DOE/IG-0442

INSPECTION REPORT

INSPECTION OF SELECTED ISSUES REGARDING THE DEPARTMENT OF ENERGY ACCIDENT INVESTIGATION PROGRAM

APRIL 1999

U.S. DEPARTMENT OF ENERGY
OFFICE OF INSPECTOR GENERAL
OFFICE OF INSPECTIONS

April 1, 1999

FROM: **Gregory H. Friedman /s/**
Inspector General

SUBJECT: INFORMATION: Report on "Inspection of Selected Issues Regarding the Department of Energy Accident Investigation Program"

BACKGROUND

One method used by the Department of Energy (DOE) to promote worker safety is through the Department's accident investigation program. The objectives of the program are, among other things, to enhance safety and health of employees, to prevent the recurrence of accidents, and to reduce accident fatality rates and promote a downward trend in the number and severity of accidents. The Assistant Secretary, Office of Environment, Safety and Health (EH), through the EH Office of the Deputy Assistant Secretary for Oversight, is responsible for implementation of the Department's accident investigation program.

As part of our inspection, we reviewed an April 1997 EH accident investigation report regarding an accident involving a Lockheed Martin Energy Systems (LMES) welder, who suffered fatal burns when his clothing caught fire while he was using a cutting torch at the Oak Ridge K-25 Site. We also reviewed reports of other accident investigations conducted by EH and DOE field organizations. Based on our review of these reports, we identified issues concerning the adequacy of the examination and reporting by accident investigation boards of specific management systems and organizations as a possible accident root cause. Our inspection also identified issues concerning worker safety that we determined required immediate management attention, such as whether occurrences were being reported in the appropriate management systems and whether prompt consideration was being given to implementing revisions of national standards when the revisions increased worker safety.

RESULTS OF INSPECTION

Although considerable improvement has occurred in the Department's accident investigation process, we concluded that additional improvement is needed in the identification of the root and contributing causes of accidents. More importantly, we concluded that deficiencies regarding root cause analysis were more the result of inadequate implementation of existing policies, procedures, and guidelines, than the result of deficiencies in the guidance. Requiring at least one board member or advisor to be trained and experienced in causal analysis could alleviate many of the deficiencies we identified regarding the root cause analyses conducted by accident investigation boards.

Also, we determined that incidents involving welders' clothing burning or catching fire and resulting in medical treatment, which had been reported in the Department's Computerized Accident/Incident Reporting System, had not been reported in the Department's Occurrence Reporting and Processing System (ORPS). In our judgement, these incidents were "near misses" and should have been reported in ORPS . The term "near miss" refers generally to an incident in which only one remaining "barrier" prevented a serious accident or injury, after other "barriers" failed. We concluded that actions are needed by management to ensure that "near misses" are being reported in the appropriate management systems and that trends, which may indicate a potential safety and health concern, are identified.

In addition, we found that although an earlier 1967 revision of a national standard regarding welding and cutting operations was incorporated in the LMES contract, a 1994 revision of the standard that contained a requirement concerning the selection of welders' protective clothing had not been incorporated into the contract at the time of the welder fatality. We concluded that management systems should have ensured that requirements, such as those pertaining to welders' protective clothing contained in the 1994 revision of the national standard, had been incorporated in the LMES contract. We also concluded that action is required to ensure that contractors immediately implement the DOE order requirements regarding compliance with the current revision of the national standard.

Our report contains recommendations for corrective actions to ensure: (1) the proper reporting and trending of occurrences, including "near-misses;" (2) an annual review is conducted of the "List B" set of requirements in contracts to ensure the requirements are current; (3) emphasis is placed on conducting a thorough causal analysis, to include root cause analysis, for accident investigations; and (4) determinations regarding possible conflict of interests involving accident investigation board members or advisors are appropriately documented.

MANAGEMENT REACTION

Management concurred with the findings and recommendations and initiated appropriate corrective actions.

Attachment

cc: Deputy Secretary
Under Secretary

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INTRODUCTION AND OBJECTIVE

One of the critical success factors identified in the Department of Energy's (DOE) Strategic Plan for environment, safety and health is "how will we ensure the safety and health of workers and the public, and protect and restore the environment." One method used by the Department to promote worker safety is through the Department's accident investigation program. The objectives of the program are, among other things, to enhance safety and health of employees, to prevent the recurrence of accidents, and to reduce accident fatality rates and promote a downward trend in the number and severity of accidents. The Assistant Secretary, Office of Environment, Safety and Health (EH), through the EH Office of the Deputy Assistant Secretary for Oversight, is responsible for implementation of the Department's accident investigation program.

Accidents are categorized according to severity. For example, a Type A accident, which is the most severe, could involve a fatality or a property loss estimated at equal to or greater than $2.5 million. A Type B accident, which is less severe, could involve serious injuries or a property loss estimated at less than $2.5 million, but greater than $1 million. Following the categorization of an accident as a Type A or Type B accident, an accident investigation board is appointed to determine the facts of the accident and report the investigation results without determining individual fault or proposing punitive measures. One of the most important responsibilities of the appointing official is to ensure that the board's authority is clear in investigating potential causes, including the root cause(s), of a given accident. This authority includes reviewing, as possible root causes, management systems, policy, and line management oversight processes up to and beyond the level of the appointing official. Root cause analysis is used to identify those deficiencies, including management systems factors that, if corrected, would prevent recurrence of the accident.

In March 1996, we issued an inspection report titled "Summary Results of the Inspection of Issues Regarding the Scope of the Accident Investigation of the TRISTAN Fire at the Brookhaven National Laboratory," DOE/IG-0386, which concerned issues regarding the scope of the Department's accident investigation of a March 31, 1994, fire at the Terrific Reactor Separator To Analyze Nuclides (TRISTAN) experiment at the Department's Brookhaven National Laboratory). We were concerned that the accident

investigation board did not adequately examine and report on specific management systems and organizations as a possible root cause.

In April 1997, EH issued an accident investigation report, titled "Type A Accident Investigation Board Report on the February 13, 1997, Welding/Cutting Fatality at the K-33 Building, K-25 Site Oak Ridge, Tennessee." The report concerned the investigation of an accident involving a Lockheed Martin Energy Systems, Inc. (LMES) welder, who suffered fatal burns when his clothing caught fire while he was using a cutting torch at the K-33 Building, Oak Ridge K-25 Site, now the Oak Ridge East Tennessee Technology Park. After reviewing the root causes identified by the EH Accident Investigation Board (Board), we determined that the Board did not adequately examine and report on specific management systems and organizations as a possible accident root cause. Instead, the Board chose to report what it believed were urgent policy issues concerning the welder's clothing and fire watch responsibilities as the accident root causes, even though the Board identified as the overwhelming concern the failure to conduct adequate work planning and hazards analyses, which are specific management systems.

The objective of our inspection was to review the Board's root cause analysis and the resolution of an alleged conflict of interest by a technical advisor to the Board. However, during our preliminary fieldwork, we identified additional issues concerning worker safety that we determined required immediate management attention. These issues concerned whether occurrences were being reported in the appropriate management systems, and whether prompt consideration was being given to implement revisions of national standards, when the revisions increased worker safety. These issues were discussed in an Office of Inspector General Management Alert, titled "Inspection of K-25 Type A Accident Investigation," S98IS004, issued on November 7, 1997.

Since February 1997, when the welder fatality occurred, reports regarding the reporting of contractor injuries have been issued and a significant safety initiative was announced by the Department. For example, in May 1997, the Office of Inspector General issued an audit report titled: "Audit of Department of Energy Contractor Occupational Injury and Illness Reporting Practices," DOE/IG-0404, which found that management and operating contractors

were not reporting all significant work-related injuries/illnesses as required by Departmental and Occupational Safety and Health Administration (OSHA) guidelines. Also, in September 1997, the Department's Oak Ridge Operations Office (OR) issued a report titled: "Report on the For Cause Review of the Lockheed Martin Energy Systems (LMES) Occurrence Reporting Program," which determined that "near misses" are not adequately defined by the Department, so there is no clear expectation for what types of events would be reportable. In addition, on April 14, 1998, the then Secretary of Energy announced a new safety initiative under which the Department will adopt a "zero tolerance" policy for serious accidents that result in life-threatening injuries or major environmental contamination. This safety initiative is a Department-wide effort intended to make a dramatic improvement in environment, safety and health.

OBSERVATIONS AND CONCLUSIONS

Incidents involving welders' clothing burning or catching fire and resulting in medical treatment had been reported in the Department's Computerized Accident/Incident Reporting System (CAIRS), but not in the Department's Occurrence Reporting and Processing System (ORPS). In our view, these incidents were "near misses" that also should have been reported in ORPS. We concluded that actions are needed by management to ensure that "near misses" are being reported in the appropriate management systems and that trends, which may indicate a potential safety and health concern, are identified. [Note: As part of its implementation of the Government Performance and Results Act of 1993 (GPRA), the Department must, among other things, establish program goals and measure performance against these goals. The ORPS database is a performance-based management system that can be used to evaluate the Department's performance under GPRA.]

Also, an earlier 1967 revision of a national standard, American National Standards Institute (ANSI) Z49.1, "Safety in Welding, Cutting and Allied Processes," was incorporated in the LMES contract through the Standards/Requirements Document (S/RID). However, at the time of the welder fatality, a 1994 revision of the standard that contained a requirement concerning the selection of welders' protective clothing had not been incorporated into the Department's contract with LMES. We concluded that management systems should have ensured that requirements, such

as those pertaining to welders' protective clothing contained in the 1994 revision of the ANSI standard, had been incorporated in the LMES contract through the S/RID.

In addition, EH's implementation of the EH Accident Investigation Board's "Proposed Judgements of Need" may not fully address the Board's purported desire to require the use of flame-retardant, anti-contamination clothing in cutting, welding, and hotwork operations. We concluded that action is required to ensure that contractors immediately implement the DOE order requirements regarding compliance with the current revision of ANSI Z49.1 for cutting, welding, and hotwork activities. The DOE order does not require immediate modification of existing contracts to ensure compliance with the current ANSI Z49.1 standard.

Considerable improvement has occurred in the Department's accident investigation process since the release of our report on the investigation of the TRISTAN fire. However, we concluded that additional improvement is needed in the identification of the root and contributing causes of accidents. More importantly, we concluded that deficiencies regarding root cause analysis were more the result of inadequate implementation of existing policies, procedures, and guidelines, than the result of deficiencies in the guidance. Requiring at least one board member or advisor to be trained and experienced in causal analysis could alleviate many of the deficiencies we identified regarding the root cause analyses conducted by accident investigation boards.

Finally, there was a difference of opinion whether a possible conflict of interest was resolved regarding the assignment of a former LMES safety manager as a technical advisor to the EH Accident Investigation Board investigating the welder fatality. We concluded that when legal advice is obtained by the board chairperson regarding a possible conflict of interest determination, the legal advice should be appropriately documented.

We found that incidents of welders' clothing burning or catching fire and resulting in medical treatment had been reported in one management system, CAIRS, but had not been reported in ORPS. The purpose of ORPS is to ensure appropriate and timely identification, categorization, response, notification, investigation, and reporting of abnormal conditions and events.

"Near Misses" Not Reported In ORPS

Between January 1990 and February 13, 1997, the date of the welder fatality, five incidents had occurred at the Oak Ridge Site involving welders' clothing burning or catching fire and resulting in medical treatment. However, key fire protection personnel at the Oak Ridge site said that they had not been aware of the reported incidents prior to the welder fatality. These incidents had been reported in CAIRS, but not in ORPS. According to the Headquarters ORPS Manager, incidents of welders' clothing burning or catching fire, including the five incidents at the Oak Ridge Site, should have been reported in ORPS.

Subsequent to the release of our Management Alert, we also identified four incidents involving welders' clothing burning or catching fire and resulting in medical treatment at another DOE site, the Savannah River Site. Although these incidents had also been reported in CAIRS, the incidents had not been reported in ORPS.

Definition of "Near Miss" Was a Concern

Requirements for reporting "near misses" in ORPS are contained in DOE orders and implementing manuals concerning occurrence reporting. DOE Order 5000.3A, "Occurrence Reporting and Processing of Operations Information," dated May 5, 1990, and subsequent DOE orders and implementing manuals concerning occurrence reporting, established groups of categorized occurrences. Under Group 10, "Cross-Category Items," a near miss occurrence that should be reported as an "Off-Normal" occurrence is "a near miss to one of the reporting classifications under preceding categories [e.g., "Group 3-Personnel Safety"] where the conditions necessary to cause a reportable occurrence were prevented from existing by one remaining barrier after other barriers had been compromised (i.e., one additional independent failure/degradation was necessary for event initiation to be possible)."

Comments that we received on a draft of our report, however, expressed concern with the adequacy of the current definition of "near miss" in DOE orders. We understand that the Department's Occurrence Reporting Special Interest Group is addressing this matter.

Based on our review of the data in the CAIRS and ORPS databases for the Oak Ridge and Savannah River Sites, we concluded that actions are needed by management to ensure that "near misses" are being reported in the appropriate management systems and that trends, which may indicate a potential safety and health concern, are identified.

Recommendations

We recommend that:

The Director, Office of Procurement and Assistance Management:

1. In coordination with the Office of Environment, Safety and Health, develop and issue guidance for field office managers and field contracting officers regarding the use of incentives and disincentives for contractors to properly report occurrences, including near misses.

The Assistant Secretary for Environment, Safety and Health:

2. Emphasize to field office reporting coordinators and contractor management the need to ensure adherence to current policy and guidance for reporting of occurrences, including near misses.

3. Increase dissemination and awareness of reported accident information at the Oak Ridge site and other Department sites.

4. Ensure wide dissemination of analytical tools that assist in the identification of trends involving safety and health concerns.

The Director, Office of Field Management:

5. Using the guidance developed by the Office of Procurement and Assistance Management and the Office of Environment, Safety and Health, emphasize to field office managers and

facility representatives the need for proper reporting of occurrences, including near misses.

6. Emphasize to field office managers and facility representatives the need for contractor management to utilize the analytical tools disseminated by the Office of Environment, Safety and Health to identify trends involving safety and health concerns.

Current National Standard Contains A Requirement

The 1967 revision of ANSI Z49.1, which contained recommendations but no requirements concerning protective clothing, was incorporated into the Department's contract with LMES at the time of the K-25 Site welder accident, rather than the current 1994 revision of ANSI Z49.1, which contains a specific requirement regarding management's role in the selection of welders' protective clothing. The specific requirement in the 1994 revision of ANSI Z49.1 was that "clothing shall be selected to minimize the potential for ignition, burning . . . ." [Emphasis added.] Also, at the time of the accident, the cotton anti-contamination clothing worn by the welder was not heavy cotton or fire-retardant, as recommended by the 1994 revision of ANSI Z49.1. We concluded that management systems should have ensured that requirements, such as the requirement in the current 1994 revision of the national standard concerning welders' protective clothing, were incorporated in the LMES contract through the S/RID.

Also, EH's implementation of the EH Accident Investigation Board's "Proposed Judgements of Need" concerning the use of flame-retardant, anti-contamination clothing and personal protection equipment may not fully address the Board's purported desire to require the use of flame-retardant, anti-contamination clothing in cutting, welding, and hotwork operations. According to the EH Accident Investigation report, one of the root causes of the welder fatality, which by definition, if eliminated would have prevented the accident, was the failure to use flame-retardant, anti-contamination clothing. The Board Chairman said that it was the Board's desire to require, through EH policy changes, welders at all DOE sites to wear flame-resistant, anti-contamination clothing. However, a proposed change to DOE Order 440.1, "Worker Protection Management for DOE Federal and Contractor Employees," which was to mandate compliance with the 1994 revision of ANSI Z49.1, did not identify the revision of ANSI Z49.1 that should be followed or require that contracts be immediately modified to meet this requirement.

We concluded, therefore, that action is required to ensure that contractors immediately implement the requirements in the current order, DOE 440.1A, regarding compliance with the current revision of ANSI Z49.1 for cutting, welding, and hotwork activities. We also concluded that the "List B" set of requirements

that was in existing contracts should be reviewed for new standards and revisions and updated as appropriate.

Recommendations

We recommend that:

The Director, Office of Procurement and Assistance Management:

7. In coordination with the Office of Environment, Safety and Health, develop and issue guidance regarding the need for field contracting officers to ensure, on an annual basis, that the "List B" set of requirements in contracts is reviewed and updated as appropriate.

The Director, Office of Field Management:

8. Emphasize to field office managers the need for field contracting officers, on an annual basis, to ensure that the "List B" set of requirements in contracts is reviewed and updated as appropriate.

We found that, as in the earlier investigation of the TRISTAN Type B accident, the accident investigation of the K-25 Site welder fatality did not adequately examine and report on specific management systems and organizations as a possible accident root cause. In addition, after reviewing several recent accident investigation reports, we found that most of these investigations also did not adequately examine and report on specific management systems and organizations as a possible accident root cause.

Management Systems As A Root Cause

One of the more difficult challenges facing an accident investigation board is identifying the root cause(s) to prevent a recurrence of the accident. According to the DOE Workbook on conducting accident investigations, the main focus of the accident investigation board should be finding concise and valid root causes that address the fundamental system deficiencies that led to the accident. Root cause analysis is used to identify the most basic deficiencies, including those management systems that, if corrected, would prevent recurrence of the accident. Simply stated, the root cause is the underlying reason that answers the investigator's question, "Why?" Root cause analysis does not only apply to a specific accident, but is intended to have generic implications for lessons learned applicable to a broad group of DOE sites and facilities. In accident investigations, finding root causes is prerequisite to the development and implementation of corrective and preventive measures.

We discussed the issue of root cause analysis with an expert who assisted EH in developing its accident investigation guidelines. He informed us that management failure was frequently the root cause of industrial-type accidents. In addition, much of the literature on root cause analysis identified the breakdown of specific management systems as the main reason for accidents.

Root Causes of K-25 Site Welder Fatality Not Identified

The EH Accident Investigation Board reported two root causes for the welder fatality: (1) personal protective equipment worn by the welder was not identified as a hazard (i.e., the personal protective equipment was not flame-retardant), and (2) personnel safety responsibilities for the fire watch were not appropriately emphasized. Given the definition that a root cause is a fundamental cause, that, if eliminated or modified, would prevent recurrence of this and similar accidents, we determined that there is sufficient evidence to show that neither of the causes reported by the Board

as the "root causes" of the welder accident could be an actual root cause. For example, an investigation into specific management systems and organizations to determine why the current standards for protective clothing (1994 revision of ANSI Z49.1) had not been implemented, may have led the Board to identification of the actual root cause regarding the clothing hazard to the welder. Also, an investigation into specific management systems and organizations to determine why a fire watch had not been designated and why a fire watch was not present during the welder's activities, may have led the Board to identification of the actual root cause regarding the fire watch.

Root cause was likely a management system failure

We found evidence that the root cause of the K-25 Site welder fatality was most likely the failure of a management system or organization. However, we were told that Board members made a conscious decision not to "push" the root cause analysis to a higher level (i.e., conduct an analysis of specific management systems and organizations as a possible root cause), because of the desire to immediately correct the situation regarding the lack of flame-retardant clothing and the lack of personnel safety responsibility by the fire watches.

For example, we found evidence that management should have known of prior incidents involving welders' clothing catching fire. Through interviews, the EH Accident Investigation Board had identified several occurrences involving welders' clothing burning or catching fire that had occurred prior to the welder fatality, but which allegedly had not been reported to management. According to the Board, since workers had not reported earlier clothing fires, supervisors had not recognized the rather frequent occurrence of such fires. We determined, however, that previous incidents involving welders' clothing catching fire were reported in CAIRS and were known to the welders' supervisors, which provided management the opportunity to recognize the potential for such fires.

We also determined that the Board had developed sufficient evidence to warrant an investigation into specific management systems and organizations associated with the welder's activities, which may have led the Board to identify the actual root cause. According to the EH Accident Investigation Report, the "overarching" concern stemming from the investigation was the failure to conduct adequate work planning and hazard analysis.

Also, according to the EH Accident Investigation Report, the facts surrounding the welder fatality included a variety of management system breakdowns, e.g., management follow-up on their written commitment to safety for the work being conducted was not effective.

The existence of a national standard (ANSI Z49.1-1994) that contained requirements regarding welders' protective clothing and the absence of a fire watch provide a compelling basis for taking the causal analysis to a higher level by asking the root cause question, "Why?", e.g., why wasn't the current revision of the national standard incorporated in the LMES contract, and why wasn't a fire watch designated and present at the time of the accident? We concluded that, by possibly identifying the actual root cause(s) of the accident, the Board could have come closer to fulfilling the scope of the accident investigation established by the EH Assistant Secretary.

Selected Accident Investigation Reports Reviewed For Root Cause

We reviewed several recent Type B accident investigation reports to determine whether the accident investigation boards adequately examined and reported on specific management systems and organizations as a possible root cause. We also reviewed two Type A accident investigation reports that were provided by EH management as examples of accident investigations that adequately identified and investigated specific management systems and organizations as a possible cause of the accident.

Type B accident investigation reports did not adequately examine management systems

After reviewing four Type B accident investigation reports issued between February and April 1998 that we had received through the Department's report distribution system, we determined that the accident investigation boards that conducted the investigations did not adequately examine and report on specific management systems and organizations as possible root causes of the accidents. We also determined that where the reported root cause involved management, the root cause was reported in general terms and a specific management system or organization was not identified.

One accident investigation report, which concerned an apprentice lineman who received an electric shock from an electrical "transfer bus," reported the root cause as the individual leaving the safe work area. However, prior to initiating the work, the workers had been

told by the work supervisor that the "transfer bus" had been "deenergized." Another report, which concerned a drum explosion that resulted in the spill of hazardous/radioactive waste (mixed waste), reported the root cause as "failure of management control systems." However, the report did not identify the specific management control system(s) that failed and that, if corrected, would prevent the accident from recurring. A third report, which concerned the collapse of a building service employee working under a permanent medical restriction, reported the root cause as "management did not recognize the extent of the employee's concerns." However, the report did not identify the level of management that could have prevented the occurrence. A fourth report, which concerned a shipment of radioactive samples that did not comply with Federal and State requirements, reported the root causes as failure to comply with regulations and procedures, and lack of trained, competent personnel commensurate with responsibilities for packaging and transportation. However, an indicator that the actual root cause of the occurrence may involve a management system or organization was the statement in the accident investigation report that similar problems concerning sample shipments had occurred in the past.

We concluded that by not adequately examining and reporting on specific management systems and organizations as a possible root cause, the Type B accident investigation boards might not have identified the actual root causes of the accidents.

Type A accident investigation reports adequately examined management systems

EH management provided us two Type A accident investigation reports as examples of accident investigations that adequately examined and reported on specific management systems and organizations as a possible cause of the accident. One report concerned the deaths of contractor employees from the crash of a DOE-owned, contractor-operated helicopter at the Nevada Test Site. We determined, based on the information in the "ANALYSIS" section of the accident investigation report, that the accident investigation board adequately examined specific management systems and organizations as a possible cause of the accident. For example, the report discussed responsibilities of the Headquarters Office of Safeguards and Security and the Nevada Operations Office Safeguards and Security Division that played a role in the accident. However, the board did not report on specific management organizations relative to the causes of the accident. The "CONCLUSIONS" and "PROBABLE CAUSES" sections of

the report, for example, only discussed management problems relative to higher-tier organizations, e.g., Headquarters and the Nevada Operations Office, but did not identify the specific lower-tier organizations that were involved.

The other report, which concerned the death of a laborer who was hit by a heavy construction wheel loader, reported the root cause of the accident as "a lapse of judgment." We determined that the accident investigation board adequately examined specific management systems and organizations as a possible root cause of the accident. However, the root cause analysis could have been taken further. For example, in its root cause discussion, the board cited both the equipment operator and the laborer for a lapse of judgment. However, there is evidence that the operator should bear a greater share of the responsibility for the accident.

We determined that the two Type A accident investigation boards adequately examined specific management systems and organizations as a possible cause of the accident. However, we concluded that accident investigation boards should ensure that a thorough analysis is conducted to identify the actual accident root cause, to include, if appropriate, reporting on specific organizations that may be the root cause.

Existing Guidelines Not Adequately Implemented

Considerable improvement has occurred in the Department's accident investigation process since the release of our report on the investigation of the TRISTAN fire. Also, the Department is in the process of implementing the Integrated Safety Management program, which should aid the accident investigation process. However, additional improvement is needed in the causal analyses being conducted to identify the root and contributing causes of accidents. More importantly, we concluded that the deficiencies regarding root cause analysis are more the result of inadequate implementation of existing policies, procedures, and guidelines, than the result of deficiencies in the guidance.

DOE guidance regarding accident investigations contain detailed discussions of root cause analysis. For example, DOE Implementation Guide, DOE G 225.1A-1, "Implementation Guide for Use with DOE O 225.1A, Accident Investigations," states that 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. According to the Guide, to find out why management systems were not effective in preventing conditions leading to the accident, investigators should examine the components of the Department's integrated safety management system. The Guide states that the investigator must identify system deficiencies at the work and management levels to determine the underlying oversights, omissions, performance errors, and accepted risks, which are the root causes. These causes may lie in the organizational structure, safety management systems, or line management oversight processes related to the accident. Contributing and root causes should always be identified in order to complete the causal factors analysis.

Trained Analyst Not Required

Causal analysis is a significant aspect of accident investigations. However, there is no requirement for an analyst specifically trained and experienced in causal analysis to be a board member or advisor. The DOE Implementation Guide discusses the use by accident investigation boards of analytical techniques to identify the causes of the accident, but to ensure the proper conduct of investigations, only recommends that DOE accident investigators be appointed to the board. These investigators have some training in causal analysis. We concluded, however, that requiring at least one board member or advisor to be trained and experienced in causal analysis could alleviate many of the deficiencies we identified regarding the root causes analyses conducted by accident investigation boards. We also concluded that the Board Chairperson, who is responsible for managing the Board's activities, should have an understanding of the identification and determination of root causes. This would aid in ensuring that an adequate root cause analysis is conducted by the board.

Recommendations

We recommend that the Assistant Secretary for Environment, Safety and Health:

9. Ensure that specific management systems and organizations are adequately investigated as a possible accident root cause for Type A and Type B accident investigations.

10. Ensure that the Chairperson of an accident investigation board is adequately trained in the identification and determination of root causes.

11. Ensure that, as part of the accident investigation oversight process, reviews of accident investigation reports are conducted to assure that, among other things, accident root causes identify the specific management systems, policies, organizations, line management oversight processes, etc., that, if changed, would have prevented the accident. For example, a "failure of management control systems" should not be accepted as an accident root cause.

12. Ensure that accident investigation boards include, either as a board member or advisor, individuals trained and experienced in causal analysis.

Possible Conflict of Interest

Difference of Opinion Regarding Resolution of Possible Conflict of Interest

There was a difference of opinion whether a possible conflict of interest was resolved regarding the assignment of a former LMES safety manager as a technical advisor to the EH Accident Investigation Board investigating the welder fatality. A concern had been raised regarding a possible conflict of interest after an individual who had worked for LMES as the Health and Safety Director for K-25 was hired as an advisor to the Board.

According to the Board Chairman, LMES and OR attorneys had advised that there was no conflict of interest for the individual to serve as an advisor to the Board. However, the LMES attorney told us that it was up to the OR attorney to determine if there was a problem concerning the individual's involvement with the Board. We were told by the OR attorney that no one had asked him to make a decision regarding a possible conflict of interest, and he did not. We concluded that when legal advice is obtained by the board chairperson regarding a possible conflict of interest determination, the legal advice should be appropriately documented.

Recommendation

We recommend that the Assistant Secretary for Environment, Safety and Health:

13. Ensure that, when concerns are raised regarding a possible conflict of interest concerning a board member or advisor participating in an accident investigation, the board chairperson either excludes the individual, or documents in writing, that there is no conflict, and identifies limitations, if any, on participation. If the board chairperson relies on the advice of legal counsel, legal counsel should document the advice in writing.

Management Comments

Management concurred with all our recommendations.

The following are excerpts from comments dated January 25, 1999, to our draft report, from the Assistant Secretary for Environment, Safety and Health. [See Appendix A for the Assistant Secretary's complete comments.]

Regarding Recommendation 1, he said that EH will work with the Director, Office of Procurement and Assistance Management, to develop guidance for field office managers and contracting officers to use the "Conditional Payment of Fee" contract clause to incentivize contractors to properly report occurrences, including near misses.

Regarding Recommendation 2, he said that, by March 1, 1999, he will develop and issue a memorandum for field office and contractor occurrence reporting contractors and management that emphasizes the importance of adhering to current policy and guidance for occurrence reporting, including near miss reporting.

Regarding Recommendation 3, he said that EH will continue to disseminate accident information at Oak Ridge and other DOE sites and he identified six mechanisms used to disseminate the information.

Regarding Recommendation 4, he said that under Integrated Safety Management (ISM), DOE and contractor line management are responsible to use available analytical tools and data to perform analysis to identify trends on a local level for individual sites and facilities. He identified three mechanisms through which EH will continue to make analytical tools available.

Regarding Recommendations 5 and 6, he said that he will assist the Director, Office of Field Management, as appropriate, to emphasize the proper reporting of occurrences, including near misses, and the need for contractor management to utilize analytical tools to identify safety trends.

Regarding Recommendation 7, he said that he will work with the Director, Office of Procurement and Assistance Management, to develop guidance for field contracting officers for updating and maintaining the contract "List B" set of requirements.

Regarding Recommendation 8, he said that EH will assist the Director, Office of Field Management, as appropriate, in emphasizing the importance of updating and maintaining the contract "List B" set of requirements.

Regarding Recommendation 9, he said that EH will continue to strengthen the analysis and prioritization of management systems as a contribution to accidents. He identified four ways that EH will assure a consistent approach by investigation boards.

Regarding Recommendation 10, he identified four ways that EH will continue to strengthen board chairperson's capabilities and expertise.

Regarding Recommendation 11, he identified four ways that EH will continue to strengthen the identification of specific and correctable management factors.

Regarding Recommendation 12, he identified three ways that EH will assure a continuing and adequate cadre of analytical expertise.

Regarding Recommendation 13, he said that EH will have procedures in place by January 30, 1999, to address the recommendation.

In comments dated January 29, 1999, to our draft report, the Director of Management and Administration said that efforts have already begun with regard to the two recommendations [Recommendations 1 and 7] directed to the Director, Office of Procurement and Assistance Management. Guidance addressing the specific matters in the recommendations has been prepared and is undergoing coordination with the appropriate EH staff offices. This guidance will be distributed to the Heads of the Contracting Activities within the Department. It is anticipated that the action will be completed by the end of March 1999.

In comments dated February 23, 1999, to our draft report, the Director, Office of Field Management, said that his office concurs with the specific recommendations for which his office will be responsible.

Inspector Comments	We believe the proposed actions by management are responsive to our recommendations.

COMMENTS BY THE ASSISTANT SECRETARY FOR ENVIRONMENT, SAFETY AND HEALTH

January 25, 1999

MEMORANDUM FOR ALFRED K. WALTER

FROM: David Michaels, PhD, MPH
Assistant Secretary
Environment, Safety and Health

SUBJECT: Draft Report "Inspection of Selected Issues Regarding the Department of Energy Accident Investigation Program"

The Office of Environment, Safety and Health (EH) concurs with the subject report, and provides the following response to the recommendations:

Recommendation 1. EH agrees that occurrences, including near misses, need to be properly reported, and has developed policy requiring contractors to do so. Under Integrated Safety Management (ISM), line management has fundamental responsibility to ensure proper reporting by contractors. EH will work with the Director, Office of Procurement and Assistance Management to develop guidance for field office managers and contracting officers to use the "Conditional Payment of Fee" contract clause to incentivize contractors to properly report occurrences, including near misses.

Recommendation 2. By March 1, 1999, the Assistant Secretary for Environment, Safety and Health will develop and issue a memorandum for field office and contractor occurrence reporting coordinators and management that emphasizes the importance of adhering to current policy and guidance for occurrence reporting, including near miss reporting.

Recommendation 3. EH will continue to disseminate accident information at Oak Ridge and other DOE sites through the following mechanisms:

- EH will continue to produce and distribute the *Operating Experience Weekly Summary* – a summary of safety lessons learned from operating experience within and external to DOE, which is available at www.tis.eh.doe.gov/web/oeaf/oe_weekly/oe_weekly.html.

- EH will continue to produce and distribute *Safety Alerts* – one page documents concerning the most serious, safety-significant events with applicability to other sites. The alerts are signed by the Assistant Secretary for Environment, Safety and Health, and get immediate attention across all sites. Hard copies distributed to all DOE line programs, operating

contractors, and the DOE safety and health community, posted on the Internet at www.tis.eh.doe.gov/docs/safe_alert, and e-mailed to lessons learned coordinators at all sites.

- EH will continue to produce and distribute *Safety Notices* and *Safety and Health Bulletins* that provide information from technical studies based on trend analyses or generic safety issues that promote "pursuit of excellence" in worker safety and health. They are distributed to all line programs, operating contractors, and the safety community, and are posted on the Internet (notices at www.tis.eh.doe.gov/web/oeaf/lessons_learned/ons/ons.html and bulletins at www.tis.eh.doe.gov/docs/bull/links.html).

- EH will continue to maintain the *Lessons Learned Home Page*, that provides Internet access to DOE lessons learned information at www.tis-hq.eh.doe.gov/others/ll/ll.html.

- EH will continue to support the *Lessons Learned List Server* – an automatic E-mail system that receives and redistributes lessons to over 300 subscribers across the complex. Site lessons learned coordinators e-mail Red Alerts (actual event/urgent), Yellow Alerts (potential event/caution), Blue Alerts (fact or discovery of benefit to others/information), and Green Alerts (good work practice), generally within a day of a major event. The alerts are automatically re-transmitted to lessons learned coordinators at each site for further distribution and review for applicability. The server is maintained by the DOE Society for Effective Lessons Learned Sharing at www.tis.eh.doe.gov/others/ll/listserv.html.

- EH will continue to distribute accident investigation reports and lessons learned through a variety of networks. For example, the Idaho carbon dioxide accident report is posted on the Internet, and an article was published in the *Operating Experience Weekly Summary*. A video tape of lessons learned from the accident was produced and distributed to 400 key DOE management personnel, with instructions to duplicate and further distribute the tape as appropriate. EH staff personally briefed key DOE senior management, including the Secretary and the Principal Secretarial Officers, on the details of the accident. A lessons learned report will be distributed in January 1999 to approximately 4000 key DOE complex personnel.

Recommendation 4. Under ISM, DOE and contractor line management are responsible to use available analytical tools and data to perform analyses to identify safety trends on a local level for individual sites and facilities. EH agrees that analytical tools should be widely available, and will continue to make these tools available through mechanisms such as:

- Information sources listed in Recommendation 3 above, and databases such as the Occurrence Reporting and Processing System (ORPS) and Computerized Accident and Injury Reporting System (CAIRS).

- Activities such as the *DOE Operating Experience Forum*, scheduled for January 26 - 28,

1999, in Las Vegas, Nevada. The forum will focus on sharing analytical tools to collect, validate, and analyze operational data to permit line managers to make decisions regarding safety trends.

- Analytical tools and techniques available on the EH operating experience analysis web page at www.tis.eh.doe.gov/web/oeaf.

Recommendations 5 and 6. EH will assist the Director, Office of Field Management, as appropriate, to emphasize the proper reporting of occurrences, including near misses, and the need for contractor management to utilize analytical tools to identify safety trends.

Recommendation 7. EH agrees that requirements in contracts need to be updated annually, as appropriate, and will work with the Director, Office of Procurement and Assistance Management develop guidance for field contracting officers for updating and maintaining the "List B" set of requirements in the contract.

Recommendation 8. EH will assist the Director, Office of Field Management, as appropriate, in emphasizing the importance of updating and maintaining the "List B" set of requirements in the contract.

Recommendation 9. EH has direct control of Type A accident investigations, and influences Type B accident investigations through review and comment on reports, and oversight of the investigation process. The K-25 Type A accident investigation identified management issues, but, as noted in the subject report, did not elevate these management issues to the level of root causes. DOE O 225.1A and the implementation guide require that management systems be analyzed as potential causes of accidents, and EH agrees that the identification and resolution of overlying management weaknesses is essential to present recurrence of accidents. A number of Type A investigations have been very successful in this area including a 1994 investigation, in which all four root causes were management systems weaknesses, and the recent Idaho carbon dioxide accident investigation.

EH will continue to strengthen the analysis and prioritization of management systems as a contribution to accidents and to assure a consistent approach by investigation boards through:

- Overlaying the investigation causal analysis on the Department's ISM policy, including the seven principles and five core functions.

- Including personnel with management experience and expertise on Type A investigation boards.

- Utilizing the Quality Review Board (QRB) to independently review the results of Type A investigations, including root cause identification, and consideration of the contribution of management systems.

- Continuing to review and comment on Type B investigation reports, and to oversee the investigation process, including assuring that the scope includes management systems.

Recommendation 10. EH appoints chairpersons for Type A boards only, but provides training for Type B board chairpersons. EH has provided comprehensive training for both Type A and Type B investigation chairpersons since 1996, and further upgraded this training twice – in 1997 and 1998. EH provided this training to over 100 prospective Type A and Type B chairpersons in 1998. EH will continue to strengthen board chairperson's capabilities and expertise through:

- Incorporation of the Department's ISM policy into investigation training and retraining, including casual analysis, for board chairpersons.

- Conducting oversight of Type B investigations and reports, including assuring evaluation of management systems.

- Assuring EH senior management assistance, support, and advice to board chairpersons and members, including during the causal analysis phase of Type A investigations.

- Supporting line management requests to provide training to board chairpersons and members for Type B investigations, including analysis of management systems within the ISM framework.

Recommendation 11. DOE O 225.1A requires that management systems be evaluated as potential root causes and other causal factors of accidents. Management weaknesses identified must be of sufficient specificity to: (1) support development of judgements of needs, and (2) to facilitate effective and sustained corrective actions. EH will continue to strengthen the identification of specific and correctable management factors through:

- Selecting board chairpersons from a cadre of trained and experienced managers for Type A investigations.

- Including personnel with management experience and expertise on Type A boards.

- Overlaying the Department's ISM policy template on causal analysis of management systems.

- Utilizing the QRB to independently review investigation results, and the identification of specific and correctable management causal factors.

Recommendation 12. EH maintains a trained cadre of accident Board chairs, members, and analysts. EH provides training of these personnel to support both Type A investigations (performed by EH) and Type B investigations (performed by line management). The recent INEEL carbon dioxide Type A accident investigation board included two trained and highly experienced analysts, including a Ph.D. in organizational behavior, to assist the board in the

causal analysis process. EH will continue to strengthen this area to assure a continuing and adequate cadre of analytical expertise by:

- Providing additional training and retraining on causal analysis techniques, including application of ISM principles, and core functions, to the analysis process.

- Continuing to expand the cadre of available board chairs, members, and analysts through recruiting and training.

- Continuing to maintain a cadre of consultants and National Laboratory employees highly trained and experienced in causal analysis.

Recommendation 13. EH will have procedures in place by January 30, 1999 to address this recommendation. The procedures will include practical considerations, such as time restraints under which accident investigations are conducted. EH has direct control over the selection of board members and advisors for Type A accident investigations only, but will emphasize the importance of resolving conflict of interest issues for Type B investigations through training.

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Scope and Methodology

We conducted the fieldwork portion of our inspection during June 1997 to May 1998, at DOE Headquarters and the Oak Ridge Operations Office (OR). We interviewed selected Office of Environment, Safety and Health (EH) and OR officials; DOE Board members and advisors to the EH Accident Investigation Board that investigated the K-25 welder fatality; Lockheed Martin Energy Systems (LMES) officials; individuals knowledgeable in causal analysis; individuals knowledgeable of ANSI Z-49.1; and DOE officials knowledgeable of the Department's Occurrence Reporting and Processing System (ORPS) and the Department's Computerized Accident Investigation Reporting System (CAIRS).

We reviewed the Department's policies, procedures and guidelines regarding accident investigations; selected Occupational Safety and Health Administration regulations; data from the Department's CAIRS and ORPS data bases; LMES contractual documents; the official investigation file maintained by the EH Accident Investigation Board that investigated the K-25 welder fatality; revisions of ANSI Z-49.1 from 1967 to 1994; and literature regarding root cause analysis.

We also reviewed the EH accident investigation report, titled: "Type A Accident Investigation Board Report on the February 13, 1997, Welding/Cutting Fatality at the K-33 Building, K-25 Site Oak Ridge, Tennessee," and selected DOE Type A and Type B accident investigation reports.

This inspection was conducted in accordance with the Quality Standards for Inspections issued by the President's Council on Integrity and Efficiency.

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