

# **U.S. Department of Energy Orders Self-Study Program**

## **DOE O 225.1** ACCIDENT INVESTIGATION



**ALBUQUERQUE OPERATIONS OFFICE**

Change No: 0 DOE O 225.1A Level: Familiar Date: 7/24/98
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**DOE ORDER O 225.1  
ACCIDENT INVESTIGATION  
FAMILIAR LEVEL**

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**OBJECTIVES**

Given the Familiar Level of this module and the resources listed below, you will be able to:

1. State the purpose of implementing U.S. Department of Energy (DOE) Order O 225.1.
2. Define the following terms.
  - Type A investigation
  - Type B investigation
3. Identify the types of occurrences that require Type A and Type B investigations.

<p><b>Note: If you think that you can complete the practice at the end of this level without working through the instructional material and/or the examples, complete the practice now. The course manager will check your work. You will need to complete the practice in this level successfully before taking the criterion test.</b></p>
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**RESOURCES**

DOE Order O 225.1A, Accident Investigation, 11/26/97.

DOE Guide G 225.1A-1, Guide for O 225.1, Accident Investigations, 11/26/97

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## **INTRODUCTION**

In this module we will discuss the important elements of DOE Order O 225.1A and its supporting guide DOE G 225.1A-1. This Order replaces the requirements of DOE 5484.1, Paragraphs 1 through 5; 6a(1) through (10); 6b; 6d; 6f(1) through (8); and the second misnumbered 6f, and Chapters I and II. Under DOE O 225.1A, it is anticipated that contracts will be modified to meet the new Order. After the contracts have been modified, if an incident does not meet the criteria for a Type A or Type B investigation, it may have to be reported and investigated according to the Occurrence Reporting and Processing System or the Computerized Accident and Incident Reporting System according to DOE Order O 232.1 or DOE O 231.1 respectively. We have provided examples and a practice in the module to help familiarize you with the material. The practice will help prepare you for the criterion test.

Before continuing, you should obtain copies of the resources listed in this module. Copies of the Orders are available on the Los Alamos National Laboratory Website at <http://iosun.lanl.gov:1776/htmls/directives.html> or through the course manager. You should have access to these resources and be familiar with their contents. You may need to refer to these documents to complete the examples and criterion test.

## **DOE ORDER O 225.1A, ACCIDENT INVESTIGATIONS**

### **OBJECTIVES**

To prescribe requirements for conducting investigations of certain accidents occurring at DOE operations and sites; to prevent the recurrence of such accidents; and to contribute to improved environmental protection and safety and health of DOE employees, contractors, and the public.

### **REQUIREMENTS**

#### **Categorization**

DOE field elements shall categorize the type of investigation according to the algorithm in Attachment 2, to determine if a Type A or Type B investigation is required. Categorization of all Type A and Type B accident investigations shall be reported promptly to the Office of the Deputy Assistant Secretary for Oversight (EH-2). Categorization shall be made expeditiously, taking into

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account that timeliness is crucial to conducting an accurate investigation, preserving the accident scene and evidence, and identifying causal factors.

### **Notification of Other Agencies**

Public law or regulation assigns other agencies responsibility for investigating certain types of accidents that could occur at DOE facilities or as a result of DOE activities. In some cases, DOE may have a memorandum of understanding with another agency to this effect. The appointing official shall determine if applicable memoranda of understanding have been executed through Headquarters or field elements. The appointing official shall notify local agencies with which the department has memoranda of understanding or which have responsibilities or interests related to the accident under investigation. Notification of other than local agencies having agreements with Headquarters shall be made through the Office of the Deputy Assistant Secretary for Oversight.

### **Conducting the Investigation**

A Type A investigation is conducted for the more serious accidents and is appointed and managed by the Office of the Assistant Secretary for Environment, Safety and Health (EH-1). A Type B investigation is appointed and managed at the field level. However, the elements of the investigation and the report format are the same. Accident investigations categorized as either Type A or Type B shall be conducted as follows:

- Appoint the accident investigation board.
  - The appointing official shall formally appoint DOE employees to a DOE accident investigation board within three calendar days of the accident categorization. If the appointment of a Type A or Type B accident investigation board is delayed beyond three calendar days, the rationale for the delay must be documented and provided to EH-1. The board shall consist of an accident investigation board chairperson and three to six members, at least one of whom shall be a DOE accident investigator. The appointing official or his/her representative shall brief the board on their roles and responsibilities and other pertinent information within three calendar days of their appointment.
  - The board appointment shall be in writing and shall include the scope of the investigation, individuals being appointed, special provisions of the investigation,

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and a specified completion date for the final report. The scope of the investigation shall include gathering facts, analyzing causes, developing conclusions, and developing judgments of need pertaining to DOE and contractor organizations and management systems that could have or should have prevented the accident. The scope shall include all levels of the organization up to and beyond the level of the appointing official.

- The DOE accident investigation board chairperson shall:
  - a. be a DOE senior manager with demonstrated managerial competence, preferably a member of the senior executive service, or at a senior general service grade level determined to be appropriate by the appointing official;
  - b. be knowledgeable of DOE accident investigation techniques and experienced in conducting accident investigations through participation in at least one Type A or Type B investigation, or have equivalent accident investigation experience, as determined to be appropriate and documented by the appointing official; and
  - c. have attended an accident investigation course of instruction that is based on current materials developed by the Office of the Deputy Assistant Secretary for Oversight. This requirement is effective October 1, 1998.
- DOE accident investigation board members shall be DOE employees with subject matter expertise in areas related to the accident, including knowledge of the department's safety management system policy and integrated safety management system. At least one member shall be a DOE accident investigator. The board may be supported by appropriate advisors and consultants as determined by the accident investigation board chairperson. Investigative and technical expertise may be requested from the Office of the Deputy Assistant Secretary for Oversight.
- The DOE accident investigation board chairperson and members shall:
  - a. report only to the Appointing Official or his/her representative identified in the letter/memorandum of appointment during the investigation;
  - b. be independent of the direct line management chain responsible for day- to-day operation or oversight of the facility, area, or activity involved in the

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accident; and

c. not include a supervisor and his or her subordinate.

▪ Investigate the Accident

- The board shall be responsible for conducting a thorough investigation of all individuals, organizations, management systems, and facilities having a stake in or potential impact on the accident, as well as the operation or oversight of the facility, area, or activity involved in the accident, including all levels of the organization up to and beyond the level of the appointing official.
- The board shall determine the facts of the accident by examining the accident scene, examining DOE and contractor documentation, interviewing witnesses and other personnel directly associated with the accident, and performing engineering tests and analyses as appropriate. The board shall also examine policies, standards, and requirements that are applicable to the accident being investigated, as well as management and safety systems at Headquarters and in the field that could have contributed to or prevented the accident.
- The board shall analyze the facts and identify causal factors and judgments of need. The board shall ensure that all causal factors have been identified, that the conclusions are supported by the facts and analysis, and that the judgments of need are consistent with the facts and conclusions.
- The board shall evaluate the effectiveness of safety management systems, the adequacy of policy and policy implementation, and the effectiveness of line management oversight as they relate to the accident.

- \_ Before completing the investigation, the board shall conduct an internal review of the investigation process to ensure that:
  - a. all of the pertinent facts, standards, and requirements relating to the accident have been identified, a thorough analysis has been conducted, and causal factors have been determined; and
  - b. judgments of need have been stated and can be supported by the facts.

Following is a brief discussion of analytical techniques that are used in most accidents.

*Barrier Analysis* The basic premise of barrier analysis is that there is energy flow associated with all accidents. This energy may be kinetic, potential, electromagnetic, thermal, steam, other pressurized gases or liquids, or a myriad of other types of energy. It is the isolation, shielding, and control of this energy from people, property, or the environment that prevents accidents. Barriers generally fall in the following categories: equipment, design, administrative, supervisory/management, warning devices, knowledge and skills, and physical. Therefore, identifying the energy sources and the failed or deficient barriers and controls in an accident investigation provides the means for identifying the causal factors of the accident. If barriers were installed and one failed partially or totally, an investigator would examine the secondary safety systems, if any, that were in place to mitigate the failure. The investigator would also determine what events led up to and through the failure sequence, paying particular attention to changes made in the system. To accomplish this, the entire sequence of events can be broken down into a logical flow from the beginning to the end of an accident. Questions are asked about the practicality of the barriers and controls selected, why they failed, or why none were selected for use. The principal benefits of barrier analysis are that it identifies safety system elements that failed, and the results can be succinctly presented. Another benefit of barrier analysis is that the results can easily be presented graphically. A graphical flowchart can clearly and concisely portray the energy flows and failed or unused barriers that led to the accident. Thus, barrier analysis is valuable in understanding the accident and the sequence of events that led to it.

*Change Analysis* Change analysis is a systematic approach to problem-solving that can

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help identify accident causes. Change analysis is a simple, straightforward process that is relatively quick and easy to learn and apply. Change is a necessary ingredient for progress. However, changes to systems and their impact also contribute to errors, loss of control, and accidents. The purpose of change analysis is to identify and examine all changes systematically and to determine the significance or impact of the changes. The use of this technique in accident investigation is particularly well suited for finding quick answers and identifying causal factors that are not otherwise obvious. It has been demonstrated that, when problems arise for any functional system that has been operating satisfactorily, changes and differences associated with personnel, plant and hardware, or procedures and managerial controls are actual causal factors in creating these problems. Change can be thought of as stress on a system that was previously in a state of dynamic equilibrium. Change can also be viewed as anything that disturbs the planned or normal functioning of a system. Accident investigators need to carefully evaluate all the changes identified during the investigation. Did the change really cause the result, or did the change merely bring an existing system deficiency to light? The investigation must focus on the systemic deficiencies that allowed the accident to happen and not just accept the changes identified as being the sole cause of the accident. Often, change analysis will lead to further insight into areas that must be explored by other analytical techniques.

*Events and Causal Factors Charting and Analysis* Identifying systemic causal factors requires understanding the sequence of events over time and the interaction of those events and their causal factors. This sequence proceeds from an initiating event through the final loss-producing occurrence. A meticulous tracing of unwanted energy transfers and their relationships to each other and to the people, plant, procedures, and controls involved in an accident will usually reveal a definable sequence for an accident. Two basic principles are helpful in defining and understanding these sequences of events, causal factors, and energy transfers:

- Accidents result from a set of successive events that produce unintentional harm.
- The accident sequence occurs during the conduct of some work activity.

Events and causal factors charting is an integral and important part of the DOE accident

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investigation process. It is used in conjunction with other key tools to achieve optimal analytical results in accident investigation. An events and causal factors chart is a graphic representation that produces a picture of the accident: both the sequence of events that led to the accident and the conditions that were causal factors. Events and causal factors analysis is an effective means of integrating other analytical techniques into a concise and complete investigative summary. Events and causal factors analysis depicts, in logical sequence, the necessary and sufficient events and conditions for accident occurrence. It provides a systematic accident analysis tool to aid in collecting, organizing, and depicting accident information; validating information from other analytical techniques; writing and illustrating the accident investigation report; and briefing management on the results of the investigation.

*Root Cause Analysis* Root cause analysis is used in accident investigations to identify those deficiencies, including management systems factors, that, if corrected, would prevent recurrence of the accident. Root causes of an accident can be determined using numerous automated and manual techniques. A manual version of root cause analysis such as compliance/noncompliance or tier diagramming is acceptable. Commercially available automated techniques are widely used in the DOE complex. Whatever technique is used, investigators should ensure that actual root causes are determined, not just contributing causes. The contributing causes are important; however, the need to find concise and justified root causes should be the main intent of using these analytical techniques.

*Analytical Trees* An analytical tree is a graphical representation of an accident using a deductive approach (general to specific). The tree starts with the event (accident) and branches out as specific details are developed. The bottom branches of the tree can be used to identify the causal factors. There are many acceptable equivalent methods of using analytical trees, such as fault trees (computerized and manual versions), of which management oversight and risk tree (MORT) and project evaluation tree (PET) are two examples. Additional information on the application of analytical trees to accident investigations can be found in Section 7.4 of the DOE workbook "Conducting Accident Investigations."

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- Report Investigation Results
  - The board shall report investigation results without determining individual fault or proposing punitive measures. The report shall contain judgments of need based upon objective analysis of the facts, root and contributing causes, and DOE or contractor management systems that could have prevented the accident.
  - The board shall offer the facts section of the draft investigation report to the affected DOE and contractor line management to allow a review for factual accuracy prior to completion of the report.
  - Before completing the investigation, the board shall:
    - a. conduct a review of the report to ensure its technical accuracy, completeness, and internal consistency,
    - b. ensure that the report includes results from an analysis of management control and safety systems that may have contributed to the accident, and
    - c. ensure that a review of the report is conducted by qualified and authorized personnel to determine that it does not contain classified or unclassified controlled nuclear information, or information protected by the Privacy Act. Documentation that these reviews have been conducted shall be retained as part of the investigation file.
  - The board chairperson and board members shall sign and date the final investigation report and, if appropriate, include a minority opinion section should any board member wish to offer an opinion different from that of the board.
  - The board shall submit the investigation report to the appointing official for acceptance within the time frame established by the appointing official. Once the accident investigation report is accepted by the appointing official, the report is considered final, and the board is released from its responsibilities.
  
- Investigation Closeout.
  - The appointing official shall close Type A and Type B investigations after ensuring the following:

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- a. DOE and contractor line organizations affected by the investigation have had an opportunity to review the facts section of the draft report for accuracy and provide their comments to the board.
- b. A statement signed and dated by the appointing official is included in the final report accepting the investigation report, including the board's conclusions and judgments of need.
- c. The board chairperson and the Head of the Field Element have conducted a formal briefing of Headquarters and field line management, as well as the EH-1 on the outcome of the investigation.
- d. The final report is published and distributed within seven calendar days of report acceptance by the appointing official. One copy each shall be provided to the affected Secretarial Officer(s), operations office and/or field element, and appropriate Headquarters program office(s). One copy shall be provided to the Assistant Secretary for Environment, Safety and Health. One copy and an electronic version of the final report shall be provided to the Office of the Deputy Assistant Secretary for Oversight. The final report shall also be distributed to senior managers of organizations identified in the judgments of need with a request for their organizations to submit corrective action plans, nominally within 30 calendar days from report acceptance by the Appointing Official.
- e. Lessons learned from the accident investigation are developed and disseminated DOE-wide within 90 calendar days of acceptance of the investigation report by the appointing official, except for delegated Type A investigations.
- f. Corrective action plans are completed, and corrective actions are implemented to satisfy the judgments of need identified in the final investigation report.

#### **Accident Investigation Categorization Algorithm**

Accidents shall be analyzed and characterized expeditiously to determine if either a Type A or Type B investigation shall be conducted based on the criteria indicated below. Uncertainty in

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categorization shall be mutually resolved by the Office of the Deputy Assistant Secretary for Oversight and the Heads of Field Elements. All accidents not meeting the criteria for a Type A or Type B investigation shall be categorized, investigated, and reported according to the requirements of DOE O 231.1, Environment, Safety, and Health Reporting and/or DOE O 232.1, Occurrence Reporting and Processing of Operations Information. Investigations required by these Orders may provide indicators of future, more severe accidents, which when identified and corrected early can prevent more serious accidents.

Onsite accidents meeting the Type A or Type B criteria involving Federal or contractor employees driving government or personal vehicles while on official government business shall be investigated unless the Head of the Field Element requests and receives a waiver from EH-1.

Offsite accidents meeting the Type A or Type B criteria involving Federal or contractor employees driving government-owned or rented vehicles shall not be investigated unless the Head of the Field Element determines an investigation is appropriate based on circumstances surrounding the accident or the potential for significant lessons learned. The following categorization criteria shall apply to any accident resulting from DOE, its contractor, or subcontractor operations.

## HUMAN EFFECTS

Accidents requiring Type A investigations include any of the following.

- Any injury or chemical or biological exposure that results in, or is likely to result in the fatality of an employee or member of the public.
- Any accident where three or more DOE, contractor, or subcontractor employees, or members of the public incur a serious injury that requires hospitalization for more than 48 hours, commencing within 7 calendar days from the date the injury was received; results in severe hemorrhages; results in severe damage to nerves, muscles, tendons, or internal organs; results in second or third degree burns affecting more than 9 percent of the body surface; or has a high probability of realizing a permanent total disability due to injuries, chemical exposures, or biological exposures received.
- A single individual radiation exposure resulting in: a total effective dose equivalent of 25 rem or more; a dose equivalent to the lens of the eye of 75 rem or more; a shallow dose equivalent to an extremity or skin of 250 rem or more; the sum of the deep dose equivalent for external exposure and the committed dose equivalent to any organ or tissue other than the lens of the eye of 250 rem or more; or a dose equivalent to the embryo or fetus of a declared pregnant worker of 2.5 rem or more.

Accidents requiring Type B investigations include any of the following.

- Any accident that results in the hospitalization of one or more DOE, contractor, subcontractor employees or members of the public for five continuous calendar days or longer due to serious, occupational illness, chemical exposure, or biological exposure.
- Any one accident resulting in five or more lost-workday cases.
- A series of accidents involving five or more lost-workday cases occurring within a one- year time period that involve identical or similar facilities, systems, equipment, materials, or procedures. This criterion is intended to cover injuries, illnesses, and exposures that reveal a pattern and cause for concern.
- A single radiation exposure to an individual that results in: a total effective dose equivalent of at least 10 rem but less than 25 rem; a dose equivalent to the lens of the eye of at least 30 rem but less than 75 rem; a shallow dose equivalent to an extremity or skin of at least 100 rem but less than 250 rem; the sum of the deep dose equivalent for external exposure and

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the committed dose equivalent to any organ or tissue other than the lens of the eye of at least 100 rem but, less than 250 rem; or a dose equivalent to the embryo or fetus of a declared pregnant worker of at least 1 rem but less than 2.5 rem.

#### ENVIRONMENTAL EFFECTS

Accidents requiring Type A investigations include any of the following.

- Release of a hazardous substance, material, waste, or radionuclide from a DOE facility in an amount greater than five times the reportable quantities specified in 40 CFR Part 302, that results in serious environmental damage.

Accidents requiring Type B investigations.

- Release of a hazardous substance, material, waste, or radionuclide from a DOE facility in an amount equal to or greater than two times but less than five times the reportable quantities specified in 40 CFR Part 302, that results in serious environmental damage.

#### PROPERTY EFFECTS

Accidents requiring Type A investigations include any of the following

- Estimated loss of, or damage to, DOE or other property, including aircraft damage equal to or greater than \$2.5 million or requiring estimated costs equal to or greater than \$2.5 million for cleaning, decontaminating, renovating, replacing, or rehabilitating structures, equipment, or property.
- Any apparent loss, explosion, or theft involving radioactive or hazardous material under the control of DOE, contractors, or subcontractors in such quantities and under such circumstances to constitute a hazard to human health and safety or private property.
- Any unplanned nuclear criticality.

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Accidents Requiring Type B Investigations include any of the following.

- Estimated loss of, or damage to, DOE or other property of less than \$2.5 million but more than \$1 million, including aircraft damage, and costs of cleaning, decontaminating, renovating, replacing, or rehabilitating structures, equipment, or property.
- The operation of a nuclear facility beyond its authorized limits resulting in the consequences identified in the criteria for human, environmental, or property effects.

Cost estimates of accidents requiring Type A or Type B investigations.

When estimating the cost of an accident, the methods in DOE Guide 430.1-1, Cost Estimating Guide, should be used.

#### OTHER EFFECTS

Accidents requiring Type A investigations include any accident or series of accidents for which a Type A investigation is deemed appropriate by the Secretary or the Assistant Secretary for Environment, Safety and Health.

Accidents requiring Type B investigations include any accident or series of accidents for which a Type B investigation is deemed appropriate by the Secretary; Assistant Secretary for Environment, Safety and Health; Associate Deputy Secretary for Field Management; Cognizant Secretarial Officer; or Head of the Field Element. This includes, for example, departmental crosscutting issues and issues warranting the attention of local news or interest groups.

<b>Note: You do not have to do Example 1 on the following pages, but it is a good time to check your skill and knowledge of the information covered. You may do the Example 1 or go to the practice.</b>
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### EXAMPLE 1 SELF-CHECK

1. State the purpose of implementing DOE Order O 225.1.  
To prescribe requirements for conducting investigations of certain accidents occurring at Department of Energy (DOE) operations and sites; to prevent the recurrence of such accidents; and to contribute to improved environmental protection and safety and health of DOE employees, contractors, and the public.
2. List the three steps required to complete an accident investigation.
  - Appoint the accident investigation board.
  - Investigate the accident.
  - Report investigation results.
3. Differentiate between Type A and Type B investigation teams  
A Type A investigation is conducted for more serious accidents and is appointed and managed by the Office of the Assistant Secretary for Environment, Safety, and Health. A Type B investigation is appointed and managed at the field level.





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**DOE ORDER O 225.1A  
ACCIDENT INVESTIGATION  
GENERAL LEVEL**

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**OBJECTIVES**

Given the Familiar Level of this module, and a scenario, you will be able to perform the following:

1. List the key elements you would look for in the contractor's action plan to correct the situation described in the scenario; and
2. State which requirements, sections, or elements of U.S. Department of Energy (DOE) Order O 225.1A apply to the situation described in the scenario.
3. Determine if the accidents were categorized correctly.

<p><b>Note: If you think that you can complete the practice at the end of this level without working through the instructional material and/or the examples, complete the practice now. The course manager will check your work. You will need to complete the practice in this level successfully before taking the criterion test.</b></p>
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**RESOURCES**

DOE Orders Self-Study Program, DOE Order O 225.1, Familiar Level, 7/24/98.

DOE Order O 225.1A, Accident Investigation, 11/26/97.

DOE Guide G 225.1A-1, Guide to DOE Order O 225.1A, 11/26/97.

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## **INTRODUCTION**

The Familiar Level of this module introduced the purpose and scope of DOE Order O 225.1A. Several definitions and the requirements associated with the Order were discussed. In the General Level of this module, students are asked to apply the information contained in the Familiar Level and the Order to a scenario related to the Order. Please refer to the resources listed on the previous page to make your analysis and answer the questions. You are not required to complete the example. However, doing so will help prepare you for the practice and criterion test.

<b>Note: You do not have to do the example on the following page, but it is a good time to check your skill and knowledge of the information covered. You may do the example or go on to the practice.</b>
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## EXAMPLE SCENARIO

Please review the following scenario, and then answer these questions.

1. Is the contractor's action plan correct? If not, state what should have been done.
2. Were the correct DOE documents or requirements cited? If not, state the correct documents or requirements.
3. Was the accident correctly categorized? (Type A or Type B investigation)

## SCENARIO

On February 13, 1997, an employee received severe burns while performing a cutting/welding operation to remove a converter from Building K-33. The work involved the removal of six converters scheduled to be shipped to Portsmouth and/or Paducah as spare parts. Although the cell's roof was removed, the lighting in the cell was very poor, and temporary lighting was installed. The physical layout of the equipment in the cell required the welders to work in a constricted space, with very difficult ingress and egress.

At the time of the accident, the welder was wearing multiple layers of clothing that were not flame-retardant and radiological protective equipment that limited his ability to detect and extinguish the flames quickly.

Although the facility's procedure requires a fire watch to be present during welding or cutting operations outside an approved shop area, a fire watch was not designated on permits for the work performed on the day of the accident. A fire watch is a designated individual trained in monitoring the work site for possible fires during welding/cutting activities and for 30 minutes after the work has stopped. Reviews of three previous permits available for work in the cell revealed that two did not have a fire watch identified.

First aid was administered to the employee at the scene and then he was transported to the hospital and placed in the intensive care unit.

On February 14, 1997, the family informed the facility that the injured employee had passed away.

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A Type B investigation was conducted and revealed the following.

- There are some urgent policy issues with respect to flame-retardant clothing and fire-watch responsibilities that have to be addressed as a result of this accident.
- The overarching concern stemming from this investigation is the failure to conduct adequate work planning and hazards analyses. Part of this failure may be because of complacency expressed by line management who believe structured work planning is not necessary because “this is a job we have performed thousands of times before.”
- Another contributor to poor work planning in DOE may be the assumption that such activities require very elaborate analysis of the hazards and preparation of a thick report. None of these reasons are accurate, nor do they reflect the policy or guidance the department has promulgated to date.

Actions taken by contractor.

- The area was secured to preserve the accident scene pending completion of the investigation.
- Nonessential welding, burning, and hotwork activities outside approved fixed weld shops was placed in a stand-down mode immediately.
- The fire and health protection standard was revised to reflect an additional responsibility for employees designated as fire watchers. Fire watchers were directed to maintain a line of sight of welders during field activities.
- The training module for fire watchers was revised.
- The Assistant Secretary of Energy for Environmental Management directed the manager to prepare a video on the lessons learned from the accident.

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DOE requirements that apply to this scenario are:

- DOE field elements shall categorize the type of investigation according to the algorithm in Attachment 2 to determine if a Type A or Type B investigation is required. (DOE Order O 225.1, paragraph 4.a.)
- The accident investigation board shall be responsible for conducting a thorough investigation of all individuals, organizations, management systems, and facilities having a stake in or potential impact on the accident. [DOE Order O 225.1A, paragraph 4.c. (2) (a)]
- The board shall analyze the facts and identify causal factors and judgments of need. [DOE Order O 225.1A, paragraph 4.c.(2)(c)]

Take some time to review the example scenario and the actions the contractor took or didn't take to correct the situation. Then decide if the contractor's actions were complete and correct; determine if the requirements cited in the scenario were appropriate; and determine if the situation was classified correctly.

Write your answers below and then compare your answer to the one contained in the example self-check.

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### EXAMPLE SELF-CHECK

Your answer does not have to match the following exactly. You may have added more corrective actions or cited other requirements from the Order that apply. To be considered correct, your answer must include at least the following.

The contractor took all the appropriate actions. However, some additional actions should have been taken.

- Work planning procedures should be revised to account for nonroutine work. Improper classification of work (i.e., routine vs nonroutine) can lead to a failure to adequately identify hazards.
- Pre-job hazard screening and analysis procedures should be developed. An integrated, tailored, pre-job hazard screening and analysis, based upon the risks and complexity of work activity, is an integral component of an effective work planning process designed to ensure that potential and known hazards are identified and controlled.
- The policies regarding flame-retardant clothing and appropriate personal protective equipment should be reviewed for welding/cutting operations.

The DOE requirements cited were correct. One additional requirement should be mentioned. Any injury that results in a fatality should be categorized as an accident requiring a Type A investigation.

The scenario stated that a Type B investigation was conducted. A Type A investigation is required for a fatality.

**(Reference: DOE Order O 225.1A, Attachment 2)**

## **PRACTICE**

This practice is required if your proficiency is to be verified at the General Level. The practice will prepare you for the criterion test. You will need to refer to the Orders and the implementation guide to answer the questions in the practice correctly. The practice and criterion test will also challenge additional analytical skills that you have acquired in other formal and on-the-job training.

Please review the following scenario and answer the following questions.

1. Were the conclusions and judgements of need presented by the board correct and complete? If not, what should else should be considered?
2. Was the list of requirements, sections, and elements complete and correct? If not, state the correct or omitted requirements.
3. Was the accident classified correctly? (Type A or Type B investigation)

## **SCENARIO**

On May 7, 1997, an ironworker was injured when he was pinched between two large, steel I-beams. The accident occurred when the ironworker, an ironworker supervisor, and a crane operator rigged one of the columns in preparation for placing it on a deck. The workers were lowering the column temporarily to adjust the rigging sling. The column was setting on a protruding gusset on one end and settling on dunnage on the other end when the ironworker stepped between it and another column. The column they were lowering rolled toward the ironworker, pinching his pelvis between the two columns. The load was lifted immediately, but the ironworker's pelvis was fractured.

An investigation of the situation revealed the following conclusions and judgments of need.

- All personnel involved in the accident had extensive construction experience. This included the injured worker, his coworkers, the ironworker supervisor, and the structural superintendent.
- The injured ironworker did not attend the required job safety analysis training.
- This accident occurred one day after a carpenter on the same project was injured during a fall. The carpenter was protected by his safety harness and lanyard, but was knocked

momentarily unconscious when he hit his head during the fall. The carpenter was dismantling some shoring at the time of the accident.

- Most of the contractor personnel interviewed by the board believed the columns were too close for welding and rigging operations. The injured ironworker had noted this but said nothing to his supervision or management. Another ironworker said that he had mentioned his concern to the ironworker supervisor, but action had not been taken.
- The workers involved in the accident told the board they recognized the dunnage used to support the weight of the columns was inadequate. The safety professionals reached the same conclusion.
- The workers involved in the accident told the board that staffing of the rigging operation was inadequate. In particular, the ironworker supervisor was filling the roles of designated leader, signaler, and rigger. The Hoisting and Rigging Manual do not prohibit the designated leader from serving other functions. However, the board concluded he could not serve effectively in all three roles.
- The ironworker supervisor did not follow the training requirements of the Hoisting and Rigging Manual and failed to ensure workers understood how to properly rig the column.
- The job safety analysis did not address the specifics of the rigging operation and did not require mitigation of the hazards. The board concluded that task safety analysis was less than adequate.
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#### Actions taken by contractor

- The load was pulled immediately from the injured ironworker and the crane operator sounded his horn.
- The injured ironworker received immediate attention from his coworkers, one of whom called 911.
- Management judged the columns in the laydown area were unsafe. They ordered the columns to be moved so they were all set on dunnage and appropriately spaced. While some stabilization of the material may have been in order, the board concluded the accident scene was unnecessarily disturbed by this action.
- The manager directed a Type A accident investigation be conducted. This decision was based on the requirement of DOE Order 225.1, Accident Investigations, Attachment 2,

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Section 2.b.(1), which requires a Type A investigation for any accident resulting in hospitalization of one or more employees for more than five days.

Requirements related to this scenario.

- DOE field elements shall categorize the type of investigation according to the algorithm in Attachment 2 to determine if a Type A or Type B investigation is required. (DOE Order O 225.1, paragraph 4.a.)
- The accident investigation board shall be responsible for conducting a thorough investigation of all individuals, organizations, management systems, and facilities having a stake in or potential impact on the accident. [DOE Order O 225.1A, paragraph 4.c.(2) (a)]
- The board shall analyze the facts and identify causal factors and judgments of need. [DOE Order O 225.1A, paragraph 4.c.(2)(c)]

Take some time to review the scenario and the actions the contractor took or didn't take to correct the situation. Then decide if the contractor's actions were complete and correct; determine if the requirements, sections, or elements of DOE Order O 225.1A cited in the scenario were correct; and determine if the accident was categorized correctly as requiring a Type A or Type B investigation.

Write your answer below and on the next page and then bring the completed practice to the course manager for review.

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Write your answer here.

**Note: The course manager will check your practice and verify your success at the General Level. When you have successfully completed this practice, the course manager will give you the criterion test.**