-processing abilities and requirements. Experience has shown that failure to deal with such characteristics can lead to wasted functionality, user frustration, inefficient practices, discomfort, and errors.

Ultimately, the human factors field is concerned with providing a good "fit" between people and their work or leisure environments. "Fit" might be the literal word, as with the design of ejector seats for aircraft (ejector seats designed for average size), or might be more metaphorical (designing to complement task activities, such as a specifically designed kitchen). Notably, the fit can be made in either direction. We can fit the environment to the person (by providing adjustable ejector seats to accommodate a range of heights and weights) or we can fit the person to the environment (providing extensive training or using people of a certain build). Although the terms "human factors" and "ergonomics"—the science of making design account for human characteristics—have only been widely known in recent times, the fields' origins are in the design and use of aircraft during World War II to improve aviation safety. The war marked the development of new and complex machines and weaponry, and these made new demands on operators' cognition. The decision-making, attention, situational awareness, and hand-eye coordination of the machine's operator became key in the success or failure of a task.

It was observed that fully functional aircraft, flown by the best-trained pilots, still crashed. In 1943, Alphonse Chapanis, a lieutenant in the U.S. Army, showed that this so-called "pilot error" could be greatly reduced when more logical and differentiable controls replaced confusing designs in airplane cockpits. Chapanis, a founding father of ergonomics, also pioneered the design of the standard telephone touchpad, teleconferencing, safety labels, night vision goggles, digitized speech, and human-computer interaction.

Paul Fitts was an American Air Force colonel who also examined the man-machine interface in aviation. He studied pilot accident records, digging through 460 cases of what were labeled as "pilot errors" in 1947. He found that a large number of the cases consisted of pilots confusing the flap and gear handles. Typically, a pilot would land and then raise the gear instead of the flaps, causing the airplane to collapse onto the ground, leaving it with considerable damage. Fitts examined the hardware in the average cockpit to find that the controls for gear and flaps were often placed next to one another. They looked the same, felt the same, and which one was on which side was not standardized across cockpits. This was an error trap waiting to happen. Confusing the two handles was not incomprehensible or random; it was systematic: connected clearly to features of the cockpit layout.

Areas of interest for human factors practitioners may include training, learnability, staffing evaluation, communication, task analyses, functional requirements analyses and allocation, procedures and procedure use, organizational culture, human-machine interaction, workload on the human, fatigue, stress, shift work, safety, user interface, attention, vigilance, decision making, human performance, human reliability, human differences, human-computer interaction, control and display design, visualization of data, and work in extreme environments, among others.

In the decades since the war, ergonomics has continued to flourish and diversify. The space age created new human factors issues such as weightlessness and extreme g-forces. How far could environments in space be tolerated, and what effects would they have on the mind and the body?

The information age has resulted in the new ergonomics field of human-computer interaction. Further, the growing demand for and competition among consumer goods and electronics has resulted in more companies including human factors in product design. The contributions made by human factors and ergonomic engineers are numerous and have benefited organizations in many ways.

The following is a small representative sample:

- Improving the design of control panel boards, instrument boards etc. by clearly and uniquely distinguishing buttons, switches, warning alarms, instrument indicators and so on, by the use of color, shape, size, position, labeling, and proximity to reduce the probability of operator error.
- Improving the design of equipment and components taking into consideration the tasks that will be required to maintain the equipment. This includes easy access to components, grouping together components that are functionally related, clear labeling, minimal use of special tools, reduction (if not elimination) of delicate adjustments in the field, and equipment design that facilitates fault isolation.
- Providing research on human behavior and performance in which workers are exposed to prolonged overtime that causes excessive fatigue; adverse working conditions, such as interruptions; distractions caused by abnormal noise; adverse environmental conditions; and numerous other circumstances that negatively impact worker attention and the ability to focus, concentrate, and perform error-free work. Thoughtful organizations have used the results of these research findings to revise hiring and training practices in order to reduce excessive overtime, to better organize work, and to better control the work environment.
- Ergonomics research related to positioning of office equipment and computers; the design of furniture and seating; the design of industrial power tools, conveyer systems transport vehicles; and a myriad of other items that have emerged in the workplace in recent decades that better complement people's physical limitations and capabilities.

Video 6. Types of human errors and how to avoid them
http://www.youtube.com/watch?v=Hm7k0TRaPHI

aa. Identify and discuss the role and use of human factors approaches and methodologies in hazard and accident analysis.

The following is taken from DOE-HDBK-1028-2009.

Table 1 illustrates the relationship between human factor management and hazard analysis and control. Hazards analysis in DOE is an iterative and multi-disciplined process that begins with gross analysis in the earlier stages of work planning and proceeds to ever more detailed refinements that determine the controls to be used. Because the qualifications of work planners varies across DOE, hazards analysis for many work activities requires input of

engineers, scientists, safety professional staff and work performers. Table 1 is merely illustrative of how HPI concepts and tools can add new dimensions to the execution of the ISM functions.

Table 1. Integration of human factors and hazard analysis and control

Integrated Safety Management	Human Performance Improvement Strategic Approach	
ISM Core Functions	Reduce Human Error	Manage Controls
Analyze and Categorize the Hazards Analyze all types of hazards to workers, the public, and the environment. HPI tools that support this function include job-site review, pre-job briefing, and questioning attitude. These tools can be used to identify hazards and unsafe conditions before starting a job.	When hazards are properly analyzed during the ISM cycle, the results can be used to analyze work procedures for latent weaknesses and initiate procedure changes to eliminate those weaknesses. Similarly, robust hazards analysis should consider error precursors in the work place such as • adverse environmental conditions • unclear roles/responsibilities • time pressures • high workload • confusing displays or controls	Reducing latent weaknesses in the procedures strengthens the engineering and administrative controls that are an important cornerstone of the overall defense system. Strong administrative and cultural controls can withstand human error. Controls are weakened when conditions are present that provoke error. Eliminating error precursors at the job site reduces the incidence of active errors.
Develop and Implement Hazard Controls HPI principle 2, "Error-likely situations are predictable, manageable, and preventable," complements this ISM core function. Hazards are the markers for error-likely situations—work situations in which there are greater opportunities for error when performing specific actions or tasks due to error traps. The recognition in HPI that error-likely situations can be managed and prevented supports the ISM core function that hazards are identifiable and controllable. HPI tools that support this core function are self-check, peer check, procedure use, and adherence.	The ISM core function, "implement hazard controls", improves conditions at the job site. HPI describes the job site as the location where behavior occurs during task performance and is characterized by environmental and individual factors. Environmental factors include conditions external to the individual and often beyond his or her direct control, such as procedure quality, component labeling, human-machine interface, heat, and humidity. Individual factors include conditions that are a function of the person assigned the task, such as knowledge, skills, experience, family problems, and color blindness.	Hazard controls initiated in the ISM framework are supplemental reinforcements to the engineered and administrative controls and barriers discussed in association with the HPI performance model. Hazard controls not only help ensure worker and environmental safety, they also relieve workers from worry, stress, and anxiety when performing work in the face of known hazards. Such conditions provoke human error and mistakes. When hazard controls are in place, worker stress and anxiety drops, human performance improves, and human error decreases.

Source: DOE-HDBK-1028-2009

bb. Identify and discuss aspects of person-machine interface that can degrade or enhance the performance of personnel.

The following is taken from Wikipedia, *User Interface*.

The user interface, in the industrial design field of human-machine interaction, is the space where interaction between humans and machines occurs. The goal of interaction between a human and a machine at the user interface is effective operation and control of the machine, and feedback from the machine which aids the operator in making operational decisions. Examples of this broad concept of user interfaces include the interactive aspects of computer operating systems, hand tools, heavy machinery operator controls, and process controls. The design considerations applicable when creating user interfaces are related to or involve such disciplines as ergonomics and psychology.

A user interface is the system by which people interact with a machine. The user interface includes hardware and software components. User interfaces exist for various systems, and provide a means of

- input, allowing the users to manipulate a system; and
- output, allowing the system to indicate the effects of the users' manipulation.

Generally, the goal of human-machine interaction engineering is to produce a user interface which makes it easy, efficient, and enjoyable to operate a machine in the way that produces the desired result. This generally means that the operator needs to provide minimal input to achieve the desired output, and also that the machine minimizes undesired outputs to the operator.

With the increased use of personal computers and the relative decline in societal awareness of heavy machinery, the term user interface is generally assumed to mean graphical user interface, while industrial control panel and machinery control design discussions more commonly refer to human-machine interfaces.

Other terms for user interface include human–computer interface and person–machine interface.

The following is taken from *How to Avoid Foolish Consistency*, by Scott Berkun.

People do not like to learn things. If they take the time to learn something, they expect to be able to apply that knowledge in many places. It follows that good designers conserve the number of things users need to learn to get stuff done. The streets in American cities are good examples of conservation of knowledge. Anywhere in America, yield and stop signs look exactly the same. Traffic lights use red, yellow, and green to mean precisely the same things regardless of the street or city. Mailboxes on street corners use the same colors and icons, so they are clearly identifiable anywhere. It becomes difficult for people when their knowledge of things breaks down. A driver from a country with different street signs who visits America will make mistakes until they learn the new signs. Even subtle variances like the difference in speed of two different yellow traffic lights can cause American drivers to make mistakes.

The rules from the streets apply to web design and all forms of interface design. If an application names a piece of functionality “print,” users will expect the meaning of “print” to be the same throughout the application. On a Web site, if the user sees the shopping cart icon in the upper-right corner, they will expect to see it in the same place, with the same appearance, on every page on that Web site, if not on all of the Web sites they visit. Not only does consistency benefit the user, it also benefits the designers and developers. Once the “print” command has been named by the designer, the developer does not have to spend any more time thinking about how to name it. If there is code for their print command, it can be reused anywhere inside the application. Consistency is wonderful when used appropriately because it improves the experience for developers and their users.

In rare cases, consistency can become a self-perpetuating monster: It has to be used for a purpose. A foolish consistency is one that serves no benefit for the end user. Making things look and work the same as they always have is pointless if the user can no longer accomplish necessary tasks. Rank making things useful above making them consistent. An example is interfaces for video games. Imagine your company was developing two video games, a driving game and a Pac-Man game. The best user interface for the driving game would be a steering wheel, but the Pac-Man game would work better with a joystick and some buttons. Trying to design one user interface for both of these games would be a disaster. At best you would reach a middle ground that was not good at anything. Consistency applied to certain user tasks can make the user experience worse, not better. Consistency does not guarantee usability. It generally helps a user interface, but there are no guarantees in interface design. In this video game example you would have to choose between the user’s cost of learning two different specialized user interfaces against learning one user interface they could reapply but was not well suited to any of the tasks they wanted to do.

In the traffic-light example, the timing of the yellow light in a four-way intersection might be changed by engineers to compensate for the specific traffic patterns of an intersection. A longer yellow light in one direction may give the busier road more time to get cars through than the other road with less traffic. It is a trade-off of a local optimization instead of a global simplification. Fixing a severe local problem may be worth creating a minor global problem. Having good data about how things are used, like the traffic data for the intersection, is the key to making these decisions. The pros and cons of each end of the trade-off have to be clear, and make the best decisions for the feature in relation to the entire product. Sometimes global consistency is the right choice. Sometimes the best thing is to optimize locally.

cc. Discuss the influence of management and organizational factors on performance.

The following is taken from DOE-HDBK-1028-2009.

Organizational factors have a strong influence on human performance. Organizational factors encompass all the ways management uses to direct and coordinate the work of the facility, which shapes the behavior of the people performing their jobs. Collectively, they are the hub of all that goes on at the facility. Organizational factors reveal themselves in engineered controls, administrative controls, cultural controls, and oversight controls.

Some of the more important organizational factors known to impact performance are the following:

- Communication methods and practices
- Management styles and degree of workforce participation
- Tools and resources
- Procedure development and review
- Cleanliness of the work environment
- Layout of facilities and structures
- Staffing levels
- Experience level of the workforce
- Design and modification
- Work processes
- Management visibility
- Human resources policies and practices
- Training programs
- Priorities (production and safety)
- Expectations and standards
- Emphasis on health and safety
- Work planning and scheduling

For specific jobs or tasks, organizational factors create a unique array of job-site conditions—good or bad—that set people up for either success or failure.

Video 7.The influence of management on employee performance
http://www.youtube.com/watch?v=GK_ytpNVSyk

dd. Identify when a HFE SME involvement/engagement is necessary.

The following is taken from DOE-HDBK-1028-2009.

A contextual understanding of individuals' conscious and automatic behaviors as described in the skill, rule, and knowledge performance modes, and knowing the kinds of errors individuals tend to make while working in those various modes, can be extremely useful. Managers responsible for establishing and maintaining effective controls can make good use of this information. Workers need accurate, complete, and unambiguous procedures and guides for reference when doing rule-based work. They may also need access to a subject matter expert when making choices about the rules to select and for correct application of those rules.

Mandatory Performance Activities:

a. Lead or participate in an assessment of a site or facility's implementation of Integrated Safety Management.

This is a performance-based KSA. The Qualifying Official will evaluate its completion. However, the following information from DOE-HDBK-3027-99 may be helpful.

DOE-HDBK-3027-99 provides guidance to an ISMS verification team leader and the verification team in conducting ISMS verifications. This handbook describes the methods and approaches to

- develop the scope of the phase I and phase II review processes to be consistent with the history, hazards, and complexity of the site, facility, or activity;
- develop procedures for the conduct of the phase I review, validating that the ISMS documentation satisfies the DEAR clause as amplified in DOE P 450.4A, *Integrated Safety Management Policy*, and associated guidance and that DOE can effectively execute responsibilities as described in the *Manual of Safety Management Functions, Responsibilities, and Authorities* (FRAM);
- develop procedures for the conduct of the phase II review, validating that the description approved by the approval authority, following or concurrent with the phase I review, has been implemented; and
- describe a methodology by which the DOE ISMS verification teams will be advised, trained, and/or mentored to conduct subsequent ISMS verifications.

DOE-HDBK-3027-99 provides proven approaches and methodologies for the review of the ISMS descriptions provided by contractors.

4. An STSM must have a working level knowledge of the content of the safety basis requirements, as described in 10 Code of Federal Regulations (CFR) 830, "Nuclear Safety Management," Subpart B, "Safety Basis Requirements" and familiarity level knowledge of the related DOE Orders, standards, and guides.

a. Discuss the purpose and objectives of the nuclear facility safety basis program.

The following is taken from 10 CFR 830, subpart B.

The contractor responsible for a DOE nuclear facility must analyze the facility, the work to be performed, and the associated hazards, and identify the conditions, safe boundaries, and hazard controls necessary to protect workers, the public, and the environment from adverse consequences. These analyses and hazard controls constitute the safety basis on which the contractor and DOE rely to conclude that the facility can be operated safely. Performing work consistent with the safety basis provides reasonable assurance of adequate protection of workers, the public, and the environment.

b. Discuss each of the following nuclear safety Orders, standards, guides, and handbooks and relate each of them to establishing and maintaining the safety basis requirements for a given facility:

- **DOE O 420.1C, *Facility Safety***
- **DOE G 421.1-2A, *Implementation Guide For Use in Developing Documented Safety Analyses to Meet Subpart B of 10 CFR 830***
- **DOE G 423.1-1A, *Implementation Guide For Use In Developing Technical Safety Requirements***
- **DOE G 424.1-1B, *Implementation Guide For Use In Addressing Unreviewed Safety Question Requirements***
- **DOE O 425.1D, *Verification of Readiness to Start Up or Restart Nuclear Facilities***
- **DOE O 460.1C, *Packaging and Transportation Safety***

- **DOE G 460.1-1, *Implementation Guide for Use with DOE O 460.1A, Packaging and Transportation Safety***
- **DOE-STD-1020-2012, *Natural Phenomena Hazards Analysis and Design Criteria for Department of Energy Facilities***
- **DOE-STD-1027-92, chg. 1, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports [SAR]***
- **DOE-STD-1083-2009, *Processing Exemptions to Nuclear Safety Rules and Approval of Alternative Methods for Documented Safety Analyses***
- **DOE-STD-1104-2009, *Review and Approval of Nuclear Safety Basis and Safety Design Basis Documents***
- **DOE-STD-1120-2005*, Integration of Environment, Safety, and Health into Facility Disposition Activities, Volumes 1 and 2***
- **DOE-STD-1186-2004, *Specific Administrative Controls***
- **DOE-STD-3009-94, (Change Notice 3), *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses***
- **DOE-HDBK-3010-94, *Airborne Release Fractions/Rates and Respirable Fractions for Nonreactor Nuclear Facilities, volumes 1 and 2***
- **DOE-STD-3011-2002, *Guidance For Preparation Of Basis For Interim Operation (BIO) Documents***
- **DOE-STD-1066-2012, *Fire Protection***
- **DOE-STD-3014-2006, *Accident Analysis for Aircraft Crash into Hazardous Facilities***
- **10 CFR 820, "Procedural Rules for DOE Nuclear Activities"**
- **10 CFR 830, Subpart B, "Safety Basis Requirements"**

DOE O 420.1C, Facility Safety

OBJECTIVE

The objective of DOE O 420.1C is to establish facility and programmatic safety requirements related to nuclear safety design criteria, criticality safety, fire protection, natural phenomena hazards (NPH) mitigation, and the system engineer program.

INTRODUCTION

DOE O 420.1C includes requirements for nuclear and explosives safety design criteria, fire protection, nuclear criticality safety, NPH mitigation, and the system engineer program. DOE O 420.1C also includes a list of positional responsibilities associated with these requirements. Finally, DOE O 420.1C establishes contractor requirements in a contractor requirements document (CRD).

DOE G 421.1-2A, Implementation Guide for Use in Developing Documented Safety Analyses to Meet Subpart B of 10 CFR 830

PURPOSE

DOE G 421.1-2A was developed in support of 10 CFR 830, subpart B, and provides guidance in meeting the provisions for documented safety analyses (DSAs) defined in that subpart.

INTRODUCTION

10 CFR 830, subpart B requires the contractor responsible for a DOE nuclear facility to analyze the facility, the work to be performed, and the associated hazards and to identify the

conditions, safe boundaries, and hazard controls necessary to protect workers, the public, and the environment from adverse consequences. These analyses and hazard controls constitute the safety basis on which the contractor and DOE rely to conclude that the facility can be operated safely. Performing work consistent with the safety basis provides reasonable assurance of adequate protection of workers, the public, and the environment.

DOE G 423.1-1A, Implementation Guide for Use in Developing Technical Safety Requirements

PURPOSE

DOE G 423.1-1A provides elaboration on the content of technical safety requirements (TSRs). 10 CFR 830.205, "Technical Safety Requirements," requires DOE contractors responsible for category 1, 2, and 3 DOE nuclear facilities to develop TSRs. These TSRs identify the limitations of each DOE-owned, contractor-operated nuclear facility based on the DSA and any additional safety requirements established for the facility.

INTRODUCTION

The TSR rule requires contractors to prepare and submit TSRs for DOE approval. DOE G 423.1-1A provides guidance in identifying important safety parameters and developing the content for the TSRs that are required by 10 CFR 830.205.

The appendix to 10 CFR 830, subpart B of the nuclear safety management rule specifies the types of safety limits (SLs), operating limits, surveillance requirements, and administrative controls (ACs) that define the safety envelope necessary to protect the health and safety of the public and workers. The TSR derivation chapter in the DSA is the key component that provides the basis for TSRs.

DOE G 424.1-1B, Implementation Guide for Use in Addressing Unreviewed Safety Question Requirements

PURPOSE

DOE G 424.1-1B provides information to assist in the implementation of 10 CFR 830.203, "Unreviewed Safety Question Process," of the nuclear safety management rules for applicable nuclear facilities owned or operated by DOE, including the NNSA.

10 CFR 830.203 allows contractors to make physical and procedural changes and to conduct tests and experiments without prior DOE approval if the proposed change can be accommodated within the existing safety basis. The contractor must evaluate any proposed change to ensure that it will not explicitly or implicitly affect the safety basis of the facility. The unreviewed safety question (USQ) process is primarily applicable to the DSA. The rule references only the DSA, and includes conditions of approval in safety evaluation reports and facility-specific commitments made in compliance with DOE rules, Orders, or policies. Because application of the USQ process depends on facility-specific information, results of a USQ determination in one facility generally cannot be extrapolated to other facilities. DOE approves procedures to implement the USQ process as required by 10 CFR 830.203.

DOE O 425.1D, Verification of Readiness to Start Up or Restart Nuclear Facilities

OBJECTIVE

The objective of DOE O 425.1D is to establish the requirements for the DOE, including the NNSA, for verifying readiness for startup of new hazard category 1, 2, and 3 nuclear facilities, activities, and operations, and for the restart of existing hazard category 1, 2, and 3 nuclear facilities, activities, and operations that have been shut down.

The readiness reviews provide an independent verification of readiness to start or restart operations.

INTRODUCTION

DOE and NNSA line management must

- establish procedures as necessary to manage the verification of readiness to start up or restart nuclear facilities, activities, or operations according to the requirements of DOE O 425.1D and forward those procedures to the appropriate PSO and CTA as well as HSS for information; and
- exercise delegation of authority and document all delegations of authority made under the provisions granted by DOE O 425.1D.

DOE O 460.1C, Packaging and Transportation Safety

PURPOSE

The purpose of DOE O 460.1C is to establish safety requirements for the proper packaging and transportation of DOE/NNSA offsite shipments and onsite transfers of hazardous materials and for modal transport.

INTRODUCTION

Each entity subject to DOE O 460.1C must perform packaging and transportation activities according to the U.S. Department of Transportation (DOT) requirements of the hazardous materials regulations.

Heads of operations offices or field offices/site office managers are responsible to implement the requirements of DOE O 460.1C and ensure that contractors under their purview fully implement and comply with the requirements of DOE O 460.1C.

DOE G 460.1-1, Implementation Guide for Use with DOE O 460.1A, Packaging and Transportation Safety

PURPOSE

DOE G 460.1-1 provides information concerning the use of current principles and practices, including regulatory guidance from the DOT and the NRC, where available, to establish and implement effective packaging and transportation safety programs. The intent of DOE G 460.1-1 is to aid in the development of implementation plans to effectively carry out the requirements and responsibilities of DOE O 460.1B, *Packaging and Transportation Safety*, which replaced DOE O 460.1A.

INTRODUCTION
DOE G 460.1-1 was written to supplement DOE O 460.1B, by providing clarifying material for the implementation of packaging and transportation safety of hazardous materials.

DOE-STD-1020-2012, Natural Phenomena Hazards Analysis and Design Criteria for Department of Energy Facilities

PURPOSE
DOE-STD-1020-2012 provides criteria and guidance for the analysis and design of facility SSCs that are necessary to implement the requirements of DOE O 420.1C, and to ensure that the SSCs will be able to effectively perform their intended safety functions under the effects of NPHs. DOE-STD-1020-2012 also provides criteria and guidance for the use of industry building codes and voluntary consensus standards in the NPH analysis and design of SSCs in DOE facilities.

INTRODUCTION
The NPH analysis and design process involves the following steps:

Step 1: Siting new facilities to avoid active geologic faults, areas of instability subject to landslides, and areas of likely soil liquefaction. Also, unless impractical from cost and strategic considerations, facilities shall not be located below the design basis flood level determined from a probabilistic flood hazard analysis. Special attention shall be given to sites potentially subject to flooding from upstream dams or reservoirs, including seismically induced failures.1

Step 2: Establishing the performance requirements for SSCs in terms of parameters that define failure of their safety functions that can be determined from the NPH design category that is based on the consequences of SSC failure when subjected to NPH events.

Step 3: Calculating NPH demands on SSCs resulting from NPH events in terms of parameters that define failure of their safety functions.

Step 4: Designing SSCs to ensure their ability to maintain required functionality when subjected to demands of NPH events.

DOE-STD-1027-92, chg. 1, Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports

PURPOSE
The purpose of DOE-STD-1027-92 is to establish guidance for facility managers and PSOs and thereby help them to comply consistently and more efficiently with the requirements for DSAs. To this end, this guidance provides the following practical information:

- The threshold quantities of radiological material inventory below which compliance is not required
- The level of effort to develop the program plan and schedule, and the information for making a preliminary assessment of facility hazards
- A uniform methodology for hazard categorization
- Insight into the “graded approach” for DSA development, especially in hazard assessment and accident analysis techniques

Individual PSOs may develop additional guidance addressing safety requirements for facilities which fall below the threshold quantities specified in DOE-STD-1027-92.

INTRODUCTION

DOE-STD-1027-92 establishes the threshold quantities of hazardous materials that if exceeded, would mandate the development of a DSA. Section 2 discusses the upgrade plan and schedule that must be submitted to each secretarial officer (SO). Section 3 provides a uniform methodology for hazard categorization. Section 4 gives additional specific guidance on the use of the graded approach and accident/hazard analysis techniques for compliance.

DOE-STD-1083-2009, Processing Exemptions to Nuclear Safety Rules and Approval of Alternative Methods for Documented Safety Analyses

PURPOSE

DOE-STD-1083-2009 establishes acceptable procedures that may be used to request and grant exemptions to DOE nuclear safety rules according to 10 CFR 820.

INTRODUCTION

DOE may grant temporary or permanent exemptions from its nuclear safety requirements in rules provided that the provisions of 10 CFR 820, subpart E, "Exemption Relief," are met. The provisions of 10 CFR 820 state that the SO shall use any procedures deemed necessary and appropriate to comply with the exemption responsibilities. DOE-STD-1083-2009 establishes acceptable procedures to be used to request and grant exemptions to DOE nuclear safety rules according to 10 CFR 820.

DOE-STD-1104-2009, Review and Approval of Nuclear Facility Safety Basis and Safety Design Basis Documents

PURPOSE

DOE-STD-1104-2009 describes a framework and criteria for reviewing safety basis documents that will support DOE approval of the documents as required by 10 CFR 830 subpart B, and DOE-STD-1189-2008, *Integration of Safety Into the Design Process*, including preparation of safety evaluation reports and safety validation reports for nuclear facilities.

INTRODUCTION

Safety and health assurance may be increased by standardizing the process of reviewing and approving safety design strategies, conceptual safety design reports, preliminary safety design reports, preliminary DSAs (PDSA), DSAs and TSRs. Although complete standardization of the process requires substantial commitment and is complicated by the diversity of facility operations throughout the DOE complex, certain benefits are gained by standardizing fundamental elements of the review and approval process. To that end, DOE-STD-1104-2009 establishes DOE guidelines for the review and approval of these documents.

DOE-STD-1120-2005, Integration of Environment, Safety, and Health into Facility Disposition Activities, Volumes 1 and 2

PURPOSE

Volume 1 of DOE-STD-1120-2005 has been revised to provide a DOE-approved methodology for preparing a DSA for decommissioning of nuclear facilities, as well as environmental restoration activities that involve work not done within a permanent structure.

Volume 2 of DOE-STD-1120-2005 is much broader in scope than volume 1 and satisfies several purposes. Integrated safety management expectations are provided according to facility disposition requirements contained in DOE O 430.1B, *Real Property Asset Management.* The collection of appendices in volume 2 also provides additional guidance that supplements various practices described in volume 1.

INTRODUCTION

Volume 1, *Documented Safety Analysis for Decommissioning and Environmental Restoration Projects*, has four sections:

1. Introduction
2. Guidance on general safety basis concepts that have a direct or indirect impact on the DSA
3. Guidance on preparing DSAs and TSRs that are compliant with 10 CFR 830, subpart B requirements, and associated methodology for decommissioning of a nuclear facility
4. Guidance on preparing DSAs and TSRs that are compliant with 10 CFR 830, subpart B requirements, and associated methodology for environmental restoration activities involving work not performed within a permanent structure

Volume 2, "Appendices", complements other sections of DOE-STD-1120-2005 with additional ES&H information:

- "Appendix A" provides a set of candidate DOE ES&H directives and external regulations (organized by hazard types) that may be used to identify potentially applicable directives to a specific facility disposition activity.
- "Appendix B" offers examples and lessons learned that illustrate implementation of ES&H approaches discussed in section 3 of volume 1.
- "Appendix C" contains ISM guidance that applies to all facility disposition projects.
- "Appendix D" provides supplemental safety basis guidance related to inactive waste sites.
- "Appendix E" provides example risk binning guidelines that can be used to support control selection.
- "Appendix F" provides guidance for readiness evaluations.

DOE-STD-1186-2004, Specific Administrative Controls

PURPOSE

DOE-STD-1186-2004 clarifies and focuses existing requirements and guidance for the development and implementation of ACs relied upon to perform specific safety functions of importance similar to those of safety SSCs. To focus attention on the unique issues

associated with this type of AC, DOE-STD-1186-2004 introduces a classification of AC to be known as a specific AC (SAC). An SAC exists when an AC

- is identified in the DSA as a control needed to prevent or mitigate an accident scenario; and
- has a safety function that would be safety significant (SS) or safety class (SC) if the function were provided by an SSC.

INTRODUCTION

When a specific-action AC is elevated to the class of SAC, the guidance of DOE-STD-1186-2004 should be used to enhance assurance of the effectiveness and dependability of this AC beyond that which might be experienced if the specific-action AC were simply to be implemented under the auspices of a safety management program.

- Section 1 introduces the concept of SACs and relates this to the existing requirements for derivation of safety bases, including hazard analyses, identification of hazard controls, derivation of TSRs, and the role of ACs in the TSR. Section 1 also describes the general expectations for the formulation, implementation, and maintenance of ACs.
- Section 2 provides guidance for criteria used to classify ACs as SACs, the application of the safety approach from DOE O 420.1B, to SACs, and how SACs are formulated, implemented, and maintained.
- Section 3 provides guidance on measures that should be used to improve the dependability of SACs.
- Section 4 provides guidance on the formats for treatment of SACs in TSRs.
- Section 5 discusses causal and failure analyses as applied to SACs.
- Section 6 presents TSR examples.

DOE-STD-3009-94, (Change Notice 3) Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analysis

PURPOSE

DOE-STD-3009-94 describes a DSA preparation method that is acceptable to the DOE, and was developed to assist hazard category 2 and 3 facilities in preparing DSAs that will satisfy the requirements of 10 CFR 830. Hazard category 1 facilities are typically expected to be category A reactors for which extensive precedents for DSAs already exist.

Guidance provided by DOE-STD-3009-94 is generally applicable to any facility that is required to document its safety basis according to 10 CFR 830. For new facilities in which conceptual design or construction activities are in progress, elements of this guidance may be more appropriately handled as an integral part of the overall design requirements. The methodology provided by DOE-STD-3009-94 focuses more on characterizing facility safety with or without well-documented information than on the determination of facility design. Accordingly, contractors for facilities that are documenting conceptual designs for preliminary DSA should apply the process and format of DOE-STD-3009-94 to the extent it is judged to be of benefit.

Beyond conceptual design and construction, the methodology in DOE-STD-3009-94 is applicable to the spectrum of missions expected to occur over the lifetime of a facility. As the phases of facility life change, suitable methodology is provided for use in updating an

existing DSA and in developing a new DSA if the new mission is no longer adequately encompassed by the existing DSA. This integration of the DSA with changes in facility mission and associated updates should be controlled as part of an overall safety management plan.

INTRODUCTION

DOE-STD-3009-94 addresses the following tasks related to implementing the requirements of 10 CFR 830:

- Ensures consistent and appropriate treatment of all DSA requirements for the variety of DOE nonreactor nuclear facilities.
- Provides final facility hazard categorization and considers and incorporates the categorization into programmatic requirement measures to protect workers, the public, and the environment from hazardous and accident conditions. TSRs and SS SSCs that are major contributors to worker safety and defense in depth are identified in the hazard analysis.
- Designates SC SSCs and safety controls as a function of the evaluation guideline.
- Provides a consistent and measured treatment of the application of the graded approach, including guidance on the minimum acceptable DSA content.

DOE-HDBK-3010-94, Airborne Release Fractions/Rates and Respirable Fractions for Nonreactor Nuclear Facilities

PURPOSE

The purpose of DOE-HDBK-3010-94 is to provide a compendium and analysis of experimental data from which airborne release fractions and respirable fractions may be derived. Such values are needed to determine quantities of radioactive material driven airborne to estimate the scope of the potential release spectrum and potential downwind consequences from a given facility or activity. The information provided in DOE-HDBK-3010-94 aids in making such estimates.

INTRODUCTION

DOE-HDBK-3010-94 discusses the following major topics:

- Source term formula: provides a computational formula for using the information gained from analysis.
- Applicability of data: distinguishes proper use of information.
- Accident stresses: identifies the types of accident conditions for which this information is applicable.
- Handbook organization: explains the presentation of information and the use of examples.

The data in DOE-HDBK-3010-94 can be used in a variety of applications, such as safety and environmental analyses, and to provide information relevant to system and experiment design. However, the data and the analyses of the data contained therein need to be critically evaluated for applicability in each situation in which they are used, and represent only one source of information in a complete safety analysis or design process.

DOE-STD-3011-2002, Guidance for Preparation of Basis for Interim Operation (BIO) Documents

PURPOSE

DOE-STD-3011-2002 provides guidance for the development of BIO documents, which are an acceptable form of DSA under the provision of 10 CFR 830.

INTRODUCTION

DOE-STD-3011-2002 provides a DOE-approved methodology for preparing a BIO document. DOE-STD-3011-2002 supplements the information in DOE G 421.1-2.

DOE-STD-1066-2012, Fire Protection

PURPOSE

The purpose of DOE-STD-1066-2012 is to facilitate implementation of requirements in DOE O 420.1C by providing criteria and guidance for a standard and acceptable approach to meet the DOE O 420.1C requirements for fire protection programs.

DOE-STD-1066-2012 was developed to provide acceptable methods and approaches for meeting DOE fire protection program and design requirements and to address special or unique fire protection issues at DOE facilities that are not comprehensively or adequately addressed in national consensus standards or other design criteria.

INTRODUCTION

A fire protection policy statement should document the fire protection program's expectations of senior DOE and contractor management. These statements should detail strategies to maintain an awareness of the importance of fire prevention features, such as housekeeping, unobstructed means of egress, and the control of sources of heat. For site emergency response organizations, statements should include strategies to describe the level of service that DOE expects, as well as the level of capability that the contractors intend to provide. Such policy statements may not conflict with regulatory, DOE, or contractual obligations.

DOE-STD-3014-2006, Accident Analysis for Aircraft Crash into Hazardous Facilities

PURPOSE

DOE-STD-3014-2006 is an analytical standard intended to provide a sound, technically justifiable, and consistent approach to analyzing the risk posed by an aircraft crash into a facility containing radioactive or hazardous chemical materials. The focus is on analyzing the risk posed to the health and safety of the public and onsite workers from a release of hazardous material following an aircraft crash. Thus, this is not a standard on aviation safety and does not consider the risk to the occupants of the aircraft; the risk to individuals inside a building affected by the crash itself; or the risk to other individuals on the ground, either inside or outside a facility boundary, who might be directly impacted by the crash. This focus forms the basis for the standard's assumptions about excluding the consideration of consequences within a certain distance from the hazardous material release point.

INTRODUCTION

DOE-STD-30014-2006 provides the user with sufficient information to evaluate and assess the significance of aircraft crash risk on facility safety without expending excessive effort where it is not required. The implementation guidance provides a framework of step-wise increases in analytical sophistication aimed at eliciting only that amount of analysis needed to demonstrate that aircraft crash either does or does not exceed a risk level of concern equivalent to what is generally applied to other sources of risk from the operation of hazardous material facilities. DOE-STD-3014-2006 establishes an approach for performing a conservative analysis of the risk posed by a release of hazardous radioactive or chemical material resulting from an aircraft crash into a facility containing significant quantities of such material. This approach can establish whether a facility has a significant potential for an aircraft impact, and, given an aircraft impact, whether a facility has the potential for an accident producing significant offsite or onsite consequences. The analysis is based on the structural properties of a facility and the inventory at a facility.

10 CFR 820, "Procedural Rules for DOE Nuclear Activities"

PURPOSE

DOE has adopted procedural rules in 10 CFR 820 to provide for the enforcement of violations of DOE nuclear safety requirements for which civil and criminal penalties can be imposed under the Price-Anderson Amendments Act of 1988.

INTRODUCTION

10 CFR 820 provides criteria and procedures to protect employees of DOE contractors who believe they have suffered retaliation for disclosing information concerning danger to public health or safety, substantial violations of law, fraud or gross mismanagement; for participating in congressional proceedings; or for refusing to participate in dangerous activities.

10 CFR 830, Subpart B, "Safety Basis Requirements"

PURPOSE

10 CFR 830, subpart B, establishes safety basis requirements for hazard category 1, 2, and 3 DOE nuclear facilities.

INTRODUCTION

In establishing the safety basis for a hazard category 1, 2, or 3 DOE nuclear facility, the contractor responsible for the facility must

- define the scope of the work to be performed;
- identify and analyze the hazards associated with the work;
- categorize the facility consistent with DOE-STD-1027-92, CN1;
- prepare a DSA for the facility; and
- establish the hazard controls on which the contractor will rely to ensure adequate protection of workers, the public, and the environment.

c. Discuss the development and maintenance of programs and documents that implement the requirements of 10 CFR 830, Subpart B, for DOE and contractors authorized to operate nuclear facilities.

The following is taken from 10 CFR 830, subpart B.

In establishing the safety basis for a hazard category 1, 2, or 3 DOE nuclear facility, the contractor responsible for the facility must

- define the scope of the work to be performed;
- identify and analyze the hazards associated with the work;
- categorize the facility consistent with DOE-STD-1027-92, CN1;
- prepare a DSA for the facility; and
- establish the hazard controls on which the contractor will rely to ensure adequate protection of workers, the public, and the environment.

In maintaining the safety basis for a hazard category 1, 2, or 3 DOE nuclear facility, the contractor responsible for the facility must

- update the safety basis to keep it current and to reflect changes in the facility, the work and the hazards as they are analyzed in the DSA;
- annually submit to DOE either the updated DSA for approval or a letter stating that there have been no changes in the DSA since the prior submission; and
- incorporate in the safety basis any changes, conditions, or hazard controls directed by DOE.

d. Discuss the following items in the context of safe operation of a nuclear facility:

- **Authorization basis**
- **Documented safety analysis**
- **Fire hazard analysis**
- **Graded approach**
- **Limiting conditions for operation**
- **Limiting control setting**
- **Operational readiness review**
- **Preliminary documented safety analysis (PDSA)**
- **Potential inadequacies of the safety analysis (PISA)**
- **Readiness assessment (RA)**
- **Structures, systems, and components (SSCs)**
- **Safe harbor methodologies**
- **Safety analysis report for packaging**
- **Safety basis**
- **Safety class SSCs**
- **Safety evaluation report**
- **Safety limits**
- **Safety significant SSCs**
- **Shipper receiver agreements**
- **Specific administrative controls**
- **Startup notification report**
- **Surveillance requirements**
- **TSRs**
- **Design basis**
- **USQ process**

The information for all of the terms in this KSA is taken from DOE-HDBK-1188-2006 unless otherwise specified.

Authorization Basis

The authorization basis represents those aspects of the facility design basis and operational requirements relied upon by DOE to authorize operation. These aspects are considered to be important to the safety of facility operations. The authorization basis is described in documents such as the facility DSA and other safety analyses; hazard classification documents, the TSRs, DOE-issued safety evaluation reports, and facility-specific commitments made in order to comply with DOE Orders or policies.

Documented Safety Analysis

A DSA is a documented analysis of the extent to which a nuclear facility can be operated safely with respect to workers, the public, and the environment, including a description of the conditions, safe boundaries, and hazard controls that provide the basis for ensuring safety.

Fire Hazard Analysis

A fire hazard analysis is an assessment of the risks from fire within an individual fire area in a DOE nuclear facility, analyzing the relationship to existing or proposed fire protection. This shall include an assessment of the consequences of fire on safety systems and the capability to safely operate a facility during and after a fire.

Graded Approach

The graded approach is the process of ensuring that the level of analysis, documentation, and actions used to comply with a requirement in 10 CFR 830 are commensurate with the following attributes:

1. The relative importance to safety, safeguards, and security
2. The magnitude of any hazard involved
3. The life-cycle stage of a facility
4. The programmatic mission of a facility
5. The particular characteristics of a facility
6. The relative importance of radiological and nonradiological hazards
7. Any other relevant factor

DOE-STD-3009-94 specifies only three of the above seven attributes (attributes 2, 3, and 5) for the graded approach but also provides some guidance for the application of attribute 6. The rule, Orders, or standards referenced in this procedure provide no other specific guidance regarding the application of attributes 1, 4, or 7.

Limiting Conditions for Operation

Limiting conditions for operation (LCOs) are the limits that represent the lowest functional capability or performance level of safety SSCs required for safe operations.

Limiting Control Setting

Limiting control setting (LCS) are the settings on safety systems that control process variables to prevent exceeding a safety limit.

Operational Readiness Review

The following is taken from DOE-STD-3006-2010.

The operational readiness review (ORR) is a performance-based assessment that includes observing and documenting the responses of operating and support program personnel to normal and off-normal events as demonstrated by drills, preoperational tests, and exercises.

In addition, field assessments should be conducted to verify that field configurations match the applicable supporting documentation.

The ORR is intended to examine the aspects of the activity under review and to ensure that the equipment, procedures, and personnel associated with the activity are ready for startup and safe operation. The ORR is also intended to verify that site infrastructures, including the safety management programs, ensure that the status of readiness to safely conduct nuclear operations are sustained throughout the operating cycle.

Preliminary Documented Safety Analysis (PDSA)

The PDSA is the documentation prepared in connection with the design and construction of a new DOE nuclear facility or a major modification to a DOE nuclear facility that provides a reasonable basis for the preliminary conclusion that the nuclear facility can be operated safely through the consideration of factors such as

- the nuclear safety design criteria to be satisfied;
- a safety analysis that derives aspects of design that are necessary to satisfy the nuclear safety design criteria; and
- an initial listing of the safety management programs that must be developed to address operational safety considerations.

Potential Inadequacies of the Safety Analysis (PISA)

The following is taken from DOE G 424.1-1A.

In general, a PISA arises from the following entry conditions:

- A discrepant as-found condition
- An operational event or incident
- New information, including discovery of an error, sometimes from an external source

When a PISA is suspected, based on a discrepancy or as-found condition, the usual USQ process may be used in a backward-looking manner. That is, the as-found condition can be viewed as a proposed activity. Other PISAs may result from an operational event or incident or from new information, including discovery of an error. The USQ process is often modified to add a question that asks if the issue is a PISA to ensure that all potential inadequacies are properly identified. Once declared, a PISA must be the subject of an unreviewed safety question determination (USQD), and it cannot be screened out of the process. If a PISA or a possible reduction in the safety margins defined in the TSR bases is identified, the safety basis may no longer be bounding, or it may be inadequate in other ways. In this case, the contractor must do the following:

- Notify DOE

- Place the facility in a safe and stable condition until the safety evaluation is completed
- Conduct a USQD (within a few days, not weeks or months)
- Submit a completed safety evaluation to DOE before removing any operational restrictions

Readiness Assessment (RA)

The following is taken from DOE-STD-3006-2010.

An RA is a review conducted to determine a facility's readiness to start up or restart when an ORR is not required.

The majority of readiness reviews that are planned and accomplished to meet the requirements of DOE O 425.1D are RAs. The scope and complexity of RAs may range from a simple checklist, if local procedures permit, to a scope that approximates that of an ORR. Local implementing procedures for RAs should provide detailed processes and expectations for the unique aspects of RAs permitted in the order such as use of checklists and parallel accomplishment of contractor and DOE RAs.

Structures, Systems, and Components (SSCs)

The following is taken from the International Atomic Energy Agency, IAEA Safety Guide NS-G-1.11.

"Structures, systems, and components" is a general term encompassing all of the elements of a facility or activity that contribute to protection and safety. Structures are the passive elements: buildings, vessels, shielding, etc. A system comprises several components, assembled in such a way as to perform a specific (active) function.

Safe Harbor Methodologies

The following is taken from *The Nuclear Engineering Handbook*, by Kenneth D. Kok.

The safe harbor methodologies are methods identified in standards developed by DOE or the NRC, or defined in regulations promulgated by OSHA. These standards are based on many years of experience with the types of facilities and activities to which they may be applied. Contractors do not need to get prior DOE approval to use the safe harbor methods according to the stated provisions in 10 CFR 830. Contractors will need DOE approval to use a method other than the safe harbor methods.

Safety Analysis Report for Packaging

The following is taken from DOE G 460.1-1.

The safety analysis report for packaging should be sufficiently detailed to permit the reviewer to determine that the package is adequately designed and analyzed, and should document the adequacy of the packaging with respect to 10 CFR 71, "Packaging and Transportation of Radioactive Material," standards or the equivalency thereto. These regulations state that a package must meet certain containment, radiation control, and subcriticality assurance requirements when subjected to specified normal transport and hypothetical accident conditions.

Safety Basis
The safety basis is the DSA and hazard controls that provide reasonable assurance that a DOE nuclear facility can be operated safely in a manner that adequately protects workers, the public, and the environment.

Safety Class SSCs
Safety class SSCs are the SSCs, including portions of process systems, whose preventive or mitigative function is necessary to limit radioactive hazardous material exposure to the public, as determined from safety analyses.

Safety Evaluation Report
The safety evaluation report is the report prepared by DOE to document the sufficiency of the DSA for a hazard category 1, 2, or 3 nuclear facility, the extent to which a contractor has satisfied the requirements of 10 CFR 830 subpart B, and the basis for approval by DOE of the safety basis for the facility, including any conditions for approval.

Safety Limits
Safety limits are the limits on process variables associated with those SC physical barriers (generally passive) that are necessary for the intended facility function and that are required to guard against the uncontrolled release of radioactive materials.

Safety Significant SSCs
Safety significant SSCs are the SSCs which are not designated as SC SSCs but whose preventive or mitigative function is a major contributor to defense-in-depth and/or worker safety as determined from safety analyses.

As a general rule of thumb, SS SSC designations based on worker safety are limited to those SSCs whose failure is estimated to result in a near-term worker fatality or serious injuries or significant radiological or chemical exposures to workers. The term, serious injuries, as used in this definition, refers to medical treatment for immediately life-threatening or permanently disabling injuries (e.g., loss of eye, loss of limb).

Shipper Receiver Agreements
The following is taken from DOE M 470.4-6, chg. 1 (archived).

The site/facility operator must develop and implement a program to control and account for internal and external transfers of nuclear materials for each facility. This program must include documented procedures that specify requirements for authorization, documentation, tracking, verification, and response to abnormal situations that may occur during transfer of nuclear materials. Use of confirmatory measurements in lieu of verification/accountability measurements for such items requires a shipper/receiver agreement approved by the shipper’s and receiver’s DOE cognizant security authority.

Specific Administrative Controls
The following is taken from DOE-STD-1186-2004.

Specific administrative controls are ACs that are selected to provide preventive and/or mitigative functions for specific potential accident scenarios, and that also have safety importance equivalent to engineered controls that would be classified as SC or SS if the engineered controls were available and selected.

Similar to the classification of SSCs as safety SSCs, not all ACs requiring specific actions related to individual accident scenarios rise to the level of importance of SACs. Similar to SSCs of lower importance, which are sometimes referred to as "important to safety" or "defense-in-depth" SSCs, SACs of lesser importance can be addressed under the implementation of related safety management programs.

An SAC exists when an AC (1) is identified in the DSA as a control needed to prevent or mitigate an accident scenario, and (2) has a safety function that would be SS or SC if the function were provided by an SSC.

Startup Notification Report
The following is taken from DOE-STD-3006-2010.

A startup notification report (SNR) is a quarterly report (or at a periodical as designated by the PSO) by each responsible contractor to identify nuclear facility new starts and restarts scheduled in the next year. The report identifies the facility and, based on the criteria in DOE O 425.1D, specifies whether an ORR or a RA is required. The SNR also identifies the startup authorization authority and updates previously provided information.

Surveillance Requirements
Surveillance requirements are requirements relating to test, calibration, or inspection to ensure that the necessary operability and quality of safety SSCs and their support systems required for safe operations are maintained, that facility operation is within safety limits, and the LSCs and LCOs are met.

Technical Safety Requirements (TSRs)
TSRs are the limits, controls, and related actions that establish the specific parameters and requisite actions for the safe operation of a nuclear facility and include, as appropriate for the work and the hazards identified in the DSA for the facility, safety limits, operating limits, surveillance requirements, administrative and management controls, use and application provisions, and design features, as well as a bases appendix.

Design Basis
The design basis is the design inputs, the design constraints, and the design analysis and calculations. It includes topical areas such as seismic qualification, fire protections, and safe shutdown. It encompasses consideration of such factors as plant availability, plant efficiency, costs, and maintainability, and that subset that relates to safety and the authorization basis.

USQ Process

The following is taken from 10 CFR 830.3.

The USQ process is the mechanism for keeping a safety basis current by reviewing potential USQs, reporting USQs to DOE, and obtaining approval from DOE prior to taking any action that involves a USQ.

e. Describe how TSRs are derived, how they are used, and what constitutes a violation.

The following is taken from DOE G 423.1-1A.

Technical safety requirements define the performance requirements of SSCs and identify the safety management programs personnel use to ensure safety. TSRs are aimed at confirming the ability of the SSCs and personnel to perform their intended safety functions under normal, abnormal, and accident conditions. These requirements are identified through hazard analysis and through the identification of the potential sources of safety issues. Also contributing to the development of TSRs are safety analyses to identify and analyze a set of bounding accidents that take into account all potential causes of releases of radioactivity. Through the analyses of the encompassing bounding accidents, the necessary safety systems and accident mitigating systems are identified and their characteristics are defined. Flowing from the analyses is information that provides the bases for controls, limits, and conditions for operation, known as TSRs. TSRs explicitly show this relationship. The content of the DSA must remain valid so that the safety basis of the facility, as implemented in operations through the TSR, remains valid.

Although the TSR elements have an importance hierarchy, a TSR violation can occur for each type of TSR. Violations of a TSR occur as a result of the following four circumstances:

1. Exceeding an SL
2. Failure to complete an action statement within the required time limit following exceeding an LCS or failing to comply with an LCO
3. Failure to perform a surveillance within the required time limit
4. Failure to comply with an AC statement

Failure to comply with an AC statement is a TSR violation when either the AC is directly violated, as would be the case with not meeting minimum staffing requirements for example, or the intent of a referenced program is not fulfilled. To qualify as a TSR violation, the failure to meet the intent of the referenced program would need to be significant enough to render the DSA summary invalid. TSR violations involving SLs require the facility to begin immediately to go to the most stable, safe condition attainable, including total shutdown.

f. Discuss the hazard categorization levels, chemical hazard classification levels, and the process utilized to determine the facility hazard category or classification.

Hazard Categorization Levels

The following is taken from DOE-STD-1027-92.

Category level 1 hazards have the potential for significant offsite consequences, based on total curie content, potential material forms, and maximum energy for dispersion available. One class of facilities that possess this hazard potential are class A nuclear reactors.

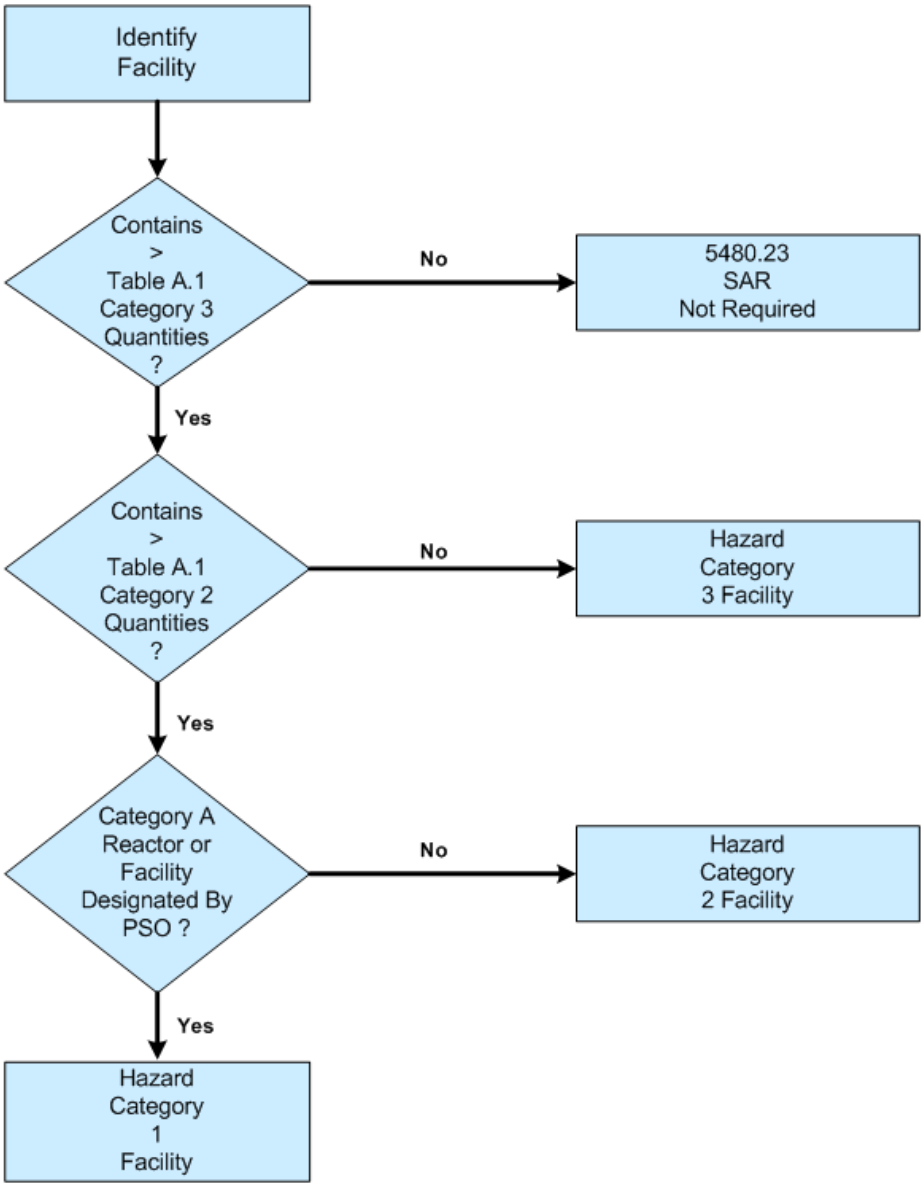
Category level 2 facilities have the potential for significant onsite consequences.

Category level 3 is designed to capture facilities that largely include laboratory operations, low-level waste-handling facilities, and research machines that possess less than the category 2 quantities of material and are considered to represent a low hazard. Facilities should be classified as category level 3 if there is only the potential for significant localized consequences. Essentially all industrial facilities have a potential for significant localized consequences because the potential to injure workers from typical industrial accidents is always present. However, category 3 facilities pose additional hazards due to the presence of radionuclides.

Contractors are required to perform a hazard analysis of their nuclear activities and classify their processes, operations, or activities according to the following requirements:

- The hazard analysis should be based on an inventory enveloping all radioactive and nonradioactive hazardous materials that are stored, utilized, or may be formed within a nuclear facility.
- The hazard analysis should identify energy sources or processes that might contribute to the generation or uncontrolled release of hazardous materials. The hazard analysis should estimate the consequences of accidents in which the facility or process and/or materials in the inventory are assumed to interact, react, or be released in a manner to produce a threat or challenge to the health and safety of individuals onsite and offsite.
- The hazard analysis should be submitted to DOE for approval according to the safety analysis plan.

Figure 4 depicts the process by which a nuclear facility hazard category is determined.



Source: DOE-STD-1027-92

Figure 4. Hazard classification decision process

Chemical Hazard Classification Levels

The following is taken from Occupational Safety and Health Administration, *A Guide to The Globally Harmonized System of Classification and Labeling of Chemicals (GHS).*

Classification is the starting point for hazard communication. It involves the identification of the hazard(s) of a chemical or mixture by assigning a category of hazard/danger using defined criteria. The GHS is designed to be consistent and transparent. It draws a clear distinction between classes and categories to allow for self classification. For many hazards,

a decision tree approach is provided in the GHS document. For several hazards, the GHS criteria are semi-quantitative or qualitative. Expert judgment may be required to interpret these data.

The term "hazard classification" is used to indicate that only the intrinsic hazardous properties of substances and mixtures are considered, and involves the following 3 steps:

1. Identification of relevant data regarding the hazards of a substance or mixture
2. Subsequent review of those data to ascertain the hazards associated with the substance or mixture
3. A decision on whether the substance or mixture will be classified as a hazardous substance or mixture and the degree of hazard, where appropriate, by comparison of the data with agreed hazard classification criteria

The data used for classification may be obtained from tests, literature, and practical experience. The GHS health and environmental hazard criteria/definitions are test method neutral. Accordingly, tests that determine hazardous properties conducted according to internationally recognized scientific principles can be used for purposes of hazard classification.

g. Discuss the reasons for performing a USQ determination.

The following is taken from 10 CFR 830.203.

The contractor responsible for a hazard category 1, 2, or 3 DOE nuclear facility must implement the DOE-approved USQ procedure in situations where there is a

- temporary or permanent change in the facility as described in the existing DSA;
- temporary or permanent change in the procedures as described in the existing DSA;
- test or experiment not described in the existing DSA; or
- possible inadequacy of the DSA because the analysis potentially may not be bounding or may be otherwise inadequate.

h. Discuss the responsibilities of DOE and contractors authorized to operate nuclear facilities for the performance of USQ determinations.

The following is taken from DOE G 424.1-1B.

Contractor Responsibilities

Contractors are expected to provide a detailed procedure on how to perform a USQD. Specific guidance on how to conduct a USQD is in DOE G 424.1-1B, attachment A.

Four criteria define a USQ. Three can be addressed by answering seven questions. The fourth PISA criterion also invokes the following seven questions:

1. Could the proposed change increase the probability of an accident previously evaluated in the facility's existing safety analyses?
2. Could the proposed change increase the consequences (to workers or the public) of an accident previously evaluated in the facility's existing safety analyses?
3. Could the proposed change increase the probability of a malfunction of equipment important to safety previously described in the facility's existing safety analyses?

4. Could the proposed change increase the consequences of a malfunction of equipment important to safety described in the facility's existing safety analyses?
5. Could the proposed change create the possibility of an accident of a different type than any previously evaluated in the facility's existing safety analyses?
6. Could the proposed change create the possibility of a malfunction of equipment important to safety of a different type than any previously evaluated in the facility's existing safety analyses?
7. Could the proposed change reduce a margin of safety?

If the answer to any of these questions is yes, the change is considered a USQ.

The contractor's USQ procedures should include documenting defensible technical explanations based on sound engineering judgment for each of the answers to the seven questions. It is inappropriate to perform extensive analyses or to set a numerical margin for increases in the probability or consequences within which a positive USQD would not be triggered.

Specific responsibilities of those performing or reviewing USQDs should be clearly defined. Documentation should also be discussed in the implementing procedures. The procedures should identify the level of detail necessary to document performance of a USQD and conclusions reached, and include a list of references relied upon to reach the conclusions as well as guidance for the retention of records.

DOE Responsibilities

DOE wants to review and approve those changes that involve a USQ (that is, when the USQ determination is positive) to verify that the safety controls are adequate to provide an acceptable level of safety to the public and workers.

DOE approves procedures to implement the USQ process as required by 10 CFR 830.203. Where site level and facility level procedures are used, site and facility level procedures are approved by DOE. This ensures that line management is informed of the results of the USQ process and can take whatever follow-up actions are appropriate to enable prompt submission of changes to DOE for safety review and approval or cancellation of proposed changes.

i. Discuss the actions to be taken by a contractor and DOE upon identifying information that indicates a PISA.

The following is taken from DOE G 424.1-1B.

Written USQDs are needed when a contractor identifies or is informed of a situation that indicates that the safety analyses that support the DOE-approved safety basis may not be bounding or may be otherwise inadequate.

The USQ process starts when facility management has information that gives reason to believe that there is a potential that the facility DSA might be inadequate.

Because a safety analysis inadequacy has potential to call into question information on which authorization of operations is based, per 10 CFR 830.203(g) the contractor is to

- take action, as appropriate, to place or maintain the facility in a safe condition until an evaluation of the safety of the situation is completed;
- notify DOE of the situation;
- perform a USQ determination and notify DOE promptly of the results; and
- submit the evaluation of the safety of the situation to DOE prior to removing any operational restrictions that were initiated.

No DOE approval of any operational restrictions that were initiated is needed; however, DOE should review them and can direct that other restrictions be implemented if needed.

j. Discuss the actions to be taken by a contractor and DOE if it is determined that a PISA exists.

A potentially inadequate safety analysis (PISA) may result from situations that indicate that the safety basis may not be bounding or may be otherwise inadequate; for example, discrepant as-found conditions, operational events, or the discovery of new information. It is appropriate to allow a short period of time (hours or days but not weeks) to investigate the conditions to confirm that a safety analysis is potentially inadequate before declaring a PISA. The main consideration is that the safety analysis does not match the current physical configuration, or the safety analysis is inappropriate or contains errors. If it is immediately clear that a PISA exists, then the PISA should be declared immediately.

After the PISA has been confirmed, 10 CFR 830.203(g) requires contractors to take four specific actions. One of those actions is to notify DOE of the situation. The current DOE reporting system requires that a potential inadequacy of the safety basis be reported as a significance category 3 situation. The occurrence reporting and processing system (ORPS) may be used for this notification if the report explicitly states that the situation involves a "potential USQ involving a potentially inadequate safety analysis." The ORPS reporting designation used for this notification is group 3 B (2), "Declaration of a potential inadequacy of the DSA." The DOE FR and/or other DOE management responsible for the facility should be notified immediately. The DOE notification should clearly identify any operational restrictions that were invoked to ensure the facility is in a safe condition. No DOE approval of the operational restrictions is needed; however, DOE should review them and can direct other restrictions be implemented if needed.

k. Describe the safety basis documents for the facilities in the STSM's organization and how they are prepared, reviewed, approved, and updated:

- **The safety basis documents for the facilities under the purview of the STSM's organization**
- **The scope of operations, hazards, postulated accidents, and controls/requirements for the assigned facilities as documented in the safety basis documents**
- **The safety basis documentation preparation, revision, and update processes and the associated responsibilities of the contractor and DOE**
- **The review and approval processes for safety basis documents and the associated responsibilities of the contractor and DOE**

- **The level of approval authority as it relates to facility hazard categorization and classification and safety basis documents**
- **The steps in the preparation, review, and approval of a safety evaluation report**
- **The process for flow down of controls and requirements and the derived operating procedures, processes, and programs**
- **The conditions and procedures used to maintain and modify safety documents**

This is a facility-based KSA. The Qualifying Official at the facility will evaluate its completion.

I. Discuss the purpose, content, and philosophy, as appropriate to the position, of the following safety management standards for nuclear explosive safety:
- **DOE O 452.1D, *Nuclear Explosive and Weapons Surety Program***
- **DOE O 452.2D, *Safety of Nuclear Explosive Operations***
- **DOE O 461.1B, *Packaging and Transfer or Transportation of Materials of National Security Interest***

DOE O 452.1D, Nuclear Explosive and Weapons Surety Program

PURPOSE

DOE O 452.1D describes the nuclear explosive and weapons surety (NEWS) program. The NEWS program is implemented through the following Orders:
- DOE O 452.1D, *Nuclear Explosive and Weapons Surety Program*
- DOE O 452.2D, *Nuclear Explosive Safety*
- DOE O 452.4A, *Security and Control of Nuclear Explosives and Nuclear Weapons*
- DOE O 452.6A, *Nuclear Weapon Surety Interface with the Department of Defense*

The objectives of the NEWS Program are
- to prevent accidents involving U.S. nuclear weapons and nuclear explosives;
- to prevent inadvertent or unauthorized use of U.S. nuclear weapons and nuclear explosives;
- in conjunction with the U.S. Department of Defense (DoD), to protect the public health and safety by providing dual-agency judgment and responsibility for the safety, security, and control (surety) of nuclear weapons;
- to establish nuclear explosive surety standards and nuclear weapon design surety requirements;
- to address surety vulnerabilities during all phases of the nuclear weapon life cycle and to upgrade surety during weapon stockpile refurbishments and/or new weapon development; and
- to establish requirements and responsibilities for planned nuclear explosive operations (NEOs).

DOE O 452.2D, Nuclear Explosive Safety

PURPOSE

The purpose of DOE O 452.2D is to establish requirements to implement the nuclear explosive safety (NES) elements of DOE O 452.1D for routine and planned NEOs.

CONTENTS
DOE O 452.2D includes DOE NES standards. It also includes the establishment of a NES program, under which NEOs require special consideration because of the potentially high consequences of an accident or unauthorized act. All NEOs must be designed and conducted in a manner that meets the NES standards of DOE O 452.1D. The deputy administrator for defense programs must ensure implementation of NES programs.

DOE O 461.1B, Packaging and Transportation for Offsite Shipment of Materials of National Security Interest

PURPOSE
The purpose of DOE O 461.1B is to make clear that the packaging and transportation of all offsite shipments of materials of national security interest for DOE must be conducted according to DOT and NRC regulations that would be applicable to comparable commercial shipments, except where an alternative course of action is identified in DOE O 461.1B.

CONTENTS
The contents of DOE O 461.1B include requirements relating to packaging, transportation, certification, and approval/authorization of offsite shipments; preparation and approval of packaging and transportation procedures, review and concurrence with related QA plans; scheduling of transportation safeguards shipments; training; and maintenance of documents and records.

Mandatory Performance Activities:

a. Review and evaluate a USQ Determination, including walking down the proposed change/potential inadequacy.

b. Review and evaluate a Safety Evaluation Report (SER).

c. Walk down a facility with Safety System Oversight person, safety analyst, or SME, identifying the safety controls contained in a TSR.

d. Complete a review of a hazard analysis or accident analysis including walking down the scope of work area or accident scenario.

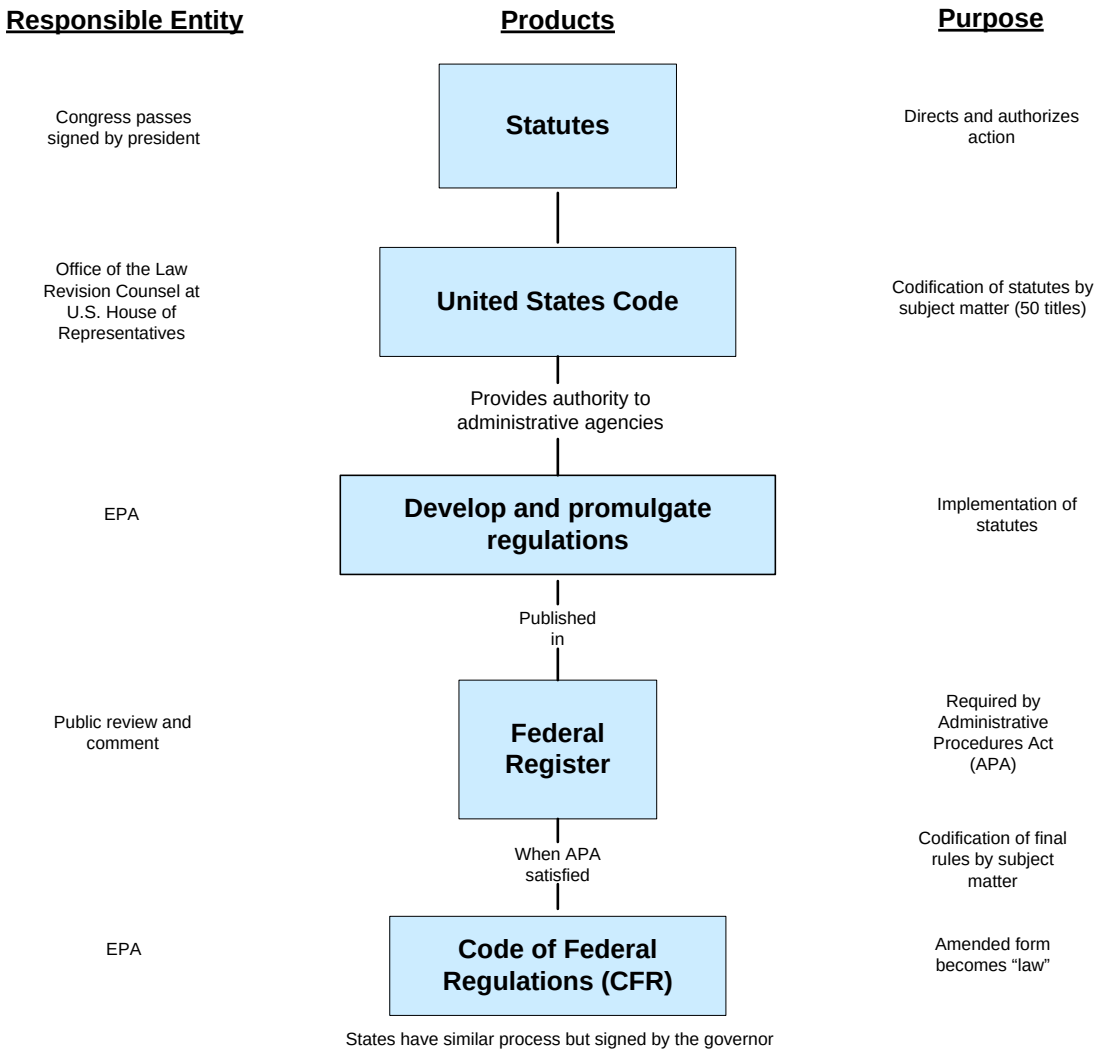
KSAs a through e are performance-based. The Qualifying Official will evaluate their completion.

5. An STSM must have a familiarity level knowledge (demonstrate awareness) of environmental standards, laws, and regulations, and must have a working level knowledge of the safety impacts of the application of environmental standards, laws, and regulations, and waste management principles and practices.

a. Demonstrate awareness of sources of environmental requirements, such as Federal and state statutes, regulations, and DOE orders.

The following is taken from original material provided by the DOE National Training Center.

Environmental law consists of a system using all of the laws in the U.S. legal system to minimize, prevent, punish, or remedy actions that damage or threaten to damage the public health and safety or the environment. Statutes or executive orders (EOs) empower an administrative agency to develop and promulgate regulations. Statutes direct and authorize, while regulations detail implementation. When a statute is passed through both houses of Congress and is signed into law by the president, it becomes the authorization and guidance to a regulating agency to establish a regulation, and is published in the United States Code. The regulating agency formulates and promulgates the proposed regulation by publishing it in the Federal Register to allow for public review and comment. When finalized, the regulation is again published in the Federal Register in its amended form to become law. These final regulations are combined annually into the Code of Federal Regulations. State laws and regulations are passed in the same manner as Federal laws, except they require the signature of the state's governor to become law. With respect to environmental laws, the states can enact laws and regulations more stringent than their Federal counterparts, but no less stringent or they are prone to preemption. This process example is shown in figure 5.



Source: DOE National Training Center

Figure 5. Process for environmental statues to become laws

b. Demonstrate awareness of sources of the organization, mission, and enforcement authorities of the Environmental Protection Agency (EPA).

The following is taken from various links on the U.S. Environmental Protection Agency website.

EPA Organization

The EPA is directed by an administrator and a deputy administrator who are appointed by the President and subject to the approval of the senate. The President also appoints EPA's inspector general, general counsel, and nine assistant administrators, each subject to senate confirmation. The nine assistant administrators are charged with management of specific programs. Additionally, three associate administrators are appointed by the administrator and tasked with the execution of programs for public affairs; congressional and legislative relations; and regional, state, and local relations. Ten regional administrators have the task of interfacing with state and local governments to achieve the agency's mission.

EPA Mission

The mission of the EPA is the protection of human health and the environment.

EPA Enforcement Authorities

EPA is organized into offices for the enforcement of environmental regulations and the management of agency functions as follows:

- The Office of Water administers the Safe Drinking Water Act, the Clean Water Act, and the Ocean Dumping Ban Act of 1988.
- The Office of Air and Radiation enforces the Clean Air Act, sets the National Ambient Air Quality Standards, and establishes criteria, standards, and policies to control radiation and indoor air pollution exposures.
- The Office of Solid Waste and Emergency Response administers the provisions of the RCRA, the CERCLA, and the Emergency Planning and Community Right-to-Know Act (EPCRA).
- The Office of Pollution Prevention, Pesticides, and Toxic Substances enforces the provisions of the Federal Insecticide, Fungicide, and Rodenticide Act, and the Toxic Substances Control Act, and establishes tolerances for pesticide residues in foods under the Federal Food, Drug, and Cosmetics Act.

Video 8. History of the EPA
http://www.youtube.com/watch?v=K1l5mbVKSsw

c. Discuss the National Environmental Policy Act (NEPA) process and the role of the Department and its contractors in implementation.

The following is taken from the U.S. Environmental Protection Agency, *National Environmental Policy Act*, "Basic Information."

The NEPA process consists of an evaluation of the environmental effects of a Federal undertaking including its alternatives. There are three levels of analysis: categorical exclusion determination; preparation of an environmental assessment/finding of no significant impact (EA/FONSI); and preparation of an environmental impact statement (EIS).

- Categorical Exclusion: At the first level, an undertaking may be categorically excluded from a detailed environmental analysis if it meets certain criteria which a Federal agency has previously determined as having no significant environmental impact. A number of agencies have developed lists of actions which are normally categorically excluded from environmental evaluation under their NEPA regulations.
- EA/FONSI: At the second level of analysis, a Federal agency prepares a written EA to determine whether or not a Federal undertaking would significantly affect the environment. If the answer is no, the agency issues a FONSI. The FONSI may address measures which an agency will take to mitigate potentially significant impacts.
- EIS: If the EA determines that the environmental consequences of a proposed Federal undertaking may be significant, an EIS is prepared. An EIS is a more detailed evaluation of the proposed action and alternatives. The public, other Federal agencies, and outside parties may provide input into the preparation of an EIS and then comment on the draft EIS when it is completed. The Office of Enforcement and Compliance Assurance enforces environmental laws by investigating and preparing cases for judicial action, as necessary. This office administers the NEPA and other regulations pertaining to Federal agencies.

If a Federal agency anticipates that an undertaking may significantly impact the environment, or if a project is environmentally controversial, a Federal agency may choose to prepare an EIS without having to first prepare an EA. After a final EIS is prepared, and at the time of its decision, a Federal agency will prepare a public record of its decision addressing how the findings of the EIS, including consideration of alternatives, were incorporated into the agency's decision-making process.

The role of a Federal agency in the NEPA process depends on the agency's expertise and relationship to the proposed undertaking. The agency carrying out the Federal action is responsible for complying with the requirements of NEPA.

- Lead agency: In some cases, there may be more than one Federal agency involved in an undertaking. In this situation, a lead agency is designated to supervise preparation of the environmental analysis. Federal agencies, together with state, tribal, or local agencies, may act as joint lead agencies.
- Cooperating agency: A Federal, state, tribal, or local agency having special expertise with respect to an environmental issue or jurisdiction by law may be a cooperating agency in the NEPA process. A cooperating agency has the responsibility to assist the lead agency by participating in the NEPA process at the earliest possible time by participating in the scoping process; in developing information and preparing environmental analyses, including portions of the EIS with which the cooperating agency has special expertise; and in making available staff support at the lead agency's request to enhance the lead agency's interdisciplinary capabilities.
- Council of Environmental Quality (CEQ): Under section 1504 of CEQ's NEPA regulations, Federal agencies may refer to CEQ on interagency disagreements concerning proposed Federal actions that might cause unsatisfactory environmental effects. CEQ's role, when it accepts a referral, is generally to develop findings and recommendations, consistent with the policy goals of section 101 of NEPA.

Video 9. The NEPA
http://www.youtube.com/watch?v=xQRlOYJV6Pg

d. Describe the role(s) of a DOE contractor with respect to compliance with environmental laws and regulations, and discuss the responsibilities of the Federal staff employees for management and oversight of the DOE contractor for such compliance.

The following is taken from DOE O 436.1.

The purpose of DOE O 436.1, *Departmental Sustainability*, is to provide requirements and responsibilities for managing sustainability within DOE to

- ensure the Department carries out its missions in a sustainable manner that addresses national energy security and global environmental challenges, and advances sustainable, efficient, and reliable energy for the future;
- institute wholesale cultural change to factor sustainability and greenhouse gas (GHG) reductions into all DOE corporate management decisions;
- ensure DOE achieves the sustainability goals established in its strategic sustainability performance plan (SSPP) pursuant to applicable laws, regulations and EOs, related performance scorecards, and sustainability initiatives.

Roles of a DOE Contractor

Regardless of the performer of the work, the contractor is responsible for complying with the requirements of the DOE O 436.1 CRD and flowing down the CRD requirements to subcontracts to the extent necessary to ensure contractor compliance with these requirements.

- Reporting. The contractor must establish and implement activities that support the Department's required submittal of reports and data and implementation of sustainability goals specified by DOE in the contract. The contractor must also meet the requirements of the EPCRA.
- The contractor must establish and implement the following activities:
  - Site sustainability plans (SSPs). Contractors must develop or support development and commitments to identify their respective contributions toward meeting the Department's sustainability goals. Contractors must integrate their SSP with their operational plans.
  - Environmental management systems (EMS). Contractors must develop and implement an EMS that is certified to or conforms with International Organization for Standardizations (ISO) 14001:2004. Site sustainability goals must be integrated into the EMS.

Federal Staff (i.e., FEM) Responsibilities for Management and Oversight of DOE Contractors

Ensure appropriate quantifiable sustainability and energy goals/targets are integrated into contracting documents, such as the performance evaluation and measurement plans.

Ensure that EMSs covering all site activities are certified to, or conform to, ISO 14001:2004 (E) according to the accredited registrar provisions of the international standard or the self-declaration instructions are maintained at sites under their purview.

- At sites with multiple contracts, where appropriate, designate a lead coordinating contractor to maintain a site-wide EMS that accounts for all site operations.
- At sites with multiple EMSs, ensure the sustainability objectives and targets established in each are provided for in a consolidated SSP.

Monitor site performance in implementing the requirements of DOE O 436.1 and make such information available annually to their PSO/associate administrator.

Ensure that sites under their purview provide the DOE Federal energy management program (FEMP) all contracts for utilities, services, and modifications to such contracts (excluding administrative or incremental funding modifications) prior to execution for review and concurrence by FEMP and the Office of General Council. For NNSA utility services contracts, FEMP provides expert analysis to NNSA, including their opinion on the acceptability of the contract action. Utilities services must be awarded via DOE prime contract and DOE elements must ensure that all applicable Federal, state, and local laws and regulations are followed.

Notify contracting officers of those contracts that must include the DOE O 436.1 CRD.

e. Demonstrate awareness of environmental requirement liabilities.

The following is taken from the U.S. Environmental Protection Agency, *Basic Information*, "Enforcement Programs."

Civil enforcement protects human health and the environment by taking legal action to bring polluters into compliance with the law.

Criminal enforcement investigates and assists in the criminal prosecution of deliberate or egregious violations of environmental laws or regulations and any associated violation of the U.S. criminal code.

What is the difference between Criminal and Civil Enforcement?

Criminal and civil enforcement differ in

- legal standard
- burden of proof
- results

LEGAL STANDARD

Environmental civil liability is strict: it arises simply through the existence of the environmental violation, without regard to what the responsible party knew about the matter.

Environmental criminal liability is triggered through the existence of some level of intent.

As a result of this distinction, most of the environmental crimes that EPA investigates involve knowing violations of the law, which are classified as felonies in all but two of the

federal environmental statutes, Toxic Substance Control Act (TSCA) and Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).

A knowing violation is one in which the defendant is aware of the facts that constitute the violation; an instance in which conscious and informed action brought about the violation, rather than, as would be the case with a civil violation, an accident or mistake.

For example, an intentional decision to discharge pollutants into a river without a permit, or to bypass a required air pollution control device could be a knowing violation, and thus criminal, without regard to the defendants knowledge of the law.

BURDEN OF PROOF

To be found civilly liable (note that a party can only be found guilty in a criminal case), the standard of proof is based on the preponderance of the evidence, which means that the proposition is more likely to be true than not true. Effectively, the standard is satisfied if there is a greater than 50 percent chance that the proposition is true.

The defendant in a civil suit can either be found liable following a trial or reach a consent decree (a mutually agreed on settlement with the government). While the defendant is then required to meet all of the terms of the consent decree, he does not have to acknowledge that he violated the law.

Criminal guilt must be established beyond a reasonable doubt, which is a higher or stricter standard than the civil liability standard. When a criminal defendant pleads guilty or is convicted by a jury, there is no question of legal wrong doing; he has legally committed the crime.

RESULTS

The major difference in the result between civil and criminal prosecutions is that an individual can be sentenced to prison for breaking the criminal law. It is the possibility of incarceration that most distinguishes criminal law from civil law; therefore, criminal law provides the most deterrence.

If a civil defendant is found liable or agrees to a consent decree, the result is usually a monetary fine, injunctive relief (which are the actions required to correct the violation, e.g., install pollution control equipment), or additional actions taken to improve the environment.

If a criminal defendant is convicted or pleads guilty, the result can be a criminal fine (e.g., a monetary fine paid to the U.S. Treasury), and/or restitution (e.g., reimbursing the government for the cost of cleanup or response or paying for the harm caused by the violation such as paying for medical testing for people exposed to asbestos) as a result of breaking the law.

f. Discuss ISO 14001, Environmental Management Systems (EMS), and their relevance to DOE and contractor performance.

The following is taken from International Organization for Standardization, ISO 14001:2004.

ISO 14001:2004 specifies requirements for an EMS to enable an organization to develop and implement a policy and to identify objectives that take into account legal requirements and other requirements to which the organization subscribes, and to gather information about significant environmental aspects. It applies to those environmental aspects that the organization identifies as those which it can control and those which it can influence. It does not itself state specific environmental performance criteria.

Video 10. ISO 14001
http://www.youtube.com/watch?v=J7Fak8QI6Ww

g. Discuss awareness of definitions of the following types of waste that may be provided in Federal laws and regulations:
- **Low level waste**
- **High level waste**
- **Transuranic waste**
- **Mixed waste**

The following is taken from DOE M 435.1-1.

Low-Level Waste
Low-level waste is radioactive waste that is not high-level radioactive waste, spent nuclear fuel, transuranic (TRU) waste, byproduct material (as defined in section 11.e(2) of the AEA of 1954, as amended), or naturally occurring radioactive material.

Examples can include radioactively contaminated industrial or research waste such as
- paper
- rags
- plastic bags
- personal protective equipment
- water-treatment residues

High-Level Waste
High-level waste is the highly radioactive waste material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains fission products in sufficient concentrations, and other highly radioactive material that is determined, consistent with existing law, to require permanent isolation.

Examples include
- liquid waste directly produced in reprocessing
- any solid material derived from the liquid wastes having a sufficient concentration of fission products

Transuranic Waste

Transuranic waste is radioactive waste containing more than 100 nanocuries (3700 becquerels [Bq]) of alpha-emitting TRU isotopes per gram of waste, with half-lives greater than 20 years, except for high-level radioactive waste; waste that the Secretary of Energy has determined, with the concurrence of the administrator of the EPA, does not need the degree of isolation required by the 40 CFR 191, "Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes" disposal regulations; or waste that the NRC has approved for disposal on a case-by-case basis according to 10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Waste."

Mixed Waste

Waste that contains a combination of source, special nuclear, or by-product material subject to the Atomic Energy Act (AEA) of 1954, as amended, and a hazardous component subject to RCRA.

h. Discuss the Department's policies and practices regarding the handling and management of waste as described in DOE O 435.1, Chg. 1, *Radioactive Waste Management.*

The following is taken from DOE O 435.1.

DOE radioactive waste management activities should be systematically planned, documented, executed, and evaluated. Radioactive waste should be managed to

- protect the public from exposure to radiation from radioactive materials;
- protect the environment;
- protect workers; and
- comply with applicable Federal, state, and local laws and regulations.

All radioactive waste should be managed according to the requirements in DOE M 435.1-1.

DOE, within its authority, may impose such requirements, in addition to those established in DOE O 435.1, as it deems appropriate and necessary to protect the public, workers, and the environment, or to minimize threats to property.

Video 11. Waste handling at the DOE WIPP facility
http://www.youtube.com/watch?v=GlEtQ2qlxEU

i. Demonstrate awareness of the Department's performance objectives and performance assessment requirements as outlined in DOE O 435.1, Chg. 1.

DOE O 435.1 does not provide specific performance objectives or performance assessment requirements, but states all radioactive waste shall be managed according to the requirements in DOE M 435.1-1 from which the following is taken. This manual lists performance objectives and performance assessment requirements only for low-level waste.

Performance Objectives

Low-level waste disposal facilities shall be sited, designed, operated, maintained, and closed so that a reasonable expectation exists that the following performance objectives will be met for waste disposed of after September 26, 1988:

- Dose to representative members of the public shall not exceed 25 millirem (mrem) (0.25 mSv) in a year total effective dose equivalent (TEDE) from all exposure pathways, excluding the dose from radon and its progeny in air.
- Dose to representative members of the public via the air pathway shall not exceed 10 mrem (0.10 mSv) in a year TEDE, excluding the dose from radon and its progeny.
- Release of radon shall be less than an average flux of 20 pCi/m2/s (0.74Bq/m2/s) at the surface of the disposal facility. Alternatively, a limit of 0.5 pCi/1 (0.0185 Bq/l) of air may be applied at the boundary of the facility.

Performance Assessment

A site-specific radiological performance assessment shall be prepared and maintained for DOE low-level waste disposed of after September 26, 1988. The performance assessment shall include calculations, for a 1,000-year period after closure, of potential doses to representative future members of the public and potential releases from the facility. This provides a reasonable expectation that the performance objectives identified in DOE M 435.1-1 are not exceeded as a result of operation and closure of the facility.

- Analyses performed to demonstrate compliance with the performance objectives in DOE M 435.1-1, chapter 4, and to establish limits on concentrations of radionuclides for disposal, based on the performance measures for inadvertent intruders, shall be based on reasonable activities in the critical group of exposed individuals. Unless otherwise specified, it is appropriate to assume average living habits and exposure conditions in representative critical groups of individuals projected to receive the highest doses. The likelihood of inadvertent intruder scenarios may be considered in interpreting the results of the analyses, and establishing radionuclide concentrations, if adequate justification is provided.
- The point of compliance shall correspond to the point of highest projected dose or concentration beyond a 100-meter buffer zone surrounding the disposed waste. A larger or smaller buffer zone may be used if adequate justification is provided.
- Performance assessments shall address reasonably foreseeable natural processes that might disrupt barriers against release and transport of radioactive materials.
- Performance assessments shall use DOE-approved dose coefficients (dose conversion factors) for internal and external exposure of reference adults.
- The performance assessment shall include a sensitivity/uncertainty analysis.
- Performance assessments shall include a demonstration that projected releases of radionuclides to the environment shall be maintained ALARA (as low as reasonably achievable).
- For purposes of establishing limits on radionuclides that may be disposed of near-surface, the performance assessment shall include an assessment of impacts to water resources.
- For purposes of establishing limits on the concentration of radionuclides that may be disposed of near-surface, the performance assessment shall include an assessment of impacts calculated for a hypothetical person assumed to inadvertently intrude, for a temporary period, into the low-level waste disposal facility. For intruder analyses,

institutional controls shall be assumed to be effective in deterring intrusion for at least 100 years following closure. The intruder analyses shall use performance measures for chronic and acute exposure scenarios, respectively, of 100 mrem (1 mSv) in a year and 500 mrem (5 mSv) TEDE excluding radon in air.

j. Demonstrate awareness of the Department's policies on waste management, with a focus of safety, including
- **generation reduction**
- **segregation**
- **minimization**
- **pollution prevention**
- **disposal**

The following is taken from DOE Order 5820.2A (archived).

Generation Reduction

TRANSURANIC WASTE
Technical and administrative controls shall be directed to reducing the gross volume of waste generated and/or the amount of radioactivity requiring disposal. TRU waste reduction efforts shall be based on the implementation of techniques such as process modification, process optimization, materials substitution, decontamination, assay of suspect waste, and new technology development. Volume reduction techniques, such as incineration, compaction, extraction, and shredding, shall be implemented wherever cost effective and practical.

LOW-LEVEL WASTE
Technical and administrative controls shall be directed to reducing the gross volume of waste generated and/or the amount of radioactivity requiring disposal. Waste reduction efforts shall include consideration of process modification, process optimization, materials substitution, and decontamination.

All DOE low-level waste generators shall establish auditable programs (goals, incentives, procedures, and reports) to ensure that the amount of low-level waste generated and/or shipped for disposal is minimized.

Segregation

To the extent practical, waste shall be segregated by type (sludge, salt, high activity, and low activity) to make accessibility for future processing easier.

Each DOE low-level waste generator shall separate uncontaminated waste from low-level waste to facilitate cost effective treatment and disposal.

The following is taken from DOE M 435.1-1, chg. 2.

Minimization and Pollution Prevention

Waste minimization and P2 shall be implemented for radioactive waste management facilities, operations, and activities to meet the requirements of EO 12856, "Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements," and EO

13101, “Greening the Government through Waste Prevention, Recycling, and Federal Acquisition.”

Disposal

Disposal of high-level waste must be according to the provisions of the AEA of 1954, as amended, the Nuclear Waste Policy Act of 1982, as amended, or any other applicable statutes.

Transuranic waste shall be disposed according to the requirements of 40 CFR 191.

Low-level waste disposal facilities shall meet the performance objectives and performance assessment requirements discussed in KSA c of this competency statement.

k. Demonstrate awareness of how the following Acts apply to and impact the Department’s waste management programs:
- **Federal Facilities Compliance Act (FFCA)**
- **Pollution Prevention Act of 1990**
- **Superfund Amendment Reauthorization Act**

Federal Facilities Compliance Act (FFCA)

The FFCA of 1992 established that Federal facilities do not have sovereign immunity from state enforcement of state environmental laws under the solid and hazardous waste provisions of the Solid Waste Disposal Act. Thus, Federal facilities are obligated to pay fines and penalties assessed by states. Additionally, provisions of the Act give EPA broader enforcement authority at Federal facilities. Specific to DOE, the Act includes a three-year moratorium on enforcement of storage provisions for mixed hazardous and radioactive wastes. The Act created a new mixed-waste provision requiring reports on the national inventory of all mixed waste on a state-by-state basis and on the nation’s inventory on mixed-waste treatment capacities and technologies.

The Act limits the civil liability of Federal employees acting within the scope of their official duties; however, it increases the potential criminal liability of Federal employees.

Pollution Prevention Act

The Pollution Prevention Act states,

> . . . the Congress hereby declares it to be the national policy of the United States that pollution should be prevented or reduced at the source whenever feasible; pollution that cannot be prevented should be recycled in an environmentally safe manner, whenever feasible; pollution that cannot be prevented or recycled should be treated in an environmentally safe manner whenever feasible; and disposal or other release into the environment should be employed only as a last resort and should be conducted in an environmentally safe manner.

Based on DOE O 436.1 requirements, among others, pollution prevention efforts are mandated as being part of a site EMS, which is part of the site’s ISMS.

Superfund Amendment Reauthorization Act

Requirements found in DOE O 451.1B must be adhered to as they relate to DOE activities. These requirements are in support and application of EPCRA or Title III of Superfund Amendments and Reauthorization Act of 1986, 42 U.S.C. 11001, and the Pollution Prevention Act of 1990, 42 U.S.C. 13101, et seq.

l. Discuss the general requirements of Section 3116 of the 2005 National Defense Authorization Act regarding appropriate classification of waste.

The National Defense Authorization Act (NDAA) for fiscal year 2005 states the following:

IN GENERAL—Notwithstanding any other provision of law, with respect to material stored at a Department of Energy site at which activities are regulated by the State pursuant to approved closure plans or permits issued by the State, the term high-level radioactive waste does not include radioactive material resulting from the reprocessing of spent nuclear fuel that the Secretary of Energy determines

1. does not require permanent isolation in a deep geologic repository for spent fuel or highly radioactive waste pursuant to criteria promulgated by the Department of Energy by rule approved by the NRC;
2. has had highly radioactive radionuclides removed to the maximum extent practical in accordance with the NRC-approved criteria; and
3. in the case of material derived from the storage tanks, is disposed of in a facility (including a tank) within the State pursuant to a State-approved closure plan or a State-issued permit, authority for the approval or issuance of which is conferred on the State outside of this Act.

Therefore, section 3116 of the Ronald W. Reagan NDAA for Fiscal Year 2005 authorizes the Secretary of Energy, in consultation with the NRC, to determine that certain waste from reprocessing spent nuclear fuel is not high-level waste and that it may instead be disposed of as low-level waste if it meets the criteria set forth in section 3116.

m. Discuss the general requirements of the Resource Conservation and Recovery Act of 1976 as it applies to hazardous and mixed waste.

Hazardous Waste

The following is taken from the U.S. Environmental Protection Agency, *Hazardous Waste—RCRA Subtitle C*.

The RCRA subtitle C establishes a Federal program to manage hazardous wastes from cradle to grave. The objective of the subtitle C program is to ensure that hazardous waste is handled in a manner that protects human health and the environment. To this end, there are subtitle C regulations for the generation; transportation; and treatment, storage, or disposal of hazardous wastes. In practical terms, this means regulating a large number of hazardous waste handlers.

The RCRA subtitle C program also

- conducts compliance evaluation inspections to ensure that hazardous waste is managed in accordance with law, regulations, and safe handling practices;

- works with state agencies and the Department of Justice on civil and criminal enforcement of hazardous waste laws where violations are observed; and
- helps state and local agencies develop and administer hazardous waste management programs.

The subtitle C program has resulted in perhaps the most comprehensive regulations EPA has ever developed. The regulations first identify the criteria to determine which solid wastes are hazardous, and then establish various requirements for the three categories of hazardous waste handlers: generators; transporters; and treatment, storage and disposal facilities (TSDFs). In addition, the subtitle C regulations set technical standards for the design and safe operation of TSDFs. These standards are designed to minimize the release of hazardous waste into the environment. Furthermore, the regulations for TSDFs serve as a basis for developing and issuing the permits required by the RCRA for each facility. Permits are essential to making the subtitle C regulatory program work, since it is through the permitting process that the EPA or state applies standards to TSDFs.

The RCRA corrective action program is a result of the 1984 Hazardous and Solid Waste Amendments (HSWA) passed by Congress. These amendments required the cleanup of contamination from improper waste management practices prior to and after the passage of RCRA. The statute requires responsible parties that are seeking a permit to treat, store or dispose of hazardous wastes to clean up environmental contaminants at their sites regardless of the time of release. EPA's corrective action authority was substantially expanded by HSWA, allowing the Agency to address any releases of hazardous waste or hazardous waste constituents to all environmental media at RCRA permitted and non-permitted facilities.

Mixed Waste

The following is taken from U.S. Environmental Protection Agency, *Mixed Waste*.

Mixed waste contains a combination of radioactive and hazardous waste components. As a result, treatment and regulation are complex. Mixed wastes are regulated by the RCRA and the AEA. In general, the requirements of RCRA and AEA are consistent and compatible. However, in cases where requirements of the two acts are found to be inconsistent, the AEA takes precedence.

The NRC and the DOE regulate the radioactive portion of mixed waste under AEA authority, while EPA regulates the hazardous waste portion of mixed waste under RCRA authority.

Most commercially-generated mixed waste is classified as low-level mixed waste (LLMW). LLMW is waste that contains low-level radioactive waste (LLRW) and hazardous waste. LLRW is defined as any radioactive waste that is not high-level radioactive waste, spent nuclear fuel, or byproduct material. LLMW is generated commercially in all 50 states at industrial, hospital, and nuclear power plant facilities in a number of processes such as medical diagnostic testing and research, pharmaceutical and biotechnology development, pesticide research, and nuclear power plant operations.

The US DOE produces three types of mixed waste:

- Low-level mixed waste (LLMW) - results from research, development, and production of nuclear weapons. An estimated 226,000 cubic meters (m^3) of DOE LLMW will require management over the next 20 years.
- High-level mixed waste (HLW) - results from reprocessing spent nuclear fuel and irradiated targets from reactors. These wastes often contain highly-corrosive components, organics, or heavy metals that are regulated under RCRA. DOE has about 399,000 m^3 of HLW stored in large tanks at four locations across the U.S.
- Mixed transuranic waste (MTRU) - contains radioactive elements heavier than uranium and includes a hazardous waste component. MTRU is primarily generated from nuclear weapons fabrication, plutonium bearing reactor fuel fabrication, and spent fuel reprocessing.

The US DOE is currently self-regulating and its orders apply to DOE sites and contractors. As mandated by the FFCA, which was signed into law on October 6, 1992, DOE has developed site treatment plans to handle its mixed wastes under the review of EPA and authorized states.

n. Discuss the process for determining whether or not waste is hazardous.

The following is taken from U.S. DOE Office of Health, Safety and Security, *Resource Conservation and Recovery Act.*

> The statutory definition of a hazardous waste is provided in RCRA as follows:
>
> . . . a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may (A) cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or (B) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.
>
> Furthermore, a solid waste is a hazardous waste if it is not excluded by regulation and if it is listed as a hazardous waste, is a waste mixture containing one or more listed hazardous wastes, or exhibits one or more characteristics of hazardous waste. Listed wastes meet the definition of hazardous waste regardless of the concentration level of hazardous constituents in them. When listed wastes are mixed with nonhazardous wastes or materials, the mixture must be managed as hazardous waste.

o. Demonstrate awareness of the general requirements and issues associated with the transportation and packaging of radioactive wastes.

The following is taken from DOE M 435.1-1.

General Requirements

Radioactive waste shall be packaged and transported in accordance with DOE O 460.1C, and DOE O 460.2A, *Departmental Materials Transportation and Packaging Management*.

High-Level Waste

PACKAGING AND TRANSPORTATION
The following requirement is in addition to the general requirements specified previously:

Canistered waste form: Immobilized high-level waste shall meet the requirements of the DOE/EM-0093, *Waste Acceptance Product Specifications for Vitrified High-Level Waste Forms*, or DOE/RW-0351P, Waste Acceptance System Requirements Document, for non-vitrified, immobilized high-level waste.

Transuranic Waste

The following requirements are in addition to the general requirements specified previously:

PACKAGING
TRU waste shall be packaged in a manner that provides containment and protection for the duration of the anticipated storage period and until disposal is achieved or until the waste is removed from the container.

Vents or other mechanisms to prevent pressurization of containers or generation of flammable or explosive concentrations of gases shall be installed on containers of newly-generated waste at the time the waste is packaged. Containers of currently stored waste shall meet this requirement as soon as practical unless analyses demonstrate that the waste can otherwise be managed safely.

When TRU waste is packaged, defense waste shall be packaged separately from non-defense waste, if feasible.

Containers of TRU waste shall be marked such that their contents can be identified.

TRANSPORTATION
To the extent practical, the volume of waste and number of TRU waste shipments shall be minimized.

Low-Level Waste

The following requirements are in addition to the general requirements specified previously:

PACKAGING
If containers are used

- low-level waste shall be packaged in a manner that provides containment and protection for the duration of the anticipated storage period and until disposal is achieved or until the waste has been removed from the container;
- when waste is packaged, vents or other measures shall be provided if the potential exists for pressurizing or generating flammable or explosive concentrations of gases within the waste container; and
- containers of low-level waste shall be marked such that their contents can be identified.

TRANSPORTATION

To the extent practical, the volume of waste and number of low-level waste shipments shall be minimized.

p. Conduct an assessment of waste management practices at a given site/facility and prepare a report on how these practices can be improved.

q. Participate on an environmental assessment team, preparing and reporting the team's results to senior Federal and contractor management.

This is a performance-based KSA. The Qualifying Official will evaluate its completion.

6. An STSM must have a working level knowledge of the application of worker protection standards.

a. Demonstrate awareness of sources of occupational safety and health rules, such as Federal and State statutes, regulations, and orders (e.g., DOE O 440.1B, Chg. 1, *Worker Protection Program for DOE (including the National Nuclear Security Administration) Federal and Contractor Employees*, and 10 CFR 851, "Worker Safety and Health Program").

The following is taken from DOE O 440.1B.

DOE O 440.1B establishes the framework for an effective worker protection program that will reduce or prevent injuries, illnesses, and accidental losses by providing DOE Federal workers with a safe and healthful workplace.

DOE elements must establish and implement a written worker protection program appropriate for the facility hazards that provides a place of employment free from recognized hazards that cause or are likely to cause death or serious physical harm to their employees and that integrates all requirements in paragraphs 4a through 4m of DOE O 440.1B, program requirements contained in 29 CFR 1960, applicable functional area requirements, and other related site-specific worker protection activities.

DOE elements should comply with the following worker protection requirements that are applicable to the hazards at the facility:

- 29 CFR 1910, "Occupational Safety and Health Standards."
- 29 CFR 1915, "Occupational Safety and Health Standards for Shipyard Employment."
- 29 CFR 1917, "Marine Terminals."
- 29 CFR 1918, "Safety and Health Regulations for Longshoring."
- 29 CFR 1926, "Safety and Health Regulations for Construction."
- 29 CFR 1928, "Occupational Safety and Health Standards for Agriculture."
- 29 CFR Sections 1904.4 through 1904.11; 1904.29 through 1904.33; 1904.44; and 1904.46, "Recording and Reporting Occupational Injuries and Illnesses."
- 10 CFR 850, "Chronic Beryllium Disease Prevention Program."
- American Conference of Governmental Industrial Hygienists (ACGIH), *Threshold Limit Values (TLV) for Chemical Substances and Physical Agents and Biological Exposure Indices*, when ACGIH TLVs are lower (more protective) than OSHA

permissible exposure limits. The TLVs for exposures to laser emissions in the ACGIH indices are excluded from this requirement.

- ANSI Z136.1, *Safe Use of Lasers*.
- ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*, sections 4.3 and E4.3.
- NFPA 70, National Electrical Code.
- NFPA 70E, Standard for Electrical Safety in the Workplace.
- 42 CFR 73, "Select Agents and Toxins."
- 9 CFR 121, "Possession, Use and Transfer of Select Agents and Toxins."
- 7 CFR 331, "Possession, Use and Transfer of Select Agents and Toxins."

The Occupational Safety and Health Act of 1970 assigns two regulatory functions: setting standards and conducting inspections to ensure that employers are providing safe and healthful workplaces. OSHA standards may require that employers adopt certain practices, means, methods, or processes reasonably necessary and appropriate to protect workers on the job. Employers must become familiar with the standards applicable to their establishments and eliminate hazards. Compliance with standards may include ensuring that employees have and use personal protective equipment (PPE) when required for safety or health. Employees must comply with all rules and regulations that apply to their own actions and conduct. Even in areas where OSHA has not set forth a standard addressing a specific hazard, employers are responsible for complying with the Act's "general duty" clause. The general duty clause states that each employer "should furnish a place of employment which is free from recognized hazards that cause or are likely to cause death or serious physical harm to his/her employees." Statutes or executive orders empower an administrative agency to develop and promulgate regulations. Statutes direct and authorize, while regulations detail implementation. When a statute is passed through both houses of Congress, and is signed into law by the President, it becomes the authorization and guidance to a regulating agency to establish a regulation, and is published in the United States Code. The regulating agency formulates and promulgates the proposed regulation by publishing it in the Federal Register to allow for public review and comment. When finalized, the regulation is again published in the Federal Register in its amended form to become law. These final regulations are combined annually into the Code of Federal Regulations. State laws and regulations are passed in the same manner as Federal laws, except they require the signature of the state's governor to become law. With respect to environmental laws, the states can enact laws and regulations more stringent than their Federal counterparts, but no less stringent, or they are prone to preemption.

10 CFR 851 establishes a worker safety and health program for DOE contractors. This program establishes the framework for a worker protection program that will reduce or prevent occupational injuries, illnesses, and accidental losses by requiring DOE contractors to provide their employees with safe and healthful workplaces. Also, the program establishes procedures for investigating whether a requirement has been violated, for determining the nature and extent of such violation, and for imposing an appropriate remedy.

DOE P 450.4A, states that it is the Department's policy that work be conducted safely and efficiently and in a manner that ensures protection of workers, the public, and the environment. To achieve this policy, effective safety requirements and goals are established; applicable national and international consensus standards are adopted; and where necessary

to address unique conditions, additional standards are developed and effectively implemented. Implementing ISM requirements for Federal organizations is established through directives, and for contractor organizations through contract clauses.

It is Department policy that safety management systems (SMS) should be used to systematically integrate safety into management and work practices at all levels so that missions are accomplished. Direct involvement of workers during the development and implementation of SMSs is essential for their success.

b. Describe how the ISM core functions and principles and the quality assurance (QA) criteria are integrated into the activity-level work planning and control processes for protection of the workers at a given facility or site.

The following is taken from DOE G 414.1-2B chg. 1.

Integrating the Safety Management and Quality Assurance Program

The QAP should be integrated with the ISMS, as described in DOE P 450.4A, and DEAR 48 CFR.970.5204-2. The QAP provides processes and tools for ensuring that ISMS objectives are achieved. DOE P 450.4A expresses a fundamental expectation that work will be performed safely.

The ten criteria of DOE O 414.1D, *Quality Assurance* and 10 CFR 830 subpart A define the generic elements of a management system applicable to DOE work. They are implemented using a graded approach based on an evaluation of the risks associated with the work to be performed. The SMS defined in DOE O 450.2, selectively applies and amplifies the generic management system requirements defined by the ten criteria to ensure that DOE work is performed safely.

This also ensures that workers, the environment, and the public are reasonably protected from harm. At the organizational or institutional level, the DOE quality and safety requirements share a management systems approach (see table 2) to achieving their objectives. Therefore, the required system documentation for each ISMS description and QAP may be integrated into a single document to describe how the organization intends to implement the requirements. In some cases, the local DOE office and contractor may determine that maintaining both an ISMS description and a QAP is expedient. In such cases, at a minimum, the implementing mechanisms that are described in each should be integrated to the maximum extent practical, and the system description and the QAP should cross-reference these procedures as applicable. For example, the processes and procedures for conducting management assessments should be referenced in the QAP and the ISMS description. Table 2 is representative of criteria that apply, but is not all inclusive.

Table 2. Integration of QA criteria into the SMS principles and functions

QA Criteria	Program	Training and Qualification	Quality Improvement	Documents and Records	Work Processes	Design	Procurement	Inspection/Acceptance Testing	Management Assessment	Independent Assessment
SMS Principles and Functions										
Principles										
1. Line Management Responsibility for Safety	X		X	X						
2. Clear Roles and Responsibilities	X	X	X	X	X					
3. Competence Commensurate with Responsibilities		X		X						
4. Balanced Priorities	X			X			X			
5. Identification of Safety Standards and Requirements			X	X	X	X	X		X	
6. Hazard Controls Tailored to Work Being Performed				X	X	X				
7. Operations Authorization				X	X					
Core Functions										
1. Define the Scope of Work	X			X					X	X
2. Analyze the Hazards				X	X					
3. Develop and Implement Hazard Controls				X	X					
4. Perform Work Within Controls				X	X					
5. Provide Feedback and Continuous Improvement			X	X	X				X	X
Note: X indicates cross reference delineating (a) when the QA criteria and the principle/function have shared intent or (b) when the QA criterion is applied to the ISMS principle or function.										

Source: DOE G 414.1-2B

c. Describe the relationships and authorities among DOE, NNSA, and the Occupational Safety and Health Administration (OSHA) for enforcement of safety and health requirements at DOE sites.

The following is taken from Federal Registers Notice; *Addendum to the Memorandum of Understanding: To Formalize the Working Relationship Between the Department of Energy and the Department of Labor*.

On August 10, 1992, DOE and OSHA entered into a Memorandum of Understanding, delineating regulatory authority over the occupational safety and health of contract employees at DOE Government-Owned or Leased Contractor-Operated (GOCO) facilities. In general, the memorandum of understanding recognizes that DOE exercises statutory authority under section 161(f) of the Atomic Energy Act of 1954, as amended, relating to the occupational safety and health of private-sector employees at these facilities.

Section 4(b)(1) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 653(b)(1), exempts from OSHA authority working conditions with respect to which other federal agencies have exercised statutory authority to prescribe or enforce standards or regulations affecting occupational safety or health. The 1992 Memorandum of Understanding acknowledges DOE's extensive regulation of contractor health and safety through safety orders, which require contractor compliance with all OSHA standards as well as additional requirements prescribed by DOE, and concludes with an agreement by the agencies that the provisions of the Occupational Safety and Health Act will not apply to GOCO sites for which

DOE has exercised its authority to regulate occupational safety and health under the Atomic Energy Act. In light of DOE's policy emphasis on privatization activities, OSHA and DOE entered into a second Memorandum of Understanding on July 25, 2000 that establishes interagency procedures to address regulatory authority for occupational safety and health at specified privatized facilities and operations on DOE sites. The 2000 Memorandum of Understanding specifically covers facilities and operations on lands that have been leased to private enterprises, which are not conducting activities for or on behalf of DOE, and where there is no likelihood that any employee exposure to radiation from DOE sources would be 25 mrem/yr or more.

Video 12. The history of OSHA
http://www.youtube.com/watch?v=A-TXgSQ-0c4&feature=related

d. Discuss awareness that occupational safety and health requirements are enforceable criminally and civilly.

The following is taken from the *Occupational Safety and Health Act*, section 17, "Penalties."

Any employer who willfully or repeatedly violates the requirements of section 5 of the OSH Act, any standard, rule, or Order promulgated pursuant to section 6 of the OSH Act, or regulations prescribed pursuant to the OSH Act, may be assessed a civil penalty of not more than $70,000 for each violation, but not less than $5,000 for each willful violation.

Any employer who has received a citation for a serious violation of the requirements of section 5 of the OSH Act, of any standard, rule, or Order promulgated pursuant to section 6 of the OSH Act, or of any regulations prescribed pursuant to the OSH Act, shall be assessed a civil penalty of up to $7,000 for each such violation.

Any employer who has received a citation for a violation of the requirements of section 5 of the OSH Act, of any standard, rule, or Order promulgated pursuant to section 6 of the OSH Act, or of regulations prescribed pursuant to the OSH Act, and such violation is specifically determined not to be of a serious nature, may be assessed a civil penalty of up to $7,000 for each violation.

Any employer who fails to correct a violation for which a citation has been issued within the period permitted for its correction may be assessed a civil penalty of not more than $7,000 for each day during which such failure or violation continues.

Any employer who willfully violates any standard, rule, or Order promulgated pursuant to section 6 of the OSH Act, or of any regulations prescribed pursuant to the OSH Act, and that violation caused death to any employee, shall, upon conviction, be punished by a fine of not more than $10,000 or by imprisonment for not more than six months, or by both; except that if the conviction is for a violation committed after a first conviction of such person, punishment shall be by a fine of not more than $20,000 or by imprisonment for not more than one year, or by both.

Any person who gives advance notice of any inspection to be conducted under the OSH Act, without authority from the secretary or his designees, shall, upon conviction, be punished by a fine of not more than $1,000 or by imprisonment for not more than six months, or by both.

Whoever knowingly makes any false statement, representation, or certification in any application, record, report, plan, or other document filed or required to be maintained pursuant to the OSH Act shall, upon conviction, be punished by a fine of not more than $10,000, or by imprisonment for not more than six months, or by both.

Video 13. Penalties are inadequate
http://www.youtube.com/watch?v=p5j_4_kIzCw&feature=relmfu

e. Describe the role(s) the contractor plays in implementing occupational safety and health regulations.

The following is taken from DOE G 440.1-1B

It is the Department's policy to provide a safe and healthful workplace for its Federal and contractor employees. This provision closely parallels OSHA's general duty clause established in section 5(a)(1) of the OSH Act. Accordingly, in implementing this provision, DOE and its contractors should consider criteria similar to those established by OSHA for the implementation of the general duty clause. Specifically, in determining whether a workplace condition presents a recognized hazard that causes or has the potential to cause death or serious physical harm to workers, contractors should consider whether the condition presents a hazard to which workers are exposed; the hazard is a recognized hazard; the hazard causes or is likely to cause death or serious physical harm; and feasible and useful methods exist to correct the hazard.

For DOE contractors, the terms "feasible" and "serious physical harm" are subjective terms the meanings of which depend on the specific context in which the terms are used. The meanings of these terms in a situation should be determined by DOE line management starting with the head of the DOE field element and progressing to the under secretary depending on the impact of the meanings. DOE line managers should obtain input from safety and health professionals and other relevant subject matter experts in making their determinations.

Fundamental elements of the worker's safety and health plan include the following:

- Establishing a written program with policy, goals, objectives, and performance measures
- Using qualified staff
- Assigning responsibility and holding personnel accountable
- Encouraging involvement of workers
- Ensuring workers' rights and informing workers of their rights and responsibilities
- Identifying workplace hazards and evaluating risk of injury and illness
- Preventing or abating workplace hazards
- Providing worker protection training
- Complying with DOE-prescribed worker protection standards

f. Describe the criteria for designating and processing occupational health and safety concerns.

The following is taken from DOE G 442.1-1.

Concerns are designated for processing according to the criteria established by the HSS. An employee concern involving an imminent danger condition/concern or serious condition/ concern will be immediately brought to the attention of the appropriate line manager and/or the HSS program office for evaluation and action. The Employee Concerns Program must ensure that an initial determination of the health and safety significance of the concern is performed. Priorities for resolution must be established based on determination of the risk of the concern. Generic guidance for safety significance is provided below; however, for occupational safety and health concerns, additional classifications follow.

- Imminent danger condition/concern: Any condition or practice in any workplace that creates a danger that could reasonably be expected to cause death or serious physical harm immediately or before the onset of the danger that could be eliminated through the normal procedural mechanism. HSS requires that such concerns be investigated within 24 hours.
- Serious condition/concern: A hazard, violation, or condition that causes a substantial probability that death or serious physical harm, property loss, and/or environmental impact could result. HSS requires that such concerns be investigated within 3 working days.
- Other-than-serious condition/concern: Hazards, violations, or conditions that may not result in death or serious physical harm, property loss, and/or environmental impact but may have a direct and immediate relationship to WS&H or the environment. HSS requires that such concerns be investigated within 20 working days.

The following HSS guidelines are intended to be illustrative, not all-inclusive, of criteria that should be used to assess the significance of the concern. The degree to which a concern involves an imminent danger or condition is judged by determining if the concern involves any of the following criteria:

- Initiation of work in the face of identified ES&H concerns that could result in an immediate or near-term threat to the safety or health of the public or workers
- Continuation of operations in the face of inoperable or deficient ES&H equipment, monitoring instrumentation, or systems
- Violations of the PAAA enforcement authority; criminal acts involving nuclear safety matters; willful violations of regulations, DOE directives, operating procedures, or specifications; or other criminal acts
- Deficiencies observed in the normal reporting system
- Collection, dissemination, and recording of inaccurate or falsified environmental, safety, or health-related data
- Material misrepresentations to inspectors, auditors, or reviewers when performing official duties

g. Participate in an assessment of the implementation of safety and health requirements at a given facility or site and report the results to senior Federal and contractor management.

This is a performance-based KSA. The Qualifying Official will evaluate its completion. 10 CFR 851.20, "Management Responsibilities and Worker Rights and Responsibilities," outlines management requirements for a worker program at a given facility or site, against which criteria may be assessed.

h. Discuss management systems in supporting enforcement of worker safety and health requirements.

The following is taken from DOE G 440.1-1B.

Attachment A of DOE O 440.1B establishes the mandatory requirements for implementing the applicable functional areas that support enforcement of worker safety and health. DOE G 440 1.1B describes the systems associated with each of the functional areas.

Construction Safety

The construction-specific provisions apply to activities defined as construction under the definition section of 10 CFR 851. This definition is consistent with the definition provided by OSHA and the Davis-Bacon Act. Identification of construction activities is required by the Davis-Bacon Act for all Federally-funded projects in excess of $2,000. Accordingly, the determination as to which activities are considered to be construction defaults to an existing, formalized methodology in place at DOE sites.

The intent of the construction-specific requirements is to compel proactive management of construction safety on all construction projects through systematic and timely evaluation of project hazards, planning and selection of appropriate and effective protective measures, informing workers of all foreseeable hazards and required protective measures, and an active regimen of workplace inspections and prompt abatement of identified hazards.

Fire Protection

DOE contractors are required to implement and maintain a comprehensive, multi-faceted fire protection and response program that is predicated, in part, on compliance with applicable building codes and NFPA codes and standards and should incorporate applicable provisions of DOE O 420.1C. 10 CFR 851 adopts as requirements NFPA 70, *National Electrical Code*, and NFPA 70E, *Standard for Electrical Safety in the Workplace*.

Explosives Safety

A comprehensive explosives safety program must implement and comply with all applicable requirements of DOE O 440.1B.

DOE O 420.1C addresses the design of facilities that contain explosives; within which explosives activities are conducted; or that can be adversely affected by an explosives accident or detonation.

Pressure Safety

Safety policies and procedures to ensure that pressure systems are designed, fabricated, tested, inspected, maintained, repaired, and operated by trained and qualified personnel in accordance with applicable and sound engineering principles must be established. Contractors should consider pressure relief devices, piping, fittings, gauges, valves, pumps, heat exchangers, and associated pressure-retaining hardware to be part of pressure systems and should subject these devices and hardware to protection measures that are equivalent to codes. 10 CFR 851 also references specific American Society of Mechanical Engineers (ASME) codes for pressure vessels, boilers, air receivers, and supporting piping systems. Hazards presented by cryogenic, pneumatic, hydraulic, steam, and vacuum systems should be addressed. Vacuum systems should be addressed due to their potential for catastrophic failure in the event of backfill pressurization.

Firearms Safety

A firearms safety program must be established and implemented for DOE activities involving the use of firearms. Implementation guidance for comprehensive protective force firearms safety programs can be found within the relevant provisions of DOE O 473.3, *Protection Program Operations*.

Firearms protocols for the Office of Inspector General are governed by its internal policies and procedures and associated guidance from the Federal Law Enforcement Training Center, the U.S. Attorney General, and related Federal law enforcement requirements.

Industrial Hygiene

Consult DOE-STD-6005-01, *Industrial Hygiene Practices*, for additional guidance for complying with industrial hygiene requirements. Title 10 CFR 851 Appendix A section 6(a) effectively addresses worker health risks in typical work areas and operations. Typical work areas and operations tend to be stable.

Occupational Medicine

Protection of the safety and health of workers and the public and protection and restoration of the environment are fundamental responsibilities of DOE. A policy that promotes excellence in environmental, safety, and health activities is essential. Prompt recognition, diagnosis, and treatment of occupational injury or disease is paramount in managing and maintaining worker health.

The following outlines the methods and approaches that may be used to implement an occupational medical program and provide assistance in meeting the following objectives:

- Assist contractor management in protecting employees from health hazards in their work environments
- Assist contractor management in ensuring the placement of employees in work that can be performed in a reliable and safe manner consistent with the requirements of the Americans with Disabilities Act of 1990
- Provide support to contractor management in the medical, mental, and substance abuse aspects of personnel reliability and fitness for duty
- Assist contractor management in planning responses to medical emergencies, including the provision of onsite aid when appropriate

- Promote the early detection, treatment, and rehabilitation of employees who are ill, injured, or otherwise impaired
- Apply preventive medical measures toward the maintenance of the optimal physical and mental health of employees through health promotion and education
- Provide professional guidance and consultation to contractor management on all health-related issues
- Provide employees, as appropriate, with professional medical evaluation, guidance, counseling, and referrals to specialists in support of optimal physical and mental health
- Protect the privacy of employees and the confidentiality of their medical records
- Provide support to DOE and contractor management and to the Office of Health and Safety by the collection and analysis, when requested, of employee health data for the purpose of early detection and prevention of occupational and non-occupational illnesses and injuries, thereby reducing morbidity and mortality.

Motor Vehicle Safety

The U.S. Department of Labor, OSHA, provides guidance on motor vehicle safety policies and programs, applicable standards, hazard recognition and control, and additional information. States have policies and regulations that may apply to sites that include state roads.

Electrical Safety

A comprehensive electrical safety program appropriate for the activities at the site must be implemented. The program must meet the applicable electrical safety codes and standards. Specifically, those codes and standards include in the applicable electrical safety regulations promulgated by OSHA, such as Subpart S of 29 CFR 1910, for general industry operations, and Subpart K of 29 CFR 1926 for construction operations and NFPA electrical safety standards: NFPA 70 and NFPA 70E.

The purpose of the electrical safety program is to provide a sound and effective approach to electrical safety to ensure the safety and well-being of all DOE contractor and subcontractor employees, enhance electrical safety awareness, and mitigate potential electrical hazards to employees, the public, and the environment associated with the use of electrical energy within any DOE site or facility.

7. An STSM must have a working level knowledge of the Department's Emergency Management including resources, emergency plans, external agency involvements, interagency relationships, and the command and control function during an emergency.

a. Discuss the roles and responsibilities of the departmental elements for management of the Department's Emergency Management System as defined in DOE O 151.1C, *Comprehensive Emergency Management System*.

The following is taken from DOE O 151.1C.

The following roles and responsibilities related to the management of emergency management systems apply to departmental elements:

- Implement emergency management policy and requirements and maintain programs and systems consistent with policy and requirements.
- Establish and maintain an effective, integrated, emergency management program.
- In coordination with the director, Office of Emergency Operations, and the PSOs, support a readiness assurance program, consisting of evaluations, improvements, and emergency readiness assurance plans (ERAPs). Ensure that appropriate measures of the effectiveness of contractor site/facility emergency management programs are incorporated in contractual arrangements.
- Coordinate with the PSOs to ensure resources are available to implement DOE O 151.1C for facilities and activities under their cognizance.
- Ensure development of appropriate emergency plan implementing procedures for timely and accurate emergency classification, notification, and reporting of emergency events for facilities under their cognizance. Establish preauthorization criteria when possible.
- Ensure that emergency public information planning (EPI) is integrated with the development and maintenance of emergency plans.
- Ensure that effective communication systems and protocols are coordinated and maintained with the HQ operations center regarding emergencies involving or affecting facilities or materials under DOE/NNSA jurisdiction or requiring DOE/NNSA assistance.
- Review and approve ERAPs that cover facilities under their supervision; prepare the cognizant field element annual ERAP; submit it to the PSO and the director, Office of Emergency Operations, for inclusion in the annual report on the status of the emergency management system.
- Where applicable, pre-designate a DOE/NNSA employee as
  - the on-scene coordinator when DOE/NNSA is the lead agency for Federal responses under the National Contingency Plan or its replacement;
  - the senior Federal official when DOE/NNSA is the coordinating agency under the nuclear/radiological incident annex of the national response plan or its replacement; and/or
  - the senior energy official to coordinate departmental activities under appropriate Federal plans.
- Participate in the development and implementation of mutual assistance agreements with state, tribal, and local authorities.

- Ensure that emergency planning hazards assessments (EPHAs) and hazards surveys for emergency planning purposes are adequately performed and documented. Ensure that EPHAs and hazards surveys are updated every three years, and prior to significant changes to the site/facility or to hazardous material inventories. For example, significant changes are those changes which would result in an USQ for nuclear facilities, as defined in 10 CFR 830, or in an unreviewed safety issue for accelerator facilities, as defined in DOE O 420.2C, *Safety of Accelerator Facilities*. Review and approve EPHAs and hazards surveys and forward the approved EPHAs and/or hazards surveys to the PSO(s) and the director, Office of Emergency Operations.
- Ensure that cognizant field element personnel and contractors participate in a continuing emergency preparedness program of training, drills, and exercises.
- Conduct assessments of facility emergency management programs at least once every three years and review contractor self-assessment programs annually to ensure compliance with DOE directives and policy; provide the results/conclusions to the PSO(s) and the director, Office of Emergency Operations.
- Conduct appropriate and necessary emergency actions during an emergency.
- Implement corrective actions lessons learned from actual emergency responses and based on findings from evaluations, assessments, and appraisals.
- Establish and maintain an emergency operations center (EOC) to respond to emergency events if not collocated with the contractor's command center. To maintain continuous operations, an alternate facility must be available to replace the EOC.
- Ensure that emergency plans and procedures are prepared, reviewed annually, and updated, as necessary, for all facilities under their purview and are integrated within the overall cognizant field element emergency preparedness program.
- Assign senior representatives to the emergency management advisory committee.
- Comply with the requirements of the DOE Orders, or their replacements, that establish requirements for the radiological emergency response assets programs.
- Integrate applicable policies and requirements, including those promulgated by other Federal agencies and interagency emergency plans, into appropriate DOE/NNSA emergency plans.
- Notify contracting officers of affected contracts to incorporate the CRD of this Order into those contracts.
- Effectively integrate the activities of a leased facility and NRC-licensed facilities into the DOE/NNSA site-wide emergency management program, and ensure that lease arrangements include a description of how each of the lessee's emergency management program elements is integrated into the site-wide program; and a requirement that tenant hazardous material inventories are reported to the site emergency management organization annually or when inventories change.
- Approve site exercise packages prior to the exercise.

Video 14. Emergency Management
http://wn.com/Emergency_Management_Services#/videos

b. Demonstrate awareness with the objectives of DOE O 153,1 *Departmental Radiological Emergency Response Assets*.

The following is taken from DOE O 153.1.

The objectives of DOE O 153.1 are to establish requirements and responsibilities for DOE's national radiological emergency response (RER) assets and capabilities and Nuclear Emergency Support Team (NEST) assets. DOE O 153.1 is not intended to provide details concerning operational procedures nor readiness reporting of NEST assets. It provides the basic structure of the assets and management that collectively comprise the NEST and RER. Operational procedures and reporting requirements are contained in handbooks, manuals, standard operating procedures, policy notes, classification guidance, memoranda of understanding and agreement, field operations guides and other documentation maintained and promulgated by the NNSA Office of Emergency Operations and Office of Emergency Response. These procedures follow the structures described in the National Incident Management System and are consistent with the National Response Plan and DOE O 151.1C. The assets described in DOE O 153.1 consist of the personnel and equipment needed to perform carefully defined missions related to nuclear/radiological emergency response. Other existing statutes, regulations, directives, and standards applicable to emergency response assets also apply for planning, preparedness and response.

c. Define "Operational Emergencies" and the circumstances to which they apply as defined in DOE O 151.1C.

The following is taken from DOE O 151.1C.

Operational emergencies are major unplanned or abnormal events or conditions that involve or affect DOE/NNSA facilities and activities by causing or having the potential to cause serious health and safety or environmental impacts; require resources from outside the immediate/affected area or local event scene to supplement the initial response; and require time-urgent notifications to initiate response activities at locations beyond the event scene.

In general, to be considered an operational emergency, an event or condition involving the uncontrolled release of a hazardous material must immediately threaten or endanger personnel who are in proximity of the event; have the potential for dispersal beyond the immediate vicinity of the release in quantities that threaten the health and safety of onsite personnel or the public in collocated facilities, activities, and/or offsite; and have a potential rate of dispersal sufficient to require a time-urgent response to implement protective actions for workers and the public.

d. Discuss the concept of Emergency Public Information and the different roles of the Department's Public Affairs Office and the Joint Information Center in disseminating information in an emergency.

The following is taken from DOE G 151.1-4.

Emergency Public Information (EPI)

The ability to provide the public, the media, and DOE employees with accurate and timely information is based on an effective EPI program. To be effective, EPI should be coordinated with onsite and offsite Federal, state, local, and tribal emergency response organizations. The EPI program provides the means for a facility to coordinate the timely exchange of information among representatives of DOE with other organizations. This coordination is critical to prevent dissemination of confusing, conflicting, and erroneous information.

Departmental and emergency response credibility is enhanced through an effective EPI program, which should be based on a day-to-day public information operation that can be expanded for an emergency response. This capability to expand is developed in cooperation with onsite and offsite organizations through the detailed preparation and coordination of plans, procedures, education, and training.

Joint Information Center (JIC)

An EPI plan needs to have provisions to establish a JIC, which is a working location where multiple jurisdictions gather, process, and disseminate public information during an OE. The JIC news manager accommodates the news media, coordinates news conferences, provides media kits and news releases to the media, and assists the JIC manager in all matters pertaining to interaction with the media. The JIC news manager serves as an extension of the JIC manager by tracking inquiries between the EOC and the JIC, keeping the public and media inquiry teams updated on emergency events, ensuring that the JIC manager has adequate review of information prior to media briefings, ensuring that communications are maintained with the EOC, and remaining in direct communication with the JIC manager.

e. Discuss the involvement of external agencies in the Department's Emergency Management System.

The following is taken from DOE G 151.1-4.

Hazards survey and EPHA results should be used to develop a list of emergency services, which may be needed to respond to potential accident conditions. Examples of required services include hospitals, fire departments, law enforcement, accident investigation, analytical laboratory services, ambulance services, coroners, materials suppliers, contractors, specialists, and others. Offsite response agencies and organizations responsible for augmenting site response resources, and state, local, and tribal agencies responsible for protecting the public and environment within the vicinity of the facility/site should be identified. These agencies and organizations should be contacted to determine and/or establish authorities, responsibilities, resources, notification procedures, and information necessary in the event of an emergency at a DOE/NNSA facility/site.

f. Describe the contents, the requirements for, and where each of the following types of emergency plans can be located on-site:

- **Site Emergency Plan**
- **Facility Emergency Plan**
- **Building Emergency Plan**
- **Security Emergency Plan**
- **Fire Prevention/ Suppression Plan**

- **Worker Safety Plan(s)**
- **Continuity of Operations Plan**

This is a site-specific KSA. The Qualifying Official will evaluate its completion. Contact your local emergency management team for information. However, the following information may be helpful.

Federal Preparedness Circular (FPC) 65, *Federal Executive Branch Continuity of Operations* issued by the Federal Emergency Management Administration (FEMA), states, "It is the policy of the United States to have in place a comprehensive and effective program to ensure continuity of essential Federal functions under all circumstances." To support this policy, the Federal executive branch implemented the continuity of operations program (COOP). COOP is defined as the activities of individual departments and agencies and their sub-components to ensure that their essential functions are performed. This includes plans and procedures that delineate essential functions; specify succession to office and the emergency delegation of authority; provide for the safekeeping of vital records and databases; identify alternate operating facilities; provide for interoperable communications; and validate the capability through tests, training, and exercises. All Federal agencies, regardless of location, should have in place a viable COOP capability to ensure continued performance of essential functions from alternate operating sites during any emergency or situation that may disrupt normal operations.

DOE N 150.1, *Continuity of Operations*, states that all Federal departments and agencies are required to establish the capability to continue essential Federal government functions as necessary to meet civilian and defense needs during any emergency, including natural disasters, accidents, military or terrorist attacks, and technological emergencies. This requirement also applies to agency and Department subcomponents such as DOE field elements.

The DOE COOP manager will develop an overarching DOE COOP plan based on the Department's essential functions identified in attachment 2 of DOE N 150.1. The DOE COOP plan will address all the program elements specified in FEMA FPC 65.

Each primary DOE organization must develop a COOP implementation plan to support execution of the Department's essential functions and implementation of the DOE COOP plan.

Each DOE field element must develop a COOP plan that addresses the elements in FEMA FPC 65.

The degree of field element COOP planning will be commensurate with that field element's role in supporting execution of the Department's essential functions and the extent to which an event directly affecting the field element would impact the continuity of departmental and local essential functions.

Mandatory Performance Activities:

a. **Participate in the EOC during a site emergency management drill. Prior to participation in the drill, complete Emergency Manager Training or EOC training and the Federal Emergency Management Administration (FEMA Emergency Management Institute IS-700 "National Incident Management Systems (NIMS) and Introduction" course.**

This is a performance based KSA. The Qualifying Official will evaluate its completion.

8. **An STSM must have working level knowledge of conduct of operations, and conduct of engineering, including formal configuration and maintenance management as it relates to safety.**

a. **Describe the reason for implementing conduct of operations at DOE facilities.**

The following is taken from DOE O 422.1.

A conduct of operations program consists of formal documentation, practices, and actions implementing disciplined and structured operations that support mission success and promote worker, public, and environmental protection. The goal is to minimize the likelihood and consequences of human fallibility or technical and organizational system failures.

b. **Discuss the requirements for implementing conduct of operations at DOE facilities and the associated impact on safety and efficiency of operations.**

The following is taken from DOE O 422.1.

Conduct of Operations Implementation

The general approach to implementing DOE O 422.1 is for contractors (or DOE organizations in the case of government-owned, government-operated [GO/GO] facilities) to develop, for DOE line management approval, documentation demonstrating implementation of the requirements in the CRD (or attachment 2 for GO/GOs). It is not necessary to develop new documents to demonstrate implementation, but at a minimum to provide a conduct of operations matrix, which is a list of CRD requirements, citing the specific documentation that implements each item, or providing justification for each item that is not implemented.

Impact on Safety and Efficiency of Operations

Conduct of operations is one of the safety management programs recognized in 10 CFR 830, but it also supports safety and mission success for a wide range of hazardous, complex, or mission-critical operations. Some conduct of operations attributes can enhance even routine operations.

The term "operations" encompasses the work activities of any facility or organization; from building infrastructure, to print shops, computer centers, scientific research, and nuclear facilities. While many hazards can be dealt with through engineered solutions, people still have to perform operations, and they can and do make mistakes. The purpose of this Order is to ensure that management systems are designed to anticipate and mitigate the consequences

of human fallibility or potential latent conditions and to provide a vital barrier to prevent injury, environmental insult or asset damage, and to promote mission success.

c. Discuss the purpose and describe the roles and responsibilities of the STSM in implementing DOE O 422.1, *Conduct of Operations*.

The following is taken from DOE O 422.1.

Purpose

The objective of DOE O 422.1 is to define the requirements for establishing and implementing conduct of operations programs at DOE, including NNSA, facilities and projects.

Roles and Responsibilities of the STSM

The STSM roles and responsibilities listed are those of the Head of Field Element.

The role and responsibilities of STSMs include the following:

- Notify contracting officers to incorporate the CRD into the affected contracts via the laws, regulations, and DOE directives clause for those contracts that contain this clause. For contracts that do not contain DEAR 970.5204-2, request that the contracting officer attempt to get the CRD incorporated into the contract via a contract modification. Notify contracting officers in advance to include the requirements of the CRD in the terms and conditions of any request for proposals for any new contracts.
- Provide direction and oversight for the development and implementation of conduct of operations applicability matrices, manuals, plans, procedures, and programs consistent with the provisions of this Order. Perform oversight of the contractor's conduct of operations performance.
- Review and approve the documentation prepared by the contractor, demonstrating conformance to the specific requirements stated in the CRD.
- Assign DOE FRs to oversee conduct of operations according to DOE-STD-1063-2011, Chg. 1, *Facility Representatives*.

d. Discuss the concept of "graded approach" and how it applies to the implementation of conduct of operations.

The following is taken from 10 CFR 830.3.

A graded approach is the process of ensuring that the level of analysis, documentation, and actions used to comply with a requirement is commensurate with the following seven attributes:

1. The relative importance to safety, safeguards, and security
2. The magnitude of any hazard involved
3. The life-cycle stage of a facility
4. The programmatic mission of a facility
5. The particular characteristics of a facility
6. The relative importance of radiological and nonradiological hazards
7. Any other relevant factor

The following is taken from DOE O 422.1.

As applied to conduct of operations, the graded approach ensures that the depth of detail required and the magnitude of resources expended for operations are commensurate with each facility's programmatic importance and potential environmental, safety, and/or health impact.

e. For each of the 18 specific requirements in DOE O 422.1, Attachment 2, describe how each activity contributes to an effective and safe operational environment.

The following is taken from DOE O 422.1.

Specific Requirement a—Organization and Administration

The operator must establish policies, programs, and procedures that define an effective operations organization, including the following elements:

- Organizational roles, responsibilities, authority, and accountability
- Adequate material and personnel resources to accomplish operations
- Monitoring and self-assessment of operations
- Management and worker accountability for the safe performance of work
- Management training, qualification, succession, and, when appropriate, certification
- Methods for the analysis of hazards and implementation of hazard controls in the work planning and execution process
- Methods for approving, posting, maintaining, and controlling access to electronic operations documents if electronic documents are used

Specific Requirement b—Shift Routines and Operating Practices

The operator must establish and implement operations practices to ensure that shift operators are alert, informed of conditions, and operate equipment properly, addressing the following elements:

- The facility status, abnormalities, or difficulties encountered in performing assigned tasks
- Adherence by operating personnel and other workers to established safety requirements
- Awareness by operating personnel of the status of equipment through inspection, conducting checks, and tours of equipment and work areas
- Procedures for completing round sheets or inspection logs, responding to abnormal conditions, and periodic supervisory reviews of round sheets or inspection logs
- Procedures for protecting operators from personnel hazards
- Prompt response to instrument indications, including the use of multiple indications to obtain parameters
- Procedures for resetting protective devices
- Authorization to operate facility equipment
- Designating shift operating bases and providing equipment for them
- Professional and disciplined operator performance of duties

Specific Requirement c—Control Area Activities

The operator must establish and implement operations practices that promote orderly, business-like control area operations and address the following elements:

- Control-area access
- Formality and discipline in the control and at-the-controls areas
- Surveillance of control panels and timely response to determine and correct the cause of abnormalities/out-of-specification conditions
- Limitation of the number of concurrent evolutions and duties
- Authorization to operate control area equipment

Specific Requirement d—Communications

The operator must establish and implement operations practices that ensure accurate, unambiguous communications among operations personnel and address the following elements:

- Provision of communications systems for emergency and normal operations
- Administrative control of communications equipment, including authorization to use the public address system, and allowable locations and purposes for radio use
- Methods for control areas to contact operators and supervisors
- Use of abbreviations and acronyms
- Use of oral instructions and communications, including use of repeat-backs and sender/receiver identifications

Specific Requirement e—On-shift Training

The operator must establish and implement operations practices that control on-shift training of facility operators, prevent inadvertent or incorrect trainee manipulation of equipment, and address the following elements:

- On-shift training program
- Authorization and documentation of training activities
- Supervision and control of personnel under instruction by qualified personnel
- Facility conditions and controls for conducting training during operational activities, including suspension of training during unanticipated or abnormal events

Specific Requirement f—Investigation of Abnormal Events, Conditions, and Trends

The operator must establish and implement operations practices for investigating events to determine their impact and prevent recurrence, addressing the following elements:

- Specific events requiring investigation, and criteria for identifying other events or conditions to be investigated
- Designation of investigators and their training and qualification
- Investigation process and techniques
- Causal analysis and corrective action determination
- Event investigation reporting, training, and trending
- Response to known or suspected sabotage

Specific Requirement g—Notifications

The operator must establish and implement operations practices to ensure appropriate event notification for timely response, addressing the following elements:

- Procedures for internal, DOE, and external notifications, including event notifications, persons to be notified, persons responsible for making notifications, maintaining contact information, and recordkeeping
- Communications equipment for notifications

Specific Requirement h—Control of Equipment and System Status

The operator must establish and implement operations practices for initial equipment lineups and subsequent changes to ensure that facilities operate with known, proper configuration as designed, addressing the following elements:

- Authorization for, and awareness of, equipment and system status changes
- Initial system alignment, and maintaining control of equipment and system status through startup, operation, and shutdown, and documentation of status
- Use and approval of lockouts and tagouts for administrative control of equipment status
- Operational limits compliance and documentation
- Management of equipment deficiencies, maintenance activities, post maintenance testing, and return to service
- Awareness and documentation of control panel and local alarm issues
- Control of temporary equipment modifications and temporary systems
- Configuration control and distribution of engineering documents

Specific Requirement i—Lockout and Tagouts

The operator must establish and implement operations practices that address the following elements for the installation and removal of lockout/tagouts (LOTO) for the protection of personnel:

- Procedures, roles, and responsibilities associated with the development, documentation, review, installation, and removal of a LOTO
- Compliance with OSHA rules, 29 CFR 1910, and/or 29 CFR 1926, requirements for the protection of workers using LOTO
- Compliance with NFPA 70E electrical safety requirements using LOTO
- Description and control of the tags, locks, lockboxes, chains, and other components utilized for the LOTO program
- Training and qualification in LOTO and special considerations for DOE facilities

The operator must establish and implement operations practices that address the following elements for the installation and removal of caution tags for equipment protection or operational control:

- Roles and responsibilities associated with the development, documentation, review, installation, and removal of caution tags to convey operational information or equipment alignments for protection of equipment
- Description and control of the tags
- Measures to prevent relying on caution tags for personnel protection

Specific Requirement j—Independent Verification

The operator must establish and implement operations practices to verify that critical equipment configuration is in accordance with controlling documents, addressing the following elements:

- Structures, systems, components, operations, and programs requiring independent verification
- Situations requiring independent verification
- Methods for performing and documenting independent verification
- Situations, if any, allowing concurrent dual verification
- Methods for performing concurrent dual verification, if used

Specific Requirement k—Logkeeping

The operator must establish and implement operations practices to ensure thorough, accurate, and timely recording of equipment information for performance analysis and trend detection, addressing the following elements:

- Narrative logs at all key positions, as defined by management, for the recording of pertinent information
- Prompt and accurate recording of information
- Type, scope, and format for log entries
- Method for recording late entries and correcting erroneous entries without obscuring the original entry
- Periodic supervisory reviews for accuracy, adequacy, and trends
- Document retention requirements

Specific Requirement l—Turnover and Assumption of Responsibilities

The operator must establish and implement operations practices for thorough, accurate transfer of information and responsibilities at shift or operator relief to ensure continued safe operation, addressing the following elements:

- Definitions for all key positions requiring a formal turnover process
- Turnover of equipment/facility status, duties, and responsibilities that results in the safe and effective transfer of equipment status and in-progress or planned activities from one shift or workgroup to the next
- Process for reliefs during a shift

Specific Requirement m—Control of Interrelated Processes

The operator must establish and implement operations practices to ensure that interrelated processes do not adversely affect facility safety or operations, addressing the following elements:

- Defined responsibilities with respect to the control of interrelated processes
- Operator training and qualification to understand interrelated processes, to interpret instrument readings, and provide timely corrective action for process-related problems
- Established lines of communication between operating personnel, process support personnel, and other interrelated process operators for coordination of activities

Specific Requirement n—Required Reading

The operator must establish and implement operations practices for an effective required reading program to keep operators updated on equipment or document changes, lessons learned, or other important information, addressing the following elements:

- Identification of material to be distributed via required reading
- Identification of which personnel are required to read specific required reading items

- Distribution of required reading to appropriate personnel and documentation of their timely completion

Specific Requirement o—Timely Instructions/Orders

The operator must establish and implement operations practices for timely written direction and guidance from management to operators, addressing the following elements:

- Appropriate circumstances for the use of timely instructions/orders
- Designated levels of review and approval prior to issuance
- Configuration control of timely instructions/orders
- Distribution of timely instructions/orders to appropriate personnel and documentation of their receipt and understanding

Specific Requirement p—Technical Procedures

The operator must establish and implement operations practices for developing and maintaining accurate, understandable, written technical procedures that ensure safe and effective facility and equipment operation, addressing the following elements:

- Expectations for the use of procedures to perform operations
- A process for procedure development
- Procedure content, including consistent format and use of terms, detail sufficient for accomplishing the operation, technically accurate procedures capable of performance as written, and procedure conformance with the facility design and manufacturer's documentation
- A process for procedure changes and revisions
- A process for training personnel on new, revised, or changed procedures
- A process for approval of new, revised, or changed procedures
- Initial-issue and periodic review and testing of procedures
- Availability and use of the latest revisions of procedures
- Specified and defined procedure use requirements

Specific Requirement q—Operator Aids

The operator must establish and implement operations practices to provide accurate, current, and approved operator aids, addressing the following elements:

- Technical evaluation and management approval of operator aids
- Operator aids serve as conveniences, not operational requirements
- Operator aids do not obscure equipment
- Administrative control of installed operational aids
- Periodic review for adequacy and correctness

Specific Requirement r—Component Labeling)

The operator must establish and implement operations practices for clear, accurate equipment labeling, addressing the following elements:

- Components that require a label
- Label information that uniquely identifies components and is consistent with regulations, standards, and facility documents
- Durable and securely attached labels that do not interfere with controls or equipment

- Administrative control of labels, including a process for promptly identifying and replacing lost or damaged labels, preventing unauthorized or incorrect labels, and control of temporary labels

f. Describe the types of operations where formal conducts of operations apply.

The following is taken from DOE O 422.1.

The term "operations" encompasses the work activities of any facility or organization; from building infrastructure to print shops, computer centers, scientific research, and nuclear facilities. While many hazards can be dealt with through engineered solutions, people still have to perform operations, and they can and do make mistakes.

The purpose of DOE O 422.1 is to ensure that management systems are designed to anticipate and mitigate the consequences of human fallibility or potential latent conditions and to provide a vital barrier to prevent injury, environmental insult or asset damage, and to promote mission success.

g. Discuss how the self-assessment process is applied to ensure safe operations.

The following is taken from DOE O 422.1.

DOE O 422.1 provides the following detailed self-assessment attributes for monitoring and self-assessment of operations.

- Operating problems are documented and evaluated, and corrective actions are taken.
- Supervisors and managers directly observe operations frequently and provide feedback.
- Appropriate outside organizations such as QA or other oversight organizations observe operations and provide feedback.
- Assessment and observation issues are tracked and corrected.
- Auditable, measurable, realistic, and challenging safety, environmental, and operations goals are set. Examples are safety system operability; radiological or other exposure; facility operational availability; unscheduled shutdowns; overtime; staffing; qualification and training; waste production; and plant instrumentation alarms and warnings.
- Facilities develop an action plan to achieve safety, environment, and operations goals with input from operations personnel, and review and approval by management.
- Facilities monitor and report to line and DOE management their progress on completing the action plan and achieving goals. Goals and plans are adjusted and modified as needed.

h. Working with a qualified DOE Facility Representative in a given facility, review/assess the conduct of operations or work in progress in the facility. Develop a report of your findings and discuss it with the contractor facility management.

This is a performance-based KSA. The Qualifying Official will evaluate its completion.

i. Describe DOE O 433.1B, *Maintenance Management Program for DOE Nuclear Facilities*, to explain
- **DOE's role in the oversight of contractor maintenance operations;**
- **the intent of maintenance management programs;**
- **the Department's policy and objectives for maintenance management; and**
- **the responsibilities and authorities for maintenance management programs.**

DOE Oversight
The following is taken from DOE G 433.1-1A.

DOE involvement in the oversight of nuclear facility maintenance programs should include reviews by the DOE FR, field and area offices, and HQ. Inspections, audits, reviews, investigations, and continuous self-assessment are necessary ingredients to achieving excellence in maintenance activities. Whether DOE or contractor, senior managers should periodically review and assess elements of the maintenance program for effectiveness and to identify areas of needed improvement. A comprehensive assessment of maintenance program elements should be conducted periodically and should include input from managers and supervisors from maintenance and other groups such as operations, technical staff, and appropriate corporate departments.

The following is taken from DOE O 433.1B.

Intent of Maintenance Management Programs
The purpose of DOE O 433.1B, *Maintenance Management Program for DOE Nuclear Facilities*, is to define the safety management program required by 10 CFR 830.204, "Documented Safety Analysis," for maintenance and the reliable performance of SSCs that are part of the safety basis required by 10 CFR 830.202, "Safety Basis," at hazard category 1, 2 and 3 DOE nuclear facilities. Because DOE O 433.1B provides the requirements for maintenance management programs for DOE nuclear facilities, its purpose is essentially the intent of those programs.

Policy and Objectives
While DOE O 433.1B does not contain a specific policy statement, best practices dictate the following:
- The maintenance management program for all DOE property is consistent with DOE O 433.1B, which requires that all DOE property is maintained in a manner that promotes operational safety, worker health, environmental protection and compliance, property preservation, and cost-effectiveness while meeting the programmatic mission.
- SSCs that are important to safe operation should be subject to a maintenance program in order to meet or exceed their design requirements throughout their life.
- Periodic inspection of SSCs, and equipment is performed to determine deterioration or technical obsolescence which threatens performance and/or safety.
- Primary responsibility, authority, and accountability for the direction and management of the maintenance programs for all property resides with the line management assigned direct programmatic responsibility.

The objectives for maintenance management are the following:

- Develop, for all DOE property, a cost-effective and efficient maintenance program that is consistent with DOE's mission, safety and health, reliability, quality, and environmental protection objectives.
- Establish a review and analysis capability for evaluation of maintenance program performance and effectiveness.
- Ensure the reliability, safety, and operability of SSCs.
- Ensure compliance with ES&H standards.
- Ensure that the responsibility, authority, and accountability for maintenance are clearly defined and appropriately assigned.
- Ensure that, where maintenance requirements or accepted maintenance standards cannot be met, such instances are appropriately documented and acknowledged by line management.
- Ensure that sufficient resources are budgeted in a timely manner to accomplish the maintenance program.
- Ensure that effective programs are in place to evaluate and measure property condition.
- Ensure that a graded approach is taken by the line management in the development and implementation of maintenance programs.
- Ensure that the maintenance of DOE property meets the equivalent guidelines, as appropriate, as required for the conduct of maintenance in commercial industry.

Responsibilities

Managers of field elements are responsible for the following:

- Ensure that maintenance activities and programs at hazard category 1, 2, and 3 nuclear facilities under their purview are conducted in compliance with the requirements of DOE O 433.1B.
- Ensure that sufficient resources are requested to meet the requirements of DOE O 433.1B and to ensure that safety SSCs are sufficiently maintained to perform their assigned safety function.
- Ensure that cost-effective nuclear maintenance management programs (NMMPs) are developed and implemented for all hazard category 1, 2, and 3 DOE nuclear facilities.
- Ensure that the requirements of DOE O 433.1B are incorporated into contracts, subcontracts, and support services contracts for hazard category 1, 2, and 3 nuclear facilities as appropriate.
- Notify contracting officers when contracts are affected by DOE O 433.1B.
- Review and approve NMMP program description documentation that demonstrates compliance with the specific requirements in the CRD, attachment 1.
- Conduct comprehensive self-assessments and assessments of contractor maintenance management programs as specified in DOE O 433.1B and according to DOE O 226.1B.

j. Discuss the requirements for the control and integration of contractor and subcontractor personnel in maintenance activities.

The following is taken from DOE O 433.1B.

Secretarial officers are responsible for ensuring that contractors conduct maintenance of SSCs in accordance with a DOE/NNSA approved NMMP.

Central technical authorities must concur with decisions regarding applicability of CRDs related to DOE O 433.1B, according to DOE O 410.1.

Field office managers are responsible for the following:

- Ensure that maintenance activities and programs at hazard category 1, 2, and 3 nuclear facilities under their purview are conducted in compliance with the requirements of DOE O 433.1B.
- Ensure that the requirements of DOE O 433.1B are incorporated into contracts, subcontracts, and support services contracts for hazard category 1, 2, and 3 nuclear facilities as appropriate.
- Review and approve NMMP program description documentation that demonstrates compliance with the specific requirements in the CRD.
- Conduct comprehensive self-assessments and assessments of contractor maintenance management programs as specified in DOE O 433.1B and in accordance with DOE O 226.1B.

Contracting officers must incorporate the CRD into affected contracts in a timely manner when notified.

k. Discuss the graded approach process by which Department line management oversees facility maintenance management activities.

The following is taken from DOE G 433.1-1A.

DOE O 433.1B requires Federal and contractor organizations to submit NMMP description documentation that provides, "Documentation of the basis for applying a graded approach, if applicable." The graded approach methodology ensures that the level of rigor for implementing DOE O 433.1B's 17 maintenance management elements is based on their importance/significance and associated consequences.

DOE contractors should use knowledge of their nuclear facilities and sound engineering judgment to determine the depth of detail and magnitude of resources required for implementing each of DOE O 433.1B's 17 maintenance management elements.

The method of and basis for applying the graded approach should be documented and should address the following:

- How was the graded approach defined in 10 CFR 830 used?
- Where was it applied?
- Why was it used and how does it ensure an adequate level of safety for this SSC?

l. Discuss how maintenance activities interface with the following as they relate to safety:

- **Conduct of operations**
- **Quality assurance**
- **Configuration management**

- **Safety structures, systems, and components**
- **Authorization safety basis**
- **Design basis**
- **Suspect/counterfeit items**

The following is taken from DOE G 433.1-1 (archived).

[Note: The archived guide is referenced because the current guide no longer provides the requisite information.]

Conduct of Operations

Due to the complex nature of operations and maintenance at DOE nuclear facilities and the interdependence of job activities, the way workers perform day-to-day activities to meet facility mission objectives should be formalized by established rules governing their work. For every operation, whether it be routine, infrequent, abnormal, emergency, or casualty, a procedure should be in place so workers know how the operation should be conducted. Good procedures should produce good products. Verbatim compliance with procedures should be mandated policy. Compliance with procedures that are wrong or simply nonexistent could lead to failure. Knowing what to do when things go wrong is the fundamental key to understanding formal conduct of operations. Conduct of operations is the formality needed to ensure that workers know the status and configuration of systems and equipment at the facility during all phases of operations and maintenance.

Quality Assurance

Contractors responsible for a nuclear facility are required to implement a DOE-approved QAP according to 10 CFR 830 subpart A. Consequently, a QAP that applies to the maintenance management program should already be in place at each DOE nuclear facility. 10 CFR 830 includes ten criteria for the management, performance, and assessment of work so that it meets requirements. One of the criteria explicitly requires that items be maintained to prevent their damage, loss, or deterioration. A maintenance management program established using DOE G 433.1-1 will satisfy that explicit criterion and address the other QA criteria in an integrated fashion.

Examples of the maintenance management program elements that integrate and satisfy the QA criteria include the following:

- Organization—program, training, and qualification
- Condition of facilities and equipment—inspection and test
- Maintenance documents and records
- Work-control system—work processes
- Maintenance evaluation and analysis—quality improvement, independent assessment, and management assessment

A maintenance management program that integrates the QA criteria will perform continuing analysis and surveillance of the facility activities for safety, mission objectives, economics, system function, and compliance. The program should provide constant oversight of nuclear operations, maintenance, and program performance and should make the results available to contractor and DOE management or external regulators through the following:

- Reports on organization and system performance

- Identification of maintenance problem areas
- System corrective action plans
- Assurance that corrective actions have been accomplished to prevent recurrence of the root cause of problems on a continuing basis, thereby ensuring compliance on a continuing basis

A DOE nuclear facility QAP should be an integrated management plan for fitting all hardware and ACs together in a framework which provides for management visibility of the operation, clear decision-making authority, identification of decision-makers according to the matter under consideration, identification of interfaces, communication channels, and all control points. The details of the program should be in written form and provide attributes that apply to all modes of facility operation, accident prevention, and accident mitigation. The administrative attributes intended to ensure that all SSCs required for safe operation of the facility are present should be identified in the facility DSA and should be classified by quality application such that they can be properly controlled.

All external organizations interfacing and performing work affecting the quality of a DOE nuclear facility design and operation should be identified in writing. This includes those organizations providing criteria, designs, specifications, and technical details to cover the preparation, review, and approval of documents involving design and operational interfaces.

Persons and organizations performing independent assessment of the maintenance management program must have sufficient internal authority and organizational freedom to identify quality problems; initiate, recommend, or provide solutions; and verify implementation of solutions for QA.

Configuration Management (CM)

Configuration management is a discipline that applies technical and administrative direction and surveillance to identify and document the physical characteristics of a facility. It is a method of doing business that maintains consistency among design requirements, physical configuration, and facility documentation. It audits to verify conformance to specifications and related documentation. Basically, it boils down to doing those things that should be done all along to properly manage and control physical and functional items at a facility. Such a program can be broken down into five basic programmatic elements.

1. Program management
2. Design requirements
3. Document control
4. Change control
5. Assessments

An important aspect of a CM program is the assurance that the design basis of a DOE nuclear facility is established, documented, and maintained. The facility SSCs, and computer software should conform to approved design requirements, and any changes to them must be minimized through an integrated management review process, with established approval criteria. This will help to establish that the operations of the facility are reliable if personnel operating the facility are knowledgeable about changes through timely review and training. Proposed changes should be thoroughly evaluated to determine their impact on other

hardware and documents. Such changes should be reviewed and approved by appropriate, responsible managers before implementation. This way, the program maintains a consistency between the documents of all departments and organizations. Safety, mission, economic impact, and benefit can be fully analyzed through the full range of review and approval contained in the program.

The following is taken from DOE G 433.1-1A.

Safety Structures, Systems, and Components

10 CFR 830 subpart B and DOE O 420.1B require formal definition of minimum acceptable performance of safety SSCs in the DSA. This is accomplished by first defining a safety function, then describing the SSCs, placing functional requirements on those portions of the SSCs required for the safety function, and identifying performance criteria that will ensure functional requirements are met.

A product of initial safety basis development and updates should be a listing of these SSCs, which is then used to develop and maintain the master equipment list (MEL). The MEL clearly identifies all SSCs that are part of the safety basis, thus requiring controls that are more rigorous. The organization may include in the MEL and the nuclear maintenance program those non-safety SSCs to which they chose to apply rigorous controls.

Within the design change and/or configuration management process, the facility should evaluate changes/modifications to identify any necessary updates to the MEL. The work planning process should include checking equipment that will be affected in the MEL to determine if special controls are required in the maintenance package.

While an approved hard-copy list of all SSCs that are part of the safety basis is acceptable, typically the MEL is maintained electronically in the facility's computerized maintenance management system and includes all facility equipment, with the safety basis items coded for identification. Thus, the MEL can be an index with many uses, including periodic maintenance, spare parts inventories, and equipment history. Each MEL item should be identified uniquely. An engineering group typically develops and maintains the MEL. Additional information, such as the following, may be included or linked/referenced to the MEL items:

- Equipment name/type
- Equipment tag in field (location)
- Safety category
- Reference to safety basis source
- Any applicable TSRs/LCOs
- Installed make and model
- Spare parts
- Status (active, retired, inactive)

Authorization Basis

The DSA and TSR are part of a nuclear facility's authorization basis. The DSA describes the hazard analysis and accident consequence analysis that was conducted to define the conditions under which the facility can be safely operated, and specifies safe operating

conditions and parameters. The TSR contains individual operational requirements that need to be met to ensure safe operation. Effective control of maintenance activities is essential to ensure safe operating conditions and maintain the facility safety basis.

The dependence of a facility's authorization basis on periodic maintenance of safety-related systems can be a strong justification for maintenance budget requests.

Design Basis

Management should ensure that plant configuration, including the manner in which the facility is maintained, conforms to the established design basis requirements. Many routine activities, if carried out improperly, can have an adverse impact on facility configuration and cause eventual equipment damage or increase the probability or consequences of a significant event.

Suspect/Counterfeit Items (S/CIs)

According to DOE O 433.1B, the NMMP must include incorporation of the process to prevent the use of S/CIs into maintenance procedures and work instructions. The controls to prevent entry of, and to detect, control, report, and dispose of S/CIs should interface with a facility's maintenance program.

The NMMP should address the following:

- The controls established to ensure that items and services meet specified requirements as set forth in DOE O 414.1D and the 10 CFR 830 subpart A
- The processes to prevent entry of, and to detect, control, report, and dispose of S/CIs per DOE O 414.1D and DOE G 414.1-2B

m. Review and evaluate the adequacy of a work package.

n. Observe in the field and evaluate the conduct of maintenance work utilizing a work package from start to finish.

KSAs m and n are performance-based. The Qualifying Official will evaluate their completion.

o. Discuss the roles and responsibilities of the STSM related to implementing and maintaining configuration management programs.

The following is derived from DOE-STD-1073-2003.

The STSM should review the CM program to ensure that the program accomplishes the following:

- Establishes and documents the configuration baseline
- Institutes a configuration control system to ensure the review, approval, and documentation of changes
- Institutes a program of configuration audits to comply with the form and intent of the configuration

The STSM must enforce the requirements of DOE P 450.4A, which states that DOE contractors are expected to use ISMS to integrate safety into all aspects of work planning and execution. All SMSs and programs should be designed to fit together to permit safe and efficient performance. Consistent with that goal, CM should function as an integrated process that marries seamlessly with other safety management processes at the facility or activity, and not as a separate and distinct program. In addition, the contractor must flow down the CM process to subcontractors and suppliers as appropriate to the work and ensure subcontractors and suppliers are implementing it appropriately.

p. Discuss the concept of configuration management and its importance in ensuring operational safety.

The following is taken from DOE-STD-1073-2003.

Configuration management is a disciplined process that involves management and technical direction to establish and document the design requirements and the physical configuration of the nuclear facility and to ensure that they remain consistent with each other and the documentation.

The basic objectives and general principles of configuration management are the same for all activities. The objectives of configuration management are to

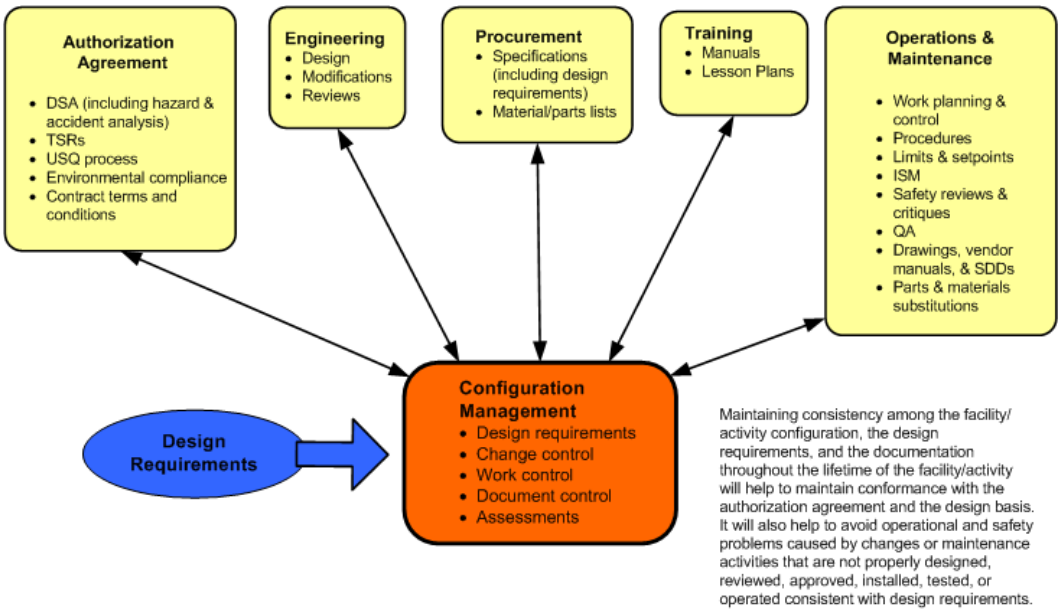
- establish consistency among design requirements, physical configuration, and documentation (including analysis, drawings, and procedures) for the activity; and
- maintain this consistency throughout the life of the facility or activity, particularly as changes are being made.

In addition to maintaining consistency among the design requirements, the physical configuration, and the documentation for the activity, the CM process must

- support the ISMS;
- help to maintain the safety basis as required by 10 CFR 830, subpart B;
- meet the QA requirements for work processes and assessments in subpart A of 10 CFR 830;
- meet the CM requirements of DOE O 420.1B,
- meet the CM and work control requirements of DOE O 433.1B;
- support the requirement for documentation, traceability, and accountability for pressure vessels in DOE O 440.1B; and
- ensure that changes to the design requirements, physical configuration, or documentation are reflected in procedures and training.

All safety management systems and programs should be designed to fit together to permit safe and efficient performance. Consistent with that goal, configuration management should function as an integrated process that marries seamlessly with other safety management processes at the facility or activity, not as a separate and distinct program.

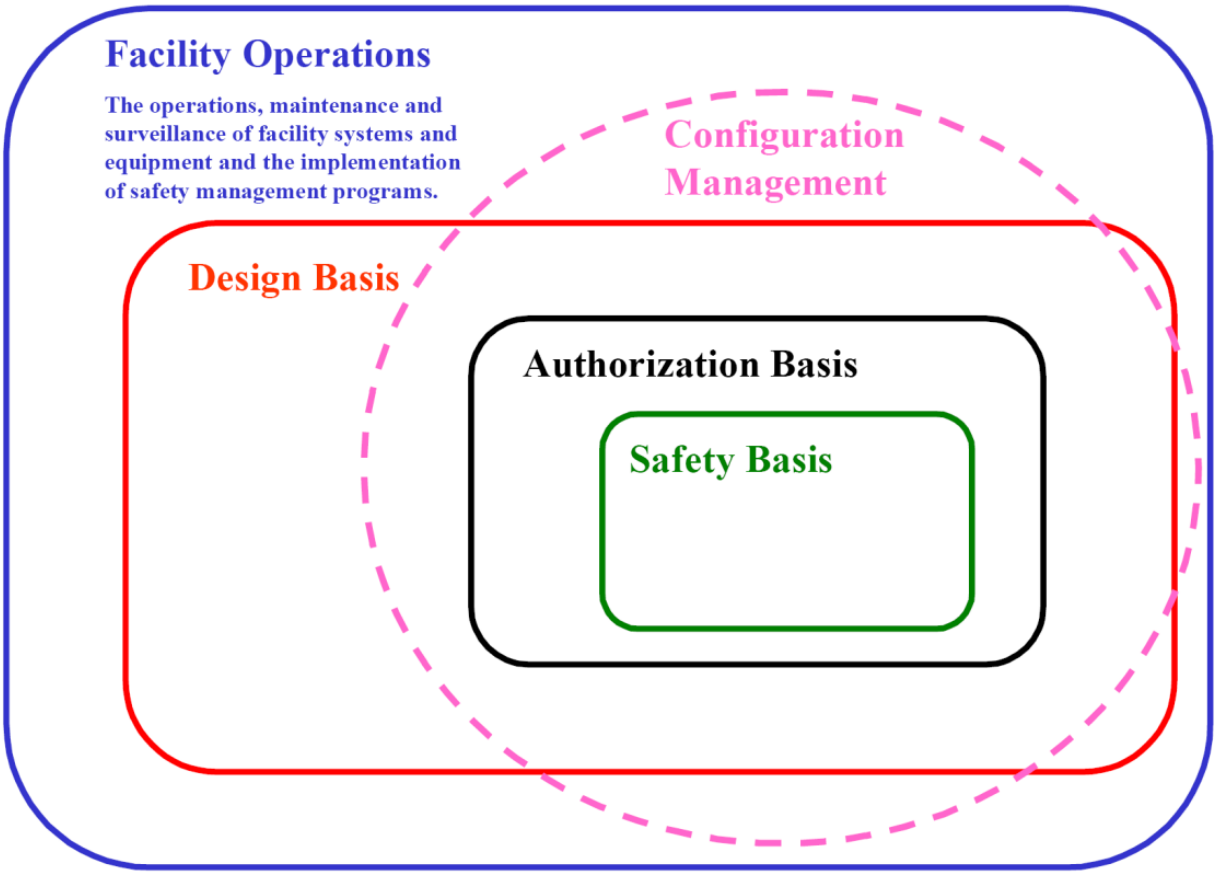
Configuration management supports a number of contractor organizations and initiatives by ensuring conformance with the established design requirements. Figure 6 illustrates some of these interfaces.



Source: DOE-STD-1073-2003

Figure 6. Configuration management interfaces

Proper application of the CM process should facilitate the contractor's efforts to maintain the safety and the authorization bases. This relationship is illustrated in figure 7.



Source: DOE-STD-1073-2003

Figure 7. Relationship of CM to design, safety, and authorization bases

q. For the elements identified above, describe the possible effects on safe operations if they are ineffectively implemented.

The following is taken from DOE-STD-1073-93.

An effective CM program increases efficiency by ensuring the prompt availability of needed information, thereby preventing errors and resultant rework, reducing duplications of effort, and improving scheduling and planning estimates. A CM program improves response to critical design and operational problems by making complete and accurate information readily available. Moreover, it enhances worker safety by providing assurance that equipment will perform as intended and by reducing exposures to radiological and other hazards, such as stored-energy sources. The cumulative benefits of a CM program include increased facility safety and reliability, improved environmental protection, and a reduced potential for extended facility shutdowns.

r. Describe a typical configuration management process.

The following is taken from DOE-STD-1073-2003.

CM is a disciplined process that involves management and technical direction to establish and document the design requirements and the physical configuration of the nuclear facility and to ensure that they remain consistent with each other and the documentation. As depicted in figure 6, the elements of the CM process are as follows:

- Design requirements
- Change control
- Work control
- Document control
- Assessments

The size, complexity, and missions of DOE nuclear facilities vary widely and CM processes may need to be structured to individual facilities, activities, and operations. It would generally be inappropriate to apply the same CM standards to widely different activities, for example, a reactor facility and a small, simple laboratory. The detailed examples and methodologies in DOE-STD-1073-2003 are provided to aid those developing their CM processes; however, they are provided for guidance only and may not be appropriate for application to all DOE nuclear activities. The individuals defining the CM process for a particular nuclear activity will need to apply judgment to determine if the examples and methods presented in this standard are appropriate for the activity. Nevertheless, the basic objectives and general principles of CM are the same for all activities.

s. Utilizing DOE O 420.1C, *Facility Safety*, discuss the system engineer concept as it applies to oversight of safety systems. Specifically address the areas of configuration management, assessment of system status and performance, and technical support for operations, maintenance activities and for Documented Safety Analysis reviews.

The following is taken from DOE-STD-1073-2003.

DOE O 420.1C requires contractors to designate a cognizant system engineer (CSE) for each system for DOE category 1, 2, or 3 nuclear facilities. The qualifications for the CSE must be consistent with those defined in DOE O 420.1C.

The CSE must be knowledgeable of the system and the related safety bases. The CSE must also retain a working knowledge of the facility's operation and the existing condition of the system. Consequently, the CSE is also responsible for overseeing the configuration of the assigned system to ensure that it continues to be able to perform its expected functions. The CSE should

- be knowledgeable of the system safety functions, requirements, and performance criteria and their bases;
- understand how the system SSCs are designed and how they function to meet the requirements and performance criteria;
- understand system operation;

- be knowledgeable of the testing and maintenance necessary to ensure the system continues to be able to perform its safety functions;
- be responsible for ensuring that documents related to the system are complete, accurate, and up-to-date, including system design descriptions, technical drawings, diagrams, and procedures for surveillance, testing, and maintenance; and
- be appropriately involved in the design, review, and approval of changes affecting/impacting system design, operation, and maintenance.

Because the CSEs are expected to have a thorough understanding of system design expectations, operating requirements, and current configuration, the CSEs should have a major role in identifying the CM SSCs. Each CSE should also participate in the identification of the design requirements for their system and the SSCs within the system. Finally, the CSE should participate in the CM review of any changes that are made to the system for which the CSE has cognizance responsibility.

A change to a component may also impact system performance. Consequently, a CSE should be engaged in the review process. A change to a component or system may impact nearby or interconnected components or systems. This potential should be assessed in the review. The CSEs for nearby or interfacing systems should be consulted as appropriate.

The technical review team must be aware of the potential impact of a change on safety and reliability, as well as the design requirements. One of the challenges of change control is to be cognizant of many ongoing changes—from proposal, through development, to implementation—and to understand the integrated effect of the various changes. The CSE concept has been used in the commercial nuclear industry to provide a technical focal point for each system. The CSE develops resident technical expertise and facility knowledge, centralizes resolution of SSC performance problems for more timely and effective response, and interfaces between the facility operations and maintenance organizations and the design engineering organization. The CSE concept benefits CM as well as many other facility activities including facility status and troubleshooting, operations support, coordination of testing and other system-related activities, and communication among departments.

As discussed in DOE-STD-1073-2003, DOE O 420.1B requires contractors to designate a CSE for each system for DOE category 1, 2, or 3 nuclear facilities. The duties, responsibilities, and interfaces of each CSE need to be clearly defined, documented, communicated to and understood by supporting facility organizations. To facilitate the change control process, each CSE should perform the following functions:

- Monitor and track the status of the assigned system, especially during changes (e.g., physical changes in progress and temporary physical changes).
- Conduct and/or observe equipment performance monitoring, evaluating the results of performance monitoring and surveillance, trending important data, and initiating corrective actions.
- Review and approve post-modification, post-maintenance surveillance, and special test procedures and test results.
- Provide assistance to operations and maintenance, as needed.
- Identify any situation where the design engineering organization should be consulted for advice or services.

Consideration should be given to assigning an individual the responsibility for tracking physical change status and ensuring that the change is completed in accordance with the change control package. Contractors have successfully used CSE or dedicated CM specialists to perform this function.

Another area where the contractor must pay particular attention is the parallel implementation of two or more changes that affect or involve the same SSC. In such cases, a single person, such as the CSE, should be assigned to oversee the implementation of all changes being made to the SSC.

CSEs should maintain cognizance over performance monitoring activities on assigned systems. Their responsibilities should include the identification of performance goals and acceptance criteria consistent with the associated SSC design requirements. Reviewing trend graphs of collected equipment data at specified intervals is a proven, effective approach. For example, if the trend graph indicates that the equipment is not likely to meet the acceptance criteria at or before the next scheduled test, an adjustment in the test schedule and other maintenance actions would be necessary.

Contractors should include the design engineers, as well as CSEs, in the periodic review of operating and maintenance procedures to alert maintenance and other organizations to any design changes in the affected systems.

t. Discuss each of the following elements of configuration management and how they contribute to safety and an effective configuration management program:
- **Program management**
- **Document control**
- **Change control**
- **Graded approach**
- **Design requirements**
- **Assessments**

[Note: DOE-STD-1073-2003 no longer includes the CM process element "program management." The information for the program management element is taken from DOE-STD-1073-93. The information for the other elements in this KSA is taken from DOE-STD-1073-2003.]

Program Management

The following is taken from DOE-STD-1073-93.

The program management element ensures that the various aspects of program development and implementation are integrated, complete, and effective. The program management element provides the leadership and management necessary to coordinate and integrate the many program functions and activities. This program element ensures that the efforts of the other elements are in balance (i.e., there is not too much effort in one area and too little in another) and maintains sight of the overall programs objectives. This program element also establishes the overall CM program scope and objectives, develops the program plan, and defines the appropriate program and organizational interfaces. To establish a consistent and common understanding throughout the affected organizations, the program management

element communicates the program scope and activities through standard concepts and terminology, CM program orientations and general training, and top-level CM procedures. Terminology, definitions, procedures, and training associated with the CM program are very important to program success. This program element also establishes and maintains certain controls that cross many organizational boundaries, such as technical vendor control and database control. In addition, this program element controls and monitors CM program development and implementation activities to ensure adequate performance of the CM program.

The program management element establishes and communicates program expectations through a number of formal policy documents, such as policy directives, program and action plans, and governing procedures. The program management element also ensures that appropriate lower-level or implementing procedures are in place for each CM program function. These vehicles or mechanisms, used to implement the program management element, support program implementation by providing increasing levels of detail to communicate program direction and guidance. CM policy directives confirm management support for the CM program, establish program scope and terminology, and establish key roles and responsibilities. CM program plans define specific actions and program commitments. Action plans go into further detail, describing methods, procedures, staffing, and schedules to accomplish the program plan commitments. Governing procedures identify the specific implementing procedures for accomplishing the CM program functions and correlate the implementing procedures to the CM program plan.

Video 15. What is configuration management
http://wn.com/Configuration_Management

Document Control

The following is taken from DOE-STD-1073-2003.

Document control ensures that only the most recently approved versions of documents are used in the process of operating, maintaining, and modifying the nuclear facility. Document control helps ensure that

- important facility documents are properly stored;
- revisions to documents are controlled, tracked, and completed in a timely manner;
- revised documents are formally distributed to designated users; and
- information concerning pending revisions is made available.

As controlled documents are updated to reflect changes to the requirements and/or physical installation, the contractor must ensure that each

- updated document is uniquely identified and includes a revision number and date; and
- outdated document is replaced by the latest revision.

Video 16. Configuration management and document control
http://www.professormesser.com/n10-004/configuration-management-documentation/

Change Control

The following is taken from DOE-STD-1073-2003.

Contractors must establish and use a formal change control process as part of the configuration management process. The objective of change control is to maintain consistency among design requirements, the physical configuration, and the related facility documentation, even as changes are made. The change control process is used to ensure changes are properly reviewed and coordinated across the various organizations and personnel responsible for activities and programs at the nuclear facility.

Through the change control process, contractors must ensure that

- changes are identified and assessed through the change control process;
- changes receive appropriate technical and management review to evaluate the consequences of the change;
- changes are approved or disapproved;
- waivers and deviations are properly evaluated and approved or denied and the technical basis for the approval or the denial is documented;
- approved changes are adequately and fully implemented or the effects of the partial implementation are evaluated and accepted;
- implemented changes are properly assessed to ensure the results of the changes agree with the expectations; and
- documents are revised consistent with the changes and the revised documents are provided to the users.

Graded Approach

The following is taken from DOE-STD-1073-2003.

DOE defines graded approach as a process of ensuring that the level of analysis, documentation, and actions used to comply with a requirement are commensurate with the following:

- The relative importance to safety, safeguards, and security
- The magnitude of any hazard involved
- The life cycle stage of a facility
- The programmatic mission of a facility
- The particular characteristics of a facility
- The relative importance of radiological and nonradiological hazards
- Any other relative hazard

In applying the graded approach to the configuration management process, relative importance factors and situational/circumstantial considerations should be considered as specified in chapter 3.10 of DOE-STD-1073-2003.

Design Requirements

The following is taken from DOE-STD-1073-2003.

The objective of the design requirements element of configuration management is to document the design requirements. The design requirements define the constraints and

objectives placed on the physical and functional configuration. The design requirements to be controlled under configuration management will envelope the safety basis and, typically, the authorization basis. Consequently, proper application of the configuration management process should facilitate the contractor's efforts to maintain the safety basis and the authorization basis. Contractors must establish procedures and controls to assess new facilities and activities and modifications to facilities and activities to identify and document design requirements.

Assessments

The following is taken from DOE-STD-1073-2003.

The quality assurance criteria of 10 CFR 830, subpart A, require DOE contractors for nuclear facilities (including activities and operations) to assess management processes and measure the adequacy of work performance. Furthermore, the assessment criteria require that the persons performing the assessments

- have sufficient authority and freedom from line management; and
- are qualified to perform the assessments.

The maintenance criteria of DOE O 433.1B also require periodic assessments to verify the condition of systems and equipment.

Chapter 7 of DOE-STD-1073-2003 discusses assessments/tests that can be performed to determine the effectiveness of different aspects of the configuration management process. Periodic assessments help ensure that work processes continue to function properly or problems are identified, root causes are determined, and problems are corrected. Chapter 7 of DOE-STD-1073-2003 provides guidance on performing assessments directly related to configuration management. While contractors may perform these assessments of the configuration management process separate from other assessments, it may be more efficient to combine these assessments with other periodic assessments of the activity. All or part of the assessment of the adequacy of configuration management for an activity may be integrated into broader management and performance assessments, such as quality assurance, maintenance, or integrated safety management assessments. If the contractor decides to fold the assessment of configuration management into a broader assessment, it must consider the criteria in this chapter when developing the assessment criteria for the broader assessment.

The objective of assessing configuration management is to detect, document, determine the cause of, and initiate correction of inconsistencies among design requirements, documentation, and physical configuration. Properly performed assessments should help identify inconsistencies between these areas, evaluate the root causes of these problems, and prescribe improvements to avoid similar inconsistencies in the future.

The five specific types of assessments/tests discussed in chapter 7 of DOE-STD-1073-2003 are as follows:

1. Construction assessments are performed to ensure configuration is managed throughout the construction process for new construction or major modifications.
2. Physical configuration assessments are conducted to evaluate the consistency between the physical configuration and the facility documentation.

3. Design assessments are done to ensure that design documents have been updated to reflect changes and accurately reflect the physical configuration of the nuclear facility.
4. Post-construction, -modification, or -installation inspections and tests are performed either after construction, modification, or installation to verify operation is as expected.
5. Periodic performance assessments are conducted to verify that systems and components continue to meet design and performance requirements in their current configurations.

u. Discuss approved/recommended compensatory actions where inadequate configuration management exists and work is ongoing or to be initiated.

v. Using system drawings, walk down and assess the configuration management, operability, and reliability of a safety-class or safety-significant system in a facility with system engineer/safety system oversight (SSO) personnel.

KSAs u and v are site-specific. The Qualifying Official will evaluate their completion. Check with your CM program for information to complete these KSAs.

<u>Mandatory Performance Activities:</u>

a. Participate in an assessment of facility conduct of operations, or complete a facility walk through with a qualified facility representative and provide a report to the facility representative on potential conduct of operations concerns that were observed.

This is a performance-based KSA. The Qualifying Official will evaluate it completion.

9. An STSM must have a familiarity level knowledge (demonstrate awareness) of safeguards and security directives, standards, and general requirements, and must have a working level knowledge of safeguards and security as it impacts safety.

a. Define the terms "safeguards" and "security" as they apply to the DOE Safeguards and Security Program.

The following is taken from the *DOE HSS Safeguards and Security (S&S) Public Information Resource*, "Glossary."

Safeguards is defined as an integrated system of physical protection, material accounting, and material control measures that deters, prevents, detects, and responds to unauthorized possession, use, or sabotage of special nuclear materials (SNM).

Security is defined as an integrated system of activities, systems, programs, facilities, and policies for the protection of classified matter, unclassified controlled information, nuclear materials, nuclear weapons, nuclear weapon components, and/or the Department's and its contractors' facilities, property, and equipment.

b. Discuss a Site Safeguards and Security Plan (SSSP), to include

- **content and purpose**
- **review/approval cycle**
- **graded security protection (GSP)**
- **process (e.g., vulnerability assessments)**
- **system effectiveness (P_E) reporting**

[Note: DOE O 470.4B, *Safeguards and Security Program*, cancelled DOE O 470.4A and DOE M 470.4-1 chg. 2, which contained the term "site safeguards and security plan." The term used in DOE O 470.B is "security plan."]

The following is taken from DOE O 470.4B.

Content and Purpose

All facilities and sites under DOE cognizance must have a security plan (SP) that reflects the assets, security interests, approved S&S program implementation at that location, and any residual risks associated with operation under the SP.

The SP is the approved method for conducting security operations at a facility or site and therefore must reflect security operations at that facility or site at all times. The plan must describe in detail, either in its content or in combination with other explicitly referenced documents, all aspects of S&S operations occurring at the location and must include documentation of any deviations from national or DOE requirements. At those locations where management has determined that several facilities can be consolidated into a site, the site SP may consolidate or replace individual facility SPs in whole or in part but must establish a unified approach to conducting site operations. Security plans must be based on in-depth analysis of considerations specific to the location and the assets and interests to be protected.

All SPs must include the following:

- A listing and prioritization of the assets and security interests at the facility or site; a description of how the protection program is managed; and a description of how national and DOE S&S requirements are met, including any deviations from requirements.
- Implementation plans, as required, for meeting changes in national or DOE policies or other changes (such as the addition or removal of security interests) that may require an extended time frame to implement due to financial or other resource considerations, including an implementation schedule and planned contingency measures in case the requirements cannot be met as scheduled. Implementation plans and contingency measures may be included in the SP by reference. DOE cognizant security offices must monitor contractors' implementation plans to ensure that requirements are implemented without unnecessary delays.

Review and Approval

Security plans must be reviewed as required to ensure that the plans are current and reflect the actual operating conditions at the covered location. Changes to approved SPs must be approved by the DOE cognizant security office, and the Federal office may require more

frequent reviews or may direct a contractor to review the contractor's plan at any time. Updates to SPs must be made whenever any of the following conditions apply:

- Changes in baseline security requirements in national-level or DOE policy
- Changes in facility operators/contractors
- Changes in assets or security interests
- Changes in facilities included in a site SP
- Changes in the security posture of a facility or site
- Planned changes to the security program at the facility or site
- Changes in operations at a facility or site that require modification to approved security measures

Graded Security Protection (GSP)

The following is taken from DOE M 470.4-1 chg. 1 (archived.

While the GSP provides specific description of threats that all components of the S&S system must be capable of defeating, analysis of terrorism should be an ongoing process. Although each analysis relies on information included in previous assessments, judgments with respect to threats to Federal and DOE-affiliated personnel, facilities, and assets begin anew with each analysis.

Homeland security threat conditions (SECONs) are established based on the analysis of a continuous and timely flow of integrated all-source threat assessments and reporting provided to executive branch decision-makers. A threat indicator is a condition that, when present, increases the possibility of a terrorist incident. Seldom does one single indicator suggest that the threat is imminent; but when a number of indicators are present, the level of concern should increase correspondingly. A decision to assign SECONs must integrate a variety of considerations. This integration will rely on qualitative assessment, not quantitative calculation. Higher SECONs indicate greater risk of a terrorist act, with risk including probability and gravity. There can be no guarantee that, at any given SECON, a terrorist attack will not occur. An initial and important factor is the quality of the threat information itself. The evaluation of this threat information includes, but is not limited to, the following factors:

- To what degree is the threat information credible?
- To what degree is the threat information corroborated?
- To what degree is the threat specific and/or imminent?
- How grave are the potential consequences of the threat?

Local and site-specific threat analysis is a dynamic process because the threat and the countermeasures used to combat the threat are constantly changing. To keep up with possible changes in the threat, security professionals should develop a predetermined list of general and specific threat indicators. Threat indicators should be revised according to site/facility situations and needs. They should be reviewed at least every six months or when a significant incident or change in conditions indicates that the threat level is increasing or decreasing. Examples of threat indicators that can be used to develop a site-/facility-specific assessment are

- international incidents or indicators against U.S. interests, personnel, or facilities;
- domestic incidents or indicators against Federal or state interests countrywide;

- local incidents or indicators directed against Federal or DOE interests; and
- specific targeting of DOE personnel, facilities, or materials.

Process (i.e., vulnerability assessment)

[Note: The following material is taken from DOE M 470.4-1 chg. 1 (archived), but was reviewed and edited by an SME to ensure that it is current and contains no classified information.]

The process of conducting a vulnerability assessment (VA) includes gathering data that describe the physical, operational, and protective force response characteristics of an S&S system, assigning values such as delay and detection, and analyzing the results to determine the relative protective system effectiveness in conjunction with the adversary's capabilities as identified in the DBT and the adversary capabilities list.

The VA process consists of the following:

- Assumptions. Assumptions and scoping agreements must be defined. All assumptions must be documented in the VA report.
- Threat. The person responsible for the conduct of VAs must understand how the DBT relates to the targets being protected.
- Targets. All security interests whose loss, theft, compromise, and/or unauthorized use will affect national security and/or the health and safety of DOE and contractor employees, the public, the environment, or DOE programs are potential targets. Targets that require a VA include assembled nuclear weapons, category I quantities of SNM (either discrete or roll up quantities), and significant radiological and biological sabotage.
- Modeling. Modeling is used to analyze S&S programs, interests, assets, and the effectiveness of program implementation. Modeling can include computer-based tools and simulations, table-top analyses, and SME analyses.
- Performance testing. Data used in VAs should be performance-based. When conducted, the results of the following tests (including validation) must be considered in determining system effectiveness:
  - Force-on-force exercises
  - Limited scope performance tests
  - Alarm response and assessment performance tests
  - Breaching test data
  - Critical system element tests
- Results. The results of VAs indicate performance effectiveness. The VA results must be used for determining the following:
  - Protection system effectiveness reporting
  - S&S upgrades
  - Manning/armament levels for the protective force (PF)
  - Justifications for waivers of and exceptions to S&S policy
- VA practitioner training. VA practitioners must successfully complete VA program training within two years of appointment.

The VA report documents the results of a VA. VA reports must include targets analyzed, methodology used, system effectiveness results, parameters and assumptions under which the VA was conducted, and reference to evidence files.

S&S programs must be based on the results of vulnerability and risk assessments, which are used to design and provide graded protection in accordance with an asset's importance or the impact of its loss, destruction, or misuse. The results of the assessments, to include the determination of system effectiveness, are one of the key considerations the manager must evaluate when establishing the level of risk.

System Effectiveness (P_E)

System effectiveness methodology requires the determination of the probability of sensing, probability of assessment, and probability of detection at each layer. These are combined to determine the contribution to overall system effectiveness represented by each layer.

P_E is defined as the system effectiveness of the layer. The system effectiveness of the layer is the product of the probability of interruption of the layer and the probability of neutralization given that detection occurred at that layer ($P_I \times P_N$). The probability of neutralization is determined discretely for each layer given detection at the layer. The neutralization determination is made if detection (regardless of the extent) takes place at the layer in question. Neutralization will occur sometime past the detection point and would be valid for the probability of neutralization of that specific layer.

For those protection systems based on sensing, assessment, detection, interruption, and active neutralization of an adversary, credit can only be taken up to the "point on the pathway" at which the total of the adversary task time, engagement times, and delay times exceeds the PF response times. This limiting criterion eliminates credit being taken for protection system capabilities that are not engaged prior to the adversary completing their objective. For denial-based protection systems, the point on the pathway is the critical detection point (CDP). The CDP is defined as the point at which the PF must have timely detection, assessment, and response to initiate an action that will have a high probability of success in the neutralization of the adversary or denial of the adversary's task/objective. Therefore, for a facility employing multiple, complementary layers of protection, the representative total protection system effectiveness is calculated up to the point at which the protection systems can still effectively engage an adversary prior to completion of the objective.

The contributions of each layer along the adversary pathway are then combined to determine the overall system effectiveness, where the overall system effectiveness is provided by the sum of the contributions of each layer (only those encountered along the adversary pathway) to the system effectiveness.

c. Demonstrate awareness of the purpose, interrelationship, responsibilities, and basic requirements for the following:
- **Physical security**
- **Personnel security**
- **Material control and accountability**

Physical Security

The following is taken from DOE O 473.3.

PURPOSE

DOE O 473.3, *Protection Program Operations*, establishes requirements for the physical protection of interests under DOE's purview ranging from facilities, buildings, government property, and employees to national security interests such as classified information, SNM, and nuclear weapons.

RESPONSIBILITIES

DOE line management must

- provide guidance and oversight to site and facility management and operations offices that oversee the physical security, DOE PF, PF firearms programs for the purposes of protecting S&S interests; and
- implement the requirements in paragraphs 4.a through 4.c of DOE O 473.3.

Heads of field elements and HQ departmental elements must

- administer DOE physical security, PF and PF firearms programs for the purposes of protecting S&S interests; and
- notify contracting officers of affected site/facility management contracts that must include the CRD; and
- review procurement requests for new non-site/non-facility-management contracts that involve classified information or matter, or nuclear materials and contain DEAR clause 952.204-2, titled "Security Requirements." If appropriate, notify contracting offices that the requirements of the CRD to the Order must be included in the contract.

REQUIREMENTS

The following requirements are applicable to all departmental facilities and sites:

- Protection planning: The implementation of graded physical protection programs required by DOE O 473.3 must be systematically planned, executed, evaluated, and documented as described by an SP.
- Security areas: The security areas described in DOE O 473.3, attachment 3, section A, chapter 2, address a graded approach for the protection of S&S interests as well as direction provided through national level standards.
- Posting notices: Signs must be posted at facilities, installations, and real property based on the need to implement Federal statutes protecting against degradation of S&S interests. DOE property must be posted against trespassing according to statutes, regulations, and the administrative requirements for posting specified in DOE O 473.3, attachment 3, section A, chapter 3.
- Locks and keys: A program to protect and manage locks and keys must be established by the officially designated security authority (ODSA). The lock and key program must be applied in a graded manner based on the S&S interests being protected, identified threat, existing barriers, and other protection measures afforded these interests. Security locks and keys are devices used to secure movable barriers and can include electrical or mechanical locks and keys, key cards, access codes, and other non-standard locking type devices.

- Maintenance: Security related subsystems and components must be maintained in operable condition. A regularly scheduled testing and maintenance program must be established and documented.
- Barriers: Physical barriers serve as the physical demarcation of the security area. Barriers such as fences, walls, and doors or activated barriers must be used to deter and delay unauthorized access. At a minimum, an analysis is required of high consequence security areas to determine the protection measures against vehicle-borne improvised explosive devices. Barriers may be used to support the prevention of standoff attacks.
- Communications, electrical power, and lighting:
  - Communications equipment must be provided to facilitate reliable information exchanges between PF personnel. Security system transmission lines and data must be protected in a graded manner from tampering and substitution.
  - Power supply elements located or operating within the confines of the site should be protected from malicious physical attacks based on a documented local site determination of impact. The site must determine the need for auxiliary power based on other S&S interests being protected and document it in the SP.
  - Lighting systems must allow for detection and assessment of unauthorized persons.
- Secure storage: The storage requirements for classified matter can be found in information security policy.
- Intrusion detection and assessment systems (IDASs): The IDASs must be configured to support interior and exterior applications. IDASs and/or visual observation by PF personnel must be used to protect classified matter, government property, and SNM to ensure that breaches of security barriers or boundaries are detected and responded to appropriately. The systems must be configured so that only authorized personnel may make adjustments.
- Entry/exit screening: The ODSA must determine the locations and scope of the screening program at other than protected area (PA) and material access area (MAA) boundaries. An inspection program must be configured to detect prohibited and controlled articles before being brought into DOE facilities. Any entry/exit inspection program must be documented in an SP or procedure.
- DOE security badge, credential, and shield program: DOE security badges issued to Federal and contractor employees have been determined to be the Department's Federal agency identity credential. Within the DOE, a homeland security Presidential Directive 12 credential, hereafter referred to as the DOE security badge, must be issued to and worn by all DOE and contractor personnel (cleared and specified to replace the existing DOE standard security badge).

The following additional requirements apply to category III and IV quantities of SNM.

- Protection measures: The priority of protection measures must be designed to prevent malevolent acts such as theft, diversion, and radiological sabotage and to respond to adverse conditions such as emergencies caused by acts of nature.
  - Category III quantities of SNM must be

        - used or processed in an access controlled security area within at least a limited area and in accordance with local security procedures approved by the ODFSA (officially designated Federal security authority); and
        - stored within a locked security container or room, either of which must be located within at least a limited area. The container or room must be under the protection of an intrusion detection system (IDS) or PF patrol physical check at least every eight hours.
    - Category IV quantities of SNM must be
        - used or processed within at least a property protection area and in accordance with local security procedures approved by the ODFSA; and
        - stored in a locked area within at least a property protection area and procedures must be documented in an approved site SP.

- Alarm management and control establishes requirements for integrated physical protection systems protecting category III SNM and, if used, for category IV SNM. When IDS sensors are used to protect S&S interests the sensors must annunciate directly to alarm stations when an alarm is activated.
- IDASs and/or visual observations by PF personnel must be used to protect SNM and classified matter to ensure breaches of security barriers or boundaries are detected and alarms annunciate. Intrusion detection and assessment must be conducted in accordance with the SP.
- Communications: IDSs may use radio frequency communications to transmit alarm and other data for alarms, video, early warning devices, and other data utilized by the IDS provided the data being transmitted are not classified and are protected consistent with the program office cyber SP and DOE requirements.
- Protection during transportation: Category III quantities of SNM may be transported as specified below unless otherwise prohibited by statute. Classified nuclear explosive parts, components, special assemblies, sub-critical test devices, trainers or shapes containing no fissile nuclear material or less than category II quantities of fissile nuclear material must be shipped consistent with DOE policy governing protection of classified information and DOT regulations governing interstate transportation.
    - Category III quantities of SNM require that
        - domestic offsite shipments of classified configurations of category III quantities of SNM must be made by Office of Secure Transportation (OST) or by an OST approved commercial carrier;
        - offsite shipments of unclassified configurations of category III quantities of SNM are not required to be made by OST. If OST is not used, the shipments may be made as specified in DOE O 473.3, attachment 3, section B, chapter V.2.b.; and

        - movement between security areas at the same site must comply with the locally developed and approved shipment SP.

- Category IV quantities of SNM require that
  - domestic offsite shipments of classified configurations of category IV quantities of SNM may be made by the OST or by other means when approved by DOE line management;
  - shipments of unclassified category IV quantities of SNM may be made by truck, rail, air, or watercraft in commercial for hire or leased vehicles;
  - consignees must promptly notify the shipper by telephone and written confirmation upon determination that a shipment has not arrived by the scheduled time; and
  - shipments must be made by a mode of transportation that can be traced, and within 24 hours from request, can report on the last known location of the shipment should it fail to arrive on schedule.

In addition to the physical requirements and requirements for category III and IV quantities of SNM discussed above, the following additional requirements apply to nuclear weapons, components, and category I and II quantities of SNM. The priority of protection measures must be designed to prevent malevolent acts such as theft, diversion, and radiological sabotage and to respond to adverse conditions such as emergencies caused by acts of nature. SNM must be protected at the higher level when roll up to category I quantities can occur within a single security area unless the facility has conducted an analysis that determined roll up was not credible.

- Category I quantities of SNM must be
  - located within an MAA inside a PA. Any MAA containing unattended category I quantities of SNM must be equipped with an IDS or detection must be provided by the PF; and
  - stored within an MAA.

- Category II quantities of SNM must be
  - located within a PA and under material surveillance procedures; and
  - stored in a vault or vault-type room located within a PA.
- Alarm management and control establishes requirements for integrated physical protection systems protecting nuclear weapons, components, and category I and II SNM. Facilities with category I and II quantities of SNM, or other high consequence targets as identified by VAs, must have a central alarm station and a secondary alarm station.
- Communications, electrical power and lighting require that
  - communications equipment must have a minimum of two different voice communications technologies to link the central alarm station/secondary alarm station to each fixed post and PF duty location. Protection system communications must support two vital functions: alarm communication/display and PF communications;
  - all IDSs protecting S&S interests must have a primary electrical power source from normal onsite power. Early warning systems that have self-contained electrical power are exempt from this requirement. Power sources must contain a

switching capability for operational testing to determine required auxiliary power sources; and
    - lights must support a 24-hour visual assessment and provide, at a minimum, 2 foot candle illumination at ground level at least 30-feet in diameter around PF posts and a minimum of 0.2 foot candle illumination within the perimeter intrusion detection and assessment system (PIDAS) isolation zone.

- IDASs: Nuclear weapons and category I and II quantities of SNM must be protected by an integrated physical protection system using PF, barriers, and IDASs. Exterior IDASs are designed to detect unauthorized entry into security areas.
- Access controls and entry/exit inspections include the following requirements:
    - Entry control points must be located within the PIDAS and protected by the PIDAS when not in use.
    - Automated access control systems may be used in place of or in conjunction with protective or other authorized personnel to meet access requirements.
    - Entry/exit inspections are required at PAs, MAAs, and at other security areas as required by DOE line management and documented in the site SP.

- Secure storage: An SNM vault must be a penetration-resistant enclosure that has doors, walls, floor, and roof/ceiling designed and constructed to significantly delay penetration from forced entry and equipped with IDS devices on openings allowing access.
- Protective force posts: Permanent PF posts controlling access to PAs and MAAs must be constructed to meet the requirements for a hardened post.
- Barriers: In addition to the requirements for a limited area, penetration of security area barrier requirements for a PA include
    - overhead utilities must not allow for access into a PA or higher security area without physical protection features to prevent or detect unauthorized access into the security area; and
    - two permanent, continuous parallel fences must identify the boundary of the PA.

- Protection during transportation: Packages or containers containing SNM must be sealed with tamper indicating devices. Movements of SNM between PAs at the same site or between PAs and staging areas on the same site must be escorted by armed PF officers.
- Maintenance: Maintenance must be performed on site-determined essential and non-essential system elements.

Video 17. Why physical security matters
http://vimeo.com/21852825

Personnel Security

The following is taken from DOE O 472.2.

PURPOSE

The purpose of the personnel security program is to ensure accurate, timely and equitable determinations of individuals' eligibility for access to classified information and SNM.

RESPONSIBILITIES

Federal heads of departmental elements must

- ensure that the requirements associated with determining the level of security clearance required and the means through which to request a security clearance are communicated to and implemented by the appropriate offices, individuals, and contracting/procurement officials under their cognizance;
- determine whether and when an interim security clearance is warranted for an individual under their cognizance; and
- direct contracting/procurement officials under their cognizance to incorporate this Order's CRD into affected contracts.

Site managers must

- ensure that the requirements of this Order are communicated to and implemented by the appropriate offices, individuals and contracting/procurement officials under their cognizance;
- determine whether and when to request security clearances for employees under their cognizance who, though they do not require access to classified information or SNM, nevertheless are situated such that inadvertent exposure cannot otherwise be reasonably prevented;
- determine whether and when to approve requests for temporary security clearance upgrades;
- with the concurrence of the director of the Office of Departmental Personnel Security, determine whether and when to modify procedures for reinstating security clearances; and
- communicate to all cleared DOE personnel under their cognizance their personal responsibilities with regard to holding a DOE security clearance. Such individuals are thereafter responsible for adhering to these responsibilities.

REQUIREMENTS

General requirements for personnel security include the following:

- Unless otherwise specifically noted, the provisions of DOE O 472.2 apply only to DOE (to include NNSA) Federal, contractor and subcontractor employees, applicants for employment, consultants, and access permittees.
- No individual will be provided access to classified information or SNM unless that individual has been granted the appropriate security clearance and possesses a need-to-know.
- With the few exceptions noted in DOE O 472.2 and provided for in EO 12968, section 3.3, individuals must not be afforded access to classified information or SNM until they have been granted a security clearance in accordance with the procedures in DOE O 472.2.
- Security clearances will not be processed in any manner merely to achieve the six objectives stated in DOE O 472.2, section 4.a.(5).
- Only individuals who are U.S. citizens and are at least 18 years of age may be processed for or granted a security clearance.
- With the exception of circumstances described in DOE O 472.2, an individual's security clearance will be based on the review of investigative reports provided to DOE by the OPM, the Federal Bureau of Investigation, or other Federal agency authorized to conduct background investigations.

- All individuals processed for security clearances must be treated equally, in accordance with the requirements set forth in DOE O 472.2, to preclude the appearance, inference, or practice of partiality or favoritism.

Nuclear Material Control and Accountability

The following is taken from DOE O 474.2 chg. 1.

PURPOSE

The purpose of DOE O 474.2 chg. 1 is to establish performance objectives, metrics, and requirements for developing, implementing, and maintaining a nuclear material control and accountability (MC&A) program within the DOE, including the NNSA, and for DOE-owned materials at other facilities that are exempt from licensing by the NRC.

RESPONSIBILITIES

If site offices are responsible for oversight of a site/facility possessing nuclear material, oversight entails the following responsibilities:

- Review and approve MC&A plans that conform to DOE O 474.2, chg. 1, and any additional direction provided by DOE line management. Confirm site compliance with the approved plans and periodically assess the effectiveness of the operators' programs against the metrics provided in the CRD or documented alternative metrics.
- Detect anomalies indicative of unauthorized activities or diversion of nuclear material.

If Federal staff is responsible for the operation of a site/facility possessing accountable nuclear materials, this operation entails the following responsibilities:

- Develop, implement, and maintain MC&A programs that conform to DOE O 474.2, chg. 1, and any additional direction provided by DOE line management.
- Identify MC&A responsibilities and authorities for each organization at the site/facility.
- Identify needed MC&A resources, supported by system assessment results, and submit budgets to the secretarial office for approval.
- Report MC&A program deficiencies, anomalous conditions, and incidents that potentially impact the protection of nuclear materials to the DOE line management according to preapproved reportable timelines (MC&A plan).
- Ensure completion of corrective action plans with root-cause analysis to resolve issues.

REQUIREMENTS

[Note: Only DOE line management requirements and specific material control and accounting objectives will be discussed here. See DOE O 474.2, chg. 1 for additional MC&A requirements and objectives.]

DOE line management must detect nuclear materials diversion and theft or unlawful activities by the site or facility operator, and confirm the effectiveness of the MC&A programs.

DOE line management must ensure and assess the performance of DOE MC&A programs in the following:

- Providing accurate nuclear material inventory information

- Controlling nuclear materials to deter and detect loss or misuse
- Providing timely and localized detection of unauthorized removals within specified limits
- Providing assurance that all nuclear materials are accounted for and that theft/diversion has not occurred
- Assisting in the detection and deterrence of radiological and/or toxicological sabotage involving nuclear materials that could adversely impact national security, the health and safety of employees, the public, or the environment

Material control objectives are as follows:

- Detect, assess, and deter unauthorized access to nuclear material.
- Detect, assess, and communicate alarms to response personnel, in time to impede unauthorized use of nuclear material.
- Provide loss detection capability for nuclear material and, when not in its authorized location, be able to provide accurate information needed to assist in locating the material in a timely manner.
- The material containment and surveillance program in conjunction with other security program elements must have the capability to detect, assess, and respond to unauthorized activities and anomalous conditions/events.
- In coordination with security organizations, material control measures ensure that appropriate protection and controls are applied to nuclear materials according to the quantity and attractiveness of the material.

Material accounting objectives are to ensure the following:

- Accurate records of nuclear materials inventory are maintained and transactions and adjustments are made.
- The accounting system
  - provides data and reports on nuclear material sufficient to support local, national, and international commitments;
  - must accurately reflect the nuclear material inventory and have sufficient controls to ensure data integrity;
  - provides data and reports on accountable nuclear material to the nuclear materials management and safeguards system; and
  - must use material balance areas as the basis of the accounting structure with key measurement points established to localize and identify inventory differences.

Interrelationship

The following is taken from DOE P 470.1.A.

The S&S program ensures that the DOE efficiently and effectively meets all its obligations to protect SNM, other nuclear materials, classified matter, sensitive information, government property, and the safety and security of employees, contractors, and the general public.

d. Demonstrate awareness of information security systems within DOE.

The following is taken from DOE O 471.6.

Classified information in all forms must be protected in accordance with all applicable laws, regulations, policies, directives, and other requirements; and must only be processed on information systems that have received authority to operate at the appropriate classification for the information according to DOE Office of the Chief Information officer directives.

The Office of the Chief Information Officer provides DOE directives

- for the security of the information systems that store classified information; and
- to ensure that classified information is only processed on information systems that achieve the appropriate requirements for national security systems.

When information is prepared on classified information systems, the hard copy output (which includes paper, microfiche, film, and other media) must be correctly marked either according to its classification per review of the output, or as a working paper.

Classified matter may be transmitted by approved electronic means. When using this method, the transmitting and receiving systems must be approved for the classification level and category of the information to be transmitted. Facilities also must have an approved SP and procedure(s) for transmitting the information by electronic means.

e. Discuss the interrelationship between safeguards and security to safety practices and facility operations.

The following is taken from DOE O 470.4B.

Safeguards and security programs must incorporate a risk-based approach to protect assets and activities against the consequences of attempted theft, diversion, terrorist attack, industrial sabotage, radiological sabotage, chemical sabotage, biological sabotage, espionage, unauthorized access, compromise, and other acts that may have an adverse impact on national security or the environment, or that may pose significant danger to the health and safety of DOE Federal and contractor employees or the public.

Interfaces and necessary interactions between S&S programs and other disciplines such as safety, emergency management, classification, counterintelligence, facility operations, cyber system operations and security, and business and budget operations including property management must be identified and clearly defined. These interfaces and interactions must be maintained throughout the life cycle of protective measures to ensure that S&S planning and operations work together effectively with these disciplines.

The following is taken from DOE O 440.1B.

DOE O 440.1B states that DOE elements must establish firearms safety policies and procedures for security operations and training to ensure proper accident prevention controls are in place. Written procedures must address firearms safety and engineering and administrative controls, as well as PPE requirements.

f. Participate and/or review the results of an audit of safeguards and security practices at a given facility or site.

This is a performance-based KSA. The Qualifying Official will evaluate its completion.

g. Demonstrate awareness of the scope and application of 10 CFR 824, "Procedural Rules for the Assessment of Civil Penalties for Classified Information Security Violations," and the potential ramifications for failing to comply with classified information security requirements.

The following is taken from 10 CFR 824.

10 CFR 824 implements subsections a., c., and d. of section 234B of the Atomic Energy Act. Subsection a. provides that any person who has entered into a contract or agreement with DOE, or a subcontract or subagreement thereto, and who violates any applicable rule, regulation, or Order under the Act relating to the security or safeguarding of restricted data or other classified information, shall be subject to a civil penalty not to exceed $110,000 for each violation. Subsections c. and d. specify certain additional authorities and limitations respecting the assessment of such penalties.

The regulations apply to any person who has entered into a contract or agreement with DOE, or a subcontract or sub-agreement thereto.

DOE may not assess any civil penalty against any entity specified at subsection d. of section 234A of the Act until the entity enters, after October 5, 1999, into a new contract with DOE or an extension of a current contract with DOE, and the total amount of civil penalties may not exceed the total amount of fees paid by the DOE to that entity in that fiscal year.

No civil penalty may be assessed against an individual employee of a contractor or any other entity which enters into an agreement with DOE.

Any person who violates a classified information protection requirement of any of the following is subject to a civil penalty:

- 10 CFR 1016—Safeguarding of Restricted Data
- 10 CFR 1045—Nuclear Classification and Declassification
- Any other DOE regulation or rule related to the safeguarding or security of classified information if the regulation or rule provides that violation of its provisions may result in a civil penalty pursuant to subsection a. of section 234B. of the Act

If, without violating a classified information protection requirement of any regulation or rule, a person, by an act or omission, causes or creates a risk of the loss, compromise or unauthorized disclosure of classified information, the Secretary may issue a compliance order to that person requiring the person to take corrective action and notifying the person that violation of the compliance order is subject to a notice of violation and assessment of a civil penalty. If a person wishes to contest the compliance order, the person must file a notice of appeal with the Secretary within 15 days of receipt of the compliance order.

The Director may propose imposition of a civil penalty for violation of a requirement of a regulation or rule or a compliance order not to exceed $110,000 for each violation.

If any violation is a continuing one, each day of such violation shall constitute a separate violation for the purpose of computing the applicable civil penalty.

The Director may enter into a settlement, with or without conditions, of an enforcement proceeding at any time if the settlement is consistent with the objectives of DOE's classified information protection requirements.

10. An STSM must have a working level knowledge of technical management and performance assessment, and DOE directives structure, and their relationship to applicable laws, rules, Federal/state regulations and industry standards.

a. Identify the three major DOE contract types and describe the characteristics, and the advantages and disadvantages of each.

The following is taken from 48 CFR 916.

Cost-Plus-Award-Fee Contract

A cost-plus-award-fee contract is a cost-reimbursement contract that provides for a fee consisting of a base amount fixed at inception of the contract and an award amount that the contractor may earn in whole or in part during performance and that is sufficient to provide motivation for excellence in such areas as quality, timeliness, technical ingenuity, and cost-effective management. The amount of the award fee to be paid is determined by the government's judgmental evaluation of the contractor's performance in terms of the criteria stated in the contract. This determination and the methodology for determining the award fee are unilateral decisions made solely at the discretion of the government.

The cost-plus-award-fee contract is suitable for use when

- the work to be performed is such that it is neither feasible nor effective to devise predetermined, objective incentive targets applicable to cost, technical performance, or schedule;
- the likelihood of meeting acquisition objectives will be enhanced by using a contract that effectively motivates the contractor toward exceptional performance and provides the government with the flexibility to evaluate actual performance and the conditions under which it was achieved; and
- any additional administrative effort and cost required to monitor and evaluate performance are justified by the expected benefits.

The number of evaluation criteria and the requirements they represent will differ widely among contracts. The criteria and rating plan should motivate the contractor to improve performance in the areas rated, but not at the expense of at least minimum acceptable performance in all other areas.

Cost-plus-award-fee contracts should provide for evaluation at stated intervals during performance so that the contractor will periodically be informed of the quality of its performance and the areas in which improvement is expected. Partial payment of fee should

generally correspond to the evaluation periods. This makes effective the incentive that the award fee can create by inducing the contractor to improve poor performance or to continue good performance.

The advantage to the contractor is monetary in nature. The disadvantage to the contractor is that the award fee amount is subject to a judgmental evaluation by the purchasing organization. The contractor faces the possibility of earning a reduced award fee or no award fee if the contractor's performance ranges from marginal to unacceptable. The advantage to DOE is that the contractor is more motivated to perform well. The disadvantage to DOE is increased cost if the award is actually earned.

Cost-Plus-Fixed-Fee Contract

A cost-plus-fixed-fee contract is a cost-reimbursement contract that provides for payment to the contractor of a negotiated fee that is fixed at the inception of the contract. The fixed fee does not vary with actual cost, but may be adjusted as a result of changes in the work to be performed under the contract. This contract type permits contracting for efforts that might otherwise present too great a risk to contractors (an advantage), but it provides the contractor only a minimum incentive to control costs.

A cost-plus-fixed-fee contract is suitable for use when either of the following conditions of the Federal Acquisition Regulation (FAR) part 16.301-2 is present:

- The contract is for the performance of research or preliminary exploration or study, and the level of effort required is unknown.
- The contract is for development and test, and using a cost-plus-incentive-fee contract is not practical.

A cost-plus-fixed-fee contract normally should not be used in the development of major systems once preliminary exploration, studies, and risk reduction have indicated a high degree of probability that the development is achievable, and the government has established reasonably firm performance objectives and schedules.

The advantage of this type of contract to the contractor is the inherent risk reduction. The disadvantage is a decreased incentive to perform optimally. The advantage to DOE is a fixed expenditure. The disadvantage is the potential for increased costs due to adjustments.

Video 18. Cost-plus fixed fee contract
http://www.bing.com/videos/search?q=cost+plus+award+fee+contracts+&view=detail&mid=7DCC2FEB7E9F08B079BD7DCC2FEB7E9F08B079BD&first=0

Cost-Plus-No-Fee Contract

This contract compensates the contractor for costs incurred in management and operations of a facility or installation. No additional fee is paid for contract performance. In contracts with some academic institutions, the contract provides for a management allowance paid by the DOE to cover general and administrative (G&A) costs incurred by the parent institution in support of departmental operations.

The advantage to the contractor is the opportunity to have some G&A costs covered that may or may not apply to the contract work (incidental to the contract). The disadvantage to the contractor is decreased incentive for optimal performance. The advantage to DOE is a fixed expenditure—a known quantity.

b. Identify and discuss the types of contracting processes that are used to put major contracts in place.

Sealed Bidding

The following is taken from 48 CFR 14.1.

Sealed bidding is a method of contracting that employs competitive bids, public opening of bids, and awards. The following steps are involved:

PREPARATION OF INVITATIONS FOR BIDS
Invitations must describe the requirements of the government clearly, accurately, and completely. Unnecessarily restrictive specifications or requirements that might unduly limit the number of bidders are prohibited. The invitation includes all documents (whether attached or incorporated by reference) that are furnished to prospective bidders for the purpose of bidding.

PUBLICIZING THE INVITATION FOR BIDS
Invitations must be publicized through distribution to prospective bidders, posting in public places, and such other means as may be appropriate. Publicizing must occur a sufficient time before public opening of bids to enable prospective bidders to prepare and submit bids.

SUBMISSION OF BIDS
Bidders must submit sealed bids to be opened at the time and place stated in the solicitation for the public opening of bids.

EVALUATION OF BIDS
Bids should be evaluated without discussions.

CONTRACT AWARD
After bids are publicly opened, an award will be made with reasonable promptness to that responsible bidder whose bid, conforming to the invitation for bids, will be most advantageous to the government, considering only price and the price-related factors included in the invitation.

Contracting by Negotiation

The following is taken from 48 CFR 15.002.

A contract awarded using other than sealed-bidding procedures is a negotiated contract. There are two types of negotiated contracts: sole source and competitive acquisitions.

SOLE SOURCE ACQUISITIONS
When contracting in a sole source environment, the request for proposal should be tailored to remove unnecessary information and requirements (e.g., evaluation criteria and voluminous proposal preparation instructions).

COMPETITIVE ACQUISITIONS

When contracting in a competitive environment, the procedures in 48 CFR 15 are intended to minimize the complexity of the solicitation, the evaluation, and the source selection decision, while maintaining a process designed to foster an impartial and comprehensive evaluation of offerors' proposals, leading to selection of the proposal representing the best value to the government.

c. Discuss how the Statement of Work is developed and contract deliverables are identified, including
- **Technical specification(s)**
- **Quality assurance requirements**
- **Technical review and acceptance of deliverables**

The following is taken from National Oceanic and Atmospheric Administration, Acquisitions and Grants Office, "Developing Performance-based Work Statements."

The following is a summary of the recommended process steps for preparing a statement of work:
- Establish a preliminary scope statement (i.e., the purpose or objective of the procurement).
- List the tasks to be performed (i.e., all performance requirements the contractor must satisfy, all requirements that the contractor must comply with during contract performance).
- Group similar and related tasks.
- Organize the tasks in logical sequence.
- Identify the input (required resources to perform the tasks).
- Identify the output (required results or deliverables).
- Identify the timeline or frequency of the deliverables (output).
- Develop the parameters for acceptable quality and performance.
- Determine how to monitor the deliverables. Methods include
  - 100 percent inspection
  - random sampling
  - periodic inspection
  - customer complaints
  - review of progress milestones
  - reports by contractor

The following is taken from DOE G 414.1-2B.

To accomplish the DOE's missions and objectives, DOE and its contractors are responsible for the management and oversight functions of a wide range of work activities, including basic and applied research; product development; design, construction, operation, modification, decommissioning, and environmental remediation of DOE facilities and sites. This work should be accomplished safely while minimizing potential hazards to the public, site or facility workers, and the environment consistent with the QA requirements of DOE O 414.1D and 10 CFR 830, subpart A. The quality criteria of DOE O 414.1D and 10 CFR 830, subpart A provide the requirements for a QAP which ensures work is consistent with DOE requirements and expectations.

d. Discuss the following terms as they apply to financial accountability:
- **Incentives (Award Fee, Conditional Payment of Fee (CPOF), Fee Withholding)**
- **Fines and penalties**
- **Third-party liabilities**
- **Loss of, or damage to, Government property**
- **Allowable and non-allowable costs**

Incentives
The following is taken from 48 CFR 16.401.

Incentive contracts are appropriate when a firm-fixed-price contract is not appropriate and the required supplies or services can be acquired at lower costs and, in certain instances, with improved delivery or technical performance, by relating the amount of profit or fee payable under the contract to the contractor's performance. Incentive contracts are designed to obtain specific acquisition objectives by
- establishing reasonable and attainable targets that are clearly communicated to the contractor; and
- including appropriate incentive arrangements.

The two basic categories of incentive contracts are fixed-price incentive and cost-reimbursement incentive contracts. Since it is usually to the government's advantage for the contractor to assume substantial cost responsibility and an appropriate share of the cost risk, fixed-price incentive contracts are preferred when contract costs and performance requirements are reasonably certain. Cost-reimbursement incentive contracts are subject to the overall limitations that apply to all cost-reimbursement contracts.

Award Fee
The following is taken from DOE G 430.1-1, App A.

An award fee contract is a contract where the contractor recovers actual costs incurred for completed work and is awarded a fee based on performance. Actual costs include general administration, overhead, labor and fringe benefits, other direct costs, and materials, including mark-up.

Conditional Payment of Fee
The following is taken from 49 CFR 970.5215-3.

The payment of earned fee, fixed fee, profit, or share of cost savings under a conditional payment of fee contract is dependent upon
- The contractor's or contractor employees' compliance with the terms and conditions of this contract relating to ES&H, which includes worker safety and health, including performance under an approved ISMS; and
- The contractor's or contractor employees' compliance with the terms and conditions of this contract relating to the safeguarding of restricted data and other classified information.

The ES&H performance requirements of this contract are set forth in its ES&H terms and conditions, including the DOE approved contractor ISMS or similar document. Financial

incentives for timely mission accomplishment or cost effectiveness shall never compromise or impede full and effective implementation of the ISMS and full ES&H compliance.

The performance requirements of this contract relating to the safeguarding of restricted data and other classified information are set forth in the clauses of this contract entitled, "Security" and "Laws, Regulations, and DOE Directives," as well as in other terms and conditions.

If the contractor does not meet the performance requirements of this contract relating to ES&H or to the safeguarding of restricted data and other classified information during any performance evaluation period established under the contract, pursuant to the clause of this contract entitled, "Total Available Fee: Base Fee Amount and Performance Fee Amount," earned fee, fixed fee, profit, or share of cost savings may be unilaterally reduced by the contracting officer.

Fee Withholding

The following is taken from 49 CFR 52.232-9.

If more than one clause or schedule term of the contract authorizes the temporary withholding of amounts otherwise payable to the contractor for supplies delivered or services performed, the total of the amounts withheld at any one time shall not exceed the greatest amount that may be withheld under any one clause or schedule term at that time, provided that this limitation shall not apply to

- withholdings pursuant to any clause relating to wages or hours of employees;
- withholdings not specifically provided for by the contract;
- the recovery of overpayments; or
- any other withholding for which the contracting officer determines that this limitation is inappropriate.

Fines and Penalties

The following is taken from 48 CFR 31.205.

Costs of fines and penalties resulting from violations of, or failure of the contractor to comply with, Federal, state, local, or foreign laws and regulations are unallowable except when incurred as a result of compliance with specific terms and conditions of the contract or written instructions from the contracting officer.

Third-Party Liabilities

The following is taken from U.S. DOE, Office of the Chief Financial Officer, *Accounting Handbook*, chapter 11, "Liabilities."

The principle of materiality and full disclosure should govern the inclusion of third-party liabilities. The nature of the liability should be identified and reported, either by a footnote to the financial statement or by actual inclusion of an amount in a liability account if the potential amount due or loss can be estimated.

Loss of or Damage to Government Property

The following is taken from 48 CFR 45.104.

Contractors are responsible and liable for government property in their possession, unless otherwise provided by the contract. Generally, government contracts do not hold contractors liable for loss of or damage to government property when the property is provided under any of the following:

- Negotiated fixed-price contracts for which the contract price is not based on any exception
- Cost-reimbursement contracts
- Facilities contracts
- Negotiated or sealed bid service contracts performed on a government installation where the contracting officer determines that the contractor has little direct control over the government property because it is located on a government installation and is subject to accessibility by personnel other than the contractor's employees and that by placing the risk on the contractor, the cost of the contract would be substantially increased

When justified by the circumstances, the contract may require the contractor to assume greater liability for loss of or damage to government property than that contemplated by the government property clauses. For example, this may be the case when the contractor is using government property primarily for commercial work rather than government work.

Under certain conditions subcontractors are liable for loss of or damage to government property furnished through a prime contractor.

A prime contractor that provides government property to a subcontractor should not be relieved of any responsibility to the government that the prime contractor may have under the terms of the prime contract.

Allowable Costs

The following is taken from 48 CFR 31.

Cost is allowable only when the cost complies with all of the following requirements:

- Reasonableness.
- Allocability.
- Standards promulgated by the cost accounting standard (CAS) board, if applicable.
- Terms of the contract.
- Any limitations set forth in 48 CFR 31, "Contract Cost Principles and Procedures".
- Certain cost principles in 48 CFR 31 incorporate the measurement, assignment, and allocability rules of selected CAS and limit the allowability of costs to the amounts determined using the criteria in those selected standards. Only those CAS or portions of standards specifically made applicable by the cost principles in this part are mandatory unless the contract is CAS covered. Business units that are not otherwise subject to these standards under a CAS clause are subject to the selected standards only for the purpose of determining allowability of costs on government contracts. Including the selected standards in the cost principles does not subject the business unit to any other CAS rules and regulations. The applicability of the CAS rules and regulations is determined by the CAS clause, if any in the contract, and the requirements of the standards themselves.

- When contractor accounting practices are inconsistent with 48 CFR 31.201, costs resulting from such inconsistent practices in excess of the amount that would have resulted from using practices consistent with this subpart are unallowable.
- A contractor is responsible for accounting for costs appropriately and for maintaining records, including supporting documentation adequate to demonstrate that costs claimed have been incurred, are allocable to the contract, and comply with applicable cost principles in this subpart and agency supplements. The contracting officer may disallow all or part of a claimed cost that is inadequately supported.

Non-Allowable Costs (Unallowable Costs)

The following is taken from 48 CFR 31

- Costs that are expressly unallowable or mutually agreed to be unallowable, including mutually agreed to be unallowable directly associated costs, should be identified and excluded from any billing, claim, or proposal applicable to a government contract. A directly associated cost is any cost which is generated solely as a result of incurring another cost, and which would not have been incurred had the other cost not been incurred. When an unallowable cost is incurred, its directly associated costs are also unallowable.
- Costs that specifically become designated as unallowable, or as unallowable directly associated costs as a result of a written decision furnished by a contracting officer, should be identified if included in or used in computing any billing, claim, or proposal applicable to a government contract. This identification requirement applies also to any costs incurred for the same purpose under like circumstances as the costs specifically identified as unallowable under either this paragraph or the preceding paragraph.
- If a directly associated cost is included in a cost pool that is allocated over a base that includes the unallowable cost with which it is associated, the directly associated cost should remain in the cost pool. Since the unallowable costs will attract their allocable share of costs from the cost pool, no further action is required to ensure disallowance of the directly associated costs. In all other cases, the directly associated costs, if material in amount, must be purged from the cost pool as unallowable costs.
- The practices for accounting for and presentation of unallowable costs will be those as described in 48 CFR 9904.405, “Accounting for Unallowable Costs,” and 48 CFR 9905.505, “Accounting for Unallowable Costs—Educational.”

e. Discuss the technical oversight and qualifications required to assess contractor performance and the training of contractor employees.

The following is taken from DOE P 226.1B.

The purpose of DOE P 226.1B, *Department of Energy Oversight Policy*, is to establish the DOE’s expectations for the implementation of a comprehensive and robust oversight process that enables the Department’s mission to be accomplished effectively and efficiently while maintaining the highest standard of performance for safety and security. As used in DOE P 226.1B, any reference to DOE is also meant to include the NNSA. The scope of DOE P 226.1B covers operational aspects of environment, safety, and health; safeguards and security; cyber security; and emergency management

Effective and properly implemented oversight processes and assurance systems are expected to result in the following:

- DOE HQ and field having assurance that site workers, the public, and the environment are protected while mission objectives are met, contract requirements are fulfilled; and operations, facilities, and systems are being effectively run and continuously improved
- The establishment of metrics and targets for assessing performance and holding managers accountable for achieving their targets
- Improvements in the efficiency and effectiveness of DOE oversight programs by leveraging, when appropriate, the processes and outcomes of contractors' assurance systems

The following is taken from DOE O 226.1B.

DOE O 226.1B states that it is the responsibility of the administrator, NNSA; CSOs; DOE and NNSA procurement executives; and PSOs to establish and maintain appropriate qualification standards for personnel with HQ and field oversight responsibilities, and clear, unambiguous lines of authority and responsibility for oversight.

The following is taken from DOE O 426.2.

Heads of field organizations/field element manager (FEM) for NNSA operations or designee must evaluate contractor training and qualification programs using the methodology described in DOE-STD-1070-94. They must ensure that the entire scope of DOE-STD-1070-94 that is applicable to their site is addressed at least once in each three year interval.

The following is taken from DOE-STD-1070-94.

Each evaluator's experience should be commensurate with individually assigned objectives and criteria. Before beginning the evaluation the evaluator(s) should be trained in evaluation methodology and should be familiar with the objectives and criteria that they are assigned to evaluate.

The training program objectives and criteria contained in DOE-STD-1070-94, *Guidelines for Evaluation of Nuclear Facility Training Programs*, are not a substitute for the evaluator's technical knowledge of the facility or program. The evaluation must be performed using personnel who have a technical background (e.g., nuclear facility operations, maintenance, and radiological protection personnel, and/or expertise in tritium, plutonium, or other subjects) in the subject area(s) being evaluated. If a group of individuals is performing the evaluation, the team should be made up of an appropriate balance of personnel with training and technical backgrounds. The optimum situation is to use personnel with a technical background and experience in training design, development, and management. If the evaluation is conducted by someone who does not have the specific technical qualifications, the results should be reviewed by an SME with expertise in the subject area(s) before the evaluation is forwarded to the management and operating (M&O) contractor. Techniques for assessing performance are available in DOE G 120.1-5, *Guidelines for Performance Measurement*.

f. Discuss the fee-based evaluation process including the development of performance criteria, conduct of the evaluation, and documentation and transmittal requirements for performance.

The following is taken from NNSA Policy Letter NAP-4B, "Corporate Performance Evaluation Process for Management and Operating Contractors."

The objective of NNSA Policy Letter NAP-4B is to establish and implement a uniform, corporate process for evaluation of national NNSA M&O contractors' performance that promotes effective and efficient accomplishment of the NNSA mission while balancing safety and production effectively. This process results in documented, consistent, and fair evaluation of M&O contractor performance.

Fee-Based Evaluation Process

The contractor performance evaluation process will be an NNSA-corporate, integrated process applied consistently by all NNSA sites. The corporate process may be updated periodically to reflect changes and lessons learned. The annual performance evaluation plan (PEP) for each site will follow the format and boundaries as follows:

- PEPs shall contain performance objectives (POs) and performance-based incentives (PBIs), if applicable.
- PEPs shall provide essential and stretch goals, although fee for stretch can only be earned if performance on essential goals meets certain expectations.
- PEPs shall provide appropriate weight/fee distribution among POs and PBIs based on criticality of the represented scope and its relative cost, benefit, and risk.
- Fee determining official (FDO) has the discretion to adjust the site office manager's recommended rating or fee.

The FDO will review and approve, unless otherwise specified in the contract, the fee rate, the amount of available fee for each period of performance, the award term incentives and the performance targets in the PEP based on the recommendation of the site office managers and management council.

The following is taken from 48 CFR 970.1504.

DOE M&O contractors may be paid a fee in accordance with the requirements of this subsection.

There are three basic principles underlying the Department's fee policy:

1. The amount of available fee should reflect the financial risk assumed by the contractor.
2. It is the policy of the Department, when work elements cannot be fixed price, incentive fees (including award fees) tied to objective measures should be used to the maximum extent appropriate.
3. When work elements cannot be fixed price and award fees are employed, they should be tied to either objective or subjective measures. Each measure should, to the maximum extent appropriate, be directly tied to a specific portion of the fee pool.

Fee objectives and amounts are to be determined for each contract. Standard fees or across-the-board fee agreements will not be used or made. Due to the nature of funding M&O contracts, it is anticipated that fee shall be established in accordance with the annual funding cycle; however, with the prior approval of the procurement executive, or designee, a longer period may be used where necessary to incentivize performance objectives that span funding cycles or to optimize cost reduction efforts.

Annual fee amounts shall be established in accordance with this subsection. Annual amounts shall not exceed maximum amounts derived from the appropriate fee schedule (and classification factor, if applicable) unless approved in advance by the procurement executive, or designee. In no event shall any fee exceed statutory limits.

Contracting officers shall include negative fee incentives in contracts when appropriate. A negative fee incentive is one in which the contractor will not be paid the full target fee amount when the actual performance level falls below the target level established in the contract. Negative fee incentives may only be used when

- a target level of performance can be established, which the contractor can reasonably be expected to reach;
- the value of the negative incentive is commensurate with the lower level of performance and any additional administrative costs;
- factors likely to prevent attainment of the target level of performance are clearly within the control of the contractor; and
- the contract clearly indicates a level below which performance is not acceptable.

It is in 48 CFR 970.1504, "Contract Pricing," that the concept of target performance levels is established, and the related "negative fee" based on an unacceptable performance level. The results of the evaluation correlate directly with the loss of fee that would have been awarded had the performance levels met pre-established criteria. The failure to perform is documented and transmitted to the DOE M&O contractor on the evaluation's finalization. Contract clauses in M&O contracts spell out expectations and requirements for this process and related consequences regarding the award of fee.

Development of Performance Criteria

The development of performance criteria begins with a survey of contract requirements to identify specific, tangible actions, performance measures, and other measurable means.

The remaining information for this KSA is taken from NNSA Policy Letter NAP-4B.

NNSA sites shall use consistent format and definitions for describing the desired performance for its M&O contractors in the PEP. PEPs shall use the following definitions:

- Performance objective: A statement of desired results for an organization or activity.
- Performance measure: Term used to describe a particular value or characteristic designated to measure input, output, outcome, efficiency, or effectiveness. Performance measures are composed of a number and a unit of measure. The number provides the magnitude (how much) and the unit is what gives the number its meaning (what).

- Performance target: The desired condition or target level of achievement for each measure, established at an appropriately detailed level that can be tracked and used for a judgment or decision on performance assessment.

The following is an example of a performance objective, measure and target for a site:

- Performance objective: Provide effective management of facility space.
- Performance measure: Reduction of the site's facility footprint.
- Performance target for fiscal year 20xx: Reduce facility footprint by ten percent within budgeted cost and schedule.

Conduct of the Evaluation

The assessment phase begins after the execution year has ended and shall be completed before interest penalties are assessed on late payment of fee, if applicable.

- Site offices, with input from program offices, functional offices and non-NNSA offices, as applicable, shall validate contractor performance at the end of the performance period and provide recommended ratings and/or a recommended fee amount to the management council and ultimately the FDO. Timely and effective HQ input is critical to a successful assessment phase.
- The FDO will determine the final performance rating and earned fee for the contractors.
- The FDO has the discretion to adjust the recommended rating or earned fee within the available fee pool. The adjustment should generally be within the range of plus or minus ten percent. If the adjustment is more than plus or minus ten percent, the site office manager's letter to the contractor that transmits the final performance evaluation report (PER) will provide a rationale for the adjustment.

Documentation and Transmittal Requirements for Performance

POST ASSESSMENT PHASE

Site office managers shall be aware that a "fully releasable" PEP and PER suitable for public posting may be requested for public affairs and/or congressional purposes. At a minimum, the following documents should be readily available:

- Summary of available and earned fee
- One page narrative summary on contractor performance
- PER
- Redacted PER

g. Identify who can make contractual requests or approvals of contract provisions, and the qualifications required of that individual(s).

The following is taken from DOE O 361.1B.

Contracts may be entered into and signed on behalf of the government only by contracting officers (COs).

To remain current in acquisition knowledge, skills, and techniques, all members of the acquisition workforce including COs must obtain continuing learning according to the requirement set forth in their career field. Alternate training may be used, with the

concurrence of the head of the contracting unit, based on similarities in subject matter and course content.

All individuals who hold CO warrants, irrespective of job series, are required to obtain continuing learning consistent with their career field certification requirements. That is, a non-1102 holding an administrative warrant must be certified to the level indicated in the Acquisition Career Management Program (ACMP) handbook and must obtain the hours of continuing learning specified in the ACMP handbook.

h. Discuss the intent of the DEAR Clause, 970.5223-1, regarding environment, safety, and health (ES&H).

The current 48 CFR 970.5223-1 is reproduced here in its entirety.

In performing work under this contract, the contractor shall perform work safely, in a manner that ensures adequate protection for employees, the public, and the environment, and shall be accountable for the safe performance of work. The contractor shall exercise a degree of care commensurate with the work and the associated hazards. The contractor shall ensure that management of environment ES&H functions and activities becomes an integral but visible part of the Contractor's work planning and execution processes. The contractor shall, in the performance of work, ensure that the following is complied with:

- Line management is responsible for the protection of employees, the public, and the environment. Line management includes those Contractor and subcontractor employees managing or supervising employees performing work.
- Clear and unambiguous lines of authority and responsibility for ensuring ES&H are established and maintained at all organizational levels.
- Personnel possess the experience, knowledge, skills, and abilities that are necessary to discharge their responsibilities.
- Resources are effectively allocated to address ES&H, programmatic, and operational considerations. Protecting employees, the public, and the environment is a priority whenever activities are planned and performed.
- Before work is performed, the associated hazards are evaluated and an agreed upon set of ES&H standards and requirements are established which, if properly implemented, provide adequate assurance that employees, the public, and the environment are protected from adverse consequences.
- Administrative and engineering controls to prevent and mitigate hazards are tailored to the work being performed and associated hazards. Emphasis should be on designing the work and/or controls to reduce or eliminate the hazards and to prevent accidents and unplanned releases and exposures.
- The conditions and requirements to be satisfied for operations to be initiated and conducted are established and agreed upon by DOE and the Contractor. These agreed upon conditions and requirements are requirements of the contract and binding upon the Contractor. The extent of documentation and level of authority for agreement shall be tailored to the complexity and hazards associated with the work and shall be established in a Safety Management System.

The contractor shall manage and perform work according to a documented SMS that fulfills all conditions in 48 CFR 970.5223-1 at a minimum. Documentation of the system shall include the following:

- Define the scope of work.
- Identify and analyze hazards associated with the work.
- Develop and implement hazard controls.
- Perform work within controls.
- Provide feedback on adequacy of controls and continue to improve safety management.

The system shall describe how the contractor will establish, document, and implement safety performance objectives, performance measures, and commitments in response to DOE program and budget execution guidance while maintaining the integrity of the system. The system shall also describe how the contractor will measure system effectiveness.

The contractor shall submit to the CO documentation of its system for review and approval. Dates for submittal, discussions, and revisions to the system will be established by the CO. Guidance on the preparation, content, review, and approval of the system will be provided by the CO. On an annual basis, the contractor shall review and update, for DOE approval, its safety performance objectives, performance measures, and commitments consistent with and in response to DOE's program and budget execution guidance and direction. Resources shall be identified and allocated to meet the safety objectives and performance commitments as well as maintain the integrity of the entire system. Accordingly, the system shall be integrated with the contractor's business processes for work planning, budgeting, authorization, execution, and change control.

The contractor shall comply with, and assist DOE in complying with, ES&H requirements of all applicable laws and regulations, and applicable directives identified in the clause of this contract entitled "Laws, Regulations, and DOE Directives." The contractor shall cooperate with Federal and non-Federal agencies having jurisdiction over ES&H matters under this contract.

The contractor shall promptly evaluate and resolve any noncompliance with applicable ES&H requirements and the system. If the contractor fails to provide resolution or if, at any time, the contractor's acts or failure to act causes substantial harm or an imminent danger to the environment or health and safety of employees or the public, the CO may issue an order stopping work in whole or in part. Any stop work order issued by a CO under this clause shall be without prejudice to any other legal or contractual rights of the government. In the event that the CO issues a stop work order, an order authorizing the resumption of the work may be issued at the discretion of the CO. The contractor shall not be entitled to an extension of time or additional fee or damages by reason of, or in connection with, any work stoppage ordered according to 48 CFR 970.5223-1.

Regardless of the performer of the work, the contractor is responsible for compliance with the ES&H requirements applicable to this contract. The contractor is responsible for flowing down the ES&H requirements applicable to this contract to subcontracts at any tier to the extent necessary to ensure the contractor's compliance with the requirements.

The contractor shall include a clause substantially the same as this clause in subcontracts involving complex or hazardous work on site at a DOE-owned or -leased facility. Such subcontracts shall provide for the right to stop work under the conditions described in paragraph (g) of this clause. Depending on the complexity and hazards associated with the work, the contractor may choose not to require the subcontractor to submit a SMS for the contractor's review and approval.

i. Participate on a team reviewing the contractor's subcontracting practices.

This is a performance-based KSA. The Qualifying Official will evaluate its completion.

j. Discuss the purpose and the relationship between DOE Orders, directives, Federal regulations, and State regulations.

The following is taken from DOE O 251.1C.

Policies:

DOE policies

- establish high-level expectations in the conduct of the Department's mission and impact two or more departmental elements;
- are either memoranda issued by the Secretary or deputy or documents developed by an OPI using the process outlined in appendix B to DOE O 251.1C;
- will be posted in RevCom for information purposes; and
- remain in effect until canceled by the Secretary or deputy secretary;

Orders:

DOE orders

- establish management objectives, requirements and assignment of responsibilities for DOE Federal employees consistent with policy and regulations;
- are documents developed by an OPI and issued by the Secretary or deputy secretary using the process outlined in appendix A to DOE O 251.1C;
- include requirements for contractors if necessary, in the form of an attachment called a CRD; and
- Include detailed instructions describing how requirements are to be implemented, in the form of appendices.

Notices:

DOE notices

- have the same effect as an Order, but are issued in response to a departmental matter requiring prompt action to establish short-term management objectives;
- are documents developed by an OPI and issued by the Secretary or deputy secretary using the process outlined in appendix B to DOE O 251.1C;
- are expedited through the directives process and expire after one year;
- must be converted to or incorporated into an Order within one year of the effective date of the notice unless an extension is granted or the notice is allowed to expire; and
- may be extended through the issuance of another notice provided the conversion of the notice to an Order has been initiated.

Manuals:

DOE manuals

- supplement other directives, laws, regulations, or other requirements by providing more instructions or details on how the provisions of those directives or laws must be carried out throughout DOE;
- identify procedural requirements in more detail than Orders for DOE Federal employees and intended requirements for contractors, which must be in the form of the CRD attached to the manual; and
- will remain in effect until revised according to DOE O 251.1C and will be phased out over time as a result of DOE O 251.1C.

k. Discuss the DOE directives process.

The following is taken from DOE O 251.1C.

The following steps must be complied with for each new Order:

- The OPI must develop a justification memorandum that follows the prescribed template, justifies why the Order is necessary, describes anticipated costs associated with implementation, identifies issues that must be resolved or addressed, is accompanied when applicable by a one to two page outline of the Order that follows the directives principles outlined in DOE O 251.1C, and is signed by the SO initiating the proposed Order and sent to the Director, Office of Management, through the Office of Information Resources.
- Once the justification memorandum meets the prescribed requirements, the Office of Information Resources e-mails it to the directives review board (DRB) members for review.
- The director, Office of Management, will convene a biweekly meeting of the DRB to discuss justification memoranda. A senior representative from the office initiating each justification memorandum will be invited to address the DRB.
- The OPI (writer) that receives approval to proceed from the director, Office of Management, through the organization's SO will be given a specified number of days in which to develop a draft for submission to the Office of Information Resources. During this time, the OPIs must engage stakeholders and field offices and solicit any substantive technical comments on the draft, and engage appropriate program counsel.
- When the first draft is completed, the OPI must email a copy to the Office of Information Resources. The Office of Information Resources will then process the draft for posting in RevCom.
- Directives points of contact (DPCs) will have a specified number of days in which to solicit, reconcile, consolidate and submit proposed comments for approval by their SO or his/her designee. Review time frames will be consistent with the complexity of the document and need for technical review. The DOE departmental representative to the Defense Nuclear Facility Safety Board (DNFSB) must enter DNFSB comments into RevCom.
- After receiving comments, the OPI will have a specified number of days in which to consider comments and create a comment and response document and a redlined/strikeout second draft. When the documents are completed, the OPI must

email copies of the documents to the Office of Information Resources to be processed for a second posting in RevCom.

- At the end of the second posting, DPCs must submit either concurrence or nonconcurrence in RevCom and then forward any comments approved by their SOs or their designees to their respective DRB representatives. OPIs will then have a specified number of days in which to attempt to resolve any non-concurrences, after which time the SO responsible for the proposed Order or guide will submit the proposed Order or guide through the Office of Information Resources for approval. The departmental representative to the DNFSB will facilitate communication between the OPI and DNFSB. The proposed Order must be submitted through the Office of Information Resources and the Office of Management to the Deputy Secretary for approval.
- The Office of Information Resources will then present a final draft to the DRB members at their bi-weekly meeting for their concurrence. The director, Office of Management will serve as DRB representative for departmental staff/support offices not represented on the DRB. The director, Office of Management may invite SOs (or designee) to attend the DRB meeting, as appropriate. If DRB members reach consensus, the director, Office of Management, will present the proposed Order to the deputy secretary for approval.

I. Discuss the DOE rulemaking process.

The following is taken from U.S. Nuclear Regulatory Commission, NUREG/BR-0125, *Public Involvement in the Nuclear Regulatory Process*.

One of the primary duties of DOE is to establish regulations on the safe use of nuclear materials. These regulations are developed in collaboration with the NRC. The regulations address such issues as siting, design, construction, operation, and ultimate shutdown of nuclear power plants, uranium mills, fuel facilities, waste repositories, and transportation systems. The regulations also address other uses of nuclear materials, such as nuclear medicine programs at hospitals, academic activities, research work, industrial applications such as the use of gauges and testing equipment, and the import and export of nuclear materials and technologies. The process of developing these regulations is called rulemaking. A regulation is sometimes referred to as a rule. Rulemaking is initiated mostly by the NRC's technical staff, although any member of the public may petition the NRC to develop, change, or rescind any regulation.

Most rulemakings provide the public with at least one opportunity for comment in a process found in 5 U.S.C., section 553. Often, there are several opportunities. In some cases, NRC and/or DOE holds meetings and workshops before a proposed rule is drafted. This way, members of the public can express their concerns early in the process and identify important issues to be covered in the rule. Sometimes, the NRC publishes an advance notice of proposed rulemaking in the Federal Register main page, to present options, questions, and ideas, and the public is asked to comment on these options or present options of their own. An advance notice does not include a preferred approach for which comments are being solicited. After the public comment period is over, a decision is made whether or not to

continue with the rulemaking and if so, what form it will take. The NRC may issue an emergency rule or a minor administrative rule without seeking public comment.

When a proposed rule is developed, it is published in the Federal Register for public comment. The notice identifies a contact who can reply to questions and an address to which comments can be sent. The Department may hold meetings and workshops to discuss the proposed rule, explain its purpose and background, and receive further comments. These meetings are normally announced in the Federal Register.

m. Discuss the relationship between the DOE and other agencies, such as OSHA, Nuclear Regulatory Commission (NRC), and EPA.

The following is taken from Notice; Addendum to the Memorandum of Understanding: *To Formalize the Working Relationship Between the Department of Energy and the Department of Labor* (August 28, 1992).

On August 10, 1992, DOE and OSHA entered into a MOU delineating regulatory authority over the occupational safety and health of contract employees at DOE GOCO facilities. In general, the MOU recognizes that DOE exercises statutory authority under section 161(f) of the Atomic Energy Act of 1954, as amended, relating to the occupational safety and health of private-sector employees at these facilities.

Section 4(b)(1) of the Occupational Safety and Health Act of 1970, exempts from OSHA authority working conditions with respect to which other Federal agencies have exercised statutory authority to prescribe or enforce standards or regulations affecting occupational safety or health. The 1992 MOU acknowledges DOE's extensive regulation of contractor health and safety through safety orders, which require contractor compliance with all OSHA standards as well as additional requirements prescribed by DOE, and concludes with an agreement by the agencies that the provisions of the Occupational Safety and Health Act will not apply to GOCO sites for which DOE has exercised its authority to regulate occupational safety and health under the Atomic Energy Act.

In light of DOE's policy emphasis on privatization activities, OSHA and DOE entered into a second MOU on July 25, 2000; that establishes interagency procedures to address regulatory authority for occupational safety and health at specified privatized facilities and operations on DOE sites. The 2000 MOU specifically covers facilities and operations on lands that have been leased to private enterprises, which are not conducting activities for or on behalf of DOE and where there is no likelihood that any employee exposure to radiation from DOE sources would be 25 mrem/yr or more.

The following is taken from the *Policy on Decommissioning of Department of Energy Facilities Under the Comprehensive Environmental Response, Compensation, And Liability Act*.

Executive Order 12580 "Superfund Implementation" delegates from the President to the Secretary of Energy certain CERCLA response authorities for facilities under DOE jurisdiction, custody, or control. The EPA/DOE/DOD *Guidance on Accelerating CERCLA Environmental Restoration at Federal Facilities* reaffirms this point, stating that Federal

agencies, other than EPA, have jurisdiction for carrying out most response actions at federal facility sites. As EPA is not the lead agency at such sites, its role is different from that at other Superfund sites. Consistent with Executive Order 12580, the National Contingency Plan (NCP) designates DOE as the lead agency for responding to releases on, or where the sole source of the release is from, a facility under DOE's jurisdiction, custody, or control. As lead agency, DOE is authorized to conduct removal action, remedial action, and any other response measures consistent with the NCP. The exercise of such response authority must be in accordance with the requirements of section 120 of CERCLA. For facilities that are listed on the National Priorities List (NPL), section 120 of CERCLA requires DOE and EPA to enter into an interagency agreement (IAG), which establishes requirements for remedial action at the facility. Therefore, the roles and authority of DOE and EPA will be defined, in part, by the terms of such agreement. For non-NPL facilities, DOE may take response action subject to CERCLA, the NCP, and other applicable requirements.

DOE will use CERCLA response authority whenever a hazardous substance is released, or there is a substantial threat of release into the environment and response is necessary to protect public health, welfare, or the environment. DOE Orders require DOE to respond to any release or substantial threat of a release of a hazardous substance into the environment in a manner consistent with CERCLA and the NCP, regardless of whether or not the release or threatened release is from a site listed on the NPL.

The following is taken from Memorandum of Understanding Between the Department of Energy and the Nuclear Regulatory Commission.

The Atomic Energy Act created the United States Enrichment Corporation (USEC), a government corporation, for the purpose of managing and operating the uranium enrichment enterprise owned and previously operated by DOE. USEC subsequently leased from DOE, portions of the Portsmouth Gaseous Diffusion Plant (Portsmouth Site) and the Paducah Gaseous Diffusion Plant (Paducah Site) which related to the gaseous diffusion plant (GDP) process. The framework for DOE's authority to regulate nuclear safety, safeguards and security at the GDP sites was contained in the Regulatory Oversight Agreement (ROA)

The Energy Policy Act of 1992 also required the NRC to certify USEC's operation of the GDPs to ensure compliance with its safety, safeguards, and security requirements. DOE agreed to retain oversight of the plants until the NRC finished its certification process and was ready to assume jurisdiction.

In November 1996, NRC issued initial certificates of compliance for the plants. The certificates provided for a transition period before NRC assumed regulatory authority to allow USEC to complete actions such as procedural revisions and training. DOE continued regulatory oversight during this transition period. Transition to NRC regulatory oversight occurred on March 3, 1997. By agreement dated October 10, 1995, DOE and USEC agreed that the DOE ROA will continue to govern leased uncertified facilities or activities after NRC certification.

In June 2002, USEC Inc. (parent company of USEC) and DOE signed an Agreement whereby USEC Inc. made long-term commitments that will ensure stability for the domestic

uranium enrichment industry and provide a continued, reliable fuel source for the world's nuclear reactors.

The U.S. gas centrifuge technology was developed by the U.S. government and demonstrated by DOE until 1985. In September 2002, USEC Inc. signed a Cooperative Research and Development Agreement (CRADA) with UT-Battelle LLC, approved by DOE, to expand cooperative efforts to deploy proven U.S. gas centrifuge uranium enrichment technology.

USEC Inc.'s design will use the advantages of DOE's design while incorporating key technological advancements and cost reductions. UT-Battelle LLC and USEC Inc. will conduct further centrifuge development work at DOE;s East Tennessee Technology Park in Oak Ridge, TN, where centrifuge test facilities already exist.

USEC Inc. announced in December 2002 that it will site its American Centrifuge Lead Cascade Facility centrifuge uranium enrichment test and demonstration facility at DOE's Portsmouth Site. USEC Inc. submitted a 10 CFR 70 license application to the NRC in February 2003 to possess and use a limited quantity of special nuclear material in the American Centrifuge Demonstration Facility. In January 2004, the NRC completed its review of the application and issued its environmental assessment with a Finding Of No Significant Impact and Safety Evaluation Report. On February 24, 2004, the NRC issued a license for the Lead Cascade Facility after DOE approved the lease on February 17, 2004, allowing USEC Inc. to refurbish and subsequently operate the facility in accordance with its license application. The Lead Cascade will consist of up to 240 full-scale centrifuge machines in a closed cycle, enriching uranium within the process, while only withdrawing small quantities of low-enriched uranium for sampling purposes. The purpose of the Lead Cascade is to provide updated cost, schedule, and performance data to reduce the financial risks of eventually building a $1 billion to $1.5 billion commercial enrichment plant.

USEC has leased portions of DOE's gas centrifuge enrichment plant (GCEP) facilities at the Portsmouth Site. Following USEC's GCEP cleanup work, USEC Inc. will sublease from USEC these facilities for deploying the Lead Cascade. As described in USEC Inc.'s license application, a portion of the leased-GCEP Facilities will be regulated by NRC. The remaining portion of the leased-GCEP Facilities will be regulated by DOE.

n. Discuss the purpose of the Federal Facility Compliance Act (FFCA).

The following is taken from the Office of Health, Safety, and Security, *Federal Facility Compliance Act.*

Before the passage of the FFCA, the Federal government maintained that it was not subject to administrative and civil fines and penalties under solid and hazardous waste law due to the doctrine of sovereign immunity. The State of Ohio challenged the Federal government's claim of sovereign immunity in Ohio v. DOE. In this case, the U.S. Circuit Court of Appeals found in favor of the State, saying that the Federal government's sovereign immunity is waived under the Clean Water Act's (CWA's) sovereign immunity provision and the RCRA's citizen suit provision. The Circuit Court's decision was overturned by the Supreme Court on April 21, 1992, in DOE v. Ohio. The Supreme Court held that the waiver of

sovereign immunity in RCRA and CWA is not clear enough to allow states to impose civil penalties directly, although penalties could be pursued in certain situations.

After the high court's ruling, many in Congress believed that there was a need to enact legislation that would bring Federal facilities into the same legal framework as those in the private sector. The consensus among lawmakers was that there was a double standard in the United States by which the same government that developed laws to protect human health and the environment, and required compliance in the private sector, was itself not assuming the burden of compliance.

As a result, Congress enacted the FFCA, which effectively overturned the Supreme Court's ruling. In the legislation Congress specifically waived sovereign immunity with respect to RCRA for Federal facilities.

Under section 102, The FFCA amends section 6001 of RCRA to specify that Federal facilities are subject to all civil and administrative penalties and fines, regardless of whether such penalties or fines are punitive or coercive in nature. These penalties and fines can be levied by EPA or by authorized states. In addition, the FFCA states that the United States hereby expressly waives any immunity otherwise applicable to the United States. It should be noted that Federal agents, employees, and officers are not liable for civil penalties, however, they are subject to criminal sanctions. No departments, agencies, or instrumentalities are subject to criminal sanctions.

Section 104 (1) and (2) require EPA to conduct annual RCRA inspections of all Federal facilities. As part of the first inspection conducted under this authority, EPA is required to conduct a comprehensive ground water monitoring evaluation, unless such an evaluation was conducted in the preceding 12 months. Authorized states are also given authority to conduct inspection of Federal facilities for the purpose of enforcing compliance with the state hazardous waste program.

Under section 104(4), the Federal agency is required to reimburse EPA for reasonable service charges associated with conducting the inspections of its facilities. States are allowed to recover the costs of inspections under the authority granted in section 102(3). In the case of corrective action DOE can expect more frequent progress inspections by the regulator and that all eligible expenses incurred will have to be reimbursed. It should be noted that on an annual basis, EPA negotiates IAGs with other Federal agencies, including DOE, for reimbursement for these costs. Once the IAGs are executed and processed, only a few basic steps must be followed to use and track these funds appropriately.

o. Discuss the use of Memoranda of Understanding (MOU) and Memoranda of Agreement (MOA) with external agencies and organizations.

The following is taken from DOE Order 1280.1A.

A MOU is a written agreement broadly stating basic understandings of tasks and describing a method for performing these tasks between the Department and other signatory authorities which include: other Federal agencies; local, state, international, tribal, or other Government entities; the private sector; and educational institutions. An MOU is not a binding contract. It

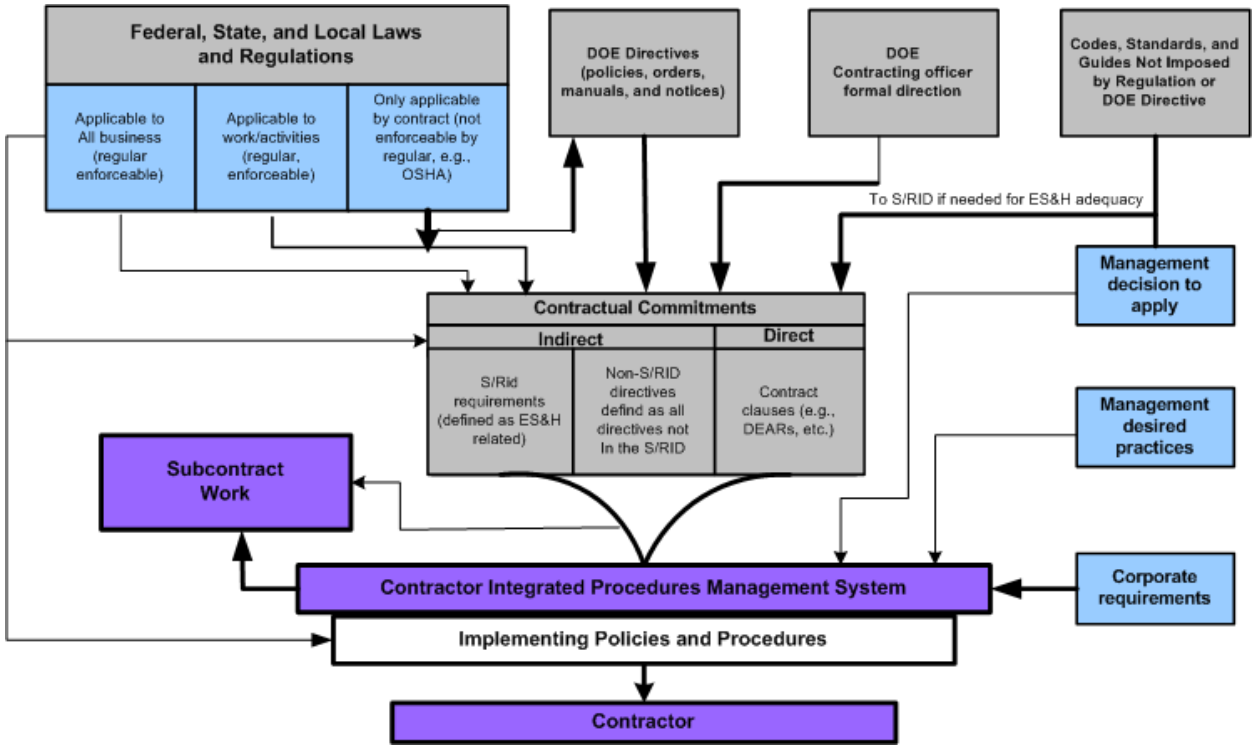
cannot be used to obligate or commit funds or as the basis for the transfer of funds. Agreements within DOE between departmental elements are not considered MOUs for purposes of this Order. A Memorandum of Agreement can be used between/among DOE elements.

p. Discuss the directives' flow down and their relationship to Contract List A and List B.

The following is taken from DOE G 440.1-8 (archived).

[Note: The archived guide is referenced because the current guide no longer provides the requisite information.]

Environment, safety, and health requirements in the form of laws, regulations, DOE directives, consensus standards, and others flow down from their source into the contractor's S/RID listing requirements that DOE agrees are applicable to the work and conditions at the site. The S/RID defines the applicability of requirements on a facility basis according to the work conducted and hazards present at each facility. The contract directs that all work be conducted according to the applicable requirements in the S/RID. From the S/RID, the applicable requirements flow down to policies and procedures established and maintained by the integrated procedures management system. These policies and procedures include controls tailored to the work/activity and the type and level of hazards present. An example of the site flow down process is shown in figure 8.



Source: DOE G 440.1-8

Figure 8. Site system for flowing down ES&H and other requirements to the work

List A and List B

The following is taken from 48 CFR 970.5204-2.

In performing work under a DOE contract, the contractor shall comply with the requirements of applicable Federal, state, and local laws and regulations (including DOE regulations). A list of applicable laws and regulations (list A) may be appended to the contract for information purposes.

In performing work under a DOE contract, the contractor shall comply with the requirements of those DOE directives, or parts thereof, identified in the list of applicable directives (list B) appended to the contract.

q. Discuss Public Law 104-113 regarding the use of industry consensus standards.

The following is taken from the Office of Health, Safety, and Security, National Technology Transfer and Advancement Act of 1995 [Public Law (PL) 104-113.

On March 7, 1996, President Clinton signed into law The National Technology Transfer and Advancement Act of 1995. The new law, referred to as PL 104-113, serves to continue the policy changes initiated in the 1980s under OMB Circular A-119, *Federal Participation in the Development and Use of Voluntary Standards*, that are transitioning the Executive branch of the Federal Government from a developer of internal standards to a customer of external standards. Section 12, Standards Conformity, of the act states that "...all Federal agencies and departments shall use technical standards that are developed and adopted by voluntary consensus standards bodies, using such technical standards as a means to carry out policy objectives or activities determined by the agencies and departments." The act further states that "...Federal agencies and departments shall consult with voluntary, private sector, consensus standards bodies, and shall ... participate with such bodies in the development of technical standards."

r. Discuss the purpose of the Federal Advisory Committee Act (FACA).

The following is taken from Wikipedia, *Federal Advisory Committee Act*.

The FACA defines advisory committee as any committee, board, commission, council, conference, panel, task force, or other similar group that dispenses advice or recommendations to the president of the United States, and excludes bodies that also exercise operational functions. Advisory committees are provisional bodies and have the advantage of being able to circumvent bureaucracy and collect a range of opinions.

Committees composed of full-time officers or employees of the Federal government do not count as advisory committees under FACA.

In drafting FACA, legislators wanted to ensure that advice by the various advisory committees is objective and accessible to the public by formalizing the process for establishing, operating, overseeing, and terminating the committees. The Committee Management Secretariat at the General Services Administration is charged with monitoring compliance.

In particular the act restricts the formation of such committees to only those that are deemed essential, limits their powers to provision of advice to officers and agencies in the executive branch of the Federal government, and limits the length of term during which any such committee may operate. Further, FACA was an attempt by Congress to curtail the rampant locker-room discussion that had become prevalent in administrative decisions. These locker-room discussions are masked under titles like task force, subcommittee, and working group meetings, which are less than full FACA meetings and so they do not have to be open to the public. FACA declared that all administrative procedures and hearings were to be public knowledge.

11. An STSM must have a working level knowledge of the Price-Anderson Amendments Act of 1988 (PAAA) and its impact on DOE nuclear safety activities.

a. Demonstrate an understanding of the PAAA.

The following is taken from American Nuclear Society, *Background for Position Statement 54*.

The Price-Anderson Act was enacted into law in 1957 and has been revised several times. It constitutes section 170 of the AEA. The latest revision was enacted through the Energy Policy Act of 2005, and extended it through December 31, 2025.

The main purpose of the PAAA is to ensure the availability of a large pool of funds to provide prompt and orderly compensation to members of the public who incur damages from a nuclear or radiological incident no matter who might be liable.

The PAAA provides omnibus coverage, that is, the same protection available for a covered licensee or contractor extends through indemnification to any persons who may be legally liable, regardless of their identity or relationship to the licensed activity. Because the PAAA channels the obligation to pay compensation for damages, a claimant need not sue several parties but can bring its claim to the licensee or contractor.

The following is taken from DOE Report to Congress on the Price-Anderson Act.

With respect to activities conducted for DOE, the PAAA achieves its objectives by requiring DOE to include an indemnification in each contract that involves the risk of a nuclear incident.

This DOE indemnification (1) provides omnibus coverage of a DOE contractor and all other persons who might be legally liable for injury or damage resulting from a nuclear incident; (2) indemnifies fully all legal liability up to the statutory limit on such liability; (3) covers any DOE contractual activity that might result in a nuclear incident in the United States; (4) is not subject to the availability of appropriated funds; and (5) is mandatory and exclusive. The DEAR sets forth standard nuclear indemnification clauses that are incorporated into all DOE contracts and subcontracts involving source, special nuclear, or by-product material.

b. Demonstrate an understanding of the Act's applicability to the Department's nuclear safety activities, and specifically to each of the site's facilities and major activities.

The following is taken from DOE Report to Congress on the Price-Anderson Act.

Subsequent to the enactment of the 1988 PAAA amendments, DOE has undertaken several initiatives to improve the safety of its nuclear activities. These initiatives include (1) greater emphasis on the identification and implementation of appropriate nuclear safety requirements; (2) creation of the Office of Enforcement and Investigations and increased use of field offices to enforce nuclear safety; (3) contract reform, including the adoption of ISM requirements in DOE contracts; and (4) more independent oversight of nuclear safety matters and public participation in decisions concerning the safety of DOE nuclear activities.

Identification and Implementation of Nuclear Safety Requirements

DOE has enhanced the quality of the safety requirements applicable to its nuclear activities in several ways. DOE streamlined the nuclear safety orders and related documents in the DOE directives system to reduce unnecessary and redundant requirements. At the same time, where appropriate, DOE adopted certain requirements as regulations through the rulemaking process. Specifically, DOE adopted (1) procedural rules for DOE nuclear activities, including procedures for investigating possible violations of nuclear safety requirements and assessing civil penalties where such violations occur; (2) radiological protection rules for workers and other persons involved in the conduct of DOE nuclear activities; (3) QA rules; (4) rules on workplace substance abuse programs at DOE sites; and (5) whistleblower protection rules. DOE currently is considering the need for additional regulatory requirements on safety management and on radiological protection of the public and the environment. In addition, DOE has engaged in a comprehensive exercise to ensure that appropriate nuclear safety requirements are identified and implemented with respect to DOE activities. The department standards committee (DSC) has coordinated efforts to ensure that the requirements used in connection with a particular activity are sufficient to ensure adequate protection of workers, members of the public, and the environment in a manner commensurate with the type and complexity of the activity and the associated hazards. To accomplish this task, the DSC developed the necessary and sufficient process to identify environment, health, and safety requirements appropriate for a particular DOE activity. This process is based on defining the work to be performed and analyzing the hazards associated with the work.

Enforcement Program

DOE established the Office of Enforcement and Investigations, which reports to the assistant secretary for ES&H, to investigate possible violations of the nuclear safety requirements and, where appropriate, to impose civil penalties and other remedies and corrective actions. DOE field office and program personnel assist in investigations and enforcement and provide regular oversight of contractor activities.

Contract Reform

DOE has undertaken an extensive reform of its contracting process to improve the management of work and safety throughout the DOE complex. Specifically, DOE has revised the DEAR to include provisions on performance-based contracting, competition, award fees,

property management, recordkeeping, insurance, litigation, claims, accountability provisions, and the conditional fee policy. The most significant contract reform affecting nuclear safety is the adoption of DEAR clauses that mandate (1) the use of ISMSs and (2) the identification of laws, regulations, and DOE directives to be applied to activities under DOE contracts.

DOE adopted the DEAR clause on the "integration of environment, safety and health into work planning and execution" to create a standard prescribed contract clause on how contractors should perform work in a manner that ensures adequate protection for employees, the public, and the environment. It provides for (1) defining the scope of work; (2) identifying and analyzing hazards associated with the work; (3) developing and implementing hazard controls; (4) performing work within controls; and (5) providing feedback on adequacy of controls and continuing to improve safety management. The clause establishes the principles that (1) line managers must be given responsibility and held accountable for implementing health and safety requirements; (2) clear lines of authority and responsibility must be established; (3) workers and managers must have competence to assess and deal with the hazards; (4) resources must be effectively allocated; (5) hazards must be evaluated and an agreed-upon set of standards and requirements must be established before work is performed; (6) administrative and engineering controls must be tailored to the work and associated hazards; and (7) conditions and authorization authorities must be agreed upon. The clause specifically requires each contractor to submit an SMS description for DOE approval that explains how the contractor will implement the system to establish performance objectives, measures and commitments; integrate work planning; hazards assessment; hazard controls; budget and resource planning; and continuous improvement.

DOE also developed a DEAR clause on "laws, regulations and DOE directives" and made it an integral part of the SMS. This clause requires clear identification of requirements, including nuclear safety requirements, to be implemented in connection with nuclear activities under a contract. In general, the clause requires a contractor either to incorporate all applicable requirements in DOE Orders and regulations or to use a tailoring process to develop a set of environment, health, and safety requirements that is commensurate with the complexities and hazards associated with the work to be performed under the contract.

Independent Oversight and Public Participation

Since its creation in 1988, the DNFSB has provided independent oversight of DOE defense nuclear facilities and made many valuable recommendations on nuclear safety issues. Implementing these recommendations has been and continues to be an impetus for enhancing safety throughout the DOE complex. The DNFSB's annual report to Congress provides a categorization of recommendations by complexity, lead organization, and progress toward completion. In addition, DOE has established an oversight program within the office of the assistant secretary for ES&H to independently inspect and assess ES&H and S&S at its facilities.

DOE has adopted and implemented a public participation policy. This policy fosters improvements in nuclear safety by ensuring decisions benefit from the perspective of those interested in and affected by DOE activities, such as workers and those who live in communities where DOE activities take place.

In furtherance of this policy, DOE has established citizens' advisory boards at all its major sites to establish open, ongoing, two-way communication, formal and informal, between DOE and its stakeholders. This process provides a diverse collection of opinions, perspectives, and values and enables each party to learn about and better understand the other's views and positions. As a result of such communication, DOE can make better, more informed decisions.

c. Demonstrate an understanding that violations of applicable nuclear safety rules and regulations are enforceable criminally and civilly.

Criminal Penalties

The following is taken from 10 CFR 820.71.

If a person subject to the AEA of 1954, as amended (Act) or the DOE nuclear safety requirements has, by act or omission, knowingly and willfully violated, caused to be violated, attempted to violate, or conspired to violate any section of the Act or any applicable DOE nuclear safety requirement, the person shall be subject to criminal sanctions under the Act.

If there is reason to believe a criminal violation of the Act or the DOE nuclear safety requirements has occurred, DOE may refer the matter to the Attorney General of the United States for investigation or prosecution.

Civil Penalties

The following is taken from 10 CFR 820.81.

Any person subject to a penalty under 42 U.S.C. 2282a shall be subject to a civil penalty in an amount not to exceed $150,000 for each such violation. If any violation under 42 U.S.C. 2282a is a continuing one, each day of such violation shall constitute a separate violation for the purpose of computing the applicable civil penalty.

d. Demonstrate an understanding of the topics below, associated with the PAAA:

- **"Procedural Rules for DOE Nuclear Activities" (10 CFR 820)**
- **"Documented Safety Analyses" (10 CFR 830 Subpart B)**
- **"Un-reviewed Safety Questions" (10 CFR 830 Subpart B)**
- **"Quality Assurance Requirements" (10 CFR 830 Subpart A)**
- **"Technical Safety Requirements" (10 CFR 830 Subpart B)**
- **"Occupational Radiation Protection" (10 CFR 835)**

Procedural Rules for DOE Nuclear Activities

10 CFR 820.1 sets forth the procedures to govern the conduct of persons involved in DOE nuclear activities and, in particular, to achieve compliance with the DOE nuclear safety requirements by all persons subject to those requirements.

Documented Safety Analysis

The following is taken from 10 CFR 830.204.

The documented safety analysis for a hazard category 1, 2, or 3 DOE nuclear facility must, as appropriate for the complexities and hazards associated with the facility

- describe the facility;
- provide a systematic identification of natural and man-made hazards associated with the facility;
- evaluate normal, abnormal, and accident conditions, including consideration of natural and man-made external events; identify energy sources or processes that might contribute to the generation or uncontrolled release of radioactive and other hazardous materials; and consider the need for analysis of accidents which may be beyond the design basis of the facility;
- derive the hazard controls necessary to ensure adequate protection of workers, the public, and the environment; demonstrate the adequacy of these controls to eliminate, limit, or mitigate identified hazards; and define the process for maintaining the hazard controls current at all times and controlling their use;
- define the characteristics of the safety management programs necessary to ensure the safe operation of the facility, including (where applicable) quality assurance, procedures, maintenance, personnel training, conduct of operations, emergency preparedness, fire protection, waste management, and radiation protection; and
- define, with respect to a nonreactor nuclear facility with fissionable material in a form and amount sufficient to pose a potential for criticality, a criticality safety program that
  - ensures that operations with fissionable material remain subcritical under all normal and credible abnormal conditions;
  - identifies applicable nuclear criticality safety standards; and
  - describes how the program meets applicable nuclear criticality safety standards.

Unreviewed Safety Questions

The following is taken from 10 CFR 830.203.

The contractor responsible for a hazard category 1, 2, or 3 DOE nuclear facility must implement the DOE-approved USQ procedure in situations where there is a

- temporary or permanent change in the facility as described in the existing DSA;
- temporary or permanent change in the procedures as described in the existing DSA;
- test or experiment not described in the existing DSA; or
- potential inadequacy of the DSA because the analysis potentially may not be bounding or may be otherwise inadequate.

Quality Assurance Requirements

The following is taken from 10 CFR 830.121.

The contractor responsible for a DOE nuclear facility must

- submit a QAP to DOE for approval and regard the QAP as approved 90 days after submittal, unless it is approved or rejected by DOE at an earlier date;
- modify the QAP as directed by DOE;
- annually submit any changes to the DOE-approved QAP to DOE for approval. Justify in the submittal why the changes continue to satisfy the quality assurance requirements; and
- conduct work according to the QAP.

The QAP must

- describe how the quality assurance criteria of 10 CFR 830.122, "Quality Assurance Criteria," are satisfied;
- integrate the quality assurance criteria with the SMS, or describe how the quality assurance criteria apply to the SMS;
- use voluntary consensus standards in its development and implementation, where practicable and consistent with contractual and regulatory requirements, and identify the standards used; and
- describe how the contractor responsible for the nuclear facility ensures that subcontractors and suppliers satisfy the criteria of 10 CFR 830.122.

Technical Safety Requirements

The following is taken from 10 CFR 830.205.

A contractor responsible for a hazard category 1, 2, or 3 DOE nuclear facility must

- develop TSRs that are derived from the DSA;
- prior to use, obtain DOE approval of TSRs and any change to TSR; and
- notify DOE of any violation of a TSR.

Occupational Radiation Protection

The following is taken from 10 CFR 835.101.

A DOE activity shall be conducted in compliance with a documented radiation protection program (RPP) as approved by the DOE.

The DOE may direct or make modifications to a RPP.

The content of each RPP shall be commensurate with the nature of the activities performed and shall include formal plans and measures for applying the ALARA process to occupational exposure.

The RPP shall specify the existing and/or anticipated operational tasks that are intended to be within the scope of the RPP. Except as provided in 10 CFR 835.101, any task outside the scope of a RPP shall not be initiated until an update of the RPP is approved by DOE.

The content of the RPP shall address, but shall not necessarily be limited to, each requirement in this part.

The RPP shall include plans, schedules, and other measures for achieving compliance with regulations of this part.

An update of the RPP shall be submitted to DOE.

e. Discuss the role of Federal line management with respect to implementing the requirements of the PAAA.

The following is taken from the PAAA training presentation at http://www.efcog.org/wg/ec/docs/PAAA%20Training.pdf.

Under the PAAA, line management is responsible for implementing and assuring compliance with nuclear safety requirements, which include

- 10 CFR 708—"DOE Contractor Employee Protection Program" (whistleblower)
- 10 CFR 820—"Procedural Rules for DOE Nuclear Activities"
- 10 CFR 830—"Nuclear Safety Management", subpart A: "Quality Assurance" and subpart B: "Safety Basis"
- 10 CFR 835—"Occupational Radiation Protection"

The following is taken from DOE O 226.1B.

DOE line management must establish and communicate performance expectations to contractors through formal contract mechanisms. Such expectations must be established on an annual basis, or as otherwise required or determined appropriate by the field element.

f. Discuss the role of the site's Enforcement or PAAA Coordinator.

The following is taken from Fermilab ES&H Manual, *Noncompliance Tracking System (NTS).*

PAAA- Coordinator or Alternate is responsible for

- entering non-compliances into the NTS;
- conducting a quarterly review of reported incidents, inspection reports, and program reviews to identify programmatic trends which need to be screened for NTS submission, and notifying the PAAA Coordinator and/or Alternate;
- inputting any audit, review or trending analysis which meets NTS reporting requirements;
- coordinating through the host Division/Center/Section for information review;
- ensuring forms are completed in a timely manner; and
- tracking corrective actions and closing them out in NTS on receiving report by the Division/Center/Section.

g. Review the supporting management systems (e.g., Noncompliance Tracking System (NTS)) and recent PAAA notices and decisions with the site's Enforcement or PAAA Coordinator to determine close-out status and verification of corrective actions.

This is a performance-based KSA. The Qualifying Official will evaluate its completion.

12. An STSM must have a working level knowledge of the Defense Nuclear Facilities Safety Board's (DNFSB) purpose and their interaction with the DOE.

a. Discuss the enabling legislation and the purpose of the DNFSB.

The following is taken from DOE M 140.1-1B.

DNFSB is an independent executive branch establishment responsible for providing advice and recommendations to the president and the secretary of energy regarding public health and safety issues at departmental defense nuclear facilities.

The board was established by Congress in 1988 to perform the functions summarized in the following:

- Review and evaluate the content and implementation of the standards relating to the design, construction, operation, and decommissioning of departmental defense nuclear facilities.
- Investigate any event or practice at departmental defense nuclear facilities that has adversely affected or may adversely affect public health and safety.
- Analyze design and operational data, including safety analysis reports, from any departmental defense nuclear facility.
- Review the design and construction of a new departmental defense nuclear facility and make recommendations considered necessary to protect public health and safety.
- Make such recommendations to the secretary with respect to departmental defense nuclear facilities, including operations of such facilities, standards, and research needs, as the board determines are necessary to ensure adequate protection of public health and safety.

b. Identify and discuss applicable DNFSB Recommendations.

The following is taken from DOE M 140.1-1B.

The Board issues recommendations to the secretary on issues or circumstances it determines need to be resolved to ensure adequate protection of the public health and safety. The secretary must respond to each Board recommendation within 45 days of its publication in the Federal Register.

c. Identify and discuss Department Implementation Plans and commitments made in response to DNFSB Recommendations.

The following is taken from DOE M 140.1-1B.

When a Board recommendation is received, the departmental representative must coordinate with the affected secretarial officers to designate the CSO. If necessary, the deputy secretary must resolve any disagreements regarding designation of the CSO. The CSO must oversee the development of the Department's response. If the recommendation is accepted, the cognizant secretarial office also must oversee development of the associated implementation plan and resolution of the applicable safety issues, through to the ultimate closure of the recommendation.

The CSO must designate a responsible manager, typically a deputy assistant secretary or operations/area office manager or equivalent, to manage development and implementation of an adequate response and, if necessary, an implementation plan for resolving the Board recommendation. The responsible manager should possess sufficient stature and authority to obtain the necessary commitments of action from the various organizations involved. An operations/area office manager should be considered for recommendations that are limited to a single site; a deputy assistant secretary is more appropriate for recommendations with implications for multiple sites and organizations. This responsible manager may, in turn, identify a technical lead to assist in coordinating response development and implementation planning. The selection of an appropriate responsible manager and an experienced technical

lead with the necessary technical, communications, and management skills is key to the Department's success. The continuous commitment of the responsible manager and technical lead throughout the life of a recommendation has also proven to be important for effective departmental interface with the Board.

The secretary must submit an implementation plan to the Board within 90 days of the date that the secretary's acceptance of the recommendation is published in the Federal Register. The response team should begin implementation plan development immediately after the recommendation is received and conduct plan development in parallel with development of the Department's response. The CSO, responsible manager, and response team that developed the Department's response should develop the associated implementation plan.

The primary purpose of the implementation plan is to describe the appropriate actions and schedule for ensuring that the accepted recommendation is resolved. The Board uses the following six substantive criteria to judge the adequacy of an implementation plan:

1. Understanding. The implementation plan must show an understanding of the safety issues raised by the Board's recommendation.
2. Responsiveness. The Department's planned course of action must address the complete Board recommendation and accomplish satisfactory resolution of the underlying safety issues.
3. Assumptions. The important baseline assumptions for successful plan implementation must be detailed.
4. Planning Detail. The Department's approach to resolve the associated safety issues must be described in sufficient detail to permit the Board to independently determine that the approach and schedule are reasonable and achievable.
5. Technical Basis. The Department's plan must be based on sound evaluation, including identification of the underlying causes.
6. Focus on Closure. The Department's plan must define completion deliverables for demonstrating safety issue resolution in a verifiable manner.

d. Discuss the roles and responsibilities of the Departmental Representative to the DNFSB as described in DOE M 140.1-1B, *Interface with the Defense Nuclear Facilities Safety Board.*

The following is taken from DOE M 140.1-1B.

The departmental representative to the Board has the following roles and responsibilities:

- Represents the secretary in regular and continuing interactions with the Board
- Advises the secretary, deputy secretary, secretarial officers, and other departmental officials on Board priorities, concerns, actions, and plans
- Manages departmental interface activities and provides direction and advice to line management on Board-related matters
- Coordinates with affected secretarial officers and designates a CSO to respond to a Board recommendation, Board correspondence, or other Board issue
- Facilitates communication and cooperation between departmental elements and the Board and its staff

- Reviews written communications to the Board for consistency and responsiveness, and provides concurrence approval or disapproval
- Manages the Department's safety issues management system for Board-related issues, commitments, and actions
- Maintains awareness of line implementation of departmental commitments to the Board and takes appropriate action to focus line management attention on resolving the identified safety and management issues
- Prepares reports on Board-related activities for senior departmental management, Congress, and the president
- Provides guidance and training on DOE M 140.1-1B to departmental points of contact and support personnel.
- Maintains and distributes a listing of key departmental personnel for Board-related activities.
- Maintains the Department's central repository of official Board communications and makes this information available to departmental personnel, contractor personnel, and the public.
- Facilitates Board review of and comment resolution on departmental directives, rules, and standards.

e. Prepare and/or participate in a briefing, implementation plan, or other correspondence to the DNFSB on the status of a Departmental activity or initiative.

This is a performance-based KSA. The Qualifying Official will evaluate its completion.

13. An STSM must have a working level knowledge of Contractor Assurance Systems and risk management, including problem identification, solving, and decision making techniques.

a. Identify the responsibilities of Heads of Field Elements/Heads of Contracting Activities in providing oversight of contractor activities as described in DOE O 226.1B, *Implementation of DOE Oversight Policy*.

The following is taken from DOE O 226.1B.

The heads of field elements/heads of contracting activities responsibilities are the following:

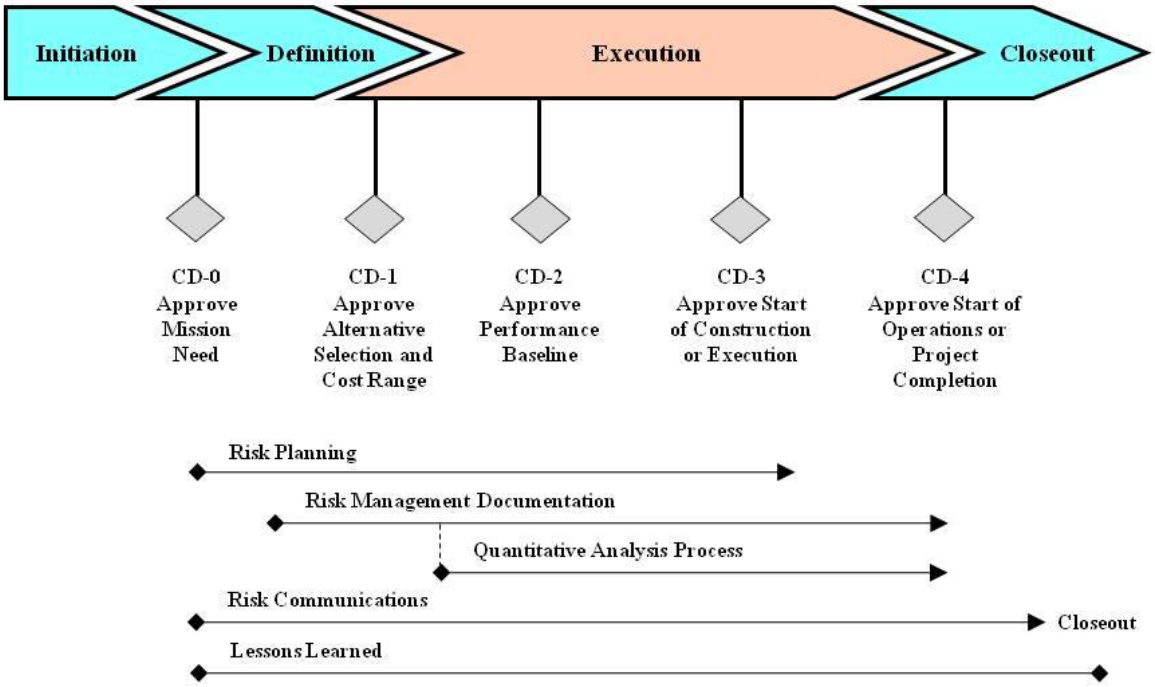
- Establish oversight programs and implement the requirements in DOE O 226.1B.
- Notify the contracting officer of affected contracts so that the CRD, or its applicable requirements, may be incorporated into those affected contracts as appropriate.
- Establish and implement line management oversight programs and processes at the field element level to meet the requirements of DOE O 226.1B and hold personnel accountable for implementing these programs and processes.
- Approve the initial contractor assurance system description. Review and assess the effectiveness of the contractor assurance system.
- Establish performance expectations and communicate same to contractors through formal contract mechanisms.

- Use the results of DOE line and independent oversight and contractor assurance systems to make informed decisions about corrective actions and the acceptability of risks and to improve the effectiveness and efficiency of programs and site operations.

b. Discuss the principles and concepts of risk management and its application in oversight programs, requirements development, and correct action development.

The following is taken from DOE 413.3-7.

Wherever possible, the project phases should be aligned with the risk management process to allow an integrated view. Figure 9 provides a view of the steps of the risk management process against the Critical Decision Phases of a project. While this view presents a static view of risk management, it is not meant to infer that the process is static. Instead it is meant to demonstrate when one should initiate for the first time certain process steps.



Source: DOE G 413.3-7

Figure 9. Critical Decision Phases with Continuous and Iterative Risk Management

The risk management plan should be included in or referenced in the preliminary project execution plan during CD-1.

While the process flow appears linear, the process itself is iterative and not necessarily consecutive. The risk planning step, for example, is continuous throughout the project life cycle, as is the need for risk communication and documentation. The pattern that is represented by a linear process diagram demonstrates that certain steps generally precede others; however, as the project proceeds, the review processes do not necessarily progress in the same manner.

Risk Planning

The risk planning process should begin as early in the project life cycle as possible. Planning sets the stage and tone for risk management and involves many critical initial decisions that should be documented and organized for interactive strategy development.

Risk planning is conducted by the integrated project team (IPT) (if assembled by this time) and a Federal project director (FPD) or an assigned lead federal employee if the FPD is not yet assigned. Risk planning should establish methods to manage risks, including metrics and other mechanisms or determining and documenting modifications to those metrics and mechanisms. A communication structure should be developed to determine whether a formal risk management communication plan should be written and executed as part of the tailoring decisions to be made in regard to the project. Input to the risk planning process includes the project objectives, assumptions, mission need statement, customer/stakeholder expectations, and site office risk management policies and practices.

The team should also establish what resources, both human and material, would be required for successful risk management on the project. Further, an initial reporting structure and documentation format should also be established for the project.

Risk Assessment

Risk assessment includes the overall processes of risk identification and analysis. The risk assessment process identifies, analyzes, and quantifies potential program and project risks in terms of probability and consequences. Risk analysis is a technical and systematic process that is designed to examine risks, identify assumptions regarding those risks, identify potential causes for those risks, and determine any relationships to other identified risks, as well as stating the overall risk factor in terms of the probability and consequence, if the risk should occur. Risk identification and analysis are performed sequentially with identification being the first step.

Risk Identification

As with each step in the risk management process, risk identification should be done continuously throughout the project life cycle. As projects change—particularly in terms of budget, schedule, or scope—or when a mandatory review or update is required, the risk identification process should be iterated, at least in part. Post CD-1, the Risk Register should be evaluated at least quarterly.

To begin risk identification, break the project elements into a risk breakdown structure that is the hierarchical structuring of risks. The risk breakdown structure is a structured and organized method to present the project risks and to allow for an understanding of those risks in one or more hierarchical manners to demonstrate the most likely source of the risk. The risk breakdown structure provides an organized list of risks that represents a coherent portrayal of project risk and lends itself to a broader risk analysis. The upper levels of the structure can be set to project, technical, external, and internal risks; the second tier can be set to cost, schedule, and scope. Each tier can be broken down further as it makes sense for the project and lends itself to the next step of risk analysis. To be useful, the risk breakdown structure should have at least three tiers.

Such a breakdown is just one methodology, as the type of project or project organization may dictate the best risk breakdown structure to apply. Templates for project types may be found in the literature for software projects, construction projects, and others; however, these templates should be modified based upon the specifics of the project being undertaken. The reason for this statement is that the taxonomy to be used is often project specific and scope dependent.

Assignment of Probability and Consequence

Risk analysis has two dimensions—probability and consequence. Probability is the likelihood of an event occurring, expressed as a qualitative and/or quantitative metric. Consequence is the outcome of an event. The outcome of an event may include cost and/or schedule impacts. The initial assessments should assume that no risk handling strategy has been developed. After the risk mitigation approach is identified and a decision made to implement the mitigation, the mitigation cost becomes part of the line item cost and not the contingency. Only the remaining residual risk should be included in the risk register and contingency analysis. During the qualitative analysis, the probability and consequence scales can be categorical. However, it is often useful to assign quantitative metrics to the qualitative categories to help ensure consistent assignment of probabilities and consequences across a project. This approach works well for probability and consequence.

Assignment of Risk Trigger Metrics

A risk trigger metric is an event, occurrence or sequence of events that indicates that a risk may be about to occur, or the pre-step for the risk indicating that the risk will be initiated. The risk trigger metric is assigned to the risk at the time the risk is identified and entered into the risk register. The trigger metric is then assigned a date that would allow both the risk owner and the FPD to monitor the trigger. The purpose of monitoring the trigger is to allow adequate preparation for the initiation of the risk handling strategy and to verify that there is adequate cost and schedule to implement the risk handling strategy.

Risk Register

The risk register is the information repository for each identified risk. It provides a common, uniform format to present the identified risks. The level of risk detail may vary depending upon the complexity of the project and the overall risk level presented by the project as determined initially at the initiation phase of the project.

Risk Analysis

Risk analysis should begin as early in the project life cycle as possible. The simplest analysis is a cost and benefit review, a type of qualitative review. The qualitative approach involves listing the presumed overall range of costs over the presumed range of costs for projected benefits. The result would be a high level overall assessment of the risks on the project.

After CD-1 approval, two forms of risk analysis may be performed: Qualitative and quantitative. These analyses serve as the foundation for continuing dialog about future risk realizations and the need for the application of the contingency and management reserve, which are subjects addressed in other DOE G 413.3-series guides that handle cost and contingency calculations.

c. Identify and discuss the minimum elements of a contractor assurance system.

The following is taken from DOE O 226.1B.

The contractor assurance system, at a minimum, must include the following:

- A method for validating the effectiveness of assurance system processes. Third party audits, peer reviews, independent assessments, and external certification may be used and integrated into the contractor's assurance system to complement, but not replace, internal assurance systems.
- Rigorous, risk-informed, and credible self-assessment and feedback and improvement activities. Assessment programs must be risk-informed, formally described and documented, and appropriately cover potentially high consequence activities.
- A structured issues management system that is formally described and documented and that
  - captures program and performance deficiencies in systems that provide for timely reporting, and takes compensatory corrective actions when needed; and
  - contains an issues management process that is capable of categorizing the significance of findings based on risk and priority and other appropriate factors that enables contractor management to ensure that problems are evaluated and corrected on a timely basis. For issues categorized as higher significance findings, contractor management must ensure the following activities are completed and documented:
    - A thorough analysis of the underlying causal factors is completed;
    - Timely corrective actions that will address the cause(s) of the findings and prevent recurrence are identified and implemented;
    - After completion of a corrective action or a set of corrective actions, an effectiveness review is conducted using trained and qualified personnel that can validate the effectiveness of corrective action/plan implementation and results in preventing recurrences; and
    - Documentation of the analysis process and results described in (1) above, and maintenance and tracking to completion of plans and schedules for the corrective actions and effectiveness reviews described in (2) and (3) above in a readily accessible system.
    - Communicates issues and performance trends or analysis results up the contractor management chain to senior management using a graded approach that considers hazards and risks, and provides sufficient technical basis to allow managers to make informed decisions and correct negative performance/compliance trends before they become significant issues.
      - Timely and appropriate communication to the CO, including electronic access of assurance-related information.
      - Continuous feedback and improvement, including worker feedback mechanisms, improvements in work planning and hazard identification activities, and lessons learned programs.
      - Metrics and targets to assess the effectiveness of performance, including benchmarking of key functional areas with other DOE contractors, industry, and research institutions.

The contractor must submit an initial contractor assurance system description to the CO for DOE review and approval. That description must clearly define processes, key activities, and accountabilities. An implementation plan that considers and mitigates risks should also be submitted if needed and should encompass all facilities, systems, and organization elements. Once the description is approved, timely notification must be made to the CO of significant assurance system changes prior to the changes being made.

To facilitate appropriate oversight, contractor assurance system data must be documented and readily available to DOE. Results of assurance processes must be analyzed, compiled, and reported to DOE as requested by the CO.

d. Describe and explain the application of problem analysis techniques in

- **root cause analysis**
- **causal factor analysis**
- **change analysis**
- **barrier analysis**

Root Cause Analysis

The following is taken from Wikipedia, *Root Cause Analysis*.

Root cause analysis (RCA) is a class of problem solving methods aimed at identifying the root causes of problems or events.

The practice of RCA is predicated on the belief that problems are best solved by attempting to address, correct, or eliminate root causes, as opposed to merely addressing the immediately obvious symptoms. By directing corrective measures at root causes, it is more probable that problem recurrence will be prevented. However, it is recognized that complete prevention of recurrence by one corrective action is not always possible.

Nevertheless, in the U.S. nuclear power industry the NRC requires that “In the case of significant conditions adverse to quality, the measures shall assure that the cause of the condition is determined and corrective action taken to prevent repetition.” In practice more than one cause is allowed and more than one corrective action is not forbidden.

Conversely, there may be several effective measures (methods) that address the root causes of a problem. Thus, RCA is often considered to be an iterative process, and is frequently viewed as a tool of continuous improvement.

RCA is typically used as a reactive method of identifying event(s) causes, revealing problems and solving them. Analysis is done after an event has occurred. Insights in RCA may make it useful as a pro-active method. In that event, RCA can be used to forecast or predict probable events even before they occur. While one follows the other, RCA is a completely separate process to incident management.

Root cause analysis is not a single, sharply defined methodology; there are many different tools, processes, and philosophies for performing RCA. However, several very-broadly defined approaches or schools can be identified by their basic approach or field of origin; safety-based, production-based, process-based, failure-based, and systems-based:

- Safety-based RCA descends from the fields of accident analysis and occupational safety and health.
- Production-based RCA has its origins in the field of quality control for industrial manufacturing.
- Process-based RCA is basically a follow-on to production-based RCA, but with a scope that has been expanded to include business processes.
- Failure-based RCA is rooted in the practice of failure analysis as employed in engineering and maintenance.
- Systems-based RCA has emerged as an amalgamation of the preceding schools, along with ideas taken from fields such as change management, risk management, and systems analysis.

Despite the different approaches among the various schools of root cause analysis, there are some common principles. It is also possible to define several general processes for performing RCA.

GENERAL PRINCIPLES OF ROOT CAUSE ANALYSIS

The primary aim of RCA is to identify the factors that resulted in the nature, the magnitude, the location, and the timing of the harmful outcomes of one or more past events to identify what behaviors, actions, inactions, or conditions need to be changed to prevent recurrence of similar harmful outcomes and to identify the lessons to be learned to promote the achievement of better consequences.

To be effective, RCA must be performed systematically, usually as part of an investigation, with conclusions and root causes that are identified and backed up by documented evidence. Usually a team effort is required.

There may be more than one root cause for an event or a problem, the difficult part is demonstrating the persistence and sustaining the effort required to determine them.

The purpose of identifying all solutions to a problem is to prevent recurrence at lowest cost in the simplest way. If there are alternatives that are equally effective, then the simplest or lowest cost approach is preferred.

Root causes identified depend on the way in which the problem or event is defined. Effective problem statements and event descriptions are helpful, or even required.

To be effective, the analysis should establish a sequence of events or timeline to understand the relationships between contributory factors, root cause(s) and the defined problem or event to prevent in the future.

Root cause analysis can help to transform a reactive culture into a forward-looking culture that solves problems before they occur or escalate. More importantly, it reduces the

frequency of problems occurring over time within the environment where the RCA process is used.

RCA is a threat to many cultures and environments. Threats to cultures often meet with resistance. There may be other forms of management support required to achieve RCA effectiveness and success. For example, a non-punitive policy toward problem identifiers may be required.

GENERAL PROCESS FOR PERFORMING AND DOCUMENTING AN RCA-BASED CORRECTIVE ACTION

1. Define the problem or describe the event factually. Include the qualitative and quantitative attributes of the harmful outcomes. This usually includes specifying the natures, the magnitudes, the locations, and the timing of events.
2. Gather data and evidence, classifying it along a timeline of events to the final failure or crisis. For every behavior, condition, action, and inaction specify in the timeline what should have been done when it differs from what was actually done.
3. Ask "why" and identify the causes associated with each step in the sequence towards the defined problem or event. "Why" is taken to mean "What were the factors that directly resulted in the effect?"
4. Classify causes into causal factors that relate to an event in the sequence and root causes, which if eliminated, can be agreed to have interrupted that step of the sequence chain.
5. Identify all other harmful factors that have equal or better claim to be called "root causes."If there are multiple root causes, which is often the case, reveal those clearly for later optimum selection.
6. Identify corrective action(s) that will with certainty prevent recurrence of each harmful effect, including outcomes and factors. Check that each corrective action would, if pre-implemented before the event, have reduced or prevented specific harmful effects.
7. Identify solutions that, with consensus agreement of the group, and when effective, prevent recurrence with reasonable certainty, are within the STSM's control, meet goals and objectives, and do not cause or introduce other new, unforeseen problems.
8. Implement the recommended root cause correction(s).
9. Ensure effectiveness by observing the implemented recommendation solutions.
10. Identify other methodologies for problem solving and problem avoidance that may be useful.
11. Identify and address the other instances of each harmful outcome and harmful factor

Video 19. Root cause analysis
http://www.youtube.com/watch?v=GOVeO5_0qD0

Causal Factor Analysis

The following is taken from *Causal Factor Tree Analysis* by Bill Wilson.

Typically, a causal factor tree is used to investigate a single adverse event or consequence, which is usually shown as the top item in the tree. Factors that were immediate causes of this effect are then displayed below it, linked to the effect using branches. Note that the set of

immediate causes must meet certain criteria for necessity, sufficiency, and existence. Proof of existence requires evidence.

Once the immediate causes for the top item in the tree are shown, then the immediate causes for each of these factors can be added, and so on. Every cause added to the tree must meet the same requirements for necessity, sufficiency, and existence. Eventually, the structure begins to resemble a tree's root system. Chains of cause and effect flow upwards from the bottom of the tree, ultimately reaching the top level. In this way, a complete description of the factors that led to the adverse consequence can be built.

Often, an item in the tree will require explanation, but the immediate causes are not yet known. The causal factor tree process will only expose this knowledge gap; it does not provide any means to resolve it. This is when other methods such as change analysis or barrier analysis can be used to provide answers to the unknowns. Once the unknowns become known, they can be added to the tree as immediate causes for the item in question.

Each new cause added to the tree should be evaluated as a potential endpoint. When can a cause be designated as an endpoint? This is an object of some debate. Several notable RCA practitioners use some version of the following criteria:

- The cause must be fundamental.
- The cause must be correctable by management.
- If the cause is removed or corrected, the adverse consequence does not occur.

These criteria, taken together, are basically just a statement of the most-widely used definition for root cause. An alternate set of criteria follows. Note that these are all referenced to the system being analyzed.

- The cause is a system response to a requirement imposed from outside the system.
- The cause is a contradiction between requirements imposed from within the system.
- The cause is a lack of control over system response to a disturbance.
- The cause is a fundamental limit of the system design.

A causal factor tree will usually have many endpoints. The set of all endpoints is a fundamental set of causes for the top consequence in the tree. This fundamental set includes endpoints that would be considered either beneficial or detrimental; every one of them had to exist, otherwise the consequence would have been different. Endpoints that require corrective action would typically be called root causes, or root and contributing causes, if some scheme is being used to differentiate causes in terms of importance.

In summary, the causal factor tree is an investigation/analysis tool that is used to display a logical hierarchy of all the causes leading to a given effect or consequence. When gaps in knowledge are encountered, the tree exposes the gap, but does not provide any means to resolve it; other tools are required. Once the required knowledge is available, it can be added to the tree. A completed causal factor tree provides a complete picture of all the actions and conditions that were required for the consequence to have occurred. Success in causal factor tree analysis depends on the rigor used in adding causes to the tree, and in stopping any given cause-effect chain at an appropriate endpoint.

Video 20. Causal factor analysis
http://www.bing.com/videos/search?q=causal+factor+analysis&view=detail&mid=688B9B1584793737F29D688B9B1584793737F29D&first=0

Change Analysis

The following is taken from *Change Analysis* by Bill Wilson.

Change analysis is an investigation technique that involves the precise specification of a single deviation so that changes and/or differences leading to the deviation may be found by comparison to similar situations in which no deviation occurred.

As suggested by the name of the technique, change analysis is based on the concept that change (or difference) can lead to deviations in performance. This presupposes that a suitable basis for comparison exists. What is required is to fully specify the deviated and undeviated conditions, and then compare the two so that changes or differences can be identified. Any change identified in this process thus becomes a candidate cause of the overall deviation.

What is a suitable basis for comparison? There are basically three types of situations that can be used. First, if the deviation occurred during performance of some task or operation that has been performed before, then this past experience can be the basis. Second, if there is some other task or operation that is similar to the deviated situation, it can be used instead. Finally, a detailed model or simulation of the task (including controlled event reconstruction) can be used, if feasible.

Once a suitable basis for comparison is identified, then the deviation can be specified. Various schemes exist for performing this specification. Perhaps the most useful scheme (attributed to Kepner and Tregoe) involves four dimensions (WHAT, WHERE, WHEN, and EXTENT) and two aspects (IS and IS NOT). Regardless of the scheme used, the end result should be a list of characteristics that fully describes the deviated condition.

Given the full specification of the deviated condition, it becomes possible to perform a detailed comparison with the selected undeviated condition. Each difference between the deviated and undeviated situations is marked for further investigation. In essence, each individual difference (or some combination of differences) is a potential cause of the overall deviation.

After the potential causes are found, each is reviewed to determine if it could reasonably lead to the deviation, and under what circumstances. The most likely causes are those that require the fewest additional conditions or assumptions. In this way, a large list of potential causes can be whittled down to a short list of likely causes. Finally, given the likely causes, the actual or true cause(s) must be identified. Generally speaking, the only way to verify which likely cause is the true cause is by testing.

The purpose of change analysis is thus to discover likely causes of a deviation through comparison with a non-deviated condition, and then to verify true causes by testing. True causes found by using change analysis are usually direct causes of a single deviation; change analysis will not usually yield root causes. However, change analysis may at times be the

only method that can find important, direct causes that are obscure or hidden. Success in change analysis depends ultimately on the precision used to specify a deviation, and in verification of true cause through testing.

Barrier Analysis

The following is taken from *Barrier Analysis* by Bill Wilson.

Barrier analysis is an investigation or design method that involves the tracing of pathways by which a target is adversely affected by a hazard, including the identification of any failed or missing countermeasures that could or should have prevented the undesired effect(s).

At the heart of barrier analysis is the concept of the target. The primary quality of a target is that it exists under a specified range or set of conditions, and that we require it to be maintained within that specified range or set of conditions. This very general quality means that almost anything can be a target -- a person, a piece of equipment, a collection of data, etc.

Given the concept of the target, we move to the means by which a target is adversely affected. By adverse effect, we mean that the target is somehow moved outside of its required range or set of conditions. Anything that does this is called a hazard. This is a very general quality—almost anything can be a hazard. However, it is possible to uniquely define hazard/target pairs by the pathways through which hazards affect targets.

Having identified hazards, targets, and the pathways through which hazards affect targets, we arrive at the concepts of barriers and controls. These are used to protect and/or maintain a target within its specified range or set of conditions, despite the presence of hazards. The primary quality of a barrier or control is that it cuts off a pathway by which a hazard can affect a target.

Barriers and controls are often designed into systems, or planned into activities, to protect people, equipment, information, etc. The problem is that design and planning are rarely perfect. All hazards may not be identified beforehand, or unrecognized pathways to targets may surface. In both of these cases, appropriate barriers and controls may not be present. Even if they are present, they may not be as effective as originally intended. As a result, targets may lack adequate protection from change or damage.

The purpose of barrier analysis is thus to identify pathways that were left unprotected, or barriers and controls that were present but not effective. All pathways relate to specific hazard/target pairs, and all barriers and controls relate to specific pathways. Success in barrier analysis depends on the complete and thorough identification of all pathways.

e. Describe and explain the application of the following Root Cause Analysis processes in the performance of occurrence investigations:
- **Events and causal factors charting**
- **Root cause coding**
- **Recommendation generation**

Events and Causal Factors Charting

The following is taken from DOE Workbook, *Conducting Accident Investigations*, chapter 7.

Accidents rarely result from a single cause. Event and causal factor (E&CF) charting is useful in identifying the multiple causes and graphically depicting the triggering conditions and events necessary and sufficient for an accident to occur.

E&CF charting and E&CF analysis are usually considered one technique. They are addressed separately because they are conducted at different stages of the investigation. E&CF charting is a graphical display of the accident's chronology and is used primarily for compiling and organizing evidence to portray the sequence of the accident's events. It is a continuous process performed throughout the investigation. E&CF analysis is the application of analysis to determine causal factors by identifying significant events and conditions that led to the accident. As the results of other analytical techniques are completed, they are incorporated into the E&CF chart. After the chart is fully developed, the analysis is performed to identify causal factors.

E&CF charting is possibly the most widely used analytic technique in DOE accident investigations, because the E&CF chart is easy to develop and provides a clear depiction of the data. By carefully tracing the events and conditions that allowed the accident to occur, board members can pinpoint specific events and conditions that, if addressed through corrective actions, would prevent a recurrence. The benefits of this technique include the following:

- Illustrating and validating the sequence of events leading to the accident and the conditions affecting these events
- Showing the relationship of immediately relevant events and conditions to those that are associated but less apparent—portraying the relationships of organizations and individuals involved in the accident
- Directing the progression of additional data collection and analysis by identifying information gaps
- Linking facts and causal factors to organizational issues and management systems
- Validating the results of other analytic techniques
- Providing a structured method for collecting, organizing, and integrating collected evidence
- Conveying the possibility of multiple causes
- Providing an ongoing method of organizing and presenting data to facilitate communication among the investigators
- Presenting clearly the information regarding the accident so that it can be used to guide report writing
- Providing an effective visual aid that summarizes key information regarding the accident and its causes in the investigation report

To identify causal factors, board members must have a clear understanding of the relationships among the events and the conditions that allowed the accident to occur. E&CF charting provides a graphical representation of these relationships.

CONSTRUCTING THE CHART

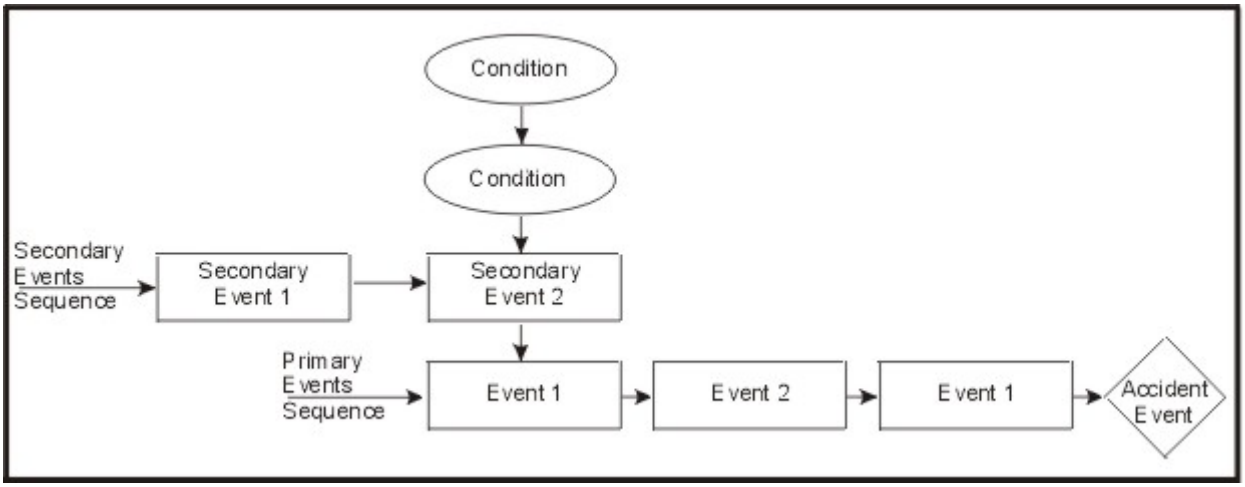
Constructing the E&CF chart should begin immediately after the accident. However, the initial chart will be only a skeleton of the final product. Many events and conditions will be discovered in a short amount of time, and therefore, the chart should be updated almost daily throughout the investigative data collection phase. Keeping the chart up to date helps ensure that the investigation proceeds smoothly, that gaps in information are identified, and that the investigators have a clear representation of accident chronology for use in evidence collection and witness interviewing.

Investigators and analysts can construct an events and causal factors chart using either a manual or computerized method. Accident investigation boards often use both techniques during the course of the investigation, developing the initial chart manually and then transferring the resulting data into computer programs.

The manual method employs removable adhesive notes to chronologically depict events and the conditions affecting these events. The chart is generally constructed on a large conference room wall or many sheets of poster paper. Accident events and conditions are recorded on removable adhesive notes and affixed sequentially to the wall in the board's conference room or command center. Because the exact chronology of the information is not yet known, using removable adhesive notes allows investigators to easily change the sequence of this information and to add information as it becomes available. Different colored notes or inks can be used to distinguish between events and conditions in this initial manual construction of the events and causal factors chart.

If the information becomes too unwieldy to manipulate manually, the data can be entered into a computerized analysis program. Using specialized analytical software, investigators can produce an events and causal factors graphic, as well as other analytical trees or accident models.

Whether using a manual or a computerized approach, the process begins by chronologically constructing, from left to right, the primary chain of events that led to an accident. Next, secondary and miscellaneous events are then added to the events and causal factors chart, inserted where appropriate in a line above the primary sequence line. Finally, conditions that affect either the primary or secondary events are placed above or below these events. Figure 10 illustrates the basic format of the events and causal factors chart.



Source: DOE Workbook, Conducting Accident Investigations, chapter 7
Figure 10. Simplified events and causal factors chart

Depending on the complexity of the accident, the chart may result in a very large, complex sequence of events covering several walls in the command center. For the purpose of inclusion in the investigation report and closeout briefings, the chart is generally summarized.

Root Cause Coding

The following is taken from DOE O 232.2.

Root-cause coding is a useful tool that enables an investigator to visualize the various root causes, as well as contributing causes of an accident. The coding system taken from DOE O 232.2, *Occurrence Reporting and Processing of Operations Information*, "Causal Analysis Tree", is depicted in Table 3 and is broken down into seven main categories:

1. A1 羊design/engineering problem
2. A2 羊equipment/material problem
3. A3 羊human performance LTA (less than adequate)
4. A4 羊management problem
5. A5 羊communications LTA
6. A6 羊training deficiency
7. A7羊other problem

Additional coding is available in the causal analysis tree.

Table 3. Root cause codes

Category	Code Description	Category	Code Description
A1 Design/Engineering Problem		A5 Communications LTA	
B1	Design input LTA	B1	Written communications method of presentation LTA
B2	Design output LTA	B2	Written communications content LTA
B3	Design documentation LTA	B3	Written communication not used
B4	Design installation verification LTA	B4	Verbal communication LTA
B5	Operability of design/environment LTA		
A2 Equipment/Material Problem		A6 Training Deficiency	
B1	Calibration for instruments LTA	B1	No training provided
B2	Periodic / corrective maintenance LTA	B2	Training methods LTA
B3	Inspection / testing LTA	B3	Training material LTA
B4	Material control LTA		
B5	Procurement control LTA		
B6	Defective, failed or contaminated		
A3 Human Performance LTA		A7 Other Problem	
B1	Skill-based error	B1	External phenomena
B2	Rule-based error	B2	Radiological/hazardous material problem
B3	Knowledge-based error	B3	Legacy
B4	Work practices LTA	B4	No cause is applicable
A4 Management Problem			
B1	Management methods LTA		
B2	Resource management LTA		
B3	Work organization and planning LTA		
B4	Supervisory methods LTA		
B5	Change management LTA		

Source: DOE O 232.2

Recommendation Generation

The following is taken from *Root Cause Analysis Handbook: A Guide to Effective Incident Investigation.* By Lee N. Vanden Heuvel, et al.

Perhaps the most significant aspect of root cause analysis is the final step. Following the identification of root cause(s) for a particular causal factor, recommendations for preventing its recurrence must be generated. The identification of effective corrective actions is addressed explicitly in the definition of root causes. Root causes are defined as the most basic causes that can reasonably be identified, which management has control to fix, and for which effective recommendations for preventing recurrence can be generated. The emphasis is on

correcting the problem so that it will not be repeated. The following criteria for ensuring the viability of corrective actions are suggested:

- Will these corrective actions prevent recurrence of the condition or event?
- Is the corrective action within the capability of the organization to implement?
- Are the recommendations directly related to the root causes?
- Can we ensure that implementation of the recommendation will not introduce unacceptable risks?

The corrective actions developed should address not only the specific circumstances of the event that occurred, but also system improvements aimed at the incident's root causes. They should address options for reducing the frequency, minimizing the personnel exposures, and/or lessening the consequences of one or more of the root causes. In general, three types of recommendations should be generated for each root cause:

1. Correct the specific problem
2. Correct similar existing problems
3. Correct the system that created the problems

f. Describe the elements of an effective issues management system and its importance to safety.

The following is taken from DOE O 226.1B.

The field elements should develop an issues management process that is capable of categorizing findings based on risk and priority, ensuring that relevant line management findings are effectively communicated to the contractors, and ensuring that problems are evaluated and corrected on a timely basis. The issues management process must ensure the following for issues categorized as high significance findings:

- Complete a thorough analysis of the underlying causal factors.
- Identify and implement corrective actions that will address the cause(s) of the findings and prevent recurrence.
- Conduct an effectiveness review using trained and qualified personnel after completion of a corrective action or a set of corrective actions. Verify that the corrective action/corrective action plan has been effectively implemented to prevent recurrences.
- Document the analysis process and results and maintain tracking of completion of plans and schedules for the corrective actions and effectiveness reviews in a readily accessible system.
- Appoint a lead office by mutual agreement between the affected secretarial officers when findings and/or corrective actions apply to more than one Secretarial Office.

g. Discuss the necessary considerations that must be addressed when developing a corrective action.

The following is taken from DOE G 414.1-1B.

Managers responsible for the activities assessed are also responsible for the development of effective corrective actions for the problem areas/deficiencies discovered during the assessment. At a minimum, these corrective actions should include the following:

- Measures to correct each deficiency
- Identification of all root causes for significant deficiencies
- Determination of the existence of similar deficiencies or underlying causes
- Actions to preclude recurrence of like or similar deficiencies
- Assignment of corrective action responsibility
- Completion dates for each corrective action

Managers should verify that corrective actions are likely to fully address the identified deficiency and when actions are completed, validate that the actions have corrected the deficiency.

h. Discuss the actions taken as the result of problem identification or an occurrence.

The following is taken from DOE G 225.1A-1 (archived).

The final report is submitted by the appointing official to senior managers of organizations identified in the judgments of need in the report, with a request for the organizations to prepare corrective action plans. These plans contain actions for addressing judgments of need identified in the report and include milestones for completing the actions.

Corrective actions fall into four categories:

1. Immediate corrective actions that are taken by the organization managing the site where the accident occurred to prevent a second or related accident.
2. Corrective actions required to satisfy judgments of need identified by the board in the final report. These corrective actions are developed by the heads of field elements and/or contractors responsible for the activities resulting in the accident and are designed to prevent recurrence and correct system problems.
3. Corrective actions determined by the appointing official to be appropriate for DOE-wide application. The appointing official recommends these corrective actions when the report is distributed.
4. DOE headquarters corrective actions that result from discussions with senior management. These actions usually address DOE policy.

i. Describe the assessment requirements and limitations associated with the interface with contractor employees.

Requirements for program assessments can be found in 10 CFR 830, Subpart A. Additional requirements are also located in DOE O 226.1B. Further, DOE G 414.1-1B provides detailed guidance for management assessments and independent assessments.

The following is taken from DOE G 414.1-1B.

Independent Assessments

Effective assessments use a combination of tools and techniques to maximize the productivity of the assessment team and resources. Such assessment techniques include interviews, document reviews, observation, inspection, and performance testing.

When using any of these techniques, assessors should maintain good records of the assessment results. These may include personal notes or other information to support the assessment, and may be included in the checklist information. These records are useful in writing the report and any associated findings and recommendations, and will be valuable if questions arise during the report review process.

- Interviews provide the means of verifying the results of observation, document review, inspection, and performance testing; allow the responsible person to explain and clarify those results; help to eliminate misunderstandings about program implementation; and provide a venue where apparent conflicts or recent changes can be discussed and organization and program expectations can be described.
- Document reviews provide the objective evidence to substantiate compliance with applicable requirements. A drawback is that the accuracy of the records cannot be ascertained by review alone. This technique should be combined with interviews, observation, inspection, and/or performance testing to complete the performance picture. Records and documents should be selected carefully to ensure that they adequately characterize the program, system, or process being assessed.
- Observation, the viewing of actual work activities, is often considered the most effective technique for determining whether performance is in accordance with requirements. A drawback is the effect the assessor's presence has on the person being observed; therefore the assessor should convey an attitude that is helpful, constructive, positive, and unbiased. The primary goal during observation is to obtain the most complete picture possible of the performance, which should then be put into perspective relative to the overall program, system, or process.
- Inspections are performed in accordance with acceptance criteria to verify the condition of physical facilities, systems, equipment, and components.
- Performance testing is used to observe the response of personnel or equipment by creating a specific situation and noting the resulting performance. This technique is especially helpful when activities of interest would not normally occur during an assessment visit. It is also useful when the timeliness and appropriateness of the response are critical (e.g., emergency responses).

j. Explain the essential elements of the below activities including

- **investigation**
- **fact-finding**
- **reporting**
- **tracking to closure**
- **follow-up**
- **corrective action implementation**

All of the information for this KSA is taken from DOE G 414.1-1B, except where noted otherwise.

Investigation

The following is derived from DOE G 414.1-1A (archived).

Effective assessments use a combination of tools and techniques to maximize the productivity of the assessment team and resources. Such assessment techniques include document reviews, interviews, observation, inspection, and performance testing. Investigations (using these techniques) should be sufficiently thorough and information gathered with sufficient diligence that accurate, detailed conclusions and issues can be provided to assist the organizations that will receive the final report.

Fact Finding

Techniques that may be used in fact-finding are discussed below.

INTERVIEWS

Interviews provide the means of verifying the results of observation, document review, inspection, and performance testing; allow the responsible person to explain and clarify those results; help to eliminate misunderstandings about program implementation; and provide a venue where apparent conflicts or recent changes can be discussed and organization and program expectations can be described.

DOCUMENT REVIEWS

Document reviews provide the objective evidence to substantiate compliance with applicable requirements. A drawback is that the accuracy of the records cannot be ascertained by review alone. This technique should be combined with interviews, observation, inspection, and/or performance testing to complete the performance picture. Records and documents should be selected carefully to ensure that they adequately characterize the program, system, or process being assessed.

OBSERVATION

Observation, the viewing of actual work activities is often considered the most effective technique for determining whether performance is in accordance with requirements. Assessors should understand the effect their presence has on the person being observed and convey an attitude that is helpful, constructive, positive, and unbiased. The primary goal during observation is to obtain the most complete picture possible of the performance, which should then be put into perspective relative to the overall program, system, or process.

INSPECTIONS

Inspections are performed in accordance with acceptance criteria to verify the condition of physical facilities, systems, equipment, and components.

PERFORMANCE TESTING

Performance testing is used to observe the response of personnel or equipment by creating a specific situation and noting the resulting performance. This technique is especially helpful

when activities of interest would not normally occur during an assessment visit. It is also useful when the timeliness and appropriateness of the response are critical.

Reporting

Assessment reports are required for documentation of assessment results. Assessment team leaders have the overall responsibility for preparing the report and obtaining appropriate approval for its release as applicable. The report may be formal or informal depending on the level of assessment performed, but should provide a clear picture of the results in terms of the programs, systems, and processes assessed. The assessment report should be clear, concise, accurate, and easy to understand, and should include only facts that directly relate to assessment observations and results. It should include sufficient information to enable the assessed organization to develop and implement appropriate improvement plans.

[Note: A management assessment report may not require all of the content listed below and may only require an executive summary.]

Specific report formats may vary considerably from one organization to the next. An independent assessment report usually includes the following sections:

- Executive summary
- Assessment scope
- Identification of team members
- Identification of personnel contacted
- Documents reviewed
- Work performance observed
- Assessment process and criteria
- Results of the assessment including identification of areas for improvement, and/or strengths

Tracking to Closure

The following is taken from DOE G 414.1-5 (archived).

An integral part of a successful corrective action program is the capability to maintain a systematic approach for tracking and reporting the status of the corrective actions to successful closure and implementation. This may be accomplished manually or electronically.

Maintaining and updating this information provides consistent data for tracking and analyzing program status and trends. The process used to track and report corrective action progress should be readily accessible and provide sufficient data to appraise, analyze, and report the status of corrective actions affecting the safety, mission performance, and security of the site/organization.

Follow-up

A follow-up assessment with special focus may be performed and should be completed in accordance with applicable corrective action documents. Particularly, this follow-up assessment should evaluate the effectiveness of corrective actions. A reasonable subset of corrective actions should be reviewed for effectiveness.

Corrective Action Implementation

Management responsible for the activities assessed is also responsible for the development of effective corrective action of the problem areas or deficiencies discovered during the assessment. At a minimum, the corrective action should address

- measures to correct each deficiency;
- identification of all root causes for significant deficiencies;
- determination of the existence of similar deficiencies;
- corrective actions to preclude recurrence of like or similar deficiencies;
- assignment of corrective action responsibility; and
- completion dates for each corrective action.

Managers should verify that corrective actions are likely to fully address the identified deficiency and when actions are completed, validate that the actions have corrected the deficiency.

k. Describe the actions to be taken if the contractor challenges the assessment findings and explain how such challenges can be avoided.

The following is taken from DOE G 414.1-5 (archived).

Disputes between assessed and assessing employees or organizations concerning corrective action plan development, implementation, or completion should be resolved at the lowest possible organizational level. If informal discussions successfully resolve the dispute, the resolution should be documented in a mutually agreeable way. If the dispute cannot be resolved in informal discussions, it should be elevated to the minimum extent necessary to reach resolution through the organizational level of management hierarchy.

The following is taken from DOE G 414.1-1B.

When using any assessment techniques, assessors should maintain good records of the assessment results. These may include personal notes or other information to support the assessment, and may be included in the checklist information. These records are useful in writing the report and any associated findings and recommendations, and will be valuable if questions arise during the report review process.

l. Discuss the key processes used in the trending and analysis of operations.

The following is taken from DOE Order 5480.26.

Contractors for each facility, group of facilities, or site shall review and assess their performance indicators and other operations information such as reportable occurrences.

Facility managers shall assess their facility operating information for trends and indications of deteriorating/improving conditions and identify lessons-learned and good practices that should be used in their facility to prevent occurrences or to improve safety and/or operations.

Each level of DOE line management shall adopt the use of trending and analysis of performance indicators and other operations information, such as reportable occurrences, to

provide ongoing feedback to operators, support personnel, and managers of the condition and performance of their operations with the intent of identifying deficiencies/good practices and opportunities for improvement in safety and performance at all levels of operation.

Video 21. Trending and Analysis
http://www.youtube.com/watch?v=e4VYiQbUj04

m. Discuss the key process to develop and implement metrics and performance measures, validate performance against metrics and performance measures, and trend/analyze data to establish a continuous improvement program.

The following is taken from DOE G 120.1-5.

Metrics and other performance measures are part of a program that identifies, gathers, verifies, analyzes, trends, disseminates, and makes use of ES&H performance indicators to improve the performance of DOE facilities, programs, and organizations. The program should include the following actions:

- Gather, verify, analyze, trend, and disseminate ES&H performance indicator data, including narrative data, which can help assess performance; and where appropriate, perform root cause analyses.
- Implement feedback mechanisms for identification and communication of ES&H good practices, lessons learned, and corrective actions.
- Maintain a management information system containing appropriate ES&H performance indicator data for historical reference.
- Assess ES&H performance indicator programs periodically to verify that indicators are accurately measuring performance and are resulting in improved performance.

n. Discuss the importance and key elements of the following:

- **Maintenance history**
- **Operational incident/occurrence report data**
- **Security infractions**
- **Safety incidents**
- **Radiation exposure and incident reporting**
- **Schedule variances**
- **Counterfeit and suspect parts**

Maintenance History

The following is taken from DOE G 433.1-1A.

A maintenance history and trending program should be implemented to document maintenance performed, to provide historical information for maintenance planning, to support maintenance and performance trending of facility systems and components, and to improve facility reliability. The documentation of complete, detailed, and usable history will be increasingly important as plant-life extension becomes an issue. Maintenance history enables trending to identify improvements for the maintenance program and needed equipment replacements or modifications. This history should assist in ensuring that root causes of failures are determined, corrected, and used in future work planning.

The maintenance history program data should be collected and recorded to effectively support the uses discussed in chapter III, section L.2 of DOE G 433.1-1A. Some examples of data that should be included or cross-referenced in the program are corrective maintenance records; PM records; modification packages; vendor repair information start-up tests and other baseline data; appropriate surveillance test data; calibration data; and applicable industry experience information. The specific data to be collected should include details of the work performed; special equipment and tools used; procedures or drawings needed; spare parts installed; personnel safety and radiation protection requirements; post maintenance testing results; and any other information that may be useful later.

Operational Incident/Occurrence Report Data

The following is taken from DOE O 232.2.

The objectives of DOE O 232.2 are the following:

- Ensure that the DOE and NNSA are informed about events that could adversely affect the health and safety of the public, the workers, the environment, DOE missions, or the credibility of the Department.
- Promote organizational learning consistent with DOE's ISMS goal of enhancing mission safety, and sharing effective practices to support continuous improvement and adaptation to change.

Notification, update, and final reports must be written clearly and concisely so the general reader can understand the basic "who, what, when, where, how" of the event; the safety issues involved; and the actions taken.

Security Infractions

The following is taken from DOE O 475.2A.

Any knowing, willful, or negligent action that results in the misclassification of information, documents, or material may result in termination of the classification official's authority. Additional consequences such as disciplinary action or the issuance of a security infraction may result in accordance with other DOE directives. Examples of knowing, willful, or negligent actions include classifying without authority, classifying outside of granted authority, and failing to obtain a classification review when required to do so. Such actions do not include cases where classification officials legitimately disagree about the reasonable interpretation of classification guidance.

Safety Incidents

The following is taken from DOE O 231.1B.

The purpose of DOE O 231.1B is to ensure the DOE, including the NNSA, receives timely and accurate information about events that have affected or could adversely affect the health, safety and security of the public or workers, the environment, the operations of DOE facilities, or the credibility of the Department. This will be accomplished through timely collection, reporting, analysis, and dissemination of data pertaining to ES&H issues as required by law, or regulations, or in support of U.S. political commitments to the IAEA.

Radiation Exposure and Incident Reporting

The following is taken from DOE O 232.2.

Radiation exposure occurrence reporting criteria, as listed in DOE O 232.2, attachment 2, section 6, group 6, subgroup C are as follows:

- Determination of a dose that exceeds the limits specified in 10 CFR 835, subpart C, or in DOE O 458.1, chg. 2, *Radiation Protection of the Public and the Environment*
- Failure to provide the required monitoring for an exposure estimated to exceed the values for providing personnel dosimeters and bioassays as stated in 10 CFR 835.402 10 CFR 835.402(c)
- Determination of a single occupational dose, attributable to an identified event that exceeds an expected dose by either of the following:
  - 500 mrem committed effective dose
  - The greater of ten percent or 100 mrem effective dose due to external exposure
- A radiological release that exceeds any limit contained in paragraphs 4.f.(2), 4.f.(5), 4.g.(4), 4.g.(5)(a), 4.g.(7), 4.g.(8)(a)4 or 4.i.(1) of DOE O 458.1, chg. 2, or exceeds the 40 CFR 61.92 requirements

Schedule Variance

The following is taken from Project-Management-Knowledge.com.

Schedule variance (SV) is a quantitative measure used by project management personnel to determine schedule performance during or after the completion of a project. It is calculated using a simple algebraic equation where the earned value (EV) represents the actual amount of time taken to either complete the project or progress to the project's current stage. The planned value (PV) represents the amount of time that reaching the project's current progress should have taken to achieve according to the project management's schedule. Schedule variance is found by subtracting PV from EV: EV-PV=SV

Schedule variance and its exact number may indicate many possible things to project management. A number approaching zero would indicate that the scheduling and timeframes generated by project management were accurate within a small margin of error. A figure that is well into negative numbers would mean that either project management overestimated the amount of time needed or they overestimated the budget and workforce measured in raw man hours that would necessary to complete the project. This is not a good thing either as it represents an unnecessary expenditure of resources. An SV figure high in positive numbers could represent many things. It could indicate that project management underestimated the amount of time needed to complete the project, or it might indicate that the budget and workforce was insufficient. It could also mean that project management or the workforce suffered setbacks, foreseen or otherwise, which may or may not have been avoidable.

Counterfeit and Suspect Parts

The following is taken from DOE O 414.1D.

An S/CI is an item which is suspect when inspection or testing indicates that it may not conform to established government or industry-accepted specifications or national consensus

standards; or whose documentation, appearance, performance, material, or other characteristics may have been misrepresented by the vendor, supplier, distributor, or manufacturer. A counterfeit item is one that has been copied or substituted without legal right or authority; or whose material, performance, or characteristics have been misrepresented by the vendor, supplier, distributor, or manufacturer. Items that do not conform to established requirements are not normally considered S/CIs if non-conformity results from one or more of the following conditions:

- Defects resulting from inadequate design or production quality control
- Damage during shipping, handling, or storage
- Improper installation
- Deterioration during service
- Degradation during removal
- Failure resulting from aging or misapplication
- Other controllable causes

o. Using DOE O 231.1B, Admin Chg.1, *Environment, Safety, and Health Reporting*, and DOE O 232.2, *Occurrence Reporting and Processing of Operations Information*, discuss the role of an STSM related to reportable occurrences. Given an occurrence report, determine whether

- **review processes are adequate;**
- **causes are appropriately defined;**
- **corrective actions address causes;**
- **lessons learned are appropriate; and**
- **corrective actions are completed.**

The following is taken from DOE O 232.2.

For the purposes of this KSA, it is assumed that an STSM should be able to perform the same responsibilities as the head of a field element, if called upon to do so. Therefore, an STSM should be able to perform the following functions:

- Assess performance of facility personnel in carrying out the requirements of this Order according to established agreements with the responsible SOs or deputy administrators
- Designate and direct FRs and designees to fulfill the responsibilities required by this Order
- Identify contracts to which the CRD should apply and notify the cognizant contracting officers
- Ensure that initiators of procurement requests identify in procurement requests whether the requirements in the CRD for DOE O 232.2 are to be applied to the award or sub-awards resulting from the procurement request and any special instructions for the application of the CRD

The determination portion of this KSA is performance-based. The Qualifying Official will evaluate its completion.

p. Discuss the process for preparing a minority report and explain the importance of encouraging and evaluating differing professional/technical opinions.

Minority Report

The following is taken from *DOE Workbook: Conducting Accident Investigations*, section 9.

The minority report should

- address only those sections of the overall report that warrant the dissenting opinion;
- follow the same format as the overall report, addressing only the points of variance; and
- summarize, not be a complete rewrite of the overall report.

Differing Professional Opinions

The following is taken from DOE O 442.2.

DOE O 442.2, *Differing Professional Opinions for Technical Issues Involving Environmental, Safety, and Health Technical Concerns*, establishes the DOE DPO process for employees to raise technical concerns related to ES&H which cannot be resolved using routine processes.

Employees are encouraged to report concerns to their immediate supervisor, to any level of management, or to offices responsible for dealing with the particular subject matter of the concern. DOE seeks to promote resolution of concerns at the lowest possible level. In rare cases, an employee may decide that the routine work process did not adequately resolve a concern. The DPO process exists for use in these cases; however, before initiating the DPO process, the employee must first attempt to resolve the issue through his/her organization's routine work processes.

q. Lead a team to conduct compliance-based and performance-based assessments. Identify the differences in outcomes and the reasons for these differences.

r. Write, or review and approve, an assessment report.

s. Based on an evaluation of contractor activities, review and approve corrective actions and recommendations, and communicate the results to contractor management.

t. Participate in formal meetings between Federal line management and assessed contractor organization management to discuss the results of the assessments.

u. Given incident/occurrence report data for a specified period, analyze the information for contributing factors and safety trends.

v. Given the data for an event, determine the root cause and develop corrective actions. Compare the results with those of the originator. Discuss any differences.

KSAs p through u are performance-based. The Qualifying Official will evaluate their completion.

14. An STSM must have a familiarity level knowledge (demonstrate awareness) to understand program and project management, and must have a working level knowledge to effectively manage program and project utilizing the processes and procedures necessary to ensure the safety of departmental activities, including some knowledge of the mission and key programs.

a. Discuss the Department's policy for planning, programming, budgeting, and acquisition of capital assets as described in DOE O 413.3B, *Program and Project Management for the Acquisition of Capital Assets.*

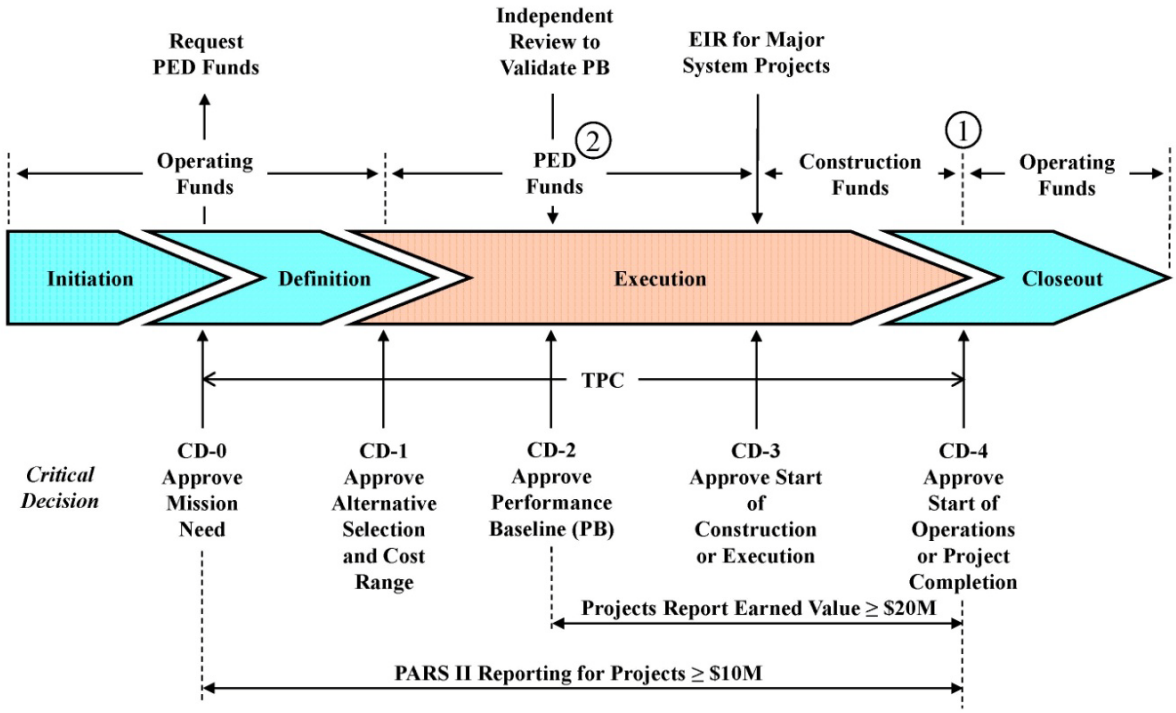
The following is taken from DOE O 413.3B.

The DOE acquisition management system establishes principles and processes that translate user needs and technological opportunities into reliable and sustainable facilities, systems, and assets that provide a required mission capability. The system will be organized by project phases and critical decisions (CDs), progressing from broadly-stated mission needs into well-defined requirements resulting in operationally effective, suitable, and affordable facilities, systems, and other products.

Within DOE, projects typically progress through five CDs, which serve as major milestones approved by the secretarial acquisition executive or acquisition executive. Each CD marks an authorization to increase the commitment of resources by DOE and requires successful completion of the preceding phase or CD. The amount of time between decisions will vary. The five CDs are

1. CD-0, approve mission need. There is a need that cannot be met through other than material means;
2. CD-1, approve alternative selection and cost range. The selected alternative and approach is the optimum solution;
3. CD-2, approve performance baseline. Definitive scope, schedule and cost baselines have been developed;
4. CD-3, approve start of construction/execution. The project is ready for implementation; and
5. CD-4, approve start of operations or project completion. The project is ready for turnover or transition to operations, if applicable.

Figure 11 illustrates the requirements for the typical implementation of the DOE acquisition management system for line item capital asset projects.



Source: DOE O 413.3B

Figure 11. Typical DOE acquisition management system for line item capital asset projects

b. Define the following terms:

- **Baseline**
- **Graded approach**
- **Infrastructure**
- **Life-cycle**
- **Programmatic management**
- **Metrics and performance measures**

Baseline

The following is taken from DOE-HDBK-1188-2006.

Baseline is a quantitative expression of projected costs, schedule, and technical requirements; the established plan against which the status of resources and the progress of a project can be measured.

Graded Approach
The following is taken from DOE-HDBK-1188-2006.

Graded approach is the process of ensuring that the level of analysis, documentation, and actions used to comply with a requirement in 10 CFR 830 are commensurate with the relative importance to safety, safeguards, and security; the magnitude of any hazard involved; the life cycle stage of a facility; the programmatic mission of a facility; the particular characteristics of a facility; the relative importance of radiological and nonradiological hazards; and any other relevant factor.

Infrastructure
The following is taken from DOE O 430.1B, chg. 2.

Infrastructure is all real property, installed equipment, and related real property that is not solely supporting a single program mission at a multiprogram site or that is not programmatic real property at a single program site.

Life Cycle
The following is taken from DOE O 430.1B, chg. 2.

Life cycle is the life of an asset from planning through acquisition, maintenance, operation, remediation, disposition, long-term stewardship, and disposal.

Programmatic Management
The following is taken from DOE O 430.1A.

Programmatic management consists of functions that include planning and developing the overall program; establishing broad priorities; providing program technical direction; preparing and defending the program budget; controlling milestones; integrating all components of the program; providing public and private sector policy liaison; expediting interface activities and follow-up actions; and retaining overall accountability for program success.

Metrics and Performance Measures
The following is taken from DOE G 435.1-1 chapter 1.

Performance measures—metrics to be used in evaluating performance against program, environment, health, and safety goals.

The following is taken from NNSA Policy Letter NAP-4B.

Performance measures are terms used to describe a particular value or characteristic designated to measure input, output, outcome, efficiency, or effectiveness.

c. Describe the key elements of supervising/monitoring program activities and contractors.

The following is taken from DOE O 226.1B.

All applicable DOE organizations must

- establish and implement an effective oversight program consistent with DOE P 226.1B and the requirements of DOE O 226.1B; and
- maintain sufficient technical capability and knowledge of site and contractor activities to make informed decisions about hazards, risks, and resource allocation; provide direction to contractors; and evaluate contractor performance.

Oversight processes implemented by applicable DOE line management organizations must

- evaluate contractor and DOE programs and management systems, including site assurance systems, for effectiveness of performance (including compliance with requirements);
- include written plans and schedules for planned assessments, focus areas for operational oversight, and reviews of the contractor's self-assessment of processes and systems. Address the role of the CTAs and their support staff for core nuclear safety functions;
- include DOE HQ line organizations' conduct of oversight processes that are focused primarily on their DOE field elements, including reviewing contractor activities to the extent necessary to evaluate the implementation and effectiveness of the field element's oversight of its contractors;
- include an issues management process that is capable of categorizing findings based on risk and priority, ensuring relevant line management findings are effectively communicated to the contractors, and ensuring that problems are evaluated and corrected on a timely basis; and
- be tailored according to the effectiveness of contractor assurance systems, the hazards at the site/activity, and the degree of risk, giving additional emphasis to potentially high consequence activities.

DOE line management must establish and communicate performance expectations to contractors through formal contract mechanisms. Such expectations (e.g., safety performance measures and commitments) must be established on an annual basis, or as otherwise required or determined appropriate by the field element.

DOE line management must have effective processes for communicating oversight results and other issues in a timely manner up the line management chain, and to the contractor as appropriate, sufficient to allow senior managers to make informed decisions.

d. Describe the purpose of schedules, and discuss the use of milestones and activities.

The following is taken from DOE G 430.1-1.

The schedule is one of the building blocks for project development. A schedule helps determine the duration of the project, the critical activities, and when funds are required. The

basic elements comprising the schedule consist of the activities in the project, the duration of each activity, and the sequence in which those activities occur.

The activities from a work breakdown structure become the building blocks for a schedule. An activity is any specific element of work. It is important that activities not be confused with schedule events. Events are indicators of the beginning or completion of an activity. An event milestone is usually one specific point in time, whereas an activity occurs over a period of time.

e. Define and compare the terms cost estimate and budget.

Cost Estimate

The following is taken from DOE G 430.1-1.

A cost estimate is a statement of costs estimated to be incurred in the conduct of an activity, such as a program, or the acquisition of a project or system. The estimate can be in the form of proposals by contractors or government agencies, a response to a program opportunity notice, or a DOE estimate.

Budget

The following is taken from the United States Government Accountability Office, GAO-05-734SP, A *Glossary of Terms Used in the Federal Budget Process*.

A budget is a detailed statement of anticipated revenues and expenditures during an accounting period.

The following is taken from *Cost Estimating Simplified*, by Nick Butcher and Linda Demmers.

A cost estimate should not be confused with a project budget. A project budget will include the total of the cost estimate, and will also include what are known as “soft costs.” These soft costs will specifically be excluded from the cost estimate and will typically include land acquisition, architectural and design fees, movable furniture and equipment, building permits and fees, fire and all risk insurance. The project budget will also include non-construction related costs such as fundraising and moving costs.

f. Describe the process for preparing cost estimates and budgets.

Cost Estimates

The following is taken from DOE G 413.3-21.

Traditionally, cost estimates are produced by gathering input, developing the cost estimate and its documentation, and generating necessary output. The scope of work, schedule, risk management plan, and peer review interact to influence the cost estimating process and techniques used to develop the output. These process interactions—inputs, processes, and outputs—are used by the Project Management Institute and others to depict the transfer of information between steps in a knowledge area such as cost estimating.

Cost estimate development is initiated by inputs to the process. These inputs are process elements that can be either one-time or iterative in nature. One-time inputs may include project/program requirements, the mission need statement, and the acquisition strategy or acquisition plan. Iterative inputs may include the technical/scope development, the schedule development, and the risk management plan with associated risk identification and mitigation strategies.

Budget

The following is taken from DOE O 130.1.

The Department's annual budget formulation process consists of four distinct phases. Detailed reporting requirements for each phase are contained in the DOE budget formulation instructions.

FIELD BUDGET PROCESS

The field budget process is the first phase of the Department's annual budget formulation process. It is the process through which field offices prepare and submit field budget data to HQ elements for use in the corporate review budget (CRB) process.

CORPORATE REVIEW BUDGET PROCESS

The CRB process is the second phase of the Department's annual budget formulation process. It is the process whereby HQ organizations use, among other budget related information, field budget data and spring planning decisions to develop initial organizational budget requests that are jointly evaluated and considered in the Department's internal budget review, resulting in CRB budget allowances.

OFFICE OF MANAGEMENT AND BUDGET, BUDGET REVIEW PROCESS

The OMB budget review process is the third phase of the Department's annual budget formulation process. It is the principal mechanism for preparing the Department's annual budget submission to the OMB. The Department's OMB request is based on the Secretary's final budget allowances resulting from the CRB process.

CONGRESSIONAL BUDGET REVIEW PROCESS

The congressional budget review process is the final phase of the Department's annual budget formulation process. It is based on final presidential funding and policy determinations resulting from the OMB budget review process.

g. Demonstrate awareness of the relationship between following terms:
- **Budgeted Cost of Work Scheduled (BCWS)**
- **Budgeted Cost of Work Performed (BCWP)**
- **Actual Cost of Work Performed (ACWP)**

[Note: These three terms are discussed but not defined in current DOE directives.]

The following definitions are taken from DOE M 413.3-1 (archived).

Budgeted Cost of Work Scheduled (This term is now referred to as PV)
The sum of the budgets for all work scheduled to be accomplished, plus the level of effort and apportioned effort scheduled to be accomplished within a given time period.

Budgeted Cost of Work Performed (This term is now referred to as EV)
A measure of work completed. BCWP is the value of work performed, or "earned" when compared to the original plan (the BCWS).

Actual Cost of Work Performed (This term is now referred to as AC)
Total costs incurred in accomplishing an identified element or scope of work during a given time period.

The following is taken from DOE G 413.3-10.

An earned value management system (EVMS) is an integrated set of policies, procedures, and practices to support program and project management as a decision-enhancing tool and a critical component of risk management. An EVMS reliably tracks PV of work to be performed (or the BCWS), the EV of actual work performed (or the BCWP), and the AC (or ACWP).

h. Discuss how priorities should be balanced to achieve the following:
- **Resources are effectively allocated to address safety, programmatic, and operational considerations.**
- **Protecting the public, the workers, and the environment is a priority whenever activities are planned and performed.**

The following is taken from DOE G 450.4-1C, attachment 1.

Balanced Priorities (ISM guiding principle number 4)
Resources are effectively allocated to address safety, programmatic, and operational considerations. Protecting the workers, the public, and the environment is a priority whenever activities are planned and performed.

Basic 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, in production and safety.

Safety and productivity are highly valued. Safety and productivity concerns 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 resources remain adequate to address emergent issues. The organization develops sufficient resources to rapidly cope with and respond to unexpected changes.

Key technical officials are assigned for long terms of service to provide institutional continuity and consistency 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 QA 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.

i. Discuss DOE's budgeting process to capture funding decisions based on prioritization of work.

The following is taken from ES/ER/TM-112/R2, *Environmental Restoration, Risk-based Prioritization, Work Package Planning, and Risk Ranking Methodology.*

The risk-based prioritization methodology presented here is used to identify Environmental Restoration (ER) Program activities that reduce the most significant risks or provide the most value toward achieving the ER mission at DOE, Oak Ridge Field Office (DOE-ORO) sites.

Prioritization is conducted as an integral component of the fiscal funding cycle to establish program budget priorities. The methodology provides the ER Program with a framework for (1) organizing information about identified DOE-ORO environmental problems; (2) generating qualitative assessments of the long- and short-term risks posed by DOE-ORO environmental problems; and (3) evaluating the benefits associated with candidate work

packages to reduce those risks. This document presents the technical basis for the decision support tools and prioritization process.

The identification, evaluation, and prioritization of ER fiscal funding decisions is conducted qualitatively and relies on the technical expertise and professional judgment of Lockheed Martin Energy Systems, Inc. (LMES) and DOE ER program/project experts, managers, and regulatory agency representatives. The ER Prioritization Board, composed of senior DOE and LMES ER program managers and representatives from EPA Region IV (Tennessee Department of Environment and Conservation, Kentucky Department of Environmental Protection, and Ohio Environmental Protection Agency), conducts the final "scoring" and prioritization of work packages.

Two decision aids facilitate the decision-making process. The ER work package planning form is completed by site technical experts and project managers for each candidate work package and submitted to the ER Prioritization Board for use in evaluating and prioritizing the work packages. The environmental restoration benefit assessment Matrix is a three-dimensional analytical decision support tool containing (1) a standard set of impact categories that balance the major objectives within the ER Program; (2) a scale for measuring impact severity; and (3) a scale for measuring impact likelihood. To derive a score representing the benefits of a work package, each criterion's weight is multiplied by a value representing the severity of an impact and a value representing the likelihood of an impact. The matrix evaluation yields a numerical value that describes the existing situation at a site and a value that describes the situation that would exist after a work package has been implemented. The delta (Δ) risk score represents the benefits a work package provides. This score is used initially to rank a set of work packages.

j. Demonstrate awareness of the requirements to procure external products and services for DOE projects.

The following is taken from DOE G 414.1-2B.

The procurement process should ensure that items and/or services provided by suppliers meet the requirements and expectations of the end user. The procurement process should be planned, implemented and controlled to ensure the following:

- Supplier QAP requirements are identified using a grading process such as the process defined in DOE G 414.1-2B.
- Proper flow down takes place and the supplier/vendor clearly understands all procurement requirements.
- The end user's requirements are accurately, completely, and clearly communicated to the supplier.
- Supplier, designer, and end user requirements are met during the production phase.
- The product is delivered on time.
- Special handling and storage requirements are specified at time of delivery.

The selection of procurement requirements should be commensurate with the importance of the end use of the purchased item or service. Management controls exist for DOE procurement and subcontracts through applicable DOE Orders, the DEAR in 48 CFR

subchapters A through H, and the FAR in 48 CFR 970, "DOE Management and Operating Contracts," and the following paragraphs. The requirements in DOE O 414.1D and 10 CFR 830 subpart A should not be interpreted to require the development of redundant procurement management systems, but rather to ensure that existing procurement management systems adequately respond to end user requirements.

The procurement process of DOE nuclear facility contractors should include a determination of the applicability of 10 CFR 830 subpart A to the supplier or subcontractor. If applicable, procurement documents and contracts for items and services provided to facilities covered by 10 CFR 830 subpart A should include a statement informing the supplier/vendor or subcontractor of 10 CFR 830 subpart A requirements and of the potential for enforcement actions under 10 CFR 20. In addition, DOE O 414.1D requires that contractors be responsible for ensuring proper flow down of all applicable requirements to suppliers/vendors and subcontractors. DOE should ensure proper oversight of the flow down of requirements by their contractors to subcontractors, vendors and suppliers. The DOE contractor is responsible for determining methods to ensure that procured items and services meet requirements and perform as expected, including the prevention and control of the introduction of S/CIs. The selection of prospective suppliers should be based on specified criteria. Suppliers/vendors should be evaluated to verify their capability to meet performance and schedule requirements.

Procurement processes should be established and implemented to ensure that approved suppliers continue to provide acceptable items and services. Suppliers/vendors should be monitored to ensure that acceptable items or services are produced within the specified schedule.

k. Demonstrate awareness of the methods for procuring DOE or other government products and services.

The following is taken from Federal Acquisitions Regulations 8.4, "Federal Supply Schedules."

The Federal supply schedule program is also known as the General Services Administration (GSA) schedules program or the multiple award schedule program. The Federal supply schedule program is directed and managed by GSA and provides Federal agencies with a simplified process for obtaining commercial supplies and services at prices associated with volume buying. Indefinite delivery contracts are awarded to provide supplies and services at stated prices for given periods of time. GSA may delegate certain responsibilities to other agencies.

Other procurement vehicles include direct contracting with vendors, and government-issued credit cards, both of which have dollar limitations associated with their use.

Additional information is available in the FAR, part 8.

Video 22. GSA schedules
https://www.youtube.com/watch?v=FeoexpB63hI&feature=youtu.be

I. Discuss the responsibilities, authorities, and implementation requirements for DOE O 430.1B, Chg, 2, Real Property and Asset Management, at defense nuclear facilities.

The following is taken from DOE O 430.1B, chg. 2.

Responsibilities and Authorities

The lead program secretarial office and cognizant secretarial office are responsible for notifying contracting officers about the site/facility management contracts to which this Order is applicable. Once notified, contracting officers are responsible for incorporating the CRD into affected site/facility management contracts via the laws, regulations, and DOE directives clause of the contracts.

As the laws, regulations, and DOE directives clause of site/facility management contracts states, regardless of the performer of the work, site/facility management contractors with the CRD incorporated into their contracts are responsible for compliance with the requirements of the CRD. Affected site/facility management contractors are responsible for flowing down the requirements of this CRD to subcontracts at any tier to the extent necessary to ensure compliance with the requirements. In doing so, contractors must not unnecessarily or imprudently flow down requirements to subcontracts. That is, contractors will ensure that they and their subcontractors comply with the requirements of this CRD and only incur costs that would be incurred by a prudent person in the conduct of competitive business.

Implementation

The deputy secretary of energy exercises responsibility for implementation of DOE O 430.1B, chg. 2 by departmental elements.

The lead PSO ensures a qualified DOE Federal facilities management staff is assigned at HQ offices and field elements to provide for implementation of DOE O 430.1B, chg. 2, and to ensure Federal accountability for the proper stewardship of real property assets and real estate actions.

The Office of Engineering and Construction Management provides independent corporate oversight for the implementation of the real property asset management requirements of DOE O 430.1B, chg. 2, and provides an annual summary report to the Deputy Secretary on the state of the Department's real property assets.

A qualified DOE Federal facilities management staff must be assigned at cognizant HQ offices and field elements to provide for implementation of DOE O 430.1B, chg. 2, and to ensure accountability.

The site/field office manager

- oversees implementation of the requirements in DOE O 430.1B, chg. 2 at the site consistent with the annual program direction and guidance issued by the lead program secretarial office responsible for the site; and
- monitors DOE O 430.1B, chg. 2 implementation through the establishment, by contract or financial assistance agreement, of a site-specific performance measurement system.

m. Compare and contrast the project manager and program manager qualification requirements at a given office or site.

n. Manage or oversee the performance of a given project or program that has a minimum duration of six months.

KSAs m and n are performance-based. The Qualifying Official will evaluate their completion.

15. An STSM must have a working level knowledge of quality assurance policies, programs, and processes.

a. Describe the general requirements, purpose, interrelationships, and importance of DOE O 414.1D, *Quality Assurance*, 10 CFR 830, "Nuclear Safety Management"; 10 CFR 830, Subpart A, "Quality Assurance Requirements"; and national or international consensus standards on quality assurance.

The following is taken from DOE O 414.1D.

The purpose of DOE O 414.1D is to

- ensure DOE and NNSA products and services meet or exceed customers' requirements and expectations;
- achieve QA for all work based on the principles that
  - all work, as defined in DOE O 414.1D, is conducted through an integrated and effective management system;
  - management support for planning, organization, resources, direction, and control is essential to QA;
  - performance and quality improvement require thorough, rigorous assessments and effective corrective actions;
  - all personnel are responsible for achieving and maintaining quality;
  - risks and adverse mission impacts associated with work processes are minimized while maximizing reliability and performance of work products; and
- establish additional process-specific quality requirements to be implemented under a QAP for the control of S/CIs, and nuclear safety software as defined in DOE 414.1D.

Requirements

Quality Assurance Program Development and Implementation

Each departmental element and associated field element(s) must identify and assign a senior manager to have responsibility, authority, and accountability to ensure the development, implementation, assessment, maintenance, and improvement of the QAP. Using a graded approach, the organization must develop a QAP and implement the approved QAP. The QAP must do the following:

- Describe the graded approach used in the QAP.
- Implement QA criteria as defined in DOE O 414.1D, attachment 2, as well as the requirements in DOE O 414.1D, attachment 3, for all facilities, and for nuclear facilities, the requirements in DOE O 414.1D, attachment 4. This requires that all

software meet applicable QA requirements in DOE O 414.1D, attachment 2, using a graded approach.

- Describe how the criteria/requirements are met, using the documented graded approach:
  - Flow down the applicable QA requirements and responsibilities throughout all levels of the organization.
  - Use appropriate national or international consensus standards in whole or in part, consistent with regulatory requirements and SO direction. When standards do not fully address these requirements, the gaps must be addressed in the QAP.
  - Clearly identify which standards, or parts of the standards, are used.

Quality Assurance Program Approval and Changes

Each departmental element and associated field element(s) must do the following:

- Submit a QAP to the designated DOE approval authority.
- Review the QAP annually, or on a periodic basis defined in the QAP, and update the QAP, as needed. Submit a summary of the review of the QAP and, if necessary, also submit the modified QAP to the DOE approval authority. Editorial changes to the QAP, that do not reduce or change commitments, do not require approval.
- Regard the QAP as approved 90 calendar days after receipt by the approval authority, unless approved or rejected at an earlier date.

Federal Technical Capability and Qualifications

Qualification for the functional areas identified in paragraphs 4.c.(1) and (2) of DOE O 414.1D are achieved as defined in DOE O 426.1, (or successor document).

- Federal personnel directly responsible for the oversight of quality requirements governing defense nuclear facilities must be qualified according to DOE-STD-1150-2002, *Quality Assurance Functional Area Qualification Standard*.
- Federal personnel directly responsible for oversight of safety software quality assurance activities of defense nuclear facilities must be qualified in accordance with DOE STD-1172-2011, *Safety Software Quality Assurance Functional Area Qualification Standard.*

The following is taken from 10 CFR 830.

10 CFR 830, governs the conduct of DOE contractors, DOE personnel, and other persons conducting activities, including providing items and services that affect, or may affect, the safety of DOE nuclear facilities. The requirements of this part must be implemented in a manner that provides reasonable assurance of adequate protection of workers, the public, and the environment from adverse consequences, taking into account the work to be performed and the associated hazards.

[Note: 10 CFR 830.120 is the scope statement for 10 CFR 830, subpart A, "Quality Assurance Requirements." 10 CFR 830 subpart A is discussed in the following section.]

The following is taken from 10 CFR 830 subpart A.

10 CFR 830, subpart A establishes QA requirements for contractors conducting activities, including providing items or services that affect, or may affect, nuclear safety of DOE nuclear facilities. It provides details on QAPs and lists the QA criteria.

The interrelationship between these regulations is their shared primary focus points of quality and safety of operations, and the importance of their implementation to ensure successful program functionality.

National and international consensus standards on QA should be applied to activities when they add an additional level of rigor, thus resulting in a higher level of quality control of the activity. An example of this application is aspiring to "do better than required" and have expectations exceeded, not just met.

b. Describe how ASME NQA-1-2008 with the NQA-1a-2011 addenda, "Quality Assurance Requirements for Nuclear Facility Applications" is applied to implement the QA criteria.

The following is taken from ASME (American Society of Mechanical Engineers) NQA-1a-2009.

ASME NQA-1-2008 reflects industry experience and current understanding of the quality assurance requirements necessary to achieve safe, reliable, and efficient use of nuclear energy, and management and processing of radioactive materials. ASME NQA-1-2008 focuses on the achievement of results, emphasizes the role of the individual and line management in the achievement of quality, and fosters the application of these requirements in a manner consistent with the relative importance of the item or activity.

c. Describe how the QA requirements are related to the Documented Safety Analysis.

The following is taken from DOE-STD-3009-94.

Chapter 14 of the DSA describes the provisions for a quality assurance program. Expected products of this chapter, as applicable based on the graded approach, include

- description of quality assurance program and organization;
- description of document control and records management; and
- description of the quality assurance process ensuring that performed safety related work meets requirements.

Existing supporting documentation is to be referenced. Include brief abstracts of referenced documentation with enough of the salient facts to provide an understanding of the referenced documentation and its relation to this chapter.

The level of quality control and assurance required is directly related to the magnitude of hazards and incorporates considerations of stage and complexity of the facility or activity. A higher hazard facility with complex systems requires a more formalized quality assurance program. Discussions can be brief and are limited to summaries of the major features of the programmatic commitment to the safety basis.

d. Describe the DOE and contractor responsibilities and requirements for implementing a Quality Assurance Program (QAP).

The following is taken from DOE O 414.1D.

DOE QAP Implementation Responsibilities and Requirements

Each departmental element and associated field element(s) must identify and assign a senior manager to have responsibility, authority, and accountability to ensure the development, implementation, assessment, maintenance, and improvement of the QAP. Using a graded approach, the organization must develop a QAP and implement the approved QAP.

The deputy secretary must ensure implementation of DOE QA requirements throughout the Department.

Secretarial officers must notify cognizant contracting officers, of those contractors that should include the CRD or its requirements, as appropriate. The SO has the authority to direct the contracting officer, as necessary, to ensure appropriate quality requirements are implemented by the contractor.

The chief health, safety, and security officer must

- provide advice and assistance to DOE elements and contractors concerning implementation of DOE O 414.1D; and
- identify and propose resolutions for crosscutting QA issues within the Department to improve implementation.

Contractor QAP Implementation Responsibilities and Requirements

The contractor must

- identify and assign an individual to have responsibility, authority, and accountability to ensure the development, implementation, assessment, maintenance, and improvement of the QAP; and
- implement the QAP as approved by DOE.

e. Discuss the role of STSMs with respect to DOE O 414.1D, 10 CFR 830, and 10 CFR 830, Subpart A.

The following is taken from DOE O 414.1D.

The following are the responsibilities assigned to the STSM acting as the field element manager:

- Notify contracting officers for field-issued contracts as to which contractors are affected by DOE O 414.1D. The SO has the authority to direct the contracting officer, as necessary, to ensure appropriate quality requirements are implemented by the contractor.
- For FEMs of sites, other than NNSA sites, where approval authority is delegated to the FEM, review and approve any new or revised QAPs for work under the FEM's purview. Where authority is not delegated to the FEM, review and comment on, and submit the QAPs to the SO for approval.

- For FEMs of NNSA sites, review and approve any new or revised QAPs for work under the FEM's purview, including the FEM and contractor QAPs.
- Provide resources and staff to meet the provisions of DOE O 414.1D and ensure that appropriate staff is qualified, as specified in paragraph 4.c of DOE 414.1D.
- Ensure reviews are performed of the field element QAP per paragraph 4.b.(2) of DOE O 414.1D and update as necessary. Submit to the approval authority the modified QAP.
- Ensure review of safety documentation for the facility or activity to validate that safety software has been properly identified.
- Ensure review of grading levels of safety software for approval by the QAP approval authority.

f. Describe the 10 quality assurance criteria of DOE O 414.1D and 10 CFR 830 Subpart A which address the following:
- **Management**
- **Performance**
- **Assessment**

The following is taken from DOE O 414.1D.

Management

CRITERION 1—MANAGEMENT/PROGRAM
- Establish an organizational structure, functional responsibilities, levels of authority, and interfaces for those managing, performing, and assessing the work.
- Establish management processes, including planning, scheduling, and providing resources for the work.

CRITERION 2—MANAGEMENT/PERSONNEL TRAINING AND QUALIFICATION
- Train and qualify personnel to be capable of performing their assigned work.
- Provide continuing training to personnel to maintain their job proficiency.

CRITERION 3—MANAGEMENT/QUALITY IMPROVEMENT
- Establish and implement processes to detect and prevent quality problems.
- Identify, control, and correct items, services, and processes that do not meet established requirements.
- Identify the causes of problems, and include prevention of recurrence as a part of corrective action planning.
- Review item characteristics, process implementation, and other quality related information to identify items, services, and processes needing improvement.

CRITERION 4—MANAGEMENT/DOCUMENTS AND RECORDS
- Prepare, review, approve, issue, use, and revise documents to prescribe processes, specify requirements, or establish design.
- Specify, prepare, review, approve, and maintain records.

Performance

CRITERION 5—PERFORMANCE/WORK PROCESSES

- Perform work consistent with technical standards, ACs, and other hazard controls adopted to meet regulatory or contract requirements using approved instructions, procedures, or other appropriate means.
- Identify and control items to ensure proper use.
- Maintain items to prevent damage, loss, or deterioration.
- Calibrate and maintain equipment used for process monitoring or data collection.

CRITERION 6—PERFORMANCE/DESIGN

- Design items and processes using sound engineering/scientific principles and appropriate standards.
- Incorporate applicable requirements and design bases in design work and design changes.
- Identify and control design interfaces.
- Verify or validate the adequacy of design products using individuals or groups other than those who performed the work.
- Verify or validate work before approval and implementation of the design.

CRITERION 7—PERFORMANCE/PROCUREMENT

- Procure items and services that meet established requirements and perform as specified.
- Evaluate and select prospective suppliers on the basis of specified criteria.
- Establish and implement processes to ensure that approved suppliers continue to provide acceptable items and services.

CRITERION 8—PERFORMANCE/INSPECTION AND ACCEPTANCE TESTING

- Inspect and test specified items, services, and processes using established acceptance and performance criteria.
- Calibrate and maintain equipment used for inspections and tests.

Assessment

CRITERION 9—ASSESSMENT/MANAGEMENT ASSESSMENT

- Ensure that managers assess their management processes and identify and correct problems that hinder the organization from achieving its objectives.

CRITERION 10—ASSESSMENT/INDEPENDENT ASSESSMENT

- Plan and conduct independent assessments to measure item and service quality, to measure the adequacy of work performance, and to promote improvement.
- Establish sufficient authority and freedom from line management for independent assessment teams.

g. Referring to the following DOE Guides supporting DOE O 414.1D and 10 CFR 830, Subpart A, discuss the implementation of an effective QAP:

- **DOE G 414.1-1B, *Management and Independent Assessment Guide for Use with 10 CFR Part 830, Subpart A*, and *DOE O 414.1C, Quality Assurance; DOE M 450.4-1, Integrated Safety Management System Manual; and DOE O 226.1A, Implementation of DOE Oversight Policy***
- **DOE G 414.1-2B, Admin Chg.1, *Quality Assurance Program Guide***
- **DOE G 414.1-4, *Safety Software Guide for Use with 10 CFR 830, Subpart A, Quality Assurance Requirements, and DOE O 414.1C, Quality Assurance***

DOE G 414.1-1B

DOE G 414.1-1B expands on the details of the assessment criteria discussed in DOE G 414.1-2B. In addition, DOE G 414.1-2B describes the relationship between QA and integrating the safety management system requirements. DOE G 450.4-1C describes the role of assessment in the feedback and improvement of safety management functions.

ASSESSMENT BENEFITS

The success of an organization depends on the extent to which its products and services satisfy customer requirements and expectations. Each member of an organization is responsible for customer satisfaction. The results-oriented quality program described in 10 CFR 830 and DOE O 414.1D focuses on customer requirements and expectations, and embraces continuous improvement.

Assessments build confidence that organizations can meet customer expectations, self-identify areas where improvement is needed, and correct problems before they become major issues or events.

Effective internal assessments prepare an organization for external governmental and nongovernmental assessments of performance, and conformity with national and international standards.

DOE G 414.1-2B

DOE G 414.1-2B provides information on principles, requirements, and practices used to establish and implement an effective QAP for non-nuclear and nuclear facilities consistent with the requirements of DOE O 414.1D and 10 CFR 830.

MANAGEMENT CRITERIA

DOE O 414.1D and 10 CFR 830 require that an organization develop, document, implement, and maintain an effective QAP. The goal of the QAP is delivery of safe, reliable products and services that meet or exceed the customer's requirements, needs, and expectations. The QAP is defined as the overall program or management system established to assign responsibilities and authorities, define policies and requirements, and provide for the performance and assessment of work. Defining the proper structure for the organization and the management processes necessary to conduct work within the organization is critical to assure that work can be controlled and conducted safely. This allows the organization to conduct work safely and efficiently, as well as meeting or exceeding applicable requirements and expectations.

PERFORMANCE CRITERIA

Work performed should be consistent with technical standards, administrative controls, and hazard controls adopted to meet regulatory or contract requirements using approved instructions, procedures, or other appropriate means. Work processes consist of a series of actions planned and carried out by qualified personnel using approved procedures, instructions, and equipment under administrative, technical, and environmental controls to achieve a result.

Managers are responsible for ensuring that personnel under their supervision have the training, skills, equipment, work process documents, and resources needed to accomplish work. Line management and workers should cooperate to identify processes that can be

improved based on feedback prior to and following implementation of the work process. Before workers begin work, management should provide adequate information on

- customer requirements;
- hazards associated with the work;
- safety, administrative, technical, environmental, and quality controls to be used during the work;
- technical standards applicable to the work and final product;
- data requirements for the work and final product;
- acceptance criteria applicable to the work and final product; and
- procedures for verification of the completed work using established criteria.

Procedures, work instructions, or other appropriate means used to define work processes should be documented and controlled. The scope and detail of documentation should be commensurate with the complexity and importance of the work; the skills required to perform the work; the hazards and risks or consequences of quality problems in the product, process, or service; and the need to meet regulatory and contract requirements. Control of processes, skills, hazards, and equipment should be clearly specified, understood, and fully documented. This can serve as the point of integration for the ISMS and QA into an integrated management approach.

ASSESSMENT CRITERIA

DOE O 414.1D and 10 CFR 830 require that managers assess their management processes, and identify and correct problems that hinder the organization from achieving its objectives. Assessments should promote continuous improvement and ensure that the organization's performance is acceptable.

DOE G 414.1-4

DOE G 414.1-4 provides information plus acceptable methods for implementing the safety software quality assurance (SQA) requirements of DOE O 414.1D. DOE O 414.1D requirements supplement the QAP requirements of 10 CFR 830, for DOE nuclear facilities and activities. The safety SQA requirements for DOE and its contractors are necessary to implement effective QA processes and achieve safe nuclear facility operations.

DOE promulgated the safety software requirements and guidance to control or eliminate the hazards and associated potential accidents posed by nuclear operations, including radiological operations. Safety software failures or unintended output can lead to unexpected system or equipment failures and undue risks to the DOE/NNSA mission, the environment, the public, and the workers. Thus DOE G 414.1-4 has been developed to provide guidance on establishing and implementing effective QA processes tied specifically to nuclear facility safety software applications. DOE also provides guidance for the overarching QA program, which includes safety software within its scope. DOE G 414.1-4 includes software application practices covered by appropriate national and international consensus standards and various processes currently in use at DOE facilities. This guidance is also considered to be of sufficient rigor and depth to ensure acceptable reliability of safety software at DOE nuclear facilities. This guidance should be used by organizations to help determine and support the steps necessary to address possible design or functional implementation deficiencies that might exist and to reduce operational hazards-related risks to an acceptable

level. Attributes such as the facility life-cycle stage and the hazardous nature of each facility's operations should be considered when using DOE G 414.1-4. Alternative methods to those described in DOE G 414.1-4 may be used provided they result in compliance with the requirements of 10 CFR 830 Subpart A and DOE O 414.1D. Another objective of this guidance is to encourage robust software quality methods to enable the development of high quality safety applications.

h. Describe the scope, purpose, and application of the safety software quality assurance requirements and work practices.

The following is derived from DOE G 414.1-4.

Scope

The scope of DOE G 414.1-4 includes software applications that meet safety software definitions as stated in DOE O 414.1C. This includes software applications important to safety that may be included or associated with SSCs for less than hazard category 3 facilities. Safety software includes safety system software, safety and hazard analysis software and design software, and safety management and AC software.

Purpose

DOE promulgated the safety software requirements and this guidance to control or eliminate the hazards and associated postulated accidents posed by nuclear operations, including radiological operations. Safety software failures or unintended output can lead to unexpected system or equipment failures and undue risks to the DOE/NNSA mission, the environment, the public, and the workers. Thus DOE G 414.1-4 has been developed to provide guidance on establishing and implementing effective QA processes tied specifically to nuclear facility safety software applications. DOE also has guidance for the overarching QAP, which includes safety software within its scope. DOE G 414.1-4 includes software application practices covered by appropriate national and international consensus standards and various processes currently in use at DOE facilities. This guidance is also considered to be of sufficient rigor and depth to ensure acceptable reliability of safety software at DOE nuclear facilities.

Graded Application

Proper implementation of DOE O 414.1D will be enhanced by grading safety software based on its application. Safety software grading levels should be described in terms of safety consequence and regulatory compliance. DOE G 414.1-4 utilizes the grading levels and the software types (custom-developed, configurable, acquired, utility calculations, and commercial design and analysis tools) to recommend how the SSQA work activities are applied. The grading levels are defined as follows:

- Level A 羊 his grading level includes safety software applications that meet one or more of the following criteria:
    - Software failure that could compromise a limiting condition for operation
    - Software failure that could cause a reduction in the safety margin for a safety SSC that is cited in DOE-approved DSA
    - Software failure that could cause a reduction in the safety margin for other systems such as toxic or chemical protection systems that are cited in either (a) a

DOE-approved DSA or (b) an approved hazard analysis per DOE P 450.1 and the DEAR ISMS clause
    - Software failure that could result in nonconservative safety analysis, design, or misclassification of facilities or SSCs

- Level B羊 his grading level includes safety software applications that do not meet level A criteria but meet one or more of the following criteria:
    - Safety management databases used to aid in decision-making whose failure could impact safety SSC operation
    - Software failure that could result in incorrect analysis, design, monitoring, alarming, or recording of hazardous exposures to workers or the public
    - Software failure that could compromise the defense-in-depth capability for the nuclear facility

- Level C羊 his grading level includes software applications that do not meet level B criteria but meet one or more of the following criteria:
    - Software failure that could cause a potential violation of regulatory permitting requirements
    - Software failure that could affect ES&H monitoring or alarming systems
    - Software failure that could affect the safe operation of an SSC

The grading level criteria should provide for a higher grade level for software in nuclear facilities categorized as category 1, 2, or 3 and the lower grading level for software in facilities categorized as less than category 3.

i. Discuss how the approved Quality Assurance Program at a given DOE site office or contractor is applied to safety system design, construction, and operations, and implementation of its Integrated Safety Management System. Address in the report how the 10 QA criteria and the 12 safety management principles/functions are integrated and the approach used, and effectiveness of the flow-down of QA criteria to subcontractors.

This KSA is site/contractor-specific. The Qualifying Official will evaluate its completion.

16. An STSM must have a working level knowledge of radiation protection program requirements described in 10 CFR 835; and related DOE Orders, Standards, and Guides.

a. Discuss the purpose and objectives of a DOE Radiation Protection Program.

The following is taken from DOE G 441.1-1C, admin chg. 1.

Purpose

A DOE radiation protection program (RPP) is intended to provide DOE reasonable assurance that the DOE activity will be conducted in compliance with the provisions of 10 CFR 835, "Occupational Radiation Protection." The RPP also satisfies the requirement for an implementation plan found in other DOE directives.

Objectives

Administrative processes should include a hierarchy of documents that clearly and unambiguously delineate management policies, requirements, expectations, and objectives for the RPP. This documentation should typically include the following:

- Policy statement 羊the policy statement should articulate management's commitment to conduct radiological operations in a manner that will ensure the health and safety of all its employees, contractors, and the general public. This policy statement should be patterned after DOE P 450.4A.
- Site-specific radiological control manual or handbook 羊this document should be issued and endorsed by senior management for a DOE activity. This manual or handbook should address all functional elements of the RPP for the DOE activity.
- Procedures 羊these documents should provide detailed instructions for implementing various functional elements of the RPP. Responsibilities and actions required of management and workers should be clearly and unambiguously stated. Written procedures shall be developed and implemented as necessary to ensure compliance with 10 CFR 835, commensurate with the radiological hazards created by the activity and consistent with the education, training, and skills of the individuals exposed to those hazards. It is not necessary for written procedures to be developed and implemented for all of the requirements of 10 CFR 835. Written procedures should be developed and employed under the following circumstances:
  - Worker health and safety are directly affected.
  - The expected outcome for the process or operation requires that a specific method be followed.
  - The process or operation is infrequently used and competence training cannot ensure adequate implementation.
  - To document the approved method to implement specific processes or operations.
- Technical basis documents 羊document decisions and approaches used to achieve regulatory compliance, such as those decisions where professional judgment has been exercised. The document should include supporting analyses and justifications sufficient to demonstrate that regulatory compliance can be achieved and maintained. DOE G 441.1-1C, *Radiation Protection Programs Guide for Use with Title 10, Code of Federal Regulations, Part 835, Occupational Radiation Protection*, contains specific recommendations for documenting the technical basis for various RPP functional elements.

b. Identify and explain the general and unique radiological hazards associated with the following (as applicable to the STSM):

- **Plutonium operations**
- **Uranium operations**
- **Tritium operations**
- **Nuclear explosive operations**
- **Production/experimental reactors**
- **Accelerator operations**
- **Waste handling/processing operations**
- **Decontamination and decommissioning**
- **Use of radiation generating devices**
- **Environmental restoration activities**

Plutonium Operations

The following is taken from DOE-STD-1128-2008.

The major industrial hazard in plutonium facilities is the potential for loss of control of a highly toxic substance, resulting in either the inhalation or ingestion of plutonium or one of its compounds by personnel, or the exposure to excessive radiation from a criticality accident. The possibility of a fire or explosion in a plutonium facility is probably the most serious threat because the consequences of a fire could lead to loss of containment and subsequent disbursement of highly mobile plutonium particulates. In addition, fighting the fire with water to maintain containment could create the potential for a criticality accident and/or loss of containment in the immediate vicinity.

The day-to-day hazards for personnel in plutonium facilities involve exposure to gamma rays, x-rays, and neutrons, as well as possible accumulation of plutonium in the body.

Uranium Operations

The following is taken from DOE-STD-1136-2009.

The principal industrial hazards associated with uranium are fires, hydrogen generation, generation of oxides of nitrogen, and associated mechanical hazards characteristic of heavy objects. Hydrogen fluoride and oxides of nitrogen are by-products or reactants of common chemical processes. Hydrogen can be generated by reaction of water with uranium metal, and finely divided uranium or uranium chips with a large surface-area-to-volume ratio can ignite spontaneously.

The chemical and radiological hazards of uranium are moderate compared to those of other industrial materials and radionuclides.

The chemical toxicity of uranium is a primary concern in establishing control limits. A heavy metal, uranium is chemically toxic to kidneys and exposure to soluble compounds can result in renal injury. The factors to be considered in determining whether the chemical or radiological hazard is controlling are the enrichment, mode of entry, and the solubility/transportability of the material. Chemical toxicity is a higher risk with soluble material of ten percent or less enrichment.

The predominant hazard associated with uranium exposure depends on its degree of enrichment, its chemical form, and its physical form. The degree of enrichment determines the gamma radiation intensity and the overall specific activity. Chemical form determines solubility and consequent transportability in body fluids. International Commission on Radiological Protection, ICRP Publication 103, 2007, *Recommendations of the International Commission on Radiological Protection,* classifies all materials into three material types: F, M, and S. Type F is most transportable (pulmonary removal half-time of days), type S the least transportable (removal half-time of years), and type M an intermediate category (removal half-time of weeks). The transportability of an inhaled or ingested material determines its fate within the body and, therefore, the resulting radiation dose or chemical effect.

Tritium Operations

The following is taken from U.S. Department of Defense, Directive 5100.52-M, *Nuclear Weapon Accident Response Procedures*, chapter 9, "Radioactive Materials, Characteristics, Hazards and Health Considerations."

Tritium constitutes a health hazard when personnel are engaged in specific weapon render-safe procedures, when responding to an accident that has occurred in an enclosed space, and during accidents that have occurred in rain, snow, or in a body of water. In its gaseous state, tritium is not absorbed by the skin to any significant degree. The hazardous nature of tritium is due to its ability to combine with other materials. Tritium water vapor is readily absorbed by the body through inhalation and through the skin. The radioactive water that enters the body is chemically identical to ordinary water and is distributed throughout the body tissue. Although it takes a relatively large amount of tritium to be a significant radiation hazard, caution should be used. Tritium that has plated out on a surface or combined chemically with solid materials is a contact hazard. The human body normally eliminates and renews 50 percent of its water in about 8–12 days.

Video 23. Trouble with tritium
http://www.youtube.com/watch?v=-pnRtT7RxoI

Nuclear Explosive Operations

The following is taken from Sandia National Laboratories Manual MN471011, *Explosives Safety Manual*, chapter II, "Operational Safety, Part 1."

Explosives materials, explosives components (additives or adhesives), and materials such as organic solvents used in explosives processing can be toxic when inhaled, ingested, or absorbed through the skin. The most frequently reported effect from working with explosives is a skin rash resulting from skin contact with explosives materials or with solvents and adhesives used with explosives operations.

The following is taken from *Nuclear Weapons Frequently Asked Questions*, section 5.0, "Effects of Nuclear Explosions," by Carey Sublette.

THERMAL INJURY

Very intense heating of skin causes burn injuries. The burns caused by the sudden intense thermal radiation from a fireball are called "flash burns". The more thermal radiation absorbed, the more serious the burn:

- First degree flash burns are not serious, no tissue destruction occurs.
- Second degree burns cause damage to the underlying dermal tissue, killing some portion of it.
- Third degree burns cause tissue death all the way through the skin, including the stem cells required to regenerate skin tissue.
- Even more serious burns are possible, which have been classified as fourth (even fifth) degree burns. These burns destroy tissue below the skin: muscle, connective tissue, etc.

INCENDIARY EFFECTS

Despite the extreme intensity of thermal radiation, and the extraordinary surface temperatures that occur, it has less incendiary effect than might be supposed. This is mostly due to its short duration, and the shallow penetration of heat into affected materials. The extreme heating can cause pyrolysis (the charring of organic material, with the release of combustible gases), and momentary ignition, but it is rarely sufficient to cause self-sustained combustion.

EYE INJURY

The brightness and thermal output of a nuclear explosion presents an obvious source of injury to the eye. Injury to the cornea through surface heating, and injury to the retina are both possible risks.

- The most common eye injury is flash blindness, a temporary condition in which the visual pigment of retina is bleached out by the intense light. Vision is completely recovered as the pigment is regenerated, a process that takes several seconds to several minutes.
- Retinal injury is the most far reaching injury effect of nuclear explosions, but it is relatively rare since the eye must be looking directly at the detonation. Retinal injury results from burns in the area of the retina where the fireball image is focused.

Production/Experimental Reactors

The following is taken from *The Accident Hazards of Nuclear Power Plants*, by Richard E. Webb.

Nuclear reactors present a hazard to the health and safety of the public because they are subject to accidents such as explosions in which radioactivity could be released to the atmosphere as dust and expose a large population to lethal or injurious radiation. The nuclear reactor generates nuclear energy for making electricity, and in the process, it generates radioactivity as a by-product. This radioactivity builds up in the reactor and is even used as fuel in the case of plutonium, which is perhaps the most potent of all radioactive substances.

Accelerator Operations

The following is taken from DOE-HDBK-1108-2002, CN 1.

Accelerators are capable of creating a radiological area or other radiological hazards:

- The primary beam of an accelerator consists of accelerated charged particles prior to any interactions. The primary beam is the most intense form of radiation present at an accelerator facility and is made inaccessible to personnel through engineering design and administrative controls. Direct exposure to a particle beam can result in a potentially dangerous, or even lethal, dose of radiation.
- A secondary beam is produced by interaction of the primary beam with targets or beamline components.
- Skyshine is the radiation scattered from air molecules. Accelerator-produced skyshine is usually neutron radiation, scattered after emerging more or less vertically from the shielded enclosure. It can cause elevated radiation fields at ground level considerable distances from the source.

Waste-Handling/Processing Operations

The following is taken from U.S. Department of Labor, *Summary Report: Hazardous Waste Site Safety Hazards Study*.

Hazardous waste site inspections usually focus on health hazards. Employers report, however, that safety hazards are far more common and cause most of the OSHA recordables.

As part of its participation in the EPA Office of Solid Waste and Emergency Response and Labor Union Health and Safety Task Force, OSHA investigated this claim by conducting an information-gathering study of hazardous waste site safety hazards. An OSHA contractor performed the study, whose purpose was to identify safety hazards and implemented controls through field investigation and to seek patterns of hazards.

The contractor secured permission for access to six hazardous waste sites by working with the U.S. Army Corps of Engineers and by working with business contacts for large remediation contractors.

A wide variety of chemical contamination existed in various media at the sites. Among these contaminants were heavy metals such as lead and cadmium, polychlorinated biphenyls, polycyclic aromatic hydrocarbons, solvents, pesticides, and radioactive waste.

Operations at the sites included trenching and other types of soil and material handling, thermal desorption, chemical stabilization, high-efficiency particulate air vacuuming, water treatment, metals reclamation, demolition, well drilling, high-pressure water spraying, and painting.

Table 4 provides a list of common hazards observed or reported by site personnel. A discussion of the most frequently observed hazards follows.

Table 4. Hazards noted during field study

Rank Number	Type of Hazard	Number of Safety Hazards
1	Electrical	14
2	Excavations/Construction	11
3	Walking-Working Surfaces	8
4	General Environmental Controls	7
5	Materials Handling and Storage	6
5	Personal Protective Equipment	6
6	Welding, Cutting, Brazing	5
6	Motorized Vehicles. Mechanized Equipment Construction	5
7	Toxic and Hazardous Substances	4
7	Cranes, Derricks, Hoists, Elevators, and Conveyors Construction	4
8	Hazardous Materials	3
9	Hand and Portable Powered Tools	2

10	Fall Protection Construction	1
10	Occupational Health and Environmental Control	1
10	Materials Handling, Storage, Use and Disposal Construction	1
10	Concrete and Masonry Construction	1
10	Commercial Diving Operations	1
10	Stairways and Ladders	1
10	Blasting and Use of Explosives	1

Source: U.S. Department of Labor, Summary Report: Hazardous Waste Site Safety Hazards Study

ELECTRICAL

Electrical hazards were the most common safety hazards identified during the site visits. Many of the electrical hazards identified involved improper use of flexible cords. Damaged cords and cords missing ground prongs were frequently observed. Other common electrical hazards reported by site representatives included unlabeled circuit breakers and missing doors on electrical panels. Site representatives described injuries and near misses to workers exposed to shock from energized parts as well as cords that were driven over. It was reported that at one site a worker suffered a shock injury from cutting into a live 480-volt line that was lying on the ground outside a building. An unqualified electrician had removed the line from the building.

EXCAVATIONS

Excavation hazards were not often observed but were frequently discussed by site representatives. Several instances of striking underground installations during trenching activities at other sites were described. At one site, a local utility locator was not used to identify existing lines. Instead, old facility blueprints were relied upon. In another case, an operational cable bundle was struck and damaged because of an inadequate site walkover. A monument indicating the presence of the cable bundle was extant relatively near the excavation area, but wasn't noted until the post-incident investigation. In still another case, an electrical line was hit because a foreman and his technical manager did not communicate vital information.

The field team did observe hazards associated with soil stockpiles. During trenching operations, a competent person must watch the trench walls for cracks and fissures that may signify weaknesses. This practice is used less often for the sides of soil stockpiles. At one site, sizable cracks and fissures were observed in the side of a large soil stockpile. Heavy equipment was operating at the top of the pile. A road used by both cars and pedestrians was at the bottom of the banked soil. At this site, the field team promptly informed site representatives of the hazard.

Other common excavation hazards reported by site representatives included workers entering into unshored or improperly shored excavations and workers falling into unmarked trenches.

WALKING-WORKING SURFACES

Walking-working surface hazards were often identified during the site visits. The most common hazard mentioned was a lack of fall protection on elevated working surfaces such as

scissor lifts. Two other examples of reported hazards included a worker who fell into a manhole with no cover and another worker who slipped and fell from a catwalk because the non-skid coating was worn off and there was inadequate fall protection.

GENERAL ENVIRONMENTAL CONTROLS

Hazards involving general environmental controls such as confined spaces, lockout/tagout operations, and sanitation were common. Of these, the most frequently observed hazard was a lack of written procedures for lockout/tagout and confined space. On several of the sites visited, there were no specific written lockout/tagout procedures and no list of who was authorized to implement lockout/tagout procedures. In addition, on one site visited, appropriate lockout devices were not immediately available. A sanitation hazard commonly reported was that water for onsite showers froze during winter months.

MATERIAL HANDLING EQUIPMENT AND MOTOR VEHICLES

Material handling equipment, including earth moving equipment, cranes, and motor vehicles, contributed to the safety hazards. Many unsafe conditions discussed by site personnel were caused by inappropriate use of heavy equipment that resulted in rollovers. On one site, an operator was observed using the front bucket of a backhoe to move an intermodal container.

Several site representatives reported that unsafe hoists resulting in crane rollovers were a common concern. Frequent causes of crane rollovers included miscalculating load weight, unstable surfaces, inexperienced operators, and high wind conditions.

Other common hazards discussed by site personnel included operating heavy equipment too close to power lines, not barricading the swing radius, leaving running equipment unattended, not wearing seat belts, and stacking supplies improperly. At one site, an excavator was traversing under overhead lines and the boom pulled down an inactive communications line. At another site, a drill rig being moved with the mast up struck overhead power lines.

Site representatives reported that workers driving leased or rented vehicles were a source of many traffic accidents. Reasons include crossing dangerous intersections frequently and falling asleep at the wheel while driving to and from job sites.

HAND AND PORTABLE POWERED TOOLS

Site representatives reported that site clearing activities resulted in several accidents. Hard hats and face shields reduced the severity of the injuries. Several site representatives expressed the need for chain saw training and the importance of adequate PPE.

WELDING AND CUTTING

Safety hazards involving welding and cutting activities were observed and reported at several of the sites. Some of the common hazards reported included oxygen cylinders and fuel cylinders stored together and hoses or cables not protected from traffic. Inappropriate repairs to cables, and welding screens insufficient to protect adjacent workers from the arc were actually observed. On one site, welding screens were used on one side of an arc welding operation, but did not shield the other side that was in direct view of on-coming traffic and adjacent residences. Arc welding produces ultraviolet light that can injure eyes.

OTHER HAZARDS

The emphasis of the site visits was on safety, not health hazards. Nevertheless, tick bites resulting in Lyme disease were reported as a serious problem on one site. Other biological hazards reported included insects, snakes, and vegetation. It was reported that on two sites, burns from hot incinerator surfaces were common injuries.

One health deficiency is noted here because it occurred at all six sites. None of the sites maintained a written Exposure Control Plan for Bloodborne Pathogens as required by 29 CFR 1910.1030, "Bloodborne Pathogens." Certain sites also lacked a list of designated first aid responders. An exposure control plan is required if personnel are required to provide first aid, and sites with permit-required confined spaces are required to have first aid providers.

Decontamination and Decommissioning

The following is taken from the EH/EM *Handbook for Occupational Health and Safety during Hazardous Waste Activities*.

Potential decontamination hazards include, but are not limited to, the following:

- Incompatibility between decontaminating agents and contaminants
- Incompatibility between decontaminating agents and clothing or equipment being decontaminated
- Potential effects of inclement weather
- Potential effects of hazards on worker health and safety
- Generation of airborne contaminants from improper use of equipment

Stringent regulatory controls protect the public, the environment, and workers from the hazards associated with nuclear facilities. These hazards arise from the radioactive inventory of the facility and from the nature of the operations carried out. When a facility is shut down because of age, redundancy, or breakdown, the hazards associated with operational activities are generally eliminated or substantially reduced, but those associated with the radioactive inventory remain, and tight regulation is still required.

Use of Radiation Generating Devices

The following is taken from University of Rochester, *Radiation Safety Manual*.

Hazards from radiation-producing equipment are classified as primary beam hazards and scattered radiation. The fact that adequate shielding against either the primary or the secondary radiation can be designed to eliminate such radiation hazards requires, in principle, well-defined rules for the elimination of such hazards.

Environmental Restoration Activities

The following is taken from 29 CFR 1910.120.

All suspected conditions that may pose inhalation or skin absorption hazards that are immediately dangerous to life or health, or other conditions that may cause death or serious harm, shall be identified during the preliminary survey and evaluated during the detailed survey. Examples of such hazards include, but are not limited to, confined space entry, potentially explosive or flammable situations, visible vapor clouds, or areas where biological indicators such as dead animals or vegetation are located.

c. Discuss how the radiation protection program is related to the nuclear safety basis (and Documented Safety Analysis) for the STSM's cognizant facility(s) and activities.

This KSA is facility-specific. The Qualifying Official will evaluate its completion.

d. Identify and discuss the required elements of a radiation protection program, including the requirements for internal audits.

As stated in 10 CFR 835, the functional elements of a RPP are as follows:

- Organization and administration
- An ALARA program
- External dosimetry
- Internal dosimetry
- Area monitoring and control
- Radiological controls
- Emergency exposure situations
- Nuclear accident dosimetry
- Records
- Reports to individuals
- Radiation safety training
- Limits for the embryo/fetus

All of the information for this KSA is taken from DOE G 441.1-1C unless stated otherwise.

Organization and Administration

The RPP shall include plans, schedules, and other measures for achieving compliance with 10 CFR 835. Plans should include establishing the organization and administration of the RPP to ensure that the program is effectively implementing appropriate measures that ensure regulatory compliance can be achieved and sustained. The authority and responsibility for radiation protection should originate at the highest levels of line management and should be emphasized throughout the organization. Ultimately, workers should be aware of their individual responsibilities for radiation protection. Programmatic documentation should be developed to document the organizational and administrative aspects of the RPP.

The degree of formality and the scope of the associated administrative processes should be commensurate with the radiological hazards encountered and the complexity of the associated control measures. More rigorous administrative processes should be implemented for more complex or hazardous DOE activities. Administrative processes should include a hierarchy of documents that clearly and unambiguously delineate management policies, requirements, expectations, and objectives for the RPP. This documentation should typically include the following:

- Policy statement 羊the policy statement should articulate management's commitment to conduct radiological operations in a manner that will ensure the health and safety of all its employees, contractors, and the general public.
- Site-specific radiological control manual or handbook 羊this document should be issued and endorsed by senior management for a DOE activity. This manual or handbook should address all functional elements of the RPP for the DOE activity.

- Procedures 羊these documents should provide detailed instructions for implementing various functional elements of the RPP. Responsibilities and actions required of management and workers should be clearly and unambiguously stated. Written procedures shall be developed and implemented as necessary to ensure compliance with 10 CFR 835, commensurate with the radiological hazards created by the activity and consistent with the education, training, and skills of the individuals exposed to those hazards.

ALARA Program

In promulgating 10 CFR 835, DOE considered alternatives to reduce the risk from radiation exposure to workers that included retaining the current occupational dose limits, reducing these limits, and emphasizing efforts to maintain occupational doses as low as is reasonably achievable. After considering public comments on this issue, DOE elected to emphasize the ALARA process to maintain occupational dose for DOE and contractor employees well below the current regulatory occupational dose limits. Adopting the ALARA process in DOE occupational radiation protection regulations also provides consistency with recommendations provided in the president's *Radiation Protection Guidance to Federal Agencies for Occupational Exposure* which endorsed the ALARA process.

The importance of the ALARA concept was further stressed in DOE Policy 441.1, *DOE Radiological Health and Safety Policy*, which states:

It is the policy of the Department of Energy to conduct its radiological operations in a manner that ensures the health and safety of all its employees, contractors, and the general public. In achieving this objective, the Department shall ensure that radiation exposures to its workers and the public and releases of radioactivity to the environment are maintained below regulatory limits and deliberate efforts are taken to further reduce exposures and releases as low as reasonably achievable. The Department is fully committed to implementing a radiological control program of the highest quality that consistently reflects this policy.

10 CFR 835 requires formal plans and measures for maintaining occupational exposures ALARA as part of the documented RPP. Measures include incorporating ALARA considerations into the design of new facilities and modifications of existing facilities, as well as activities that pose the potential for significant occupational dose. Additionally, ACs are addressed as measures that supplement physical design features and controls and are integrated into the work planning process. Recordkeeping and training requirements related to ALARA are also specified. DOE G 441.1-1C discusses acceptable methods for implementing the ALARA process provisions in 10 CFR 835.

Due to the complex nature of many DOE activities, a combination of radiological and non-radiological hazards may be encountered. Identification of nonradiological hazards is critical to the ALARA process, because efforts to apply the ALARA process may inadvertently increase risks from nonradiological hazards. An ISM approach that optimizes worker protection from all hazards should be considered in the ALARA process for a given DOE activity.

Video 24 . ALARA and TDS

http://www.bing.com/videos/search?q=as+low+as+reasonably+achievable&view=detail&mid=37E32425D68666A8115B37E32425D68666A8115B&first=0#view=detail&mid=37E32425D68666A8115B37E32425D68666A8115B

External Dosimetry

Due to the types of material handled or processed, low-level, chronic occupational exposures to external ionizing radiation are difficult to avoid, necessitating an external dosimetry program at most DOE and DOE contractor facilities that use, handle, or store radioactive materials. An external dosimetry program generally consists of three elements:

1. An area monitoring program, using an array of fixed and portable devices, as appropriate
2. An individual monitoring program, using personnel dosimeters
3. A dose evaluation program that evaluates the data collected by the area and individual monitoring programs to determine the magnitude of individual doses

Internal Dosimetry

Radiation protection programs for limiting intakes of radioactive material are based on the DOE policy of controlling radioactive material at the source. It is nonetheless recognized that low-level, chronic, or intermittent occupational exposures to some materials may be difficult to avoid due to the types of material handled or processed, their chemical or physical forms, and the nature of operations, and that incidents may cause unplanned releases of radioactive material. 10 CFR 835.402, "Individual Monitoring," requires internal dosimetry programs, including routine radiobioassay programs be conducted for radiological workers, declared pregnant workers, occupationally exposed minors, and members of the public who, due to entering controlled areas, are likely to receive intakes that exceed specified levels for committed effective dose equivalent in a year. An internal dosimetry program generally consists of three elements:

1. An air monitoring program, using a combination of real-time, fixed, and portable devices, as appropriate
2. An individual monitoring program, using direct and/or indirect radiobioassay, and personal breathing zone air monitoring, as appropriate
3. A dose evaluation program that evaluates the data collected by the air and individual monitoring programs to determine the magnitude of individual doses

Area Monitoring and Control

The following is taken from10 CFR 835.401.

Monitoring of individuals and areas shall be performed to

- demonstrate compliance with the regulations in 10 CFR 835;
- document radiological conditions;
- detect changes in radiological conditions;
- detect the gradual buildup of radioactive material;
- verify the effectiveness of engineering and process controls in containing radioactive material and reducing radiation exposure; and
- identify and control potential sources of individual exposure to radiation and/or radioactive material.

Instruments and equipment used for monitoring shall be

- periodically maintained and calibrated on an established frequency;
- appropriate for the type(s), levels, and energies of the radiation(s) encountered;
- appropriate for existing environmental conditions; and
- routinely tested for operability.

Radiological Controls

The following is taken from DOE-STD-1098-2008.

Superior, consistent performance is achieved when qualified individuals use approved procedures and management actively monitors the workplace and assesses ongoing activities. Such ongoing activities include, but are not limited to, operations, remediation, laboratory work, research and development, and cleanup. Constant review and informed interest by senior management are required to achieve a superior radiological control program. Management at all levels should emphasize the need for high standards for radiological control through direct communication, instruction, and inspection of the work space. The DOE operations office manager and the contractor senior site executive responsible for the site should have a basic knowledge of radiation, its effects, and radiological control requirements. The DOE operations office manager and the contractor senior site executive should also be familiar with the current radiological control performance record. Key principles common in a successful, well-managed radiological control program are provided in DOE-STD-1098-2008, *Radiological Control*.

Emergency Exposure Situations

The following is taken from 10 CFR 835.1301.

A general employee whose occupational dose has exceeded the numerical value of any of the limits specified in 10 CFR 835.202, “Occupational Dose Limits for General Employees,” as a result of an authorized emergency exposure may be permitted to return to work in radiological areas during the current year providing that all of the following conditions are met:

- Approval is first obtained from the contractor management and the head of the responsible DOE field organization.
- The individual receives counseling from radiological protection and medical personnel regarding the consequences of receiving additional occupational exposure during the year.
- The affected employee agrees to return to radiological work.

All doses exceeding the limits specified in 10 CFR 835.202 shall be recorded in the affected individual’s occupational dose record.

When the conditions under which a dose was received in excess of the limits specified in 10 CFR 835.202 (except those received according to 10 CFR 835.204, “Planned Special Exposures,”) have been eliminated, operating management shall notify the head of the responsible DOE field organization.

Operations after a dose was received in excess of the limits specified in 10 CFR 835.202 (except those received in accordance with 10 CFR 835.204), may be resumed only with the approval of DOE.

Nuclear Accident Dosimetry

The following is taken from 10 CFR 835.1304.

Installations possessing sufficient quantities of fissile material to potentially constitute a critical mass, such that the excessive exposure of individuals to radiation from a nuclear accident is possible, shall provide nuclear accident dosimetry for those individuals.

Nuclear accident dosimetry shall include all of the following:

- A method to conduct initial screening of individuals involved in a nuclear accident to determine whether significant exposures to radiation occurred
- Methods and equipment for analysis of biological materials
- A system of fixed nuclear accident dosimeter units
- Personal nuclear accident dosimeters

Records

DOE G 441.1-1C provides instructions for implementing a program that will meet DOE requirements for generating, administering, and retaining occupational radiation protection records and reports. Complete and accurate radiation protection records are necessary to

- provide information used to protect individuals from radiation exposure;
- evaluate the effectiveness of the RPP;
- demonstrate compliance with regulations and requirements; and
- defend the RPP against unwarranted litigation.

Supporting guidance useful in developing and implementing occupational radiation protection record-keeping programs is provided in ANSI N13.6, *Practice for Radiation Exposure Records Systems* and National Council on Radiation Protection and Measurements, Report No. 114, *Maintaining Radiation Protection Records*. These documents should be used in concert with DOE G 441.1-1C and 10 CFR 835 because they may not address every DOE-specific occupational radiation protection record-keeping requirement.

DOE-STD-1098-2008 provides detailed information concerning various aspects of records management programs, including record-keeping standards. The radiological control standard (RCS) provides detailed technical guidance concerning employee records, radiological control procedures, area monitoring, and instrumentation and calibration. The information provided by the RCS, used in conjunction with DOE G 441.1-1C, will ensure that a records management program will meet the recordkeeping requirements and relevant DOE contractual requirements.

Reports to Individuals

The following is taken from 10 CFR 835.801.

Radiation exposure data for individuals monitored in accordance with 10 CFR 835.402 shall be reported as specified in 10 CFR 835. 801, “Reports to Individuals.” The information shall include the data required under 10 CFR 835.702, “Individual Monitoring Records.” Each

notification and report shall be in writing and include the DOE site or facility name, the name of the individual, and the individual's social security number, employee number, or other unique identification number.

Upon request from an individual terminating employment, records of exposure shall be provided to that individual as soon as the data are available, but not later than 90 days after termination. A written estimate of the radiation dose received by that employee, based on available information, shall be provided at the time of termination, if requested.

Each DOE or DOE contractor-operated site or facility shall, on an annual basis, provide a radiation dose report to each individual monitored during the year at that site or facility in accordance with 10 CFR 835.402.

Detailed information concerning any individual's exposure shall be made available to the individual upon request of that individual, consistent with the provisions of the Privacy Act.

When a DOE contractor is required to report to the Department, pursuant to departmental requirements for occurrence reporting and processing, any exposure of an individual to radiation and/or radioactive material, or planned special exposure in accordance with 10 CFR 835.204, the contractor shall also provide that individual with a report on his or her exposure data included therein. Such report shall be transmitted at a time not later than the transmittal to the Department.

Radiation Safety Training

While there are significant differences in the missions of various DOE and DOE-contractor operations, and thus significant differences in the content of radiation safety training programs necessary for adequate protection of employees, the basics of radiation safety for DOE activities can be taught using core course material augmented by site-specific material.

Different levels of radiation safety training are used to ensure the safe and efficient conduct of work. Training courses, such as radiological worker training take into account different levels of risk associated with various job functions and duty locations. Training shall be commensurate with the level of potential radiological hazards.

A training program that evaluates the knowledge and skills that a worker needs for safe job performance, in conjunction with core course material for teaching the fundamentals of radiation safety, should be implemented to ensure that individuals can perform their assigned duties safely and respond appropriately to normal and abnormal situations they may encounter.

Limits for the Embryo/Fetus

DOE has codified in 10 CFR 835.206, "Limits for the Embryo/Fetus," radiation dose limits for the embryo/fetus as a result of the occupational exposure of a declared pregnant worker. These requirements are established to provide protection to the embryo/fetus in a manner that does not discriminate against the rights of the pregnant worker.

Programs established to evaluate and control radiation dose to the embryo/fetus need to balance protection of the embryo/fetus against the possibility of work discrimination against

the mother. The choice of providing additional protection to the embryo/fetus is left entirely to the voluntary discretion of the mother. The Supreme Court ruled in United Automobile Workers v. Johnson Controls, Inc., 499 U.S.187, 206 that ". . . decisions about the welfare of future children must be left to the parents who conceive, bear, support, and raise them rather than to the employers who hire those parents."

Internal Audits

Internal audits and self-assessments are two of the numerous checks and balances needed in an effective RPP. Internal audits of the RPP, including examination of program content and implementation, should be conducted through a process that ensures that all functional elements of the program are reviewed no less frequently than every 36 months.

An audit plan should be developed that identifies the functional elements of the RPP and the schedule for review should be developed to ensure that over a 36-month period, all of the functional elements are reviewed. Internal audits should be conducted on a continuing basis. DOE cautions against conducting a single comprehensive internal audit of the entire RPP once every 3 years. DOE does not believe that such an approach is effective in ensuring that a DOE activity will be conducted in conformance with its approved RPP. DOE recommends that, at a minimum, an annual, broad scope audit of the program be conducted. Under this approach, the audit plan would identify each functional element to be reviewed during the annual audit and ensure that all functional elements would be reviewed during a 36-month cycle. Thus, the RPP is under continuing review, and deficiencies can be identified and corrected in a timely manner.

Internal audits should be conducted by individuals who are organizationally independent from the organizations responsible for developing and implementing the RPP.

e. Discuss the role of the following radiation protection policy, guide, and standard in establishing and maintaining a radiation protection program for a given DOE nuclear facility/activity:

- **DOE G 441.1-1C*, Admin Chg. 1, Radiation Protection Programs Guide for Use with title 10, Code of Federal Regulations, Part 835, Occupational Radiation Protection*; and**
- **DOE-STD-1098-2008, CN 1, *Radiological Control*.**

DOE G 441.1-1C, Radiation Protection Programs Guide for Use with 10 CFR 835, Occupational Radiation Protection

DOE G 441.1-1C provides guidance with respect to implementing the provisions of all the functional areas contained in 10 CFR 835. These are listed in chapter 3. Specific regulatory citations are provided in the body of the guide.

DOE G 441.1-1C amplifies the regulatory requirements of 10 CFR 835 and provides explanations and examples of the basic requirements for implementing the requirements of 10 CFR 835.

Except for requirements established by a regulation, contract, or administrative means, the provisions in DOE G 441.1-1C are DOE's views on acceptable methods of program

implementation and are not mandatory. Conformance with the guide will, however, create an inference of compliance with the related regulatory requirements.

DOE-STD-1098-2008, Radiological Control

DOE-STD-1098-2008 supplements DOE G 441.1-1C, and serves as a secondary source of guidance for achieving compliance with 10 CFR 835. While there is significant overlap between the DOE G 441.1-1C and DOE-STD-1098-2008, the standard differs from the guide in intent and detail. In contrast to the macroscopic view adopted by the guide, DOE-STD-1098-2008 discusses specific measures that should be implemented by affected line managers, workers, and support staff to ensure proper fulfillment of their radiological control responsibilities. DOE expects that each site will identify the provisions of DOE-STD-1098-2008 that support its efforts to implement an effective radiological control program and incorporate these provisions, as appropriate, into the site-specific radiological control manual, site procedures, training, or other administrative instruments that are used to guide employee activities. The specific administrative instruments used at DOE sites vary widely, as would be expected given the varying nature of DOE facilities and activities and their associated hazards.

f. Discuss the requirements delineated in DOE O 458.1, Chg. 2, *Radiation Protection of the Public and the Environment.*

Environmental Radiological Protection Program

DOE must ensure that

- DOE or DOE contractors operating sites or implementing projects involving radiological activities that can affect the public or environment establish and maintain a program that complies with applicable requirements of DOE O 458.1;
- the program, which is the composite of plans, procedures, protocols, and other documents describing the methods used to achieve compliance, must be tailored to the hazard or risk and particular radiological activities being conducted at the site and relevant requirements of DOE O 458.1; and
- for any determination that a requirement of DOE O 458.1 is not relevant, the basis for that determination is appropriate to the hazard and adequately documented:
  - DOE must document directions to the contractor necessary to correct any potential inadequacies or inappropriate determinations of relevancy; and
  - DOE must ensure that long-term stewardship and institutional controls for protection of the public and environment determined necessary to meet the requirements of DOE O 458.1 are adequately documented and implemented as long as is necessary.

Public Dose Limit

DOE radiological activities, including remedial actions and activities using technologically enhanced, naturally occurring radioactive material must be conducted so that exposure of members of the public to ionizing radiation will

- not cause a total effective dose (TED) exceeding 100 mrem (1mSv) in a year, an equivalent dose to the lens of the eye exceeding 1500 mrem (15 mSv) in a year, or an equivalent dose to the skin or extremities exceeding 5000 mrem (50 mSv) in a year,

from all sources of ionizing radiation and exposure pathways that could contribute significantly to the total dose except as specified in DOE O 458.1; and
- comply with ALARA requirements in paragraph 4.d. of DOE O 458.1.

The public dose limit applies to members of the public located off DOE sites and on DOE sites outside of controlled areas, and to those exposed to residual radioactive material subsequent to any remedial action or clearance of property.

Temporary Dose Limits

Special circumstances could affect a DOE radiological activity in such a manner that the potential dose to a member of the public could exceed a TED of 100 mrem (1 mSv) in a year.

The FEM may request specific authorization for a temporary public dose limit higher than 100 mrem (1 mSv) in a year from a CSO in consultation with the chief HSS officer. This request must include documentation that justifies the need for the increase, the alternatives considered, and the application of the ALARA process.

A CSO must limit approval of such requests to no more than 500 mrem (5 mSv) TED, provided that the average TED over any five contiguous years does not exceed 100 mrem per year.

The specific exposure pathways excepted in DOE O 458.1 are also excepted for temporary dose limits.

As Low as Reasonably Achievable

A documented ALARA process must be implemented to optimize control and management of radiological activities so that doses to members of the public and releases to the environment are kept as low as reasonably achievable. The process must be applied to the design or modification of facilities and conduct of activities that expose the public or the environment to radiation or radioactive material.

The ALARA process must: consider DOE sources, modes of exposure, and all pathways which potentially could result in the release of radioactive materials into the environment, or exposure to the public; use a graded approach; and to the extent practical and when appropriate, be coordinated with the 10 CFR 835 ALARA process.

The ALARA process must be applied to all routine radiological activities. Though not applicable to non-routine radiological events, the ALARA process is applicable during recovery and remediation activities associated with a non-routine event.

Demonstrating Compliance with the Public Dose Limit

Dose evaluations to demonstrate compliance with the public dose limit in DOE O 458.1 and to assess collective dose must include the following:

- The TED to members of the public from exposure to radiation, airborne effluents, and liquid effluents, of DOE origin.
- Analytical models that consider likely exposure pathways.
- The dose to members of the public from DOE-related exposure sources only, if the projected DOE-related dose to the representative person or maximally exposed

individual (MEI) is 25 mrem (0.25mSv) in a year or less. If the DOE-related dose is greater than 25 mrem in a year, the dose to members of the public must include both major non-DOE sources of exposure and dose from DOE-related sources.

- Collective dose for members of the public resulting from radiation emitted and radioactive materials released from DOE radiological activities only.

The estimated individual dose to the MEI or representative person that is representative of the persons or group likely to receive the most dose is based on pathway and exposure parameters that are not likely to underestimate or substantially overestimate the dose; and the collective dose that is a realistic as practicable estimate of the sum of the doses to all members of the actual exposed population.

Site-specific information on radiation source dispersion patterns, location and demography of members of the public in the vicinity of DOE radiological activities, land use, food supplies, and exposure pathway information must be updated, as necessary, to document significant changes that could affect dose evaluations.

Values of assumed default or site-specific parameters used in calculations must be identified and included with the documentation of the calculations.

Direct measurements must be made, to the extent practicable, to obtain information characterizing source terms, exposures, exposure modes, and other information needed in evaluating dose.

Dose evaluation models that are codified or approved for use by DOE must be used.

DOE-approved dose coefficients must be used to evaluate doses resulting from DOE radiological activities.

Doses to members of the public from airborne effluents must be evaluated with an EPA-approved model or method to demonstrate compliance with applicable subparts of 40 CFR 61, “National Emission Standards for Hazardous Air Pollutants.”

Environmental monitoring must be conducted to characterize routine and non-routine releases of radioactive material from radiological activities, estimate the dispersal pattern in the environs, characterize the pathway(s) of exposure to members of the public, and estimate the doses to individuals and populations in the vicinity of the site or operation commensurate with the nature of the DOE radiological activities and the risk to the public and the environment. Radiological monitoring must be integrated with general environmental and effluent monitoring. Environmental monitoring must include, but is not limited to the following:

- Effluent monitoring
- Environmental surveillance
- Meteorological monitoring
- Pre-operational monitoring

Site-specific environmental monitoring criteria must be established to ensure that representative measurements of quantities and concentrations of radiological contaminants

are conducted and that the effects from DOE radiological activities on members of the public and the environment are monitored sufficiently to demonstrate compliance with DOE O 458.1.

Airborne Radioactive Effluents

Radiological activities must be conducted in a manner such that the release of radioactive material to the atmosphere will

- be evaluated using the ALARA process established in paragraph 4.d. of DOE O 458.1;
- not cause radon-222 flux rates to exceed 20 pCi (0.7 Bq) m-2 sec-1 averaged over the surface area overlaying waste, including the covering or other confinement structures, wherever radium-226 wastes are accepted for storage or disposal (see 40 CFR 61, subparts Q and T);
- meet compliance agreements under 40 CFR 61, subparts H, Q, and T;
- not cause the radon-220 and radon-222 decay product concentration, including background, to exceed 0.03 working levels in buildings that are being released from DOE control. Further, a reasonable effort must be made to meet a 0.02 working levels generic guideline for annual average radon-220 and radon-222 decay product concentration, including background, in such buildings; and
- not exceed 3 pCi/L annual average radon-220 and radon-222 concentration, not including background, at the site boundary if DOE activities release radon-220 and radon-222 or their decay products.

Control and Management of Radionuclides from DOE Activities in Liquid Discharges

Operators of DOE facilities discharging or releasing liquids containing radionuclides from DOE activities must do the following:

- Characterize planned and unplanned releases of liquids containing radionuclides from DOE activities, consistent with the potential for on and offsite impacts, and provide an assessment of radiological consequences as necessary to demonstrate compliance with the requirements of DOE O 458.1
- Comply with the ALARA process requirements in DOE O 458.1
- Conduct activities to ensure that liquid releases containing radionuclides from DOE activities are managed in a manner that protects groundwater resources now and in the future, based on use and value considerations
- Conduct activities to ensure that liquid discharges containing radionuclides from DOE activities do not exceed an annual average of either of the following:
  - 5 pCi (0.2 Bq) per gram above background of settleable solids for alpha-emitting radionuclides
  - 50 pCi (2 Bq) per gram above background of settleable solids for beta-emitting radionuclides
- Apply best available technology (BAT) if the limits specified in DOE O 458.1 are exceeded at the point of discharge
- Control releases of tritium in a manner that has been established by application of the ALARA process
- Conduct radiological activities to ensure that radionuclides from DOE activities contained in liquid effluents do not cause private or public drinking water systems to

exceed the drinking water maximum contamination limits in 40 CFR 141, "National Primary Drinking Water Regulations"

- Control discharges into sanitary sewers in accordance with the requirements specified in DOE O 458.1
- Prohibit the use of soil columns
- Manage the disposition of non-process water potentially containing radionuclides from DOE activities to protect soil and groundwater and prevent the creation of future cleanup sites
- Ensure that storm water runoff containing radionuclides from DOE activities is considered, as appropriate, as a pathway of exposure that has the potential for on and offsite impacts

Radioactive Waste and Spent Nuclear Fuel

MANAGEMENT, STORAGE AND DISPOSAL OF RADIOACTIVE WASTE
Radiological activities must be conducted in a manner such that radiation exposure to members of the public from management and storage of radioactive waste complies with ALARA process requirements and does not result in a TED greater than 25 mrem (0.25 mSv) in a year from all exposure pathways and radiation sources associated with the waste, except for transportation and radon and its decay products.

Management of spent nuclear fuel, and high-level and TRU wastes at a disposal facility which is not regulated by the NRC must comply with the requirements of the DOE O 458.1 CRD and 40 CFR 191.

Management, storage, and disposal of low-level radioactive waste must be conducted in a manner such that exposure to members of the public to radiation from radioactive waste complies with ALARA process requirements, and does not exceed a TED of 25 mrem (0.25 mSv) in a year from all exposure pathways and radiation sources associated with the waste, except for transportation and radon and its decay products.

Management, storage, and disposal of byproduct material, as defined in AEA and other wastes containing uranium and thorium and their decay products which are not subject to the requirements of 40 CFR 192, "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings," are not at facilities licensed by the NRC, or are not disposed of at DOE low-level waste disposal facilities, must be according to the requirements of DOE O 458.1 CRD and DOE-approved plans.

Discrete sources of radium-226, accelerator-produced radioactive material, or naturally occurring radioactive material that pose a threat similar to discrete sources of radium-226, must be managed as high-level waste, low-level waste or 11e.(2) material as appropriate under DOE AEA authorities and in compliance with the specific requirements in the DOE O 458.1 CRD and the requirements in the CRD to DOE O 435.1 chg. 1.

Protection of Drinking Water and Groundwater

The contractor must establish and implement procedures and practices to ensure that DOE sites provide a level of radiation protection for persons consuming water from a drinking water system operated by DOE, directly or through a DOE contractor, which is equivalent to

that provided to members of the public by the community drinking-water standards of 40 CFR 141.

The contractor must protect groundwater from radiological contamination to ensure compliance with dose limits in the specific requirements in the DOE O 458.1 CRD and consistent with ALARA process requirements. To that end the contractor must ensure the following:

- Baseline conditions of the groundwater quantity and quality are documented.
- Possible sources of, and potential for, radiological contamination are identified and assessed.
- Strategies to control radiological contamination are documented and implemented.
- Monitoring methodologies are documented and implemented.
- Groundwater monitoring activities are integrated with other environmental monitoring activities.

Protection of Biota

The contractor must establish and implement procedures and practices to ensure that biota are protected and to address the following elements:

- Radiological activities that have the potential to impact the environment must be conducted in a manner that protects populations of aquatic animals, terrestrial plants, and terrestrial animals in local ecosystems from adverse effects due to radiation and radioactive material released from DOE operations.
- When actions taken to protect humans from radiation and radioactive materials are not adequate to protect biota, evaluations must be done to demonstrate compliance with DOE O 458.1 CRD.

Release and Clearance of Property

The contractor must establish and implement procedures and practices to ensure that release or clearance of property with the potential to contain residual radioactive material must be conducted in accordance with DOE direction and in accordance with the requirements in paragraph 2.k. of the specific requirements in the DOE O 458.1 CRD.

Property control and clearance processes must be developed and implemented according to the dose limits in DOE O 458.1 CRD under any plausible use of the property and the ALARA process requirements in DOE O 458.1 CRD must be met before property is cleared.

Dose constraints 羊 unless alternative dose constraints are approved by issuance of a directive or memorandum by the chief HSS officer or for NNSA, the CSO in consultation with the chief HSS officer, the following dose constraints for DOE residual radioactive material must be applied to each specific clearance of property for any actual or likely future use of the property:

- Real property—a TED of 25 mrem (0.25 mSv) above background in any calendar year
- Personal property—a TED of 1 mrem (0.01 mSv) above background in any calendar year

Residual radioactive material – property potentially containing residual radioactive material must not be cleared from DOE control unless either

- the property is demonstrated not to contain residual radioactive material based on process and historical knowledge, radiological monitoring or surveys, or a combination of these; or
- the property is evaluated and appropriately monitored or surveyed to determine that it meets the requirements specified in this paragraph of DOE O 458.1.

Evaluation of the need for maintaining institutional controls for real property – real property under evaluation for clearance from DOE radiological controls must be evaluated against the need for maintaining institutional controls or impacting long-term stewardship of adjacent DOE real property.

Process and historical knowledge – contractors responsible for radiological clearance of property, when they rely in part on process knowledge as a basis for clearance decisions, must establish a documented evaluation process using a graded approach for applying process and historical knowledge to determine if property potentially contains residual radioactive material.

AUTHORIZED LIMITS:
Authorized limits for the clearance of any property with residual radioactive material must provide reasonable assurance that the requirements of DOE O 458.1 CRD are met. Authorized limits may be applied to property for which process knowledge cannot establish the absence of residual radioactive material but in which no residual radioactive material can be detected:

- Authorized limits must meet the requirements specified in DOE O 458.1.
- Applications for DOE approval of authorized limits must contain the following:
  - A description of the property
  - Specific limits proposed for each radionuclide or group of radionuclides and/or external radiation exposure, surrogate metrics, or conditions used to limit radionuclides
  - Potential collective dose to the exposed population and the potential dose to a member of the public most likely to receive the highest dose for actual or likely future use, and plausible future use of the property
  - ALARA assessments conducted under paragraph 2.d. of the specific requirements in DOE O 458.1 CRD for the proposed clearance action
  - A description of the procedures and radiological monitoring or surveys to be used to demonstrate compliance with proposed limits
  - Identification of any restrictions or conditions on the future use of the property upon which the proposed limits are based, and the means by which the restrictions or conditions will be implemented and maintained
  - An estimated date for when the property will be cleared and an estimate of when the property will be released from DOE control
- Property covered by authorized limits is subject to 10 CFR 835 requirements unless the criteria in DOE O 458.1 CRD have been met and the authorized limits have been approved by a CSO in consultation with the chief HSS officer as required by the 10 CFR 835 exclusion.

- Revision of authorized limits. If established authorized limits are found not to be protective, appropriate, or practical to apply to a specific type or portion of property, further clearance for that specific type or portion of property must not proceed without revised authorized limits.
- Pre-approved authorized limits have been specified by DOE in this paragraph, and may be used instead of developing specific authorized limits. These pre-approved authorized limits may be used for any radiological activity (instead of developing specific authorized limits) if their use is documented in the environmental radiological protection program and the specific application of the authorized limits is approved by the responsible FEM.
- Documentation of approved authorized limits. Approved authorized limits and approved revised authorized limits and supporting documentation must be made available to the public.

Clearance of environmental restoration, deactivation and decommissioning, and other cleanup materials including the following:

- Clearance of property with residual radioactive material from environmental restoration activities, including deactivation and decommissioning, must meet the specific requirements in the DOE O 458.1 CRD. Environmental restoration activities using the CERCLA process may demonstrate compliance with the specific requirements in the DOE O 458.1 CRD using documentation from the CERCLA process and any necessary supplemental information.
- For the purpose of clearance of real or personal property, approved CERCLA remediation criteria may be considered equivalent to authorized limits if the appropriate FEM has determined that the criteria meet the specific requirements in the DOE 458.1 CRD for authorized limits, and provided that the use of the criteria as DOE authorized limits is documented and approved as would be an authorized limit. Compliance with all specific requirements in the DOE 458.1 CRD not met through the CERCLA process must also be demonstrated.
- If the contractor performs environmental restoration activities involving clearance of real or personal property with residual radioactive material under CERCLA that use the CERCLA analysis and documentation in lieu of analysis and documentation developed expressly to demonstrate compliance with the specific requirements in the DOE 458.1 CRD, the contractor must submit the relevant CERCLA documentation and any additional information necessary to demonstrate that the requirements for authorized limits have been met to the responsible FEM.

Radiological Monitoring or Surveys:

All radiological monitoring or surveys performed in support of clearance of property must

- use methodologies sufficient to meet measurement objectives such as those in the *Multi-Agency Radiation Survey and Site Investigation Manual*, the *Multi-Agency Radiation Survey and Assessment of Materials and Equipment Manual*, or other methodologies approved by DOE;
- meet measurement quality objectives;
- use DOE-approved sampling and analysis techniques, if applicable; and
- include an evaluation of non-uniformly distributed residual radioactive material, if applicable.

Instrumentation used for radiological monitoring or surveys must be capable of detecting and quantifying residual radioactive material consistent with the applicable authorized limits, and be

- periodically maintained and calibrated on an established frequency;
- appropriate for the type(s), levels, and energies of the radiation(s) encountered; and
- appropriate for existing environmental conditions and routinely tested for operability.

Documentation and verification 羊 any contractor responsible for radiological clearance of property must ensure that final radiological monitoring or surveys are conducted and that documentation is prepared that shows that the clearance meets applicable DOE authorized limits or other applicable requirements including associated restrictions or institutional controls.

Public notification of clearance of property 羊 information on approved authorized limits, any approved revised authorized limits, use of pre-approved authorized limits, results of radiological monitoring, surveys of cleared property with type and quantity of property cleared, and independent verification results must be summarized in the annual site environmental report.

Final clearance documentation 羊 clearance of property must be documented. The contents of the documentation or the mechanism for documenting information may be tailored to the need, situation, and type of property being cleared. For ongoing, routine clearances, such documentation may be based on the general process(es) rather than each specific clearance. In general, the documentation must describe the clearance process(es) and the property being cleared. The documentation must serve to demonstrate requirements have been met; show criteria used for clearance; identify the property's destination or disposition, as appropriate; and provide additional confidence to DOE and assurance to other interested parties that the public and the environment are being protected.

Records, Retention and Reporting Requirements

The contractor must establish and implement recordkeeping, retention, and reporting procedures and practices to ensure that the following elements are addressed:

- Records must be maintained to document compliance with the specific requirements in this CRD.
- Required records include the following:
  - Information and data necessary to identify and characterize releases of radioactive material to the environment, their fate in the environment, their probable impact on radiation dose to members of the public, and any impacts on ecological systems
  - Documentation of individual and collective dose to members of the public due to radiological activities
  - Requests for specific authorization for temporary public dose limits, and subsequent approvals and other related actions
  - Identification of radiological activities subject to environmental radiological protection program requirements, and descriptions of the measures to be used in implementing these requirements

- Documentation of actions taken to implement the ALARA process identified in paragraph 2.d. of the specific requirements in the DOE O 458.1 CRD
- Documentation of actions taken to demonstrate compliance with the public dose limit (see paragraph 2.e.(1) of the specific requirements in the DOE O 458.1 CRD)
- Documentation of actions taken to implement the BAT selection process in regulating liquid discharges, including documentation of analyses and factors considered to be important, including alternative processes, for the BAT selection process
- Effluent monitoring and environmental surveillance information and data as specified in DOE O 458.1
- Documentation related to the long-term management of radioactive waste and residual radioactive material
- Final documentation for clearance of property containing residual radioactive material
- Documentation of
  - approved authorized limits for routine clearance of property for unrestricted or restricted use and the scenarios evaluated in selecting the limits
  - approved revised authorized limits for clearance of property
- Annual summaries related to clearance of property

- Records required by the specific requirements in the DOE O 458.1 CRD must be maintained by, or transferred to, DOE upon cessation of a DOE radiological activity at a site.
- Records must be retained until final disposition is authorized by DOE in accordance with the CRD to DOE O 243.1A, *Records Management Program*.
- Reporting
  - Reporting requirements are contained in the CRDs to DOE O 232.2 and DOE O 231.1-1B.
  - The contractor must notify the FEM within 30 calendar days when it has been identified that any specific requirement in the DOE O 458.1 CRD that is not required to be reported under paragraph 2.1-(5)(a) has not been met.

- Units 羊unless otherwise specified, the quantities used in the reports and records required by the specific requirements of the DOE O 458.1 CRD must be clearly indicated in special units of curie, rad, roentgen, or rem, including multiples and subdivisions of these units, or other conventional units, such as dpm, dpm/100 cm2, or mass units. The SI units, and becquerel (Bq), gray (GY), and sievert (Sv) may be provided parenthetically for reference with scientific standards.

g. Identify key controls the Department and its contractors use for contamination control.

The following is taken from DOE G 441.1-1C.

Work with unsealed quantities of radioactive material creates the potential for generating radioactive contamination. 10 CFR 835 requires, in part, a contamination control program sufficient to provide warning of the presence of surface contamination and to prevent the

inadvertent transfer of contamination at levels exceeding specified values outside of radiological areas under normal operating conditions.

An acceptable contamination control program incorporates two types of control: 1) engineered control, and 2) administrative control. Contamination monitoring is part of, and verifies the effectiveness of, the contamination control program.

In implementing a contamination control program, engineered controls that control contamination at the source are the most important element. Engineered controls incorporated into older facilities may not be sufficient to meet modern contamination control standards. The engineered controls used in a contamination control program may include temporary containment and ventilation, which may be the primary methods of controlling airborne radioactivity and internal exposures to workers in older facilities, during relatively short-term operations and maintenance, and in other situations in which permanent engineered controls are unavailable or inadequate. For example, a permanently installed high efficiency particulate air (HEPA)-filtered ventilation system may be included as a physical design feature in a facility to control airborne radioactive material concentrations during routine operations, but a temporary HEPA-filtered ventilation system may be used as an engineering control during certain maintenance activities. Similarly, a drain system may be included as a physical design feature to route contaminated fluids to a controlled collection point, but temporary drains may be installed as engineered controls during system breach. Finally, administrative controls, including access restrictions and the use of specific work practices designed to minimize contamination transfer, should be used as the tertiary method to control exposure to contamination hazards. These elements of a contamination control program are not independent. The permanent engineered controls included in a facility will dictate the types and levels of administrative controls and engineered controls that are possible and necessary. A contamination control program is an essential element of a comprehensive radiological control program.

Common characteristics of effective contamination control programs include

- strong, written upper management commitment to control of contamination in the workplace;
- consistent line management implementation of required controls through established procedures, training, and frequent supervision;
- detailed work planning, including effective hazards analysis, pre-job briefings, and post-job debriefings; and
- consistent program support by affected individuals.

Engineered Controls

Appropriate controls that prevent the inadvertent transfer of removable contamination to locations outside of radiological areas under normal operating conditions shall be maintained and verified. 10 CFR 835 requires measures to be taken to maintain radiation exposure as low as is reasonably achievable through engineered controls and administrative controls. The primary methods used shall be engineered controls. Administrative controls shall be employed only as supplemental methods to control radiation exposure.

DOE recognizes the fact that the design and operating history of its facilities and the nature of existing contamination hazards may make control of contamination problematic, particularly in outdoor areas where legacy contamination may exist. Therefore, DOE regulations do not require that the controls implemented to prevent the transfer of removable contamination be impervious to ensure regulatory compliance. However, the controls should be appropriate to the extent of the hazard and the potential adverse effects that may result from such transfer. Should the potential exist for radioactive contamination to be transferred outside of posted or controlled radiological areas, enhanced monitoring and control programs should be developed and implemented to identify affected areas and ensure timely detection of the transfer and institution of appropriate controls over the affected area as required by 10 CFR 835.

Engineered controls that should be considered to enhance control of workplace contamination include containment of process materials to the maximum practicable extent; components and materials that minimize leakage across seals; catch basins and controlled drains from potential leakage points; use of multiple barriers as necessary to control the spread of contamination. (For instance, a room, system, or vessel that contains radioactive material should be designed and operated to retain that material, and should also be equipped as necessary with drain and ventilation systems to direct any leakage that may occur to appropriate collection systems); adequate working space around serviceable components to facilitate maintenance and repairs; filtered ventilation from areas of lower to areas of higher contamination levels; adequate space for donning and removal of protective clothing and individual frisking in low-background areas; and location of office and break areas away from radiological areas.

In addition to the above, facility design, including materials selected, shall include features that facilitate operations, maintenance, decontamination, and decommissioning. These activities should be facilitated by limiting the size of any contaminated areas and the magnitude of the contamination levels within those areas. To the maximum possible extent, materials used should be readily decontaminated using non-hazardous compounds, particularly water or steam. Smooth, corrosion resistant surfaces and rounded edges also facilitate decontamination.

When permanent engineered controls are not sufficient to prevent the spread of contamination in the workplace, temporary engineered controls, such as containment devices and portable or auxiliary ventilation, should be installed. These circumstances arise frequently during maintenance, modifications, and decontamination and decommissioning. Planning for such activities should include evaluation of the potential for contamination spread and the effectiveness of engineered controls to reduce such potential, and, to the extent that engineered controls will not be effective, prescription of administrative controls to limit the spread of contamination.

Temporary containment devices may be particularly useful in controlling contamination spread resulting from system leaks and from maintenance that requires contaminated system breach. These devices range in complexity from simple plastic catch-basins suspended below leakage points to complex portable buildings used to enclose an entire work area. Many

commercially-available designs include provisions for glove and equipment ports, ventilation, and contamination reduction exit portals.

Portable air handling systems used in contaminated areas, including vacuum cleaners, should be equipped with HEPA filtered exhausts or have their exhausts directed to installed systems that are so equipped. These provisions may not be necessary in areas where only tritium or radioactive noble gases are present or when the material to be vacuumed is wet enough to preclude re-suspension after entry into the system collection chamber. Improper use of vacuum cleaners and portable air-handling equipment may result in the generation of airborne radioactive material or removable surface contamination. Extended use of air handling equipment may result in a significant build-up of radioactive material in the ductwork and filters. Periodic monitoring of the exhausted air and accessible equipment surfaces should be performed to assess the radiological impact of equipment operation. Although use of the devices discussed above has been proven effective in reducing contamination spread and the associated decontamination costs, these benefits must be weighed against the potential costs. Use of engineered controls may require expenditure of worker dose to set up, work in, maintain, and remove the device. There may be financial costs associated with device purchase or manufacture, training, possible reduced productivity, and device or component set-up, maintenance, and disposal. These factors are considered in implementation of an effective ALARA program.

Administrative Controls

When the use of engineered controls to limit individual exposures is impractical, administrative controls shall be implemented to maintain exposures ALARA. To control the spread of contamination and limit individual exposures, a graded, multiple-tier system should be used in and around contaminated areas. The effectiveness of the controls should be verified through the conduct of contamination monitoring.

h. Conduct an assessment of the radiation protection program at a given site/facility and report the results to DOE management.

i. Review a radiation protection program assessment for a DOE nuclear facility/activity; evaluate proposed corrective actions; and discuss the results of the review with the DOE radiation protection program subject matter expert.

KSAs h and i are performance-based. The Qualifying Official will evaluate their completion.

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