National Nuclear Security Administration

Emergency Management

Qualification Standard
Reference Guide

JUNE 2009

Table of Contents

LIST OF FIGURES ..... **ii**
LIST OF TABLES ..... **ii**
ACRONYMS ..... **i**
PURPOSE **1**
SCOPE **1**
PREFACE **1**
TECHNICAL COMPETENCIES **3**

1. Emergency management personnel shall demonstrate a familiarity level knowledge of the relationship of other disciplines to the emergency management function and the ability to work with personnel in these other disciplines. 3
2. Emergency management personnel shall demonstrate a working level knowledge of hazardous material safety to oversee emergency activities and to provide guidance in mitigating emergencies. 9
3. Emergency management personnel shall demonstrate a working level knowledge of health physics and radiation protection to oversee emergency activities and provide guidance in mitigating emergencies. 19
4. Emergency management personnel shall demonstrate a working level knowledge of protective measures. 30
5. Emergency management personnel shall demonstrate a working level knowledge of agency response to an emergency. 39
6. Emergency management personnel shall demonstrate a familiarity level knowledge of the concepts associated with atmospheric transport and diffusion and environmental protection. 41
7. Emergency management personnel shall demonstrate a working level knowledge of command and control during an emergency. 45
8. Emergency management personnel shall demonstrate a familiarity level knowledge of decontamination procedures. 51
9. Emergency management personnel shall have a familiarity level knowledge of emergency rescue and treatment. 54
10. Emergency management personnel shall demonstrate a working level knowledge of the integration/interface of the following types of emergency plans: 56
11. Emergency management personnel shall demonstrate a working level knowledge of the relationships of emergency planning, preparedness, readiness assurance, response, and recovery. 61
12. Emergency management personnel shall demonstrate an expert level knowledge of DOE O 151.1B, Comprehensive Emergency Management System, and the DOE 151.1 Guides... 64
13. Emergency management personnel shall demonstrate familiarity level knowledge of the capabilities of DOE national response assets. 82
14. Emergency management personnel shall demonstrate an expert level knowledge of the notification and event classification requirements in DOE O 151.1C. 86

Table of Contents

15. Emergency management personnel shall demonstrate a working level knowledge of the following guidelines sufficient to apply them to emergency management activities: 90
16. Emergency management personnel shall demonstrate a working level knowledge of the development, review, and/or approval of emergency management planning documents. 94
17. Emergency management personnel shall demonstrate a working level knowledge of the process for planning, conducting, and evaluating emergency response exercises. 102
18. Emergency management personnel shall demonstrate a familiarity level knowledge of contract management as it relates to emergency management. 112
19. Emergency management personnel shall demonstrate a working level knowledge of Integrated Safety Management System assessment techniques to include the planning and use of observations, interviews, and document reviews to assess DOE and facility performance, report results of assessments, and follow-up on actions taken as the result of assessments. 117

Selected Bibliography and Suggested Reading 125

Figure 1. A soldier using an improved chemical agent monitor 11

TABLES

Table 1. Infiltration rates – Air changes/hr 34
Table 2. Air changes per hour 35
Table 3. Concentration vs. dose 35

ACRONYMS	
AAR	after action report
AEGL	acute exposure guideline level
AMS	aerial measuring system
ARG	accident response group
C	corridor
CA	chemical agent
CAAA	Clean Air Act Amendments
CAM	constant air monitor
CAMP	corrective action management program
CATS	corrective action tracking system
CAP	corrective action plan
CDC	Centers for Disease Control
CDE	chemical detection equipment
CRC	contamination reduction corridor
CRZ	Contamination reduction zone
CRM	count rate meter
DHS	Department of Homeland Security
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DTRA	Defense Threat Reduction Agency
EAL	emergency action level
EEG	exercise evaluation guide
EOC	emergency operations center
EMT	Emergency management team
EPA	Environmental Protection Agency
EPI	emergency public information
ERAP	emergency readiness assurance plans
ERG	emergency response guidebook
ERPG	emergency response planning guideline
EPHA	emergency planning hazard assessment
EPZ	emergency planning zone
ERO	emergency response organization
FAQS	functional area qualification standard
FBI	Federal Bureau of Investigation
FDA	Food and Drug Administration
FDO	fee determining official
FEMA	Federal Emergency Management Agency
FRMAC	Federal Radiological Monitoring and Assessment Center
FRP	Federal response plan
GET	general employee training
GM	Geiger-Muller

ACRONYMS	
GPRA	Government Performance Results Act
HASP	health and safety plan
HAZMAT	hazardous material
HEPA	high-efficiency particulate air
HF	hafnium
HQ	DOE Headquarters
HVAC	heating, ventilation, and air conditioning
IAEA	International Atomic Energy Agency
IBC	Institutional Biosafety Committee
ICAM	improved chemical agent monitor
IC	incident commander
ICS	incident command system
IDLH	immediately dangerous to life or health
IMS	ion mobility spectroscopy
IP	implementation plan
IR	infrared radiation
ISM	integrated safety management
JIC	joint information center
JIS	Joint Information System
KSA	knowledge, skill, and ability
LFA	Lead Federal Agency
LFAO	Lead Federal Agency Official
LLEA	local law enforcement agency
m/s	miles per second
MAA	mutual aid agreement
M&O	management and operating
MOA	memoranda of agreement
MOU	memoranda of understanding
MSHA	Mine Safety and Health Administration
NARAC	National Atmospheric Release Advisory Center
NEST	nuclear emergency support team
NFPA	National Fire Protection Association
NIIMS	National Interagency Incident Management System
NIOSH	National Institute of Occupational Safety and Health
NMSP	New Mexico State Police
NNSA	National Nuclear Security Administration
NO_2	nitrogen dioxide
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NRP	national response plan
NSO	Nevada Site Office
NTS	noncompliance tracking system
OE	operational emergency
OEI	Office of Enforcement and Investigation

ACRONYMS	
OEMT	operational emergency management team
ORISE	Oak Ridge Institute for Science and Education
OSHA	Occupational Safety and Health Administration
PA	protective action
PAAA	Price-Anderson Amendments Act
PAC	protective action criteria
PAG	protective action guide
PAR	protective action recommendation
PEP	performance evaluation plan
PER	performance evaluation report
PF	protective force
PM	Photomultiplier
PPBE/E	programming, budgeting and execution/evaluation
PPE	personal protective equipment
ppm	parts per million
PSO	Program Secretarial Officer
Pu	plutonium
R	roentgen
RAP	radiological assistance program
RAT	radiological assistance team
RCO	regional coordinating office or radiological control organization
REAC/TS	Radiation Emergency Assistance Center/Training Site
rem	roentgen equivalent man
RER	radiological emergency response
SAR	supplied-air respirator
SCAPA	Subcommittee on Consequence Assessment and Protective Action
SCBA	self-contained breathing apparatus
SNM	special nuclear material
TEEL	temporary emergency exposure limits
TEL	threshold for early lethality
TLD	thermoluminescent dosimeters
TWA	time-weighted average
USDA	United States Department of Agriculture

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 Emergency Management 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 addresses the competency statements in the January 2004 edition of DOE-STD-1177-2004, *Emergency Management Functional Area Qualification Standard*. The qualification standard contains 19 competency statements.

Please direct your questions or comments related to this document to the NNSA Learning and Career Development Department.

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 and abbreviations is found at the beginning of this document. It is recommended that the candidate review the list prior to proceeding with the competencies, as the acronyms and abbreviations 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, and all document-related titles, which variously appear in roman or italic type or set within quotation marks, have been changed to plain text, also mostly without remark. Capitalized terms are found as such in the qualification standard and remain so in this reference guide. 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 June 2009. 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 Technical Qualification Program.

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.

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.

TECHNICAL COMPETENCIES

1. **Emergency management personnel shall demonstrate a familiarity level knowledge of the relationship of other disciplines to the emergency management function and the ability to work with personnel in these other disciplines.**

   a. **Explain the roles and responsibilities of each of the following disciplines to emergency management:**
      - **Integrated safety management**
      - **Health physics**
      - **Environmental transport and diffusion (air and water)**
      - **Industrial hygiene**
      - **Chemistry**
      - **Biology**
      - **Worker and public health and safety**
      - **Hazardous material (storage, handling, and transport)**
      - **Criticality safety**
      - **Explosives safety**
      - **Environmental protection**
      - **Detection and monitoring (radiological and non-radiological)**
      - **Consequence assessment (models and codes)**
      - **Protective measures (personal protective equipment, sheltering, decontamination, evacuation, and relocation)**
      - **Fire protection/fire suppression operations**
      - **Operations and maintenance**
      - **Security**
      - **Law enforcement**
      - **Medical**
      - **Public affairs**
      - **Legal**

Integrated Safety Management

The following is taken from DOE G 151.1-1A.

As the last line of defense in protecting workers, the public, and the environment, the comprehensive emergency management program at each DOE/NNSA facility/site or activity is a key element of work planning and execution in accordance with integrated safety management (ISM). Emergency management (like quality assurance, maintenance, personnel training, conduct of operations, fire protection, and waste management) should be a specific function addressed by the safety management program necessary to ensure the safe operation of a facility/site or activity. The DOE emergency management system ensures consistency across the complex through a common understanding of emergencies and the expected DOE response at all organizational levels, including the local worker and facility/site or activity level, which are the primary focus of ISM.

Since 1991, DOE emergency management Orders have incorporated the concept of "tailoring" requirements to specific hazards through the "commensurate with hazards" approach. The approach begins with a complete understanding of the emergencies that could impact DOE facilities/sites or activities followed by analyses of the resultant hazards to workers, the public, the environment, and national security. Based on the hazards analyses,

the requirements in the Order are tailored to develop an emergency management program (e.g., plans, tools, training, response, resources) that addresses the unique hazards and operating environment of each facility/site or activity. The hazards survey and emergency planning hazard assessment (EPHA), which are integral parts of the "commensurate with hazards" or "tailoring" approach, provide the recognition tools (e.g., emergency action levels [EALs]) and defines the appropriate response (e.g., protective actions) to potential releases of hazardous materials. Such hazard controls are essential components in the last line of defense in protecting workers, the public, and the environment.

Continuous improvement is a fundamental concept embedded in ISM and the DOE emergency management system. In DOE emergency management, continuous improvement is provided through the readiness assurance program required of all DOE/NNSA facility/site and activity emergency management programs. Readiness assurance provides the framework and associated mechanisms to assure that planning and resources are adequate and sufficiently maintained, exercised, and evaluated, and that appropriate, timely improvements are made in response to needs identified. A structured and focused program of evaluations (program and exercise evaluations) and a reliable lessons-learned process ensure that an effective program of continuous improvement maintains DOE/NNSA emergency management programs.

Thus, the fundamental concepts that characterize DOE emergency management and the requirements contained in DOE O 151.1C, C*omprehensive Emergency Management System,* set forth DOE/NNSA expectations for emergency management and provide effective mechanisms for integrating emergency management objectives effectively and seamlessly with ISM fundamental concepts and core safety management functions.

Health Physics

The following is taken from The Radiation Safety Journal, vol. 87, suppl 1, *Health Physics Considerations in Medical Radiation Emergencies*. August 2004.

Throughout the course of a medical radiation emergency, the health physicist assumes a host of responsibilities and must work to maintain a sense of order and calm among the numerous and varied staff attending to the emergency. In helping to prevent things from being overlooked, the health physicist must communicate frequently with the emergency department physician, the charge nurse, the incident commander (IC), and others who play active roles in responding to such emergency situations.

Environmental Transport and Diffusion

The following is taken from *Modeling Tools for Environmental Engineers and Scientists* by Nirmala Khandan.

Chemicals can be transported through the various compartments of the environment by microscopic level and macroscopic level processes. At the microscopic level, the primary mechanism of transport is by molecular diffusion driven by concentration gradients. At the macroscopic level, mixing (due to turbulence, eddy currents, velocity gradients) and bulk movement of the medium are the primary transport mechanisms. Transport by molecular diffusion and mixing has been referred to as dispersive transport, while transport by bulk movement of the medium is referred to as advective transport. Advective and dispersive

transport are fluid-element driven, whereas diffusion transport is concentration-driven and can proceed under quiescent conditions.

Diffusive transport at the molecular level can take place under steady or unsteady conditions in homogeneous (gases, soils, water) or multiphase (sediments, biofilms) engineered and natural environmental systems. The rate of chemical transport under these conditions can be quantified using Fick's Laws of diffusion.

Once a hazardous material is released into the diffusion environment, it will be moved through the environment according to meteorological conditions and the characteristics of the hazard itself.

Industrial Hygiene

According to DOE O 151.1C, The American Industrial Hygiene Association has published emergency response planning guidelines to which the exposure level resulting from the release of non-radiological material is compared for determining whether protective actions should be implemented.

Chemistry

The following is taken from the Occupational Safety and Health Administration (OSHA), *Process Safety Management*.

On July 17, 1990, OSHA published in the Federal Register (55 FR 29150) a proposed standard, "Process Safety Management of Highly Hazardous Chemicals," containing requirements for the management of hazards associated with processes using highly hazardous chemicals to help assure safe and healthful workplaces.

Approximately four months after the publication of OSHA's proposed standard for process safety management of highly hazardous chemicals, the Clean Air Act Amendments (CAAA) were enacted into law (November 15, 1990). Section 304 of the CAAA requires that the Secretary of Labor, in coordination with the Administrator of the Environmental Protection Agency (EPA), promulgate, pursuant to the Occupational Safety and Health Act of 1970, a chemical process safety standard to prevent accidental releases of chemicals that could pose a threat to employees.

Biology

The following is taken from DOE G 151.1-5.

Integration of hazardous biological materials into the emergency management program is directed by 10 CFR 851, "Worker Safety and Health Program," appendix A7, "Biological Safety." According to this rule, contractors must establish and implement a biological safety program that establishes an Institutional Biosafety Committee (IBC) or equivalent. The IBC must review the site's security, safeguards, and emergency management plans and procedures to ensure they adequately consider work involving biological etiologic (i.e., disease causing) agents. In addition, the biological safety program confirms that the site safeguards and security plans and emergency management programs address biological etiologic agents, with particular emphasis on biological select agents. Other Federal

regulations that govern the use and storage of select agents and toxins require that mandated incident response planning be integrated with any site-wide emergency response plans.

Worker and Public Health and Safety

The following is taken from DOE G 151.1-4.

Radiological, chemical, biological, and occupational safety support may be required for exposure and dose control, or environmental contamination assessments.

Hazardous Material

The following is taken from DOE G 151.1-4.

Hazardous material survey, sampling and sample analysis teams should be designated to evaluate the occupational, radiological, and environmental health hazard at or near an accident scene. These teams should be equipped with adequate monitoring equipment and personnel. Teams should possess knowledge on the use of protective gear, monitoring equipment, and communication equipment and should be equipped and trained to accomplish field monitoring and plume tracking, when appropriate, within and beyond the emergency planning zone.

Criticality Safety

The following is taken from DOE G 420.1-1.

DOE O 420.1B, *Facility Safety*, chapter III, contains requirements that facilities be designed in such a manner that the probability of a criticality accident is acceptably low and, to the extent practical, the public, the workers, and the environment are protected from damaging effects and undue hazards that may arise from a criticality accident as required; that no single credible event or failure must result in a criticality accident having unmitigated consequences; and that criticality accident alarm systems and criticality detection systems be included. See DOE O 420.1B, *Facility Safety*, chapter III, and its supporting standards for details.

Explosives Safety

The following is taken from DOE M 440.1-1.

Explosives should not be transported in hazardous conditions (e.g., storms, icy roads, or poor visibility), unless an emergency plan is in effect to provide instruction and guidelines while an explosives-transport vehicle is in transit.

The plan should address the following issues:

- Parking the vehicle.
- Safeguarding the vehicle from other traffic.
- Notifying appropriate authorities of the emergency situation.
- Leaving the vehicle unattended.

A plan shall be prepared to address mechanical breakdowns. The plan shall address the following issues:

- Removing the vehicle from the road as far as practical.

- Posting emergency reflectors, signals, etc. (carrying flares on the vehicle is not permitted).
- Reporting the problem.
- Maintaining surveillance of the vehicle.
- If necessary, removing the vehicle load to facilitate repair of the vehicle.

If an explosives-carrying vehicle is involved in an accident, the following steps should be taken:

- Inspect the load for evidence of fire.
- If there is a fire, but the explosives material is not presently or imminently involved, attempt to prevent the fire from spreading to the load. The fire may be fought using the vehicle's fire extinguishers. Ensure the security of explosives items removed from the vehicle.
- If a fire presently or imminently involves the explosives load, evacuate all personnel to a pre-established safe distance. Block or divert traffic from the vicinity of the accident. Evacuate potentially affected area residents.
- Unless the explosive cargo is imminently involved in fire, the operator is to stay with the vehicle until the cargo is properly dispositioned.
- Notify the fire department or fire brigade of the accident immediately and inform them of the general type and approximate quantity of explosives involved.
- Inform the proper authorities of the accident.

Environmental Protection

The following is taken from DOE O 151.1C.

The operational emergency base program must provide for compliance with EPA requirements implementing the Clean Water Act through the National Pollution Discharge Elimination System and with EPA requirements implementing the Comprehensive Environmental Response, Compensation, and Liability Act, embodied in the 40 CFR 300 series, including Title III, the Emergency Planning and Community Right-to-Know Act, embodied at 40 CFR 355

Detection and Monitoring

The following is taken from DOE G 151.1-1A.

Detection and monitoring briefly describes the process for obtaining in situ information about the impact of an actual or suspected release of radiological or chemical hazardous material by taking direct measurements in the environment or by sampling environmental media for subsequent laboratory analysis. The integration of monitoring data and results of calculations is addressed.

Consequence Assessment

The following is taken from DOE G 151.1-4.

This support function should assist emergency assessment teams and protective actions personnel in estimating and measuring onsite and offsite consequences. This function may

include directing environmental sampling and analysis teams, meteorological data monitors, etc.

Protective Measures

The following is taken from DOE G 151.1-5.

Protective actions to be implemented or recommended for biological operational emergencies will likely be a combination of general protective actions and specific measures that depend on the agent transport mechanism, characteristics, and the associated disease. General protective actions might include evacuation, accountability, access control, and sheltering. The select agent rules emergency plan (incident response plan) requirements include a description of the procedures for emergency evacuation, including type of evacuation, exit route assignments, safe distances, and places of refuge.

Specific protective measures may also depend on characteristics of the agent and associated disease. These protective actions may include personal protective equipment (PPE), decontamination, quarantine, and medical prophylaxis. Selection of these measures will depend on agent/disease characteristics, including: stability in the environment, transmissibility, and infectivity.

Fire Protection

The following is taken from DOE G 151.1-4.

Fire and rescue support should be capable of responding to the scene of the emergency safely. Response units should possess the proper amount and type of specialized equipment. Search and rescue operations should be capable of being conducted in an efficient and effective manner. Depending on the situation, fire and rescue operations should include monitoring for PPE acceptability by industrial hygiene and health physics personnel. Fire and rescue support is determined by the baseline needs assessment performed in accordance with DOE O 420.1B, using the hazards survey and EPHA.

Operations and Maintenance

The following is taken from DOE G 151.1-4.

Operational support in the form of a coordinated work force and equipment for performance of assessment or damage control, maintenance/ repair, or implementation of mitigative actions should be considered for most operational events.

Repair and maintenance support should be available for carrying out repair and maintenance activities during an emergency in a timely and efficient manner. Repair and maintenance teams should possess the proper tools and the capabilities to procure replacement parts if needed. Repair and maintenance activities should include personnel protection and monitoring as well as coordination with other support groups, such as health physics and chemistry personnel.

Security

The following is taken from DOE G 151.1-4.

Security support will be required to interface with emergency management personnel in several different response activities (e.g., control of an incident scene, direction of evacuation efforts, control of classified material, protection of nuclear, biological, toxicological, or other sensitive assets, and preservation of the accident/incident scene).

Organizational and operational interfaces between these traditional emergency response functions and security organizations should be clearly defined in emergency plans and procedures to ensure timely decision-making, coordination of actions, field communications, Headquarters communications, and recovery. Expected interfaces with offsite security and law enforcement organizations should be defined and covered in emergency plans.

Law Enforcement

According to DOE G 151.1-1A, law enforcement provides information on services that are essentially the same as law enforcement services that would apply to a non-DOE facility.

Medical

The following is taken from DOE G 151.1-4.

Medical support should be provided for all injured and/or potentially contaminated or infected personnel, including emergency responders. Medical advice should also be provided to emergency management when there is a potential for significant injuries or casualties from an event. Interfaces with offsite medical support organizations are within the responsibilities of the site medical staff.

Public Affairs

The following is taken from DOE G 151.1-4.

Public and media information support should be available to perform such tasks as interfacing with the media; updating the public, including facility/site personnel not directly involved with the response; providing rumor control, etc.

Legal

Legal provides information on liabilities and responsibilities related to emergency management.

2. Emergency management personnel shall demonstrate a working level knowledge of hazardous material safety to oversee emergency activities and to provide guidance in mitigating emergencies.

a. Discuss the concerns associated with the use of hazardous materials.

The following is taken from DOE G 151.1-1A.

The EPHA analysis of identified hazardous materials associated with a facility/site or activity consists of a systematic examination of hazardous materials that identifies potential release scenarios for each substance in each location where it exists in the facility/site or activity. A range of different failure modes and initiating events are considered, including accidents;

natural phenomena (e.g., earthquakes, tornadoes); external events (e.g., aircraft crashes, offsite transportation accidents involving hazardous materials, pipeline explosions); and, terrorism, sabotage, or other malevolent acts. A spectrum of potential events ranging from low-consequence, high-probability events to high-consequence, low-probability events are postulated and realistically analyzed. The DOE approach requires some planning even for events whose severity exceeds the design basis for safety controls; the facility/site or activity must be prepared to take actions to limit or prevent adverse health and safety impacts to workers and the public.

The EPHA analysis determines the amount of the substance that would be released, the rate of release, the pathway by which it would reach the environment, and observable indicators associated with the release event. By comparing the features of the different release scenarios, a number of specific cases are selected to represent the range or spectrum of possibilities. Using source and atmospheric transport models appropriate to the substance and the release conditions, the hazardous material concentration (for toxic chemicals) or dose (for radioactive materials) at several receptor locations is calculated.

Receptor locations are chosen to represent a nearby worker, workers at other facilities on the same site, and the public. The health impact at each of these receptors is judged by comparing the dose or concentration to the applicable protective action criteria that are specified in the DOE Order and guidance for each hazardous material.

b. Discuss the general safety precautions necessary for the handling, storage, and disposal of hazardous materials, to include explosive, flammable, and combustible substances.

The following is taken from the University of California, Environmental Safety and Health, *Flammable Materials*.

The guidelines for safe handling of flammable and combustible materials are as follows:

- Minimize the quantity of flammable materials on hand in operating areas, particularly in laboratories. Make it a habit to put flammables back in the flammable storage cabinet.
- Do not utilize flammable liquids on the bench top — use the fume hood.
- Label repackaged combustible and flammable materials as such.
- Store flammable and combustible substances in closed metal safety cans or cabinets whenever possible.
- Store and use flammable materials away from electrical equipment, sources of static electricity, and machinery with moving parts.
- A maximum of 10 gallons of flammable liquids may be stored outside of a flammable storage cabinet, provided the following are observed:
  - Quantities exceeding the above totals must be stored in approved metal flammable liquid storage cabinets.
  - Quantities stored in approved cabinets within labs or classrooms must not exceed 60 gallons/cabinet and 120 gallons total.
- Remove all obstructions that are blocking corridors and exits. Storage of any kind is not permitted within corridors.
- Never store anything in front of fire extinguishers or electrical panels.

- Become familiar with evacuation routes from the building, and know the emergency assembly point for your building.
- Know how to use and locate fire alarms, fire extinguishers, and cut-offs for electricity to work areas.
- Report any problems with accumulation of stored materials, locked or blocked exits, or other fire-related problems to your supervisor.
- Use secondary containment for large containers to prevent the spread of spills.
- Electrically ground all containers involved when pumping flammable liquids to prevent the buildup of static electricity.

c. Describe the types, uses, and limitations of chemical detection and monitoring equipment.

The following is taken from eMedicine, *Chemical Detection Equipment*.

Chemical detection equipment (CDE) is an essential component of hazardous material (HAZMAT) emergency response. This equipment should detect the harmful agent, correctly identify the agent, and define the area of exposure. Rapid detection is essential so that responders and military targets can recognize a threat and don protective gear (ideally in <9 seconds). It is also important to know the extent of contamination.

Source: eMedicine: Image courtesy of Environmental Technologies Group Inc.

Figure 1. A soldier using an improved chemical agent monitor

Several different technologies are used today to detect chemical agents (CAs). CAs are defined as chemicals intended to kill or seriously injure human beings. CDE usually detects the most common CAs: nerve agents, blister agents, and arsenical vesicants. A large variety

of equipment is available that is capable of identifying liquid droplets of CAs on surfaces and in vapors. Laboratory-based equipment can detect agents in water, food, and human samples. The main challenges with these technologies are ensuring an appropriate sample for analysis and filtering out nonhazardous environmental chemicals that may be present. A device may detect agents quickly and accurately in a rural setting only to be confused in an urban city by the exhaust from a vehicle.

The following paragraphs focus on the technologies and devices that may be used by first responder teams in the field.

Chemical Detection Paper

Chemical detection paper is a very sensitive technique for detecting CAs. It is one of the least sophisticated and thus least expensive methods of detection. It is used to detect liquids and aerosols and is a common means for defining a contaminated area.

Chemical detection paper is composed of 2 dyes soluble in CAs and a pH indicator integrated into cellulose fibers. When exposed to CAs, it can change color according to the type of agent. If an aerosolized droplet encounters the paper, the diameter and density of the spot can be used to determine the droplet size of the agent and the degree of contamination.

Chemical detection paper lacks specificity and is prone to error because it reacts with contaminants such as brake fluid, antifreeze, and insect repellent, resulting in false-positive readings. False readings are especially undesirable in civilian situations because they may lead to mass panic. Therefore, always use chemical detection paper with another modality for accuracy of detection.

Colorimetric Tubes

Colorimetric tubes such as those available from Draeger and RAE systems use enzymatic techniques to identify CAs. A hand pump is used to draw a sample into a specific tube, and the concentration of the substance is read from the tube. This is another simple and inexpensive way of detecting and identifying a CA. It is used extensively in civilian response units for this reason, but it has some disadvantages. Available are 160 substance-specific reagent tubes identifying different agents. For each agent, a different tube must be used. Efficient use of this system demands knowledge of which CA is likely to be present in a given environment. If a tube for vesicants is used to sample the air and the CA is a nerve agent, the tube reports a false-negative result. A tube for each possible CA must be used for thorough detection.

Draegar has made this process simpler by offering a chip measurement system analyzer. The analyzer integrates an optical system for analyzing the color reaction, a flow controller, a pump system, and 10 capillaries, each capable of detecting an agent. As long as the proper chip is inserted, 10 agents can be detected and measured accurately within 20 seconds using this device. Draegar offers this device as part of an emergency response kit available to the public.

Ion Mobility Spectroscopy

Ion mobility spectroscopy (IMS) is used in many handheld and stand-alone detection devices that can be used to scan equipment, surfaces, and people for contamination. This technology involves drawing a gaseous sample into a reaction chamber using an air pump. The air molecules then are ionized, most commonly using radioactive beta emitters such as ^{63}nickel or ^{241}americium. The ionized particles then are passed through a weak electrical field toward an ion detector.

Contaminants are identified according to the time it takes to traverse the distance to the detector and the amount of electrical charge detected. The time is proportional to the mass of the molecule. The pattern is compared to a sample of clean air; if the pattern is markedly different and unique to certain types of agents, the alarm sounds. These systems are capable of detecting and distinguishing between nerve gas, mustard gas, and vesicants. Its sensitivity ranges from 0.03 mg/m^3 for nerve gases such as sarin to 0.1mg/m^3 for mustard gas.

IMS has certain advantages. It is less sensitive to contaminants, because it relies on a clean air sample for calibration. Thus, if an area has a certain baseline nonhazardous environmental vapor present, it is not detected. Differential ion mobility spectrometry is a variation of IMS that measures the difference between the ion mobilities as they pass through the field to separate ions.

Improved Chemical Agent Monitor and Other Handheld Devices

IMS is the cornerstone of many devices used today. The Finnish M86 and M90 are handheld devices that use IMS, as is the Improved Chemical Agent Monitor (ICAM). The ICAM was used extensively in the Gulf War, even attached to certain vehicles. It is a handheld device that continuously displays the concentration of nerve agents or mustard agents. The ICAM is prone to erroneous detection in enclosed spaces and areas of strong vapor concentration (eg, heavy smoke). It also can become saturated, requiring recalibration. Versions of the ICAM are available for commercial purchase and are used by many medical response teams.

Infrared Radiation Detection Techniques

Infrared radiation (IR) is used in several CA detectors, including long-range detectors and point detectors. Mid-IR light (frequency 4000 cm-1 to 200 cm-1) can be used to excite molecules, and each agent has a unique infrared pattern referred to as a fingerprint. Several different detection techniques use IR, including photoacoustic infrared spectroscopy, filter-based infrared spectroscopy, forward-looking infrared spectroscopy, and Fourier transform spectroscopy.

Photoacoustic Infrared Spectroscopy

This highly selective technique is used to identify CA vapors. It usually is used in point detector devices. Modulated IR is passed through the sample. Since the CA absorbs the radiation, the temperature increases, and per Boyle law, the gas expands. The pattern of expansion or contraction depends on the modulation of the IR, which in photoacoustic spectroscopy is an audible signal. A microphone detects the modulation and alarms when it is similar to a recognizable agent.

This technique's selectivity is based on the number of wavelengths transmitted through the sample. As more wavelengths are passed, the chance of contaminants causing false alarms decreases. These devices are sensitive to environmental variables such as external vibration. Like IMS, if these devices are calibrated in the operating environment, detection should be accurate.

Filter-based Infrared Spectroscopy

This technology also is based on comparing the amount of energy absorbed by the sample, using several different wavelengths of infrared light. A series of filters is used to direct the beam through a predetermined path. Concentrations of each vapor component are used to compile trends and identify the vapor.

Differential Absorption Light Detection and Ranging

This infrared technology is used mainly to track CA clouds that already have been identified. Two pulses of laser are transmitted into the distance, and the reflected IR is detected. One pulse is a frequency that is known to be absorbed by the CA; the other is not known to be absorbed. The difference in the intensity of the return signal is used to determine the concentration of the cloud, while the time of return is used to determine the distance from the observers. This technique also is subject to environmental noise but has been used effectively to track CAs.

Passive Infrared Detection

Forward-looking infrared spectroscopy and Fourier transform infrared are techniques by which IR emitted from CA vapor is detected simply. These technologies commonly are used in stand-alone detection devices that simply alarm when a CA cloud is detected. Both of these methodologies depend on the collection of infrared information; however, the processing is different.

d. Demonstrate the proper use of portable air sampling equipment.

This is a performance-based KSA. The Qualifying Official will evaluate its completion. The following information taken from DOE-HDBK-1122-2009, may be helpful.

Beta-Gamma Constant Air Monitors (CAMs)

General Characteristics

- Continuously monitor quality of particulate beta-gamma airborne activity in selected area.

Physical characteristics

- Geiger-Muller (GM) detector(s) - usually pancake type. Some utilize one GM detector to measure activity on filter. Others utilize two GM detectors; one GM detector used to measure activity on filter, and the other GM detector to measures ambient background for background subtraction.
- Filter paper holder assembly in lead shield
- Strip chart recorder

- Mounted on enclosed, portable cart
- Photohelic air flow meter
- Alarm lights for high Activity alarm and low air flow alarm.

Limitations of CAMs

- Low air flow - must be placed near or downwind suspected source
- Poor response to low energy beta
- Lead shield ineffective for high gamma energies, therefore the CAM must be in low background
- Responds to radon, thoron, and daughters which can produce a fluctuating background on recorder.
- Not very portable; approximate weight 500 pounds

Method of sampling

- Filtration

Operation and Use

- Initial startup - Check all switches in off position (Master switch and high voltage switch) plug in power cord (110 V) - Air blower will start and reset any alarms that activate
- Ensure sufficient filter paper
- Turn master switch on and allow two minute warmup
- Turn high voltage switch on and allow 30 second warmup
- Supervisor to adjust the following settings: high voltage level, high and low level alarm settings scale switch overlap setting
- Set recorder speed selector switch; 3/4 in. per minute to ascertain chart moves, 3/4 in. per hour, routine operation
- CAM operating if slow buildup noted on recorder chart.

Alpha CAMs

Continuously monitor quality of particulate alpha airborne activity in selected areas.

Operating Characteristics

- Air pumping system pulls air through impactor head.
- Count rate meter monitors planchet which will activate high activity alarm horn and light at preset points.

Physical Characteristics

- External cabinet features are: power supply, magnehelic gauge, count rate meter (CRM), recorder chart, power switches, outlets, photohelic air flow meter, and alarm lights (Radiation alarm and Low flow alarm).
- Internal cabinet features are: Annular Kinetic Impactor sample head, blower, planchet (greased with ZnS and Silicone) and the Photomultiplier (PM) tube.

Limitation(s)

- Does not give extremely accurate quantitative alpha measurement, but it gives warning of increase activity and is possible to make estimates.
- Dust buildup and radon-thoron activity affect efficiency.

Method of Sampling

- Impaction

Operation and Use

- Initial startup.
- Place new Alpha Tak planchet on impactor head: Open light tight boxdoor, move PM tube housing from impactor head, remove any used planchet, place new planchet on impactor head, move PM tube housing back into position, close door, indicate action on recorder chart (date,time, etc.), and take any used planchets to health physics office for processing.
- Plug in power cord ensuring all switches are off prior to plugging power cord in.
- Turn on switches in following order: outlet switch, then CRM power switch.
- Set CRM to x 1 scale.
- Set alarm to desired level.
- Set CRM PHA/GROSS switch to GROSS.
- Notify supervisor of any malfunctions.

e. Discuss the emergency procedures associated with accidental releases of hazardous materials to the environment, including notifications, protective equipment, decontamination activities, and emergency rescue and treatment.

The following is taken from the Centers for Disease Control (CDC), *Public Health Emergency Response Guide for State, Local and Tribal Public Health Directors*.

Immediate Response (0-2 hours)

- Initiate the response by assessing the situation.
- Contact personnel within your health department that have emergency response roles and responsibilities.
- Develop initial health response objectives that are specific, measurable, and achievable. Establish an action plan based on your assessment of the situation. Assign responsibilities and record all actions.
- Assign a health representative(s) from your department to establish communications and maintain close coordination with the local, state, or tribal emergency operations center (EOC) and its associated components, if operational. The health representative(s) may or may not be physically located in the EOC depending on the specific incident and established emergency operations, plans, procedures, and guidelines.
- Coordinate with the safety officer to identify hazards or unsafe conditions associated with the incident and immediately alert and inform appropriate supervisors and leadership personnel. This can be achieved through site safety briefings and at shift changes. Health responder safety reports, updates, and briefings should be initiated at this stage of the response. Ensure that medical personnel are available to evaluate and treat response personnel.

- Establish communications with other health and medical agencies, facilities, and organizations that have emergency response roles and responsibilities, and verify their treatment and support capacities.
- Assign and deploy resources and assets to achieve established initial health response objectives.
- Ensure that health-related requests for assistance and information from other agencies, organizations, and the public are either directed to appropriate personnel within your health department or forwarded to appropriate agencies and organizations.
- Determine whether a Joint Information Center (JIC) and the local, state, or tribal EOC are operational. If so, ensure that a health representative(s) from your department has been assigned as part of a Joint Information System (JIS) to establish communications and maintain close coordination with the JIC. The health representative(s) may or may not be physically located in the JIC based on the specific incident and established emergency operations plans, procedures, and guidelines. Ensure that contact has been established with appropriate personnel within your health department and initiate risk communication activities. Remember to communicate public health messages in the appropriate language(s) to persons with limited English proficiency. A public health information "hotline" can be established to address requests for information from the public.
- Stay apprised of legal issues as they emerge and consult with appropriate personnel within your health department and jurisdiction.
- Document all response activities using the form(s) in your health department.

Intermediate Response (2-6 hours)

- Verify that health surveillance systems are operational.
- Ensure that laboratories likely to be used during the response are operational and verify their analytical capacity.
- Ensure that the needs of special populations are being addressed through the provision of appropriate information and assistance.
- Communicate frequently with the public regarding whether or not health-related volunteers and donations are needed. Volunteer agencies (e.g., the Red Cross) have their own needs that may differ from those of your health department. Volunteer medical personnel must be properly credentialed and insured.
- Ensure that risk communication messages are updated and coordinated with other responding agencies and organizations as necessary. If a JIC is operational, update and release messages through the JIC. Ensure that messages on public health information "hotlines" are updated as necessary.

Intermediate Response (6-12 hours)

- Begin collecting and analyzing data that are becoming available through established health surveillance systems and laboratories, and evaluate any real-time sampling data. Communicate results to appropriate personnel in a timely manner through established operations plans, procedures, or guidelines.
- Initiate staffing plan and update contact information and rosters to be used by incoming personnel. Apprise incoming personnel of response actions being taken, pending decisions, issues, deployment of resources and assets, updated health response objectives, and current media activities.

- Prepare for the arrival of state and federal onsite assistance and for the integration of these personnel into the locally established response structure.
- Assess health resource needs and acquire as necessary.

Extended Response (12-24 hours)

- Initiate preparations for providing mental and behavioral health services and social services to health department staff, response personnel, and other persons affected by the event. Address required comfort needs of health department staff.
- Consider and assess public health functions and tasks that will need to be addressed beyond the first 24 hours (i.e., the acute phase) of the incident based on incoming data and developments. Your health department may be engaged in extended operations for lengthy periods of time. Also, begin developing a strategy for disengaging and demobilizing public health functions from the response effort based on the analysis and results of incoming data and existing response objectives.

Mass casualty situations and emergencies involving casualties may involve situations where teams must reenter dangerous environments to evacuate casualties. Rescue teams are formed by a variety of organizations for these purposes. The primary responsibilities of rescue teams are to: provide immediate life-saving aid during day-to-day operations; remove victims from dangerous scenes (e.g., fires, accidents) or contaminated areas; remove gross contamination, if present and possible; and transfer the victim to medical personnel.

Rescue team size, staffing, and training should be based on the potential threats outlined in the hazards survey. Rescue teams can be composed of personnel with a range of backgrounds, but should have at least one medically trained individual (i.e., first responder, emergency medical technician, etc.) per team. Rescue teams should receive any specialized training necessary for the potential threats. This training may consist of, but is not limited to, HAZMAT, confined-space rescue, and high-angle rescue. If the facility chooses to use offsite rescue teams, the facility must ensure that the offsite teams are trained in the peculiar hazards at the facility.

f. Discuss the information resources associated with hazardous material releases that are available to emergency responders.

The following is taken from the Centers for Disease Control, *Public Health Emergency Response Guide for State, Local and Tribal Public Health Directors*.

Examples of information resources are listed below:

- Emergency management agencies
- Emergency medical services
- Medical/health/behavioral care providers
- Fire, law enforcement, and other federal, state, local, and tribal response organizations
- Local emergency planning committees
- State, regional, and tribal public health response coordinators
- Neighboring health jurisdictions
- Humanitarian/volunteer organizations
- Private businesses

- Academic institutions (schools of public health, medicine, nursing, etc.)
- Other pertinent agencies/organizations

3. Emergency management personnel shall demonstrate a working level knowledge of health physics and radiation protection to oversee emergency activities and provide guidance in mitigating emergencies.

a. Discuss the fundamentals of radiation protection as related to emergency response to various scenarios.

The following is taken from DOE O 452.1D.

All suspected conditions that may pose inhalation or skin absorption hazards that are immediately dangerous to life or health (IDLH), or other conditions that may cause death or serious harm, shall be identified during a preliminary survey and evaluated during a 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.

The following monitoring shall be conducted during initial site entry when the site evaluation produces information that shows the potential for ionizing radiation or IDLH conditions, or when the site information is not reasonably sufficient to eliminate these possible conditions:

- Monitoring with direct-reading instruments for hazardous levels of ionizing radiation
- Monitoring the air with appropriate direct-reading test equipment (i.e., combustible gas meters, detector tubes) for IDLH and other conditions that may cause death or serious harm (combustible or explosive atmospheres, oxygen deficiency, toxic substances)
- Visually observing for signs of actual or potential IDLH or other dangerous conditions

An ongoing air-monitoring program shall be implemented after site characterization has determined that the site is safe for the start-up of operations.

Once the presence and concentrations of specific hazardous substances and health hazards have been established, the risks associated with these substances shall be identified. Employees who will be working on the site shall be informed of any risks that have been identified.

The Department's radiological assistance program (RAP) is capable of providing assistance in all types of radiological incidents. The responses may include onsite, as well as offsite, assistance, as appropriate, when requested by other federal agencies and/or state, local, and tribal authorities in dealing with the impacts of radiological incidents. RAP is designed so that DOE's response to a small incident can be scaled up smoothly for a major radiological emergency.

Requests for radiological assistance will normally be directed to one of eight DOE regional coordinating offices (RCOs), although requests may also go directly to the HQ Emergency Operations Center (EOC) coordinator, who then contacts the DP-20 Program Office. The

appropriate RCO will handle the request and dispatch, if necessary, a radiological assistance team (RAT) to provide assistance. The RCO may request that other agencies with available radiological resources also provide assistance. DOE involvement in minor radiological accidents will normally end when the need for assistance is over or when there are other sufficient resources available to handle the situation.

Requests for DOE assistance following a major radiological accident would be the same as stated in the paragraph above. The regional RAP teams would likely respond first, followed by an advance Federal Radiological Monitoring and Assessment Center (FRMAC) party from the DOE Nevada Field Office (including aerial radiological survey capability), and followed finally by the full FRMAC team. Declaration of a major radiological emergency may be made by the HQ Operational Emergency Management Team (OEMT).

In the event of a major radiological emergency, DOE will set up and manage a FRMAC. The FRMAC Director (assigned by the DOE Nevada Site Office [NSO] with the coordination of the Program Secretarial Officer [PSO]) will manage and coordinate the offsite monitoring and assessment activities of all federal agencies in support of the state or tribal government and the Lead Federal Agency (LFA).

If the incident occurs at a DOE facility, DOE will serve as LFA and will appoint the Lead Federal Agency Official (LFAO) who will take control of the incident, unless there are existing agreements to the contrary. RAP elements will report directly to the LFAO. If the incident involves DOE material in shipment or shipments in transit, DOE will also serve as the LFA. For non-DOE sponsored transportation accidents and other non-DOE related radiological responses, RAP will respond to assist state or tribal officials in the same manner as they would respond to assist the LFAO.

FRMAC will coordinate and provide federal assistance in response to major radiological incidents. The response includes offsite assistance, as appropriate, when requested by federal, state, local, and tribal authorities in dealing with the impacts of radiological incidents.

A FRMAC will be established when a major radiological emergency has been declared. Any declaration of a major radiological emergency will be made by the DOE OEMT in consultation with the NSO. A major radiological emergency exists if a request for DOE assistance has been received from a DOE-owned facility or any state, local, tribal, or other federal agency which requires capabilities.

In the event of a major radiological emergency, DOE will establish and manage a FRMAC. The FRMAC Director assigned by NSO in coordination with the PSO, will manage and coordinate the offsite monitoring and assessment activities of all federal agencies in support of the state, local, or tribal government, and the LFA.

Initial requests for assistance to a radiological incident from outside the DOE complex could be directed to any of the department's sites, or directly to the HQ EOC. If the EOC is notified directly, immediate action will be taken to notify the Program Office (DP-20), which will evaluate the incident and implement an appropriate response. Requests transmitted to sites other than the HQ EOC will be evaluated by the DOE field activities and forwarded to the HQ EOC unless it is apparent that the incident does not constitute a major radiological

incident, in which case a RAP team will initially be deployed to the incident site. If, upon arrival, a determination is made that the incident exceeds the capabilities of the RAP team, the HQ EOC will be notified and the full notification process will be implemented. This may include DP-20 directing the activation of the OEMT, and depending on the severity of the incident, the deployment of an advanced FRMAC under the operational control of NSO. This action might be followed with the deployment of the full FRMAC under the operational control of NSO and direction of the OEMT.

For an incident occurring at a DOE facility, the department will be the LFA and will appoint the LFAO. FRMAC will be under the direct control of, and report to, the LFAO. DOE will also serve as LFA for incidents involving DOE materials in transit or for materials in DOE custody that are staged or stored at non-DOE facilities.

b. Discuss the emergency exposure recommendations of 10 CFR 835 Subpart N.

The emergency exposure recommendations of 10 CFR 835, subpart N, are as follows:

- The risk of injury to those individuals involved in rescue and recovery operations will be minimized.
- Operating management will weigh actual and potential risks against the benefits to be gained.
- No individual will be required to perform a rescue action that might involve substantial personal risk.
- Each individual authorized to perform emergency actions likely to result in occupational doses exceeding the values of the limits provided at 10 CFR 835.202, "Occupational Dose Limits for General Employees," will be trained according to 10 CFR 835.901, " Radiation Safety Training" and briefed beforehand on the known or anticipated hazards to which the individual will be subjected.

c. Describe the relationship between dose and radiological injury.

The following is taken from *Introduction to Environmental Technology* by Ann Boyce.

The effects of radiation upon biological systems depend on the total radiation dose and also on the dose rate (how fast the dose is received). A whole body radiation dose of 100 roentgen equivalent man (rem) received in five minutes or less is an acute exposure and may cause mile radiation sickness. A chronic radiation exposure in many small dose, such as two hundredths of a rem (0.02 rem) per day for 50 working weeks each year for 20 years, is also a total dose of 100 rems, but does not cause radiation sickness.

Radiation sickness is the result of an acute whole body dose of 100 to 400 rem of ionizing radiation. Low-level chronic radiation exposures at or below the occupational exposure limit have not been shown to result in damage to biological systems. The maximum averaged daily radiation dose for most workers is 10 to 50 percent of the 0.02 rem.

d. Discuss the following terms and concepts: uptake, biological half-life, intake, contamination, exposure, and criticality.

The following definitions are taken from DOE-HDBK-1122-2009.

Uptake

Uptake is the amount of radionuclide deposited in the body which makes its way into the body fluids or systemic system.

Biological Half-Life

Biological half-life is the time required to reduce the amount of material in the body to one-half of its original value.

Intake

Intake is the amount of radionuclide taken into the body.

Contamination

Contamination is simply defined as radioactive material in an unwanted location, e.g., personnel, work areas, etc. Two types of contamination are possible, fixed and removable. Fixed contamination is radioactive surface contamination that is not easily transferred to other personnel or equipment through normal contact. Removable contamination is radioactive surface contamination that is easily transferred to other personnel or equipment through normal contact.

Exposure

Exposure is a measure of the ability of photons (X and gamma) to produce ionization in air. Traditionally, the unit of exposure is the roentgen (R). The unit is defined as the sum of charge per unit mass of air; that is:

1 roentgen = 2.58E-4 coulombs/kg of air

Criticality

Criticality is the condition in which the neutrons produced by fission are equal to the number of neutrons in the previous generation. This means that the neutrons in one generation go on to produce an equal number of fission events, which events in turn produce neutrons that produce another generation of fissions, and so forth. This continuation results in the self-sustained chain reaction.

e. Describe the types, uses, and limitations of radiation detection and monitoring equipment.

The following is taken from DOE-HDBK-1122-2009.

In all aspects of radiological control, knowledge of the characteristic and magnitude of the radiation field is essential in evaluating the degree of radiological hazard present. Radiation itself can not be detected directly. Because of this, radiation detection is accomplished by analysis of the effects produced by the radiation as it interacts in a material. Numerous different methods of accomplishing this analysis have been developed and implemented with varying degrees of success. Several of these have found extensive application in radiological control.

All radiation measurement systems consist of a detector and some sort of a readout circuitry. A detector may be combined with appropriate circuitry to form an instrument, or the detector and the readout may be separate.

Detector Function

In the detector, the incident radiation interacts with the detector material to produce an observable effect, be it a chemical change or creation of an electrical signal. With a few exceptions, the effect caused by radiation incident on a detector is not permanent.

In these detectors the effect is observed as it occurs and yields a signal in terms of events per unit time. These detectors are typically used in association with rate meters, instruments which read out in terms of counts per minute, millirem per hour, etc.

The exceptions occur mostly in dosimetry instruments. In these detectors, the effects are accumulated for analysis at a later time. Thus, instead of events per unit time, the accumulated effect caused by all events is measured. These detectors are often classified as integrating detectors.

Detectors are characterized by the type of interaction which produces the effect and the way in which the detector is operated.

Ionization Detectors

In ionization detectors, the incident radiation creates ion pairs in the detector. The ionization media can be either gas or solid. Gas filled chambers can be operated as either ion chambers, proportional counters, or GM tubes. A typical solid ionization detector is a GeLi detector used in a multichannel analyzer.

Excitation Detectors

In excitation detectors, the incident radiation excites the atoms of the detector material. The atoms give off the excess energy in the form of visible light. Thermoluminescent dosimeters (TLD) and scintillation detectors fall in this category.

Chemical Detectors

In chemical detectors, the incident radiation causes ionization or excitation of the detector media thereby causing chemical changes which can be analyzed. Film badges are an example of a chemical detector.

Ion Chamber Detectors

As the voltage to the detector is increased, a point is reached at which essentially all of the ions are collected before they can recombine. No secondary ionization or gas amplification occurs. At this point, the output current of the detector will be at a maximum for a given radiation intensity and will be proportional to that incident radiation intensity. Also, the output current will be relatively independent of small fluctuations in the power supply.

The output of a gas-filled detector when 100 percent of the primary ion pairs are collected is called the saturation current.

Advantages

- Output current is independent of detector operating voltage. Observe the flat region of the curve in the ion chamber region. As a result, less regulated and thereby less expensive and more portable power supplies can be used with ion chamber instruments, and still offer a reasonably accurate response.
- Since the number of primary ion pairs is a function of the energy deposited in the detector by the incident radiation, the ion chamber response is directly proportional to the dose rate.
- Since exposure (x) is defined in terms of ionization of air by photons, an air-filled ion chamber, when used for photon radiation, yields the true exposure rate.

Disadvantages

- Since only primary ion pairs created by each radiation event are collected, the output currents are small. Independent current pulses large enough to measure are not formed by each ionizing event. Instead, the total current output created by many ionizing events is measured. Therefore, the sensitivity of a small ion chamber is very poor because a few ionizing events per minute do not create sufficient currents to be measured. A typical commercial portable ion chamber has a detector which produces a current of about 2 E-14 amps per mR/hr.
- Another consequence of the small output current is the effect humidity can have on the instrument response. The electronics associated with the detector must have a high impedance (approximately 1 E15 ohms) to measure currents this small. The instrument incorporates insulators designed to maintain this high impedance. High humidity conditions can cause the formation of condensation on those insulators. (The resistance of relatively pure water is approximately 1 E7 ohms per centimeter.) This condensation creates leakage paths which causes erroneous instrument response.
- Since anything which changes the density of the gas affects the response, changes in barometric pressure (or altitude) and/or ambient temperature can affect instrument response in some cases. This is particularly the case with thin-walled chambers, vented chambers, or chambers with windows. For instance, the response of a typical commercial portable ion chamber instrument decreases by 2 percent for each 10 degree increase in temperature, or decreases by 2.3 percent for each inch of mercury decrease in barometric pressure.

Typical Applications

Portable survey instruments used for measuring dose rates are typically ion chamber instruments. Ion chambers may also be used in several installed monitor systems such as the area radiation monitor systems and the various process radiation monitors.

Proportional Detectors

As the voltage on the detector is increased beyond the ion chamber region, the ions created by primary ionization are accelerated by the electric field towards the electrode. Unlike the ion chamber region, however, the primary ions gain enough energy in the acceleration to produce secondary ionization pairs. These newly formed secondary ions are also accelerated, causing additional ionizations. The large number of events, known as an avalanche, creates a single, large electrical pulse.

In a proportional detector, the detector output is proportional to the total ionization product in the detector. For a constant voltage, the ratio between the primary ionizations and the total number of ions produced is a constant and is known as the gas amplification factor. The gas amplification factors for typical proportional detectors range from a few hundred to about a million. Compare this with a gas amplification factor of only 1 for ion chamber detectors.

Since the gas amplification in a proportional detector is large, the output pulses are large enough to be measured directly and individually. Since a single pulse is produced for each incident radiation particle or photon, it is feasible to directly measure the number of incident particles or photons which interacted with the detector. For this reason, a proportional detector is often used as a proportional counter and is normally used in instruments that read out in events per unit time, such as counts per minute. The total current, which is a function of the number of the pulses and the pulse magnitude, could be measured as is done with ion chamber detectors but this is only done in one type of portable dose rate instrument.

As with the ion chamber detector, increasing radiation energy, or high specific ionization radiations, will result in a larger pulse. Since we can measure the individual pulse, it is possible to analyze the rate of incidence and the energy or type of radiation with a proportional counter. This allows for discrimination of different types of radiation or different radiation energies by varying the high voltage (which affects the gas amplification factor). When the voltage is increased, for example, the detectors output also increases.

Proportional Counter Advantages

- A proportional counter can be used to discriminate between the different types of radiation.
- A proportional counter output signal is larger and therefore a single ionizing event can be recorded (good sensitivity).
- When measuring current output, a proportional detector is useful for dose rates since the output signal is proportional to the energy deposited by ionization and therefore proportional to the dose rate.

Proportional Counter Disadvantages

- A proportional counter is sensitive to high voltage changes because of the effect on the gas amplification factor. As a result, more highly regulated power supplies are necessary for proportional counters.

Typical Applications

Proportional counters find wide application in power stations. Gas flow proportional counters are commonly used for alpha/or beta counting on laboratory samples. Proportional counters are commonly used for neutron monitoring, from portable neutron survey instruments to nuclear reactor neutron flux instruments.

Geiger-Mueller Detectors

As the voltage on the detector is increased beyond the proportional region, the detector enters the limited proportional region. This region is unusable for radiological control purposes. In this region the small individual avalanches that occur within the tube start to interfere with each other. This interference is unpredictable and reduces the overall output signal.

As the voltage is increased further, the secondary ions are also accelerated to very high velocities and gain sufficient energy to cause ionization themselves. These tertiary ionizations spread rapidly throughout the tube causing an avalanche. The avalanche, caused by a single ionization, results in a single very large pulse. The avalanche continues until the fields created by the produced ions interfere with the field created by the high voltage potential across the detector. When this occurs, the amount of acceleration decreases preventing further secondary ionization and halting the avalanche.

The output pulse size is a function of the gas amplification which occurs. In a GM tube, the gas amplification can range upwards from about 1 E8. Since the number of ions eventually produced and collected have no relation to the initial incident ionizing event, the pulse size is independent of radiation energy or specific ionization (a 0.1 MeV gamma creates the same size pulse as a 0.5 MeV gamma). For this reason, GM tubes cannot discriminate against different radiation types or radiation energies. Any radiation event with sufficient energy to create the first ion pair can create a large pulse. For this reason, the GM detector is more sensitive than the ion chamber or proportional counter.

A GM detector can also be avalanched by the small amount of energy released by a positive ion when it is neutralized at the cathode. To prevent this undesirable occurrence, a quenching gas is added to the counting gas. Thus, instead of causing ionization, this excess energy is expended in dissociating the quenching gas molecules.

Advantages of GM Detectors

- GM detectors are relatively independent of the pressure and temperature effects which affect ion chamber detectors. This is because of the magnitude of the output pulse.
- GM detectors require less highly regulated power supplies. This is because the pulse repetition rate is measured and not the pulse height.
- GM detectors are generally more sensitive to low energy and low intensity radiations than are proportional or ion chamber detectors.
- GM detectors can be used with simpler electronics packages. The input sensitivity of a typical GM survey instrument is 300-800 millivolt, while the input sensitivity of a typical proportional survey instrument is 2 millivolt.

Disadvantages of GM Detectors

- GM detector response is not related to the energy deposited; therefore GM detectors can not be used to directly measure true dose, as can be done with an ion chamber instrument.
- GM detectors have a typically large recovery time. This limits their use in extremely high radiation fields. Dead time in a GM detector can be reduced by reducing the physical size of the detector. However, the smaller the detector, the lower the sensitivity. For this reason, wide range GM survey instruments, such as the Teletector or the E520, commonly have two GM detectors - one for the low ranges, one for the high ranges.
- GM detectors can not discriminate against different types of radiation (α, β, γ), nor against various radiation energies. This is because the size of the GM avalanche is independent of the primary ionization which created it.

Typical Applications

GM detectors are widely used in portable survey instruments at nuclear power facilities due to their ruggedness and the simplicity of the associated electronics. GM detectors are also used for personal monitoring for contamination (friskers), for process monitoring, and for area radiation monitoring. In addition, GM detectors are often used for laboratory counting when just a gross count is desired.

f. Demonstrate the proper use of portable survey instruments and air samplers.

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

g. Discuss the emergency procedures associated with radiological releases to the environment, including notifications, protective equipment, decontamination activities, and emergency rescue and treatment.

This is a site-specific KSA. The local Qualifying Official will evaluate its completion. The candidate should follow site-specific emergency procedures.

h. Discuss the general safety precautions necessary for the handling, storage, and disposal of radioactive material.

A radioactive source is material used for its emitted radiation. Sources are constructed as sealed or unsealed and are classified as accountable or exempt.

Radioactive sources are used for response checks in the field, functional checks, calibration of instruments and monitors to traceable standards. To ensure the safety and welfare of all personnel it is important to maintain control of radioactive sources. Radioactive sources are controlled to minimize the potential for:

- Spread of contamination
- Unnecessary exposure to personnel
- Loss or theft
- Improper disposal

In accordance with 10 CFR 835, the following provisions apply to sealed sources:

- 10 CFR 835.1201 states that sealed radioactive sources shall be used, handled, and stored in a manner commensurate with the hazards associated with operations involving the sources.
- 10 CFR 835.1202 states the following:
  - Each accountable sealed radioactive source shall be inventoried at intervals not to exceed six months. This inventory shall:
    - establish the physical location of each accountable sealed radioactive source;
    - verify the presence and adequacy of associated postings and labels; and
    - establish the adequacy of storage locations, containers, and devices.

  - Except for sealed sources consisting solely of gaseous radioactive material or tritium, each accountable sealed radioactive source shall be subject to a source leak test upon receipt, when damage is suspected, and at intervals not to exceed six months. Source leak tests shall be capable of detecting radioactive material leakage equal to or exceeding 0.005 μCi.

- An accountable sealed radioactive source is not subject to periodic source leak testing if that source has been removed from service. Such sources shall be stored in a controlled location, subject to periodic inventory, and subject to source leak testing prior to being returned to service.
- An accountable sealed radioactive source is not subject to periodic inventory and source leak testing if that source is located in an area that is unsafe of human entry or otherwise inaccessible.
- An accountable sealed radioactive source found to be leaking radioactive material shall be controlled in a manner that minimizes the spread of radioactive contamination.

Control of Sources

Types of sources to be controlled include:

- Accountable sealed radioactive source means a sealed radioactive source having a half-life equal to or greater than 30 days and an isotopic activity equal to or greater than the corresponding value provided in appendix E of 10 CFR 835.
- Sealed radioactive source means a radioactive source manufactured, obtained, or retained for the purpose of utilizing the emitted radiation. The sealed radioactive source consists of a known or estimated quantity of radioactive material contained within a sealed capsule, sealed between layer(s) of non-radioactive material, or firmly fixed to a non-radioactive surface by electroplating or other means intended to prevent leakage or escape of the radioactive material.
- Source leak test means a test to determine if a sealed radioactive source is leaking radioactive material.

Responsibilities for controlling these sources include the following:

- It is important that the following actions be done:
  - establishing the program
  - maintaining records related to the accountability and control of accountable sealed radioactive sources for a facility
  - providing each source custodian with an inventory list of accountable sealed radioactive sources assigned to him or her
  - assisting the source custodian in training source users

- The source custodian:
  - should be responsible for ensuring that tests to establish the integrity of an accountable sealed radioactive source are conducted and inventory checks are performed at least every 6 months.
  - should maintain records of the storage and use locations of all assigned accountable sealed radioactive sources.
  - should be trained as a radiological worker prior to being designated as a source custodian.
  - should notify and obtain approval of the radiological control organization (RCO) prior to:
    - any major changes in the use of a sealed radioactive source
    - on-site transfer of a sealed radioactive source to a new permanent storage location

        - modification of a device containing a sealed radioactive source
        - disposal or off-site transfer of a sealed radioactive source
        - any procurement or acquisition of additional sealed radioactive sources

    - should also notify the RCO in the event of the loss or damage to any accountable sealed radioactive source.
- The source user:
    - should be an individual trained by the RCO and the source custodian to use either accountable or exempt sealed radioactive sources
    - should be trained as a radiological worker and receive appropriate training on handling their specific sealed radioactive source(s).

Sources are controlled using the following precautions:

- Each source is to be inspected before each use.
- Remove damaged sources from service.
- Fingers, whether gloved or not, or other objects should never be allowed to touch the active surface of unsealed sources.
- Protect the source from being contaminated when used in a surface contamination area.

Receipt

Prior to receipt of accountable sealed radioactive sources, the RCO should assign the sources to the proper source custodians. Immediately upon receipt of accountable sealed radioactive sources, the RCO should be notified. The packaging should be inspected for damage and a contamination and radiation survey performed. The RCO should perform receipt surveys. Upon receipt from radioactive material transportation, external surfaces of packages known to contain radioactive material shall be monitored if the package: (1) Is labeled with a Radioactive White I, Yellow II, or Yellow III label (as specified at 49 CFR 172.403, "Class 7 (Radioactive) Material," and 172.436-440); or (2) Has been transported as low specific activity material (as defined at 10 CFR 71.4) on an exclusive use vehicle (as defined at 10 CFR 71.4); or (3) Has evidence of degradation, such as packages that are crushed, wet, or damaged (10 CFR 835.405(b)), "Receipt of Packages Containing Radioactive Material."

Monitoring per 10 CFR 835.405 is not required for packages transported on a DOE site which have remained under the continuous observation and control of an individual who is knowledgeable of and implements required exposure control measures. This obviates the need to monitor packages being transported from building to building where the person conducting the transport has knowledge that the package has not experienced significant challenges to its integrity.

The source custodian should be notified of the arrival of the sealed sources to ensure that proper accountability and control are initiated. The sources should be placed into storage or into the device in which they will be used. The source custodian and site's records should be updated to include the new sources received.

Labeling and Storage of Radioactive Materials

Labeling requirements from 10 CFR 835 include:

- items and containers may be excepted from the radioactive material labeling requirements of 10 CFR 835.605, "Labeling Items and Containers," when:
  - used, handled, or stored in areas posted and controlled in accordance with 10 CFR 835 and sufficient information is provided to permit individuals to take precautions to avoid or control exposures; or
  - the quantity of radioactive material is less than one tenth of the values specified in appendix E of 10 CFR 835 and less than 0.1 Ci; or
  - packaged, labeled, and marked in accordance with the regulations of the Department of Transportation or DOE Orders governing radioactive material transportation; or
  - inaccessible, or accessible only to individuals authorized to handle or use them, or to work in the vicinity; or
  - installed in manufacturing, process, or other equipment, such as reactor components, piping, and tanks; or
  - the radioactive material consists solely of nuclear weapons or their components.

- radioactive material labels applied to sealed radioactive sources may be excepted from the color specifications of 10 CFR835.601, "General Requirements."

Sealed radioactive sources not in storage containers or devices and not labeled by the manufacturer must be clearly marked with a radiation symbol and have a durable label/ tag containing the following information:

- Radionuclide
- Amount of activity
- Name of manufacturer
- Date of assay
- Model and serial numbers (where available)

Source Disposal

Obsolete, excess, or leaking accountable sealed radioactive sources should be disposed of according to RCO instructions.

4. Emergency management personnel shall demonstrate a working level knowledge of protective measures.

a. Discuss the types, uses, and limitations of personal protective equipment (PPE).

The following is taken from International Association of Firefighters, T*raining for Radiation Emergencies: First Responder Operations, Instructor Guide*.

Types of Protective Equipment

Structural fire fighting clothing and equipment should not be used for hazardous materials incidents. The only possible exception to this may be incidents that involve gasoline spills. In this case, follow your own department's standard operating procedures.

National Fire Protection Association (NFPA) Standards

The NFPA has issued two standards on protective clothing for firefighters. Each of these standards is described below.

NFPA 1991. NFPA 1991 is the standard on vapor-protective suits for hazardous chemical emergencies. It represents the highest level of protection and covers the use of vapor-protective suits that are generally used only by hazardous materials team members. Vapor-protective suits should not be used for fire fighting or in flammable or explosive situations. Nor should they be used where there are biological, cryogenic, or radioactive hazards.

NFPA 1992. NFPA 1992 defines performance criteria for suits that provide protection from chemical splashes only. Although liquid splash protective suits can be used in the hot zone, they should not be used in situations where vapor or gas hazards are present. In many instances, liquid splash protective suits are also adequate for decontaminating entry personnel in vapor-protective suits.

Structural Fire Fighting Gear

Structural fire fighting gear is designed to protect firefighters from heat and flame. The coats are generally made of three layers.

- The outer layer provides durability, tear resistance, and some thermal protection, and is typically reinforced with Kevlar and Nomex
- The middle layer is usually made of a waterproof material, designed as a moisture barrier
- The inner layer is designed for thermal protection only, and may also be covered with Nomex or Kevlar

There is no layer or component designed to protect against any type of chemical.

Chemical protective clothing, on the other hand, typically provides no thermal protection. Instead, this clothing is resistant to specific chemicals, depending on the material that makes up the suit.

Protective suits may be constructed to keep out gases and vapors (fully encapsulated, vapor-protective) or to prevent exposure to liquids (liquid splash-protective).

Respiratory Equipment

Because inhalation is one of the major routes of exposure to chemicals, respiratory protection is extremely important. Most first responders use self-contained breathing apparatus (SCBA) as the primary means of respiratory protection.

SCBA usually consists of a face piece connected by a hose to a regulator. The regulator is connected to an air source carried by the wearer. SCBAs offer protection against many types and levels of airborne contaminants.

Only positive-pressure SCBAs and supplied air respirators (SARs) should be used in emergency response. SCBAs maintain a positive pressure in the face piece during inhalation and exhalation. Some other types of breathing apparatus such as air purifying respirators do not. Both SCBA and SAR face pieces should be fit-tested before use.

Air purifying respirators are unsuitable for emergency response. While cartridges on the respirator's mask filter contaminants in the environment, there is no supply of air. If the environment is oxygen-deficient, then the air taken in through the mask is oxygen-deficient as well. This could be extremely hazardous in an environment where oxygen is being displaced or consumed, as in combustion. Also, the user must know the type and concentration of material present in order to select the appropriate cartridge for the atmosphere.

Self-Contained Breathing Apparatus

SCBAs are extensively regulated by federal legislation. Federal regulations require that these devices be tested and approved by the Mine Safety and Health Administration (MSHA) and by the National Institute of Occupational Safety and Health (NIOSH).

b. Demonstrate proper donning and doffing of chemical or radiological emergency response PPE.

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

c. Discuss the concepts of sheltering, evacuation, and relocation.

The following is taken from DOE G 151.1-4.

Facility plans and procedures should include criteria for evacuation or sheltering of workers and return of workers to facilities if it is determined that no hazard exists. These criteria, when associated with initial protective actions, should be related to event categorization or the declaration of certain emergency classes based on specific EALs.

The effectiveness of sheltering-in-place versus evacuation for different types of events should be considered in establishing criteria. Facilities should ensure that their communications systems allow rapid communication of protective actions to all affected workers. A method should be employed that ensures emergency managers that affected workers have been warned and are implementing protective actions.

Evacuation is the removal of people from a geographic area that is either being impacted or is expected to be impacted during the early (plume exposure) phase of a hazardous material emergency. (Relocation is the term generally applied to the removal of people from affected areas in later phases of an emergency, due to residual hazardous material on surfaces or elsewhere in the environment).

Evacuation can generally be considered 100 percent effective for reducing hazardous material exposures and resulting health impacts, but only if it can be accomplished before the hazard is actually present in the location being evacuated and only if the people can exit the affected area without encountering the hazard while they are in transit. Accordingly, there are several important aspects to the decision to select evacuation:

- Since evacuation is fully effective only if it can be accomplished before plume arrival, the decision to evacuate usually hinges not on its effectiveness but on the following:
  - Whether it can be accomplished before plume arrival, and

- The health impacts that might occur if the plume arrives during the evacuation when people are completely unprotected. Balancing a potential short-duration unprotected exposure while evacuating against the potential longer-duration exposure that might be incurred in sheltering are the trade-offs. The protection afforded by sheltering goes down with increasing duration of the release.

- Except for emergencies that affect very small areas and distances (i.e., a few hundreds of meters), evacuation nearly always requires some type of transportation resources. Thus, any decision to evacuate should take into account whether the transportation resources:
  - Will be available where needed in the required time,
  - Can accommodate the number of people expected at each location, including persons with special needs, and
  - Can move them out of the affected area in time to avoid exposure to the plume. Because cars, vans and buses provide little or no protection from airborne hazards, evacuation can only be effective if people can be removed to a safe location without exposure to the plume, either at their point of origin or en route.

- Based on the first two considerations, evacuation nearly always requires detailed planning and preparation to be effective. Moving people from an area where they may be harmed to a safe haven without subjecting them to exposure or additional hazards along the way is not a simple matter, particularly when it should be done on a time scale of minutes to a few hours. Ad hoc evacuation conducted without detailed planning and designated transportation resources, routes, destinations, and accountability procedures can entail greater risks to the evacuees.

Evacuation itself carries some monetary and social cost, as well as a degree of additional health risk to the evacuees from traffic accidents or other causes. While generally small, the risk to populations may be much higher when the hazardous material emergency is caused by or happens to be concurrent with a natural disaster (for example, adverse weather conditions that cause reduced visibility, flying debris, slick roads, and downed power lines). The increased risk to evacuees under a variety of possible evacuation conditions should be considered in planning for protective actions. The risk to emergency workers (drivers, area wardens) who will facilitate the evacuation should also be considered.

Evacuation may be the only viable protective action choice if no structures suitable for shelter are available in the affected area or if sheltering will not be effective for other reasons (e.g., a lengthy or recurring release is anticipated). When the planning process indicates that this may be the case for a particular hazard, detailed planning for evacuation is indicated. Assembly areas, modes of transportation, evacuation routes, and reception centers should be identified in facility plans and procedures and should be clearly identifiable to users. Plans should also describe how evacuation instructions will be provided to onsite personnel and describe how evacuation will be implemented.

If private vehicles are to be used in an evacuation, plans and procedures should make the operation as efficient as possible. Planning should include subjects such as: selecting vehicles with the largest passenger capacity, ensuring that all available passenger seats are filled, ensuring that each vehicle being used has sufficient fuel to complete the trip to the reception

area, and organizing vehicles into groups of manageable size (generally not to exceed 20 vehicles in a group). There should be plans to allow sufficient space between groups to allow for other uses of evacuation routes.

Directionally separated facility egress points, assembly areas, evacuation routes and reception areas should be established to provide alternatives to routing evacuees through a plume. Egress routes should be clearly marked within and between facilities, as well as routes leading offsite. Procedures should contain guidelines for determining the optimum choice of egress and destination and concise, oral announcements for use by emergency managers. Reception areas should be equipped to monitor evacuated personnel for contamination.

Evacuation plans should be closely coordinated with offsite transportation and law enforcement officials because those officials will be expected to establish controls over roads surrounding the facility/site. Such officials would also be the primary source of information on current road conditions created by inclement weather, range fires, earthquake damage, or traffic congestion.

Sheltering (or shelter-in-place) protective action strategy reduces exposure to airborne hazardous materials by having people go (or stay) indoors while the plume is passing, thereby taking advantage of the radiation shielding provided by the structure and/or the lower concentration of airborne contaminants inside the structure. However, the effectiveness of sheltering can vary greatly depending on the nature of the hazardous material, weather conditions, type of structure, duration of the release, and the ability of the sheltered people to take additional measures to reduce infiltration of outside air into the structure.

The following provides some typical infiltration rates for modern, energy-efficient houses, older more leaky houses, and industrial-type buildings and office buildings with ventilation intakes secured:

Table 1. Infiltration rates – Air changes/hr

	Low-Wind	High-Wind
Tight house	0.1	0.8
Older house	0.5	4.0
Industrial building	0.3	2.4
Office building	0.7	5.5
Motor vehicle	0.5	15+

Source: DOE G 151.1-4

The low-wind values represent a wind speed of ~1 miles/second (m/s) and the high-wind values~8 m/s. Infiltration will typically approximate a linear function of wind speed. However, for a given release rate (source), the concentration in the plume will be inversely proportional to the wind speed.

The values given in table 2 represent estimated concentrations inside the building expressed as a fraction of the concentration in the outside air. Note that even for relatively tight shelters, the benefit of sheltering (i.e., reduction in the air concentration) is only about 50 percent after an hour or two. For a radiological release expected to last for a couple of hours or more, consider early evacuation of people sheltered in the plume path because the integrated exposure (and committed dose) may be lower for a short duration unprotected transit of the plume than for breathing the reduced, but steadily increasing concentration inside a building for several hours. If a toxic chemical release is expected to last more than a couple of hours and the outside concentration is estimated to be in the acute exposure guideline level (AEGL)-2 (or equivalent) range or below, the same approach should be considered.

However, if the outside plume concentration of a chemical is estimated to approach the level where permanent or lethal affects are expected even from a brief exposure, personnel should remain sheltered. Sheltered personnel should be provided instructions on increasing shelter effectiveness (e.g., turn off ventilation, place wet towels under doors and window sills, fashion ad hoc respiratory protection, etc.) and directed to remain in shelter until outside concentrations fall below harmful levels. For radiological and chemical releases, personnel should leave shelter as soon as it is confirmed that the plume has passed, to avoid continuing exposure from contaminants trapped within the shelter.

Table 2. Air changes per hour

Release Duration (hr)	0.3	0.5	1.	2.
0.25	0.70	0.12	0.22	0.39
0.5	0.14	0.22	0.39	0.63
1.0	0.26	0.39	0.63	0.86
2.0	0.45	0.63	0.86	0.98

Source: DOE G 151.1-4

For a radiation exposure, the parameter of concern is the total integrated exposure (or dose). The information in table 3 shows a large spread between the levels at which we seek to prevent or mitigate further exposure (the protective action criteria [PAC]) and the level at which acute health effects are expected [i.e., Threshold for Early Lethality (TEL)]. For radiation, the ratio of TEL to PAC is at least 100 and probably more like 1000 for inhaled plutonium (Pu). On the other hand, the ratio of the TEL to PAC for most chemicals is on the order of 3 to 10.

Table 3. Concentration vs. dose

Hazard	PAC	TEL	TEL/PAC
Radiation	1 rem	100 rem	100+
Chlorine	3ppm	20ppm	~7
Ammonia	150ppm	750ppm	5
HF (hafnium)	20ppm	50ppm	2.5
NO_2	15ppm	30ppm	2

Source: DOE G151.1-4

These ratios represent estimates of the slopes of dose-response curves or, effectively, the "margin of error" for making decisions related to protecting people both in distance and in time. If a person exceeds the PAC for Pu by a factor of 100, there will be no acute health effect. If the same person exceeds the PAC for chlorine by that same factor of 100 for even a few minutes, they could experience a lethal health effect.

Key considerations for selecting sheltering as a protective action include:

- Compared to evacuation, sheltering, in its most basic form, requires little special planning or preparation. The affected population needs only to be notified that they should stay inside or go into nearby structures suitable for sheltering.
- Even without special preparations, sheltering in "ordinary" structures, such as homes and office buildings, can be very effective in reducing exposures but only for releases of short duration.
- By having people take shelter, emergency management officials can communicate with them more readily and provide instructions on how to increase shelter effectiveness and take other measures to reduce their exposure. Sheltering is generally considered the only practical protective action, when there is not sufficient time to evacuate a population before the plume arrives at their location. Sheltering is the protective action of choice for most toxic chemical release scenarios due to:
    - The possible severe health consequences from even brief exposures to high concentrations of some substances, and
    - The large uncertainties associated with predicting the concentration of an airborne contaminant at any given time and location.

For substances that are hazardous through inhalation, the maximum reduction of dose/exposure from sheltering will normally be achieved if people move out of the structure promptly after passage of the plume. People who remain inside a shelter where the air is contaminated by infiltration from the passing plume will ultimately receive about the same cumulative inhalation dose or exposure as would an unprotected person exposed to the same plume.

Exposure to hazardous contamination deposited by a passing plume should be taken into account when deciding how and when to terminate sheltering. The potential exists for people to receive significant additional dose or exposure after they emerge from shelter following plume passage. The potential is greatest if the deposited contaminants produce high levels of direct (external) radiation or if the material can become resuspended from contaminated surfaces and subsequently inhaled.

During an emergency, people who are directed to shelter-in-place can take several measures to enhance the protection provided by a structure. These include:

- Closing windows and doors
- Securing ventilation systems
- Sealing penetrations with tape or plastic
- Sheltering in interior rooms

The effectiveness and dependability of these measures can be increased significantly by simple planning/preparedness actions. Examples include:

- Selecting the rooms that will provide the most protection

- Identifying and labeling Heating, Ventilation, and Air Conditioning (HVAC) controls
- Positioning necessary materials (plastic sheeting, sealants and tape) in the designated shelter rooms
- Providing written instructions for use by shelter occupants

d. Discuss the role of protective action guides (PAGs), emergency response planning guides (ERPGs), temporary emergency exposure limits (TEELS), protective action criteria (PACS), and emergency response guides (ERGs) in emergency planning and response.

PAGs

According to DOE Order 5400.5, *Radiation Protection of the Public and the Environment*, PAGs are projected numerical dose values established by the EPA, DOE, or states for individuals in the population. These values may trigger protective actions that would reduce or avoid the projected dose.

ERPGs

The following is taken from DOE G 151.1-2.

ERPG values are intended to provide estimates of concentration ranges where one reasonably might anticipate observing adverse effects as described in the definitions for ERPG-1, ERPG-2, and ERPG-3 as a consequence of exposure to the specific substance.

ERPG-1 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined, objectionable odor.

ERPG-2 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action.

ERPG-3 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing life-threatening health effects.

Temporary Emergency Exposure Limits (TEELs)

The following is taken from DOE G 151.1-2.

ERPGs have been issued for approximately 130 chemicals as of 2006, and about 185 interim and final AEGLs have been published. Because there are no approved ERPG or final AEGL values for many hazardous chemicals of particular interest to DOE and its operations, the Chemical Exposures Working Group of the DOE Emergency Management Issues Special Interest Group, Subcommittee on Consequence Assessment and Protective Action (SCAPA), developed and published a method for determining alternative planning values. The system of alternative values, termed TEELs, includes three biological reference values (TEEL-1, -2 and -3) for each substance, each with a definition similar to the corresponding ERPG value.

TEEL values and the development methodology are disseminated for use within DOE via the DOE Chemical Safety web site: http://www.eh.doe.gov/chem_safety//teel.html.

DOE facilities/sites or activities in need of PAC values for other substances should request that SCAPA develop and publish the TEELs. TEEL requests are submitted via the SCAPA website http://www.orau.gov/emi/scapa/index.htm. Future requests for TEELs should be for chemicals that are used in sufficient quantities that could result in an operational emergency.

PACs

According to DOE G 151.1-2, PAC is the general term for the level of hazardous material impact that, if observed or predicted, indicates action is needed to prevent or limit exposure of people to the hazard.

"PAC" is used for radiological and non-radiological consequence criteria in DOE facility emergency planning and response.

ERGs

According to DOE G 151.1-2 the U.S. Department of Transportation (DOT) ERG provides first responders with information on the specific or generic hazards of the materials involved in a transportation incident and recommendations for protecting themselves and the public.

e. Discuss protective actions and their effectiveness with regard to hazards and events.

According to DOE G 151.1A, the most effective protective action to mitigate the impact of the emergency will not be the same for all events. The properties of the hazard, type of scenario, and availability and effectiveness of protective equipment or shelter are all considered during the planning phase. The most effective course of action for each population group or area is selected, spelled out in the immediate response procedures and checklists, and practiced during drills and exercises.

f. Discuss protective action recommendations with regard to general public implementation.

The following is taken from DOE G 151.1-2.

Planned (or "default") initial onsite protective actions and offsite protective action recommendations associated with each EAL should be based on several factors, including:

- The type of hazardous material involved (radioactive, chemical)
- The affected area and population characteristics (onsite, offsite, time needed for warning and evacuation)
- Available options for protective actions (practicality of evacuation, suitability of structures for sheltering, effectiveness of ad hoc measures)
- The nature of the release implied by the EAL (in progress or imminent, short or long duration, ground level or elevated)

Little additional information from the hazards assessment process is needed to specifically support development of planned protective actions. The type of hazardous material that

would be involved in a particular event should be obvious from the facility description, hazard characterization, and event scenarios. The affected area and population characteristics will come from the results of the consequence calculations, specifically, the distance at which the PAC will be exceeded under adverse dispersion conditions. The available options for protective actions will be determined by the planning staff based on their knowledge of the affected area and population and the locations and types of structures available for sheltering.

5. Emergency management personnel shall demonstrate a working level knowledge of agency response to an emergency.

a. Discuss the concept of Emergency Public Information (EPI) and the role of the Joint Information Center (JIC) in disseminating information to the public in an emergency.

EPI

The following is taken from DOE G 151.1-3.

EPI provides accurate, candid, and timely information to workers, news media, and the public during an emergency to establish facts and avoid speculation. EPI efforts are coordinated with DOE and NNSA (if appropriate); tribal, state, and local governments; and Federal emergency response organizations, as appropriate. Workers and the public are informed of emergency plans and planned protective actions before emergencies.

JIC

The following is taken from DOE G 151.1-4.

DOE O 151.1C requires that each facility/site provide accurate, candid, and timely information about emergencies to workers and the public. The hazardous materials program facility/site is expected to "ensure that an adequate public information program is established and maintained, commensurate with site hazards," where an "adequate emergency public information program includes a JIC to provide resources to comply with the integrated, comprehensive emergency management system, commensurate with hazards, during an emergency." This program should "provide support in media services, public inquiry, media inquiry, JIC management and administrative activities, and media monitoring." To accomplish this, a facility should be designated as a JIC and located where controlled access by the media and public is facilitated. A consolidated JIC, with local, state, tribal, and other Federal officials, is encouraged to present a coordinated response to the public.

b. Discuss the use and implementation of Memorandums of Agreement/Understanding with off-site agencies and the effect on emergency planning and response.

The following is taken from DOE G 151.1-4.

An interface should be established with each entity from which support will be needed and appropriate agreements prepared. For multiple-facility sites, the contractor and cognizant field element with site-wide responsibility should provide centralized point of coordination. Arrangements with state and local governments should be documented. All agreements [e.g., Memoranda of Understanding (MOUs), Memoranda of Agreement (MOAs), Mutual Aid

Agreements (MAAs), Agreements in Principle, and State Oversight Agreements] with emergency management/response provisions should be consistent and contain provisions for periodic review to ensure continued applicability. These agreements should be accessible in the facility/site emergency plans.

Generally, an agreement should contain, at a minimum, the following information:

- The specific service and/or resources to be provided
- The agency, organization, or jurisdiction to which it applies
- Onsite individuals authorized to request aid from the offsite agency, organization, or jurisdiction
- Offsite individuals authorized to implement the arrangement, points-of-contact, and information required for implementation, such as names and telephone numbers
- Specific responsibilities, authorities, and command structure
- Any constraints/conditions that might preclude the agency, organization, or jurisdiction from meeting its obligation or support its refusal
- Public information release protocols
- Financial arrangements, including commitments by the facility or site to provide training, equipment, and facilities to the entity providing the service, and indemnification for injury to persons for loss and damage to property
- Specified periodic re-examination of the provisions and a renewal or termination date
- Signature of authorized individuals representing the site organizations and the offsite agency, organization, or jurisdiction

If a facility/site is to provide support to an offsite agency under the "good neighbor" policy or through MAAs, those support interfaces should be documented.

Facility/site plans should describe integrated support from offsite response organizations responding to emergencies.

The organizations may include groups from outside the facility/site emergency planning zone (EPZ) that respond under provisions of the national response plan (NRP), nuclear/radiological incident annex, for nuclear/radiological emergencies; the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), for oil and non-radiological hazardous material emergencies; or the NRP, if the situation is declared an emergency or major disaster by the President.

c. Discuss the role of the protective force (PF) in response to an emergency.

The following is taken from DOE G 473.2-1
The following emergency situations could require the establishment and deployment of a PF.

- Demonstrations or civil disturbance. These situations are normally announced, and consequently, the PF could be augmented by the local law enforcement agency (LLEA) and PF personnel from other sites, as required.
- Natural or man-made disasters. The primary concerns in these situations are environmental, safety, and health issues and the protection of classified information and special nuclear material (SNM). Because these situations offer little or no warning, augmentation would consist of recalling off-duty PF personnel, relying on supervisors, and extending work hours.

- PF work stoppages or strikes. Site security during a work stoppage can be provided by PF supervisors, managers, and qualified administrative personnel, augmented by qualified non-bargaining-unit personnel from other DOE PF contractors and sites.

d. Discuss the medical needs in response to an emergency.

The following is taken from DOE G 151.1-4.

Medical support should be provided for all injured and/or potentially contaminated or infected personnel, including emergency responders. Medical advice should also be provided to emergency management when there is a potential for significant injuries or casualties from an event. Interfaces with offsite medical support organizations are within the responsibilities of the site medical staff.

e. Using a facility exercise scenario, develop a Protective Force deployment plan for the event. Discuss the plan with the Protective Force management.

f. Using a facility exercise scenario and the site medical emergency response plans, develop potential casualties and triage issues for the event. Discuss with the site medical staff.

Elements "e" and "f" of this competency are performance-based KSAs. The Qualifying Official will evaluate their completion.

6. Emergency management personnel shall demonstrate a familiarity level knowledge of the concepts associated with atmospheric transport and diffusion and environmental protection.

a. Discuss wind speed, wind direction, and stability as related to emergency assessment and response.

The following is taken from DOE G 151.1-1, volume IV.

The most important real-time meteorological parameters for emergency response are related to the wind. The mean wind direction and speed provide the basis for determining where and when consequences will occur. The wind speed (dilution) coupled with atmospheric turbulence intensity (dispersion) provides the basis for determining how much hazardous material will arrive at the receptor. Other factors that have an effect on the transport, dispersion, and deposition of material include inversion layer height, precipitation, gravitational settling, temperature, and humidity.

The minimum data necessary to drive intermediate or advanced atmospheric dispersion models are wind speed, wind direction, and an indicator of atmospheric stability. The following describes how each meteorological parameter operates on a source term.

Wind Direction

- Identifies plume trajectory and the downwind receptors.
- Has little or no effect on concentration of effluents (except when terrain effects are included in the modeling).
- Wind is from the direction reported.

Wind Speed

- Establishes plume arrival time at a particular receptor.
- Dilutes source material (i.e., inversely proportional).
- Determines transport times to establish radioactive decay and plume depletion.

Indicator of Atmospheric Stability

- Determines plume concentration at a particular receptor.
- Disperses source material (Gaussian approximation often used).

Methods to acquire and use meteorological and other environmental data in consequence assessments should be commensurate with quantities of hazardous materials present in the facility and the need to accurately characterize the transport and dispersion of materials during a release. The environmental monitoring program required for consequence assessment should be based on an extension of the general environmental protection program required by DOE O 231.1A, *Environment, Safety and Health Reporting,* for each facility.

b. Describe the concepts of concentration and deposition and their relationship to emergency planning and response.

Concentration

The following is taken from DOE G 151.1-2.

To determine whether a chemical consequence exceeds PAC, the highest time-weighted average (TWA) concentration predicted or measured for any 15-minute period (i.e., the maximum or peak 15-minute TWA concentration) should be compared to the PAC. For exposure periods of less than 15 minutes, concentrations for comparison with the guidelines may be calculated over a shorter time period (e.g., the exposure duration). Some consequence assessment dispersion codes will calculate the desired maximum 15-minute average concentration directly, by allowing the analyst to specify the averaging period.

To determine the average concentration manually, the following formula can be used.

$$\text{TWA} = \frac{C_1T_1 + C_2T_2 + \cdots C_nT_n}{T_1 + T \ \cdots + T_n} = \sum \frac{C_nT_n}{\sum T_n}$$

where
C = Concentration
T = Time period of exposure

It is not recommended that individual time intervals less than 1 minute be used in the numerator of the above formula for calculating the TWA. For the peak 15-minute TWA, the 15-minute period of maximum exposure (concentration) is selected and input (as 15 one-minute segments) into the above formula. For exposure periods of less than 15 minutes, the product of C_xT_x may equal zero during the exposure period. These “zero” results may be factored into the 15-minute average or the use of a shorter the acute toxicity of the chemical of interest and the peak concentration observed.

For purposes of applying the DOE Order emergency class definitions, the term PAC should be interpreted to mean the following:

> A 15-minute TWA concentration of the substance in air that equals (in order of preference) the final or interim AEGL-2 (60-minute), the ERPG-2, or TEEL-2 value for that substance; if none of these values is available, an alternative concentration criterion may be selected.

Deposition

The following is taken from the Glossary of Meterology.

Atmospheric deposition is usually divided into two categories, wet deposition and dry deposition, depending on the phase of the material during the deposition process. Thus, in wet deposition, the gas or particle is first incorporated into a droplet and is then transferred to the surface via precipitation. In dry deposition, the gas or particle is transported to ground level, where it is adsorbed onto a surface. The surface can be the ocean, soil, vegetation, buildings, etc. Note that the surface involved in the dry deposition may be wet or dry—the "dry" in dry deposition refers only to the phase of the material being deposited.

c. Define the terms groundwater, surface water, and aquifer and discuss transport and diffusion in these media in the context of emergency planning and response.

Groundwater

10 CFR 260.10, "Definitions," defines groundwater as water below the land surface in a zone of saturation.

Surface Water

DOE/EH-413/9713, *Glossary of Terms Related to CERCLA, EPCRA, PPA, RCRA& TSCA*, defines surface water as bodies of water that are above ground, such as rivers, lakes, and streams.

Aquifer

40 CFR 260.10 defines aquifer as a geologic formation, group of formations, or part of a formation capable of yielding a significant amount of ground water to wells or springs.

Transport

The following is taken from Bio-Medicine, *Active Transport*.

There are two main types of transport: primary and secondary. In primary transport, energy is directly coupled to movement of a desired substance across a membrane, independent of any other species. Secondary transport concerns the diffusion of one species across a membrane to drive the transport of another.

Primary active transport directly uses energy to transport molecules across a membrane. Most of the enzymes that perform this type of transport are transmembrane ATPases. A primary ATPase universal to all cellular life is the sodium-potassium pump which helps maintain the cell potential.

In secondary active transport, there is no direct coupling of ATP; instead, the electrochemical potential difference created by pumping ions out of cells is used. The two main forms of this are counter-transport (antiport) and co-transport (symport).

Diffusion

The following is taken from Bio-Medicine, *Diffusion*.

Diffusion is one kind of transport phenomenon: compare it, for example, to radiation. All diffusion can be modeled quantitatively using the diffusion equation, the solutions of which go by different names depending on the physical situation. Steady state bi-molecular diffusion is governed by Fick's first law. Steady-state thermal diffusion is governed by Fourier's Law. Diffusion of electrons in an electrical field is essentially Ohm's law. In each, a flux (of atoms or energy or electrons) is equal to a physical property (diffusivity or thermal conductivity or electrical conductivity) multiplied by a gradient (concentration gradient or thermal gradient or electric field). The generic diffusion equation is time dependent (i.e. also applies to non-steady-state situations).

In each case, there is only a noticeable diffusion if there is a gradient: for example in thermal diffusion, if the temperature is constant, heat will move as quickly in one direction as in the other, producing no change.

d. Discuss the concepts of ecosystem and habitat in the context of environmental protection as part of emergency planning and response.

Ecosystem

The following is taken from Environmental Management, volume 20 issue 5.

The EPA has embraced a new strategy of environmental protection that is place-driven rather than program-driven. This new approach focuses on the protection of entire ecosystems. To develop an effective strategy of ecosystem protection, however, EPA will need to: (1) determine how to define and delineate ecosystems and (2) categorize threats to individual ecosystems and priority rank ecosystems at risk. Current definitions of ecosystem in use at EPA are inadequate for meaningful use in a management or regulatory context. A landscape-based definition that describes an ecosystem as a volumetric unit delineated by climatic and landscape features is suggested. Following this definition, ecosystems are organized hierarchically, from megaecosystems, which exist on a continental scale (e.g., Great Lakes), to small local ecosystems. Threats to ecosystems can generally be categorized as: (1) ecosystem degradation (occurs mainly through pollution) (2) ecosystem alteration (physical changes such as water diversion), and (3) ecosystem removal (e.g., conversion of wetlands or forest to urban or agricultural lands). Level of threat (i.e., how imminent), and distance from desired future condition are also important in evaluating threats to ecosystems. Category of threat, level of threat, and "distance" from desired future condition can be combined into a three-dimensional ranking system for ecosystems at risk. The purpose of the proposed ranking system is to suggest a preliminary framework for agencies such as EPA to prioritize responses to ecosystems at risk.

Habitat

The following is taken from Franklin Institute, *Ecosystems, Biomes, and Habitats*.

Within each ecosystem, there are habitats which may also vary in size. A habitat is the place where a population lives. A population is a group of living organisms of the same kind living in the same place at the same time. All of the populations interact and form a community. The community of living things interacts with the non-living world around it to form the ecosystem. The habitat must supply the needs of organisms, such as food, water, temperature, oxygen, and minerals. If the population's needs are not met, it will move to a better habitat. Two different populations can not occupy the same niche at the same time, however. So the processes of competition, predation, cooperation, and symbiosis occur.

e. Describe the role of the consequence assessment process, including the use of modeling techniques and computer codes and the integration of monitoring information.

The following is taken from DOE G 151.1-1A.

Consequence assessment focuses on the process of performing timely initial assessments necessary to support critical first decisions and the continuous process of refining those initial assessments as more information and resources become available. The process is discussed in terms of sequential functional areas: identification of input data/information; calculation of consequences; and the interpretation and communication of results. Consequence assessments are integrated with event classification and protective action decision-making, they incorporate facility and field indications and measurements; and, they are coordinated with offsite agencies. The importance of coordination of information is stressed.

Recommendations are provided for a systematic quality assurance approach to ensure that consequence assessment tools conform to established functional, operational, and technical requirements.

f. Demonstrate basic thumb rule-type calculations to estimate the distance from an atmospheric chemical or radiological release that respiratory protection would be required.

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

7. Emergency management personnel shall demonstrate a working level knowledge of command and control during an emergency.

a. Discuss the concept and define the components of the incident command system (ICS) in the context of on-site and off-site emergency response.

The following is taken from the Occupational Safety and Health Administration, *Incident Command System*.

An ICS is a standardized on-scene incident management concept designed specifically to allow responders to adopt an integrated organizational structure equal to the complexity and demands of any single incident or multiple incidents without being hindered by jurisdictional boundaries.

In the early 1970s, ICS was developed to manage rapidly moving wildfires and to address the following problems:

- Too many people reporting to one supervisor
- Different emergency response organizational structures
- Lack of reliable incident information
- Inadequate and incompatible communications
- Lack of structure for coordinated planning among agencies
- Unclear lines of authority
- Terminology differences among agencies
- Unclear or unspecified incident objectives

In 1980, federal officials transitioned ICS into a national program called the National Interagency Incident Management System (NIIMS), which became the basis of a response management system for all federal agencies with wildfire management responsibilities. Since then, many federal agencies have endorsed the use of ICS, and several have mandated its use.

An ICS enables integrated communication and planning by establishing a manageable span of control. An ICS divides an emergency response into five manageable functions essential for emergency response operations: command, operations, planning, logistics, and finance and administration.

b. Describe the relationship of incident command to incident mitigation.

The following is taken from DOE G 151.1-1A.

Mitigation" includes activities designed to reduce or eliminate risks to persons or property or to lessen the actual or potential effects or consequences of an incident.

Mitigation measures may be implemented prior to, during, or after an incident.

Prevention involves the use of information and data to avoid an incident or to intervene to stop an incident from occurring. The primary focus of this activity in incident management involves the use of intelligence data or other types of surveillance activities to anticipate and stop/avoid the incident. The current DOE emergency management framework accommodates this activity, but does not explicitly address the concept. Prevention activities are more closely related to activities undertaken in the security, safety, or health programs, before the event rises to the seriousness of an emergency. On the other hand, DOE activities, representing the standard components of a DOE emergency management program, explicitly incorporate the national response plan (NRP) concept of mitigation.

Examples include:

- The planning analysis associated with a hazards assessment can identify opportunities to reduce the consequences of a potential hazardous material release event using hazard mitigation activities such as inventory reduction or inventory dispersal.
- Readiness assurance activities include incorporating lessons-learned from evaluations and actual emergencies to improve the response and, perhaps, identifying vulnerabilities in hazardous materials safety procedures and systems.

- Response activities include the execution of incident mitigation activities designed to limit the loss of life, personal injury, property damage, and other unfavorable outcomes.
- Recovery includes the evaluation of the incident to identify lessons learned; and develop initiatives to mitigate the effects of future incidents.

c. Describe the relationship of the incident commander to the facility/site emergency response organization.

The individual assigned responsibility for managing and controlling all aspects of the facility/site or activity response works with the responding IC and, as necessary, establishes a unified command under the provisions of the NIMS incident ICS or other ICS system used by the local government).

d. Describe how the transfer of command should occur between facility/site emergency response organizations.

The following is taken from U.S. Department of Agriculture, *Incident Management*.

The initial IC will remain in charge until transfer of command is accomplished.

Command may be transferred when:
- A more qualified person is available to assume command.
- A jurisdiction or agency is legally required to take command.
- The incident complexity changes.
- There is turnover of personnel on long or extended incidents.
- Personnel are called home for any reason.
- Agency administrators direct a change in command.
- Changing command makes good sense.

Transfer of Command

There are six important steps in effectively transferring command of an incident in progress.

The first step in the transfer of command is for the incoming IC, if at all possible, to personally perform an assessment of the incident situation with the current IC.

The second step in the transfer of command is to adequately brief the incoming IC. This briefing must be by the current IC, and take place face-to-face, if possible.

The third step in the transfer of command is the delegation of authority. In some agencies and for some incidents the delegation of authority is required in writing, and may include, but not be limited to:
- Legal and fiscal authority;
- The ability to assign and reassign agency personnel; and
- The ability to develop interagency agreements necessary to manage the incident.

The agency administrator should clearly communicate to the IC his or her views on the following subjects:
- Legal and policy restraints and/or freedoms;

- Limitations on authority;
- Political and social concerns;
- Environmental issues; and
- Cost considerations.

All of these will affect the development of incident strategy and objectives. As time and agency policy dictate, these considerations should be documented and provided to the IC, preferably through a formal, written, delegation of authority.

The fourth step in the transfer of command is for the incoming IC to determine an appropriate time for the official transfer of command.

The fifth step in the transfer of command is to notify staff and assigned personnel of a change in incident command.

Notice of a change should be made to:
- Agency headquarters;
- General staff members;
- Command staff members; and
- All incident personnel.

The sixth and final step in the transfer of command is for the incoming IC to decide whether to give the previous IC another assignment on the incident.

The incoming IC may give the previous IC another assignment on the incident. The advantages of this are:
- Retaining first-hand knowledge at the incident site.
- Allowing the initial IC to observe the progress of the incident and to gain experience.

e. Describe how the transfer of command should occur between shifts at the incident command post and at the emergency operations center(s).

Refer to element d in this competency for information regarding the transfer of command between shifts at the incident command post and at the emergency operations centers.

f. Discuss the training needed for incident commanders and the managers of the emergency response organization.

The following is taken from 29 CFR 1910.120.

ICs who will assume control of the incident scene beyond the first responder awareness level must receive at least 24 hours of training equal to the first responder operations level, and in addition, must have competency in the following areas which the employer must so certify:
- Know and be able to implement the employer's incident command system.
- Know how to implement the employer's emergency response plan.
- Know and understand the hazards and risks associated with employees working in chemical protective clothing.
- Know how to implement the local emergency response plan.

- Know of the state emergency response plan and of the Federal Regional Response Team.
- Know and understand the importance of decontamination procedures.

Trainers who teach any of the above training subjects must have satisfactorily completed a training course for teaching the subjects they are expected to teach, such as the courses offered by the U.S. National Fire Academy, or they shall have the training and/or academic credentials and instructional experience necessary to demonstrate competent instructional skills and a good command of the subject matter of the courses they are to teach.

Those employees who are trained must receive annual refresher training of sufficient content and duration to maintain their competencies, or must demonstrate competency in those areas at least yearly.

A statement must be made of the training or competency, and if a statement of competency is made, the employer shall keep a record of the methodology used to demonstrate competency.

g. Describe the relationship and regulatory authority(ies) of the on-site emergency organization to those of local, state, and tribal emergency response organizations.

The following is taken from DOE G 151.1-3.

The following elements related to offsite interface should be included in the site emergency plan.

Overview

Provide an overview of relationships, both formal and informal, with offsite organizations, including other departmental elements and other Federal government, tribal, state, and local organizations with emergency management or emergency planning responsibilities. MAAs, MOAs, and MOUs should be described in this section of the emergency plan.

Other Federal Agencies

Describe agreements with other Federal agencies, specifying the role of the agency, potential response, regulatory control, and notification chain required. Discuss the relationship of the organization in the activation of the NRP and its role in the NIIMS. Examples of Federal agencies that may be involved in a departmental response are as follows:

- Department of Defense
- Defense Threat Reduction Agency
- Department of Homeland Security
- U.S. Forest Service
- Federal Bureau of Investigation
- Federal Aviation Administration
- U.S. Coast Guard
- U.S. Environmental Protection Agency
- Nuclear Regulatory Commission
- National Oceanic and Atmospheric Administration

Tribal Organizations

Describe the roles of tribal organizations with emergency response or regulatory control responsibilities relevant to departmental facilities and/or sites. Summarize primary and secondary support roles. Describe tribal emergency plans or procedures that affect the departmental facility or program. Specify the nature of any MAAs, MOAs, or MOUs with the local tribal organizations.

State Government

Describe the roles of state organizations with emergency response or regulatory control responsibilities relevant to departmental facilities and/or sites. Summarize primary and secondary support roles. Describe emergency plans or procedures with impact upon the departmental facility or program. Specify the nature of any MAAs, MOAs, or MOUs with the State.

Local Organizations

Describe the roles of local organizations with emergency response or regulatory control duties as they pertain to departmental facilities and/or sites. Summarize primary and secondary support roles. Describe local emergency plans or procedures that affect the departmental facility or program. Specify the nature of any MAAs, MOAs, or MOUs with the local authorities.

Private Organizations

Describe the roles of private organizations with emergency response responsibilities relevant to departmental facilities and/or sites. Summarize primary and secondary support roles. Describe private emergency plans or procedures that affect the departmental facility or program. Specify the nature of any MOAs or MOUs with the local private organizations. Describe any contractual arrangements and annual funding obligations in order to maintain the desired level of emergency preparedness.

MAAs, MOAs, and MOUs

List all MAAs, MOAs, and MOUs with offsite organizations. Include in the list the parties to the agreement, points of contact, the date of the agreement, and the expiration date of the agreement. Identify all organization(s) responsible for negotiating, executing, and maintaining agreements. Specify where documents are on file, and include copies of the unclassified MAAs, MOAs, and MOUs in an appendix to the emergency plan. List all classified MAAs, MOAs, and MOUs, identify unclassified points of contact, and state where the agreement can be viewed.

Offsite Medical Facilities

Discuss capabilities of local medical centers to support mass casualties and contamination events.

h. Explain the roles and responsibilities of the shipper, carrier, and receiving organization for transportation accidents.

The following is taken from the International Atomic Energy Agency, IAEA TS-G-1.2(ST-3).

Shipper

The shipper provides a list of instructions as to what needs to happen in the event of an accident.

Carrier

The primary responsibility for ensuring preparedness for a given shipment of radioactive material in principle should rest with the consignor. The consignor should ensure that, before undertaking the transport of radioactive material, carriers are fully aware of the procedures to be followed in the event of a transport accident.

Although the prime responsibility for safe shipping is with the consignor, the carrier also has responsibilities both for safety during transport and for the proper reaction in the event of an accident. In general, both the carrier and the consignor should be prepared to respond to an accident and provide the appropriate technical assistance to emergency responders.

The consignor should ensure that adequate arrangements are available to deal effectively with transport accidents involving radioactive material. These arrangements could include being prepared to provide information about the shipment, knowing how to deal with such an accident, and providing emergency and/or technical assistance to an accident site when requested or required.

In addition, the consignor should make available to the carrier the appropriate emergency instructions and other information concerning emergency responses.

8. Emergency management personnel shall demonstrate a familiarity level knowledge of decontamination procedures.

a. Describe the equipment and layout required for a decontamination area.

The following is taken from DOE EH/EM, *Hazardous Waste Activities Handbook*.

The location and size of the contamination reduction zone/corridor (CRZ/C) for most DOE hazardous waste activities projects depends on the amount of space available at the worksite, the use of large equipment, the number of stations necessary for the decontamination procedure, and the overall dimensions of the work zones. For some activities, wind direction is an important consideration in selecting the best location and layout for the CRZ/C (i.e., they remain upwind of the contaminated areas of the worksite).

Decontamination for hazardous waste activities is conducted in the contamination reduction corridor (CRC) within a well-defined contamination reduction zone (CRZ) or radiological buffer area. The CRC is analogous to the entryway and decontamination passageway established for a radiologically controlled area, and the design concepts used are the same. Decontamination equipment, processes, and procedures vary, as do contamination reduction zones and corridors, depending on the presence of specific hazards and the size and complexity of the worksite and project. Modifications to the location and configuration of the decontamination area may be required to accommodate changing conditions (e.g., wind) at the worksite.

The number of decontamination stations and the sequence of steps to be followed during decontamination constitute the decontamination line and are clearly defined in the health and safety plan (HASP). The proper selection and donning of PPE is of particular importance in preventing worker contamination during the decontamination process. Procedures for properly donning and doffing protective clothing are implemented before workers enter controlled areas. These procedures are detailed in the HASP, thereby preventing worker contamination and facilitating the safe decontamination of PPE as workers go through the decontamination process. For radiological decontamination, use of two step-off pads may be recommended.

The following aspects should be considered in establishing the configuration of the CRZ/C:

- Outer, more heavily contaminated items should be decontaminated first, followed by decontamination and removal of inner, less contaminated items;
- Each procedure should be performed at a separate station to prevent cross contamination;
- Stations should be physically separate and should be arranged in order of decreasing contamination, preferably in a straight line;
- Separate flow patterns and stations should be provided to isolate workers from different contamination zones containing incompatible wastes;
- Dressing stations for entry to the CRZ should be separate from redressing areas for exit from the CRZ; and
- Workers should always pass through doffing stations for respiratory protective equipment only after their garments are removed to maximize respiratory protection while decontaminating.

b. List the basic methods of decontamination and when they would be applicable.

The following is taken from EH/EM *Hazardous Waste Activities Handbook*.

DOE worksites may contain radiological as well as mixed and traditional chemical or biological wastes or both. To prevent the further generation of mixed wastes, decontamination methods are carefully chosen and implemented. Contaminants can be deposited on the surface of or, in some instances, can permeate PPE and other equipment. Most surface contamination is detected and removed by accepted decontamination practices. If, however, a contaminant has permeated the PPE (e.g., the fabric of coveralls), it may be difficult to detect and remove. When contaminants are allowed to remain in contact with materials (e.g., PPE, tools, instruments) for an extended period, those materials are particularly prone to permeation or degradation or both. The chemical and physical compatibility of decontamination solutions and methods with selected PPE is determined before use.

Decontamination by Physical Means

Some contaminants encountered are removed by physical means (e.g., washing, brushing, scraping, using sticky tape, rinsing, heating) that dislodge or displace the contaminant. Caution should be used, however, when selecting physical methods involving high pressure or heat since these methods can produce aerosols or cause burns. Weather conditions should be considered when choosing physical decontamination methods.

Contaminants that are physically removed fall into four major categories:

- Loose Contaminants. Dusts and aerosols that cling to equipment and workers or become trapped in small openings (e.g., in the weave of fabrics) can be removed with sticky tape, water, or a liquid rinse. Removal of electrostatically attached material is enhanced by coating clothing or equipment with antistatic solutions. Chemicals can be complexed (e.g., metals precipitation) and removed using specially designed vacuums equipped with high-efficiency particulate air (HEPA) filters and other system controls; asbestos fibers can be removed using similar devices. In some cases, elemental mercury can be removed using special mercury vacuums.
- Adhering Contaminants. Removal is often enhanced through methods such as solidification, freezing (e.g., with ice or dry ice), adsorption or absorption (e.g., with powdered lime or kitty litter), or melting with a low-energy heat source (e.g., hair dryer or heat lamp).
- Adsorbed or Permeated Contaminants. In some cases, contaminant removal is not possible and the PPE, tools, instruments, or other equipment has to be discarded as additional hazardous waste. Care in selecting PPE and in applying contamination prevention and control measures, along with timely and appropriate decontamination measures, often prevents this situation.
- Volatile Liquids. Volatile liquid contaminants can be removed from protective clothing or equipment by evaporation followed by a water rinse. Evaporation of volatile liquids can be enhanced by using steam jets. With any evaporation or vaporization process, care must be taken to prevent worker inhalation of vaporized chemicals.

Decontamination Using Solutions, Chemicals, and Other Materials

Physical removal of chemical or radiological contamination or both should always be followed by washing or rinsing. Steam (for equipment) or hot water with detergent is the preferred decontamination method. In some cases, it may be necessary to use a special solution or combination of solutions to decontaminate thoroughly. The site safety and health officer consults with health physicists, chemists, or toxicologists, or all three, for selection of the safest and most effective decontamination solutions for the specific contaminants. Cleaning solutions normally use one or more of the following methods:

- Dissolving contaminants. Chemical removal of surface contaminants can be accomplished by dissolving them in a solvent. The solvent must be chemically compatible with the equipment being cleaned. This is particularly important when decontaminating protective clothing constructed of organic materials that could be damaged or dissolved by organic solvents. Care must be taken in selecting, using, and disposing of any organic solvents that may be flammable or potentially toxic. Organic solvents include alcohol, ethers, ketones, aromatics, straight-chain alkanes, and common petroleum products. Halogenated solvents generally are incompatible with PPE and are toxic. They should only be used for decontamination in extreme cases where other cleaning agents will not remove the contaminant.
- Surfactants. Surfactants augment physical cleaning methods by reducing adhesion forces between contaminants and the surface being cleaned, and by preventing redeposition of the contaminants. Household detergents are among the most common surfactants. Some detergents can be used with organic solvents to improve the dissolving and dispersal of contaminants into the solvent.

- Solidification. Solidifying liquid or gel contaminants can enhance their physical removal. The mechanisms of solidification are (1) moisture removal through the use of adsorbents such as ground clay or powdered lime, (2) chemical reactions via polymerization catalysts and chemical reagents, and (3) freezing using ice water.
- Rinsing. Rinsing removes contaminants through dilution, physical attraction, and solubilization. Multiple rinses with clean solutions remove more contaminants than a single rinse with the same volume of solution. Continuous rinsing with large volumes of clean solutions will remove even more contaminants than multiple rinsing with a lesser total volume.
- Disinfection/Sterilization. Chemical disinfectants are a practical means of inactivating infectious agents. Standard sterilization techniques are generally impractical for large equipment and for PPE. For this reason, disposable PPE is recommended for use with infectious agents.

c. Describe the decontamination process for chemically-or radioactively-contaminated personnel.

The following is taken from DOE EH/EM, *Hazardous Waste Activities Handbook*.

A worker who has inhaled harmful levels of chemical contaminants should be removed from the area and receive emergency medical treatment while he or she awaits treatment by a physician. If the contaminant is on the skin or in the eyes, immediate measures should be taken to remove and counteract its effects. First-aid treatment usually involves flooding the affected area with clean water for at least 15 minutes. For a few chemicals, however, water may cause more serious problems. The HASP should anticipate and contain procedures for dealing with such possibilities.

d. Demonstrate the ability to physically locate decontamination equipment at a facility or site and to contact appropriate personnel to set up a decontamination area.

This is a performance-based KSA. The Qualifying Official will evaluate its completion. The information provided in element a of this competency may be helpful.

9. Emergency management personnel shall have a familiarity level knowledge of emergency rescue and treatment.

a. Discuss the field treatment and transportation requirements for badly injured personnel.

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

b. Discuss the use and implementation of Memorandums of Agreement/Understanding with off-site medical facilities and the effect on emergency planning and response.

Refer to element b of competency statement 5 for information regarding memorandums of agreement.

c. Explain the priorities for treatment of radioactively contaminated, injured personnel.

The following is taken from the Food and Drug Administration, *Guidance for Industry Internal Radioactive Contamination — Development of Decorporation Agents*.

Treatment of External Contamination

Radioactive contamination of the skin is usually not immediately life-threatening to either the patient or medical personnel, especially after the removal of clothing and external decontamination, unless the dose rate is several Gray per hour.

Following the removal of clothing and external decontamination, evaluation and monitoring by a medical professional or health physicist should be performed as soon as possible to provide qualitative and quantitative information about residual external contamination as well as internal contamination. If the external radioactive contaminant persists in spite of initial washing with soap or detergent and water, further decontamination should be supervised by an appropriately trained physician.

Treatment of Internal Radioactive Contamination

The goals of internal decontamination are to reduce absorption and to enhance excretion of radioactive contaminants. Treatment is most effective if it is started as soon as possible after contamination. Radioactive contaminants may be internalized via inhalation, ingestion, or through wounds and skin. Treatment should be directed by knowledge of the specific radiocontaminant. Ideally, internal decontamination should begin during the first few hours if the treating physician suspects that radiocontaminants may have been internalized. After careful retrospective review of clinical data from human exposures resulting from nuclear detonations or nuclear reactor accidents, Prussian blue, potassium iodide, and calcium-diethylenetriaminepentaacetate and zinc-diethylenetriaminepentaacetate, when manufactured under conditions specified in an approved new drug application, were found safe and effective for the treatment of internal contamination with radioactive cesium; iodine; and plutonium, americium, or curium, respectively.

General Principles

Early information on the history of the incident may identify the major radioactive contaminants involved and provide some dosimetry information. Patients will probably present with no clinical symptoms of contamination, but may have sustained burns, lacerations, or other more serious trauma. Immediate treatment for physical injuries should be initiated to stabilize the patient. After the patient is stabilized, critical decisions on initiating treatment for internal radioactive contamination will need to be made based on historical information (to determine the level of contamination and the possible radiocontaminants involved), as well as knowledge of the metabolism of the radiocontaminants, human physiology, and the pharmacology of available treatments. Treatment for internal contamination should begin as soon as possible after contamination and appropriate monitoring for excretion of radiocontaminants (a measure of treatment efficacy) should follow. Radiation dose estimates obtained by appropriate whole-body counting, by bioassay or biodosimetry, or by urinary or fecal sampling, may be used to

determine the treatment course. If feasible and the route of elimination is known, it is helpful to obtain a baseline measurement of radiation excretion.

Physicochemical properties of radiocontaminants will play a significant role in determining treatment. The solubility of the contaminant may determine its absorption and distribution within the body. Because most potential contaminants are at least partially soluble, some small fraction of the contaminant will usually become internalized from the lung or through a wound. On the other hand, normally soluble materials may be present in an insoluble form, or may become insoluble under systemic physiological conditions. Therefore, without initial knowledge of the identity of the contaminant or its solubility, treatment based on an estimate of the most probable radiocontaminants present should begin as soon as possible to significantly increase the probability of successful internal decontamination.

d. Explain the priorities for treatment of chemically-contaminated, injured personnel.

Refer to element c of this competency statement for information regarding chemically contaminated, injured personnel.

e. Demonstrate the ability to physically locate rescue or treatment equipment at a facility or central station.

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

10. Emergency management personnel shall demonstrate a working level knowledge of the integration/interface of the following types of emergency plans:

- **Site emergency plans**
- **Facility emergency plans**
- **Building emergency plans**
- **Security emergency plans**
- **Spill prevention, containment, and countermeasure plans**
- **Fire prevention/suppression plans**
- **Other worker safety plans**
- **Local, state, and tribal emergency plans**

a. Describe the typical content and applicability of each of the listed emergency plans.

Site Emergency Plans

The following is taken from DOE G 151.1-2.

The site emergency plan provides comprehensive and integrated site planning, preparedness, and response for all potential emergency conditions involving the release of hazardous materials on the site. The site plan and implementation procedures, together with the building/facility emergency plans and procedures address each of the planning, preparedness, and response requirements of DOE O 151.1C, chapter IV.

Facility Emergency Plans

The following is taken from DOE G 151.1-1A.

The facility emergency plan should state the overall function and mission of the facility and broadly describe the facility. The facility emergency plan should include a hazards survey. The hazards survey establishes the scope of the operational emergency base program that is required at a facility by identifying potential hazards and associated emergencies, possible impacts, and the applicable emergency planning and preparedness requirements. The hazards survey should also describe known hazards originating outside the departmental facility that could affect the health and safety of onsite personnel or other departmental interests'

Building Emergency Plans

The following is taken from DOE G 151.1-4.

Large multi-story office buildings will have an emergency plan that identifies evacuation routes and provisions for the evacuation of handicapped persons. References and notations can be included in the plan to link it to the categorization authority and procedures.

Security Emergency Plans

The following is taken from New Mexico Department of Homeland Security and Emergency Management *State of New Mexico All-Hazard Emergency Operations Plan* and applies to any state and DOE facility.

Responsible public safety and law enforcement agencies respond to protect life and property and provide incident stabilization under existing authorities. The New Mexico Department of Public Safety/State Police provide direct assistance and leadership through their zone and district structures when actions to cope with the situation exceed local government capabilities. Immediate response to a situation is the responsibility of the IC in whose area the disaster occurs. The IC will direct establishment of a unified command for the period of time Public safety and law enforcement objectives are pre-eminent.

New Mexico State Police (NMSP) will coordinate assessment of public safety and security needs, and respond to requests for resources and assistance. NMSP will coordinate protection of property, including critical infrastructure, and mobilizing resources and other assistance to support incident objective established by the unified command. In conjunction with the EOC operation, NMSP coordinates with assisting and cooperating agencies to ensure that the communication and coordination process is consistent with stated incident management missions and objectives.

The following activities may be undertaken as appropriate:

- Public Safety and Security Assessment—Identifying the need for support and analyzing potential factors that affect resources and actions needed.
- Access Control—Providing and coordinating security forces to support efforts to control access to the incident site and critical facilities.
- Site Security—Providing security forces and establishing protective measures around the incident site, critical infrastructure, and/or critical facilities.

- Traffic and Crowd Control—Providing emergency protective services to address public safety and security requirements.
- Force Protection—Providing for the protection of emergency responders and other workers operating in a high-threat environment.
- Badging and Credentialing—Establishment of consistent processes for issuing identification badges to emergency responders and other personnel needing access to places within a controlled area, and verifying emergency responder credentials.
- Specialized Security Resources—Providing specialized security assets such as traffic barriers; detection devices; protective gear; canine units; tactical teams; etc.

Spill Prevention, Containment, and Countermeasure Plans

The following is taken from 40 CFR 112.7.

The spill prevention plan should describe the physical layout of the facility and include a facility diagram that marks the location and contents of each container. The facility diagram must include completely buried tanks that are otherwise exempted from the requirements of 40 CFR 112.1. The facility diagram must also include all transfer stations and connecting pipes. The plan must also address:

- The contents of each container and its storage capacity;
- Discharge prevention measures, including procedures for routine handling of products;
- Discharge or drainage controls such as secondary containment around containers and other structures, equipment, and procedures for the control of a discharge;
- Countermeasures for discharge discovery, response, and cleanup;
- Methods of disposal of recovered materials in accordance with applicable legal requirements; and
- A contact list and phone numbers for the facility response coordinator, National Response Center, cleanup contractors with whom you have an agreement for response, and all appropriate Federal, state, and local agencies who must be contacted in case of a discharge as described in 40 CFR. 112.1.

Fire Prevention/Suppression Plans

The following is taken from 29 CFR 1910.39.

An employer must have a fire prevention plan when an OSHA standard requires one. The following requirements apply to fire prevention plans.

- Written and oral fire prevention plans. A fire prevention plan must be in writing, be kept in the workplace, and be made available to employees for review. However, an employer with 10or fewer employees may communicate the plan orally to employees.
- Minimum elements of a fire prevention plan. A fire prevention plan must include:
  - A list of all major fire hazards, proper handling and storage procedures for hazardous materials, potential ignition sources and their control, and the type of fire protection equipment necessary to control each major hazard;
  - Procedures to control accumulations of flammable and combustible waste materials;
  - Procedures for regular maintenance of safeguards installed on heat-producing equipment to prevent the accidental ignition of combustible materials;

- The name or job title of employees responsible for maintaining equipment to prevent or control sources of ignition or fires; and
- The name or job title of employees responsible for the control of fuel source hazards.

- Employee information. An employer must inform employees upon initial assignment to a job of the fire hazards to which they are exposed. An employer must also review with each employee those parts of the fire prevention plan necessary for self-protection.

b. Describe the integration/interface of the listed plans.

The following is taken from DOE G 151.1-4.

The listed plans are not intended to represent an all-inclusive list. A needs analysis can be used to identify emergency response organization (ERO) functions to be performed in implementing an effective emergency response based on the results of the hazards survey and EPHA, ultimately developing a list of functions similar to those indicated above. Organizations and personnel who are not part of the normal site operations, but are a part of the ERO, may perform some facility/site ERO functions. It may be more cost effective to rely on offsite providers of specialized services, such as medical support or explosive disposal, than to develop those capabilities onsite. These offsite capabilities should be clearly defined in current MOAs, MOUs, or MAAs.

Several of the listed plans may include several individual tasks. For example, in the case of a high hazard facility, a review and/or analysis of the EPHA and applicable guidance documents will be required to identify all tasks that could be necessary in response to the spectrum of emergencies analyzed. When tasks have been identified and the ongoing or intermittent characteristics of their performance during the response determined, performance-time requirements can be estimated and the process of determining positions and staffing may proceed. Once this is completed, the assignment of specific staff members may be accomplished by aligning the normal operating organization to the ERO. Personnel whose day-to-day duties most closely align with required emergency functions and tasks should be assigned to the equivalent ERO position in order to maximize organizational effectiveness and minimize training and additional qualification requirements.

Once functional areas have been determined and individual tasks within each area are identified, it will be apparent that many functions have direct counterparts in offsite organizations. One task not described in any of the listed plans is related to working level interfaces with offsite organizations. An example is the liaison function necessary between the consequence assessment team and a State's Department of Hygiene for events with offsite consequences.

c. Describe the roles and responsibilities of the on-site and off-site emergency response organizations identified in the listed emergency plans.

The following is taken from DOE G 151.1-4.

The following is a list of positions of specific responsibilities and/or authorities for a generic ERO structure:

- Duty officer is the individual assigned initial decision-making responsibility with the requisite authority to categorize the operational emergency (OE), make initial classification and protective action determination, and activate the ERO. A separate duty officer position is not necessary; for example, the duty officer may be the fire or security officer who becomes the IC in event of emergency.
- The IC maintains operational control of the response at the incident scene and transmits information to the command center or EOC.
- Emergency Director maintains overall command and control of the emergency response.
- Environmental, Safety, and Health manager oversees and monitors the operations of the occupational safety organization, the medical, and consequence assessment (including hazardous materials monitoring, modeling, and meteorological) response teams, and the activities of health physicists and industrials hygienists.
- EOC manager oversees, monitors, and directs the EOC response operations, offsite communications, notification process and administrative operations of the EOC.
- Operations manager ensures communications with incident command; manages overall impact of the event on operations; supplies needed information about facilities and processes, and monitors personnel status and accountability.
- Logistics manager ensures logistical requests are met for response support equipment, supplies, and communications.
- Public affairs manager ensures emergency public information is communicated effectively and accurately.
- Security manager ensures safeguards and security response efforts and needed liaison. The security manager coordinates security operations with offsite security liaisons [Federal Bureau of Investigation (FBI), local law agencies, etc.]

Provisions should exist for interface between other agency response personnel and the facility/site and cognizant field element EROs, with clearly defined positions or points-of-contact. Interfaces that require coordination, liaison exchange, or integration, that will also influence the structure of the ERO during an emergency, may include but are not limited to:

- Tenant and visiting national laboratories (for special projects)
- Potential Department of Defense, Defense Threat Reduction Agency (DTRA), Department of State, EPA, Department of Homeland Security (DHS), and Department of Justice/FBI presence
- Offsite organizations including local law enforcement; fire, medical, American Red Cross, local, state, Tribal, and regional Federal agencies; and joint public information groups
- Radiological emergency response assets, such as the Accident Response Group (ARG), Nuclear Emergency Support Team (NEST), Federal Radiological Monitoring and Assessment Center (FRMAC), Aerial Measuring System (AMS), National

Atmospheric Release Advisory Center (NARAC), Radiation Emergency Assistance Center/Training Site (REAC/TS), and the RAP
- Organizations under the NRP, such as the Joint Field Office or the National Oil and Hazardous Substance Pollution Contingency Plan organizations
- Organizations under National Interagency Fire Center for wild land fires

These interfaces should be preplanned and described in the emergency plan where applicable.

d. Demonstrate the ability to physically locate and use emergency response checklists for a facility.

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

11. Emergency management personnel shall demonstrate a working level knowledge of the relationships of emergency planning, preparedness, readiness assurance, response, and recovery.

a. Discuss the relationships of emergency planning, preparedness, readiness assurance, response, and recovery.

The following is taken from DOE O 151.1C.

Emergency planning must include identification of hazards and threats, hazard mitigation, development and preparation of emergency plans and procedures, and identification of personnel and resources needed for an effective response.

Emergency preparedness must include acquisition and maintenance of resources, training, drills, and exercises.

Readiness assurance must include assessments and documentation to ensure that stated emergency capabilities are sufficient to implement emergency plans.

Emergency response must include the application of resources to mitigate consequences to workers, the public, the environment, and the national security, and the initiation of recovery from an emergency.

Recovery must include planning for and actions taken following termination of the emergency to return the facility/operations to normal.

b. Define recovery and reentry, and describe the typical contents of recovery and reentry plans.

The following descriptions are taken from DOE G 151.1-4.

Reentry

Reentry involves reentering a facility or affected area that has been evacuated or closed to personnel access during the course of the emergency. In order to protect the personnel involved in reentry, the activity should be well planned, coordinated, and accomplished properly and safely. The following discusses the preplanning necessary to ensure that

personnel are prepared for reentry activities that may be encountered at the specific facility/site. This includes the availability of the appropriate support materials and resources to perform the reentry activities.

Reentry Planning

The identification and screening of facility hazards will identify the material hazards that may be encountered during reentry activities. Review of the event scenarios developed during the EPHA analyses will provide the planner with information concerning the type and nature of possible failures; possible mitigative activities; areas likely to be accessed during reentry; degree and nature of facility damage; and, systems, indicators, or controls that may be non-functional. EPHA consequence calculations will provide source term information for each analyzed event scenario that will help the planner determine the range of hazardous environments that may be encountered by personnel during reentry activities.

Using information developed in the EPHA, facility operations personnel should consider the following: special damage control equipment, provisions for spare parts, availability of back-ups for critical equipment, pre-arranged service contracts, and accessibility of critical items (e.g., controls, indicators, systems, tools and equipment) under emergency conditions.

Recovery

The goal of any recovery effort is to restore affected facilities and areas (onsite and offsite) to normal conditions following the termination of emergency response. Recovery activities and the level of effort required will be determined by the nature and magnitude of the emergency event. Emergency plans and procedures will need to address a wide range of possible circumstances and, as a result, will be general in nature.

A formal recovery plan may or may not be needed when terminating an OE not requiring classification, while, for OEs requiring classification, a formal recovery plan is needed. If a determination is made that a recovery plan is needed, the specific objectives of the recovery activity should be established at the time of termination and documented in the recovery plan. If the emergency produced offsite impacts, the recovery organization should include a liaison position for offsite interface with the state and local agencies for development and implementation of the recovery actions.

Preparation for recovery from an OE requiring classification should address the following general areas: recovery organizations, recovery plans, recovery planning and scheduling, accident assessment and investigation, and repair and restoration.

c. Discuss the roles and responsibilities of the Departmental organizational elements in developing recovery and reentry plans.

The following roles and responsibilities are taken from DOE G 151.1-4.

Recovery

Prior to terminating the emergency, the ERO should establish the recovery organization and determine that resources are available to begin recovery operations. The recovery organization is responsible for coordinating all recovery activities. Responsibilities include, but are not limited to:

- Prioritization and scheduling of activities
- Protection of worker and general public health and safety
- Dissemination of information
- Coordination of site and offsite activities
- Collection of data and assessment of long-term effects associated with the release of hazardous materials
- Formulation and implementation of long-term protective actions for the affected areas
- Providing assistance as requested to state and local agencies in the formulation of long-term protective actions for affected offsite areas

If negative effects to facilities and/or the environment are minimal, normal operations and maintenance organizations may be able to perform all necessary recovery actions. At a minimum, a recovery manager should be appointed to coordinate planning and authorize recovery operations. When a dedicated recovery organization is necessary, it should parallel the normal facility or site operating organization, when possible. To the extent possible, recovery activities should be carried out through normal facility and site operations. This arrangement provides the recovery management and staff with established and recognized channels of communication, authority, and control to facilitate the accomplishment of their mission.

The composition of the recovery organization should be based on the extent and nature of the emergency. Functional elements in a recovery organization should include, at a minimum, the following:

- A recovery manager who has the responsibility and authority to coordinate onsite recovery planning; authorize recovery activities; protect the health and safety of workers and the public; and initiate, change, or recommend protective actions. This position should have management authority commensurate with the requirements of the recovery activities.
- An offsite liaison who has the responsibility and authority to coordinate offsite recovery planning; protect the health and safety of workers and the public; recommend protective actions to the local, State and other agencies. This position should have management authority commensurate with the requirements of the recovery activities.

The contractor has primary responsibility for the development of the recovery plan, with concurrence from the field element.

Reentry

Once the decision has been made to perform a reentry activity, personnel responsible for managing the on-scene response should develop a plan. They should have direct access to the most current information, be familiar with the facility or event area, and have knowledge of the personnel and resource requirements of the task.

One position at the facility or incident scene level should be vested with the responsibility to coordinate the reentry planning process. Responsibilities of this position might include identification of personnel and equipment needs, determination of personnel protection requirements, assignment of personnel to reentry teams, job planning, team briefing/training, monitoring progress of activities, de-briefing teams, and collecting data upon completion.

During both planning and preparation, this position may require the support of several other disciplines such as: health physics, industrial hygiene, industrial safety, facility operations, engineering, medical, security, and others.

The following items should be considered when planning reentry activities and preparing reentry teams:

- Reentry planning should make use of all available information regarding interior configurations, locations of hazards, etc. Pre-fire plans are particularly well suited for use in such planning.
- Reentry planning should include security considerations. The planning effort should consider the possibility that an insider or outsider threat initiated the event and that additional security related hazards are yet unrecognized. Reentry teams should understand the importance of safeguarding national defense materials and information.
- Reentry preparation should include contingency planning to ensure the safety of reentry personnel, such as planning for the rescue of reentry teams.
- Provide guidance on selection of reentry team members. Teams should consist of the minimum number required to perform the job but should not be less than two persons, one of whom has first aid training. Team members should be chosen based upon: job qualifications; training; proficiency in the use of protective equipment; exposure history (radiological); and sensitivity to toxic materials. For very high-risk tasks, volunteers should be used. Criteria should be developed to determine what constitutes a "high-risk" task and how to select the most appropriate volunteer for a given task. Criteria for selection of volunteers may differ for radiological versus toxic material events. If feasible, volunteers should be evaluated with respect to age, health, and previous exposure history (for radiation exposure). Each volunteer should be advised of the known or anticipated hazards prior to participation.
- Under some circumstances, the control of contamination may be a concern. Reentry planning should address methods for reducing the spread of contamination and ensuring that reentry activities do not inadvertently increase the actual or potential release of hazardous material.

12. Emergency management personnel shall demonstrate an expert level knowledge of DOE O 151.1B, Comprehensive Emergency Management System, and the DOE 151.1 Guides.

[Note: DOE O 151.1B has been replaced by DOE O 151.1C. The following information is taken from DOE O 151.1C]

a. Describe the purpose of the Order.

The objectives of DOE O 151.1C are:

- To establish policy and to assign and describe roles and responsibilities for the DOE emergency management system. The emergency management system provides the framework for development, coordination, control, and direction of all emergency planning, preparedness, readiness assurance, response, and recovery actions. The emergency management system applies to DOE and to the NNSA.

- To establish requirements for comprehensive planning, preparedness, response, and recovery activities of emergency management programs or for organizations requiring DOE/NNSA assistance.
- To describe an approach to effectively integrate planning, preparedness, response, and recovery activities for a comprehensive, all-emergency management concept.
- To integrate public information and emergency planning to provide accurate, candid, and timely information to site workers and the public during all emergencies.
- To promote more efficient use of resources through greater flexibility (i.e., the graded approach) in addressing emergency management needs consistent with the changing missions of the department and its facilities.
- To ensure that the DOE emergency management system is ready to respond promptly, efficiently, and effectively to any emergency involving DOE/NNSA facilities, activities, or operations, or requiring DOE/NNSA assistance.
- To integrate applicable policies and requirements, including those promulgated by other Federal agencies and interagency emergency plans into the department's emergency management system. In compliance with the statutory requirements in 42 USC 7274k. "*Baseline Environmental Management Reports*," DOE hereby finds that DOE O 151.1C is necessary for the fulfillment of current legal requirements and conduct of critical administrative functions.
- To eliminate duplication of emergency management effort within the department.

b. Discuss the general roles and responsibilities of the Departmental elements for management of the Department's Emergency Management System.

The following is taken from DOE O 151.1C.

The manager of a government-owned, government-operated site/facility must:

- Develop, implement, maintain, and update, as necessary, an emergency management program, commensurate with the facility-specific hazards and consistent with Departmental directives and standards of performance.
- Prepare and maintain emergency plans, procedures, and technical resource capabilities that address emergency classification, notification, reporting, response actions, training and drills, exercises, emergency public information, outreach and coordination, accident investigation, and applicable Federal statutes, state and local laws, DOE Orders, and implementing regulations and guidance.
- Prepare and submit the following to the cognizant field element manager for approval: hazards surveys and EPHAs, documentation to establish emergency planning zones, emergency plans, and emergency readiness assurance plans (ERAPs).
- Direct and/or support appropriate emergency response actions within the area under their control and at the scene of the emergency.
- Participate in the development of mutual assistance agreements with state, tribal, and local authorities.
- Ensure the effectiveness of a continuing emergency preparedness program.
- Establish and maintain an internal assessment program to ensure the readiness of emergency response capabilities, including developing and conducting a self assessment program, as well as establishing systems and measures to monitor and evaluate line performance.

c. Define "operational emergencies" and the circumstances to which they apply.

The following is taken from DOE G 151.1-4.

Operational emergencies are major unplanned or non-routine 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 local event scene.

d. Discuss the Department's approach to managing operational emergencies.

The following is taken from DOE O 151.1C.

Each DOE/NNSA site/facility must have an operational emergency base program that provides the framework for response to serious events involving health and safety, the environment, safeguards, and security. These events are not unique to DOE/NNSA operations. Any event involving the release of oil is within the scope of the operational emergency base program.

The operational emergency base program must provide for compliance with the following regulations and plans developed by other federal agencies and DOE/NNSA offices, and with those state and local planning and preparedness requirements that apply.

- Occupational Safety and Health Administration requirements for employee evacuation plans and notification systems
- Federal property management regulations for occupant emergency programs and accident and fire prevention
- Federal Emergency Management Agency (FEMA) requirements for emergency operations plans for state and local governments that address similar hazards
- Federal Energy Regulatory Commission requirements for emergency plans to protect the health and safety of members of the public upstream and downstream from water projects (dams)
- EPA requirements implementing the Clean Water Act through the National Pollution Discharge Elimination System
- EPA requirements implementing the provisions of the Safe Drinking Water Act
- EPA requirements implementing the Comprehensive Environmental Response, Compensation, and Liability Act, including Title III, the Emergency Planning and Community Right-to-Know Act
- DOT requirements for emergency response information and hazardous materials training
- DOE O 420.1B, *Facility Safety*, which addresses requirements for fire protection programs
- DOE O 440.1B, *Worker Protection for DOE (Including National Nuclear Security Administration) Federal Employees*, which addresses requirements for planning for treatment of the injured during emergency or disaster situations
- DOE O 470.4A, *Safeguards and Security Program*, which addresses requirements for appropriate protection levels for DOE interests and documentation in facility-specific Site Safeguards and Security Plans

- The Health Insurance Portability and Accountability Act of 1996, which restricts access to individuals' medical information

e. Review and comment on appropriate plans and procedures for timely and accurate determination of emergency classification, notification, and reporting of emergency events.

The following is taken from DOE G 151.1-4.

Emergency Classification

Categorization of events or conditions as OEs is intended to: ensure the rapid dissemination of event facts outward and upward; activate response activities beyond the local event scene; and meet the time-sensitive information needs of strategic decision-making in areas of national security. DOE O 151.1C requires that an OE event or condition must be categorized as promptly as possible, but no later than 15 minutes after event recognition/identification/discovery.

In addition to ensuring rapid communications, the process of classifying selected OEs that involve hazardous materials was created to initiate preplanned local response and to protect the local site and offsite populations. For OEs that do not require classification, local emergency response activities may be unaffected by the categorization process with the exception of more timely recognition and notifications. Classified emergencies (i.e., Alert, Site Area Emergency, and General Emergency) are a subset of the OE category. Therefore, when an event is classified, it is (by definition) also categorized as an OE at the same time. As a result, an OE event or condition requiring classification needs to be categorized and classified, as promptly as possible, but no later than 15 minutes after event recognition/identification/discovery.

Notification

Prompt and accurate notifications are essential during OEs to mitigate consequences, activate emergency response organizations and facilities, recall essential personnel, and notify offsite agencies responsible for protecting the health and safety of the public. An emergency notification system should provide timely notice to site and facility personnel, DOE or NNSA field operations centers, and Federal, state, tribal and local emergency response organizations and authorities for all emergencies under the most limiting set of adverse conditions. The term "timely" means fast enough for response activities to be effective in protecting worker and public health and safety. Additionally, provisions should be in place to continue effective communication throughout an emergency. All aspects of notification should be carefully preplanned, documented, tested under a variety of adverse conditions, and implemented through approved notification procedures, reliable primary and backup communications equipment, and formal training programs.

Notifications associated with OEs are designed to perform the following:

- Protect facility and site personnel and emergency workers through dissemination of information necessary to implement accountability and protective actions (PAs) such as sheltering, evacuation, and decontamination.

- Notify cognizant offsite authorities and agencies, including applicable Federal, tribal, state, and local organizations, which have PA decision-making authority for the emergency to facilitate public notification.
- Activate elements of the ERO, consistent with the categorization and classification of the emergency.
- Provide initial notifications, emergency status updates, and effective communication among EROs throughout the emergency.
- Formally document categorizations and classifications, notification times, PAs, protective action recommendations (PARs), and emergency condition changes.
- Comply with regulatory notification requirements.
- A timely, reliable, and accurate communications system is essential for emergency notifications, and provides the framework for conducting emergency response operations. Establishing adequate communications to support on-scene activities is a time-urgent operation. Equally important to effective management of the emergency response is timely establishment of communications to offsite support organizations, including verification that initial notifications were received. Elements of this communications system include the communications equipment, a notification system, and a simple and effective information management structure.
- Development and implementation of notification and communication capabilities should be "commensurate with hazards" and depend on the results of the hazards survey and EPHAs.

Reporting

Emergency reporting includes initial notifications to onsite personnel and offsite authorities and emergency status updates. The accurate, timely, and useful exchange of information during an emergency response is emphasized.

f. Discuss the concept of "commensurate with hazard."

The following is taken from DOE G 151.1-2.

Since 1991, DOE emergency management orders have incorporated the concept of tailoring requirements to specific hazards through the "commensurate with hazards" approach. The approach begins with a complete understanding of the emergency situations that could impact DOE facilities/sites or activities, followed by analyses of the resultant hazards to workers, the public, and the environment. Based on completed EPHAs, the requirements in DOE O 151.1C are tailored to develop an emergency management program that addresses the unique hazards and operating environment of each facility or activity and consists of the following program elements: program administration, training and drills, exercises, readiness assurance, emergency response organization, offsite response interfaces, emergency facilities and equipment, emergency categorization and classification, notifications and communications, consequence assessment, protective actions and reentry, emergency medical support, emergency public information, and termination and recovery.

g. Discuss the purpose and function of each of the following required program elements:
- **Hazards surveys**
- **Emergency planning hazards assessments**

- **Existing plans**
- **Emergency response organization**
- **Offsite response interfaces**
- **Emergency Categorization**
- **Communications**
- **Consequence assessment**
- **Protective actions**
- **Medical support**
- **Public information**
- **Emergency facilities and equipment**
- **Program administration**
- **Training and drills**
- **Exercises**
- **Response**
- **Termination and recovery**
- **Evaluations and Readiness Assurance**

Hazards Surveys

The following is taken from DOE G 151.1-2.

The hazards survey, which is based on an examination of the features and characteristics of the facility, identifies the generic types of emergency events and conditions and the potential impacts of such emergencies to be addressed by the DOE comprehensive emergency management system. The hazards survey also identifies key components of the operational emergency base program that provide a foundation of basic emergency management requirements and an integrated framework for response to serious emergency events or conditions. Much of the information to be used in the hazards survey, and included in its documentation, should have already been collected in the course of meeting other DOE, NNSA, and Federal, state, tribal, and local authority requirements. For facilities involved in producing, processing, handling, storing, or transporting hazardous materials that have the potential to pose a serious threat to workers, the public, or the environment, the hazards survey provides a hazardous material screening process for determining whether further analysis of the hazardous materials in an EPHA is required.

Emergency Planning Hazards Assessments

The following is taken from DOE G 151.1-2.

EPHAs involve the application of rigorous hazards analysis techniques that provide sufficient detail to assess a broad spectrum of postulated events or conditions involving the potential release of hazardous materials and to analyze the resulting consequences. The screening process and the analysis of identified hazardous materials in a facility/site or activity determine the potential for producing an OE classified as an alert, site area emergency, or general emergency. If a potential classifiable OE associated with a facility/site or onsite activity is identified, an operational emergency hazardous material program needs to be developed and maintained that establishes additional, more detailed emergency management program requirements than those imposed by the Operational Emergency Base Program.

The EPHA performs three roles in a DOE emergency management program. First, by summarizing the processes and systems associated with the hazardous materials, together

with the nature and magnitude of the hazards, the EPHA provides the technical planning basis for determining the necessary plans/procedures, personnel, resources, equipment, and analyses that comprise the Operational Emergency Hazardous Material Program. Second, the documented EPHA provides an archival record of the data, assumptions, and methods used in developing the technical planning basis for the program; it also reflects the reasoning used to modify the program in response to changes in operations and hazards. The documented EPHA should enable an emergency management program to survive the inevitable turnover of hazards assessment personnel without the loss of continuity that can result from uncertainty about past analyses and decisions. Third, the EPHA performs a key readiness assurance role by providing clear and convincing evidence that facility-specific hazards are well understood by the responsible emergency management planners, and that, if used correctly, the EPHA represents a valid technical foundation for developing an emergency management program that is "commensurate with hazards."

Of particular importance in performing hazards assessments, especially for sites with multiple facilities, is consistency in the selection and application of analysis techniques, hazardous material release scenarios, and the assumptions and input data used in consequence calculations. A recommended approach for ensuring consistency is to standardize and document ground rules and criteria prior to performing the hazards assessment analyses. The selection and subsequent documentation of EPHA release criteria and analysis techniques, beforehand, ensures both consistency between EPHAs for common scenarios and analyses and consensus among diverse site functions.

Existing Plans

The following is taken from DOE G 151.1-1A.

Existing plans, such as catastrophic earthquake plans or mass casualty plans detailing compliance with Federal, state, and local standards, may be incorporated directly into the base program or invoked by reference. A sample format and associated content for the base program facility emergency plan is contained in DOE G 151.1-1A, appendix A. Further guidance on the implementation of chapter XI of DOE O 151.1C can be found in DOE G 151.1-3, chapter 1, "Program Administration."

Emergency Response Organization

The following is taken from DOE G 151.1-4.

The organizational structure of the ERO should be based on the results of the facility/site or activity hazards surveys and EPHA, the relationships between the site and facility response capabilities, and the relationships between the onsite and offsite emergency response organizations.

Characteristics of the spectrum of scenarios that constitute the technical planning basis for a facility determine the functions that will be required to respond to emergency events. Specific functions activated in a response will depend on the requirements of the particular emergency. The distribution of the emergency functions among facility- and site-levels will be determined primarily by the locations of response facilities and organizations that provide response assets. For a specific site or facility, some emergency response functions can best be organized and performed at the facility-level while others may be better served by a site-

wide organization. Facility-level functions may include control of process operations and implementation of local protective actions (e.g., building evacuations or sheltering, ventilation manipulation). Functions that are more likely to be common for a site include firefighting, medical response, and environmental monitoring. In contrast, some response functions, such as firefighting or HAZMAT response, may be performed utilizing offsite support services.

The terms "Emergency Response Organization" and "Emergency Management Team" are not synonymous. All personnel who may be needed to perform duties, beyond those specified by 29 CFR 1910.120 for the first responder awareness level, during a response to any of a broad range of emergencies defined in the hazards survey or EPHA are members of the ERO. In general, the ERO component formed to manage the response actions during emergencies is the emergency management team (EMT). At each response tier, the EMT provides for overall management, direction, and control of the emergency response and normally operates from a command center or EOC.

Offsite Response Interfaces

The following is taken from DOE G 151.1-4.

EPI plans and preparedness activities should provide for cooperative interface and coordination of public education and information activities with Federal, tribal, state, and local response organizations. During an emergency, there should be continual interface with Federal, tribal, state, and local representatives, local executives, and the Governor's office to ensure accuracy of information. These interfaces should be arranged and documented in formal plans, MOAs or MOUs, and/or other arrangements.

Tribal, state, and local governments should be encouraged to prepare their own public information response plans in conjunction with the facility/site EPI planning effort. However, all participants should subscribe to procedures for JIC operation. All official elements should be equal partners in operation of the JIC and in securing information disseminated by the JIC. However, a single individual should be in charge of JIC operation at all times. This should be arranged, discussed, and agreed to in advance by all parties.

Local government participation in a JIC is important if an emergency involves local government response. If the local government's public information officer is unable to relocate to the JIC, they should still be part of the information sharing process using available technology.

Local, state, and tribal governments should be encouraged to participate in EPI training and drills/exercises conducted by the site.

Emergency Categorization

The following is taken from DOE G 151.1-4.

Effective emergency response depends upon early recognition of emergency events and conditions, coupled with rapid implementation of emergency actions. Categorizing events as OEs was created to ensure this rapid recognition and timely response. Response to OEs requires notification of offsite authorities and may require the commitment of significant

resources. Categorization of events or conditions as OEs is intended to: ensure the rapid dissemination of event facts outward and upward; activate response activities beyond the local event scene; and meet the time-sensitive information needs of strategic decision-making in areas of national security. The DOE O 151.1C requires that an OE event or condition must be categorized as promptly as possible, but no later than 15 minutes after event recognition/identification/discovery.

In addition to ensuring rapid communications, the process of classifying selected OEs that involve hazardous materials was created to initiate preplanned local response and to protect the local site and offsite populations. For OEs that do not require classification, local emergency response activities may be unaffected by the categorization process with the exception of more timely recognition and notifications. Classified emergencies (i.e., alert, site area emergency, and general emergency) are a subset of the OE category. Therefore, when an event is classified, it is (by definition) also categorized as an OE at the same time. As a result, an OE event or condition requiring classification needs to be categorized and classified, as promptly as possible, but no later than 15 minutes after event recognition/identification/discovery.

The emergency categorization/classification system includes a set of pre-approved decisions, agreed to by senior management and tribal, state, and local officials that allow onsite supervisory personnel to make rapid decisions affecting personnel, facilities, and resources in response to an emergency. Authority to initiate emergency communications and commit resources often rests with upper management. During the onset of an emergency, adherence to the normal management approval processes may delay the initiation of response actions and mobilization of resources. For the system to be effective, responsibility and authority for initial event categorization and classification should be vested in on-duty supervisory personnel who are close to the problem and who are familiar with the facility.

Every DOE/NNSA facility/site and activity is required to produce a hazards survey to identify the types of emergency events and conditions to be addressed by the DOE comprehensive emergency management system. This survey can be used to define events and conditions that should be categorized as OEs. Facilities/sites and activities are required to identify these OEs and develop criteria for categorizing them quickly, as specified in DOE O 151.1C. OEs involving the release of hazardous materials on or from DOE sites or facilities are classified according to their severity for the purpose of rapidly implementing planned response activities and notifications that are commensurate with the degree of hazard presented by the event.

Communications

The following is taken from DOE G 151.1-4.

The facility/site should have the ability to notify all affected onsite individuals of an emergency condition in a timely manner and to provide directions to them. This notification/communication capability is usually made by a public address system and/or through alarm sirens, horn blasts, etc. Notifications to emergency responders are usually made over a radio/telephone, hard line/battery-type redundant system to reasonably ensure that communication is maintained regardless of the nature of the emergency and its impacts on facility/site systems. This same system can also serve to notify other appropriate Federal,

tribal, state, and local organizations, as well as additional offsite departmental entities. Many departmental facilities and sites have designated radio frequencies and dedicated telephone lines to be used only for emergency notification and communication purposes. Provisions are also established to ensure operational compatibility between facility response capabilities and DOE or NNSA assets.

If the resources of offsite response organizations are to be integrated into the overall facility/site response, their communications capabilities need to be compatible and procedures/terminology consistent with onsite communications. MOUs with appropriate agencies should provide communication protocols and a workable integration process. Individual facilities or the site may need to provide mobile, compatible links to these organizations or establish other means of communications, such as exchanging liaisons.

Consequence Assessment

Consequence assessment is the analysis, evaluation, and interpretation of available information associated with an actual or potential release of hazardous materials to the environment for estimating potential exposures or doses to the workers and to the public.

These estimates are then compared to applicable human health indicators, PACs, and used as the basis for emergency management decision-making for DOE/NNSA and involved tribal, state, and local organizations. Consequence assessment results support decision-making in the following areas: event classification, protective action determinations, notifications to and communications with DOE/NNSA field elements and Headquarters, tribal, state, and local organizations, and emergency public information.

The primary objective of the consequence assessment process is to provide timely and useful information to assist emergency response decision-makers in making informed decisions to protect people from the potential consequences of a release of hazardous materials.

Protective Actions

The following is taken from DOE G 151.1-4.

Depending on type and duration of emergencies that could occur at or impact a facility/site, effective sheltering or transporting of onsite personnel for evacuation purposes may be desirable or even necessary. Pre-designation of the locations for these potential shelters and rally points for evacuation is critical in order to support onsite direction and coordination actions (e.g. temporary billeting, transportation) and for obtaining accurate accountability of all potentially affected personnel. Understanding the peak, onsite number of personnel which could potentially be affected by the emergency will help determine the size/type of sheltering facility, numbers/types of vehicles needed to support their evacuation, and the optimum personnel accountability system to be used. Selected shelters should include a communications capability to and from the command center.

Medical Support

The following is taken from DOE G 151.1-4.

Emergency medical response is an essential element in the development and implementation of a site emergency management program.

It is essential that cooperation and coordination characterize the interactions between medical professionals responsible for medical emergency response and the emergency planners responsible for the overall facility/site emergency management program. Each group possesses information and skills essential for the success of an emergency response. Hence, emergency plans should be developed in concert to ensure an effective and integrated approach.

DOE/NNSA sites do not normally maintain the full range of medical capabilities usually available in the surrounding community. Therefore, injured employees will typically be transferred to offsite facilities when medical conditions necessitate. The availability of medical capabilities and resources within the surrounding community should be closely examined. The surrounding community may provide capabilities and resources that reinforce onsite capabilities. Where advantageous and effective, agreements should be developed to use offsite capabilities rather than duplicate the same capability at the DOE or NNSA facility/site. Whatever situation exists at a particular site, a close working relationship among response partners, onsite and offsite, is essential to ensure that medical support is provided seamlessly and effectively during an emergency.

Medical professionals and emergency planners should develop an emergency medical program that is commensurate with the hazards on the site to protect the health and safety of DOE workers and the public. The program should be based on the medical capabilities of the site and/or surrounding community, specialized medical capabilities available outside the local area, site-specific characteristics, and the site-specific results of the hazards surveys and EPHAs for facilities and activities on the site.

Public Information

The ability to provide the public, media and DOE/NNSA employees with accurate, candid, and timely information is based on an effective EPI program. The EPI program provides the means for a facility/site or activity to coordinate the timely exchange of information among representatives from DOE/NNSA and other organizations. To be effective, EPI should be coordinated with onsite and offsite Federal, tribal, state, and local emergency response organizations. Timely information flow will help keep workers and the public informed, dispel rumors, and provide essential health and safety information. Coordination is critical for preventing the dissemination of confusing, conflicting, and erroneous information.

An effective EPI program ensures that information, distributed to workers, site personnel, and the public during an OE, is:

- Accurate, candid, understandable, and consistent
- Current and timely
- Provided to ensure the health and safety of workers and the public
- Provided to establish facts, and avoid rumors and speculation
- Responsive to public concern and information needs
- Consistent with the requirements of the Freedom of Information Act and the Privacy

The credibility of DOE/NNSA during an emergency is enhanced through an effective EPI program. The program should be based on day-to-day public information relationships that are expanded for an emergency response. This capability to expand during an emergency is developed in cooperation with onsite and offsite organizations through detailed planning and

coordination of plans, procedures, education, and training. EPI functions and the number of EPI staff required to respond effectively to an OE will vary with the nature, severity, duration, and public and media perception of the emergency.

Each DOE/NNSA facility/site and activity needs to prepare an EPI plan that is coordinated with the emergency plan and procedures. This coordination is necessary to ensure that emergency management and EPI interactions involving assignment of resources, operations at command centers/EOCs, callout of EROs, release of emergency information, and other activities are handled effectively and without confusion. EPI staff should be proactive in obtaining emergency information from the facility command center/EOC and monitoring public perception and media reports. This is particularly important to detect, control, and correct rumors and misinformation. Accurate information disclaiming rumors and correcting misinformation should be incorporated in media briefings and press releases.

The information released to the public and media should be subject to close coordination among DOE and NNSA, local, state, and tribal governments, and Federal response organizations. The DOE/NNSA cognizant field element official responsible for emergency public information review and dissemination should be the final and only approval authority necessary for news releases or public statements. The DOE/NNSA Headquarters EMT is kept informed of all EPI actions, as soon as practicable, and is provided with copies of all releases or statements.

All updates of news releases or public statements should be coordinated with the DOE/NNSA HQ public affairs director and HQ emergency manager to avoid disseminating contradictory information regarding the emergency.

In situations involving classified or unclassified controlled information, the appropriate authorized official needs to review news releases and public statements to ensure that no information is included that presents a security risk.

Any emergency response and protective actions required for the health and safety of workers and the public should be adequately explained with unclassified information. Finally, advance education of the public concerning the emergency plans, notification methods, and potential protective actions in the event of an OE is critical for public protection and effective management.

Emergency Facilities and Equipment

The following is taken from DOE G 151.1-4.

The nature of the hazardous material releases analyzed in the EPHA should dictate many of the specifications for facilities and equipment. Overall diversity, complexity, and magnitude of the hazardous material situation at the facility/site will help define general response needs, such as communications equipment and command center capability, while the specific hazards will indicate the need for specialized equipment, such as protective clothing, portable monitoring instruments, decontamination supplies, consequence assessment models, response vehicles and supplies, and facility data acquisition systems.

For all DOE/NNSA facilities/sites, DOE O 151.1C requires that emergency facilities and equipment, including supplies, be available and maintained for use in an emergency response. These requirements mandate the ability of a facility/site to properly notify (both onsite and offsite), implement protective actions, and perform accountability for affected onsite personnel in the event of an emergency.

Specific equipment that may be needed during a response to an OE includes: current reference materials; decisional aids; area and process monitors; public address system; PPE; portable monitoring instruments and personnel monitoring devices; siren and alarm systems; decontamination equipment; and communication equipment. The actual functions and operating characteristics of the specific equipment should function as intended to provide adequate support during a response.

Additional DOE O 151.1C requirements for hazardous materials programs include: an onsite facility to serve as a command center; a facility to serve as an alternate command center in the event the primary is not available; and, the availability of adequate emergency equipment and supplies to meet the needs determined by the results of the EPHA. Depending upon these results, additional emergency facilities and capabilities may be necessary, such as technical support, security, personnel assembly/control, decontamination, medical services, process control, and chemical/biological/radiological analytic laboratories.

Emergency equipment and response facilities located throughout each site may be under different administrative or programmatic organizations but should be integrated to provide an overall, site-wide response capability.

Program Administration

The following is taken from DOE G 151.1-3.

Management and operating (M&O) contractor managers/administrators at each DOE/NNSA facility and site retain overall authority and responsibility for emergency management at their respective levels. However, responsibility for and authority over the development and day-to-day operation and maintenance of the program should be delegated to a specifically designated emergency management program administrator, with responsibility and authority to ensure:

- Development and maintenance of the hazards surveys and EPHAs, emergency plans and procedures, and related and supporting documentation
- Development and conduct of training and exercise programs, and development, conduct, and coordination of the readiness assurance program and activities
- Coordination of emergency resources by identifying resource needs and ensuring the availability of adequate resources
- Development and submittal of the annual ERAP
- Interface with state and local emergency response elements, other Federal agencies, and private institutions providing emergency medical and other emergency support to the site

The designated administrator has authority and resources in accordance with assigned responsibilities and has access to top-level management. The administrator is responsible for

implementing a facility/site- or activity-specific comprehensive emergency management program based on a graded approach that is commensurate with hazards.

The administration of programmatic activities is established and maintained through rigorous adherence to a formal process. Review and approval processes are established and documented to ensure that the planning and development of components of the emergency management program receive sufficient oversight by staff, management, and DOE/NNSA elements. To ensure that programmatic activities are initiated, completed, and periodically repeated in a timely and efficient manner, reasonable schedules are established for planning, preparedness, readiness assurance, and programmatic response element functions.

Adequate resources are identified and obtained to ensure that the program is ready to respond. Financial resource requirements are identified and budgeted. Response facility needs are identified and locations established. Equipment requirements are identified; supplies of required equipment are monitored and acquired as needed. Personnel requirements are identified and addressed.

An emergency management document control system that meets industry standards for document review, approval, distribution, and change control is established or emergency management documents are controlled under an existing site-wide document control system. An auditable administrative program for ensuring the availability of vital records, regardless of media, is established and reliably maintained. If classified information or materials are being used or generated, effective security procedures and controls are implemented, and security reviews are conducted.

Administration of an emergency management program can vary considerably from site to site depending on characteristics of the site and program, including, size, geographical layout, hazards, administrative structure of the M&O contractor, and structure and constituents of the ERO.

The program administrator's job is to ensure the emergency management program is developed and maintained—not necessarily to perform all these tasks or track/monitor all activities personally. Emergency management authority may be delegated to subordinate administrators responsible for various aspects of the program. The designated emergency management program administrator has ultimate responsibility for ensuring that requirements of the departmental emergency management-related policies and Orders are met. The program administrator coordinates with other site groups responsible for implementing various aspects of emergency preparedness and response.

Training and Drills

The following is taken from DOE G 151.1-3.

DOE/NNSA emergency management training and drill programs ensure that personnel are prepared to respond to, manage, mitigate, and recover from emergencies associated with DOE/NNSA facilities/sites and activities. Training programs can include a variety of instruction methods, such as classroom instruction, computer-based or web-based coursework, and hands-on training and drill activities.

General training for employee response, required as part of the base program, may be included as part of an employer's general employee training (GET) program. This program may include emergency awareness, warnings and alarms, evacuation and accountability, and first aid. Hazardous material programs have additional training requirements for developing and maintaining specific emergency response capabilities for all personnel identified as members of their EROs. The training program should be commensurate with the hazards identified in the EPHA.

The program administrator(s) must ensure the development and coordination of training program activities to prevent conflict with other activities and to ensure that resources are available. In larger facility/site programs, there may be an individual assigned to be the manager of the training program(s). In smaller programs, the designated site emergency management program administrator(s) may be responsible for all aspects of the training program. The program administrator should also ensure a formal training plan is developed that describes program goals and objectives, organizational responsibilities, resources, and planned activities.

The administration of training and drills programs should include functions to:

- Ensure that a plan is developed and maintained describing and documenting the training and drills program.
- Ensure a comprehensive and coordinated program of training and drills for the identified ERO, both primary and alternate members.
- Establish training requirements for each position in the facility/site- or activity-specific ERO.
- Ensure a coordinated program for all responders, both initial training, and annual refresher training based on the plan and procedures for that emergency management program.
- Identify and coordinate adequate resources for training program implementation, including facilities, equipment, budget, etc.
- Ensure the integration of GET in the base program and training programs necessitated by the DOE/NNSA hazardous material program.
- Ensure the training program adequately addresses each response element of the facility/site or activity emergency management programs.
- Ensure that the program plan provides for demonstrations of proficiency following training for ERO positions.
- Identify training needs and provide for development, scheduling and delivery of training activities.
- Establish qualifications for the training staff for each training module.
- Ensure that drills provide practical, hands-on training and use realistic situations and scenarios; ensure they are coordinated with site groups, such as health physicists, industrial hygienists, medical, public affairs, security, etc.

Exercises

The following is taken from DOE G 151.1-3.

Emergency management exercises are formal, evaluated demonstrations of the integrated response capabilities of an emergency management program. Exercises are conducted to validate the response program elements of an emergency management program. Exercises

should be realistic simulations of potential facility/site or activity emergencies. They may vary significantly in size and complexity to achieve their respective purposes. DHS exercise methodology refers to these evaluated demonstrations as discussion-based or operations-based exercises.

Exercise-specific objectives are used to establish the exercise scope, specify the emergency response functions to be demonstrated, identify the extent of organizations/ personnel participating, and identify the breadth and depth of exercise activities to be accomplished or simulated. Typically, not all emergency management program elements are demonstrated in each exercise. The program administrator(s) ensures that a systematic approach is used, with emphasis on participation and coordination among the members of the EROs, to develop an exercise plan to ensure that all elements of facility/site and activity programs are exercised and validated over a multi-year period.

Coordination of exercises is particularly important at sites with multiple, integrated facility emergency management programs, where response resources are shared, and efficiency in scheduling and conducting exercises is paramount.

The administration of exercise programs should include functions to:

- Ensure a formal exercise program to validate all response elements over a five-year period, in accordance with DOE O 151.1C.
- Ensure each exercise has specific objectives keyed to the emergency plan and procedures.
- Ensure that exercises are evaluated, including a critique process to gather and document observations of the participants.
- Ensure that a system is in place to track lessons-learned and corrective actions resulting from the evaluation of exercises.
- Ensure, at a minimum, the conduct of building evacuation exercises consistent with Federal regulations, local ordinances, or NFPA standards.
- Ensure tests of communications systems annually, or as often as needed, to ensure information can be efficiently exchanged with response organizations off site, and at DOE/NNSA field element and HQ-levels.

Response

The following is taken from DOE O 151.1C.

Operational Emergency Response

Site/Facility Personnel.Site/facility personnel and resources at the site/facility level comprise the primary response capability for an OE.

- Sites/facilities must direct appropriate emergency response within the area under their control and at the scene of the emergency, including effective coordination between the IC at the event scene and the individual in charge of overall management and coordination of site/facility response activities.
- Sites/facilities must promptly notify local, state, tribal,
- DOE/NNSA (as appropriate), and other regional Federal agencies when events categorized as OEs occur.

Cognizant Field Elements. Cognizant field elements must

- monitor the facility response, provide support, and assist with issue resolution.
- monitor the notification process at the site/facility and make notifications of applicable DOE/NNSA emergency events as necessary or appropriate.
- coordinate interagency and public information activities at the regional level and coordinate directly with HQ.

The specific structure of cognizant field element emergency management teams depends on the relationship to the site/facility. All cognizant field element emergency management teams must have a senior official who serves as an emergency manager with decision-making authority and responsibilities. Such individuals must be supported by personnel with communications, technical, liaison, and public affairs expertise. The cognizant field element emergency management team may be activated for any emergency declaration.

Energy Emergency Response

Response activities for energy emergencies are normally concentrated at DOE Headquarters. DOE responsibilities for energy emergencies are delineated within interagency Federal response and recovery plans, Executive Orders, and international agreements. DOE Headquarters must monitor energy emergencies for changing requirements and brief the White House and congressional offices when requested.

Emergency Assistance Response

Response to events requiring DOE/NNSA emergency assistance must be directed to appropriate DOE/NNSA Headquarters elements. DOE/NNSA responsibilities for emergency assistance are delineated within interagency Federal response and recovery plans, Executive Orders, and/or international agreements. DOE HQ must monitor such events for changing requirements, brief the White House and congressional offices, and develop options for continuing departmental operations and missions.

Headquarters

DOE Headquarters must receive information on the facility, site, or area response; monitor the cognizant field element response; provide appropriate support and assistance; assist with issue resolution; and coordinate interagency, congressional, and public information activities at the national level.

Termination and Recovery

The following is taken from DOE O 151.1C.

An OE can be terminated only after a predetermined set of criteria has been met and termination has been coordinated with offsite agencies. Recovery from a terminated OE must include: communication and coordination with state, tribal, and local government and other Federal agencies; planning, management, and organization of the associated recovery activities; and ensuring the health and safety of the workers and public.

The contractor at all DOE/NNSA facilities must

- coordinate termination with state, tribal, and local agencies and organizations responsible for offsite emergency response and notification;

- establish criteria for resumption of normal operations. Recovery must also include provisions for investigation of the root cause(s) of the emergency and corrective action(s) to prevent recurrence in accordance with departmental requirements.

The contractor at DOE/NNSA Operational Emergency Hazardous Material Program facilities must also

- establish predetermined criteria for termination of emergencies;
- have the means for estimating exposure to hazardous materials and for protecting workers and the general public from exposure during reentry and recovery activities;
- develop recovery procedures that include dissemination of information to Federal, state, tribal, and local organizations regarding the emergency and possible relaxation of public protective actions; planning for decontamination actions; establishment of a recovery organization; development of reporting requirements; and establishment of criteria for resumption of normal operations.
- not downgrade emergencies, once categorized, to a lower significance category unless the original categorization was incorrect.

An event determined to be an emergency will remain so until the emergency response is terminated. In general, the emergency classification should not be downgraded until termination of the event. However, emergency classification must be reviewed periodically to ensure the classification is commensurate with response activities.

Evaluations and Readiness Assurance

The following is taken from DOE O 151.1C.

Program secretarial officers and cognizant field elements must periodically review and evaluate the ability of DOE/NNSA facilities and/or DOE/NNSA contractor-operated facilities to meet requirements of the emergency management system. Program and exercise evaluations must be based on specific standards and criteria, issued by the Director, Office of Emergency Operations. Tracking performance indicators and conducting no-notice exercises can provide useful information about program readiness.

Program Evaluations

DOE/NNSA facilities and DOE/NNSA contractor-operated facilities must conduct an annual self-assessment of their emergency management programs. Self-assessment results must be documented in the ERAP submitted to the cognizant field element.

The cognizant field element must

- consolidate facility self-assessment results in the cognizant field element ERAP; and
- assess the cognizant field element emergency management program annually and record the results of the self-assessment in the cognizant field element portion of the ERAP.

Each DOE/NNSA cognizant field element must evaluate the emergency management program at each site/facility under its supervision. Each site/facility must be evaluated at least once every three years. The cognizant field element must notify the program secretarial officer of its evaluation schedule.

Program secretarial officers must schedule and perform periodic evaluations of emergency management programs every three years.

Readiness Assurance

The emergency management readiness assurance program must establish a framework and associated mechanisms for assuring that emergency plans, implementing procedures, and resources are adequate by ensuring that they are sufficiently maintained, exercised, and evaluated and that appropriate and timely improvements are made in response to needs identified through coordinated and comprehensive emergency planning, resource allocation, training and drills, exercises, and evaluations.

The contractor at all DOE/NNSA facilities must implement a readiness assurance program consisting of evaluations, improvements, and ERAPs.

13. Emergency management personnel shall demonstrate familiarity level knowledge of the capabilities of DOE national response assets.

a. Discuss the purpose and capabilities of the accident response group (ARG).

The following is taken from DOE O 153.1.

The ARG is a deployable unit that

- manages technical resolution of accidents or significant incidents involving United States nuclear weapons that are in DOE custody at the time of an accident or incident;
- provides timely worldwide support to U.S. Department of Defense (DoD) in the technical resolution of accidents and significant incidents involving United States nuclear weapons in DoD custody;
- performs risk assessments to determine safe-to-ship status of damaged nuclear weapons before recommending transport to the designated disposition site; and
- accepts custody and control of nuclear weapons or weapons components on behalf of DOE.

b. Describe the purpose and capabilities of the nuclear emergency support team.

The following is taken from DOE O 153.1

NEST and radiological emergency response (RER) assets, which are composed of DOE and NNSA personnel and equipment, are structured to provide worldwide technical support in response to radiological events and emergencies especially as the coordinating agency in accordance with the NRP. Although all of the NEST and RER assets will achieve prescribed readiness conditions during an emergency response, certain assets are more often associated with the crisis response phase of a radiological event while others are more often associated with the consequence management phase. The RAP may be expected to provide technical support in both phases; however, for descriptive purposes, RAP is included as a consequence management asset in DOE O 153.1.

c. Discuss the purpose and capabilities of the radiological assistance program.

The following is taken from DOE O 153.1.

The RAP is a deployable, tailored capability that provides first-responder radiological assistance to protect the health and safety of the public and the environment. Upon request, RAP provides radiological assistance to other Federal agencies, state, tribal, and local governments, and private businesses or individuals in the detection, identification and analysis, and response to events/incidents involving radiological/nuclear materials.

d. Describe the purpose and capabilities of the aerial measurement system.

The following is taken from DOE O 153.1.

The AMS is a deployable asset that measures and evaluates the radiological information necessary to address the relevant radiological impacts of accidents and radiological national security emergencies. AMS detects and measures radioactivity over large areas using both fixed- and rotary-wing aircraft.

e. Discuss the purpose and capabilities of the Federal Radiological Monitoring and Assessment Center (FRMAC).

The following is taken from DOE Nevada Site Office, *FRMAC Program*.

The FRMAC is a federal asset available on request by the DHS to respond to nuclear/radiological incidents as described in the national response framework. Under the NRP DOE has the responsibility to maintain the operational readiness of the FRMAC.

The FRMAC is an interagency organization with representatives from various federal, state, and local radiological response organizations. The purpose of the FRMAC is to assist the states, local and tribal governments in their mission to protect the health and well being of their citizens with:

- Verified radiation measurements
- Interpretations of radiation distributions based on Environmental Protection Agency (EPA), Food and Drug Administration (FDA), or local Protective Action Guidelines
- Characterization of overall radiological conditions

Once a declaration to respond to a radiological emergency has been made, the DOE/ NNSA HQ will coordinate the response in consultation with the cognizant DOE/NNSA RCO. Each of the eight RCOs maintains a 24-hour response capability for radiological emergencies that may occur in states served by its region.

When a FRMAC is established it operates under the parameters of the IC system as defined in the NIMS construct.

f. Describe the purpose and capabilities of the National Atmospheric Release Advisory Center (NARAC).

The following is taken from Lawrence Livermore National Laboratory (LLNL), *NARAC*.

NARAC provides tools and services that map the probable spread of hazardous material accidentally or intentionally released into the atmosphere. NARAC provides atmospheric

plume predictions in time for an emergency manager to decide if taking protective action is necessary to protect the health and safety of people in affected areas.

Located at the University of California's LLNL, NARAC is a national support and resource center for planning, real-time assessment, emergency response, and detailed studies of incidents involving a wide variety of hazards, including nuclear, radiological, chemical, biological, and natural emissions.

g. Discuss the purpose and capabilities of the Radiological Emergency Assistance Center/Training Site.

The following is taken from Oak Ridge Institute for Science and Education (ORISE), Radiological Emergency Assistance Center/Training Site.

Since 1976, the ORISE has positioned the DOE as an international leader in emergency medical response to radiation incidents through our management of the REAC/TS.

The REAC/TS mission for DOE is two-fold:

- Provide 24/7 availability to deploy and provide emergency medical services at incidents involving radiation anywhere in the world
- Provide advice and consultation on radiation emergency medicine from its Oak Ridge, TN, headquarters or at the scene of an incident

Radiological/Nuclear Incident Response

With specialized personnel and other unique resources, REAC/TS is prepared to provide emergency medical response 24/7 to incidents involving radiological or nuclear materials.

Advice and Consultation

REAC/TS answers calls of a general nature as well as consults on specific incidents.

Cytogenetics Biodosimetry Laboratory

REAC/TS initiated this new laboratory to enhance DOE's response capabilities to mass radiation exposure incidents. Researchers will also focus on perfecting the use of cytogenetics biodosimetry for calculating the radiation dose to incident victims.

Continuing Education Courses

REAC/TS staff bring to the classroom a blend of stimulating lectures based on experience with the opportunity to practice new skills through simulated drills. Anyone can register for already scheduled courses, or request customized courses that can be delivered anywhere.

Publications and Radiation Resources

REAC/TS makes available valuable reference information related to radiation emergency medicine.

h. Using facility exercise scenarios, simulate requesting appropriate National Response Asset assistance for various events.

This is a performance-based KSA. The Qualifying Official will evaluate the completion of this KSA.

i. Describe the roles and responsibilities of the Department in support of the Federal Response Plan, the Federal Radiological Emergency Response Plan, the National Contingency Plan, and the National Response Plan (NRP) referred to in Homeland Security Presidential Directive/HSPD-5.

Federal Response Plan

The following is taken from State and Local Guide, SLG 101.

Federal response plans (FRPs) and state EOPs describe each respective level of government's approach to emergency response operations. Since both levels of government provide support there are some similar and overlapping functions in the plans.

The FRP details what the Federal government will do to provide emergency assistance to a state and its affected local governments impacted by a large scale disaster. It also describes an organizational structure for providing this assistance.

The FRP may be implemented after a large-scale disaster has occurred or upon warning that such a disaster is likely to occur. In either case the fundamental assumption is that the situation has exceeded or will exceed the state and local governments' capability to respond and recover. The plan guides the activities of Federal agencies that are tasked to perform response and recovery actions.

Federal Radiological Emergency Response Plan

The following is taken from DOE G 151.1-1A.

The Nuclear/Radiological Annex of the NRP, which replaced the Federal Radiological Emergency Response Plan, provides planning guidance and outlines operational concepts for the Federal response to any nuclear/radiological incident requiring Federal coordination. DOE would serve as the coordinating agency for the Federal response to radiological incidents involving DOE/NNSA facilities or material otherwise under its jurisdiction (e.g. transportation of material shipped by or for DOE/NNSA).

National Contingency Plan

The following is taken from DOE O 151.1C.

The National Oil and Hazardous Substances Pollution Contingency Plan, or National Contingency Plan, is published in 40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan," to provide the organizational structure and procedures for Federal preparation for and response to discharges of oil and releases of hazardous substances.

14. Emergency management personnel shall demonstrate an expert level knowledge of the notification and event classification requirements in DOE O 151.1C.

a. Define the categories and classes of emergency events.

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 close 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.

In addition to being categorized as operational emergencies, events involving the actual or potential airborne release of (or loss of control over) hazardous materials from an onsite facility or activity also require prompt and accurate classification as an alert, site area emergency, or general emergency, based on health effects parameters measured or estimated at specific receptor locations (e.g., facility and site boundaries) and compared with protective action criteria. Predetermined conservative onsite protective actions and offsite protective action recommendations must be associated with the classification of these operational emergencies.

Alert

An alert must be declared when events are predicted, are in progress, or have occurred that result in one or more of the following:

- There is an actual or potential substantial degradation in the level of control over hazardous materials.
  - The radiation dose from any release to the environment of radioactive material or a concentration in air of other hazardous material is expected to exceed either a site-specific criterion corresponding to 10 percent of the applicable protective action criterion at or beyond the facility boundary, or the applicable protective action criterion at or beyond 30 meters from the point of release to the environment.
  - It is not expected that the applicable protective action criterion will be exceeded at or beyond the facility boundary.

- There is an actual or potential substantial degradation in the level of safety or security of a nuclear weapon, component, or test device that would not pose an immediate threat to workers or the public.

- There is an actual or potential substantial degradation in the level of safety or security of a facility or process that could, with further degradation, produce a site area emergency or a general emergency.

Site Area Emergency

A site area emergency must be declared when events are predicted, in progress, or have occurred that result in one or more of the following situations:

- There is an actual or potential major failure of functions necessary for the protection of workers or the public.
  - The radiation dose from any release of radioactive material or concentration in air from any release of other hazardous material is expected to exceed the applicable protective action criterion at or beyond the facility boundary.
  - The protective action criterion is not expected to be exceeded at or beyond the site boundary.

- There is an actual or potential threat to the integrity of a nuclear weapon, component, or test device that may adversely impact the health and safety of workers in the immediate area, but not the public.
- There is actual or potential major degradation in the level of safety or security of a facility or process that could, with further degradation, produce a general emergency.

General Emergency

A general emergency must be declared when events are predicted, in progress, or have occurred that result in one or more of the following situations:

- There is actual or imminent catastrophic reduction of facility safety or security systems with potential for the release of large quantities of hazardous materials to the environment.
  - The radiation dose from any release of radioactive material or a concentration in air from any release of other hazardous material is expected to exceed the applicable protective action criterion at or beyond the site boundary.

- There are actual or likely catastrophic failures in safety or security systems threatening the integrity of a nuclear weapon, component, or test device that may adversely impact the health and safety of workers and the public.

b. Define and discuss the notification requirements for the reporting of emergency events.

The following is taken from DOE O 151.1C.

Notification requirements are divided into three phases: planning, preparedness, and response.

Planning Phase

For operational emergencies, provisions must be established for prompt initial notification of workers and emergency response personnel and organizations, including appropriate DOE/NNSA elements and other federal, state, tribal, and local organizations. Provisions

must also be established for continuing effective communication among the response organizations throughout an emergency.

Notification and reporting responsibilities for energy emergencies and emergency assistance must be established to support appropriate plans and agreements.

Preparedness Phase

Adherence to operational emergency notification and reporting requirements must be demonstrated in all emergency management exercises. Preparedness responsibilities for energy emergencies and emergency assistance must be established to support appropriate plans and agreements.

Response Phase

Initial emergency notifications. For operational emergencies, initial emergency notifications must be made to workers, emergency response personnel, and organizations, including DOE/NNSA elements and other local, state, tribal, and federal organizations. The manager of each DOE/NNSA or contractor operated site/facility must

- notify state and local officials and the Cognizant Field Element Emergency Operation Center and Headquarters Operations Center within 15 minutes, and all other organizations within 30 minutes, of the declaration of an alert, site area emergency, or general emergency;
- notify the Cognizant Field Element Emergency Operation Center and Headquarters Operations Center within 30 minutes of the declaration of an Operational Emergency not requiring classification;
- notify local, state, and tribal organizations within 30 minutes or as established in mutual agreements for declaration of an operational emergency not requiring classification.

Headquarters watch office staff in the Headquarters Operations Center and Headquarters Emergency Management Team personnel must be responsible for the following:

- Receive notifications of operational emergencies and disseminate such information to Program Secretarial Officer representatives and, where appropriate, to Headquarters organizations of other federal agencies. The Headquarters Operations Center must disseminate notifications involving energy emergencies and emergency assistance to the appropriate Headquarters Cognizant Secretarial Offices and affected DOE/NNSA offices in the field.
- Facilitate communications among Headquarters organizations, DOE/NNSA field organizations, and contractor personnel.
- At a minimum, emergency notification to the Headquarters Operations Center must consist of a phone call providing as much information as is known at the time. The same information must be provided by e-mail or a fax either immediately prior to or following the phone call. Information for initial notification must include as much as possible of the following:
    - Notification that an operational emergency has been declared and, if appropriate, the classification of the emergency
    - A description of the emergency
    - The date and time the emergency was discovered
    - The damage and casualties

- Whether the emergency has stopped other facility/site operations or program activities
- The protective actions taken and/or recommended
- The notifications made
- The weather conditions at the scene of the emergency
- The level of any media interest at the scene of the emergency or at the facility/site
- The contact information of the DOE or NNSA on-scene point of contact

Emergency status updates. Emergency status reports must be forwarded to the next-higher emergency management team on a continuing basis until the emergency is terminated.

Responder communications. Effective communications methods must be established between event scene responders, emergency managers, and response facilities.

Final emergency report. Following termination of emergency response, and in conjunction with the final occurrence report, each activated emergency management team must submit a final report on the emergency response to the emergency manager for submission to the Director, Office of Emergency Operations.

Recovery reporting. Reporting requirements must be specified during recovery planning.

Review for classified and unclassified controlled information. All reports and releases must be reviewed for classified or unclassified controlled information (e.g., Unclassified Controlled Nuclear Information) prior to being: provided to personnel not authorized access to such information, entered into databases not authorized for such information, or transmitted using non-secure communications equipment.

Energy emergencies and emergency assistance response. Responsibilities for energy emergencies and emergency assistance must be established to support appropriate plans and agreements.

c. Discuss the maximum time frame to make notifications (initial and follow-up) to offsite-facility (HQ, State, local, etc.) agencies after an emergency has been declared. Include in this discussion a description of the priorities for making these notifications.

Refer to element b in this competency for information regarding notification time frames.

d. Discuss the reasons for making initial and follow-up notifications to off-site agencies.

The following is taken from DOE G 151.1-4.

Operational emergencies require time-urgent notifications to initiate response activities at locations beyond the local event scene. In an OE, time-urgent notifications to entities beyond the local event scene are needed. External organizations notified may include: DOE/NNSA HQ,DOE/NNSA cognizant field offices; tribal, state, and local response organizations; and/or, other Federal regulatory authorities. These notifications are not simply informational, but are necessary to initiate and/or promote response actions beyond the local event scene

that will have the effect of mitigating impacts to health, safety or environment. The notifications may activate interfaces with local planning partners, recommend protective actions and/or initiate planned response activities to mitigate impacts in areas beyond the immediate event scene. These notifications can also initiate strategic attention and decision-making at national levels particularly when the OE impacts areas of national security.

e. For various credible emergencies at a facility, simulate making required internal and external notifications using applicable checklists.

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

15. Emergency management personnel shall demonstrate a working level knowledge of the following guidelines sufficient to apply them to emergency management activities:

- **Emergency response planning guidelines (ERPGs)**
- **Protective action guides (PAGs)**
- **Temporary emergency exposure limits (TEELs)**
- **Protective action criteria (PACs)**
- **Emergency response guidebook (ERG)**
- **DOE Manual 460.2-1, Radioactive Material Transportation Practices Manual**

a. Discuss the development and implementation of ERPGs, PAGs, TEELs, PACs, and the ERG and alternatives to use where they do not exist.

ERPGs

The following is taken from ORISE, *ERPG Definitions and Background Information*.

ERPG values are intended to provide estimates of concentration ranges where one reasonably might anticipate observing adverse effects as described in the definitions for ERPG-1, ERPG-2, and ERPG-3 as a consequence of exposure to the specific substance.

ERPG-1 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined, objectionable odor.

ERPG-2 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action.

ERPG-3 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing life-threatening health effects.

It is recognized that human responses do not occur at precise exposure levels but can extend over a wide range of concentrations. The values derived for ERPGs should not be expected to protect everyone, but should be applicable to most individuals in the general population. In all populations there are hypersensitive individuals who will show adverse responses at exposure concentrations far below levels where most individuals normally would respond.

Furthermore, since these values have been derived as planning and emergency response guidelines, not exposure guidelines, they do not contain the safety factors normally incorporated into exposure guidelines. Instead, they are estimates of the thresholds above which there would be an unacceptable likelihood of observing the defined effects. The estimates are based on the available data that are summarized in the documentation. In some cases where the data are limited, the uncertainty of these estimates is large. Users of the ERPG values are strongly encouraged to carefully review the documentation before applying these values.

In developing these ERPGs, human experience has been emphasized to the extent data are available. However, since this type of information is rarely available, and when available is only for low-level exposures, animal exposure data most frequently forms the basis for these values. The most pertinent information is derived from acute inhalation toxicity studies that have included clinical observations and histopathology. The focus is on the highest levels not showing the effects described by the definitions of the ERPG levels. Next, data from repeat inhalation exposure studies with clinical observations and histopathology are considered. Following these in importance are the basic, typically acute studies where mortality is the major focus. When inhalation toxicity data are either unavailable or limited, data from studies involving other routes of exposure will be considered. More value is given to the more rigorously conducted studies, and data from short-term studies are considered to be more useful in estimating possible effects from a single one-hour exposure. Finally, if mechanistic or dose-response data are available, these are applied on a case by case basis, as appropriate.

It is recognized that there is a range of times that one might consider for these guidelines; however, it was the committee's decision to focus its efforts on only one time period. This decision was based on the availability to toxicology information and a reasonable estimate for an exposure scenario. Users who may choose to extrapolate these values to other time periods are cautioned to review the documentation fully since such extrapolations tend to hold over only very limited time frames, if at all.

PAGs

The following is taken from DOE G 151.1-2.

DOE O 151.1C specifies that the PAGs published by the EPA in its *Manual of Protective Action Guides and Protective Actions for Nuclear Incidents* (EPA 400-R-92-001) should be used for comparison with exposures resulting from radiological releases to determine the appropriate emergency classification. These PAGs are intended to apply only to projected doses resulting from exposures to airborne releases of radioactive materials during the early phase of an emergency. The pathways considered include the external gamma and beta dose from direct exposure to airborne and deposited material and the committed dose to internal organs from inhalation of radioactive material..

TEELs

The following is taken from DOE-HDBK-1046-2008.

AEGLs and ERPGs are developed by a painstaking process of reviewing the primary scientific literature, proposing limits, having proposals subject to peer review by subject matter experts in the field, and revising the AEGLs and ERPGs accordingly.

Although the specific processes for AEGL and ERPG value development differ significantly, both processes result in limits with a solid scientific foundation. By the end of 2006, however, there were only 89 chemicals with final or interim AEGLs and only 125 chemicals with ERPGs. Yet thousands of chemicals are used every day at DOE facilities and throughout the United States. The risk of accidental release of chemicals without AEGLs or ERPGs remains, as does the need for DOE to set emergency exposure limits.

TEELs, first referred to as alternative guidelines limits, serve this purpose. The principal difference between TEELs and AEGLs and ERPGs is that the method for developing TEELs requires far less time than do the methods for deriving AEGLs or ERPGs. The first TEEL list was released in October 1992 and included values for approximately 65 chemicals without AEGLs or ERPGs. By revision 21, published in October 2005, the TEEL database included values for 2,945 chemicals. The database includes the more common chemicals used by DOE and NNSA.

PACs

The following is taken from DOE-HDBK-1046-2008.

PACs are the concentrations of airborne hazardous materials at which protective actions are needed. Planning for emergencies at DOE and NNSA sites and facilities includes selecting or developing these criteria for protective action decision making. Emergency procedures for classifying OEs and for implementing or recommending protective actions also incorporate these criteria.

ERG

The following is taken from DOT, Emergency Response Guidebook.

The *Emergency Response Guidebook* (ERG2008) was developed jointly by the US Department of Transportation, Transport Canada, and the Secretariat of Communications and Transportation of Mexico for use by firefighters, police, and other emergency services personnel who may be the first to arrive at the scene of a transportation incident involving a hazardous material. It is primarily a guide to aid first responders in (1) quickly identifying the specific or generic classification of the material(s) involved in the incident, and (2) protecting themselves and the general public during this initial response phase of the incident. The ERG is updated every three to four years to accommodate new products and technology. The next version is scheduled for 2012.

b. Discuss the relationship between the ERPGs and the PAGs.

According to DOE G 151.1-2, PAGs are applied to radiological releases. ERPGs are applied to nonradiological releases.

c. Discuss the philosophy of Emergency Action Levels (EALs), both symptomatic and event-based, that are required by DOE Order 151.1C.

The following is taken for DOE G 151.1-4.

By custom and usage, EALs that are stated in terms of specific symptoms of a degraded safety condition are termed "symptom-based" or "symptomatic." EALs that are expressed in terms of the occurrence of an event or condition that is generally recognized by the sum of its features and characteristics are described as "event-based." The distinction is not absolute and some EALs may actually exhibit both qualities.

Symptom-based EALs define the emergency condition in terms of one or more facts or observations, such as instrument readings or alarms. By definition, existence of the "symptom" is sufficient basis for declaring an emergency and the emergency needs to be declared if the symptom is observed. It is not necessary for the person making the classification decision to know anything about the underlying cause or the sequence of events that produced the symptom.

In general, symptom-based EALs are most applicable to well-instrumented and more complex process facilities. The "symptoms" may indicate actual release of hazardous material or the actual or impending failure of barriers or controls that keep such materials in a safe condition. Using symptomatic EALs, the classification decision can be reached by simply comparing the observed "symptom" to the EAL. No additional interpretation or understanding of the underlying cause or sequence of events is required.

Event-based EALs are stated in terms of events or conditions that are recognized by the sum of their features, indications and characteristics. To apply such an EAL, the user should assess all the observed facts/indications in the context of a written definition or common understanding of the event addressed by the EAL. The user needs to decide if the "event," as represented by the sum of its indications, corresponds to the intent of the EAL.

For event-based EALs, the degree to which the "event" is expected to degrade the safety of hazardous materials will determine the emergency class. Safety degradation may result from the event's detrimental impacts on systems and equipment, confinement barriers, or the ability of personnel to monitor and/or control vital processes. The rationale that connects the occurrence of the "event," the actual or possible loss of control over hazardous material, and the emergency class should be clearly documented in the EPHA.

d. Discuss the basis for determining the event classification using EALS.

Refer to element c of this competency for a discussion regarding using EALS to determine event classifications.

16. Emergency management personnel shall demonstrate a working level knowledge of the development, review, and/or approval of emergency management planning documents.

a. Discuss the purpose and function of the emergency plan implementation procedures.

The following is taken from Federal Emergency Management Agency (FEMA), *Emergency Management Guide.*

The procedures spell out how the facility will respond to emergencies. Whenever possible, develop them as a series of checklists that can be quickly accessed by senior management, department heads, response personnel and employees.

Determine what actions would be necessary to:

- Assess the situation
- Protect employees, customers, visitors, equipment, vital records and other assets, particularly during the first three days
- Get the business back up and running.

Specific procedures might be needed for any number of situations such as bomb threats or tornadoes, and for such functions as:

- Warning employees and customers
- Communicating with personnel and community responders
- Conducting an evacuation and accounting for all persons in the facility
- Managing response activities
- Activating and operating an emergency operations center
- Fighting fires
- Shutting down operations
- Protecting vital records
- Restoring operations

b. Discuss the expected content of and processes used for the development, review, and approval of the following documents:

- **Exercise packages**
- **Exercise after action reports**
- **Hazard surveys**
- **Hazard assessments**
- **Self-assessments**
- **Exercise corrective action plans**
- **Emergency Readiness Assurance Plan**

Exercise Packages

The following is taken from DOE G 151.1-3.

An EXPLAN or exercise package, typically used for operations-based exercises, is published and distributed prior to the start of an exercise. The EXPLAN provides a synopsis of the exercise and addresses the exercise objectives and scope. The EXPLAN assigns tasks and responsibilities for successful exercise execution and provides documented components

essential for preparation, conduct, and evaluation of the exercise. The EXPLAN contains all the documentation necessary to control and evaluate the exercise, however, the extent and detail of the information will vary with the scope and complexity of the particular exercise.

The EXPLAN contains an explanation of the exercise and provides the documented components essential for preparation, conduct, and evaluation of the exercise.

Development of an EXPLAN by an exercise planning team involves an iterative process consisting of several steps:

- Address issues of exercise scope and duration, participants, objectives, administrative and logistical considerations, and operational or technical constraints
- Develop a scenario timeline, a listing of the sequence and timing of key operational, technical, and logistical events comprising the scenario
- Refine the timeline, develop detailed scenario information, prepare message injects and data, and prepare control, evaluation, and other supporting documentation

This iterative development and refinement process is followed by a final review. Final review of the EXPLAN is conducted to ensure overall completeness and technical accuracy and that players/responders are provided the opportunity to meet the exercise objectives. The EXPLAN should be completed in sufficient time to allow DOE or NNSA line management and the DOE Associate Administrator of Emergency Operations to review and comment before the conduct of the exercise. However, some elements of the EXPLAN, such as, telephone directories or lists containing names of controller/evaluators will be subject to change up to the conduct of the exercise. Prior to final review and distribution, a derivative classifier should review the EXPLAN.

The scenario reflects current facility/site- or activity-specific hazards, correlates technically with the EPHA, and is technically accurate in terms of operations and radiological, chemical, and meteorological data. A unique scenario should be developed for each exercise to prevent responder anticipation of events and to ensure a valid test of integrated response capabilities. The final approved EXPLAN or exercise package provides documentation to conduct and evaluate the exercise.

The EXPLAN or exercise package contains all documentation necessary to control and evaluate the exercise, however, the extent and detail of information will vary with the scope and complexity of the particular exercise. The format can be tailored by individual organizations but should include the information outlined below. The exercise web site at http://www.orise.orau.gov/emi contains specific examples of EXPLANs. A typical DOE/NNSA EXPLAN includes the following components:

- Scope and Purpose. All participating organizations, the extent of their participation, and the organizations being simulated are identified. States the purpose of the exercise. Contains the type of exercise, the location of the event scene (e.g., specific facility), facility/site or activity background information, and the date and expected duration.
- Exercise Objectives. The objectives are the key to the exercise. Each exercise objective should clearly state what is to be demonstrated and should be specific, attainable, and measurable. They should contain specific conditions,

performance/action, and standard of performance to define how the objective is to be evaluated. Use of an exercise objective matrix is recommended as a tool to facilitate administration of the exercise program. The matrix should identify all programmatic exercise objectives and correlate with facility/site- or activity-specific hazards and the specific objectives to be demonstrated in individual exercises. It should support/document validation of emergency management program elements over the five-year period. In order to test the interfaces between site security and facility/site emergency response capability, the exercise program at a DOE/NNSA facility/site should include security scenario events.

- Exercise Organization. The exercise organization is comprised of all participants in the actual conduct of the exercise and includes the following:
  - Exercise director/lead exercise planner ensures exercise conducted according to the EXPLAN
  - Players include actual responders and onsite and offsite organizations
  - Evaluators are subject mater experts who observe, monitor, and evaluate player performance; they are responsible for critiques and final after action report (AAR)
  - Controllers ensure that the exercise proceeds on schedule; monitor the sequence of events and input contingency injects to keep exercise on time; monitor safety; input technical data at appropriate times in the scenario; and, assist with critiques and the final AAR
  - Observers/visitors should have no interaction with players/responders

- Scenario Narrative. The scenario narrative is a storybook summary of the background, initial conditions, initiating events, and expected player/responder actions. It contains descriptions of the simulated emergency situation, including the overall sequence of events, details, supporting data, and timing of activities. The scenario reflects current facility/site- or activity specific hazards, correlates technically with the EPHA, and is technically accurate in terms of operations, radiological, chemical, and meteorological data. A unique scenario should be developed for each exercise to prevent player/responder anticipation of events and to ensure a valid test of integrated response capabilities.
- Rules of Conduct. Design and development guidelines are established for each exercise and include:
  - Limitations are management policies and guidelines of concern to the exercise developers and scenario designers; include issues such as conducting exercises on weekends, overtime restrictions or authorizations, and financial constraints.
  - Protocols (ground rules or rules of conduct) remind players/responders of drillsmanship and safety issues.
  - Pre-approved simulations list the major simulations applicable to the exercise; may include pre-determined meteorological data, response vehicle red lights, simulating road blocks without interfering or disrupting public traffic patterns, use of water to simulate a chemical liquid hazardous materials spill, use of a smoke generator to simulate fire/smoke, use of protective equipment, simulated operation of systems/equipment, and photographs to simulate equipment damage.

- Safety Issues. Safety of personnel and the facility is paramount during exercises. A major concept of DOE Integrated Safety Management (ISM) is the integration of

safety awareness and good practices into all aspects of work conducted at DOE. Simply stated, exercises should be conducted in such a manner that protects workers and other people, and does not cause harm to the environment. Safety is an integral part of each exercise; it is not a stand-alone program. The planning process and management of exercises must ensure that sufficient precautions and limitations are established and followed for safe conduct of the exercise. A person with the sole responsibility for ensuring safety during the exercise, such as an exercise safety director, should be appointed to the exercise planning team.

Exercise After Action Reports

The following is taken from DOE G 151.1-3.

The AAR is prepared by the evaluation team to document evaluation of overall exercise performance. This report is the responsibility of the lead evaluator. Information from the formal evaluation and critique process provides the supporting documentation necessary to generate the exercise report. Additional exercise reports may also be prepared by any external departmental organizations that evaluated the exercise.

The AAR covers the schedule, scenario, participants' activities, observations, and recommendations for corrective actions. The AAR considers the observations and evaluations made by the evaluators, controllers, responders (self-critiques), and other participating organizations. The AAR may contain the following:

- Executive summary
- A narrative summary with introductory and general statements noting exercise scope, purpose, objectives, participants, and an overall performance (rating may or may not be assigned) of the exercise.
- Detailed findings for each objective, including positive and negative comments regarding the effectiveness of emergency planning and preparedness elements.
- Recommendations for correcting negative findings.

Once the AAR has been drafted, the evaluators should review the report for accuracy. Evaluator findings will in turn be reviewed to ensure responders were measured against the evaluated organization's plans and procedures. Because perceptions differ, the report writers may find it necessary to adjust or "level" various findings to achieve standardization and consistency within the AAR. The lead evaluator should approve the leveling of any findings.

Hazard Surveys and Hazard Assessments

The following is taken from DOE G 151.1-3.

A hazards survey shall be used by the site, facility, or activity emergency manager to identify the planning requirements addressed in the Operational Emergency Base Program. A departmental site, facility or activity may then be required to establish and maintain a quantitative EPHA. The quantitative EPHA analyzes hazards significant enough to warrant consideration in a facility/site or activity Operational Emergency Hazardous Material Program.

Include or summarize the results of the hazards survey. Describe known hazards originating outside the departmental facility that could impact the health and safety of onsite personnel or other departmental interests.

List and/or summarize the significant radiological and non-radiological hazards present. Describe the system for updating the EPHA. The EPHA may be included as a separate appendix, if desired or necessary for completeness. Identify technical supporting documents that describe the methodology and information of EPHAs used as the bases for emergency planning. Describe the hazards associated with leased facilities (if applicable).

Self-Assessments

The following is taken from DOE G 151.1-3.

A self-assessment can be viewed as an evaluation (program or exercise) of an emergency management program performed and/or sponsored by the organization itself or by some level of the management of the organization responsible for evaluating the emergency management program. Any level of the DOE organizational structure can perform a self-assessment, including personnel who are

- involved in the emergency management program and directly responsible for activities or program components that they are assigned to evaluate;
- involved in the emergency management program, but not directly responsible for activities or program components that they are assigned to evaluate;
- within the sponsoring organization, but without a direct relationship to the emergency management activities (e.g., Quality Assurance Department);
- with no direct connection or relationship to the program or the sponsoring organization.

Personnel performing self-assessments should be qualified and trained in audits or evaluations, and, if possible, should be at most indirectly associated with the specific activities or emergency management program components they evaluate. This is particularly important for an evaluation of analyses (e.g., EPHA) related to the program bases and analytical tools. While the author of such analyses can certainly verify the required contents and end results, an objective view by another analyst is the most efficient way to evaluate their validity. The author may be too close to the analysis to judge it objectively. This discussion is not intended to preclude an author evaluating his/her own work, but merely to point out possible limitations associated with that approach. In areas other than technical analyses, the evaluations conducted by directly involved personnel are more likely to yield objective evaluation results consistent with evaluations conducted by the other groups mentioned.

Self-assessments of emergency management programs should be based on the standard performance evaluation criteria listed in appendix D of DOE G 151.1-3. Self-assessments may also include compliance with external non-DOE codes and regulations and, similarly, with internal organizational requirements and commitments. The methodology associated with self-assessments is very similar to that applied for other forms of evaluations. The data- and information-gathering and evaluation techniques will be substantially the same.

Self-assessments can contribute significantly to enhancing a program's effectiveness through

- verifying program status on a periodic basis, for the benefit of emergency management staff and management;
- identifying program and performance weaknesses and negative trends;
- providing program-specific budgetary/staffing planning basis;
- preparing for an evaluation by an external sponsor.

Secondary benefits of self-assessments, especially those performed by members of the emergency management program themselves, include

- reinforcing confidence of staff/management in the ability of the emergency management program to respond,
- providing emergency management staff with the opportunity to view the integrated program.

Using a consistent set of performance evaluation criteria and the same definitions for expressing the significance of findings will simplify the process of combining self-assessment results with the results of other evaluations. Placing self-assessments and external evaluation results on the same performance-based scale can accomplish the following:

- Validate self-assessment results and reinforce confidence in the process;
- Facilitate the identification of similar problems and possible solutions from across the DOE complex; and
- Track progress in improving and maintaining program readiness using all available performance evaluation data.

The internal program evaluation can be the primary focus, but not the only part of a self-assessment program. It provides the opportunity to examine the results of other assessment activities throughout the year. Internal evaluations should be planned and organized to include and focus on those areas that the organization most critically needs to test and evaluate each year. Emergency managers should consider the following in determining the scope and focus of self-assessments:

- Results of evaluations from the previous year
- Results of performance tests over the past year (exercises, drills, etc.)
- Results of response to actual events
- The scope of evaluations from the previous years, ensuring that areas that were not evaluated thoroughly receive greater scrutiny
- Progress in making corrective actions previously identified
- Weaknesses identified from other self-assessment activities
- Achievement of performance measures set for the organization's emergency management program
- Improvements that the organization is committed to making

As resources for external evaluation activities decrease, more emphasis will be placed on the use of self-assessments for assuring that the readiness of the emergency response capabilities is maintained at a satisfactory level. A reasonable and consistent approach for conducting these internal evaluations is to follow the guidance suggested for external evaluations using consistent evaluation criteria and the same definitions for severity of findings. This simplifies the process of combining the results of internal program evaluations with exercise results, and combining self-assessments with external evaluations.

Exercise Corrective Action Plans

The following is taken from DOE G 151.1-3.

A Corrective Action Plan (CAP) is the formal documented response to findings that have been identified in program and exercise evaluations or through observations in other preparedness activities, such as training and drills. The corrective action itself consists of the means, measures, and methods proposed by the emergency management organization for addressing and fixing the identified problem area.

In preparing/writing a CAP, the conditions, circumstances, situation, and causal factors that led to the finding should be described. A description of the specific corrective action(s) that will be taken to remove the cause of the problem and to resolve the finding must be addressed. The extent and prevalence of the same or similar problem area should also be indicated in the write up. Completion of corrective actions must include a verification and validation process, independent of those who performed the corrective action, that verifies that the corrective action has been put in place and validates that the corrective action has been effective in resolving the original finding. A general description of the conduct of an independent corrective action effectiveness review for verification and validation should be included with the CAP.

Corrective actions that address revision of procedures or training of personnel are particularly urgent and should be assigned a high priority and completed before the next evaluation of the program. In contrast, a corrective action may require some time before it is finally in place. As necessary, non-permanent interim measures should provide control over a deficient situation or condition to limit the hazard or the possibility of emergency response failure. Any interim measures or compensatory actions should be described in the CAP.

The recommended content of a CAP is summarized below:

- Conditions, circumstances, situation, and/or causal factors that led to the finding
- Extent and prevalence of similar or the same/repeat problem area
- Specific corrective action(s) that will be taken to remove the cause of the problem and to resolve the finding
- Interim measures or compensatory actions taken
- General description of the conduct of an independent corrective action effectiveness review for verification and validation

These recommendations can be used for self-assessment corrective actions and for corrective actions where the required content of the formal corrective action is unspecified. Detailed requirements associated with the management of specific departmental corrective actions are contained in DOE O 414.1C, *Quality Assurance.*

Emergency Readiness Assurance Plan

The following is taken from DOE G 151.1-3.

ERAPs are documented assessments of the development, implementation, and maintenance of emergency management programs. The ERAP is also a planning tool to identify and develop needed resources and improvements. An ERAP highlights significant changes in emergency management programs (i.e., planning basis, organizations, and exemptions) and

compares actual achievements to goals, milestones and objectives. The information reported in the ERAP should provide assurances to the organization's management as well as DOE/NNSA Headquarters that emergency management programs are "ready to respond." The ERAP is designed to be an emergency preparedness management tool for all levels of management.

While the provisions of the facility/site or activity readiness assurance program are documented in the emergency plan, the ERAP documents the annual assessment of readiness assurance activities. The ERAP provides detailed information on an annual basis about how continuous improvement in the emergency management program is being achieved and how the complimentary tools of program and exercise evaluations are being used to ensure that the emergency management program is ready to respond.

Following the direction of the Government Performance Results Act (GPRA – 31 U.S.C. 1115 and 1116), the time period for ERAP coverage was reduced to the immediate past fiscal year and the new fiscal year in DOE O 151.1C. The ERAP includes the goals for the immediate past fiscal year and compares those what was accomplished during the past year, and identifies the goals established for the new fiscal year. For example, a facility/site ERAP submitted on 9-30-07 would compare the progress made during FY07 (10-1-06 to 9-30-07) against the goals that had been set for FY07, as well as identify the goals that were set for FY08 (10-1-07 to 9-30-08).

In addition, the ERAP should contain the results of emergency preparedness activities, external evaluations/assessments, self-assessment activities, exercise after-action reports, corresponding corrective action plans, improvements based on the lessons learned program, and summary information about the facility/site or activity emergency management program in sufficient detail to be understood by managers that are not in direct contact with the program. The following general guidance regarding content should also be applied:

- The level of detail should not be voluminous.
- Include information that will help support the improvements needed for the program.
- Details about daily processes are not relevant.
- Ensure that information included is complete and accurate.
- The most detailed information should be from the past year.

DOE O 151.1C contains specific requirements addressing submittal and review and the general requirements for the ERAP summarized as follows:

- The facility/site or activity contractor is responsible for preparing the ERAP.
- An ERAP may require review for classified or controlled information prior to submittal.
- It must be submitted to the cognizant field element manager for approval.
- The cognizant field element manager should review the ERAP; comments should be addressed to the contractor representative.
- ERAPs should be consolidated for facilities/sites and activities under the supervision of the cognizant field element manager.
- The consolidated ERAP should also contain the same type of discussion regarding the emergency management program at the cognizant field element level as is contained in the facility/site or activity ERAP.

- The consolidated ERAP should be submitted to the Associate Administrator for Emergency Operations and the responsible PSO each year.

The Associate Administrator for Emergency Operations will prepare, in coordination with the responsible PSOs, an annual report summarizing the status of the DOE Emergency Management System.

c. Describe the process for developing and submitting corrective action plans in response to evaluation and appraisal findings.

Refer to element b of this competency for a discussion of corrective actions plans.

d. Demonstrate the ability to integrate the results of safety basis documentation (such as documented safety analyses, safety analysis reports, hazard analysis reports, fire hazard analyses, and environmental impact statements) into emergency management planning documentation and vice versa.

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

17. Emergency management personnel shall demonstrate a working level knowledge of the process for planning, conducting, and evaluating emergency response exercises.

a. Describe the process for planning emergency response exercises.

The following is taken from DOE G 151.1-3.

Planning for an exercise is fully documented by an exercise plan that includes: specific exercise objectives, scope, scenario, participants, simulations, timelines, injects (i.e., messages), technical data, safety and security provisions, controller instructions, and evaluation criteria. Planning should be coordinated among onsite ERO components and offsite organizations or groups regarding their respective participation and exercise objectives.

Development and conduct of a DOE/NNSA exercise requires a structured and coordinated planning process. For each exercise, the following list includes several key functions or activities that should be accomplished at some level, depending on the type and scale of the exercise:

- Development, documentation, and scheduling.
  - Scope - Who, what, where, how, and why of the exercise.
  - Objectives - Specific objectives provide the basis for evaluating/validating the performance of response capabilities by each participating organization. Each exercise objective should clearly state what is to be demonstrated and be specific, attainable, and measurable.
  - Participants - Who will plan the exercise and who will respond, control, and evaluate. Any limitations or simulations regarding their participation are identified and documented.
  - Safety - Safety is an integral part of each exercise. The exercise should be conducted in a manner that protects workers and other personnel and does not cause harm to the environment.

- Security - Instructions on facility access, use of firearms, and classification issues.
- Scenario – Technically accurate mechanism developed to provide responders with the opportunity to meet objectives. The scenario is consistent with the set of exercise objectives and explicitly supports an evaluation/validation of each objective.
- Budget - What the exercise will cost to plan, conduct, and evaluate, and the financial obligations of participating organizations.
- Logistical Support - Specific responsibilities for support activities.
- Administrative Activities - Procurement, documentation, and reproduction responsibilities.
- Public Affairs Plan - A public information/education plan should be developed, especially for full-participation site-level operations-based exercise, to coordinate activities with appropriate offsite state, tribal, and local authorities, the media, and the public. This plan should be developed early in the planning process to ensure coordination with interested offsite authorities/officials.

- Oversight of the exercise development process.
- Exercise control
- Exercise evaluation and critiques
- Exercise AAR
- Implementation of corrective actions

Planning and scheduling an exercise requires the involvement and cooperation of all participating organizations. A well planned, executed, and documented exercise requires the coordination and cooperation of senior management, facility- and site-level EROs, and, when applicable, offsite response organizations. Participating offsite response organizations must be included in the initial planning stages of the exercise. Their participation may range from the limited staffing of a control cell for the purpose of receiving notifications to the complete staffing and activation of all applicable response facilities and assets. In planning the exercise, adequate time should be allowed for effective preparation and review of the exercise plan.

b. Describe the process for conducting an emergency response exercise, including the players and controllers organizations and the opportunity for post-event critiques.

The following is taken from DOE G 151.1-3.

Control of the exercise ensures that the scenario unfolds according to the exercise plan. Controllers are responsible for staffing and positioning themselves for effective control. They must ensure there is no interference or prompting by non-responders. Players/responders must perform their respective functions, initially and throughout the exercise, in a professional manner as if the situation were an actual emergency. Simulation of activities during the exercise must be sufficiently realistic to provide confidence that the activity could have been performed during a real emergency.

Roles of Participants

Exercise Director

During the exercise, the exercise director is responsible for the following:

- Safe conduct
- Coordination and continuity
- Providing the opportunity to meet exercise objectives
- Commencing, suspending and terminating the exercise

Controllers

Controllers provide overall direction and control of the exercise. They are primarily responsible for ensuring continuity of the scenario and maintaining safety and security precautions. Controllers should do the following:

- Review appropriate emergency response plans, procedures, and checklists prior to the exercise.
- Review safety, security, communications, and logistical plans included in the exercise plan.
- Attend required training and briefing sessions.
- Allow freedom of responder decisions and actions (i.e., free play) to demonstrate exercise objectives and response capabilities.
- Preclude responder decisions or control actions that would result in loss of opportunity for a participating organization to meet its objectives.
- Inject approved contingency messages or provide instructions, as needed, to keep the exercise on track with the scenario.
- Preclude responder decisions and control actions that may compromise safety or security of the facility, personnel, or equipment.
- Refrain from prompting, in any fashion, decisions or actions of responders.
- Keep the lead controller informed of significant unplanned activities.
- Be prepared to suspend exercise activities in the immediate area and to use prearranged protocols to terminate an exercise.

Evaluators

In general, the only function performed by an evaluator during the exercise is to observe and document the responder actions; however, in some circumstances, because of limitations on available personnel or financial resources, evaluators may perform a dual role of evaluator/controller. Formal evaluation is performed after the exercise is terminated. Evaluators should be assigned specific locations or specific exercise functions. Evaluators should do the following:

- Review appropriate emergency response plans, procedures, and checklists prior to the exercise.
- Review appropriate plans (e.g., safety, security, communications, and logistical plans) developed for conduct of the exercise.
- Attend required training and briefing sessions.
- Observe performance of responders during the exercise and document their actions using their evaluator modules or checklists.
- Refrain from interfacing with responders to prevent interrupting or prompting.

- Evaluate responder performance (not the person) and adequacy of procedures, facilities, and equipment based on exercise-specific evaluation criteria and evaluator checklists.
- Document errors and problem areas in the scenario or conduct of the exercise.
- Maintain a time line of the events as they enfold.
- Present their evaluations and recommendations in a formal critique.

Observers

Observers should not interfere with or become involved in any exercise activity, nor should they contribute information or opinions to responders in any fashion.

Responders

Responders represent the majority of participants in an exercise. In addition to site DOE/NNSA and contractor emergency response personnel, responders may include personnel from DOE/NNSA Headquarters, DOE/NNSA operations/field elements and service centers, and various other DOE/NNSA elements; Federal agencies; state, tribal, local, and private organizations; and the media.

Non-Participants

Non-participants are individuals outside the scope of play who will continue to perform their normal, routine duties as though the exercise is not in progress. Such routine duties include activities necessary for continued safe and secure operation of the facility. Efforts should be made to minimize the impact of the exercise on nonparticipants and to avoid interface between responders and those individuals.

c. Describe the process for internal and external evaluation of emergency response exercises, including the development or response to findings.

The following is taken from DOE G 151.1-3.

The following steps should be implemented to effectively plan for an operations-based exercise evaluation:

- Define evaluation requirements. Determine what will be evaluated and where the observations will occur.
- Prepare the EVALPLAN. Prepare the complete package of information on the evaluation process.
- Develop evaluation tools. Develop the forms evaluators will use to capture information for evaluation during the exercise observation.
- Recruit, assign, and train evaluators. Determine the necessary qualifications of evaluators, identify appropriate individuals, obtain commitments from those individuals, and train them.
- Finalize the evaluation plan. Undertake the activities necessary to organize the evaluation just before the exercise.

Define Evaluation Requirements

While the exercise is being designed, the evaluation planning team will be provided, via the EXPLAN, the master scenario events list, and other exercise documents, with information on:

- exercise goals and objectives
- exercise flow
- critical actions
- exercise participants
- functions and activities to be evaluated

The evaluation planning team will use this information to plan the evaluation, as follows:

Step 1: The evaluation planning team will first use the exercise goals and objectives to determine what performance outcomes should be evaluated.

Step 2: Once the outcomes to be evaluated are determined, the team identifies what activities should be evaluated.

Step 3: Based on these activities, the team identifies which functions (e.g., individuals, teams, disciplines, and organizations) should be evaluated.

Step 4: From the functions, the evaluation planning team can identify where the observations should take place (i.e., what locations) and which specific tasks should be evaluated.

Step 5: From the tasks to be evaluated, the planning team should develop the guidelines within the objectives and criteria for meeting an objective when criteria are only partially met.

Step 6: Once these steps have been completed, the evaluation planning team can identify or develop the appropriate evaluation tools for the evaluators to use.

Prepare the EVALPLAN

The planning for an evaluation is incorporated in an EVALPLAN, which consists of the following:

- Exercise-specific information: The EVALPLAN should include the scenario, the map of the play site, and the exercise schedule.
- Evaluator team organization, assignments, and location: The EVALPLAN should identify how many evaluators are needed, where they will be located, and how they are organized. Evaluators cannot see everything that occurs at any one location during a response. Yet, during the exercise, evaluators must be able to capture information that provides insight into how effective each group is as well as how well they operate with each other. Thus, location and number of evaluators are crucial to the data collection process.
- Evaluator instructions: Evaluators should be given instructions on what to do before they arrive, and the EVALPLAN as well as how to proceed upon arrival.
- Evaluation tools: The EVALPLAN should include the necessary data collection instruments and guides that are described in the following paragraphs.

Develop Evaluation Tools

Once the evaluation planning team has determined what will be evaluated and where the observations will occur, specific evaluation tools are developed for use in the data collection and analysis. The exercise evaluation guides (EEGs) are developed to assist in exercise

evaluation. The facility/site- or activity-specific plans and procedures are used to describe the expected response to be evaluated for each exercise objective. EEGs provide evaluators with information on what they should expect to see at the specific location or in the specific situation. The EEG should provide the evaluator with the important parameters and actions to look for in observing the activities. Guidance is provided for determining whether the objective is met. Space in the EEG should be provided to record observations; a checklist format might be useful to link observations with the parameters and actions required in plans/procedures. Questions to address after the exercise can also be recorded in the EEG.

Recruit, Assign, and Train Evaluators

Selection, recruitment, and assignment of evaluators are crucial components of exercise design. The individual primarily responsible for these tasks is the lead evaluator. Other members of the evaluation planning team may assist the lead evaluator in this task.

The EXPLAN, which is developed by the exercise planning team, serves as the basis for determining the number and expertise of evaluators needed for the exercise. This document will define the scope and concept of play for the exercise. It describes the response tasks that will be demonstrated by exercise players and indicates whether simulations will be used for nonparticipating organizations. It also identifies exercise locations such as emergency operations centers, medical facilities, decontamination sites, and field locations.

The lead evaluator plays a critical role in operations-based exercises and should be identified early in the process to fully participate as a member of the exercise planning team. The lead evaluator should be a senior-level person who understands command and decision-making processes and interagency coordination, as well as specific response functions. Exercises with play in multiple sites will need an evaluation team leader for each site.

A number of evaluators will also be needed to observe and record player performance during the exercise. Evaluators should be chosen for their knowledge and understanding of the specific functional area they will be assigned to observe. Evaluators should be assigned to monitor all participating organizations and player locations.

Evaluation Process

Information is gathered and documented by the evaluators. Evaluators assess the performance of the ERO and adequacy of equipment, facilities, and resource documents used by the responders. The assessment consists of a comparison of performance against predetermined and documented facility/site- or activity-specific evaluation criteria based on program-specific plans/procedures. Information from the evaluation and critique processes provides feedback for use in identifying corrective actions and improvements to the emergency management program.

The evaluator organization must be sufficiently staffed to evaluate the performance and key decision-making of the responders in satisfying the exercise objectives. Evaluators should be familiar with responder organizations, functions, procedures, and anticipated responder decisions and response activities in order to accurately monitor activities and functions performed by the players.

Responders/players are evaluated with respect to their demonstrated proficiency in their respective responsibilities and functions, communication and coordination with other responders, familiarity and use of applicable procedures and equipment, and overall professional response. Facilities and equipment are evaluated with respect to adequacy of functions/operability. Procedures are evaluated with respect to their use by responders, specifically, their adequacy of content for the tasks performed. Notifications and communications are evaluated during every exercise. When offsite agencies participate, interfaces with offsite agencies are evaluated.

The following overview describes the steps in the exercise evaluation process for operations-based exercises, not including auxiliary activities such as development of the evaluation tools or training for evaluators.

Step 1

Plan and organize the evaluation. As part of the exercise planning and development process, the exercise planning team will determine what information should be collected, who will collect it, and how it will be collected.

Step 2

Observe the exercise and collect data. Expert (peer) evaluators collect data by recording their observations during exercise play and collecting additional data from records and logs. Evaluators of tabletop exercises record discussion and review documents such as plans, procedures, and interagency agreements.

Step 3

Analyze data. The analysis phase should answer the following questions about the exercise play:

- What happened?
- What was supposed to happen?
- If there is a difference, why is there a difference?
- What is the effect of that difference?
- What should be learned from this?
- What improvement should be made or exemplary practices adopted?

The first step in the analysis process is a player hot wash, i.e., a short discussion session immediately following the exercise to get player feedback. Analysis of exercises is conducted using data collected to reconstruct the timeline of events as they occurred, an approach similar to reconstruction of events that most agencies do following an accident or other type of incident. This information is then used to identify and explore the differences between what happened and what was supposed to happen to ascertain the root causes for the differences.

Step 4

Develop the draft AAR. As part of the analysis phase, the evaluation team drafts the AAR, which provides a description of what happened, exemplary practices, issues that need to be addressed, and recommendations for improvements.

The evaluators share the assessment information with management and, if appropriate, facilitate identification of improvements that can be made. This phase of the exercise evaluation and improvement process generally consists of the following steps.

Step 5

Conduct exercise debrief meeting. The exercise planners and/or evaluation team will present their analysis findings and recommendations in an exercise debrief meeting with management from the sites, facilities, departments, agencies and jurisdictions that participated in the exercise. They will also solicit feedback and validation from the attendees on their observations and recommendations.

Step 6

Identify improvements to be implemented. Much of the exercise debrief meeting will be devoted to discussing specific actions that the exercise participants will take to address the opportunities for improvement contained in the recommendations in the draft AAR. This list of actions, referred to as the improvement plan (IP), identifies what will be done, who is responsible, and the timeframe for implementation. Although the IP is a written document, it should be viewed not as a static document but as a dynamic program that is updated and modified regularly in a constant cycle of improvement.

Step 7

Finalize the AAR. Following the exercise debrief meeting, the evaluation team should finalize the AAR by incorporating any corrections or clarifications related to the observations or recommendations as well as the improvement steps that will be taken. Some of the actions may include only the preliminary step of a multi-step activity.

Findings resulting from the exercise should be subject to an in-depth review. For recurring problems, a root cause analysis should be performed. A plan should be developed to implement corrective actions and improvement items. Management should budget, schedule, and implement the actions to upgrade the emergency management program. Activities should be coordinated with affected organizations. Corrective actions, such as procedural modifications, necessitate timely feedback to the participants. Such timely feedback demonstrates management attention and concern for upgrading the emergency response capability and demonstrates management support for involvement of participants in exercises.

d. Perform one of the following activities related to emergency drills, exercises, or events:
- **In accordance with the emergency management guides, act as an evaluator or exercise controller during an exercise.**
- **Serve as a member of an exercise planning group.**
- **Serve as a member of a scenario development group for an exercise.**
- **Lead an exercise post event critique.**
- **Coordinate the writing of an exercise after action report responding to objectives that were both met and not met.**

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

e. Discuss the definitions and uses of drills and exercises. Discuss the role of players, controllers, and evaluators with respect to conduct and safety.

The following is taken from DOE G 151.1-3.

Drills are training methods that allow an individual to put knowledge into practice in the context of a scenario-based simulation. The drill provides practical training to enhance preparedness for emergency response personnel and organizations that are expected to respond to onsite emergencies. Qualification requirements for each emergency response position should include annual participation in at least one training drill (or, alternatively, an exercise) during which practical knowledge and skills are demonstrated.

Drills are supervised hands-on instruction and application sessions for individuals or teams. These sessions provide an opportunity to demonstrate and maintain individual and organizational proficiency. During drills, the desired skills or actions may or may not be first demonstrated by the instructor(s). These training activities are documented by a plan, which includes a performance checklist used by the instructor or evaluator. The checklist has two purposes: to provide feedback during the training and to summarize overall performance. Because the focus is training, it is often appropriate for the instructor to stop and correct participant actions during the activity rather than waiting until the end.

Drills should be of sufficient scope, duration, and frequency to ensure adequate training for all emergency response functions applicable to the facility. The size and complexity of any drill will depend on the objectives. Many drills will be functional, focusing on training responders involved in a specific response function. Drills can range from hands-on instruction involving one procedure to a multi-organizational, scenario-driven event. Drills should be as realistic as possible, using realistic scenarios based on hazards surveys and EPHAs as well as actual facility conditions. Conduct of drills requires a skilled and experienced instructor(s) who can present the scenario, control activities of responders, and provide feedback that enhances learning.

Within the DOE/NNSA emergency management system, the distinction between a drill and an exercise is reflected in their primary purpose, namely, a drill is oriented toward training and is not a graded evaluation of the response activity. Because the focus of a drill is training, some aspects of drill conduct can be made more flexible than in an exercise. Some emergency response roles may be combined and the instructor/controller may be free to stop and correct the responder actions during the drill. In a small drill, one instructor may plan, conduct and evaluate the performance.

Consideration should always be given to the need for safety and security plans when drills are conducted. Any drill that has the potential to affect or might be observed by an offsite population should be planned to avoid public concern or inconvenience.

The roles of drill and exercise participants is discussed in element c of this competency.

f. Discuss the bounds and limitations of free play in regards to an exercise.

The following is taken from DOE G 151.1-3.

Free play allows responders to make decisions and take actions they consider appropriate to the scenario. Realism is enhanced and responder motivation is improved when responders are provided the latitude to make decisions and take actions that may differ from those anticipated during the scenario development. The key management aspect of free play is to allow such actions to occur, but to preclude actions by responders that would

- jeopardize personnel safety;
- jeopardize site/facility safety;
- compromise security;
- exceed established exercise scope or limitations;
- preclude exercise objectives from being demonstrated.

During exercises, responders may interject innovative, unexpected response solutions or actions that can be accommodated by the scenario. In such situations, the controller(s) should allow the responders to proceed with their actions and notify the exercise lead controller that a deviation is occurring. If the responder actions compromise safety or security, or limit demonstration of stated exercise objectives, the controller should note the intended action but preclude that intended action from actually occurring. This information should be reported to the evaluator.

Actual equipment and procedural problems that are identified during the exercise interject a form of free play. Solutions to actual equipment or procedural problems on a real-time basis afford a valuable evaluation of the conduct of operation, training, and safety culture of the responders. Controllers should allow responders to solve such actual problems unless safety, security, or demonstration of exercise objectives may be compromised.

g. Discuss the responsibilities for safety during an exercise. Explain how safety is built into an exercise and how it is maintained during performance.

The following is taken from DOE G 151.1-3.

The safety of personnel and the facility is paramount during exercises. The planning process and the management of exercises must ensure that sufficient precautions and limitations are established and followed for the safe conduct of the exercise. A person with the sole responsibility for ensuring safety during the exercise, such as an exercise safety director, should be appointed to the exercise planning group.

During an exercise, all participants must comply with established safety rules and practices. Participants must understand that safety of exercise participants, non-participants, the public, and the environment is of the highest priority. An exercise safety plan is an effective method of documenting safety concerns and solutions. The plan should address generic and specific safety concerns, mitigative solutions, and required actions/notifications if a safety concern or emergency occurs during an exercise. Major elements of a generic exercise safety plan are listed in appendix B of DOE G 151.1-1, volume 7-1, Development and Conduct of Exercises.

18. Emergency management personnel shall demonstrate a familiarity level knowledge of contract management as it relates to emergency management.

a. Describe the role of emergency management personnel in contractor oversight.

The following is taken from DOE O 151.1C.

Emergency management personnel's role in contractor oversight includes the following activities:

- 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 Program Secretarial Officers, support a readiness assurance program, consisting of evaluations, improvements, and ERAPs. Ensure appropriate measures of the effectiveness of contractor site/facility emergency management programs are incorporated in contractual arrangements.
  - Approve site emergency plans, including annual updates, and submit approved site emergency plans to the Director, Office of Emergency Operations and the PSOs.
  - Approve and submit approved EPZs to the Director, Office of Emergency Operations, and the PSOs.
  - Assess the cognizant field element emergency management program annually and record the results of the self-assessment in the cognizant field element portion of the ERAP.

- 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 emergency public information planning is integrated with the development and maintenance of emergency plans.
- Ensure 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 PSOand 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 (NRP) 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 EPHAs and hazards surveys for emergency planning purposes are adequately performed and documented. Ensure EPHAs and hazards surveys are updated every three years, and prior to significant changes to the site/facility or to hazardous material inventories.
- Ensure 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 PSOs and the Director, Office of Emergency Operations.
- During an emergency, conduct appropriate and necessary emergency actions.
- Implement corrective actions lessons learned from actual emergency responses and based on findings from evaluations, assessments, and appraisals.
- Establish and maintain an 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.
- 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 contractor requirements document of DOE O 151.1C into those contracts.
- Effectively integrate the activities of a leased facility and NRC licensed facilities into the DOE/NNSA sitewide 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 sitewide 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.

b. Identify the key elements and features of an effective DOE and operating contractor relationship.

The following is taken from DOE G 450.3-3.

DOE and contractor assessments improve when their respective methods and results are shared openly and constructively. Open and constructive sharing requires a DOE-contractor relationship based on trust. Such trust should be fostered by focusing on the use of assessment results for continuous improvement, rather than for punitive actions.

Tailoring of assessments means developing performance criteria, indicators, and measures that are specific to the work, the work environment, and the agreed-upon expectations using methods that are keyed to each contractor's safety management system and providing feedback of assessment results into the safety management system where it will be most useful.

Tailoring of work management occurs at all management levels. Just so, contracts and project agreements between DOE and contractors can be thought of as tailored, or at least as providing the basis for tailoring. Agreements that are developed to direct work under a specific contract or for a specific project effectively translate DOE mission goals into work contracts.

c. Discuss the "fee-based" evaluation process. Include 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-4A.

The stated objective of NNSA Policy Letter NAP-4A, *Corporate Performance Evaluation Process for Management and Operating Contractors*, reads as follows:

> To establish and implement a uniform, corporate process for evaluation of NNSA Management and Operating (M&O) contractors' performance that promotes effective and efficient accomplishment of the NNSA mission and results in documented, consistent, and fair evaluation of results while minimizing the administrative burden from Headquarters involvement.

Through NAP-4A, the fee-based evaluation processes, performance criteria, conduct of the evaluation, and documentation and transmittal requirements are outlined.

Fee-Based Evaluation Process

Before a fee-based evaluation process can begin, it must be planned. The planning process identifies the criteria, discussed below, to which the evaluation will apply, so that specific performance measures can be established, agreed upon, then analyzed. From this analysis the level of proficiency to those measures is achieved. This is done through a Performance Evaluation Plan (PEP). The PEP development and negotiation process is described in NAP-4A. Under the letter's requirements, the following is stated:

> 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 PEP for each site will follow the format and boundaries found in the letter, which continues its discussion with the following:

> The Fee Determining Official (FDO) will review and approve where appropriate, the fee rate or amount of available fee for each PEP, based on the recommendation of the Site Office Manager and Management Council.

At a high level, the evaluation process is divided into three phases for NNSA M&O Contracts:

1. The Planning Phase precedes the execution year (generally a Government fiscal year) and includes:

    - Review and incorporation of lessons learned from the past year Identification of performance metrics consistent with the Planning, Programming, Budgeting and Execution/Evaluation (PPBE/E) process Development, review and approval of PEPs for each NNSA M&O contract.
    - Determination of the amount of fee to be available and allocated within the PEP.

2. The Monitoring Phase takes place during the execution year and includes:
    - Monitoring of contractor performance—operational awareness an evaluation of results during the execution year, supported by appropriate documentation
    - Linkage of evaluation activities to the PPBE/E process
    - Periodic reporting of performance results to appropriate NNSA management.

3. The Assessment Phase begins after the execution year has ended and should 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, will validate contractor performance and provide recommended ratings and/or recommended earned fee amount to the Management Council and, in turn, NA-1 (FDO). Timely and effective Headquarters input is critical to a successful Assessment Phase.
    - After Management Council review, NA-1 will determine the final performance rating and earned fee for the contractors.
    - The FDO has the discretion to adjust the recommended rating or earn fee within the available fee pool. The adjustment should generally be within the range of plus or minus 5 percent. The rationale for a management adjustment to an otherwise earned fee amount or rating total outside the range of plus or minus 5 percent will be included in the Site Office Manager's letter to the contractor that transmits the final Performance Evaluation Report (PER).

As found in 48 CFR 970.1504–1, " Price Analysis," and –2, "Price Negotiation."

DOE management and operating 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 management and operating 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 imposed by 41 U.S.C. 254(b), "Cost or Pricing Data: Truth in Negotiations."

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 indicates clearly a level below which performance is not acceptable.

It is here in 48 CFR 970.1504 (e)(1) and (e)(2) that the concept of target performance levels (criteria) 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 upon 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.

19. Emergency management personnel shall demonstrate a working level knowledge of Integrated Safety Management System assessment techniques to include the planning and use of observations, interviews, and document reviews to assess DOE and facility performance, report results of assessments, and follow-up on actions taken as the result of assessments.

a. Describe the assessment requirements and limitations associated with the emergency management personnel interface with contractor employees.

As assessment requirements and limitations associated with the interface of emergency management personnel and contractor employees vary from site to site, the local Qualifying Official will evaluate the completion of this competency.

b. Explain the essential elements of a performance-based assessment, including the areas of investigation, fact-finding, and reporting.

The following is taken from DOE G 414.1-1B.

Performance-based assessments take the approach of focusing first on the adequacy of the process that produced a product or service, and then on the product itself. If problems are found in the product or work processes, the assessor evaluates the methods and procedures used to implement the applicable requirements in an effort to find the failure that led to the problems. The assessor is expected to determine whether a non-compliance or series of non-compliances with procedures could result in a failure to satisfy top-level requirements. Results of prior compliance assessments may help the assessor in determining the focus areas for planning performance-based assessments.

Performance-based assessments usually provide the most useful information to management; however, it requires a much higher level of competence on the part of the assessment team. Results of performance-based assessments may provide useful insights for management's pursuit of excellence.

The following is taken from DOE-NE-STD-1004-92 (archived).

Investigation

It is important to begin the investigation as soon as an assessment is called for to ensure that data is not lost. The information that should be collected consists of conditions before, during, and after operation of the facility; personnel involvement; environmental factors; and other information having relevance to the operation of the facility.

Fact Finding

Once all the data has been collected, the data should be verified to ensure accuracy. The investigation may be enhanced if some physical evidence is retained. Establishing a quarantine area, or the tagging and segregation of pieces and material, should be performed for failed equipment or components. The basic need is to determine the direct, contributing, and root causes so that effective corrective actions can be taken that will prevent recurrence. Areas to be considered when determining what information is needed include

- activities related to the operations of the facility
- initial or recurring problems

- hardware (equipment) or software (programmatic-type issues) associated with the facility
- recent administrative program or equipment changes
- physical environment or circumstances

Methods of gathering information include conducting interviews and collecting statements. Interviews must be factual. Preparing questions before the interview is essential to ensure that all necessary information is obtained. Interviews should be conducted, preferably in person, with those people who are most familiar with the system. Individual statements could be obtained if time or the number of personnel involved makes interviewing impractical. Interviews can be documented using any format desired by the interviewer. Consider conducting a walk-through of the system or facility as part of the interview if time permits.

Reporting

Reviewing reports and documents helps develop the foundation for identifying weaknesses and areas that are of concern to an auditor.

Review relevant documents or portions of documents as necessary and reference their use in support of facility operation. Record appropriate dates and times associated with the occurrence on the documents reviewed. Relevant documents include the following:

- Operating logs
- Correspondence
- Inspection/surveillance records
- Maintenance records
- Meeting minutes
- Computer process data
- Procedures and instructions
- Vendor manuals
- Drawings and specifications
- Functional retest specifications and results
- Equipment history records
- Design basis information
- Safety analysis report technical specifications
- Related quality control evaluation reports
- Operational safety requirements
- Safety performance measurement system/occurrence reporting and processing system reports
- Radiological surveys
- Trend charts and graphs
- Facility parameter readings
- Sample analyses and results (chemistry, radiological, air, etc.)
- Work orders

c. Describe the methods by which noncompliance is determined and communicated to contractor and Department management.

The following is taken from DOE *Noncompliance Tracking System (NTS) Users Manual*.

A centralized data base maintained by DOE allows contractors to promptly report noncompliances and take advantage of the enforcement policy's mitigation provision. Reporting a noncompliance that is below a noncompliance tracking system (NTS) reporting threshold into a contractor's tracking system also constitutes formal reporting to DOE for Price –Anderson Amendments Act (PAAA) enforcement purposes. System requirements for accessing and use of the NTS are included in the *Noncompliance Tracking System (NTS) Users Manual*. Additional guidance follows.

Description of Noncompliance

This field should contain a clear, concise, factual, and objective description of the noncompliance including any impact to the environment, safety, or health of workers or the public. If the information in this field is not clear or if more information is needed, a DOE representative may request additional information. DOE will not take enforcement action based solely on information in the NTS.

Corrective Actions

The fields pertaining to corrective actions are the target and actual completion dates, and a brief summary of the root cause and corrective action. The contractor is expected to take as many corrective actions as needed to resolve a noncompliance condition and to prevent the noncompliance from recurring. The contractor need not list every corrective action milestone, but should list those that are significant. A noncompliance condition should be corrected for the nuclear facility or radiological activity where the noncompliance occurred, as well as for any other facility or activity under contractor management where Price-Anderson is applicable. Corrective actions are not required to be approved by DOE. DOE may, however, be involved in the selection of a corrective action and the timing of work activities if there will be a significant commitment of funds or a request for additional funds to correct the noncompliance. Under normal circumstances, DOE field elements will have this responsibility.

Once corrective actions have been completed and all completion dates entered into the NTS, the contractor then has the option of indicating completion of all corrective actions or leaving the report open for an additional 45 days. The NTS computer system will automatically recommend closure 45 days after the last corrective action has been completed. This option allows the contractor to add corrective actions, if appropriate, within the 45 day period. An NTS report will not be considered for closure until all reported corrective actions have been completed and verified by DOE.

Once the contractor has indicated all corrective actions have been completed, it is essential that the cognizant DOE field office conduct a verification. The field office PAAA Coordinator would subsequently enter comments into the applicable NTS report indicating either the field office is satisfied all corrective actions have been completed, or the office believes a discrepancy exists and recommends further action to the Office of Enforcement and Investigation (OEI). After the field office indicates all corrective actions have been

completed can closure of the NTS report be recommended to the OEI Director by Enforcement staff. The OEI has, however, occasionally observed NTS reports without field office comment concerning verification after all corrective action completion dates have been posted. In these circumstances, OEI staff will notify the respective field office of the need to comment in a timely manner. NTS reports that still have not received field office comment within 180 days after the latest corrective action completion date will have a statement entered by OEI staff indicating nonverification and will thus be recommended for closure to the Director. An NTS report is officially closed after the OEI Director concurs with staff's recommendation.

Corrective actions described in the NTS are primarily for tracking and closure purposes; it is not a forum to argue the comprehensiveness of corrective actions. If an enforcement action is contemplated, the contractor will have an opportunity to discuss corrective actions in more detail during the enforcement review process. As noted earlier, the contractor will have ample opportunity to update, provide additional detail, or add more corrective actions to a noncompliance report in the event the noncompliance is being considered for enforcement action.

d. Describe the contents of an assessment report.

The following is taken from DOE G 414.1-1B.

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.

Specific report formats may vary considerably from one organization to the next. An independent assessment report usually includes the sections described below.

- 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

e. Using the findings from an assessment, develop an assessment report.

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

f. Explain the significance of each of the following assessment-related activities:
- **Exit interviews**
- **Closure process**
- **Tracking to closure**
- **Follow-up**
- **Corrective action plans**

Exit Interview

The following is taken from DOE G 414.1-1B.

This interview is used primarily by the assessment team to present the assessment summary. Reasonable time should be allowed to discuss any concerns, but this meeting should not be used to argue the assessment findings or methodology. There should be no surprises during the exit meeting since the assessment team should have taken every effort possible during the conduct of the assessment to ensure that the assessed organization was aware of the team's findings and concerns. Prior to the exit meeting the assessment team should consider combining related findings into a small number of well-supported findings to help focus management's opportunities for improvement.

Closure Process, Tracking to Closure, and Follow up

The following is taken from DOE G 414.1-5.

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.

Characteristics of an effective corrective action tracking and reporting system include the following:
- The number of data elements to enter, track, trend, and report information should be standardized and relevant for the reader to fully comprehend what, how, when, and by whom the identified problem will be effectively resolved so it will not recur. An excessive number of data elements to track and report may become too cumbersome and complicated, and may over-burden the ability of the system to provide qualitative and consistent information.
- The process for populating data elements should be clearly promulgated and enforced.
- The system should employ information technology that implements user-friendly, controlled access to the system and flexible reporting.
- A dedicated, highly reliable, automated database system may be the most cost-effective approach for tracking the CAP implementation, and it may significantly enhance data collection, storage management, and processing of data and information

in a timely manner. For the DOE corrective action management program (CAMP), the corrective action tracking system (CATS) is used.

- A basic and simple process requiring minimal training and easy access to enter and retrieve data by both the computer technical expert and novice entry level member up through senior management will allow for increased participation and involvement by all personnel involved in identifying the findings and implementing corrective actions.
- The system should contain an automated workflow or a relationship capability for linking findings to corrective actions.
- The system should contain a pre-designed reporting capability for generating summary statistics and reporting timely, consistent, and accurate corrective action information.
- The information to be entered into the system should be consistent with simple, well-defined data elements and attributes for the data to be entered. Unorganized and inconsistent data collection significantly reduces the usefulness of the data. Guidance for the type of information to enter into the system should be thorough, clearly defined, and easily understood with a minimum of training and instruction.
- Access security to the data should be an integral component of the system. Access should be limited to only those with a need to know. That may include members involved in the identification of finding and implementing the associated corrective actions. The corrective action information may delineate vulnerabilities of a site or organization and should not be available to the general population. Editor access to the system for updating data should be restricted to those registered personnel authorized by their management to access and enter only data involving the specified sites or organizations for which they have received authority. For the CATS, registration is required for readers and editors.
- The system should possess the capability to pinpoint problem areas and track trends. It should maintain historical data that supports ongoing problem resolution, trend analysis, and recurrence control activities.
- The system should allow flexible reporting, CAP changes and status, and real-time visibility of open and closed findings and corrective actions.
- The system should be able to integrate and link with other applicable databases.
- After a reasonable period of time has elapsed, follow-up activities should be performed to verify the effectiveness of the corrective actions and how they were implemented. The verification should, at a minimum, sample the corrective actions to determine whether the problem/issue to be addressed has been resolved. The organization's reporting systems (e.g., noncompliance tracking system, occurrence reporting and processing system, external oversight reports and regulatory violations, performance indicators) should be reviewed for evidence of the problem (or a similar problem) recurring. The same techniques used to conduct assessments may be used for verifying corrective actions; however, there are several common ways to verify the implementation of corrective actions, including
  - reassessment of the deficient areas;
  - review of new or revised quality-affecting documents such as manuals, procedures, and training records;
  - verification during the next scheduled assessment;
  - verification by conducting a surveillance covering the areas of concern.

Corrective Action Plans

The following is taken from DOE G 414.1-5.

In summary, the generalized procedures for development, implementation, completion, and follow-up of a corrective action program are discussed below. The extent and degree of implementing each of these procedures explained below is at the discretion of management based on a graded approach of the significance and criticality of the identified problem finding. They include the following:

- Upon receipt of an event, observation, or assessment report, the manager responsible for the site/organization conducts a thorough evaluation of the reported findings and determines the causal factors contributing to each.
- Based on the results of the finding evaluation, a CAP should be developed listing the corrective actions to address each finding in the report.
- The CAP should be submitted for approval by the senior manager authorized to provide the resources (funding, personnel, time, etc.) necessary to implement the corrective actions successfully. A specified timeframe for development and senior manager approval of the CAP should be included in the corrective action process. The DOE CAMP requires Secretarial Officer approval within 60 calendar days from the date of the transmittal forwarding the assessment report.
- The senior manager approves the CAP. If the senior manager does not approve the CAP, it should be returned to the site/organization manager for followup action and be resubmitted to the senior manager. Upon approval of the CAP, the site/organization manager should forward a copy to the organization/individual that conducted the assessment/observation for review and feedback. If the assessing organization/individual provides comments concerning the CAP, they should be reviewed by the site/organization manager who will determine if any modifications of the CAP should be made based on the comments. Major modifications involving additional resources may need to be reviewed for approval by the senior manager.
- The responsible site/organization manager implements the approved CAP, enters the findings and associated corrective actions into a tracking system, and ensures the status of corrective actions is effectively tracked and continuously updated to closure.
- Upon completion of all corrective actions in the CAP, the responsible site/organization manager reports completion in the corrective action program tracking system.
- The responsible site/organization manager conducts an independent review of the completed corrective actions implemented for each finding to objectively verify closure and ensure that each finding was effectively resolved and will not recur.
- New or revised CAPs should be documented, approved by the site/organization manager, tracked, and status reported to completion. Upon completion of the revised or new corrective actions for each problem finding, a corrective action effectiveness review of the corrective actions for the specific findings should be conducted, approved and followed up.
- The responsible site/organization manager approves the corrective action effectiveness review and follows up results and recommendations of the review. This may include implementing additional courses of action for partially effective and ineffective corrective actions. The manager should annotate approval and results of the review in the CAP tracking system. Depending on the extent of additional

corrective actions determined, the site/organization manager may decide to develop a revised or additional CAP and conduct another corrective action effectiveness review of the new corrective actions for the specific findings.

- The responsible site/organization manager develops and applies lessons learned identified from the observation/assessment findings, corrective actions in response to the findings, and results of the corrective action effectiveness reviews, as applicable. Implementation of lessons learned may occur at any time during the corrective action program process.
- Upon reporting approval of the corrective action effectiveness review and completion of follow-up activities, the responsible site/organization manager closes the CAP.

g. Review emergency management items in a facility corrective action program. Follow up on two items to verify continued correction.

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

Selected Bibliography and Suggested Reading

***Code of Federal Regulations* (CFR)**

10 CFR 71.4, "Definitions." January 1, 2009.
10 CFR 835.202, "Occupational Dose Limits for General Employees." January 1, 2009.
10 CFR 835.405, "Receipt of Packages Containing Radioactive Material." January 1, 2009.
10 CFR 835.601, " General Requirements." January 1, 2009.
10 CFR 835.605, "Labeling Items and Containers." January 1, 2009.
10 CFR 835.901, "Radiation Safety Training." January 1, 2009.
10 CFR 835.1201, "Sealed Radioactive Source Control." January 1, 2009.
10 CFR 835.1202, "Accountable Sealed Radioactive Sources." January 1, 2009.
10 CFR 835, subpart N, "Emergency Exposure Situations." January 1, 2009.
10 CFR 851, "Worker Safety and Health Program." January 1, 2009.
29 CFR 1910.39, "Fire Prevention Plans." July 1, 2008.
29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response." July 1, 2008.
40 CFR 112.1, "General Applicability." July 1, 2008.
40 CFR 112.7, "General Requirements for Spill Prevention, Control, and Countermeasure Plans." July 1, 2008.
40 CFR 260.10, "Definitions." July 1, 2008.
40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan." July 1, 2008.
40 CFR 300 series, "Environmental Protection Agency." July 1, 2008.
40 CFR 355. "Emergency Planning and Notification." July 1, 2008.
48 CFR 970.1504-1, "Price Analysis." October 1, 2008.
49 CFR 970.1504-2, "Price Negotiation." October 1, 2008.
49 CFR 142.403, Class 7 (Radioactive) Materials." October 1, 2008.
49 CFR 172, subpart E, "Labeling." October 1, 2008.
49 CFR 172.403, "Class 7(Radioactive) Material. October 1, 2008.

American Meteorological Society, "Glossary of Meterology."

Bio-**Medicine**

Active Transport.
Diffusion.

Boyce, Ann, *Introduction to Environmental Technology*, 1996.

Centers for Disease Control and Prevention. *Public Health Emergency Response Guide for State, Local and Tribal Public Health Directors*.

eMedicine. *Chemical Detection Equipment*. December 2008.

Environmental Management, volume 20, issue 5. *Formulating an Ecosystem Approach to Environmental Protection*.

Federal Emergency Management Agency. *Emergency Management Guide,* "Section 1: Step 3, Develop the Plan." March 24, 2006.

Franklin Institute. *Ecosystems, Biomes, and Habitats*.

International Association of Firefighters. *Training for Radiation Emergencies: First Responder Operations Instructor Guide*. 1998.

International Atomic Energy Agency. IAEA TS-G-1.2(ST-3), *Planning and Preparing for Emergency Response to Transport Accidents Involving Radioactive Material*. 2002.

Khandan, Nirmala, *Modeling Tools for Environmental Engineers and Scientists*. December 20, 2001.

National Fire Protection Association

NFPA 1991, *Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies*. 2005.

NFPA 1992, *Standard on Liquid Splash-Protective Ensembles and Clothing for Hazardous Materials Emergencies.* 2005.

NFPA 1993,

New Mexico Department of Homeland Security and Emergency Management. *State of New Mexico All-Hazard Emergency Operations Plan*. July 2007.

National Nuclear Security Administration. NNSA Policy Letter NAP-4A, *Corporate Performance Evaluation Process for Management and Operating Contractors*.

Oak Ridge Institute for Science and Education (ORISE)

Radiation Emergency Assistance Center/Training Site.

ERPG Definitions and Background Information.

Occupational Safety and Health Administration, 55 FR 29150, *Process Safety Management of Highly Hazardous Chemicals*. July 17, 1990.

The Radiation Safety Journal, vol. 87, suppl 1, *Health Physics Considerations in Medical Radiation Emergencies*. August 2004.

University of California, Environmental Safety and Health, *Flammable Materials*. *2008.*

U.S. Congress

41 U.S.C. 254(b), "Cost or Pricing Data: Truth in Negotiations." January 3, 2007.

42 USC 7274k. "*Baseline Environmental Management Reports*. 1982.

Comprehensive Environmental Response, Compensation, and Liability Act. December 11, 1980.

Emergency Planning and Community Right-to-Know Act. October 17, 1986.

Government Performance Results Act. 1993.

Health Insurance Portability and Accountability Act of 1996. 1996.
Occupational Safety and Heath Act of 1970. 1970.

U.S. Department of Agriculture, ICS 300, *Incident Management*, lesson 5.

U.S. Department of Energy Directives (Guides, Manuals, Orders, and Policies)

DOE Guide 151.1-1, volume IV, *Program Elements*. August 1997. (Archived)
DOE Guide 151.1-1A, *Emergency Management Fundamentals and the Operational Emergency Base Program*. July 11, 2007.
DOE Guide 151.1-2, *Technical Planning Basis: Emergency Management Guide*. July 11, 2007.
DOE Guide 151.1-3, *Programmatic Elements: Emergency Management Guide*. July 11, 2007.
DOE Guide 151.1-4, R*esponse Elements: Emergency Management Guide*. July 11, 2007.
DOE Guide 151.1-5, *Biosafety Facilities: Emergency Management Guide*. July 11, 2007.
DOE Guide 414.1-1B, *Management and Independent Assessments 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 Department of Energy Oversight Policy*. September 27, 2007.
DOE Guide 414.1-5, *Corrective Action Program Guide*. March 2, 2006.
DOE Guide 420.1-1, *Nonreactor Nuclear Safety Design Criteria and Explosives Safety Criteria Guide for use with DOE O 420.1, Facility Safety*. March 28, 2000.
DOE Guide 450.3-3. *Tailoring for Integrated Safety Management Applications*. February 1997.
DOE Guide 473.2-1, *Guide for Establishment of a Contingency Protective Force*. March 27, 2003.
DOE Manual 440.1-1, *DOE Explosives Safety Manual*. January 9, 2006.
DOE Order 151.1C, C*omprehensive Emergency Management System*. November 2, 2005.
DOE Order 153.1, *Departmental Radiological Emergency Response Assets*. June 27, 2007.
DOE Order 231.1A, *Environment, Safety, and Health Reporting*. June 3, 2004.
DOE Order 414.1C, *Quality Assurance*. June 17, 2005.
DOE Order 420.1B, *Facility Safety*. December 22, 2005.
DOE Order 440.1B, *Worker Protection Program for DOE (Including the National Nuclear Security Administration) Federal Employees*. May 17, 2007.
DOE Order 452.1D, *Nuclear Explosives and Weapon Surety Program*. April 14, 2009.
DOE Order 470.4A, *Safeguards and Security Program*. May 25, 2007.
DOE Order 5400.5, *Radiation Protection of the Public and the Environment*. January 7, 1993.
DOE Order 5480.30, *Nuclear Reactor Safety Design Criteria*. March 14, 2001.

U.S. Department of Energy Directives (Handbooks and Standards)

DOE-HDBK-1046-2008, *DOE Handbook: Temporary Emergency Exposure Limits for Chemical: Methods and Practice*. August 2008.
DOE-HDBK-1122-2009, DOE Handbook: *Radiological Control Technician Training, Part 6: Radiological Control Technician Training, Site Academic Training Study Guide Phase I*. February 2009.

DOE-NE-STD-1004-92, *DOE Guideline: Root Cause Analysis Guidance Document*. February 1992. (Archived)

DOE-STD-1177-2004, *Emergency Management Functional Area Qualification Standard*. January 2004.

U.S. Department of Energy (Other References)

Office of Environment, Safety, and Health/Environmental Management, EH/EM *Hazardous Waste Activities Handbook*. June 1998.

DOE/EH-413/9713, *Glossary of Terms Related to CERCLA, EPCRA, PPA, RCRA& TSCA*. September 1997.

DOE Nevada Site Office, *FRMAC Program.*

Identifying, Reporting, and Tracking Nuclear Safety Noncompliances Under Price-Anderson Amendments Act of 1988. June 1998.

Lawrence Livermore National Laboratory, *NARAC*.

State and Local Guide, SLG 101, *Guide for All-Hazard Emergency Operations Planning*. September 1996.

Noncompliance Tracking System (NTS) Users Manual. February 6, 2006.

U.S. Department of Health and Humans Services, Food and Drug Administration. *Guidance for Industry Internal Radioactive Contamination —Development of Decorporation Agents*. March 2006.

U.S. Department of Labor, Occupational Safety and Health Administration

Incident Command System.

U.S. Department of Transportation. ERG 2008, *Emergency Response Guidebook*. 2008.

U.S. Environmental Protection Agency. *Manual of Protective Action Guide and Protective Actions for Nuclear Incidents*. May 1992.

Emergency Management Qualification Standard Reference Guide

JUNE 2009