

DOE Accident Investigation Program

Electronic Reference Tool



January 2011



DOE Accident Investigation Program Electronic Reference Toolbox

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CHAPTER I. THE DOE ACCIDENT PREVENTION AND INVESTIGATION PROGRAM INTRODUCTION

DOE Order (DOE O) 225.1B, *Accident Investigations*, prescribes organizational responsibilities, authorities, and requirements related to the Department's accident investigation program. The purpose of the Reference is to explain the requirements addressed in the Order and provide guidance regarding acceptable methods for implementing those requirements. The approach to investigations described in the Reference is similar to and consistent with methods used by other government agencies and private industry.

It provides an organized and proven methodology for effectively and efficiently conducting accident investigations.

This E-Reference provides advice to the conduct, support, and follow-up of accident investigations. To the extent the requirements of DOE O 225.1B are incorporated into appropriate contractual documents, DOE contractors and subcontractors will also find it useful in meeting support requirements for accident investigations.

This E-Reference most widespread application is for use by Appointing Officials, Accident Investigation Board (AIB) Chairpersons, Board members, and designated Headquarters and Field points of contact who must implement the requirements of DOE O 225.1B in conducting or supporting accident investigations.

DOE, DOE contractor managers, and site readiness teams will find the E-Reference useful in understanding DOE's accident investigation approach and their associated responsibilities. It is also useful to DOE contractors and subcontractors who support accident investigations and DOE line management who must develop corrective action plans for follow-up to investigations.

The E-Reference discusses information on the Department's expectations in meeting DOE O 225.1B; the E-Reference does not introduce or impose any new requirements. Users of this E-Reference have the latitude to choose whether and how to apply the procedures, methodologies, and techniques discussed in the E-Reference.

Alternative approaches and methods that implement the requirements of DOE O 225.1B are acceptable; however, this E-Reference provides proven methods for successfully conducting and reporting effective, comprehensive investigations.

The E-Reference contains general suggested approaches for categorizing accidents, establishing accident investigation Boards, and conducting and reporting accident investigations,



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investigation closure, and post-investigative activities. Roles and responsibilities for Appointing Officials, Board Chairpersons, Board members, and Field points of contact are also addressed.

Accident investigation advice, reflected in this Reference and DOE O 225.1B, involve streamlining and simplifying the process. The investigative process and the resulting report development should be conducted in a timely and efficient manner. The focus is on what happened, why it happened, and how similar accidents can be prevented.

Emphasis should be placed on the possible contributory roles of management systems, human performance, and organizational weaknesses, as root causes of accidents, where appropriate, and on the application of or failure to apply the components of DOE's safety management system. This system is described in DOE Policy (DOE P) 450.4, *Safety Management System Policy*, the *DOE Plan for the Development and Implementation of Integrated Safety Management*, and DOE P 411.1, *Safety Management Functions, Responsibilities and Authorities Policy*.

Accident investigation reports are designed to concisely convey key information in an easily understandable format, providing useful information and insight that can help prevent future accidents.



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CHAPTER II. PROGRAM OVERVIEW ROLES AND RESPONSIBILITIES

1.0 WHAT ARE THE OBJECTIVES OF THE DOE ACCIDENT INVESTIGATION PROGRAM?

The objectives of the accident investigation program are:

- Understand and identify the causes (both individual and organizational) that contributed to the accident so those deficiencies can be addressed and corrected.
- Prevent the recurrence of accidents and promote mission accomplishment.
- Contribute to improving environmental protection and enhanced safety and health of DOE employees, contractors, and the public.
- Reduce accident fatality rates and promote a downward trend in the number and severity of accidents.
- Promote the values and concepts of a learning organization.

Preventing accidents and reducing lost time and fatalities due to accidents are line management's responsibility. The accident investigation program provides useful, timely, and needed information to managers in the DOE complex to assist them in meeting these responsibilities.

To accomplish these objectives, the accident investigation process must enable the Department to respond with speed, accuracy, focus, and brevity. The results of accident investigations can help managers eliminate underlying causes and prevent similar accidents across the complex.

However, to achieve maximum benefit, accident investigations need to be convened rapidly, staffed and supported adequately, focused on pertinent and essential facts and causation, conducted accurately and thoroughly, concluded quickly, and reported clearly and concisely.

Analytical techniques used to draw conclusions and to establish causes must be valid, appropriate, and easy to use. Finally, sound Judgments of Need (JON) promote better safety practices, address systemic problems, and, when implemented, help prevent future occurrences.



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A detailed technical discussion regarding the application of these techniques may be found in the Accident Investigation Workbook at:

<http://www.hss.doe.gov/csa/csp/aip/workbook/toc.html>.

2.0 HOW IS THE OVERALL PROGRAM MANAGED?

The responsibility of each DOE/NNSA Heads of Headquarters Elements is to have the resources to support accident investigations in place. The HSS Accident Investigation Program Manager (referred to throughout the E-Reference as the “program manager”) is assigned responsibilities for day-to-day management of the program to assist the DOE/NNSA Heads of Headquarters Elements in meeting their responsibilities to implement the program requirements.

The HSS Accident Investigation Program Manager responsibilities include, but are not limited to:

- Developing Departmental policy and maintaining program guidance.
- Coordinating the program with Headquarters and field element points of contact.
- Maintaining program-related resource databases.
- Providing or identifying acceptable program-related training materials to points of contact.
- Analyzing and trending data from past accidents.
- Reviewing and providing comments on corrective action plans.
- Assisting in developing and disseminating lessons learned to the Department for accident investigations.
- Assisting in the selection, appointment, support, training, qualification, and other activities of AIBs.
- Evaluating and advising the appointing authority on requests for waivers for investigations.

3.0 WHAT ARE THE ROLES AND RESPONSIBILITIES?

DOE O 225.1B establishes requirements and responsibilities for the Chief Health, Safety and Security Officer, the Heads of Headquarters Elements, Heads of Field Elements, Appointing Officials, AIBs, and DOE/NNSA contractors, who must collectively



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implement the DOE accident investigation program. Responsibilities for Appointing Officials are discussed in detail in Chapter III of this E-Reference.

One of the most important responsibilities of Appointing Officials is to ensure that Boards understand they have the authority and responsibility to review BOTH DOE and CONTRACTOR management systems, policies, and line management oversight processes up to and beyond the level of the Appointing Official as possible root causes of the accident. This emphasis should be included in the briefing given to the Board before they begin the investigation.

The typical process flow of an Accident Investigation is:

1. Accident Occurs
2. Initial Reporting and Categorization by DOE/NNSA Field Office
3. Site Readiness Team responds, secures scene, protects evidence
4. HQ Appointing Official Selects Board Chairperson and Members
5. Board Arrives at Accident Scene
6. Board Chairperson Takes Responsibility for accident scene
7. Board Members collect, preserve, and verify evidence
8. Board Members integrate, organize, and analyze evidence
9. Board Members evaluate causal factors using an Integrated Safety Management, standards and requirements template
10. Board Members develop conclusions and JONs
11. Board Members conduct factual verification analysis of conclusions
12. Board Members prepare draft report
13. Board and Site Organization conducts factual accuracy review
14. Board Members finalize draft report
15. Board Chairperson conducts briefing
16. Appointing Official accepts report



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The Heads of Headquarters Elements assesses the significance of occurrences, incidents, and accidents in terms of their potential impact on Department-wide safety. Alternatively, if the Heads of the Headquarters Elements and HSS agree that it is in the best interest of DOE, HSS will serve as the Appointing Official.

This assessment may include an evaluation of the hazards involved, potential Department-wide implications of lessons learned, potential for safety improvement, potential presence of previously unrecognized hazards, potential public concern, and accident complexity.

Significant responsibilities of Heads of Headquarters Elements include serving as the Appointing Official for accident investigations and maintaining a staff of qualified personnel to serve in the capacity of Chairperson and DOE Accident Investigators. Heads of Field Elements must ensure that DOE and contractor organizations under their purview are trained and are prepared to effectively carry out initial investigative actions, such as preserving the accident scene and other evidence, obtaining initial witness statements, and assisting AIBs, as well as developing and implementing corrective action plans to address Judgments of Need identified by an AIB.

The AIB should ensure that its activities include gathering appropriate factual information and sufficient data to determine the impact of policy, organizational structure, management systems, and line management oversight processes on the accident. Data analysis should address these considerations as possible root or contributing causes to the accident. The Board Chairperson is responsible for ensuring the investigation is objective and is broad enough to identify and report on root causes.

4.0 WHAT IS THE TYPICAL ACCIDENT INVESTIGATION PROCESS/CYCLE?

The concept for accident investigations calls for an investigation cycle that begins with the date of Board appointment and ends with submission of the accident investigation report to the Appointing Official. The nature and complexity of the circumstances surrounding an accident will ultimately dictate the length of the investigative process.

Week one (on site) will be spent collecting data about the accident, with priority given to conducting interviews. Any testing requirements (engineering, physical, chemical, metallurgical, toxicological, destructive, nondestructive) will be identified and conducted as needed. Some analysis of collected information will occur, as will some preliminary writing. Week two (on site) will also be devoted primarily to data collection, with additional emphasis and time devoted to information analysis and preliminary writing.



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Table 1: The Time Line for an Accident Investigation Requires Conducting Multiple Simultaneous Tasks.

Time Frame *	Activities
Week 1	Collecting evidence, conducting interviews, conducting tests (engineering, chemical, nondestructive, etc.), initiating analysis, and beginning development of the report.
Week 2	Further collection of data, more in-depth analysis, and report writing by the Board.
Week 3	Additional interviews, data analysis, and report writing. Additional data collection as needed to fill gaps identified in analyses. Factual accuracy check by site DOE and contractor line management. At end of the week, the Board briefs site DOE and contractor line management on facts, conclusions, and Judgments of Need.
Week 4	Report completion, editing, and formatting; report review by Office of Corporate Safety Programs; report submittal to the Appointing Official.

Week three (on site) will be devoted primarily to data analysis and writing a final draft report; follow up data collection as necessary; and a review of the factual portion of the draft report by site DOE and contractor line management personnel. Also, the Office of Corporate Safety Programs (HS-30) will review the report and provide comments to the Board Chairperson on behalf of the Chief Health, Safety and Security Officer (HS-1). After this review and resolution of comments, all Board members will sign the report. By the end of the week, the Board may brief the responsible line managers at the site of the accident on the conclusions of the investigation. This briefing is at the discretion of the Board Chairperson.

Week four typically is devoted to final report editing and formatting. After the report is prepared, it needs to be submitted for a quality review to the HSS Accident Investigation Program Manager. The turnaround is typically 24-48 hours. This review needs to occur before report acceptance by the Appointing Official. Comments are electronically provided to the Appointing Official.

It should be noted that, if an incident does not meet the criteria for an investigation, it may have to be reported and be subject to a “Contractor lead” investigated in accordance with the Occurrence Reporting and Processing System (ORPS) or the Computerized Accident and Incident Reporting System (CAIRS), as appropriate.



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5.0 HOW DO WE DETERMINE OR CATEGORIZE AN OCCURRENCE IF AN ACCIDENT INVESTIGATION TO BE CONDUCTED?

DOE O 225.1B, Attachment 2, *Accident Investigation Criteria* contains the criteria for determining whether an accident should be categorized as an accident investigation.

The Heads of Headquarters Elements and Field Elements are jointly responsible for TIMELY categorizing all accidents to determine whether an investigation is required.

Not properly or TIMELY categorizing an accident can result in wasted resources (over-categorization), failure to secure vital evidence, or the failure to prevent similar or more serious accidents because of unresolved or unidentified causes (under-categorization). Therefore, it is important for Heads of Headquarters Elements to make accurate categorizations.

The use of best judgment in applying categorization is acceptable, provided that the rationale is documented. Uncertainty as to proper categorization should be mutually resolved by the Heads of Headquarters Elements and the HSS Accident Investigation Program Manager.

This categorization and subsequent initiation of an accident investigation should be made expeditiously, taking into account that timeliness is crucial to conducting an accurate investigation, preserving the accident scene evidence, and identifying causal factors.

LIST 1

DOE O 225.1B ATTACHMENT 2 - ACCIDENT INVESTIGATION CRITERIA

1. DETERMINATION CRITERIA.

Accidents must be analyzed expeditiously, as indicated in Section 4.a of the Order, to determine whether an AIB must be appointed based on the criteria indicated below.

a. HUMAN EFFECTS.

- (1) 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. Fatal injury is defined as any injury that results in death within 30 calendar days of the accident.
- (2) Any single accident that results in the hospitalization for more than five calendar days, commencing within seven calendar days of the accident, of one or more DOE, contractor, or subcontractor employees or members of the public due to serious personal injury. Serious personal injury means any injury that: (1) results in a fracture of any bone (except simple fracture of fingers, toes, or nose); (2) causes severe hemorrhages or nerve, muscle,



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or tendon damage; (3) involves any internal organ; or (4) involves second or third degree burns or any burns affecting more than 5 percent of the body surface.

- (3) Any single accident resulting in three or more DOE, contractor, or subcontractor employees having lost-workday cases.
- (4) Accidents involving Federal or contractor employees driving vehicles while on official Government business, on or off Government property, must be investigated by an AIB if the consequences result in meeting any of the criteria above.

b. LOSS OF CONTROL OF RADIOACTIVE MATERIAL

Categorization must be made within 72 hours of any radiation exposure to ascertain whether any single accident that results in:

- (1) A general employee, exceeding any of the limits in 10 C.F.R. Part 835.202, *Occupational Dose Limits for General Employees*, or Part 835.206, *Limits for the Embryo/Fetus*, by a factor of two or more.
- (2) The embryo/fetus of a declared pregnant worker, a minor, or a member of the public in a controlled area exceeding an external dose of 1 rem effective dose.
- (3) Any confirmed monitoring result (workplace or individual) indicating an intake (via inhalation, ingestion, wound or absorption) of radioactive material by a general employee equivalent to 2 or more times the annual limit on intake (ALI).
- (4) Any confirmed monitoring result (workplace or individual) indicating an intake of radioactive material to a declared pregnant worker; a minor; or a member of the public in a controlled area equivalent to 20% or more of an ALI.

Notes:

- (a) Dose thresholds for the embryo/fetus apply after declaration of pregnancy.
- (b) Confirmation must be made within 3 working days following identification of monitoring results (workplace or individual monitoring) indicating an exposure exceeding one or more of the criteria in this section.



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- (c) Monitoring results are those obtained prior to medical intervention to reduce or otherwise mitigate dose.
- (d) ALIs for an inhalation are 10 C.F.R. Part 835 Appendix A values, in uCi/ml, multiplied by 2.4×10^9 ; ALIs for ingestion are ingestion dose coefficients from ICRP Publication 68; ALIs for wounds should use dose coefficients published in a consensus or refereed report;
- (e) Planned special exposures (10 C.F.R. Part 835.204) or authorized emergency exposures (10 C.F.R. Part 835.1301) to general employees are excluded.
- (f) “Confirmed” means a monitoring result confirmed by follow-up radiobioassay, by association with a known incident, or by investigation.

c. ENVIRONMENTAL RELEASE OF HAZARDOUS MATERIAL.

- (1) An accident that resulted in the release of a hazardous material from a DOE facility (on site or off site), in an amount greater than five times the reportable quantities specified in 40 C.F.R. Part 302, *Designation, Reportable Quantities, and Notification*, that results in serious environmental damage.
- (2) An accident that resulted in the release of a hazardous material from a DOE facility (on site or off site) that meets the criterion for classification as a Site Area or General Emergency in DOE Order 151.1C, *Comprehensive Emergency Management System*.
- (3) Any offsite transportation incident involving hazardous materials that would require immediate notice pursuant to 40 C.F.R. Part 302.
- (4) For facilities covered by 29 C.F.R. Part 1910.119, *Process Safety Management of Highly Hazardous Chemicals*, an incident that resulted in, or could reasonably have resulted in, a catastrophic release of a highly hazardous chemical in the workplace.

d. PROPERTY EFFECTS.

- (1) Estimated loss of or damage to DOE or other property, including aircraft, 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 property. DOE facility damage is estimated within 72 hours of the accident based on comparison with the facility



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replacement value in the Facility Information Management System database maintained by the Headquarters Office of Administration, Office of Engineering and Construction Management.

(2) Any unplanned nuclear criticality.

e. OTHER EFFECTS.

(1) Any accident or series of accidents for which an investigation is deemed appropriate by the Secretary or Deputy Secretary. In such circumstances, the Secretary or Deputy Secretary may direct the Head of the Headquarters Element to conduct an accident investigation.

6.0 HOW DO WE PERFORM DELEGATIONS?

The Heads of Headquarters Elements must consider the criteria identified in DOE O 225.1B, Appendix A, the value of the knowledge to be gained by conducting the investigation, and other relevant factors, to determine whether an AIB must be appointed. This determination must be made expeditiously, taking into account that timeliness is crucial to conducting an accurate investigation, preserving the accident scene and evidence, and identifying causal factors (see Appendix B, Definitions). The Heads of Headquarters Elements must document the determination and immediately notify HSS of the determination whether to appoint or not appoint an AIB. If the Chief Health, Safety and Security Officer does not concur with rationale for not appointing an AIB, the Chief may elevate the matter for resolution by the Deputy Secretary.

7.0 HOW SHOULD WE NOTIFY OTHER FEDERAL AGENCIES OR DEPARTMENTAL ELEMENTS?

DOE O 225.1B requires that other Federal agencies be notified whenever an accident occurs at a DOE facility requiring such notification by public law, regulation, or memoranda of understanding. Public laws or regulations assign other agencies responsibility for investigating certain 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 Federal or State agency to this effect. The Appointing Official must determine whether applicable memoranda of understanding have been executed, ascertain investigative jurisdiction prior to the appointment of an AIB and, as appropriate, ensure that notifications are made in accordance to these agreements (or other requirements). The Appointing Official shall notify Federal and local agencies with which the Department has memoranda of understanding and which have responsibilities or interests



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related to the accident under investigation. The following should be considered for notification:

- The National Transportation Safety Board for accidents meeting the criteria of 49 C.F.R. Part 830.
- The DOE Nuclear Emergency Search Team for assisting in locating lost nuclear materials. This includes accidents involving aircraft, rail transportation, and motor vehicles.
- The Nuclear Regulatory Commission (NRC) for accidents meeting the criteria for facilities licensed under the NRC or agreement states. These include nuclear reactors, nuclear materials processing facilities, and nuclear materials storage facilities.
- The Mine Safety and Health Administration for mining or tunnel accidents meeting the criteria of 30 C.F.R. Part 55, 30 C.F.R. Part 56, or 30 C.F.R. Part 57. These include accidents at the Waste Isolation Pilot Project (WIPP) facility, the former Superconducting Super Collider Project, or the Weeks Island Salt Dome crude oil storage facility.
- The Occupational Safety and Health Administration (OSHA) for accidents meeting the criteria of 29 C.F.R. Part 1960. These cover a broad range of construction, operations, and maintenance activities at DOE facilities.
- The Environmental Protection Agency for accidents involving pollution of air, water, or land under the Comprehensive Environmental Response, Compensation and Liability Act, Section 104 and the Clean Air Act, Sections 103, 112, 114, and 307.
- Federal Communications Commission for accidents involving licensed radiofrequency transmitting facilities.
- United States Coast Guard for water transportation-related accidents.
- Food and Drug Administration for accidents related to food and drug services.
- The Defense Nuclear Facilities Safety Board for accidents occurring at or affecting defense nuclear facilities.



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8.0 HOW SHOULD A BOARD BE STAFFED, AND WHAT ARE MEMBERS QUALIFICATIONS AND TRAINING REQUIREMENTS?

Federal employees acting as Board Chairpersons or members may be subject to the Department's Technical Qualification Program (see DOE O 360.1B, *Federal Employee Training*). It is a local decision whether Federal staff at Headquarters or in the field, who may be Board Chairpersons or members, fall under this program. If so, the necessary competencies should be determined and added to the pertinent qualification standard in the employees' organizations; Board Chairpersons or members should also demonstrate acceptable experience, education, and skills to meet qualification standards in accordance with local procedures, as applicable and as defined in DOE O 225.1B.

The AIB must be familiar with accident investigation techniques and must have sufficient skills and knowledge, either through Board members or advisors and consultants, to evaluate: (1) the effectiveness of management systems, as defined in DOE P 450.4, *Safety Management System Policy* (there should be requisite knowledge on the Board of the Department's Integrated Safety Management System and its components); (2) the adequacy of DOE policy and policy implementation; and (3) how line management oversight responsibilities are executed, all as related to the accident.

Board Chairpersons must:

- Be a DOE manager with demonstrated managerial competence, preferably be a member of the Senior Executive Service, or at a senior general service grade level determined to be appropriate by the Appointing Official; and
- Be knowledgeable of DOE accident investigation techniques and experienced in conducting accident investigations through participation in at least one Federal accident investigation, or have equivalent accident investigation experience as determined to be appropriate and documented by the Appointing Official.

Board members must be:

- DOE Federal employees
- Subject matter experts in areas related to the accident.

At least one Board member must be a DOE accident investigator and must have participated in at least one accident investigation. At least one Board member or consultant/advisor must be knowledgeable in evaluating management systems (i.e., have demonstrated understanding and experience in applying and evaluating safety management system components as defined in DOE P 450.4 and DOE P 411.1, *Safety Management Functions, Responsibilities, and Authorities Policy*, and their accompanying implementation guidance). These skills may reside in a single Board member.



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The term “DOE accident investigator,” as defined and used in DOE O 225.1B and this E-Reference, signifies an individual who understands DOE accident investigation techniques and has experience in conducting investigations through participation in at least one investigation.

This individual’s knowledge may be demonstrated through experience, training, education, or qualification and must have attended an accident investigation course of instruction that is based on current materials developed by HSS National Training Center (NTC) within the five years preceding the accident as defined in the Order.

The HSS Accident Investigation Program Manager will keep the field and Headquarters points of contact apprised of the availability of appropriate training to support the accident investigation program. Training will be necessary in the following areas:

- basic accident investigation techniques,
- Board Chairperson skills,
- analytical techniques, and

The HSS Accident Investigation Program Manager, in coordination with field and Program Office POC, may schedule and offer training courses or distribute training materials, as required, or may identify courses available from universities, commercial sources, or other government agencies that meet the Department’s needs.

Therefore, POCs should coordinate their program-related training needs with the HSS Accident Investigation Program Manager, HSS NTC, and provide feedback and recommendations to the NTC, and HSS Accident Investigation Program Manager on training needs.

Field elements, through their points of contact, are responsible for utilizing the NTC and scheduling training required to assure readiness to conduct accident investigations.

9.0 WHAT IS THE IMPORTANCE OF POINTS OF CONTACT FOR ACCIDENT INVESTIGATIONS?

Points of contact (POCs) have important roles in supporting accident investigations. There should be at least one POC for each program element, field element, and for each site and facility that reports directly to a Heads of the Headquarters Elements. The principal responsibilities of the POCs are to assure that all of the requirements of DOE O 225.1B are understood by the field element or other organization for which they work and that the Order’s requirements can be carried out by DOE and contractor staff.



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They act as liaison with the HSS Accident Investigation Program Manager on matters pertaining to the DOE accident investigation program. In addition, they ensure that DOE and contractor personnel are trained in accident investigations in sufficient numbers to meet site needs for responding to, or assisting with, accident investigations; that appropriate equipment to support investigations is procured and available for use; and that DOE and contractor staff are trained to operate it.

It is anticipated that POCs will assist Heads of Field Elements in implementing DOE O 225.1B, as well as assist AIBs. This includes responsibilities such as those described in Section III, Paragraphs 1.1 through 1.6, of this E-Reference and:

- Maintaining the ability to conduct accident investigations throughout the field element and its operational facilities.
- Ensuring emergency management personnel coordinate or integrate their activities to facilitate an orderly transition of responsibilities for the accident scene.
- Communicating and transferring information to the Board Chairperson prior to and subsequent to his/her arrival on site.
- Coordinating corrective action planning and follow-up with the Heads of the Field Elements and coordinating comment resolution by reviewing parties.
- Assisting Heads of Field Elements in tracking implementation of corrective action plans.
- Facilitating distribution of lessons learned.
- Providing other DOE sites with DOE AIB Chairpersons and investigators on request.

A significant responsibility for the POC is to assure that contractors are aware of and trained in the requirements for supporting accident investigations and that the contractors are prepared to support the process by assisting in the functions discussed in Section III, Paragraphs 1.1 through 1.6, of this E-Reference.

10.0 WHAT NEEDS TO BE INCLUDED IN THE DOCUMENTATION FILES OF THE ACCIDENT INVESTIGATION?

Permanent records must be maintained for accident investigations in accordance with DOE record retention requirements. Accident investigation reports do not contain all records and backup data associated with the investigation; therefore, the records that form



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the basis for the facts in the report should be kept in an investigation file for future reference.

The unclassified evidence files retained by the Appointing Official for the investigation (correspondence files, work control packages, etc.) are then dispatched as temporary records to the National Archives and Records Administration for disposition in accordance with the records retention schedule for investigative records (75 years). As a result of this time period, records need to be categorized as “permanent” in accordance with 36 C.F.R. § 1225.14 and recommend that access restriction limitation be designated as “Agency Personnel.”

Examples of the type of records that should be retained in the file include: witness statements; stenographic transcripts of interviews; videotapes; photographs; analytical test results; policies and procedures pertinent to the investigation or referenced in the report; daily logs; training records; job or work records; and checklists. Documentation showing that the report was subjected to reviews for classified and Privacy Act information shall be retained in the investigation file.

If the appointment of an AIB is delayed beyond 3 calendar days from the time of the categorization of the accident, the rationale for the delay must be documented and maintained in the accident investigation file.

If the Heads of the Headquarters Elements delegates the responsibility for an accident investigation to the Heads of a Field Element, or to HSS, a copy of the memorandum of delegation shall be maintained in the accident investigation file.



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CHAPTER III. GENERAL ADVICE

1.0 SITE READINESS AND INITIAL INVESTIGATIVE ACTIONS

This Chapter addresses how field readiness for accident investigations and initial actions after an accident can meet the intent of DOE O 225.1B.

1.1 HOW DO WE ASSURE READINESS TO CONDUCT ACCIDENT INVESTIGATIONS?

Readiness to conduct accident investigations means preparing in advance of the accident to:

- Preserve the integrity of the accident scene and various types of evidence.
- Initiate data collection activities.
- Obtain witness statements.
- Document the accident scene through photographs or video.

Site personnel should coordinate their actions with or be integrated with emergency management personnel, in accordance with the requirements of DOE O 151.1, *Comprehensive Emergency Management System*. A well-trained team that participates in the initial response to an accident can greatly assist in securing, preserving, and documenting the accident scene, collecting and controlling evidence, identifying witnesses, and taking initial statements.

In addition, they can provide valuable assistance to the AIB when it assembles on site. Their composition, location, equipment, and other characteristics should be determined by the field elements and their contractors. The performance and equipment for the team should be documented in procedures and periodically tested. Heads of Headquarters Elements are responsible for providing the training required to assure readiness to conduct investigations.

When an accident occurs, initial actions include taking charge of the accident scene quickly, initiating any required emergency response, assisting injured parties, ameliorating the accident conditions, preserving and controlling evidence and the accident scene for later investigation, and restoring operations if there is no danger to workers or the public.

Each Heads of Headquarters Elements should maintain the capability to respond to accidents in this manner. To ensure the needed rapid-response capability, Heads of



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Headquarters Elements, Heads of Field Elements and designated points of contact (POCs) should ensure that sufficient numbers of initial responders and prospective accident investigation Board personnel are trained and available; adequate procedures for initial response have been established; equipment is available and functional; and the necessary infrastructure can be quickly assembled to respond to the accident and support the accident investigation.

Coordinated activities by the on-site team and emergency management personnel include the following:

- Mitigating the consequences of the accident.
- Reporting and categorizing events expeditiously, taking into account the urgency for investigative accuracy; preserving the accident scene and evidence; and returning to normal operations in accordance with DOE O 225.1B and DOE O 232.1, *Occurrence Reporting and Processing of Operations Information*.
- Determining the medical condition and fitness-for-duty status of those injured in the accident and others who are directly involved in the accident as soon as possible after the accident including requesting an autopsy and promptly collecting biological specimens, if appropriate.
- Taking initial witness statements in writing as soon as possible after an accident occurs.
- Preserving the accident scene until it is examined and released by the Board.
- Creating a photographic and/or videotape record of the accident scene as soon as possible after the accident occurs.
- Identifying, collecting, inventorying, and protecting pertinent physical evidence until it is turned over to the Board.
- Establishing and maintaining a chain of custody for photographs, videotapes, and physical and documentary evidence until it is turned over to the Board.
- Making sure all documentation pertinent to the accident, including medical records, in the possession of contractors and subcontractors is available to the Board immediately upon the Board's arrival at the site.
- Transferring responsibility for the accident scene, evidence, and documentation to the Board when it arrives at the scene.
- Briefing the Board on the day of their arrival at the accident site. This briefing should include, as a minimum:



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- a description of the accident;
 - emergency response actions taken;
 - the status of evidence and the accident scene;
 - the DOE and contractor organizations having line management, project management, and oversight responsibilities related to the accident; and
 - organization charts showing both line and project management structure for these responsibilities.
- Assisting with the investigation as requested by the Board Chairperson.

Managers, through POCs, should evaluate the need for site- or organization-specific training to ensure that sufficient numbers of staff are available to perform these functions. Contracts that address accident readiness by contractors should be modified to include these provisions under DOE O 225.1B, if they are not adequately addressed in existing contracts. The benefits of incorporating initial investigative or investigative support actions into emergency preparedness plans and drills should also be considered.

1.2 HOW DO WE ASSURE PRESERVATION OF THE ACCIDENT SCENE?

Preserving an accident scene and evidence is important to the ensuring investigation. Important evidence must be collected quickly, or it may be lost or lose its value to the investigation. Site procedures should specify the DOE or contractor official who will control the scene and access to it.

Generally, an accident scene should be isolated as soon as possible until it is turned over to the AIB. This action prevents the scene from being disturbed or altered, prevents evidence from being removed from or relocated at the scene, and protects people from hazards that may remain after an accident.

An accident scene can be protected in a number of ways, including: cordoning off the area with rope, tape, or barricades; locking doors and gates; posting warning signs; using a log to document that enters the area and their justification for entry; and posting guards to control and limit access.

Special controls and coordination with local security operations are necessary if the accident scene or evidence contains classified or unclassified controlled nuclear information material. The AIB may require that the same or different preservation and control procedures be kept in place until it has concluded the examination and documentation of the scene.

There may be circumstances where an accident scene must be preserved for investigation by an agency other than DOE. This could include the National Transportation Safety Board (e.g., for aircraft or railway accidents), OSHA, law enforcement agencies, or other agencies that may exercise jurisdiction to conduct investigations. In the event that an



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accident scene must be preserved to satisfy the investigative needs of these agencies, the scene should be cordoned off, access to it controlled, and otherwise secured, as indicated above, until the agency having jurisdiction arrives and takes control of the scene.

1.3 HOW SHOULD WE COLLECT AND CONTROL EVIDENCE?

There are three types of evidence: physical, human (given through witness statements or interviews), and documentary (including photographic media). The collection and control of physical evidence is an important element of preserving the accident scene and an important role of readiness teams. Some physical evidence can safely be left intact at a protected accident scene.

However, other evidence may be located remotely from the scene, may have been removed during emergency response or casualty evacuation activities, or may be too perishable to safely remain at the scene. Such evidence should be protected from damage or contamination and safely stored for delivery and transfer to the Board. It may not be apparent whether some items are evidence or whether they are significant to the investigation.

When in doubt, it is best to be conservative in treating items as evidence. It is easy to discard items later that are not needed but difficult or impossible to recover needed items that were not preserved.

For more information see the Accident Investigation Workbook at:
<http://www.hss.doe.gov/csa/csp/aip/workbook/toc.html>

Physical and documentary evidence should be preserved and secured as it is collected. These steps are necessary to prevent alteration and to establish the accuracy and validity of collected evidence. Evidence should be stored in a secured area and access to the evidence limited to those who have a need to examine and use it during the accident investigation. No evidence should be released without the authorization of the Board Chairperson.

1.4 WHY IS IT VITAL TO OBTAIN INITIAL WITNESS STATEMENTS?

Statements from witnesses should be taken as soon as possible, preferably before they leave the accident scene. Quickly identifying witnesses (e.g., victims, eyewitnesses, and other participants) and taking witness statements are important, because the first statements of witnesses are more accurate and have greater credibility than those made later. Other persons, such as emergency response personnel, persons who arrived at the scene shortly after the accident, and anyone else who would be expected to provide material information about the accident should be identified, located, and asked to provide a statement.



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While the Board will conduct formal interviews later, initial statements help preserve early impressions and observations and help the Board focus its efforts. A standardized witness statement form should be used to obtain initial statements. Use of a form provides necessary information about the witnesses and where they can be contacted later, ensures that a consistent set of questions is presented to all witnesses, and provides an opportunity for persons who have just witnessed or been associated with an accident to record what they know in a structured manner.

1.5 HOW DO WE DOCUMENT THE ACCIDENT?

Documenting the accident means making a record of the accident scene and collecting records of conditions before, during, and after the accident. Since the AIB may not arrive at the accident site until two or three calendar days after the accident, it is important for on-site personnel to document thoroughly the condition and status of the accident scene just after the accident has occurred.

1.6 HOW DO WE APPROACH RESTORING OPERATIONS AND OTHER POST ACCIDENT CONSIDERATIONS?

Accident investigation needs, particularly such immediate needs as preservation of evidence, will always be overridden by life- and property-saving considerations and sometimes by risk reduction and programmatic considerations, such as restoration of operations. Initial investigations normally do not commence until the accident scene has been released by the emergency response organization.

Casualties are treated and removed, fires extinguished, roads cleared, and services and operations restored or resumed, although all of these activities may alter the accident scene.

Even given the secondary nature of preserving evidence when compared with taking emergency actions, much can be done concurrently, or soon after emergency actions are taken, to preserve the accident scene and relevant evidence and records.

Training emergency response and on-site personnel in the need for and methods of evidence preservation, as well as prior planning and coordination, facilitates the ability of both groups to conduct their activities in a way that will enhance, rather than degrade, preservation of important evidence and the accident scene.

Upon arrival on site, the Board Chairperson will inspect and formally accept custody of the accident scene from local authorities. While in possession of the accident scene, the Board Chairperson will have the authority and responsibility for making decisions on restoring operations following an accident that will affect the accident scene, or impact the preservation of evidence.



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This decision is coordinated in advance with the Heads of the Headquarters Elements or his/her designee, and is made after balancing such factors as operational needs, mission objectives, and risk to workers, the public, and the environment against the need to conduct a comprehensive investigation. Care must be given to this decision, since once evidence is lost it cannot be recovered.

2.0 THE ACCIDENT INVESTIGATION BOARD

2.1 WHAT IS THE ROLE OF THE APPOINTING OFFICIAL?

2.1.1 Establishing the Board's Authority

Authority to appoint AIBs and to assign individuals to conduct accident investigations resides with the Appointing Official. The Heads of Headquarters Elements serves as the Appointing Official for accident investigations. Alternatively, if the Heads of the Headquarters Elements and HSS agree that it in the best interest of the Department, HSS will serve as the Appointing Official and conduct the accident investigation.

Each AIB must be established in writing by the Appointing Official normally within 3 calendar days of the categorization of the accident. The written authorization includes the scope of the investigation, the names of the individual Board members being appointed, a specified completion date for the final report, and any special provisions deemed appropriate.

The scope of the investigation must include gathering facts; analyzing the facts and evidence; developing conclusions regarding causal factors; and identifying Judgments of Need for DOE and contractor organizations and management systems that could have or should have prevented the accident. The scope of the investigation includes reviewing all levels of the organization up to and beyond the level of the Appointing Official. An example of an appointment memorandum is provided in Example 2.

DOE Heads of Headquarters Elements are responsible for determining whether an accident meets the criteria for an investigation. This determination must be made using the Accident Investigation Criteria contained in DOE O 225.1B, Appendix A.

The Appointing Official for accident investigations is the Heads of the Headquarters Elements for programs, offices, and facilities under their authority. Alternatively, if the Head of the Headquarters Element and HSS agree that it is in the best interest of DOE, HSS will serve as the Appointing Official and conduct the accident investigation. The AIB must be appointed in writing.

Appointing Officials select DOE/NNSA accident investigation Boards consisting of a Chairperson and three to six members who meet the qualifications and criteria in 225.1B.



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The Board shall be supported by appropriate advisors and consultants who may be Federal, contractor, and/or consultant personnel as determined by the Board Chairperson.

The HSS Program Manager maintains a list of trained and experienced Chairpersons, members, and consultants, including their areas of expertise. Appointing Officials and the POC may contact the program manager for assistance in identifying candidate Chairpersons or members. It is recommended that Appointing Officials select DOE accident investigators to fill as many Board member positions as possible.

2.1.2 Briefing the Board

The Appointing Official or his/her representative must conduct a briefing for all Board members within three calendar days of their appointment (preferably prior to their departure for the accident site) to ensure they clearly understand their roles and responsibilities. This briefing may be done in person or via videoconference or teleconference. However, if it is impractical to brief the entire Board, the Board Chairperson will receive the briefing. The Chairperson should then convey the contents of the briefing to the other Board members prior to commencing the investigation. The briefing should include the following subjects:

- Scope of the investigation.
- Emphasize that the Board is empowered to examine DOE and contractor organizations and management systems as possible root causes of the accident, the Board is required by DOE O 225.1B to do so, and they are to fully report the findings.
- Confirmation that the Board has the authority to investigate up to and beyond the level of the Appointing Official when reviewing specific management systems and organizations.
- Avoiding conflicts of interest for Board members.
- Skills and qualifications of Board members.
- Application of the principles in DOE P 450.4, *Safety Management System Policy*, DOE P 411.1, *Safety Management Functions, Responsibilities And Authorities Policy*, and draft DOE M 411.1-1, *Manual of Safety Management Functions, Responsibilities and Authorities* to the investigative process.
- Special concerns of the Appointing Official based on site accident patterns or other considerations.



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2.1.3 Avoiding Undue Influence and Conflict of Interest

Board Chairpersons and members report only to the Appointing Official or his/her representative during the investigation. During the investigation, Board members and advisors are relieved of their normal duties. The Appointing Official is responsible for avoiding undue influence and conflict of interest in selecting Board Chairpersons and members. Care must be taken in selecting Board members who are not in the direct line management chain responsible for day-to-day operations or for line management oversight of the facility, area, or activity involved in the accident. In addition, the Board must not include both a supervisor and his or her subordinate(s).

2.2 WHAT ARE THE ACCIDENT INVESTIGATION BOARD ROLES AND RESPONSIBILITIES?

The AIB has several major functions:

- Conducting a comprehensive investigation within the defined scope, collecting all pertinent information, and determining the facts relevant to the accident.
- Analyzing the facts and determining causal factors that contributed to the accident, with particular emphasis on determining the root causes of the accident.
- Identifying Judgments of Need that must be addressed to prevent recurrence of the accident.
- Reporting the essential facts and results of the investigation clearly and concisely maintaining appropriate communications with interested organizations throughout the investigation.
- Ensuring the quality and accuracy of all its activities.

2.2.1 Board Chairperson

The Board Chairperson manages Board activities and is responsible to the Appointing Official for all aspects of the investigation. The Chairperson maintains control of the accident scene until it is no longer needed for the investigation. The Chairperson will not normally conduct investigative activities, but rather will direct the overall effort, keeping it focused and on schedule, and will maintain communications and coordination with interested managers and organizations that are legitimate stakeholders, such as unions or the surrounding community. The Chairperson represents the Department in all matters pertaining to the investigation.

If allegations or evidence of criminal or suspected unlawful activity are identified in the course of the investigation, the Chairperson has the responsibility to notify appropriate DOE, other Federal, state, or local investigative or law enforcement authorities (e.g.,



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Federal Bureau of Investigation) or, in the case of fraud, waste, and abuse, the DOE Office of the Inspector General.

For more information see the DAY PLANNER: *Guide for Accident Investigation Board Chairpersons* at: <http://www.hss.doe.gov/csa/csp/aip/200009dayplanner.pdf>

2.2.2 Board Members

Board members are primarily responsible for collecting and analyzing information, reaching conclusions regarding causal factors, identifying Judgments of Need, and writing the report. Board members should use a broad range of investigative and analytical techniques to make these determinations.

2.2.3 Advisors and Consultants

The Board Chairperson may require the assistance of advisors and consultants during the investigation. Advisors and consultants may be DOE employees, DOE contractors or subcontractors, or outside personnel, and may include persons from the accident site. They should be free from involvement in issues leading to the accident and not have any conflicts of interest that would bias their judgment, as determined by the Board Chairperson.

Potential conflicts of interest should be referred to the field element's Office of Chief Council, or the Board's legal advisor for resolution, and the results documented in the accident investigation records. Advisors and consultants are normally used to provide the Board with specialized expertise.

Advisors and consultants may be site personnel with knowledge of site processes or activities, or of the accident itself, and may possess expertise in accident investigation and analytical techniques, law, medicine, metallurgy, chemistry, electricity, transportation, work planning and control, conduct of operations, or other specialized disciplines.

Advisors and consultants may be used to facilitate investigative activities or conduct specific tasks (e.g., to review medical or contractual aspects of the accident). Alternatively, they may be integrated into a broader spectrum of the Board's activities, participating throughout the investigation.

By definition, advisors and consultants can advise and consult, but cannot dictate the Board's results or the report contents; those are responsibilities of the Board. The need for consultants and advisors will be dictated by the nature of the accident and the direction of the investigation.

The HSS Accident Investigation Program Manager maintains a listing of potential subject matter experts who can be called upon for participation as required.



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Labor union representatives should be permitted to observe and advise the Board. They may be present at interviews of bargaining unit employees, unless an employee requests otherwise, and at open meetings of the Board.

2.2.4 Support Functions

Appointing Officials should assure that a Board has sufficient administrative support personnel to expedite the investigative and report-writing processes, freeing members from administrative burdens and allowing them to concentrate on data collection and analytical tasks. The following support positions are recommended.

- **Administrative Coordinator.** An individual familiar with the administrative and logistical needs and processes for an accident investigation should provide daily coordination of those matters. Other functions to be performed include tracking and controlling documentation, tracking appointments, assigning administrative tasks and priorities, and coordinating report production.
- **Analyst.** An individual trained in and knowledgeable of the various analytical techniques that can be used to support the accident investigation process (see Chapter III, Paragraph 4.4 of this E-Reference). Board members have the responsibility for collecting and analyzing information; however, a dedicated analyst can recommend the proper analytical tools based on the complexity of the accident, and process the information using the tools selected, allowing the Board members to concentrate on the results.
- **Technical Writer/Editor.** Use of a technical writer or editor can facilitate the report-writing process. While Board members have the primary writing responsibilities, a dedicated writer or editor can focus on the responsibilities for editing the report and managing report preparation, which will result in a more cohesive and readable report.
- **Typist/Text Processor.** A Board usually needs at least one typist to perform general secretarial and administrative tasks, such as filing, typing or text processing, and answering telephones. Often these personnel can be provided by the facility where the investigation is being conducted.
- **Court Reporters.** Using a court reporting service enhances the interview process by increasing the timeliness and accuracy of interview transcripts. The use of court reporters provides all members of the Board the opportunity to review interviews in which they did not participate and provides a transcript that can be used to reconstruct or develop the chronology of events preceding the accident. When an investigation requires numerous interviews, use of court reporters is essential and can help prevent the investigation from getting behind schedule in its early stages, when most of the interviewing takes place and when the



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information elicited during interviews is needed. This service is generally available commercially in most areas.

2.2.5 Managing the Accident Investigation

The accident investigation is managed as a project--a complex project that must remain focused while confronted with a significant workload, finite time constraints, sensitive issues, and a dependence on the cooperation of others.

Consequently, the investigation process (and the Board) needs to be well managed and closely controlled in order to be successful and efficient.

2.2.5.1 Role of the Chairperson

The Board Chairperson manages all aspects of the investigation. Some of the Chairperson's first decisions and actions will greatly influence the tone, tempo, and degree of difficulty associated with the entire investigative process.

A day planner format or similar tool should be used to identify the detailed list of actions that the Chairperson should complete throughout an investigation. For more information see the *DAY PLANNER: Guide for Accident Investigation Board Chairpersons* at: <http://www.hss.doe.gov/csa/csp/aip/200009dayplanner.pdf>.

An investigation is complex and requires management of several very different, interrelated activities. First, the investigative process itself needs to be managed: information must be collected, processed, and integrated; facts must be analyzed; conclusions related to causal factors must be drawn; causal factors and Judgments of Need must be identified; and a report must be prepared.

To manage this aspect of the investigation, the Chairperson organizes work assignments for the Board, establishes deadlines, requires feedback, seeks and obtains ongoing information about progress and status, and makes adjustments as necessary. The Chairperson keeps the Board focused on essential activities and ensures that all efforts are directed appropriately and not wasted on irrelevant or inconsequential pursuits.

While the Chairperson's responsibilities may preclude participation in the detailed investigative tasks, he/she should remain fully informed of those activities and be the driving force behind all decisions concerning the investigation.

Concurrently, the Chairperson manages the administrative, logistical, and budgetary activities of the Board. Support of various kinds is obtained and coordinated when needed. If administrative and logistical support functions are not well managed, the productivity, efficiency, and accomplishments of the Board can be degraded.

No less important is the Chairperson's need to manage relationships among the Board members and between the Board and organizations external to the Board. In the stressful



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situation created by the Board's intense deliberations, it is essential that the Board Chairperson understand group dynamics to manage the individual personalities of the Board members. Care must be taken to ensure that strong-willed personalities do not dominate and influence the objectivity of the investigation and that all viewpoints are heard and analyzed.

The Board may call upon a number of organizations for support, including administrative or logistical, technical, or merely cooperation in facilitating the investigation. One of the Chairperson's important functions is to manage the Board's relationship with these parties.

Interested parties may include the Appointing Official, site contractor organizations, DOE field staff, employees and their organizations, unions, local community groups, and the media. Dealing with injured parties and their families (except on matters directly related to the investigation, such as conducting interviews or taking witness statements) is generally the responsibility of the Heads of the Field Elements or contractor management.

However, contingent upon the circumstances, the Chairperson should consider contacting the family to explain the purpose of the investigation. Coordination with the field or contractor management should be accomplished prior to such contact.

2.2.5.2 Investigation Schedule

The length of each particular investigation is dictated in part by the nature and complexity of the circumstances surrounding the accident. Most accident investigations, however, can be completed in a 30-day period, organized generally as indicated in Table 2. Plans for managing the investigative process should be based on this 30-day schedule. As circumstances require, the Chairperson and Appointing Official can establish a different time frame, and the schedule can be modified accordingly. Keeping the length of the investigation (including submission of the final report) to a minimum, consistent with thoroughness and accuracy, is an important consideration.



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Table 2: Typical Investigation Schedule

Time Frame	Activities
Week 1 (onsite)	Board arrives; data collection and interviews; identification and initiation of physical testing requirements; initial data analysis; preliminary writing.
Week 2 (onsite)	Continued data collection; additional emphasis on data analysis; initial report preparation.
Week 3 (onsite)	Primarily devoted to data analysis and report preparation; follow-up data collection; factual accuracy review of draft report by site DOE and contractor managers; completion of final draft report; briefing of local DOE and contractor managers; departure from site.
Week 4	Selected personnel only: final report editing and formatting; submission of report to Appointing Official.

For more information see the DAY PLANNER: *Guide for Accident Investigation Board Chairpersons* at: <http://www.hss.doe.gov/csa/csp/aip/200009dayplanner.pdf>

2.2.5.3 Control Measures

As with any project, an accident investigation requires the use of management controls to ensure that necessary activities are completed properly and on time. Although not unique to accident investigations, the following common control methods are typically used by the Chairperson.

- Task assignments and due dates. Each specific task should be assigned to an individual or team so that responsibility is clearly understood. Due dates, including intermediate milestones, if appropriate, should be assigned.
- Daily meetings. The Board should meet at least once daily to exchange necessary information and keep the Chairperson fully informed of progress and status. On the third day of the investigation, the interview and investigation schedule should be reassessed.
- Progress reports. At the daily meetings or whenever appropriate, individuals and teams should provide the Chairperson with verbal or written progress reports, identifying potential problems and their solutions. The Chairperson may be requested to prepare periodic status reports. These reports may be necessary as background for press releases, briefings, or to dispel rumors and to keep Headquarters apprised of the investigation's progress.



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- Accountability controls. Logbooks or some other method should be used to maintain control and accountability of items of physical evidence, documents, photographs, and other material pertinent to the investigation.
- Correspondence controls. Appropriate measures should be employed to track incoming and outgoing correspondence.
- Information release. The Chairperson establishes and strictly enforces a specific policy regarding what information can be released, and by whom, to persons or organizations outside the Board. The Chairperson coordinates approved press releases with the local field and contractor public relations representatives to assure consistency and that releases are only made after review and concurrence by the Board Chairperson.

2.2.5.4 Administration and Logistics

Administrative and logistical arrangements and decisions should be made quickly and executed immediately so that start-up time is kept to a minimum once the Board arrives on-site. Inadequate or slowly developing administrative and logistical support can severely hinder an investigation. The Chairperson, assisted by the administrative coordinator and others, as appropriate, should make necessary decisions and arrange for all support.

For more information see *Guide for Editors and Coordinators for Accident Investigations* at: http://www.hss.doe.gov/csa/csp/aip/AI_Admin_Editors_Guide_Mar_2005.pdf

Normal support requirements include:

- Office/work space
- Site-specific security, safety, and health training, as required
- A dedicated conference room suitable for Board meetings and briefings
- Telephones, including speaker phones, as required (may include a publicized “hotline” number) and FAX machines
- Computers/printers and software for word processing, graphics, and analytical programs
- Copy machine (preferably dedicated)
- Document shredder
- Hotel selection and reservations



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- Rental car allotments
- Security badges and passes
- Property permits for cameras, recorders, other equipment
- Office supplies and consumables
- After-hours access to site and work space
- Administrative and logistical support personnel
- Court reporters

2.2.5.5 Quality Control

Formal quality control for all accident investigations is necessary because of the gravity and sensitivity of the work performed by accident investigation Boards, as well as the need for accuracy, thoroughness, and perspective. While the Chairperson may implement any quality control measures deemed necessary or helpful (see Chapter III, Paragraph 6.3, of this E-Reference for more specific guidance on quality control), the following procedures are typically used:

- When the Board develops conclusions from analytical results, they make a thorough effort to ensure that all verified facts, results from the analysis of those facts, and resulting conclusions are both consistent and logical.
- When essential portions of the draft report are complete, the Board conducts a verification analysis of the report to ensure that facts in the report are consistent with the best information available, that each Chapter of the report is consistent with other Chapters, and that the analyses, conclusions, and Judgments of Need in the report accurately reflect the consensus of the Board.
- The Board provides the facts Chapter of the draft report to the affected DOE and contractor managers for factual accuracy review and validation, as indicated in Chapter III, Paragraph 6.4, of this E-Reference.
- The HSS Accident Investigation Program Manager conducts a review of accident investigation reports, to include investigations delegated to the Heads of a Field Elements. This occurs before acceptance by the Appointing Official. Comments are provided to the Appointing Official. This review provides a quality check by staff not associated with the accident or the investigation and provides unbiased insight into the validity of the Board's conclusions.



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2.2.5.6 Minority Opinions

The final accident investigation report is a consensus document that must be signed by the Board Chairperson and each Board member. Should any AIB member wish to offer an opinion different from that of the AIB, the report must include a section for the minority opinion. The AIB Chairperson and the AIB member wishing to provide a minority opinion will coordinate on development of the final report. The minority opinion must identify where facts, analysis, and conclusions, and Judgments of Need differ from the opinions expressed by the Chairperson and other AIB members. The Board Chairperson should make a concerted effort to understand the logic underlying the differing opinions and to consider what changes might resolve the conflict.

2.2.5.7 Freedom of Information and Privacy Acts

Information that is generated or obtained as part of an investigation by the Board may be subject to disclosure under the Freedom of Information Act (FOIA), Whistleblower Protection Act of 1989, and the Privacy Act of 1974, as amended. The FOIA provides that any person may obtain access to agency records unless those records are protected from release by one of nine exemptions. Some of the FOIA exemptions protect classified information, deliberative materials, and personal information whose disclosure could cause an unwarranted invasion of privacy. The FOIA also protects from disclosure “information compiled for law enforcement purposes” if its disclosure could reasonably be expected to “interfere with enforcement proceedings.” Accident investigations are considered a law enforcement activity and records generated as part of these investigations may be protected from disclosure. This type of information, however, may not be protected from disclosure after implementation of corrective measures, if disclosure of the information would not interfere with an active investigation.

The FOIA further protects information compiled for law enforcement purposes if disclosure would “constitute an unwarranted invasion of personal privacy,” or “disclose the identity of a confidential source.” This information may continue to be protected after implementation of any corrective measures in response to the accident.

The Privacy Act protects from disclosure, records maintained in a system of records that are retrieved by a personal identifier. Generally, information in a system of records cannot be disclosed without the prior written consent of the individual to whom the records pertain, unless the information falls within one of the exceptions in the Act. A “record” subject to the Privacy Act is any information about an individual that identifies the individual by name, or other device particular to the individual.

A “system of records” is a group of records from which information is retrieved by a person’s name or other identifying device. Accordingly, accident investigation records that are retrieved by name or other personal identifier are deemed to be maintained in a system of records subject to the Privacy Act. For example, if witness interview transcripts or medical records of an individual injured in the accident that are part of an



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accident investigation are retrieved by a personal identifier, the records are subject to the Privacy Act. However, if the records are kept in a manner that requires identification of a particular accident as a prerequisite to finding information about any individual, the records are deemed not to be in a “system of records” and the Privacy Act does not apply.

If any questions arise concerning disclosure of accident investigation records or the applicability of the FOIA or the Privacy Act, the Chairperson should obtain guidance from the Department’s FOIA/Privacy Act attorney in the appropriate headquarters or field office.

3.0 WHAT IS IMPORTANT TO KNOW ABOUT GATHERING EVIDENCE AND FACTS?

3.1 REVIEWING STANDARDS AND REQUIREMENTS

The Board should identify DOE Orders and Standards; Federal and State regulations; other external regulatory requirements; and site-specific policies, requirements, or guidelines applicable to the accident. This is necessary to establish the requirements governing work at the site where the accident occurred, determine what role they played in the accident, and ensure that policy issues are adequately addressed during the investigation. Review of applicable safety analysis reports, standards requirements identification documents, and other requirements documents may be helpful in identifying this information.

3.2 GATHERING PHYSICAL EVIDENCE

Physical evidence should be gathered and a record made of all facts from all sources, including witness statements and interview transcripts, as soon as they become available. A good method for displaying the facts is to list them on removable, adhesive-backed notes that can be placed on a wall, so they can be used to develop the events and causal factors chart.

For more information see the Accident Investigation Workbook at:
<http://www.hss.doe.gov/csa/csp/aip/workbook/toc.html>

3.2.1 Recording the Accident Scene

Photographs, videotapes, and sketches should be used for recording and documenting the accident scene. The on-site team should document the accident scene initially (even though the Board may wish to record the scene later as well). It is important to record the location, orientation, and subject matter for each photograph. Photographic coverage should be detailed, complete, and, if necessary, should include standard references to help establish distance, perspective, color, and date. Photographs (digitized photographs are



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preferred) should be taken of obstructions, equipment, parts, material, debris, spills and stains, and anything else that may contribute to or affect the accident scene.

Videotapes should cover the overall accident scene and should focus on specific locations or items of significance. A thorough videotape may relieve the Board from making repeated visits to the accident scene; this may be important if the scene is difficult to access or it presents hazards of any kind.

If evidence must be moved, its exact location and orientation at the scene should first be recorded in detail, perhaps using sketches with measured distances and directions from reference objects that will remain at the scene. The original location of evidence can also be marked (using paint, tape, chalk, etc.) before it is removed.

A documented chain of custody on still video camera disks and prints should be maintained (see Chapter III, Paragraph 3.2.3, of this E-Reference). And, for more information see the Accident Investigation Workbook at:

<http://www.hss.doe.gov/csa/csp/aip/workbook/toc.html>

Color film pictures are preferred. These pictures should be carefully logged in an accepted form with information recording the exact time, location, direction, and other pertinent data. Photographic aids that record the date and time on the negative should be avoided, because these images may obscure important details in the photo or video.

Reference aids such as rulers, grids, and color charts should be included in the photographs when there is any chance for distorted interpretation; size, color, and exact location are critical. Videotapes are of particular value at accident scenes where progression of events is critical, such as fires.

Other specialized photographic techniques may be desirable in certain circumstances. These special techniques are used to identify foliage changes, internal conditions, and other effects not visible to normal sight. They include aerial, micrographic, ultraviolet, infrared, false color, motion pictures, stereo, x-rays, and thermal scanners.

3.2.2 Handling and Preserving Physical Evidence

Physical evidence should be gathered and assigned to categories, and a record should be made of all facts from all sources, including the witness statements and interview transcripts as soon as they become available. Care should be taken in the event pathogenic contamination of physical evidence occurs (e.g., in the case of blood). Such material may require autoclaving or other sterilization. Work practice controls, as defined by 29 C.F.R. 1910.1030, should be used.

Actions taken to mitigate blood borne pathogen hazards resulting from the accident should be documented. Potential exposures to team members should be investigated and referred to the appropriate medical personnel for immediate treatment. 29 C.F.R. Part



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1910.1030 details controls that should be followed for exposure to blood or other potentially infectious materials. In addition, a record must be established and maintained for each investigation team member who has an occupational exposure (see 29 C.F.R. Part 1910.20 and Part 1910.30).

Physical evidence is fragile: physical objects can be removed, broken, lost, misplaced, cleaned up, destroyed, distorted, or overlooked. When physical evidence is identified, it is collected and secured or the area in which it is located is secured to preserve integrity of the evidence. Materials can be bottled, bagged, or boxed, and their locations recorded or photographed. The accident scene can be roped or taped off, doors locked, and guards posted, or it can be preserved by other means.

3.2.3 Preserving the Chain of Custody

A strict chain of custody (documentation showing physical custody) should be maintained on all evidence. Security and custody of evidence are necessary to prevent alteration and to establish the accuracy and validity of the physical material, photographs, and documents collected.

To establish a chain of custody for evidence:

- The evidence should be photographed/videotaped in its original location as it was found immediately after the accident.
- The photographs/videotapes should be time- and date-stamped and inventoried and should be treated as other physical evidence, using the chain-of-custody principles described below.
- A decision should be made about what evidence is to be removed from the scene.
- The person collecting the evidence should prepare an inventory of the items and sign a chain-of-custody document stating at a minimum:
 - What items were removed from the scene
 - When the items were removed from the scene
 - Who removed the items from the scene
 - Location of the items at the time of inventory
- Evidence should be controlled by signature transfer (signatures of the recipient and the person relinquishing custody) and made available to those who have need to examine and use the evidence during the accident investigation.



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- Secure storage and access control to evidence must be maintained throughout the investigation.
- The accident investigation Board Chairperson should determine the disposition of evidence at the conclusion of the investigation.

3.2.4 Testing Physical Evidence

Testing and analyzing physical evidence may be important tools in identifying contributing and root causes of an accident. Testing is generally divided into nondestructive and destructive testing and must be properly sequenced to assure that all nondestructive testing and analysis are performed prior to the start of destructive testing. A simple test and analysis plan may help avoid problems.

Testing need not be performed by an independent off-site laboratory if the tests are straightforward and are witnessed by a Board member. Decisions on performing testing and analysis should be made early in the investigation so that the results are available in time to meet the Board's schedule.

3.3 GATHERING DOCUMENTARY AND ELECTRONIC SYSTEMS EVIDENCE

Preserving documentary evidence, data, and information is an important consideration. This evidence might be on paper, videotape, magnetic tape, or computer media, either in an area of close proximity to the accident or in files at other locations. Such evidence may include items such as permits, reports, analyses, logbooks, work process documentation, instrument charts, as-built drawings, entry control records, maintenance tags, and process records.

Documents or paper evidence can be overlooked, misplaced, or taken. Documents can be altered, disfigured, misinterpreted, or electronically sanitized. Computer software and disks can be erased by exposure to magnetic fields.

Documentary evidence that could be altered in any way should be collected, catalogued, and secured (in locked containers, if necessary).

3.4 CONDUCTING INTERVIEWS

Human evidence can be extremely delicate. Eyewitnesses can forget, overlook, or fail to recall evidence of critical value to the investigation. Individuals naturally begin to rationalize the circumstances of traumatic accidents after the event.

Therefore, to preserve accuracy, the preferred approach is to obtain and record initial eyewitness statements before the participants and witnesses leave the accident site. This step should be taken as part of the initial response efforts discussed in Chapter III, Paragraph 1.4, of this E-Reference.



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After the Board arrives, a witness interviewing schedule should be established, and interviewing should begin as soon as practical. A neutral location free from distractions (phones, noise, etc.) should be reserved for these interviews. Each Board member is responsible for assuring that the interviews are effective and productive. Court reporters should be used to document key interviews to ensure accuracy and expeditious availability of transcripts to the Board.

Recording should commence at the opening statement (see Example 3). In some cases, those being interviewed may request the presence of an attorney or union representative during the interview. Unless directed to do otherwise by DOE legal counsel, this request should be honored. The transcript should then be reviewed for accuracy by the Board and the witness, and discrepancies should be resolved. The transcript should be read by all Board members and placed in the investigation files.

3.4.1 Who to Interview

The Board should develop a strategy and the sequence of interviews prior to scheduling interviews with the following types of individuals:

- witnesses to a specific event,
- co-workers,
- supervisors,
- managers,
- injured parties,
- emergency response personnel,
- individuals first on the scene,
- medical personnel/physicians, and
- other organizational personnel

3.4.2 Interviewing Techniques

Care needs to be exercised in interviewing witnesses to minimize hearsay and collaboration. It also may be necessary to conduct follow-up interviews of witnesses for clarifying and corroborating information. A Board member should be present at key interviews and control the interviews. Good interviewing techniques that will aid in this effort include the following:

- Plan the interview. Determine ahead of time what information is needed and what questions need to be asked.



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- Establish rapport before the interview starts. Create an environment in which the witness will be more comfortable. Do not treat the interview like an interrogation.
- Provide a standard opening statement to ensure consistency for all interviews. A model opening statement is included in Appendix 3 that addresses privacy and freedom of information concerns.
- Before asking specific questions, ask the interviewee to provide a description of the events in his/her own words. Do not interrupt during this description.
- Ask open-ended questions (i.e., questions that cannot be answered by “yes” or “no” responses).
- Be unbiased and nonjudgmental. Do not ask leading questions or questions that suggest a certain point of view; the witness may believe that a decision has already been made and any contrary information will not be taken seriously.
- Schedule effectively. Schedule time between interviews to reflect on the information obtained and to decide whether any new information has affected the questions planned for the next witness.

3.5 WHAT IS IMPORTANT TO BE CONSIDERED IN EXAMINING DOE AND CONTRACTOR ORGANIZATIONAL CONCERNS, MANAGEMENT SYSTEMS, AND LINE MANAGEMENT OVERSIGHT?

Accident investigations must thoroughly examine organizational concerns, management systems, and line management oversight processes to determine whether deficiencies in these areas were root causes of the accident. This examination focuses on management systems, not on individuals.

To find out why management systems were not effective in preventing the conditions leading to the accident, investigators should examine the components of the Department’s integrated safety management system as defined in DOE P 450.4, *Safety Management System Policy*, DOE P 411.1, *Safety Management Functions, Responsibilities, and Authorities Policy*, and their accompanying implementation guidance.

The safety management system consists of six components: the objective, guiding principles, core functions, mechanisms, responsibilities, and implementation. These components provide a framework that can be used to verify whether the safety management system contributed to the accident.

Review of management issues should focus initially on the following components of safety management, latent organizational weaknesses, and how they may have contributed to the accident.



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However, the review should not be limited to these components alone and should be expanded by Board members as appropriate. Consideration of issues such as maintenance, work planning and controls, etc., may also be appropriate.

The objective of integrated safety management is to assure that the Department and contractors systematically integrate safety into management and work practices at all levels so that missions are accomplished while protecting the public, the workers, and the environment. This is accomplished through effective integration of safety management into all facets of work planning and execution.

The guiding principles of safety management are the fundamental policies that reference Department and contractor actions, from development of safety directives to performance of work. They provide the essential criteria for evaluating line management's performance in ensuring effective safety management. They are:

- (1) Line Management Responsibility for Safety. Line management is directly responsible for the protection of the public, the workers, and the environment.
- (2) Clear Roles and Responsibilities. Clear and unambiguous lines of authority and responsibility for ensuring safety are established and maintained at all organizational levels within the Department and its contractors.
- (3) Competence Commensurate with Responsibilities. Personnel shall possess the experience, knowledge, skills, and abilities that are necessary to discharge their responsibilities.
- (4) Balanced Priorities. Resources need to be effectively allocated to address safety, programmatic, and operational considerations. Protecting the public, the workers, and the environment needs to be a priority whenever activities are planned and performed.
- (5) Identification of Safety Standards and Requirements. Before work is performed, the associated hazards needs to be evaluated and an agreed-upon set of safety standards and requirements needs to be established that, if properly implemented, will provide adequate assurance that the public, the workers, and the environment are protected from adverse consequences.
- (6) Hazard Controls Tailored to Work Being Performed. Administrative and engineering controls to prevent and mitigate hazards needs to be tailored to the work being performed and associated hazards.
- (7) Operations Authorization. The conditions and requirements to be satisfied for operations to be initiated and conducted need to be clearly established and agreed upon.



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The core functions for integrated safety management provide the necessary structure for any work activity that could potentially affect the public, the workers, and the environment. The functions are applied as a continuous cycle, with the degree of rigor appropriate to address the type of work activity and the hazards involved. This framework can be useful during an accident investigation to determine whether the work activity and its hazards were appropriately analyzed and the appropriate controls were implemented during work performance. The five core functions are:

- (1) Define the Scope of Work. Missions are translated into work, expectations are set, tasks are identified and prioritized, and resources are allocated.
- (2) Analyze the Hazards. Hazards associated with the work are identified, analyzed, and categorized.
- (3) Develop and Implement Hazard Controls. Applicable standards and requirements are identified and agreed upon, controls to prevent/mitigate hazards are identified, the safety envelope is established, and controls are implemented.
- (4) Perform Work within Controls. Readiness is confirmed and work is performed safely.
- (5) Provide Feedback and Continuous Improvement. Feedback information on the adequacy of controls is gathered, opportunities for improving the definition and planning of work are identified and implemented, line and independent oversight is conducted, and, if necessary, regulatory enforcement actions occur.

Additional information on implementing the Department's safety management system is included in DOE P 450.4, DOE P 411.1, and their implementation guidance. And, for more information see the Accident Investigation Workbook at:

<http://www.hss.doe.gov/csa/csp/aip/workbook/toc.html>

4.0 HOW SHOULD WE DETERMINE FACTS AND ANALYZE INFORMATION?

4.1 DETERMINING FACTS

The first step in an accident investigation is to determine the facts or "what happened". Identifying all the relevant facts through the investigative process enables the Board to satisfy this requirement. As facts are gathered and reviewed, first impressions should not reference the investigation; rather, the Board should review all facts in the totality of the accident's circumstances to ensure that only factual information is considered in determining what actually occurred. Facts should be constantly reviewed for relevance and accuracy, and validated.

Not all information can be established as factual with complete certainty; therefore, the Board's report should identify areas of uncertainty revealed during the investigation.



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The investigation determines facts in a logical manner by:

- Establishing a clear chronological description of the accident (what happened and how)
- Stressing aspects of the accident that may have a bearing on causal considerations
- Establishing accurate, complete, and substantive information that can be used to support the analysis and conclusions of the investigation
- Resolving matters of speculation and disputed facts through analysis, testing, and Board discussions.

Care must be taken to ensure that relevant facts are not overlooked and are objectively considered during the investigation. Investigators' preconceived notions, press accounts, and other publicized information may bias the investigation. Investigators should examine evidence critically and establish an objective and independent account of the accident.

Examples of information to include in the determination of facts are:

- Pertinent background information on the site or facility (e.g., facility description and its mission, location, and history);
- Description of the injury, exposure, property damage, or costs;
- Physical evidence, including meteorological conditions at the time of the accident (if relevant);
- Chronology of pertinent events/causal factors;
- Physical hazards and safety controls present or absent at the time of the accident;
- Technical data on operations or processes impacting the accident;
- Related events that are not part of the causal sequence but that provide revealing information about how or why the accident occurred; and
- Description of organizational, procedural, policy, or safety management processes relating to the accident, such as quality assurance procedures, safety practices, work planning procedures, and hazards analyses.

One suggested procedure that has been used in the past with success in organizing factual material is to place removable, adhesive-backed notes on a wall in a large room to form an events and causal factors chart.



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The analytical tools used later in the investigation will help the Board validate and analyze the facts on this chart. This procedure will also help the Board develop a logical flow and chronology of events surrounding the accident, which all Board members can review at any time. The events and causal factors chart is constantly updated so Board members can keep current with new information. The chart is also helpful in conducting the associated analyses and in preparing the report.

4.2 HOW DO WE CONDUCT ANALYSIS OF FACTS?

Analyzing facts provides another key element of information for the investigation it explains “how the accident happened.” Analysis focuses on the facts connected to the accident and the conditions leading up to the accident, and also identifies the causal factors that allowed the accident to occur.

The Board thoroughly documents the methodology it uses to arrive at its understanding of the facts, conditions, and circumstances. Analytical tools can be used to chart events, analyze the relationships of causes to events, assist investigators in reaching conclusions about the causal factors, and help develop Judgments of Need. Proper investigation and analyses should be performed in a cost-effective manner but not at the expense of rigorous and comprehensive investigation and review of management or other system failures.

Most analyses are performed using tools such as change analysis, barrier analysis, events and causal factors analysis, and root cause analysis. Further descriptions of these techniques are provided in Chapter III, Paragraph 4.4, of this E-Reference. The results of applying each technique should be identified in the report. If the Board arrives at different conclusions from each type of analysis, the report should explain how the results fit together.

A root cause analysis should be conducted for each accident investigation. The methodology used is not as important as the results. In an accident investigation, it is important to look beyond the errors and failures that immediately precipitated the accident.

The investigator must identify system deficiencies at the work and management levels to determine the underlying oversights, omissions, performance errors, and accepted risks that are the root causes.

These causes may lie in the organizational structure, safety management systems, or line management oversight processes related to the accident.

For more information see the Accident Investigation Workbook at:
<http://www.hss.doe.gov/csa/csp/aip/workbook/toc.html>



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4.3 HOW SHOULD WE DETERMINE CAUSAL FACTORS?

A key element of the investigation is determining the causal factors or “why the accident happened”. The causal factors of an accident are events and conditions in the accident sequence necessary and sufficient to produce or contribute to the unwanted result. Causal factors generally consist of a series of relatively simple and explicit statements that summarize the causes and their contributing factors, including any systemic factors. There are three types of causal factors: direct, contributing, and root causes. Direct cause is defined as the immediate events or conditions that cause the accident. Contributing causes are conditions or events that collectively increase the likelihood of an accident but that individually did not cause the accident. Root causes are conditions or events that, if corrected or eliminated, would prevent recurrence of the accident.

DOE O 225.1B requires that causal factors, including root causes, be identified during an accident investigation. Contributing and root causes should always be identified in order to complete the causal factors analysis. If the AIB is unable to identify the root causes of the accident, a statement to that effect should be included in the report.

Identifying the direct cause of an accident is optional. While it may not be necessary to identify the direct cause in order to complete the causal factors analysis, the direct cause should be identified when it facilitates understanding why the accident occurred or when it is useful in developing lessons learned from the accident.

4.4 WHAT IS THE MINIMUM SET OF ANALYTICAL TECHNIQUES WE SHOULD USE?

A suite of analytical techniques available to support the accident investigation process is listed in Table 3. Change analysis, barrier analysis, root cause analysis, and events and causal factors charting and analysis are all considered core analytical techniques for accident investigations. They are easy to learn and use, are efficient, and meet the needs of DOE’s accident investigation program. While many techniques could be used on most accidents, those used must be suitable for the complexity of the accident. For example, causation for a complex accident could not be determined through the use of only one technique, such as barrier analysis.

In general, the core analytical techniques should be used for accident investigations to assure that all of the contributing and root causes are identified. These techniques have been used successfully in the past for accident investigations, although other techniques can be used if they yield similar results.

For complex accidents, more rigorous techniques, such as those that employ complicated analytical trees, may be necessary to assure that accident causation is identified. Two examples are Management Oversight and Risk Tree (MORT) and Project Evaluation Tree (PET).



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Other analytical techniques could be used, if needed, for specific situations such as scientific modeling (e.g., for incidents involving criticality and atmospheric dispersion), material and structural analysis, human factors analysis, software hazards analysis, common cause failure analysis, or sneak circuit analysis. In certain situations, an integrated accident event matrix may be developed to determine the actions and interactions of personnel around the time of the accident. The application of analytical techniques for a given accident is determined by the Board Chairperson, in consultation with Board members and advisors/consultants who have expertise in available techniques.

Table 3: Accident Investigation Analytical Techniques

Core Analytical Techniques
<p>For the basic accident with few system failures, these analytical techniques may be used:</p> <ul style="list-style-type: none"> • Barrier Analysis • Human Performance Analysis • Change Analysis • Root Cause Analysis (manual or automated) • Events and Causal Factors Charting and Analysis
Complex Analytical Techniques
<p>For complex accidents with multiple system failures, the analytical techniques may include fault or analytic tree analysis such as MORT, and the core analytical techniques as listed above.</p>
Specialized Analytical Techniques
<p>Other specialized analytical techniques should be used to select techniques for specific investigations (depending on the nature and complexity of the accident) as determined by subject matter experts and the Board Chairperson.</p> <ul style="list-style-type: none"> • Human Factors Analysis • Integrated Accident Event Matrix • Failure Modes and Effects Analysis • Software Hazards Analysis • Common Cause Failure Analysis • Sneak Circuit Analysis • 72-Hour Profile • Materials and Structural Analysis • Scientific Modeling (e.g., for incidents involving criticality and atmospheric dispersion)



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Following is a brief discussion of techniques that are used in most accidents. Further details are available in the DOE Workbook *Conducting Accident Investigations*. For more information see the Accident Investigation Workbook at: <http://www.hss.doe.gov/csa/csp/aip/workbook/toc.html>

4.4.1 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 (barriers) of this energy (hazard) from people, property, or the environment (targets) that prevents accidents. Barriers generally fall in the following categories: equipment, design, administrative (procedures and work processes), 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 (diagram) 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.

4.4.2 Change Analysis

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



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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 (i.e., up to some standard), 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.

4.4.3 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 (i.e., personal injury, property damage)
- The accident sequence occurs during the conduct of some work activity (i.e., a series of events directed toward some anticipated or intended outcome other than injury or damage).

Events and causal factors charting is an integral and important part of the DOE accident investigation process. It is used in conjunction with other key tools (such as root cause analysis, change analysis, and barrier analysis) to achieve optimal analytical results in accident investigation.

An events and causal factors chart is a graphic representation that produce a picture of the accident: both the sequence of events that led to the accident and the conditions that was causal factors.



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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.

For additional information on events and causal factors charting and analysis, refer to Chapter 7.3.1 of the DOE Workbook *Conducting Accident Investigations*.

4.4.4 Root Cause Analysis

DOE O 225.1B requires that root causes of each accident be identified. 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 (i.e., the root cause(s) of an 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 assure 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.

4.4.5 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 MORT and PET are two examples.

Additional information on the application of analytical trees to accident investigations can be found in Chapter 7.4 of the DOE Workbook *Conducting Accident Investigations*.



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5.0 HOW SHOULD WE DETERMINE CONCLUSIONS AND JUDGMENTS OF NEED?

5.1 ARRIVING AT CONCLUSIONS

Conclusions are significant deductions derived from the investigation's analytical results. They are derived from and supported by the facts and the results from testing and the various analyses conducted.

Conclusions are statements that answer two of the questions the accident investigation addresses: what happened and why it happened. Conclusions may include concise recapitulations of the causal factors (direct, contributing, and root causes) of the accident, as determined by analysis of the facts.

An example of a conclusion is, "XYZ contractor failed to adequately implement a medical surveillance program, thereby allowing an individual with medical restrictions to work in violation of those restrictions. This was a contributing factor to the accident. They also may be statements that alleviate potential confusion or issues that may have originally been suspected causes (e.g., "Welds did not fail during the steam line rupture.").

Conclusions may also address significant concerns arising out of the accident or address unsubstantiated concerns or inconclusive results (e.g., "Blood tests on the injured worker did not conclusively establish his blood alcohol content at the time of the accident.").

Where appropriate, conclusions may be used to highlight positive aspects of performance revealed during the investigation (e.g., "Implementation of comprehensive response procedures prevented the fire from spreading to areas containing dispersible radioactive materials, averting a significant escalation in the consequences of the fire.").

When developing conclusions, the investigator should:

- Organize conclusions sequentially, preferably in chronological order, or in logical sets (e.g., Integrated Safety Management Systems, human performance, 10 C.F.R. Part 851 Compliance, OSHA or other Standards Compliance, hardware, procedures, oversight, organizational weaknesses).
- ONLY - base conclusions on the facts and results from your analysis of the facts.
- Include only substantive conclusions that bear directly on the accident and that reinforce significant facts and pertinent analytical results that led to the accident's causes
- Keep conclusions as short as possible and, to the extent possible, limit reference citations (if used) to one per conclusion.



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5.2 STATING JUDGMENTS OF NEED

The Judgments of Need (JONs) are the Board’s decisions regarding the managerial controls and safety measures necessary to prevent or minimize the probability or severity of a recurrence. JONs should also provide the basis for subsequent corrective actions. DOE O 225.1B requires that each accident investigation report contain JONs for corrective actions based on an objective analysis of the facts and the causal factors, including DOE or contractor management systems, that could have prevented the accident.

Judgments of Need should be constructed so they clearly identify the organization that is to implement corrective actions to prevent recurrence of the accident. The Board should avoid generic statements and focus on processes and systems, not individuals. Judgments of need should focus on causal factors. Being specific and concise is essential; vague, generalized, broad-brush, sweeping solutions introduced by “should” statements ought to be avoided. Sentences listing JONs may start, “A need exists . . .” or, “There is a need to.”

As an example, a JON might be worded, “There is a need for XYZ Corporation to ensure that an adequate hazards analysis is performed prior to changes in work tasks that affect the safety and health of personnel.” A JON does not tell management how to do something; instead, it simply identifies the “what” in sufficient detail to understand what must be fixed to prevent another similar accident.

Corrective action plans are prepared to address the JON. The resulting corrective actions are the responsibility of line management. If the Board finds the need to make specific recommendations, they should be listed in a separate communication and not in the body of the report or transmittal letter to the Appointing Official.

6.0 IS THERE A SUGGESTED REPORT OUTLINE AND WHAT SHOULD AN ACCIDENT INVESTIGATION REPORT CONTAIN?

The purpose of accident investigation reports is to clearly and concisely convey the results of the investigation in a manner that will help the reader understand what happened, why it happened, and what can be done to prevent a recurrence. Investigation results needs to be reported without attributing individual fault or proposing punitive measures.

The investigation report constitutes an accurate and objective record of the accident and provides complete and accurate details and explicit statements of the Board’s investigation process, facts pertaining to the accident, analytical results, causes of the accident, conclusions reached, and Judgments of Need to correct deficiencies that should have, or could have, prevented the accident.



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In preparing your report consider examples of other reports that have been written located at: <http://www.hss.doe.gov/csa/csp/aip/accidents/typea/typea.html>

6.1 PREPARING THE REPORT

The body of the report should include the following: the facts; results from analysis of the facts; the root, contributing, and direct (as appropriate) causes of the accident, including DOE and contractor management systems that could have prevented the accident; conclusions; and Judgments of Need.

Other information, such as the investigation Board appointment letter and supporting analytical results, should be included in appendices, rather than in the body of the report. Figures, graphs, charts, and diagrams should be designed to promote quick and easy comprehension.

Each report should contain a disclaimer, as worded in Figure 1, on the back of the inside cover.

This report is an independent product of the (nature of accident) accident investigation Board appointed by (appointing authority).
The Board was appointed to perform an investigation of this accident and to prepare an investigation report in accordance with DOE O 225.1B, *ACCIDENT INVESTIGATIONS*.
The discussion of facts, as determined by the Board, and the views expressed in the report do not assume and are not intended to establish the existence of any duty at law on the part of the U.S. Government, its employees or agents, contractors, their employees or agents, or subcontractors at any tier, or any other party.
This report neither determines nor implies liability.

Figure 1: Example Report Disclaimer.

6.2 REPORT CONTENT

The investigation report should consist of the following elements:

- Appointing Official's Report Acceptance
- The Appointing Official should sign a statement that the investigation has been completed in accordance with procedures specified in DOE O 225.1B and that the



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final report has been accepted from the accident investigation Board. An example of wording for an acceptance statement is provided in Figure 2.

<p>On (Date), I established an Accident Investigation Board to investigate the (Type/Title of Accident) Accident at (Location of Accident) that resulted in (describe result, e.g., injury, death, exposure, property damage). The Board's responsibilities have been completed with respect to this investigation. The analysis process, identification of causal factors, and development of Judgments of Need were performed during the investigation in accordance with DOE O 225.1B, <i>Accident Investigations</i>. I accept the findings of the Board and authorize the release of this report for general distribution.</p>	
<p>(Signature) Signature Block of Appointing Official</p>	<p>(Date)</p>

Figure 2: Example Acceptance Statement.

The following is an annotated outline showing the recommended structure and content of the investigation report. For more information see *Guide for Editors and Coordinators for Accident Investigations* at: http://www.hss.doe.gov/csa/csp/aip/AI_Admin_Editors_Guide_Mar_2005.pdf.

SUGGESTED REPORT OUTLINE AND CONTENT

Table of Contents

Self-explanatory

Acronyms and Initializes

This is self-explanatory. If necessary, a glossary of technical terms should follow this Chapter.

Prologue - Interpretation of Significance

This is a one-page discussion of the key management concerns and the primary lessons learned from the accident.

Executive Summary

The executive summary should include a brief account of the essential facts surrounding the occurrence and major consequences (what happened); the conclusions and root causes based on factors such as the organizational, management system, and line management oversight



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deficiencies that allowed the accident to happen (why it happened); and Judgments of Need for preventing recurrence of the accident (what must be done to correct the problem and prevent it from recurring). It should be written for the executive or for the general reader who may be relatively unfamiliar with the subject matter. It should not contain information not discussed elsewhere in the report.

1.0 Introduction

This Chapter normally contains three major sub-chapters: (1) a brief description of the accident and its results, and a statement regarding the authority to conduct the investigation; (2) brief descriptive data concerning the facility, area, or site and the major organizations involved, to help the reader understand the context of the accident and the information that follows; and (3) descriptions of the scope of the investigation, its purpose, and the methodology employed in conducting the investigation.

2.0 Facts and Analysis

This Chapter states the facts related to the accident and the analysis of those facts. It focuses on events connected to the accident and the causal factors that allowed those events to occur. This Chapter should logically lead the reader to the conclusions and Judgments of Need.

It includes sub-chapters dealing with: (1) accident description and chronology, including a description of the responses to the accident; (2) facts and analysis regarding pertinent physical hazards, controls, and other related factors (a separate sub-chapter on management systems is included); (3) brief descriptions and results of various analyses that were conducted (e.g., events and causal factors analysis, barrier analysis, change analysis, root cause analysis); and (4) causal factors, including the direct (as applicable), contributing, and root causes. Care should be taken in writing the report to clearly distinguish facts from analysis, which may contain opinions. Photos and diagrams, which may provide perspectives that written narrative cannot capture, may be included, as determined by the Board.

3.0 Conclusions and Judgments of Need

This Chapter includes conclusions in the form of: (1) statements of what was found (through interviews, analysis, deduction, etc.) by the accident investigation Board and (2) Judgments of Need, which are identified needs (actions) required to prevent future accidents.

Minority Report

If required, this Chapter contains any Board member opinions that differ from the consensus of the Board. It should address only those Chapters of the report in which there is a minority opinion, should follow the same format as the overall report (addressing only the points of variance), and should not be a complete rewrite of the report. Those Chapters of the report in which there is a minority opinion, should follow the same format as the overall report (addressing only the points of variance), and should not be a complete rewrite of the report.



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Board Signatures

The accident investigation Board Chairperson and members needs to be sign and date the report, even if one or more have written a minority opinion. The signature page indicates the name and position of each Board member and the accident investigation Board Chairperson, and it indicates whether the signatory is a DOE accident investigator.

Board Members, Advisors, Consultants, and Staff

This Chapter contains the names of the Board members, advisors, and staff, indicating their employers, job titles, and positions.

Appendices

Appendices are added, as required, to provide supporting information, such as the accident investigation Board's appointment letter and results from detailed analyses conducted during the investigation.

As a general rule, the amount of documentation in the appendices should be limited. The appendices should not be more comprehensive than the report itself. If there is any doubt about whether there is benefit for including material as an appendix, it should be summarized or omitted. All appendices should be referenced in the report.

6.3 QUALITY REVIEW AND VALIDATION OF CONCLUSIONS

The Board reviews the report to ensure its technical accuracy, completeness, and internal consistency, and to ensure that analysis of organizational concerns, safety management systems, and line management oversight processes that may have contributed to the accident are properly considered. The following are further considerations for quality review of the report.

6.3.1 Structure and Format

The report is reviewed to ensure that it follows the format and contains the information outlined in Chapter III of this E-Reference to meet the intent of DOE O 225.1B. Variation in the format is acceptable, as long as it does not affect the report's quality and the requirements of the Order are met.

6.3.2 Technical and Policy Issues

Technical requirements applicable to the investigation are reviewed by appropriate subject matter experts to assure their accuracy. Likewise, a knowledgeable Board



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member or advisor reviews whether policy, requirements, and procedures were followed prior to the accident. Whether these requirements were adequate should also be reviewed by a Board member or advisor knowledgeable in such policy and requirements.

6.3.3 Requirements Verification Analysis

Requirements verification analysis is conducted after all the analytical techniques are completed and a draft of the report has been prepared. The analysis ensures that all portions of the report are accurate and consistent and verifies that the conclusions are consistent with the facts and JONs. The verification analysis determines whether the flow from facts to analysis, conclusions, and JONs is logical. The conclusions and Judgments of Need are traced back to locate the facts that support the conclusions. The goal is to eliminate conclusions that are not based on facts. One approach is to compare the facts, analysis, conclusions, causes, and Judgments of Need on a wall chart, and then validate the continuity of facts through the analysis and conclusions to the Judgments of Need. This method also identifies any misplaced facts, insufficient analyses, and unsupported conclusions or Judgments of Need.

6.3.4 Classification Review

A classification review should be completed by an authorized derivative classifier prior to dissemination of the report for factual accuracy review. Documentation of this review should be included in the investigation file.

6.3.5 Privacy Act Review

Review of the report for privacy considerations should be conducted prior to dissemination. Documentation of this review should also be included in the investigation file. In the event of any questions concerning applicability of the Privacy Act or unwarranted invasions of personal privacy, consult the appropriate Department FOIA/Privacy Act attorney.

6.4 WHY IS IT CRITICAL TO CONDUCT A FACTUAL ACCURACY REVIEW?

After the accident investigation report has been drafted in its final form and before it is sent to the appointing authority for acceptance, the facts Chapter of the report should be reviewed by DOE and contractor line management affected by the investigation to validate the factual accuracy of the report's contents. Additional portions of the report may also be provided at the discretion of the Board Chairperson. The review is important for ensuring an accurate report and agreement as to the facts by all affected parties. This is consistent with identifying system deficiencies so corrective action can be taken, rather than fixing blame.



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6.5 HOW DO WE OBTAIN A QUALITY REVIEW BY THE OFFICE OF HEALTH SAFETY AND SECURITY?

Prior to submission of the accident investigation report to the Appointing Official, the Board Chairperson should submit the final draft of the report to the HSS Accident Investigation Program Manager for a quality review and comment. After the reviews are conducted, comments are provided to the Appointing Official.

The purpose of the reviews is to ensure:

- Consistency among accident investigation techniques across the DOE complex;
- A structured approach to analysis;
- Appropriateness of Judgments of Need;
- Identification of programmatic concerns arising out of the accident;
- Identification of training needs for investigators, points of contact, and readiness teams; and
- Consistency among facts, analyses, conclusions, and Judgments of Need.

6.6 HOW ARE REPORTS SUBMITTED?

When the report is completed and all comments are resolved, the Board Chairperson provides the final report to the Appointing Official for acceptance and distribution. A Portable Document Format (PDF) of the final report signed by the Appointing Official needs to be electronically provided to the HSS Accident Investigation Program Manager for posting on the DOE Accident Investigation web site.

7.0 HOW DO WE CLOSE THE INVESTIGATION?

When the report is accepted by the Appointing Official, the onsite portion of the investigation is complete. However, the Chairperson and the Board are often requested to assist in meeting additional responsibilities, such as participating in corrective action reviews, conducting briefings, and finalizing the report.

7.1 BRIEFINGS

A briefing on the investigation's outcome is required by DOE O 225.1B. The Appointing Official for the investigation must coordinate and arrange for appropriate representatives to attend this formal briefing at a mutually convenient time and location. This briefing is conducted by the Board Chairperson and the responsible Heads of the Program. Accident



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investigation participants (Chairperson, Board members, and any consultants and advisors deemed appropriate by the Chairperson) may attend the briefing. The briefing covers:

- What happened?
- Why it happened.
- What needs to be corrected to prevent recurrence (Judgments of Need)?
- Preliminary actions planned by the field element to address the Judgments of Need.

Other briefings may be provided by the Board Chairperson and Board members, as appropriate.

7.2 APPOINTING OFFICIAL'S REPORT ACCEPTANCE

The formal investigative phase of the investigation is considered complete when the Appointing Official accepts the report. The Chairperson is responsible for final editing and production of the report, with assistance from administrative support staff. The Appointing Official indicates formal acceptance by completing an acceptance certification in the format indicated in Chapter III, Paragraph 6.2, Figure 2 of this e-Reference.

The final report is published and distributed within 7 calendar days of acceptance by the Appointing Official. One copy of both accident investigation reports need to be provided to the affected Secretarial Officer(s), each operations office and/or field element, and appropriate program office(s).

A Portable Document Format (PDF) of the final report signed by the Appointing Official needs to be electronically provided to the HSS Accident Investigation Program Manager for posting on the DOE Accident Investigation web site normally within seven days of report acceptance.

The final report needs to be distributed to senior managers of organizations identified in the Judgments of Need, with a request for action by the organizations identified in the Judgments of Need as indicated in Chapter III, Paragraph 5.2 of this E-Reference.

Once the accident investigation report is accepted by the Appointing Official, the report is considered final, and the Board is released from its responsibilities.



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8.0 WHAT POST-INVESTIGATION ACTIVITIES NEED TO BE COMPLETED?

8.1 CORRECTIVE ACTION PLANS

The final report is submitted by the Appointing Official to senior managers of organizations identified in the Judgments of Need in the report, with a request for the organizations to prepare corrective action plans. These plans contain actions for addressing Judgments of Need identified in the report and include milestones for completing the actions.

Corrective actions fall into four categories:

- Immediate corrective actions that are taken by the organization managing the site where the accident occurred to prevent a second or related accident.
- Corrective actions required to satisfy Judgments of Need identified by the Board in the final report. These corrective actions are developed by the Heads of Field Elements and/or contractors responsible for the activities resulting in the accident and are designed to prevent recurrence and correct system problems.
- Corrective actions determined by the Appointing Official to be appropriate for DOE-wide application. The Appointing Official recommends these corrective actions when the report is distributed.
- DOE Headquarters corrective actions that result from discussions with senior management. These actions usually address DOE policy.

Heads of Field Elements are responsible for developing corrective action plans, submitting them for review and approval within 30 calendar days of investigation report acceptance by the Appointing Official, and implementing and tracking action plans to completion in order to satisfy the JONs identified in the investigation report. These plans are submitted to the cognizant Secretarial Officer for approval and to the Office of Corporate Safety Programs for review and comment. Approval responsibility of the Secretarial Officer may be delegated to the field at the discretion of the Secretarial Officer.

A copy of the plan should also be forwarded to the program manager. These actions and responsibilities apply to both investigations.

8.2 HOW DO WE TRACK AND VERIFY CORRECTIVE ACTIONS?

Corrective action plans are submitted to the Head of the Program Element which reviews the plans and provides comments.

This review is done to determine the:



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- Adequacy of proposed corrective actions in meeting the deficiencies stated in the Judgments of Need.
- Feasibility of the proposed corrective actions.
- Timeliness of the proposed corrective actions.
- Necessity for any interim actions to prevent further accidents, pending permanent.
- Corrective actions.

The Heads of Field Elements whose site, facility, operation, or area was involved in the accident have responsibility for accepting, entering the corrective actions into the appropriate database established by the Head of the Program Element and implementing applicable corrective actions.

However, other DOE/NNSA Field Elements may have responsibility for completing actions resulting from the investigation. In these cases, the organization(s) indicated in the corrective action plan as having responsibility for implementation is (are) accountable for completing the requisite actions.

The s of Headquarters Elements verifies completion of approved corrective actions and satisfaction of Judgments of Need.

When corrective action plans are completed and corrective actions have been implemented, those Headquarters and field elements having responsibilities for corrective actions notify the Appointing Official, who closes the investigation. Copies of the notification to and closure by the Appointing Official are sent to the Program Manager.

8.3 HOW DO WE ESTABLISH LESSONS LEARNED?

8.3.1 Introduction

The purpose of conducting accident investigations is to determine the system deficiencies that allowed the accident to occur so that those deficiencies can be corrected and similar accidents can be prevented. Summaries of deficiencies and the recommended corrective actions are identified as “lessons learned”. In the interest of preventing recurrence of accidents, lessons learned are disseminated DOE-wide to ensure that the results of investigations have the greatest effect for continuous improvement in environment, safety, and health performance.

8.3.2 Responsibilities

The responsibility for developing and disseminating lessons learned arising from accident investigations resides with the Appointing Official as defined in DOE O 225.1B.



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8.3.2.1 Accident Investigations

For accident investigations, the Appointing Official is the Heads of Headquarters Elements. In the event that the responsibility for appointing an AIB is delegated to the Heads of Field Elements, the responsibility for developing and disseminating lessons learned from the accident investigation remains with the Heads of Headquarters Elements Quality Assurance Program.

8.3.3 Developing Lessons Learned

Lessons learned from accident investigations are developed in accordance with DOE O 210.2, *DOE Corporate Operating Experience Program* and/or other provisions that govern the DOE Lessons Learned Program. For accident investigations, the Head of the DOE/NNSA Program Element is responsible for to develop and disseminate the lessons learned.

8.3.4 Disseminating Lessons Learned

Lessons learned from the accident investigation are developed and disseminated within 90 calendar days of acceptance of the investigation report by the Appointing Official. Methods for disseminating lessons learned include; hard copy, electronic, and other methods for use both intra-site and across the DOE complex, such as reports, workshops, and newsletters.

The DOE Lessons Learned Information System provides for electronic dissemination of lessons-learned information throughout the DOE complex. Detailed information on the required elements for input to the information system may be found in the documents referenced in Chapter III of this E-Reference.



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ATTACHMENT A. DEFINITIONS

Accident. The term "accident" can be defined as an unplanned event that has resulted in or suggests the failure of a DOE safety management system, barriers, or loss of controls that rises to the threshold criteria specified in this Appendix A of DOE Order 225.1B. **Accident Investigation Board Chairperson.** The DOE Official designated by the Appointing Official and has been given the authority to: conduct the lead accident investigation; manage the activities of the Board; obtain external or internal DOE Federal and contractor resources required; control the accident scene; collect evidence; analyze evidence; and issue a formal report of the Board's conclusions and Judgments of Needs to the Appointing Official.

Accident Investigation Board Consultant/Advisor. Are either Federal, or non-Federal employees who possess subject matter expertise in more narrow or specific areas of focus of the Accident Investigation, such as accident analytical techniques, occupational medicine, toxicology, specific engineering, safety, health, environmental technical or regulatory knowledge, required by the AIB Chairperson to conduct the investigation, see Section 4.c.(1).(d).

Accident Investigation Board Members. Are DOE Federal employees, who possess subject matter expertise in core areas of focus of the Accident Investigation, required by the AIB Chairperson to conduct the accident investigation, see Section 4.c.(1).(d).

Accident Investigator. A DOE Federal employee who has participated on at least one Accident Investigation Board (AIB) and has successfully completed an Office of Health, Safety and Security (HSS) accident investigation course of instruction. Effective two years from the approval date of this Order, personnel who serve in this position must have attended a HSS National Training Center accident investigation training course within the five years preceding the accident.

Analysis. The use of methods and techniques for arranging data to: (a) assist in determining what additional data are required; (b) establish consistency, validity, and logic; (c) establish necessary and sufficient events for causes; and d) guide and support inferences and judgments.¹

Analytical tree. Graphical representation of an accident in a deductive approach (general to specific). The structure resembles a tree, narrow at the top with a single event (accident), and then branching out as the tree is developed and identifying root causes at the bottom branches.

Appointing Official. A Departmental authority responsible for appointing an AIB, with responsibilities as prescribed in DOE O 225.1B.

¹ Ferry, Ted S., Modern Accident Investigation and Analysis, 2nd Edition, John Wiley & Sons, New York, New York, 1988.



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Barrier. Anything used to control, prevent, or impede energy flows. Common types of barriers include equipment, administrative procedures and processes, supervision/management, warning devices, knowledge and skills, and physical. Barriers may be either control or safety.

Barrier analysis. An analytical technique used to identify the energy sources and the failed or deficient barriers and controls that contributed to an accident.

Causal factor. An event or condition in the accident sequence necessary and sufficient to produce or contribute to the unwanted result. Causal factors fall into three categories: direct cause, contributing cause, and root cause. A causal factor is a collective descriptive term associated with human performance or a safety management system which can be broken down to identify direct, root, and contributing causes.

Cause. Anything that contributes to an accident or incident. In an investigation, the use of the word “cause” as a singular term should be avoided. It is preferable to use it in the plural sense, such as “causal factors,” rather than identifying “the cause.”

Chain of custody. The process of documenting, controlling, securing, and accounting for physical possession of evidence, from initial collection through final disposition.

Change. Stress on a system that was previously in a state of equilibrium, or anything that disturbs the planned or normal functioning of a system.

Change analysis. An analytical technique used for accident investigations, wherein accident-free reference bases are established, and changes relative to accident causes and situations are systematically identified. In change analysis, all changes are considered, including those initially considered trivial or obscure.

Conclusions. Significant deductions derived from analytical results. Conclusions are derived from and must be supported by the facts, plus results from testing and analyses conducted. Conclusions are statements that answer two questions the accident investigation addresses: what happened and why did it happen? Conclusions include concise recapitulations of the causal factors (direct, contributing, and root causes) of the accident determined by analysis of facts.

Confirmed monitoring result. Either a dosimeter result or an intake, confirmed by follow up radio bioassay, or by association with a known incident, or by investigation.

Contributing cause. An event or condition that collectively with other causes increases the likelihood of an accident but which individually did not cause the accident.

Controls. Those barriers used to control wanted energy flows, such as the insulation on an electrical cord, a stop sign, a procedure, or a safe work permit.

Core Analytical Techniques. The techniques are events and causal factors analysis, barrier analysis, and change analysis.



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Direct cause.² The immediate events or conditions that caused the accident.

Energy. The capacity to do work and overcome resistance. Energy exists in many forms, including acoustic, potential, electrical, kinetic, thermal, biological, chemical, and radiation (both ionizing and non-ionizing).

Energy flow. The transfer of energy from its source to some other point. There are two types of energy flows: wanted (controlled--able to do work) and unwanted (uncontrolled--able to do harm).

Environmental Release. Environment means (1) the navigable waters, the waters of the contiguous zone, and the ocean waters of which the natural resources are under the exclusive management authority of the United States under the Fishery Conservation and Management Act of 1976, and (2) any other surface water, ground water, drinking water supply, land surface or subsurface strata, or ambient air within the United States or under the jurisdiction of the United States;

Release means any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment (including the abandonment or discarding of barrels, containers, and other closed receptacles containing any hazardous substance or pollutant or contaminant).

Equivalencies. Alternative approaches to fulfilling the requirements of this Order in cases where the “how” is specified. Acceptable alternative approaches to achieving the goal of this Order are approved by the cognizant Heads of the Headquarters Elements in consultation with the Office of Primary Interest (the Office of Health, Safety and Security) in accordance with the requirements specified in DOE O 251.1C, Departmental Directives Program.

Exemption. A release from one or more requirements of an Order. Exemptions are processed in the same manner as equivalencies (see above).

Heads of Field Elements. First-tier field managers of the site and operations offices. Field Elements is a general term for all DOE sites located outside of the Washington, D.C. metropolitan area.

Heads of Headquarters Elements. Headquarters first-tier organizations, Secretarial Officers, Administrator for NNSA, and Heads of Staff Offices.

² Direct cause is defined in DOE M 232.1-1, OCCURRENCE REPORTING AND PROCESS OF OPERATIONS INFORMATION, Section 10.2B(20), which is used to implement DOE O 232.1, OCCURRENCE REPORTING AND PROCESSING OF OPERATIONS INFORMATION, and is determined and reported in final ORPS reports.



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Event. An occurrence; something significant and real-time that happens. An accident involves a sequence of events occurring in the course of work activity and culminating in unintentional injury or damage.

Events and causal factors chart. Graphical depiction of a logical series of events and related conditions that precede the accident.

Fatal injury. Any injury that results in death within 30 calendar days of the accident.

Field element. A general term for all DOE sites (excluding individual duty stations) located outside the Washington, D.C. metropolitan area.

Hazard. The potential for energy flow(s) to result in an accident or otherwise adverse consequence.

Heads of field elements. First-tier field managers of the eight operations offices, the three field offices, and the Power Marketing Administrations (Administrators). Field element is a general term used for DOE sites (excluding individual duty stations) located outside of the Washington, D.C., metropolitan area.

Judgments of Need. Managerial controls, safety measures, or human performance improvements necessary to prevent or minimize the probability or severity of a recurrence of an accident.

Learning Organization. A learning organization is one that values learning and is committed to facilitating continuous performance improvement. It encourages a culture of openness and trust in an environment that rewards efforts to learn from experiences. The organization recognizes Human Performance Improvement concepts and principals in problem analysis, solution planning, and solution implementation. It rewards ongoing efforts to learn from experience, learn from others, and from self-directed studies and aggressively seeks to know what it doesn't know.

Reference: DOE M 450.4-1, *Integrated Safety Management Manual*, dated 11-1-06; DOE - HDBK-1028-2009, *Human Performance Improvement Handbook, Volume 1: Concepts and Principals*, and, DOE -HDBK1028-2009, *Human Performance Improvement Handbook, Volume 2: Human Performance Tools for Individuals, Work Teams, and Management*.

Lesson learned. A “good work practice” or innovative approach that is captured and shared to promote its widespread application. A lesson learned may also be an adverse work practice or experience that is captured and shared to avoid recurrence.

Occurrence. An event or condition that adversely affects or may adversely affect DOE or contractor personnel, the public, property, the environment, or DOE mission.

Occurrence Reporting and Processing System (ORPS). The reporting system established and maintained for reporting occurrences related to the operation of DOE facilities.



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(DOE Accident Investigation) Program Manager. The individual within the Office of the Chief Health Safety and Security Officer (HS-1), who is responsible for administering the DOE accident investigation program.

Readiness team. Trained personnel who are available to perform initial investigative response activities immediately following an accident.

Requirements verification analysis. A validation technique that determines whether the logical flow of data from analysis to conclusions and judgments of need is based on facts. This technique is conducted after all the analyses are completed.

Root Cause. The causal factor(s) that, if corrected, would prevent recurrence of the accident.

Root cause analysis. Any methodology that identifies the causal factors that, if corrected, would prevent recurrence of the accident.

Target. A person, object, or animal upon which an unwanted energy flow may act to cause damage, injury, or death.



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ATTACHMENT B. MEMORANDUM ESTABLISHING AN ACCIDENT INVESTIGATION BOARD

I hereby establish a DOE or NNSA Federal Accident Investigation Board to investigate the accident which occurred at the (site) on (date). I have determined it meets the requirements established for an accident investigation in DOE O 225.1B, *Accident Investigations*.

I appoint (name) as the accident Board Chairperson. The Board members will be (three to six names). The Board will be assisted by advisors and consultants and by other support personnel as determined by the Chairperson.

The scope of the Board's investigation will include but is not limited to identifying all relevant facts; analyzing the facts to determine the causes of the accident; developing conclusions; and determining the Judgments of Need that, when implemented, should prevent the recurrence of the accident. The investigation will be conducted in accordance with DOE O 225.1B and will specifically address the role of DOE and contractor organizations and management systems as they may have contributed to the accident. The scope will also include (specific disciplines related to the accident) and the application of lessons learned from similar accidents within the Department.

The Board will provide my office with periodic reports on the status of the investigation but will not include any conclusions until an analysis of all the causal factors has been completed. Draft copies of the factual portion of the investigation report will be submitted to (DOE and contractor organizations at the accident site) for a factual accuracy review prior to report finalization.

The report should be provided to me for acceptance within (nominally 30 calendar days or specify date) from the date of this memorandum. Discussions of the investigation and copies of the draft report will be controlled until I authorize release of the final report.

(Signature)

Signature Block of Appointing Official



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ATTACHMENT C. MODEL OPENING STATEMENT

[To be recorded]

Let the record reflect that this interview has commenced at (time, date, and place).

I am (state interviewer's name(s) and employment affiliation(s), i.e., I am Joe Smith, member of the DOE or NNSA Accident Investigation Board. With me are (name and organization of other Department personnel). For the record, please state your full name, company affiliation, job title or position.

Read into record the names and employment of any additional persons present (other than the recorder).

The Department has established an accident investigation Board to determine the facts that led to the (accident date) accident at (place of accident). The principal purpose of this investigation is to determine the facts surrounding the accident so that proper remedial measures can be instituted to prevent the recurrence of accidents. We have authority to conduct this investigation under the Department of Energy Organization Act, which incorporates provisions of the Atomic Energy Act of 1954 authorizing investigations of this type.

Your appearance here to provide information is entirely voluntary, and you may stop testifying and leave at any time. However, you should understand that giving false testimony in this investigation would be a felony under 18 U.S. Code Section 1001. Do you understand that?

You have the right to be accompanied by an attorney or a union representative. (If witness has attorney or a union representative, put the name of such person into the record.) "Let the record reflect that Mr./Mrs./Ms. _____ is accompanied by _____" (as his/her attorney or union representative).

We would like to record this interview to ensure an accurate record of your statements. A transcript of this discussion will be produced, and you will have an opportunity to review the transcript for factual accuracy and corrections. If you do not wish to have the session recorded, we will not do so. Do you have any objection to having the session recorded?

We will attempt to keep your testimony confidential but we cannot guarantee it. At a later date, we may have to release your testimony pursuant to a request made under the Freedom of Information Act, a court order, or in the course of litigation concerning the accident, should such litigation arise. Do you want your testimony to be considered confidential? (Wait for answer—if answer to preceding question is affirmative).