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October 1998

U.S. Department of Energy
Idaho Operations Office

Lockheed Martin

Consolidated Response to Type A Investigation of CO_2 Fatality at Test Reactor Area, Idaho National Engineering and Environmental Laboratory

United States Government **Department of Energy**

memorandum

Idaho Operations Office

Date: October 16, 1998

Subject: Corrective Action Plan in Response to the Investigation of the July 28, 1998, Fatality at Test Reactor Area, Idaho National Engineering and Environmental Laboratory

To: J. Owendoff, EM-1
W. D. Magwood, NE-1

Reference: Memorandum, Peter N. Brush to John M. Wilcynski, Type A Investigation Report of the July 28, 1998, Fatality and Multiple Injuries Resulting From a Release of Carbon Dioxide at Building 648, Test Reactor Area, Idaho National Engineering and Environmental Laboratory, dated September 18, 1998.

Attached is the INEEL consolidated corrective action plan developed by my staff and LMITCO, for your approval. This plan addresses the root causes, contributing causes, and judgments of need identified by the DOE Accident Investigation Board (referenced report). A copy of the plan is provided by copy of this memorandum to EH-10 for review and comment.

Numerous administrative and physical barriers were violated in order for this event to occur. ID and LMITCO recognize that fundamental changes in the way we do business are required to ensure that we never experience another tragic event such as this. In preparing this response, both LMITCO and ID conducted a supplemental root cause analysis, and these independent efforts identified additional causal factors and needs which have been addressed in the plan.

The primary emphasis of our corrective actions is on the effective implementation of integrated safety management functions and principles at the floor level. This will be accomplished through:

- Creating a LMITCO Site Operations Director position at the Vice President Level, and appointing an individual with significant nuclear operations experience who will be responsible for all site operations, maintenance, training and ISM implementation. (Completed)

- Totally redesigning the INEEL maintenance process and enhancing the rigor and discipline associated with its management and oversight to assure that work is performed with a focus on safety as a part of expediting implementation of Integrated Safety Management at the INEEL.

- Establishing an ISM Implementation Project Office in both ID and LMITCO to assure that ISM is consistently and effectively implemented at the INEEL. (Completed)

- Enhancing ID's and LMITCO's Issues Management processes, to assure that appropriate management attention is directed to prioritizing issues, addressing root causes, identifying and resolving management systems weaknesses, and ensuring that resolution of issues is validated prior to closure.

In these and other corrective actions in the plan, roles and responsibilities and expectations at all levels of the ID and LMITCO organizations will be reevaluated and clarified to ensure that everyone understands how their job contributes to the safe execution of work at the INEEL.

During the analysis phase of this process, accountability at the highest levels within both ID and LMITCO organizations was identified as a contributing cause. As a result, corrective actions are assigned by name to individuals at the ID Assistant Manager and LMITCO Vice President level or above, to ensure that there is senior management accountability for all actions.

As noted in the response, ID and LMITCO resource loaded, logic linked schedules will be developed to validate the corrective action milestone schedules identified in the report. These schedules will be submitted to your office for approval by December 7, 1998. If you or your staff have any questions on the report, please contact me (208) 526-5665 or Warren Bergholz (208) 526-2497.

J. M. Wilcynski
Manager

Attachment

cc: Peter N. Brush, DOE-HQ
Glenn S. Podonsky, DOE-HQ
G. Thomas Todd, DOE-HQ
Dave Curtis, DOE-HQ
AI Investigation Board
Idaho EH Site Representative
Kathleen Trevor, Idaho State Oversight Office

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Consolidated Response to Type A Investigation of CO_2 Fatality at Test Reactor Area, Idaho National Engineering and Environmental Laboratory

Published October 1998

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Lockheed Martin Idaho Technologies Company
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DOE and LMITCO Commitment to Safety Improvement

The U.S. Department of Energy (DOE) Idaho Operations Office (ID) and Lockheed Martin Idaho Technologies Company (LMITCO) are committed to protecting the health and safety of the workforce at the Idaho National Engineering and Environmental Laboratory (INEEL). The carbon dioxide (CO_2) discharge accident that occurred on July 28, 1998, in Building TRA-648, at the Test Reactor Area on the INEEL could have been prevented by effective requirements management and work control processes. The DOE Type A Accident Investigation Board (Board) identified two root causes and six contributing causes for the accident in its report. These causes point to an apparent design flaw and several inadequacies—at various levels in both the ID and LMITCO organizations—in effectively performing tasks and executing individual and joint responsibilities for safety. ID and LMITCO will go beyond the judgments of need identified by the Board to address the root and contributing causes, improve the rigor and discipline in the conduct of operations and maintenance; expedite the implementation of integrated safety management in the work place; and enforce accountability at all organizational levels.

This response plan deals directly with the judgments of need, as well as the root and contributing causes. It also delineates how the design, use, and maintenance of special hazard fire suppression systems will be examined and improved; requirements flowdown will be enhanced; work control improvements, which include hazard analysis enhancements, safety analysis updates, and outage planning and coordination improvements, will be accelerated; all levels of training will be updated to familiarize employees with hazards; and ID and LMITCO will be more rigorous in managing safety issues. In addition, the corrective actions (particularly those in Sections. 3.1, 3.6, 3.7, 3.14, 3.21, and 3.23) address the underlying fundamental issues of safety culture at both managerial and staff levels, including roles and responsibilities, accountability for safety, and adherence to procedures and directives. ID actions addressing underlying causes involve improvement in technical information flow, roles and responsibilities related to safety and technical decision making,

Immediately after the accident ID and LMITCO took immediate actions to limit work until measures could be established to increase rigor and discipline of conduct of operations and maintenance throughout the INEEL and improve hazard identification and mitigation at all levels of the organization. These interim measures will remain in place until the corrective actions identified in this plan are fully implemented. ID chartered a team of senior, experienced oversight professionals to monitor performance in work planning and control and help ensure that rigor and discipline are being implemented in work processes. ID worked directly with LMITCO to establish a LMITCO Director, Site Operations and Area Directors to eliminate conflicts in responsibilities between organizations, and to perform high-level reviews and approvals of work packages until process improvements are institutionalized.

The corrective actions in this response report, the near-term initiatives to increase the rigor and discipline in the conduct of operations and maintenance, and the ongoing Integrated Safety Management (ISM) and Voluntary Protection Program (VPP) implementation activities define the INEEL path of continuing improvement over the next year. These initiatives will be the major focus during the remainder of LMITCO's tenure managing the INEEL. The ID and LMITCO management teams are committed to exercising sufficient management discipline to ensure that no other issues or initiatives detract from the successful completion of these high priority objectives.

John Wilcynski, Manager
DOE Idaho Operations Office

W. John Denson, President
Lockheed Martin Idaho Technologies Company

EXECUTIVE SUMMARY

At approximately 6:00 p.m. Tuesday, July 28, 1998, thirteen workers were engaged in preventive maintenance on the electrical system in Building TRA-648 at the Test Reactor Area (TRA) on the Idaho National Engineering and Environmental Laboratory (INEEL) when the CO_2 fire suppression system unexpectedly discharged without an evacuation warning alarm. The accident resulted in one fatality from exposure to the CO_2 atmosphere and injuries to three other workers who required hospitalization. The direct cause of the accident was the unexplained activation of electric control heads that initiated the release of CO_2, without annunciation of the predischarge warning alarm.

A U.S. Department of Energy (DOE) Type A Accident Board investigated the event in accordance with DOE Order 225.1A, "Accident Investigations." The Board identified 22 judgments of need. This response report describes the actions that the DOE Idaho Operations Office (ID) and Lockheed Martin Idaho Technologies Company (LMITCO) have taken and will accomplish at the INEEL in response to the accident.

Immediately following the accident, ID and LMITCO management initiated a series of actions designed to ensure that a safe working environment would be maintained at INEEL facilities. These actions included (1) isolating and removing all CO_2 fire suppression systems at the INEEL from service, with appropriate compensatory measures; (2) performing comprehensive testing and analyses to determine the specific cause of the unexpected release of CO_2 in TRA-648; and (3) a stand-down of all but essential maintenance work, followed by a phased resumption that includes special controls and additional oversight by experienced supervisors to ensure that work is planned effectively, that hazards are correctly identified and mitigated, and that work is performed safely.

The corrective actions, presented for each judgment of need, were developed by teams working in eight response areas: management systems, safety culture, systems design, work planning and control; hazard identification and control; feedback, training, and competency; and emergency preparedness. Many of these corrective actions are closely related to ongoing actions in three areas: ISM implementation; VPP enhancements; and the near-term initiatives led by the Director, Site Operations to increase the rigor and discipline of the conduct of operations and maintenance management. Integration of these corrective actions with the conduct of operations and maintenance management initiatives will provide a structure for holding employees and all levels of management accountable for effective implementation. Integration of these corrective actions with the ISM implementation will expand the scope of the corrective actions beyond CO_2 systems and the design and work processes associated with them to all hazardous systems at the INEEL.

The combination of the corrective actions presented in this response report, and these ongoing initiatives define the INEEL path of continuing improvement over the next year. ID and LMITCO senior management will commit the energy and resources needed for the successful completion of these priority activities.

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TABLES

ACRONYMS

AE	Architectural and Engineering
AEMT	Advanced Emergency Medical Technician
AHJ	Authority Having Jurisdiction
AM	ID Assistant Manager
CAPO	Corrective Actions Program Office
CARB	Corrective Action Review Board
CFR	Code of Federal Regulations
CMMS	Computerized Maintenance Management System
CO_2	carbon dioxide
DOE	Department of Energy
DOE-ID	Department of Energy Idaho Operations Office
DOE-HQ	DOE Headquarters
DSO	Director, Site Operations
EDF	Engineering Design File
EM	Environmental Management
EMT	Emergency Medical Technician
EP	Emergency Preparedness
ES&H	Environment, Safety and Health
ESH&QA	Environment, Safety, Health and Quality Assurance
ETR	Engineering Test Reactor
EWP	Enhanced Work Planning
HIT	Hazard Identification Team
ICARE	Issue Communication and Resolution Environment
ID	Idaho Operations Office of the Department of Energy
IMED	Issues Management Electronic Database

INEEL	Idaho National Engineering and Environmental Laboratory
INTEC	Idaho Nuclear Technology & Engineering Center
IPT	Integrated Product Team
IRT	Incident Response Team
ISM	Integrated Safety Management
JRC	Job Requirements Checklist
LMITCO	Lockheed Martin Idaho Technologies Company
MCP	Management Control Procedure
MORT	Management Oversight Risk Tree
MOU	Memo of Understanding
NFPA	National Fire Protection Association
O&MM	Operations and Maintenance Manual
O_2	Oxygen
OPE	Office of Program Execution
OSHA	Occupational Safety and Health Association
PHA	process hazards analysis
PIT	Process Improvement Team
PM	preventive maintenance
PRD	Program Requirement Document
QA	Quality Assurance
RADCON	Radiological Control
SAR	Safety Analysis Report
SCBA	self-contained breathing apparatus
SME	Subject Matter Expert
SORB	Senior Operations Review Board
SMS	Safety Management System

SSC	Structure, Systems, and Components for either nuclear or non-nuclear facilities
TRA	Test Reactor Area
VP	Vice President

Consolidated Response to Type A Investigation of CO_2 Fatality at Test Reactor Area, Idaho National Engineering and Environmental Laboratory

1. RESPONSE OVERVIEW

1.1 Background and Introduction

On July 28, 1998, thirteen workers, including foremen, operators, electricians, and fire protection personnel, were engaged in deenergizing electrical circuit breakers in preparation for a preventive maintenance activity on the electrical system in Building TRA-648 of the Engineering Test Reactor Facility at the Test Reactor Area (TRA) on the Idaho National Engineering and Environmental Laboratory (INEEL). At approximately 6:11 p.m., as the last 4160 volt circuit breaker was opened the carbon dioxide (CO_2) fire suppression system unexpectedly discharged without the annunciation of the evacuation warning alarm. Eight workers, including a fire protection engineer, were able to escape from the facility unassisted. At approximately 6:15 p.m., the fire protection engineer radioed the alarm center in the INEEL Central Facilities Area and a fire truck and ambulance were dispatched, which arrived at 6:25 p.m. In the mean time, the workers who had escaped from TRA-648, security officers, and members of the Advanced Test Reactor Incident Response Team were able to rescue three of the remaining personnel from the building. The Fire Department and ambulance personnel removed the last two workers. The accident resulted in one fatality from exposure to the CO_2 atmosphere and injuries to three other workers who required hospitalization. The direct cause of the accident was the unexpected activation of electric control heads that initiated the release of CO_2, without annunciation of the predischarge warning alarm.

On July 29, 1998, Peter N. Brush, Acting Assistant Secretary, Environment, Safety and Health (ES&H) of U.S. Department of Energy (DOE) appointed a Type A Accident Investigation Board (Board) to investigate the accident in accordance with DOE Order 225.1A, "Accident Investigations." The Board began its investigation on July 29, 1998. The investigation concluded on August 28, 1998, and the findings were reported to the DOE Acting Assistant Secretary for Environment, Safety and Health on August 31, 1998. The Board's Investigation Report, "Type A Accident Investigation of the July 28, 1998, Fatality and Multiple Injuries Resulting from Release of Carbon Dioxide at Building 648, Test Reactor Area Idaho National Engineering and Environmental Laboratory," EH2PUB/09-98/01AI, (Investigation Report) was released on September 18, 1998. The Investigation Report identified 22 judgments of need that require DOE Idaho Operations Office (ID) and Lockheed Martin Idaho Technologies Company (LMITCO) response.

This response report describes the actions that ID and LMITCO have taken and will take in response to the Board's judgments of need.

Subsection 1.2 of this response report explains the approach used by ID and LMITCO to develop the corrective actions. Subsection 1.3 provides a linkage between the root and contributing causes identified by the Board and the response report sections that address them. Subsection 1.4 summarizes the corrective actions for the accident. Subsection 1.5 presents the lessons learned by ID and LMITCO from the accident.

Section 2 describes the prompt actions taken by ID and LMITCO to prevent a similar accident and provide a safety basis for continuing operation. These included (a) isolating the TRA-648 CO_2 fire suppression system and removing it from service; (b) isolating and removing the two other CO_2 fire

suppression systems at the INEEL from service; (c) comprehensive testing and analyses to determine the specific cause of the unexpected release of CO_2 in TRA-648; and (d) a stand-down of all but essential maintenance work, followed by a phased resumption that includes special controls and additional oversight by experienced supervisors to ensure that work is planned effectively, that hazards are correctly identified and mitigated, and that work is performed safely.

Section 3 of this response report presents the responses to each of the 22 judgments of need and the root and contributing causes identified by the Board. It also presents (in Subsection 3.23) the response to an additional judgment of need developed by ID based on a supplemental root cause analysis. In each response, the specific judgment of need is stated, the underlying issues are discussed, the corrective actions are described, and the schedule for completing the corrective actions is presented. ID and LMITCO accept these judgments of need as statements of DOE expectations.

1.2 Response Approach

In preparing this response, ID and LMITCO reviewed the conclusions from the Investigation Report to understand the underlying issues and to respond to both the judgments of need and associated issues. From this review, the issues were grouped into the following eight response areas:

- **Management Systems**—The judgments of need relating to: the identification of requirements and the incorporation of requirements into manuals, safety analysis reports, procedures, and work control processes; the implementation of integrated safety management; and the management and maintenance of the safety infrastructure.
- **Safety Culture**—The judgments of need associated with: establishing an environment where continuous safety improvement is a way of life (e.g., a clear definition of roles and responsibilities; rigor and discipline in following procedures; accepted accountability for safety; an environment that promotes safety as a value through leadership and employee involvement; an environment where workers report safety concerns and line management resolves them).
- **Systems Design**—The judgments of need relating to the implementation of the requirements for the design and installation of CO_2 fire suppression systems and other systems with hazardous gases, and the control of work affecting or affected by these systems.
- **Work Planning and Control**—The judgments of need associated with defining the scope of work and implementing effective work controls.
- **Hazard Identification and Control**—The judgments of need associated with identifying hazards, performing hazard analysis, and translating the controls and protective measures identified in the hazard analysis into work control requirements.
- **Emergency Management**—The judgments of need relating to assuring the ability to accomplish immediate rescue and response to planned and unplanned CO_2 discharges.
- **Training and Competency**—The judgments of need relating to assuring the competency of staff at all levels to identify and control hazards.
- **Feedback and Lessons learned**—The judgments of need associated with communication of lessons learned, integrating lessons learned into work planning, and implementing corrective actions.

ID and LMITCO established integrated teams in each of these eight areas to develop corrective actions that respond to the judgments of need (see Appendix A). The LMITCO teams were composed of craft workers, line managers, and safety and health (S&H) professionals. The LMITCO effort also included facilitation and technical support by qualified personnel from other Lockheed Martin corporations. The ID team consisted of line managers, safety professionals, and other experienced managers. Ad hoc support was used by the ID team when needed. Figure 1 illustrates the relationships among the 23 judgments of need within the eight response team areas for which corrective actions are presented in Section 3.

The eight response team areas are related to the five core functions and the seven guiding principles of Integrated Safety Management (ISM) defined in DOE P 450.4, "Safety Management System Policy." This relationship is illustrated in Figure 2. The square boxes in the figure illustrate the five core functions of ISM. The ovals illustrate the response areas, with the arrows showing the relationship among the response areas and the five core ISM functions. Recognizing the relationship among the ISM

core safety functions and guiding principles and the eight response team areas helps ensure that the corrective actions will provide a focus for, and accelerate existing LMITCO ISM system development at the INEEL. Corrective actions for several of the judgments of need will be executed in conjunction with the SMS Implementation Plan (see Appendix B).

In developing these corrective actions for the judgments of need, the teams employed a three-stage approach. The first stage was the development of corrective actions that responded to the specific issues related to CO_2 hazard identification, control, and mitigation. The second stage was the development of corrective actions that address analogous issues associated with fire protection equipment design, procurement, installation, testing, and maintenance. The third stage was to develop corrective actions that addressed broader hazards, the work control process, management systems, and institutional issues that contributed to the accident. This three-stage approach, in combination with the explicit consideration of the root and contributing causes identified in the Investigation Report, provides assurance that the corrective actions resolve the basic safety concerns.

The corrective action completion dates are divided into the following four periods:

1. Immediate/Prompt Corrective Actions (actions that are complete). These are discussed in Section 2 of the response report, and where applicable, to specific judgments of need in Section 3.

2. Near-Term Corrective Actions (completed by January 31, 1999). These are generally actions that respond to the specific issues related to CO_2 hazard identification, control, and mitigation or that address issues associated with fire protection equipment design, procurement, installation, testing, and maintenance.

3. ISM-Integrated Actions (completion date shown as August 1999). These actions are part of, or closely related to, ongoing ISM improvements. Completion dates for all ISM-related actions are shown as August 1999.

4. Long Term Actions (Completed after August 1999). Some of these actions have, of necessity, completion dates that extend beyond the scheduled date for the change of the INEEL management and operating contractor.

Although completion dates have been provided for the identified corrective actions, there has not been sufficient time to establish an integrated, resource-loaded schedule for them. As described in Subsection 1.4, LMITCO will develop an integrated implementation plan for these corrective actions and submit it to ID for approval. When this plan is developed, it may prove more efficient or cost effective to sequence the corrective actions in an order different from that presented in Section 3. Accordingly the completion dates in the ID-approved integrated implementation plan for these corrective actions will supercede the completion dates in Section 3. However, changes to the corrective action completion dates will not cross category boundaries (e.g., rescheduling the completion of a near-term corrective action to a date later than January 1999) without approval of the cognizant DOE program office.

Judgment of Need (Section Number)	Response Team Areas							
	Management Systems	Safety Culture	System Design	Work Planning & Control	Hazard Identification & Control	Emergency Management	Training and Competency	Feedback and Lessons Learned
Protection From Releases of Toxic Agents From Energized Systems (3.1)	•	•	★					
Independent Verification of System Design Modifications* (3.2)	•		★					
ID Review of Fire Protection Design and Modifications** (3.3)								
Fire Protection System Procurement (3.4)	•		★				•	
Maintenance and Use of Safety Basis Documents and Procedures for Inactive Facilities (3.5)	•		•		★			
Implementation of Integrated Safety Management* (3.6)	★	•						
Procedure System Enhancements (3.7)	★	•						
Monitoring Gaseous Fire Extinguishing Systems (3.8)	•		★					
Maintenance of Fire Protection Systems Drawings (3.9)	•		★					
Identification and Elimination of TRA-648 CO_2 Discharge Accident Initiation Mechanism(s) (3.10)			★					
DOE-HQ Improvement of Standards for CO_2 Fire Protection Systems*** (3.11)								
Positive Lockout Mechanisms for Gaseous Fire Suppression Systems (3.12)	•		★					
Work Control System Improvements (3.13)	•	•		★	•		•	
Assuring Work Control System Effectiveness (3.14)	•	•		★			•	
System Outage Planning Process Improvements (3.15)	•			★	•	•		
Training on CO_2 Hazards (3.16)				•	•	•	★	
Training on Industry Standards Related to CO_2 Hazards (3.17)	•			•		•	★	
Training on Lessons Learned for the TRA-648 CO_2 Discharge Accident (3.18)		•					•	★
Issues Management Process Improvements* (3.19)	•							★
Rescue and Response to CO_2 Discharges (3.20)	•	•				★		
Management of Safety Infrastructure* (3.21)	★	•						
Risk Benefit Analysis of Continued Use of CO_2 Fire Suppression Systems**** (3.22)	•		★					
Technical Information Flow and Analysis** (3.23)								

Note: *Indicates ID and LMITCO Judgment of Need
**Indicates ID Judgment of Need
***Indicates DOE Headquarters Judgment of Need
****Indicates LMITCO and DOE Headquarters Judgment of Need
★ Primary Area
• Supporting Area

Figure 1. Relationships among judgments of need and response team areas.

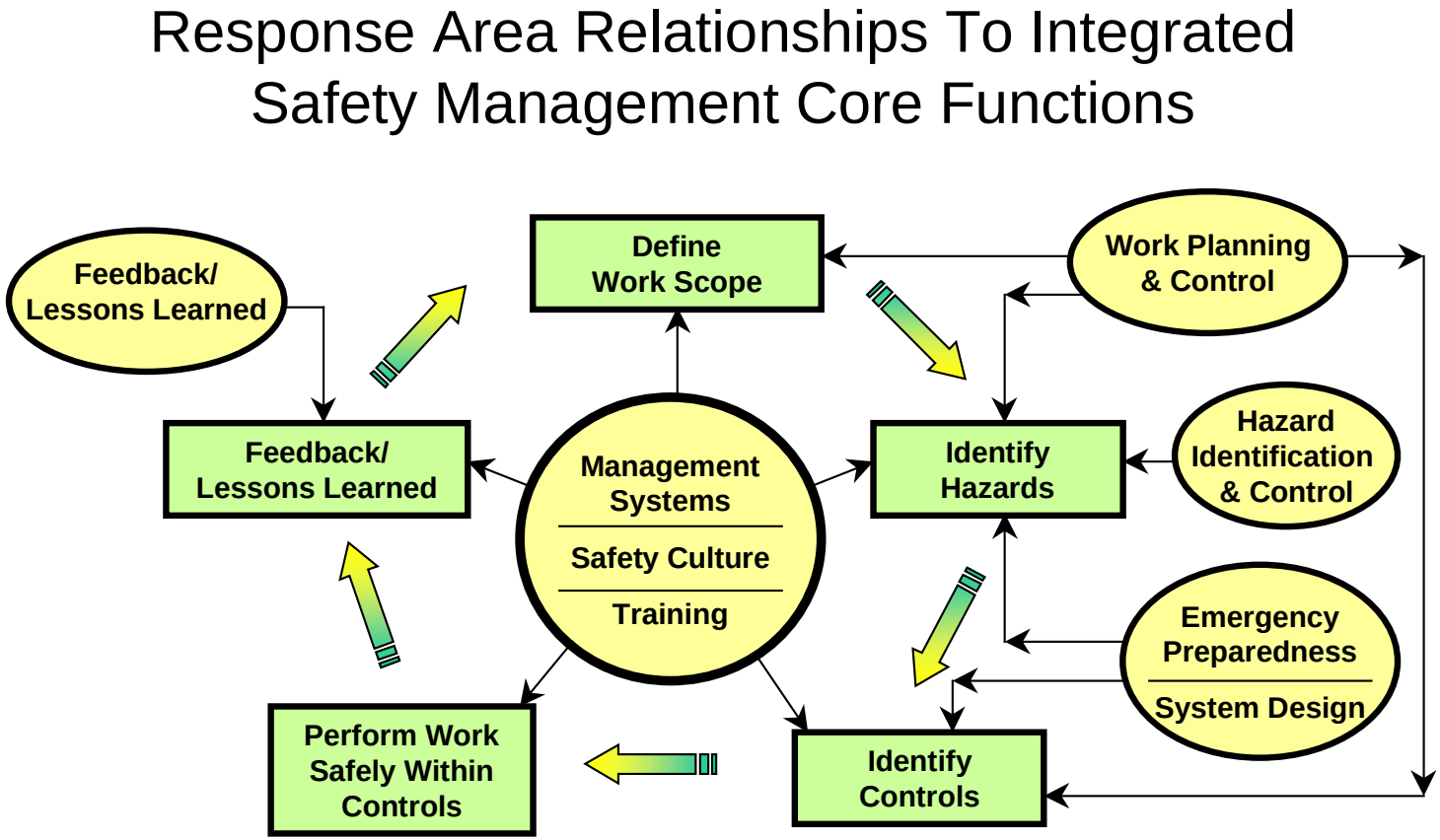


Figure 2. Relationship of response areas to integrated safety management core functions.

1.3 Supplemental Root Cause Analysis

The Board identified two root causes and six contributing causes for the accident (see Table 1). Using the root and contributing causes for the accident identified by the Board, ID performed a causal analysis employing the Management Oversight and Risk Tree (MORT) method of the events related to the accident and the Board's judgments of need.

ID and LMITCO accept the root and contributing causes identified by the Board, as well as the judgments of need and recognize the thorough, insightful analysis that the Investigation Report contains. ID and LMITCO recognize that the Board was working on an extremely tight schedule on a significant accident with many complex issues. In addition, ID and LMITCO understand that there is a close relationship among the root and contributing causes of this accident, those for the 1996 TRA electric shock event, and the 1995 Radioactive Waste Management Complex fall fatality. There were several similarities among these events. These similarities and the limitations placed on any accident investigation board indicate to ID and LMITCO the need to go forward from the Investigation Report to identify the underlying reasons for the judgments of need and contributing causes reported. Correcting the judgments of needs identified in the Investigation Report will help prevent recurrence of the tragic accident in TRA-648. Identifying and correcting the underlying causes will help assure the prevention of future accidents.

Analysis needed to prevent the conditions that led to each judgment of need is presented in Section 3. In addition, a team of ID personnel was formed to begin with the Investigation Report and derive the underlying causes for ID which, if corrected, would help prevent accidents in the future. This team consisted of experienced individuals familiar with MORT analysis, with TRA, and with the ID organization and internal processes. The team began with the two root causes, six contributing causes, and the judgments of need from the Investigation Report, as well as other facts from the Investigation Report. Causal analysis of these revealed the following recurring themes:

- Accountability was less than adequate
- Use of feedback and precursors less than adequate
- Facility and system knowledge less than adequate
- Awareness and management of assumed risks less than adequate
- Rigor and discipline variations
- Hazard identification and mitigation processes less than adequate
- Expert based performance replaced requirements based performance.

At this point, the team examined these themes as they applied to ID and used MORT principles and analysis to identify and define five broad areas for action that, if addressed, would help prevent accidents over a broad range of risks.

1. Improve ID oversight and collection of data
2. Institute a global approach for ID assessments
3. Use trending and analysis to identify assumed risks

4. Establish the roles and responsibilities of federal employees that impact safety

5. Improve safety issues management.

Safety issues management, which is already identified in the Investigation Report, is addressed in Subsection 3.19. Because a comprehensive approach will be needed to address the remaining four areas above, ID elected to classify them under a single judgment of need applicable to ID, which is discussed in Subsection 3.23. This judgment of need states:

> "ID needs to improve technical information flow and analysis to assure that management decisions are made with an adequate understanding of the assumed risks, resulting in balanced priorities."

The ID supplemental root cause team also provided four broad recommendations to address this judgment of need which are also addressed in Subsection 3.23.

LMITCO also formed a team of individuals experienced with TAPROOT analysis, TRA, and the LMITCO organization and internal process. The LMITCO team also began with the two root causes, six contributing causes, and the judgments of need from the Investigation Report, as well as other facts from the Investigation Report and interviews with LMITCO personnel familiar with the accident and related circumstances. The LMITCO causal analysis revealed the following recurring themes:

- A need for management to effectively communicate its expectations for disciplined, safe operation and that safety is the top priority

- A need for management accountability for corrective action effectiveness, consistent implementation of work processes, and ensuring that funded activities supporting the safety infrastructure are actually accomplished

- A need to strengthen the processes that ensure safety, including work planning, issues management, and planning and design processes.

The LMITCO root cause analysis did not aggregate into any new judgments of need; rather, it identified thirteen needs that were sufficiently related to the Board's judgments of need that they have been addressed within the response to those judgments of need. The needs identified by the LMITCO root cause analysis are addressed in Subsections 3.2, 3.5, 3.6, 3.7, 3.13, 3.19, and 3.21.

Table 1 lists the Board's root and contributing causes with the response report sections that include the response to the root or contributing cause.

Table 1. Root and contributing causes from the DOE Investigation Report.

	Cause	Corrective Actions(s)
Root Causes Identified in the Investigation Report		
1.	LMITCO did not have a systematic method for identifying, institutionalizing, or implementing requirements for the design, installation, and work conducted or affected by the CO_2 fire suppression system. (Investigation Report p. 64)	Subsections 3.1, 3.2, 3.3 3.4, and 3.5
2.	ID and LMITCO management have accepted unstructured work controls at the INEEL, which contribute to increased industrial safety risks to workers. (Investigation Report p. 64)	Subsections 3.6, 3.7, 3.13, and 3.14
Contributing Causes Identified in the Investigation Report		
1.	Faulty design and installation of the fire suppression system, due to failure to implement the appropriate requirements and procedures, and failure to install a monitoring or feedback circuit for the CO_2 discharge header or solenoid valve position to the discharge alarm. (Investigation Report p. 40)	Subsections 3.1, 3.2, 3.3, 3.4, 3.5, 3.8, 3.9, and 3.10
2.	Failure to use physical (lockout/tagout) and administrative barriers (current procedures and work planning and control processes) that implemented regulatory requirements. (Investigation Report p. 64)	Subsections 3.5, 3.11, 3.12, 3.13, 3.14, and 3.15
3.	Competency of staff at all levels to deal with CO_2 hazards was not assured by LMITCO. Those involved with the CO_2 fire suppression system failed to understand the necessary requirements and procedures at the design, work planning and control, and implementation stages at the Site-wide, facility, and activity levels. (Investigation Report p. 47)	Subsections 3.16 and 3.17
4.	Failure of LMITCO to take corrective actions and apply lessons learned from previous accident investigations, particularly in work planning and control; and failure of ID and LMITCO to exercise sufficient monitoring and feedback of this process to ensure correction of major safety deficiencies that are impacting worker safety. (Investigation Report p. 64)	Subsections 3.18 and 3.19
5.	Failure to identify, institutionalize, and implement requirements for immediate emergency rescue and response to planned and unplanned CO_2 discharges. (Investigation Report p. 21)	Subsections 3.20
6.	Failure on the part of ID and LMITCO to adequately evaluate the impact of incremental cost cutting and infrastructure reductions on worker safety.	Subsections 3.21 and 3.22

1.4 Summary of Corrective Actions

This section briefly summarizes the corrective actions detailed in Section 3 of this response. ID and LMITCO recognize that numerous administrative and physical barriers were violated in order for this event to occur. The resulting corrective actions represent fundamental changes in the way both ID and LMITCO do business at the INEEL with the goal of ensuring that we never experience another tragic event such as this. The Investigation Report questions the effectiveness of corrective actions for past Type A accidents at the INEEL. That will not be the case for these corrective actions. Major changes include:

- Establishing a Director, Site Operations (DSO) position at the Vice President level, and staffing the position with a manager with significant nuclear operations experience to be responsible for all site operations, maintenance, training and ISM implementation.

- Dividing the INEEL into specific areas and establishing seven Site Area Directors, reporting to the DSO, each responsible for the safe operation, maintenance, training and ISM implementation in their area.

- Redesigning the INEEL maintenance process and enhancing the rigor and discipline associated with its management and oversight, to ensure that work is performed with a primary focus on safety, as a part of expediting implementation of ISM at the INEEL.

- Defining a core level of ES&H infrastructure and ensuring that scope and/or funding changes do not negatively impact this core level.

- Clarifying ID and LMITCO roles, responsibilities, and expectations at all levels to ensure that everyone understands how their job contributes to the safe execution of work at the INEEL and can be held accountable for their performance.

- Implementing rigorous controls on facility changes, including requirements for certification/licensing of those involved in the design, review, hazard identification, installation, testing, and maintenance of the facility equipment.

- Significantly increasing senior management involvement in the Issues Management processes, ensuring that root causes are addressed, issues are prioritized, management system weaknesses are resolved, and resolution of issues is validated prior to closure.

- Developing very specific and measurable corrective actions and assigning responsibilities for their completion to individuals by name within management at the ID Assistant Manager and LMITCO Vice President level or above to ensure that the appropriate accountability is felt at the top.

- Establishing the Corrective Action Program Office (CAPO) reporting directly to the Vice President and General Manager of Environment, Safety, Health and Quality Assurance (ESH&QA) with responsibility for managing the translation of these corrective actions into an integrated implementation plan, and for coordinating and tracking the progress of each corrective action through successful completion and verification.

- Establishing the Site Operations Board consisting of the LMITCO General Manager, the DSO, and the Vice President and General Manager of ESH&QA with responsibility for ensuring effective implementation of each corrective action.

- Requiring the implementation plan to be submitted to ID for approval and requiring monthly reviews of the implementation status by the ID Deputy Manager.

- Significantly increasing the communication between ID and LMITCO on a daily basis to provide improved oversight and effect dynamic changes in field activities. Note that the positive effect of this action can be seen already in the response and prompt corrective actions described in Section 2 of this response report.

After the accident, ID promptly took action to increase the level of work control oversight by instituting a standing work control assessment team to assess process and nonprocess maintenance. This team provided ID management with real-time information regarding the rigor and discipline of LMTICO work package preparation and execution, operations, and the effectiveness of the contractors compensatory measures from direct field observations. This standing team will remain in place to periodically assess work control until ISM is implemented and verified. ID also began frequent, high-level meetings with LMITCO management to convey performance expectations, review the status of compensatory measures, and present ID's field observations. These meetings were especially useful for issue identification and resolution.

Corrective actions addressing the judgments of need common to ID and LMITCO are found in Subsections 3.2, 3.6, 3.19, and 3.21. DOE actions specific to DOE-HQ offices are contained in Subsections 3.11, 3.12, and 3.22. Subsection 3.3 pertains to ID actions only. Included in these actions are ID efforts to expedite implementation of ISM policy by establishing an ID Integrated Safety Management Project Office. ID will also correct quality assurance (QA) process failures by upgrading the ID QA Program to be compliant with DOE Order 5700.6C, "Quality Assurance." In addition, ID will strengthen the Fire Protection Program by performing periodic reviews of special hazard fire suppression systems at the INEEL and issuing a fire protection requirements document to provide clarification of INEEL specific requirements.

More fundamental changes will be undertaken to correct deficiencies identified during the ID supplemental root cause analysis. Among these, are improving technical information flow and analysis in ID to ensure that management decisions are made and priorities are set with an adequate understanding of assumed ES&H risks, and by correcting past failures in implementing an effective ESH&QA oversight system. ID will also ensure risk is limited to acceptable levels by establishing technical requirements documents for safety programs (e.g., in Safety Manuals, Architectural Engineering [AE] Standards, etc.) at the INEEL level where DOE orders, laws, etc., are not sufficient to address site-specific needs.

The LMITCO corrective actions for this accident are part of a natural evolution in LMITCO management and operating practices. One important aspect of this is organizational changes that (a) clarify roles and responsibilities; (b) align the organization for more effective performance; and (c) enhance disciplined operation and accountability. The position of DSO has been filled after being open for over one year. The DSO, who reports to the LMITCO Vice President of Operations, has been designated as the INEEL Site Integration Officer for Conduct of Operations and Conduct of Maintenance. The DSO will implement near-term initiatives to increase the rigor and discipline of the conduct of operations and maintenance and accelerate the implementation of Integrated Safety Management (ISM) at the manager and worker levels. These near-term initiatives are described in Appendix C. The reorganization also includes the designation of Site Area Directors for each INEEL facility. These individuals report to the DSO for conduct of operations and conduct of maintenance. They are

responsible for the safe operation of their facilities and for providing leadership and direction in the implementation of the integrated INEEL Site Conduct of Operations and Maintenance programs. The Operations Training organization within the LMITCO Training Organization has been realigned to report to the DSO. It is responsible for developing facility specific training programs, including the development of training and examination programs supporting the conduct of operations and maintenance initiatives.

After the accident, ID and LMITCO took prompt action to provide additional assurance of safe operation. On August 27, 1998, at the direction of ID, LMITCO formalized the Three Phase Maintenance and Operations Improvement Plan that had been evolving since the maintenance stand-down initiated on July 29, 1998. The Three Phase Maintenance and Operations Improvement Plan is detailed in Appendix D. Phase I required that all maintenance work activities be approved by the Executive Vice President for Operations. During Phase II, the authority to approve maintenance activities was delegated from the Executive Vice President for Operations to the responsible Site Area Directors. Prior to the transition to Phase II, all employees responsible for the performance, planning, and supervision of maintenance activities are briefed on lessons learned from this accident and the need to perform work safely. All areas at the INEEL are under Phase II work controls. Phase II work controls will be retained in all areas until the Integrated Site-wide Maintenance Manual has been implemented. This will be the basis for the transition to Phase III maintenance work controls, which will establish the normal, day-to-day, INEEL maintenance work control practices. Once the basis has been established, the transition to Phase III will occur upon ID approval of a LMITCO transition request.

The Investigation Report implies that past corrective actions for past Type A Accidents at the INEEL have not been effective (Investigation Report p. 60). LMITCO is evaluating the effectiveness of these corrective actions and will incorporate the lessons learned into the implementation of the corrective actions identified in this response report. ID and LMITCO have ensured that the corrective actions developed for this accident are appropriate to fix the problems. LMITCO will establish a CAPO to manage the implementation of the corrective actions described in this response report. The CAPO manager reports to both Vice-President and General Manager of Environment, Safety, Health and Quality Assurance (VP ESH&QA) and a senior management group, the Site Operations Board, which consists of the President of LMITCO (chairman), the DSO, and the VP ESH&QA. The CAPO will prepare an implementation plan for the corrective actions in this response report providing schedule, logic, resource loading, and method of verification of completion. This plan will be approved by the Senior Operations Review Board (SORB) and submitted, by November 30, 1998, to ID for approval. For ID, the Assistant Manager, Office Program Execution is responsible for the completion of corrective actions identified in this Consolidated Response Plan. The Assistant Manager, Environment, Safety, Health and Quality Assurance is responsible for evaluating the effectiveness of the corrective actions. The effectiveness of ID's issues management system will be independently evaluated in six months to ensure it is on the right track and to provide input for continuous improvement. In addition the ID Deputy Manager will hold monthly reviews of the implementation status of both the LMITCO and ID corrective actions. ID will prepare and submit a resource loaded, logic linked schedule of ID corrective actions to DOE-HQ for approval by November 30, 1998.

LMITCO will strengthen its issues management process by establishing an Independent Oversight and Trending Directorate reporting to the Vice President of Environment, Safety, Health and Quality Assurance (ESH&QA). This organization is being staffed with personnel experienced in conduct of operations and maintenance, and root cause and trend analysis. In addition, LMITCO will establish Corrective Action Review Boards (CARBs), chaired by the responsible Site Area Director and staffed by senior representatives of area operations, quality assurance, engineering, and procurement, for all site areas. These CARBs will meet at least monthly to review and evaluate issues management status. LMITCO will use the SORB to address company wide issues management

concerns and to oversee the area CARBs. One of the initial actions of the SORB will be to assess the effectiveness of LMITCO responses to past Type A Accident Investigations and to evaluate the LMITCO issues management system improvements.

Subsections 1.4.1 through 1.4.8 below provide summaries of corrective actions in each of the response areas described in Subsection 1.2.

1.4.1 Management Systems

The management systems corrective actions provide a safe work environment for employees at the INEEL. These corrective actions include expediting the implementation of ISM by accelerating the application of the ISM core functions to the INEEL work activities. The acceleration of ISM implementation at the worker level will be accomplished, in large part, through the near-term initiatives to integrate and increase the rigor and discipline of the conduct of operations and maintenance throughout the INEEL that are being led by the DSO (see Appendix C). These initiatives will focus on the working level implementation of the five core functions of ISM.

Management system improvements are described principally in Subsections 3.6, 3.7, and 3.21, with supplemental information in Subsections 3.1, 3.2, 3.4, 3.5, 3.14, 3.15, and 3.22.

1.4.2 Safety Culture

The corrective actions and ongoing progress in the area of safety culture will achieve a mature safety culture with the following attributes:

- People recognize safety as a "value" and freely and actively participate in safety activities, such as employee safety teams, procedure writing, and safety inspections.
- People clearly understand their authority, responsibility, accountability, expectations, and interfaces as well as those of others.
- Safety, health, and environmental requirements take precedence over production and schedule requirements.
- People help prepare and follow procedures. If the procedure is in error, they stop and resolve the deficiency before resuming.
- People know what to expect, are aware of hazards, and use this knowledge. If the expected does not happen, they stop and establish a safe work environment.
- People question work practices before accepting them as the norm and established standard. They take the initiative to make things better.
- People continually improve standards, procedures, and processes through free and open communication.
- People are aware of the hazards in the workplace and do not work outside of established limits.
- People are free to request needed resources and receive the resources required to accomplish safe production.

- People working safely and reliably contribute to a high level of performance.
- People freely give and receive safety-related feedback, and act on it.
- People voluntarily report incidents, near misses, barriers, safety concerns, and other safety-related information and they receive timely responses.
- Peer influence reinforces, rather than undermines, safety.
- Incident analysis is viewed as an opportunity to identify system failures and therefore improve the system(s).

The principles of Conduct of Operations, Conduct of Maintenance, and ISM are the LMITCO philosophy and provide the foundation for the LMITCO safety culture. In the area of safety culture, LMITCO will establish a mentor program to supplement job-specific training and accelerate behavior change, and ensure that the integrated Site maintenance manual contains provisions for employee involvement in work planning and control. LMITCO will also establish management metrics and feedback systems that clearly communicate the importance of safety. Safety Culture improvements are described in Subsections 3.1, 3.6, 3.7, 3.14, and 3.21.

1.4.3 Systems Design

The systems design corrective actions have immediately addressed high-risk areas (e.g., disabling CO_2 fire suppression systems and instituting compensatory measures). LMITCO has established a project to identify the fire suppression system faults that caused the system in TRA-648 to release CO_2 unexpectedly, without annunciation of the predischarge warning alarm. LMITCO has physically isolated the TRA-648 CO_2 fire suppression system and permanently removed it from service. LMITCO is currently reviewing the remaining CO_2 and other gaseous agent fire suppression systems for similar vulnerabilities and examining design modifications to provide positive lockout mechanisms. No CO_2 fire suppression systems will be returned to service without (a) positive lockout mechanisms, (b) adequately reliable discharge monitoring systems, and (c) area CO_2 monitors to ensure that CO_2 leakage or unexpected system discharges, which may have occurred without alarm, are detected prior to personnel entry. Positive lockout mechanisms will be installed on other special hazard gaseous agent fire suppression systems (e.g., Halon FM-200, FE-13 systems) where upgrades are determined to be necessary. In the longer term, LMITCO will evaluate the risks and benefits of the continued use of CO_2 fire suppression systems. LMITCO will also enhance the fire protection system design and procurement processes.

Systems design improvements are described in Subsections 3.1, 3.2, 3.4, 3.8, 3.9, 3.10, 3.12, and 3.22.

1.4.4 Work Planning and Control

The work planning and control corrective actions will enhance the rigor, discipline, and consistency in the work planning and control process. This will be accomplished by: implementing a Site-wide computerized work control system, incorporating procedural components of the work control process into an integrated Site maintenance manual, and increasing the presence of line management (managers, supervisors, foremen, tech leads) in the field with emphasis on routinely overseeing work, assessing safety conditions, and obtaining employee feedback.

The new Site-wide maintenance manual will be developed as a part of the near-term initiatives to increase the rigor and discipline of conduct of maintenance and to accelerate the implementation of ISM at the worker level. The new Site-wide maintenance manual will: establish a standard work control process for the entire INEEL; increase the rigor and discipline of work control requirements, including defining routine work more clearly; establish a Site-wide maintenance work order package format; include involvement of workers and appropriate safety and health professionals in up-front work planning; and incorporate training requirements for personnel involved in the work control process.

The work planning and control improvements are described in Subsections 3.13, 3.14, and 3.15.

1.4.5 Hazard Identification and Control

ID and LMITCO are committed to identifying and mitigating workplace hazards. The priority emphasis of hazard identification and control improvements is on hazards where inadequate control could create deficiencies classified by the Occupational Safety and Health Administration (OSHA) as a "Serious Violation" or an "Imminent Danger." Such hazards are referred to in this response report as potential and credible hazards. The hazard identification and control improvements provide a structured process that mandates an appropriate level of hazard and barrier assessment for work by: developing a database of hazards and recommended hazards control measures; enhancing tools to assist work planners in identifying and mitigating potential and credible hazards; revising procedures and guidelines to clarify the level of analysis of hazards and the barriers that protect against them for various types and locations of work; increasing the skill level of all employees in hazard identification, assessment, and mitigation; providing training in hazard identification and analysis in the work planner qualification program; and ensuring that documentation employed for hazard analysis and mitigation (e.g., safety basis documentation and work control procedures) is maintained.

Hazard analysis and control improvements are described principally in Subsections 3.5, 3.13, and 3.14 with supplemental information in Subsection 3.16.

1.4.6 Emergency Management

The emergency management corrective actions will optimize the deployment of emergency response personnel and equipment, which includes: prestaging emergency equipment and Fire Department personnel for certain high-risk work or work environments; increasing the oxygen supply on response vehicles; and performing comprehensive assessments on emergency functions and services. Emergency rescue and management improvements are described principally in Subsection 3.20 with supplemental information in Subsection 3.13 and 3.16.

1.4.7 Personnel Training and Competency

The training and competency corrective actions will improve competency of LMITCO staff in identifying and mitigating hazards found at the INEEL. These corrective actions include: implementation of a CO_2 hazard training program; an assessment of current ESH&QA training and INEEL site access training to ensure that training on existing hazards (e.g., oxygen deficient environments, corrosiveness, reactivity, and flammability) is included; enhancements to lockout/tagout training to make clear that impairments are not to be used in lieu of lockout/tagout; and development of a standard job-specific new employee checklist to enhance new employees' awareness of job-specific hazards and work controls.

Training and competency improvements are described in Subsections 3.16 and 3.17 with additional training, which supports specific disciplines addressed in other Judgments of Need.

1.4.8 Feedback and Lessons Learned

Feedback enhancements focus on improving the issues management and corrective action program. These improvements are not limited to increasing the rigor and discipline of the requirements for developing, implementing, and verifying the adequacy of corrective actions. They include organizational changes that provide senior management with more accurate feedback about the effectiveness of corrective actions. The organizational modifications include establishing an Independent Oversight and Trending Directorate reporting to the VP ESH&QA. This organization is being staffed with personnel experienced in conduct of operations, conduct of maintenance, and root cause and trend analysis and has been directed to focus on these areas, to develop performance metrics, and to keep senior management apprised of organizational performance. The Quality Assurance Director will establish a program manager for issues management, who will be responsible for developing, establishing, and implementing issues management system improvements and for monitoring the effectiveness of the corrective action process. Corrective action review boards will also be established to provide additional management oversight of the issues management process. These boards will review appropriateness and effectiveness of the corrective actions taken in response to the past two Type A Investigations of accidents.

In addition, LMITCO will establish a CAPO to manage the implementation of the corrective actions described in this response report. The CAPO manager reports to the VP ESH&QA. The Site Operations Review Board will oversee the operation of this program office.

Feedback improvements are described in Subsections 3.18 and 3.19.

1.4.9 Corrective Action Integration with Other INEEL Initiatives

Many of the corrective actions are closely related to ongoing INEEL improvement initiatives in five areas:

- Integrated Safety Management (ISM) gap closure
- Voluntary Protection Program (VPP) enhancements
- Conduct of Operations and Maintenance enhancements
- Increasing Line Accountability for ESH&QA
- Environmental Compliance initiative implementation

Integration of the corrective actions with these ongoing improvement initiatives will help institutionalize the resulting improvements. To facilitate proper coordination, focus, prioritization, and synergy for the major actions in these initiatives, the CAPO will develop and the SORB will approve an integrated schedule for all corrective actions and major improvement actions for the coming years.

1.4.10 Conclusion

The combination of the conduct of operations and maintenance management initiatives, the corrective actions presented in this response report, and ongoing ISM and VPP implementation activities define the INEEL path of continuing improvement over the next year. These initiatives will be the focus of LMITCO improvements. ID will improve issues management processes and execution, as well as take steps to ensure that the INEEL safety infrastructure will be defined and preserved. Technical information flow, including data collection, analysis, and communication will lead to

improved decisions for policy, risk management, and ID resource allocation. ID roles, responsibilities, and expectations will be reevaluated and clarified to ensure that ID employees and managers understand how their jobs contribute to the safe execution of work. The standing work control assessment team in the near term and the actions planned for the long term will ensure that ID exercises effective oversight of safety at the INEEL. ID and LMITCO senior management will commit the energy and resources needed for the successful completion of these priority activities.

1.5 Lessons Learned

DOE Order 225.1A, "Accident Investigations" requires that lessons learned from the accident investigation be developed and disseminated DOE-wide. The Appointing Official is responsible to ensure that these lessons learned are disseminated. This portion of the response report provides a description of the lessons learned by ID and LMITCO from the accident and the response preparation activities. These lessons learned are not a part of the formal corrective action response to the Investigation Report judgments of need; rather, they are provided to facilitate the process of DOE-wide dissemination of the lessons learned from the accident. Each lesson learned is followed by a description of proposed recommended actions for other DOE complexes to consider in response to the lesson learned. ID and LMITCO have either completed appropriate responses to each of the lessons learned, or incorporated them into these corrective actions.

1.5.1 Direct Monitoring of Equipment Status Important to Safety

Lesson Learned Statement—When it is important (for safety purposes) to know the status of a piece of equipment, its status/condition should be monitored directly rather than being inferred from a signal intended to indicate its status (e.g., monitor actual valve position rather than the electrical command to trip a solenoid or cause a valve to change position).

Recommended Actions—Implement processes that require designers to incorporate direct monitoring of equipment status into system designs, rather than monitoring of signals intended to set equipment status, when such monitoring is performed for safety purposes.

1.5.2 Use of Software-based Impairments For Hazard

Lesson Learned Statement—Software-based system impairments must not be used as protective barriers against significant hazards when these barriers are intended for worker protection.

Recommended Actions—Implement processes that require use of physical isolation barriers for worker protection against significant hazards rather than software-based impairments. If there is sufficient concern about a hazard to use a software-based impairment, then it is necessary to use reliable physical isolation methods.

1.5.3 Work Environment Changes

Lesson Learned Statement—Changes in the work environment that may not seem significant or threatening (e.g., the installation of new safety equipment or implementation of additional safety measures) can erode the barriers providing protection against hazards and therefore require analysis.

Recommended Actions— Emphasize the need to perform a change, hazard, or barrier analyses whenever there is a change in the work environment. When the change in the work environment involves installing new safety equipment or implementing additional safety measures, a revised analyses will consider the possible malfunctions or unintended effects that the new equipment or measures may have in reducing the barriers and increasing the severity of hazards. Particular attention should be paid to barriers affecting hazards other than those the safety equipment or safety measures are intended to protect.

1.5.4 Code Compliance

Lesson Learned Statement—Compliance with applicable consensus codes and standards may not always provide an adequate level of worker safety. There are circumstances under which it is necessary to impose additional design requirements.

Recommended Actions— Emphasize the need for systems designers to review the sufficiency of the requirements mandated by applicable codes and standards to ensure that they provide the requisite level of worker safety.

2. RESPONSE AND PROMPT CORRECTIVE ACTIONS

Immediately following the accident, ID and LMITCO Management initiated a series of actions to ensure a safe working environment. As information was gathered regarding the causal factors associated with the accident, the corrective actions were broadened to address the assurance of proper work controls in all aspects of in-progress work activities. These actions are as follows:

- At 6:11 p.m. on July 28, 1998, the Advanced Test Reactor Shift Supervisor coordinated the initial response and rescue activities until relieved by the Advanced Test Reactor Deputy Operations Manager, who was the initial Emergency Action Manager.

- Within an hour, senior LMITCO managers and the ID TRA Director, who were en route home after their work shift, returned to the TRA Emergency Control Center (ECC) and activated the TRA Emergency Response Organization.

- At 7:05 p.m., the incident was classified as an alert and notifications were made to DOE and appropriate state and local officials. The INEEL Emergency Operations Center and the Central Facilities Area Emergency Control Centers were activated and remained in operation throughout the evening. Several press releases were made to the public and were forwarded by electronic mail to all ID and LMITCO employees, providing updates of the situation at the facility and with the affected personnel who were taken to local hospitals.

- The Emergency Director in the Emergency Operations Center verbally directed TRA and other INEEL facilities to stop all work at the INEEL, with a few selected operational exceptions, until a clear understanding existed of the cause of the accident and what mitigating actions were necessary to ensure work efforts could resume with appropriate hazards identification and mitigation.

- By 10:30 p.m., senior LMITCO management assigned a Recovery Manager with responsibility for recovery issues. An evaluation of TRA site conditions verified that conditions were safe and that appropriate hazard mitigation measures remained in place for the planned power outage.

- Actions were taken to preserve the accident scene, and security personnel were posted to control the area in and around TRA-648.

- Following verification of safe conditions at the TRA site, the Executive Vice President for Operations directed an immediate stand-down for all maintenance work at the INEEL. No maintenance work was to be conducted except for that required to maintain stable facility conditions.

- The emergency condition was terminated at 12:37 a.m. on July 29, 1998.

- On July 29, LMITCO submitted an occurrence report (see Appendix E). Concurrently, LMITCO performed a review of other CO_2 fire suppression systems and took actions (e.g., mechanical isolation of CO_2 sources from fire suppression systems) to ensure that a similar event could not occur elsewhere at the INEEL.

- At the start of the work shift on July 29, maintenance personnel assigned to the TRA site were briefed about the limitations imposed by the maintenance stand-down. The criteria for

restart of maintenance work was reiterated. A similar briefing was provided to workers at the other major facilities. Concurrently, LMITCO Management initiated actions to gather information about the accident, without disturbing the accident scene, to support the pending DOE Type A Accident Investigation. This action continued until July 30, 1998, when the DOE Accident Investigation Team arrived and LMITCO assumed a support role for the Board until the Type A investigation was concluded. The maintenance stand-down was lifted by the Executive Vice President for Operations at noon on July 30.

- On July 29, ID submitted a fact sheet to Nuclear Energy-Headquarters and Naval Reactors addresses to provide initial DOE internal notification of the event.

- On July 29, Acting DOE Secretary Moler issued a memorandum to all DOE personnel emphasizing the importance of preventing accidents and reinforcing DOE's policy that the safety, health, and well being of our workers and the public must be paramount in everything that we do.

- On July 30, the ID Manager issued a memorandum to all ID employees emphasizing the need for ID to redouble its safety efforts.

- Prior to the Board's entry to the accident scene on July 31, LMITCO established and verified the safety of conditions in TRA-648. This included mechanically isolating the CO_2 sources from the TRA-648 fire suppression system.

- On August 2, after an on-scene evaluation, limited access was restored to TRA-648 to permit restoration of the electrical power distribution system to its normal configuration.

- On August 3, the ID Manager requested that LMITCO (1) "quickly engage in the identification of potential breakdowns in the hazard identification and control process and to initiate specific compensatory measures, and (2) assess and identify Site-wide vulnerabilities in conditions where methods other than physical locks and tags are used to protect personnel (e.g., electronic disabling vs. physical disabling), and in buildings, rooms, or spaces where security, safety, or other systems have the potential to trap and/or injure individuals. Compensatory measures for these conditions were to be initiated by August 6, 1998, based on LMITCO's assessment. The request also included a briefing to ID no later than August 10, 1998 to address the evaluation and compensatory measures. In addition to LMITCO assessments requested above, ID Facility Representatives also performed similar assessments of potentially hazardous conditions at INEEL facilities.

- On August 10, LMITCO presented its compensatory measures taken in response to the ID Manager's August 3 request.

- On August 11, the Assistant Manager of Office Program Execution (AM/OPE), the Deputy Assistant Manager, Office of Program Execution, the Office of Program Execution Operational Safety Division Director, and ID Facility Directors met to evaluate the LMITCO compensatory measures and formulate an appropriate ID action plan and possible recommendations or direction to LMITCO regarding the compensatory measures presented to ID on August 10.

- On August 13, ID established a standing team to assess process and nonprocess maintenance activities. The team consisted of experienced ID personnel whose duties included in-the-field observation and evaluation of safety of maintenance and operations activities of

the contractor. The team's initial focus was to ensure that rigor and discipline were occurring at all levels of LMITCO's work planning process, and that hazard identification and control were being improved. The standing team was also instructed to evaluate the effectiveness of LMITCO's compensatory actions at the field level, and chartered to periodically review and report on contractor progress in this area until the ISM System is fully implemented and verified at the INEEL.

- On August 13, senior ID management met with and verbally advised LMITCO that it had several concerns about LMITCO's compensatory measures presented to ID on August 10, especially in the areas of work planning and execution processes, and recommended that senior LMITCO management initiate additional steps to ensure adequate work package preparation and supervision of work. Along these lines, ID discussed with LMITCO the importance of increasing rigor and discipline in work control, and strongly urged LMITCO to consider implementing a single site operations director, area directors as discussed previously between LMITCO and ID, senior supervisory watches for operations and maintenance activities, as well as other potential compensatory measures.

- On August 14, conditions were established to replicate the events that occurred on the night of the accident (with the exception of the actual CO_2 discharge—the CO_2 source remained mechanically isolated). This reenactment successfully reproduced the improper activation of the CO_2 System actuation solenoids when the bus powering the fire suppression system was deenergized. The reason for the solenoid activation was not understood.

  An attempt, on September 1, to reproduce the improper activation of the CO_2 actuation solenoids by deenergizing the electrical buses in a different sequence did not cause the solenoids to activate. Therefore, LMITCO initiated a detailed troubleshooting and analysis effort on a test unit to learn the cause of the improper activation of CO_2 System actuation.

- On August 17, the Executive Vice President for Operations met with LMITCO personnel and imposed a STOP WORK ORDER for all nonemergency Facilities, Utilities, and Maintenance work. Soon thereafter, he also issued STOP WORK ORDERS for Specific Manufacturing Capability (SMC) Maintenance and for construction subcontractor excavation and surface penetrations.

  Work was stopped until each maintenance work order or construction package was personally approved by the Executive Vice President for Operations. Prior to being submitted to the Vice President, facility management was required to ensure that the maintenance work met all requirements of the Enhanced Work Planning Process; that construction excavation and surface penetration work met all LMITCO requirements; and that appropriate personnel, including health and safety professionals, had walked down the job site to ensure hazards had been identified, mitigated, and controlled.

- On August 19, the Executive Vice President for Operations assigned personnel as Area Directors. Under the Area Director Plan, which had been previously approved by the LMITCO President, the INEEL was divided into 9 geographical areas, each with an Area Director, who had responsibility for the safety and compliance of all work conducted within their area. ID concurred with this action.

- On August 25, the Executive Vice President for Operations instructed Area Directors to perform a Site-wide evaluation of all compressed gas sources to determine potential vulnerabilities in the event of an inadvertent release.

- On August 26, the Executive Vice President for Operations issued instructions establishing a three phase Maintenance and Operations Improvement Plan (see Appendix D). This Plan controlled the disciplined resumption of maintenance activities as well as provided guidelines for other operations at the INEEL. Phase I required that all maintenance work activities be approved by the Executive Vice President for Operations. During Phase II, the authority to approve maintenance activities within each area would be delegated to the Area Director. Requirements for Phase III were to be defined at a later date. The transition from Phase I to Phase II would be approved by the Executive Vice President for Operations based on personal certification by each Area Director that their area had met specific requirements. These requirements included:

  - Understanding of all roles and responsibilities for the position of Area Director
  - Completion of work control and hazard mitigation training by personnel
  - Establishing a Senior Supervisory Watch for the area
  - Summary of progress and plans for using the specific functions and guiding principles of ISM System for improving work control
  - Completion of Enhanced Work Planning Level III training for personnel
  - Certification that all Enhanced Work Planning documents were being followed
  - Description of the system for assessing work control problems and taking appropriate actions.

- On August 31, ID requested that LMITCO establish a permanent, single line manager responsible for all work and operations at the INEEL.

- On September 2, the Executive Vice President for Operations issued specific requirements for work planner training and qualification.

- On September 10, ID directed LMITCO to establish a Senior Site Operations Manager; to define the roles, responsibilities and authorities for that position; and to take these and other specified actions within one week of the date of the letter (e.g., by September 17, 1998).

- On September 14, the ID Manager gave a detailed briefing to the DOE Undersecretary on the accident, its causes, compensatory and corrective actions, and lessons learned.

- In a memorandum dated September 18, 1998, ID informed Environmental Health-Headquarters (EH-HQ) that ID had eliminated several time-consuming administrative duties for the Deputy AM/OPE who has primary responsibility for overseeing contractor performance in the field, directed LMITCO to perform a 100% verification of the flowdown of contractor Clause H.18, “Laws, Orders, and Regulations” list B requirements to LMITCO implementing procedures, and assigned an interim AM for Environmental, Safety, Health, and Quality Assurance (ESH&QA) with primary responsibility to assess ESH&QA performance of ID and the INEEL contractor.

- On September 21, the last of the nine areas was given approval to transition to Phase II of the Maintenance and Operations Improvement Plan (items 16 through 24, Appendix D).

During Phase I, the Executive Vice President for Operations had personally reviewed over 100 work orders.

- On September 29, the LMITCO President and General Manager reorganized the INEEL to further improve work performance and strengthen accountabilities. The position of Director, Site Operations was established, reporting directly to the Executive Vice President for Operations. This Director is accountable for the conduct of maintenance and operations activities. Some changes were made in Area Director assignments and Directors for areas at the Site were renamed Site Area Directors. All Site Area Directors report to him for the proper planning and execution of their site work. The primary focus of this position will be to enhance the INEEL's Conduct of Operations and Conduct of Maintenance posture and to implement the ISM System. This action was consistent with the direction of ID's Deputy Manager on September 10.

- On September 29, the Director, Site Operations met with all Site Area Directors and detailed his expectations for their performance (see Appendix C).

- On September 29, 1998, the ID Manager met with ID AMs, Deputy AMs, safety and health professionals, and OPE facility and operations Personnel. He informed them that his top priority for FY-99 was to fix safety programs at the site once and for all. The Manager also encouraged all ID personnel to read the Investigation Report in its entirety. He stated that he believed that the event stemmed, at least in part, from inadequate resolution of problems identified in previous Type A Accident investigations at the INEEL.

  The Manager stated that leadership from ID was both the issue and the answer. ID personnel and managers were encouraged to engage in persistent, critical thinking and inquiry. He stated the need for better self-assessment and that all managers and supervisors needed to welcome bad news as part of continuous improvement. He indicated that ID needed to revise the CPAF process to enhance its effectiveness. In addition, he stated that if ID resources are discovered to be inadequate, that the problem would be fixed. The manager designated the AM/OPE as the AI Corrective Action Project Manager.

- On October 5, the Site Area Directors and their Maintenance Managers began a full-time workshop sponsored by the Director, Site Operations. The purpose of the workshop is to develop a Site Maintenance Program, with an associated manual and detailed implementation plan.

- On October 5, the Deputy AM/OPE issued the interim results of the ID work control assessment team that included a summary of major issues and the team's weekly observations. The assessment showed that deficiencies in both management systems, rigor, and discipline in performing work still exist. ID also requested that LMITCO provide an INEEL Maintenance Implementation Plan (MIP) for ID approval within 60 days. In addition, ID requested that new or revised Management Control Procedures (MCPs) for Maintenance Management be submitted to ID for approval. ID will review these new or revised MCPs and compare them to DOE Order 4330.4B and other approved DOE Standards, including the principles of ISM, to ensure that the revised maintenance program meets ID expectations.

- On October 6, approval was delegated by the Executive Vice President of Operations to Site Area Directors for review and approval of excavation and surface penetration work in their

respective areas. This is documented in the Site Area Directors' staff minutes of October 7, 1996.

- On October 7, the ID Manager issued the ID expectations for performance to LMITCO. Included was the requirement that "compensatory actions will remain in place until both LMITCO and ID are satisfied that Integrated Safety Management is in place and producing the desired result on all work (item 28, Appendix D).

The response and prompt corrective actions, as augmented by DOE oversight, addressed high-risk areas and provided a rigorous work control process to ensure appropriate hazard control and mitigation. Increased management/supervisor oversight, heightened employee awareness, and a rigorous work authorization process have established assurance that work can proceed safely. Actions are being initiated to accelerate ISM System implementation. These measures provide assurance that LMITCO can safely perform maintenance activities at the INEEL in the short term, and at the same time, implement the systematic approach described in the next section, which will resolve the broader issues raised by the DOE judgments of need and their associated underlying causes.

3. RESPONSE TO ACCIDENT INVESTIGATION BOARD JUDGMENTS OF NEED

3.1 Protection From Releases of Toxic Agents From Energized Systems

3.1.1 Judgment of Need

LMITCO needs to establish and implement a program that complies with and incorporates all applicable worker protection requirements contained in Occupational Safety and Health Administration regulations, National Fire Protection Association codes and standards, and DOE Orders for CO_2 fire suppression systems and other systems with hazardous gases into applicable manuals, safety analysis reports, procedures, and work planning and control processes to ensure that employees are protected from releases of toxic agents from energized systems. (Investigation Report, pp. vii and 27)

3.1.2 Background and Analysis

In 1994, when LMITCO assumed Management and Operations responsibilities as the prime contractor at the INEEL, they consolidated the multiple requirements management programs of the previous contractors into a single requirements management system. In the process, MCPs from previous site contractors were streamlined and consolidated into new Site-level MCPs, which, in some instances, reduced the level of detail of specific safety requirements contained in the applicable codes and standards, making them less of a repository of applicable requirements for a given safety disciplines (e.g., fire protection). Because the substance of the requirements was not captured in the MCPs they did not flow down into lower level implementing procedures, forcing safety professionals to rely on personal knowledge of applicable code and standard requirements in order to capture them in operational procedures, instructions, and the work control process. In effect, LMITCO removed individual requirements and standards from company level documents (e.g., MCPs) and relied on the knowledge of cognizant safety professionals to insure compliance with model building codes and national standards. As a result, the LMITCO requirements management program changed from a standards based system to an "expert based" system.

The above paragraph explains a generic issue that is broader than CO_2 and fire protection, which needs to be addressed generally. LMITCO needs to improve its requirements management program to capture applicable health and safety requirements (DOE, National Fire Protection Association [NFPA], OSHA, etc.) in company level command media, such as MCPs, that reflect company health and safety policy. The corrective actions in this section will address this generic issue, which was also identified as part of the LMITCO gap analysis performed in conjunction with the development of the LMITCO ISM System "Safety Management System (SMS) Implementation Plan" (see Appendix B) as Gaps1 and 20.

Gap 1 identified the need to flow down ES&H requirements into company level command media (called Functional Area Manuals in the SMS Implementation Plan). Gap 20 identified the need to integrate a process for implementing ES&H requirements into work planning and execution. The corrective actions described in Subsections 3.1.3 and 3.1.4 include the procedures identified in the actions of the SMS Implementation Plan, Gaps 1 and 20.

LMITCO also recognizes that safety basis documentation needs to clearly define hazards related to specific facilities and needs to be kept up to date. Subsection 3.5 details the discussions and corrective actions for safety basis documentation with respect to CO_2 fire suppression systems and other systems with hazardous gases.

Soon after the July 28th accident, LMITCO began identifying all applicable worker protection requirements for CO_2 suppression systems. This effort was expanded to include other gaseous suppression systems, such as Halon, FM-200, and will continue to expand to include identifying worker protection requirements pertaining to nonsuppression hazardous gaseous systems.

While this specific effort has been useful in identifying specific fire protection and gaseous suppression system requirements, it does not constitute a long-term or institutional fix to the ES&H requirements management and flowdown issue. The institutional fix will be the implementation of the corrective actions for the ISM System gaps (Gaps 1 and 20) described above.

3.1.3 Description of Corrective Action(s)

LMITCO will improve ES&H requirements management by developing both a standard requirements identification management and flowdown process and a requirements linkage database.

By developing and implementing a structured requirements management and flowdown process, LMITCO can ensure consistent implementation of safety requirements into its procedures thereby strengthening safety management. The process will (a) capture requirements for review and interpretation by Functional Area Policy Managers (FAPMs) (e.g., for Fire Protection, Industrial Safety, etc.); (b) promulgate company level policies and program descriptions by the FAPMs; (c) flow these policies and program descriptions down into implementing procedures; and (d) integrate applicable requirements into site working level procedures, instructions, and work packages through the activities of the Site Document Committee and Site Training Committee (see the description of the DSO's Action Plan in Appendix C).

The requirements management and flowdown process will force the periodic update of procedures and add provisions for more frequent updating on an as-needed basis. The process will also provide for field validation of, and training on work level and operating procedures prior to implementation. The consistent use and application of procedures will be enhanced by (a) consistent interpretation and promulgation by FAPMs, (b) worker involvement in procedure development, (c) procedure impact analysis by developing procedure implementation prior to procedure implementation, (d) training on procedures prior to procedure implementation, and (e) field validation prior to implementation.

This requirements management system will provide a process for identifying appropriate requirements for the work being performed, provide correct and appropriate interpretations for those requirements, document requirements and their interpretations, and allocate the appropriate set of requirements via work instruction documents. The requirements management organization will identify requirements sources and notify the applicable functional area manager. The functional area managers are responsible to promulgate the requirements into company level policy, procedures, and training programs through the Site Document Committee and Site Training Committee. Consistent with the VPP process, employees will be involved in procedure writing and development. This is a necessary element in achieving a mature safety culture. This involvement will not only increase the employee's buy-in to the procedure requirements, but make the procedures easier to implement and more relevant to the actual work being performed. As part of the process, management and employees will perform routine self assessments to identify deficiencies in procedures and/or work packages for feedback and continuous improvement. ESH&QA organizations and line managers will perform independent assessments to ensure that ESH&QA requirements have been fully and accurately integrated into work planning, work control documents, and work processes.

As part of long-term corrective actions to develop and deploy a requirements management and flowdown system, it is believed that the number of requirements to be managed is large enough to warrant

the use of an automated system to help implement the process. The RDD-100 system form Ascent Logic Corporation, has already been chosen as the system to support the requirements management, requirements analysis, system design, system analysis, design verification, and document generation needs of the Systems Engineering Directorate, and is in use on several programs and projects at the INEEL. In addition, 20 licenses are currently available at the INEEL with the procurement of a site license planned for FY-99; 24 site personnel have been trained in its use during FY-98, with more planned in FY-99; and the personnel are in place to support the application of this tool. Although RDD-100 is already in place at the INEEL, LMITCO will undertake an evaluation of the specific needs for automated assistance of ESH&QA requirements management and flowdown as part of the response to this judgment of need.

Because it is important to quickly address the requirements flowdown issues for CO_2 and gaseous suppression systems, LMITCO is implementing near-term corrective actions for these, while it processes the initiatives to address the generic requirements management and flowdown issues. Part of these near-term actions are to identify the applicable requirements for CO_2 and other gaseous suppression systems and to incorporate them into the LMITCO longer-term SMS Implementation Plan.

3.1.4 Corrective Action Milestones and Schedule

Table 3.1-1. Scheduled corrective actions.

	Corrective Action	Responsibility and Organization	Due Date
3.1.4.1	Identify all applicable worker protection requirements for CO_2 suppression systems.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	Complete
3.1.4.2	Identify all applicable OSHA, NFPA, DOE worker protection requirements pertaining to other gaseous suppression systems.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	11/98
3.1.4.3	Identify worker protection requirements pertaining to other hazardous gaseous systems.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	12/98
3.1.4.4	Incorporate applicable worker protection requirements from steps 3.1.4.1, 3.1.4.2, and 3.1.4.3 into applicable ES&H manuals, procedures, and LMITCO work planning and control processes.	Director, Site Operations; W. Gay	4/99
3.1.4.5	Identify Functional Area Managers for all requirements in the LMITCO contract with ID.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	Completed 10/98

	Corrective Action	Responsibility and Organization	Due Date
3.1.4.6	Incorporate applicable ES&H requirements contained in company ES&H documents and policies into the work planning and control process and provide implementation training to appropriate personnel.	Director, Site Operations; W. Gay	3/99
3.1.4.7	Ensure that applicable ES&H requirements from applicable codes and standards (e.g., NFPA, OSHA) are incorporated into company policies, procedures, manuals, and training programs.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	8/99
3.1.4.8	Review and modify work planning and control process documentation and guidance as appropriate to capture the results of corrective actions 3.1.4.7.	Director, Site Operations; W. Gay	9/99
3.1.4.9	Evaluate the RDD-100 system for possible use as a platform for a linking database for the LMITCO requirements management program.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	3/99

NOTE: Corrective Action scheduled completion dates:

Immediate & prompt actions	Completed before response report issued
Near-term actions	Scheduled for completion on or before 1/99
ISM-integrated actions	Scheduled for completion on or before 8/99
Long-term actions	Scheduled for completion

3.2 Independent Verification of System Design Modifications

3.2.1 Judgment of Need

ID and LMITCO need to ensure effective quality assurance practices are in place to independently verify that system design modifications are accomplished in accordance with all applicable codes and requirements. (Investigation Report pp. vii and 65)

3.2.2 Background and Analysis

DOE-ID

ID line management is responsible for ensuring that design modifications are performed in accordance with all applicable codes and requirements. ID line management is the Assistant Manager for the Office of Program Execution (A/M OPE), and reporting to him are the Deputy A/M OPE for Operations, Facility Directors, the Deputy A/M OPE for Programs, and Program Managers. ID line management oversight for system design modification is performed by Facility Director and Program Manager organizations, with support from the Operational Safety Division and the Infrastructure Program as needed.

ID performs independent oversight for this responsibility. ID independent oversight is governed by the DOE Order 5700.6C, "Quality Assurance," and implemented by ID-N 450.A2, "Environment, Safety, Health and Quality Assurance Oversight." The ID Quality Management Plan provides Continuous Process Improvement guidelines and is approved by the ID Manager.

The ID Quality Assurance program does not meet the requirements of the DOE Order. For example, neither the ID Quality Management Plan nor the ID-N 450.A2 constitutes an approved Quality Assurance Program as required by the Order. In addition, neither ID line management oversight nor ID independent oversight has a long-term schedule for assessments that demonstrates how the 10 criteria of the DOE Order will be satisfied. Furthermore, line management and independent oversight assessments are not scheduled taking into account the risk or hazard associated with the work, system, or process, as required by the DOE Order.

As a result of the Accident Investigation Report, ID independent oversight is tentatively planning to perform an assessment of design control processes during the June 1999 timeframe. ID independent oversight performed a partial assessment of design and design modification, as part of a Site-wide Quality Assurance Assessment from September 29 to October 9, 1997. The scope of the review for design and design modification was limited, and no findings were generated for this area. ID Management does not have records to show when a prior assessment of design control activities was performed. Presently, little if any ID oversight of system design modification is performed.

In summary; the ID Quality Assurance program does not meet the requirements of the DOE Order. In addition, ID line and independent oversight of design and design modification activities is not being performed.

LMITCO

Independent review of system design modification process was previously conducted using a semi-informal selection of reviewers. Formalizing the independent verification of system design would strengthen the current design review process and provide additional assurance that errors in design inputs would be identified and corrected. Thus, the design review process needs to implement more effective

internal quality assurance practices to independently verify that system design modifications are accomplished in accordance with all applicable codes and requirements in the future.

Per previous revisions of MCP-2811 "Engineering Change Control," the LMITCO design process had included a review of the design against the design inputs; however a separate evaluation of the design inputs was not completed. As part of the analysis process that led to the latest revision of MCP-2811, LMITCO determined that a separate review of the design inputs was needed as part of the design process.

LMITCO's supplemental root cause analysis identified the need to reconsider the bases of the planning and design process for modifications to insure they are not too narrowly focused. This action is now accomplished by the newly revised MCP-2811, Rev. 2, which establishes a team approach to defining design inputs. This team approach is consistent with the implementation of the ISM system at LMITCO. The synergy of the team will help identify all the appropriate codes and standards as design inputs.

The corrective actions specified for this judgment of need define how LMITCO will enhance design review processes and procedures, training criteria, followup assessments, and feedback mechanisms. The enhancement will ensure that future system designs and modifications meet all applicable codes and requirements, especially as they pertain to fire suppression systems.

3.2.3 Description of Corrective Action

DOE-ID

As discussed in Subsection 3.3, ID will include within its Quality Assurance Program the need to validate the INEEL Operating Contractor's quality assurance practices used to independently verify that fire protection system design modifications are accomplished in accordance with applicable codes and requirements. Independent verification of selected INEEL fire protection system design modifications will be conducted by ID Authority Having Jurisdiction (AHJ).

To come into compliance with DOE Order 5700.6C, a review of the requirements of the order must be conducted to determine which areas of the program need to be upgraded. Following the review, ID will upgrade the ID Quality Assurance Program to come into compliance with the Order. An independent oversight plan and schedule must be developed to show how the Quality Assurance criteria of the Order will be satisfied to require taking into consideration the risk associated with the work. To preclude this problem from reoccurring, periodic independent assessment of the ID Quality Assurance Program will be required to be performed to ensure compliance with program requirements.

As a compensatory measure, an ID assessment of the LMITCO design control process and implementation activities will be scheduled and conducted to determine whether the LMITCO program is compliant to orders, regulations and requirements. To meet the requirements of the order with respect to design control activities, an oversight plan will be developed demonstrating that the 10 criteria of the Order, including design control, are scheduled to be evaluated as part of the overall ID ES&H Oversight program. ID will conduct training associated with the requirements of these process changes described above.

Due to the programmatic deficiencies identified by the Board related to quality assurance and procedure use and compliance, the Board Chairman has notified the DOE Office of Enforcement and Investigation of several issues that may have Price Anderson enforcement implications. A DOE evaluation of the breakdown and specific failures is planned, which will determine whether enforcement is warranted.

LMITCO

LMITCO will establish design requirements for special-hazard fire suppression systems through a review and revision to the AE Architectural Engineering Standard. LMITCO is implementing revised MCPs that control system design modifications to ensure effective quality assurance practices are in place. MCP-2811, which was developed in conjunction with MCP-2798, "Maintenance Work Control," was rewritten (Revision 2) and issued in May, 1998 to cover the engineering change processes. It defines the sequence of activities associated with the specification and design of modifications, and stresses the use of multi-disciplinary teams to define requirements and verify the design. This approach will address the deficiencies identified in the Board's Investigation Report. Corrective actions will ensure that design review is clearly defined for each reviewer and that the verification of compliance with codes and standards is completed.

As an additional measure, LMITCO will continue to use vendor trained personnel, such as Facility Fire Protection and Quality personnel, as necessary, to verify that system modifications are designed and installed according to codes and requirements. The requirements for and extent of quality inspection involvement in fire suppression system installations will be defined in MCP-2482, "Inspection for Conformance."

LMITCO shall revise MCP-2482, "Inspection for Conformance" to include fire protection systems. This will help ensure all system modifications are evaluated by an independent organization.

LMITCO will establish an assessment program to ensure that MCP-2811 and the project management guide are implemented. These assessments will include real-time evaluations of the design review process. Assessment planning will include a clear identification of the metrics, and specify the frequency and scope of assessments, reporting, and mechanics for feedback.

To ensure effective capture of concerns identified during installation or testing activities, LMITCO will evaluate the mechanisms available for personnel to communicate these concerns to responsible management and engineering personnel. If these mechanisms are lacking, corrective actions will be identified. This process will follow the 5th principle in ISM.

ID will include within its Quality Assurance Program the need to validate the INEEL Operating Contractor's quality assurance practices used to independently verify that fire protection system design modifications are accomplished in accordance with applicable codes and requirements.

3.2.4 Corrective Action Milestones and Schedule

Table 3.2-1. Scheduled corrective actions.

	Corrective Action	Responsibility and Organization	Due Date
3.2.4.1	Conduct a review the ID Quality Assurance Program against the requirements of DOE Order 5700.6C.	ID Assistant Manager, Office of Environment, Safety, Health and Quality Assurance; W. Sato	11/98
3. 2.4.2	Schedule and perform ID assessment of INEEL design control process and implementation activities.	ID Assistant Manager, Office of Assurance and Resource Management; D. Ferri	12/98

	Corrective Action	Responsibility and Organization	Due Date
3.2.4.3	Define the scope and upgrade the ID Quality Assurance Program to be in compliance with the DOE Order 5700.6C.	ID Assistant Manager, Office of Assurance and Resource Management; D. Ferri	8/99
3.2.4.4	Develop and implement an independent oversight plan and schedule to show how the Quality Assurance criteria will be satisfied, taking into consideration the risk associated with the work.	ID Assistant Manager, Office of Assurance and Resource Management; D. Ferri	8/99
3.2.4.5	Develop line management oversight requirements and schedule which ensure periodic assessment for compliance with design control requirements.	ID Assistant Manager, Office of Program Execution; J. Lyle	8/99
3.2.4.6	Complete required training on revised processes for those personnel affected.	ID Assistant Manager, Office of Program Execution; J. Lyle	8/99
3.2.4.7	Support DOE review of LMITCO Quality Assurance Program for programmatic deficiencies to determine the need for PAAA enforcement actions.	ID Assistant Manager, Office of Program Execution; J. Lyle	8/99
3.2.4.8	Revise MCP-2811, "Engineering Change Control," and the Project Management Guide to ensure that the design review process requires reviewers to verify that the original design inputs, design modifications, and final design meet applicable codes and worker protection requirements.	Vice President, Applied Engineering and Development Laboratory; W. Guyton	1/99
3.2.4.9	Institutionalize the requirement to use vendor-trained personnel as necessary, along with facility Fire Protection Engineers and Quality to verify that system modifications are designed and installed according to requirements.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	8/99
3.2.4.10	Revise MCP-2482, "Inspection for Conformance," to require quality inspection involvement in fire suppression system installations and modifications.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	8/99
3.2.4.11	Develop a feedback mechanism(s) for communicating issues or concerns identified during installation, testing, operations, and maintenance activities.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	8/99

	Corrective Action	Responsibility and Organization	Due Date
3.2.4.12	Implement a program to periodically assess the effectiveness of the engineering change control process (MCP-2811). This will include identifying relevant metrics and feedback/improvement mechanisms.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	8/99

NOTE: Corrective Action scheduled completion dates:

Immediate & prompt actions	Completed before response report issued
Near-term actions	Scheduled for completion on or before 1/99
ISM-integrated actions	Scheduled for completion on or before 8/99
Long-term actions	Scheduled for completion

3.3 DOE-ID Review of Fire Protection Design and Modifications

3.3.1 Judgment of Need

ID, in its capacity as the "Authority Having Jurisdiction" with respect to fire protection, needs to strengthen its review of fire protection design and design modifications to ensure compliance with applicable requirements, codes, and standards.

3.3.2 Background and Analysis

ID recognizes that its roles and responsibilities associated with AHJ activities are mandated through the requirements of DOE Orders. These include the requirements for ensuring compliance with the National Fire Protection Association codes and standards, the Uniform Building Code, and the Uniform Fire Code.

ID currently reviews fire protection system designs and associated modifications on an ad-hoc basis. ID does not have policy or mandatory criteria for review of fire protection systems modifications. In 1993, ID prepared and finalized the "DOE-ID Safety and Health Manual" which addressed fire suppression system design reviews and fire suppression system acceptance testing requirements at the INEEL by the AHJ. However, as part of a government-wide effort to reduce the number of redundant or unnecessary requirements, ID elected not to issue the manual. Because the manual was not issued, the specific flow-down of AHJ requirements and expectations was never institutionalized.

The ID AHJ has been assigned broader safety-related disciplines. To compensate for the loss of professional safety resources from internal transfers and attrition, the ID Fire Protection Engineer currently serves as the ID AHJ and the Subject Matter Expert (SME) in fire protection, life safety, fire department operations, and firearms safety. He also is the backup or support SME in industrial safety, occupational safety, construction safety, explosive safety, electrical safety, and hoisting and rigging. In summary, ID needs to enhance its level of effort in meeting/fulfilling its AHJ responsibilities in system design reviews and institutionalize ID AHJ activities and requirements.

3.3.3 Description of Corrective Action(s)

The ID AHJ will perform mandatory design reviews of new fire protection system designs and associated modifications on all special-hazards fire suppression systems to ensure compliance with applicable requirements, codes, and standards. Special-hazards fire suppression systems include water spray, water mist, water deluge, and gas-based suppression systems, and associated alarming systems.

ID's AHJ review will focus on ensuring system design, operability, and required institutionalization of any personnel safety-related features that may be required. ID's review of these systems will provide an additional level of rigor where personnel hazards may be associated with individual suppression systems. ID will direct the INEEL operating contractor to establish an acceptable review process for all fire suppression systems. That process will be approved by ID and reviewed during ID's biennial fire protection program assessment required by DOE Order 5480.7A, "Fire Protection."

With the inclusion of these responsibilities associated with fire suppression system design requirements, management will provide necessary training to ensure qualifications of the ID AHJ. ID will baseline AHJ responsibilities and requirements to ensure sufficient resources (see Subsection 3.21). ID recognizes its unique responsibilities with regard these activities and will institutionalize specific requirements as determined necessary to support these activities in a new ID "requirements document."

The purpose of the "requirements document" will be to capture key INEEL-specific attributes of ID's Fire Protection Program that are not addressed within DOE orders and national codes such as AHJ design review requirements, system acceptance testing, maximum fire department emergency response times, and redundant fire department response capabilities. Capturing AHJ-specific requirements in this manner will enhance ID's ability to maintain these controls through various contractor transitions.

3.3.4 Corrective Action Milestones and Schedule

Table 3.3-1. Scheduled corrective actions.

	Corrective Action	Responsibility and Organization	Due Date
3.3.4.1	Direct that the INEEL contractor provide a list of existing special-hazard fire suppression systems at the INEEL. The contractor will also be required to transmit system drawings, calculations, and supporting documentation with their response.	ID Assistant Manager, Office of Program Execution; J. Lyle	11/98
3.3.4.2	Determine and provide the necessary training and staffing to support the roles of the ID AHJ.	ID Assistant Manager, Office of Program Execution; J. Lyle	8/99
3.3.4.3	Conduct reviews of identified existing special-hazard fire suppression systems at the INEEL. These will provide an additional level of rigor where personnel hazards may be associated with individual suppression systems.	ID Assistant Manager, Office of Program Execution; J. Lyle	8/99
3.3.4.4	Institutionalize mandatory criteria requiring ID design review of all new and modified special-hazard fire protection systems at the INEEL in a ID "requirements document." The document will direct the INEEL operating contractor to establish acceptable policy, program, and procedures for the review and approval of fire protection systems.	ID Assistant Manager, Office of Program Execution; J. Lyle	8/99

NOTE: Corrective Action scheduled completion dates:

Immediate & prompt actions	Completed before response report issued
Near-term actions	Scheduled for completion on or before 1/99
ISM-integrated actions	Scheduled for completion on or before 8/99
Long-term actions	Scheduled for completion

3.4 Fire Protection System Procurement

3.4.1 Judgment of Need

"LMITCO needs to verify the qualifications of its fire protection design personnel, ensure that all fire protection contracts address required contractor submittals, ensure that those submittals receive qualified review prior to acceptance, reevaluate acceptance testing procedures, and ensure that all required reacceptance testing is in fact performed." (Investigation Report pp. vii and 42)

3.4.2 Background and Analysis

During the Type A accident investigation, the Board questioned the qualifications of personnel associated with all phases of the design, installation, and testing of the CO_2 fire suppression system. They also questioned the vendor submittal process and acceptance or reacceptance testing of the CO_2 fire suppression system

As part of the LMITCO analysis of the accident and the Investigation Report, the design process and actual design files for the fire suppression system panel were reviewed. This review established that a multidiscipline team reviewed the design. The multi-disciplined review team consisted of National Institute Certified Engineering Technologies Level II personnel and personnel from LMITCO Fire Protection, Safety, Health, and Quality Assurance. The design review was conducted according to and complied with LMITCO engineering procedures (MCP-2375, "Design Verification"). Subsection 3.2 of this response report contains additional details regarding the design review process. Although proper procedures were followed in the design review, the LMITCO analysis concluded that more specificity is needed in defining qualifications of personnel involved in the design process, including design reviews. LMITCO does not currently have a formalized qualification standard for designers or reviewers. Designers and reviewers are selected based on their individual areas of perceived expertise. See Subsection 3.4.3 for more detail.

The LMITCO response team analyzed the issues of subcontract submittals and the review of those submittals. The Type A Accident Board concluded that errors in the design should have been discovered during reviews of subcontractor submittals. Since the original design inputs (1971 and 1997) did not require the pressure switches and alarm monitoring circuits, that criterion was not used during the review of vendor submittals. As part of the LMITCO response team evaluation, it was determined that a formal vendor submittal process was used for the acquisition of the fire suppression system panel; however, a similar formal process is not used for all subcontracts for procurement of life safety systems. For example, construction projects use a vendor data schedule to specify what and when vendor data are submitted and identify those disciplines that must review or approve the submittals. Other procurements have a similar tool but its use is not mandatory. A Site-wide consistent approach to defining vendor data submittals is needed.

An additional need is the reevaluation of the acceptance criteria used to test and reaccept fire protection systems modifications and installations. The Type A Accident Board noted that "Although reacceptance testing is primarily intended to verify program changes, the prescribed methods require testing devices in addition to those directly affected by the program change. Consequently, performing reacceptance testing after each program change would have provided additional opportunities for recognizing design deficiencies" (Investigation Report p. 37).

LMITCO's response team reviewed the testing done for the procurement and installation of the subject panel, and established that a complete system retest was performed after installation of a firmware (factory programmed computer chip) upgrade (see Appendix F). However, when subsequent changes

were made to the program software involving an interface between the fire suppression system control panel and the INEEL-wide annunciating system, the associated retesting was limited to verifying performance of that interface. The response team concluded that a standardized acceptance and reacceptance testing procedure or requirements document and criteria should be established.

3.4.3 Description of Corrective Action(s)

After evaluating the Investigation Report and performing additional analyses, the need for several actions was identified. LMITCO will develop, document, and institute a qualification program for design personnel, and for personnel responsible for reviewing designs and installing, inspecting, testing and maintaining systems. The qualification program will ensure that personnel receive adequate initial and continuing training in their specific expertise and those associated disciplines needed to perform their tasks related to design, design review, system procurement and acceptance, and reacceptance testing and maintenance. Those qualified individuals will be used as part of the independent design review team discussed in Subsection 3.2 of this response report.

Part of the design teams' responsibilities is to prescribe vendor data submittals and review those submittals. A consistent approach to defining vendor data submittals will be developed for procurement actions. The vendor data submittals will include information regarding how to test the systems when installed. Using that vendor data, acceptance-testing procedures will be developed and used during installation and future modifications. In addition, a requirements document will be developed to define the minimum testing required to reaccept a system after modification or upgrade.

LMITCO shall utilize the industry standard of professional engineering licensure as the basis of qualification. In the future, engineering design, specification preparation, and subcontractor design submittal review for fire protection and all other systems impacting health and safety shall be executed by or under the responsible charge of a registered professional engineer or architect licensed in the State of Idaho. The primary responsibility of registrants is to protect the safety, health and welfare of workers and the public in the performance of their professional duties. Additional registered professional engineers and architects will be hired, or present engineers will be qualified under the processes approved by the State of Idaho, in sufficient numbers to meet future needs for the INEEL.

3.4.4 Corrective Action Milestones and Schedule

Table 3.4-1. Scheduled corrective actions.

	Corrective Action	Responsibility and Organization	Due Date
3.4.4.1	Clearly define and document qualification requirements for design, review, testing, and maintenance personnel	Vice President, Applied Engineering and Development Laboratory; W. Guyton	1/99
3.4.4.2	Identify, obtain, or develop training materials required to complete initial and continuing qualification training	Director, Site Operations; W. Gay	8/99
3.4.4.3	Complete initial qualification training and establish continuing training process	Director, Site Operations; W. Gay	8/99

	Corrective Action	Responsibility and Organization	Due Date
3.4.4.4	Formalize, in a procedure or requirements document, the requirements for submittals, qualified reviews, acceptance testing, and reacceptance testing and verification	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	8/99
3.4.4.5	Develop lesson plans and complete training on procedure or requirements document for vendor submittal process	Director, Site Operations; W. Gay	9/99
3.4.4.6	Develop a requirement document that outlines the specific acceptance and reacceptance testing required for fire protection system installations and modifications	Vice President, Applied Engineering and Development Laboratory; W. Guyton	8/99
3.4.4.7	The future needs for registered professional engineers and architects will be assessed to identify any deficiency in type and number	Vice President, Applied Engineering and Development Laboratory; W. Guyton	1/99
3.4.4.8	Procedures controlling engineering design, specification preparation and subcontractor design submittal review, for fire protection and other systems impacting health and safety will be created or revised to require execution under the responsible charge of a registered professional engineer or architect licensed in the state of Idaho. Training on new or revised procedure will be completed	Vice President, Applied Engineering and Development Laboratory; W. Guyton	5/99

NOTE: Corrective Action scheduled completion dates:

Immediate & prompt actions	Completed before response report issued
Near-term actions	Scheduled for completion on or before 1/99
ISM-integrated actions	Scheduled for completion on or before 8/99
Long-term actions	Scheduled for completion

3.5 Maintenance and Use of Safety Basis Documents and Procedures for Inactive Facilities

3.5.1 Judgment of Need

LMITCO needs to ensure that safety basis documentation and procedures for inactive facilities are updated, maintained, and appropriately used. (Investigation Report pp. vii and 57)

3.5.2 Background and Analysis

LMITCO is responsible for INEEL facilities and their related safety basis documentation. Approximately 500 buildings are contained within the 890-square-mile boundary of the INEEL. These buildings consist of nuclear and non-nuclear facilities, as well as active and inactive.

DOE Orders 5480.23 (for nuclear facilities) and 5481.1B (for non-nuclear facilities, still invoked under the LMITCO contract) and ID Notice 420.A1 require a hazards analysis of all facilities and activities. DOE Orders that specify requirements for safety analysis, change control, and review and updating safety basis documentation for nuclear and non-nuclear facilities are identified and interpreted in LMITCO Program Requirements Documents (PRDs) and the company Implementation Plan for DOE Orders 5480.22 and 5480.23. Implementation of these requirements are contained in LMITCO MCPs.

The implementation of this requirement is neither consistent nor well understood. The requirements for development of safety basis documents that clearly define all hazards related to specific facilities and activities are not clear and are not consistently implemented. In addition to answering the Judgment of need related to the nuclear safety basis documentation, it is important to also make sure that all facilities have a documented program that identifies hazards to which workers and individuals may be exposed.

Further, hazards analyses for facilities have not always addressed specific unique hazards contained within the facility that impact worker safety. In this case the Engineereing Test Reactor (ETR) Safety Analysis Report (SAR) recognized the existence of the CO_2 system, but did not recognize the need for a separate safety analysis unique to the system hazard. In addition, although the ETR SAR generally describes the work activities for the facility, the SAR was outdated and did not address modifications that had been made to the CO_2 system in TRA-648, nor did it address the potential for an accidental or manual initiation without a 30-second warning alarm.

The LMITCO company-wide Implementation Plan for DOE Orders 5480.22 and 5480.23 was submitted for review and approval to ID in June 1997. The Plan identified plans for upgrading the safety basis documentation for several facilities and requested exemptions from the orders for several inactive and shutdown nuclear facilities, including the ETR. ID is in the process of reviewing and commenting on this plan. LMITCO needs to revise the company-wide Implementation Plan as required, based on any ID comments. LMITCO will then submit the plan for ID approval.

Safety basis documentation and related procedures for active nuclear facilities are, in general, maintained in an up-to-date condition. This is in part due to the high priority placed on operational nuclear facilities and their potential impact to the public and the environment from nuclear and radiological safety concerns. However, the need still exists to ensure that both nuclear and non-nuclear inactive facilities (e.g., ETR) are analyzed to identify those hazards to which workers may be exposed and controls established to mitigate those hazards. With this in mind, the corrective actions identified below address both active and inactive nuclear and non-nuclear facilities.

Additionally, LMITCO's supplemental causal factors analysis determined a need for facility managers to be actively involved in the modification process for their facilities and in resolving any issues that delay formal turnover of systems or equipment to the facility.

Improvements in flowdown of requirements to procedures are covered in Subsection 3.1, action 3.1.4.5 (Gap #1 in SMS Implementation Plan).

3.5.3 Description of Corrective Action(s)

As an interim measure, a three-phased recovery plan has been put in place for work activities at the INEEL. The plan incorporates additional rigor and discipline by requiring senior management review of work activities. This plan will remain in place until ISM is fully implemented. The plan is discussed in more detail in Section 1 and Appendix D of this response report.

LMITCO has developed plans to utilize several generic Site-wide chapters in all new or newly upgraded SARs for nonreactor nuclear facilities. These generic SAR chapters deal primarily with Site-wide institutional safety programs. These generic chapters will ensure that much of the information in each facility-specific SAR is maintained current through the use of a centralized source of information. Most of these generic chapters have been submitted to ID for review and approval. The LMITCO company-wide Implementation Plan for DOE Orders 5480.22 and 5480.23 needs to be revised to reflect the use of these generic SAR chapters. Currently, the Implementation Plan requests that the ETR SAR be exempted from updating or upgrading.

Additional efforts are required to ensure that procedures for safety analysis, change control, and review and update of safety basis documentation are complied with. Hazard assessments and safety basis documentation for those facilities, for which an upgraded or updated hazard assessment and safety analysis has not been performed, will be reviewed and updated as required by LMITCO procedures. Internal facilities assessment and Site-wide assessment procedures need to be revised to ensure that timely assessments are made of the adequacy of facility safety basis documentation, and corrective actions taken as necessary.

While change control procedures exist for nuclear facilities through the Unreviewed Safety Question process, adequate procedures do not exist for non-nuclear facilities. Change control procedures for non-nuclear facilities will be reviewed and revised as necessary to ensure that the safety basis documentation for these facilities is kept current.

DOE Order 5480.23 for nuclear facilities and DOE Order 5481.1B for non-nuclear facilities do not provide sufficient guidance on the process for addressing controls for industrial hazards in the SAR. PRD-164 and MCP-2451 need to be revised to incorporate the guidance in ID Notice 420.A1. The common practice has often been to only reference common industrial or institutional standards. The safety analysis will document that the controls cited in these standards are adequate to control the hazards and are implemented in procedures. The unique aspects of each facility and operation need to be assessed.

LMITCO procedures currently require annual reviews of safety basis documentation for nuclear facilities and reviews every 5 years for non-nuclear facilities. Adequate assessment and operational processes will be put in place to ensure that these procedures are implemented.

All facility managers will receive training on the need for safety basis documents to be kept current and the need for safety basis documents to address all hazards.

LMITCO has implemented the Site Area Director concept at the INEEL (see Appendix C). The Site Area Directors will train Facility Managers within their areas and then hold them accountable to be actively involved in the modification process at their facilities and to resolve issues associated with formal turnover of systems or equipment to the facility.

The facility/building manager/owner will develop a hazard analysis database that will identify, evaluate, and specify appropriate mitigation for facility-specific hazards. This information should be contained in a database that is available to facility personnel as well as personnel involved in the work control and planning process. A procedure will be developed that describes the process for development and maintenance of this database.

3.5.4 Corrective Action Milestones and Schedule

Table 3.5-1. Scheduled corrective actions.

	Corrective Action	Responsibility and Organization	Due Date
3.5.4.1	Obtain comments on the company-wide Implementation Plan for DOE Orders 5480.22 and 5480.23 and make any changes required.	Vice President, Nuclear Operations; C. F. York	4/99
3.5.4.2	Obtain final approval of Implementation Plan.	Vice President, Nuclear Operations; Carey York	8/99
3.5.4.3	Complete development of Site-wide generic SAR chapters and obtain DOE approval. The Implementation Plan for DOE Orders 5480.22 and .23 will be revised to incorporate plans to utilize these chapters.	Vice President, Nuclear Operations; C. F. York	4/99
3.5.4.4	Develop a plan for updating non-nuclear hazard assessments and safety analyses for those facilities for which the safety basis documentation has not been upgraded, updated, or does not currently exist. Self-assessment procedures will be revised to ensure that safety basis documentation is current. Funding request for this effort will be submitted to DOE as necessary.	Vice President, Nuclear Operations; C. F. York	8/99
3.5.4.5	Review and revise change control procedures for non- nuclear facilities as necessary to ensure that the safety basis documentation is maintained current.	Vice President, Nuclear Operations; C. F. York	8/99
3.5.4.6	Revise MCP-2449 and MCP-2451 to provide additional guidance on when safety analysis is needed for industrial hazards and to implement ID Notice 420.A1.	Vice President, Applied Engineering and Development Laboratory; W. Guyton	8/99
3.5.4.7	Perform an independent performance assessment to ensure that procedures governing reviews of safety basis documentation are complied with.	Director, Site Operations; W. Gay	8/99

	Corrective Action	Responsibility and Organization	Due Date
3.5.4.8	Train facility managers on requirements for maintaining safety basis documentation current for nuclear facilities. Facility managers for non-nuclear, radiological, and other industrial facilities will be trained on requirements for keeping safety basis documentation current for non-nuclear facilities.	Director, Site Operations; W. Gay	8/99
3.5.4.9	Develop a site hazard analysis database and related procedure for use and maintenance.	Director, Site Operations; W. Gay In-Town Area Directors; S. Winn and J. Welch	8/99
3.5.4.10	As an interim measure, upgrade the Ellis plan to: 1. Include logout/tagout review by appropriate personnel. 2. Include review of facility basis documentation	Director, Site Operations; W. Gay	11/98
3.5.4.11	Provide comments on existing Implementation Plan	ID Assistant Manager, Office of Program Execution; J. Lyle	1/99
3.5.4.12	Submit funding request to DOE to support activities related to this judgment of need	Vice President, Nuclear Operations; C. F. York	8/99
3.5.4.13	Site Area Directors will train Facility Managers on procedures pertaining to system and equipment turnover.	Director, Site Operations; W. Gay	8/99

NOTE: Corrective Action scheduled completion dates:

Immediate & prompt actions	Completed before response report issued
Near-term actions	Scheduled for completion on or before 1/99
ISM-integrated actions	Scheduled for completion on or before 8/99
Long-term actions	Scheduled for completion

3.6 Implementation of Integrated Safety Management

3.6.1 Judgment of Need

ID and LMITCO management need to expedite the implementation of ISM policy, including the need for organizational behavior change, increased leadership and management presence, and accelerated application of core functions to all work activities on site. (Investigation Report pp. vii and 65)

3.6.2 DOE-ID

3.6.2.1 Background and Analysis

ID implementation of ISM policy comprises two distinct phases: (1) compensatory actions taken until ISM policy implementation is complete, and (2) actions ID has taken and must take to facilitate and expedite ISM implementation at the INEEL. This corrective action response addresses issues raised in the judgment of need and interim compensatory actions taken. Background status for ISM is summarized as follows:

- Clauses incorporated into contract February, 1998 with active implementation efforts from February forward
- Internal and external assessments indicated actions taken for previously identified work control issues are not yet effective
- ISM gap analysis substantiated assessment findings and solidified INEEL deficiencies. INEEL ISM gap analysis is consistent with AI team findings.

INEEL implementation of ISM has been influenced by an express decision to press forward with the fundamental elements contained within the Voluntary Protection Program and Enhanced Work Planning initiatives. The rationale is that improved work practices and controls (at the ISM activity level) through management leadership, employee participation, and improved planning efforts would have a fundamental, demonstrable impact on safety culture and performance. This foundation, it was thought, would then position the INEEL for an expedited implementation of the remaining elements of ISM. The underlying vulnerability in this approach was the lack of timely integration with ISM related management processes (due, in part, to the large number of initiatives) and inappropriate use of a graded approach that resulted in acceptance of unstructured work. Additional contributors to the delay included an apparent lack of understanding on the part of the contractor regarding the importance for expediting ISM (in total) and how urgency for its complete implementation should be balanced with the aforementioned major initiatives. The result of not aligning safety efforts on the front end was a protracted negotiation for contract modification and confusion, by both ID and the contractor, on how Integrated Safety Management connected with established safety efforts.

INEEL ISM implementation has focused on the integration of environmental, safety, and health activities into the site's five major work processes: operations, maintenance, research, construction, and environmental remediation/decommissioning and dismantlement. ID implementation of ISM has been expedited through the formation of an ID Project Office and dedicated resources necessary to aggressively pursue effective implementation. One effort that will accelerate portions of the SMS Implementation Plan (see Appendix B) is the alignment of all safety efforts with the ISM contextual framework. In addition, actions such as establishing the Integrated Site Maintenance Manual (see 3.13.4.3) will get ISM principles to INEEL workers in the near term, as well as increasing rigor and discipline across site activities. The completion of these revisions and the related training has been

expedited to ensure workers have the basis for understanding proposed workscope, have the tools to safely complete the activity, and have an understanding of their roles and responsibilities in the work effort.

ID management support for ISM has been established through verbal and written communication to the ID office and contractor. In a recent presentation to the ID work force, the ID manager conveyed that ID and LMITCO have not been successful in establishing a culture of rigor and discipline and standards-based work control, and that definition of roles, responsibilities, and accountability for implementation of these roles must be enhanced. In summary, the lack of definition of how various safety improvement efforts should be aligned and a slowness to recognize that established processes don't ensure effective implementation resulted in a level of ISM implementation that has not produced on the floor results.

3.6.2.1.1 Supplemental ID Analysis

As discussed in Subsection 1.3, ID performed a causal analysis of the events related to the accident and the Accident Board judgments of need. The intent of this analysis was to determine the underlying causes within the ID organization which, if corrected, would help prevent accidents in the future. The analysis resulted in the identification of a major area of focus related to this judgment of need; organizational behavior changes and increased management and leadership presence are fundamental to ID's successful implementation of ISM policy.

Discussions with ID staff revealed a broad range of understanding of what the past role of federal employee training was intended to convey. Some ID employees understood that they were to "task and measure" by defining "what, not how" as intended, while others believed that they were instructed to reduce their oversight of contractor safety performance. A complete evaluation of roles and responsibilities, as related to the ISM guiding principles, has not been completed at ID. However, well-known ID efforts to reduce prescriptive procedures and directives and a shift in emphasis from large independent oversight organizations to line management self-assessment are among the factors that appear related to ID's inconsistent understanding and application of the federal oversight roles. In addition, other issues relating ID ISM implementation have been raised during the development of this plan. They include (1) staffing adequacy within ID; (2) defined level of oversight and technical accountability needed for products (e.g., safety basis documentation, design); (3) the training and qualification of ID technical staff necessary to ensure the necessary skill level is commensurate with the defined level of oversight and technical accountability; and (4) the adequacy of the ID self-assessment program.

A need therefore exists for ID to ensure that:

1. Broad principles of ID management and oversight of contractor activities and accountability are established, institutionalized, and well-understood by ID staff and management.

2. The ID Functions, Responsibilities and Assignments Matrix (FRAM) reflects current organizational roles and responsibilities and meets requirements of applicable DOE/ID Orders, Notices and policy.

3. Organizations are in place and fully staffed to carry out their roles and responsibilities.

4. ID management and staff are well-trained on and understand their roles and responsibilities, and individual expectations are documented in Position Descriptions and/or Performance Agreements.

3.6.2.2 Description of Corrective Actions

ID is working actively to expedite the implementation of ISM policy at the INEEL. ID recognizes the need to increase the level of rigor on site, particularly the need to enhance site capacity to effectively identify and control workplace hazards. ID has implemented compensatory measures to better assure worker protection until ISM is fully implemented. The following discussion overviews these actions.

The Operations Office Manager met with the presidents of LMITCO's corporate partners to convey DOE's expectations regarding safety and site operations over the next year (in light of the announcement to recompete the INEEL contract). Office of Program Execution (OPE) Senior Management met with LMITCO to discuss concerns about the contractor response to existing operational deficiencies and conveyed performance expectations and proposed compensatory actions in order to better assure worker protection. The Deputy Assistant Manager for OPE has been relieved of certain administrative responsibilities to allow for more dedicated senior management attention to INEEL site activities. A standing ID Team was established to specifically monitor and report on the effectiveness of work controls at the INEEL site. An Assistant Manager for ESH&QA Performance Assurance was assigned to assess ESH&QA performance of both ID and the INEEL contractor. LMITCO was directed to establish a Site Operations Director with overall responsibility for conduct of operations & maintenance. In addition, the contractor was directed to complete assignment of Site Area Directors who are responsible for all work activities within their designated plant/facility, to designate a Project Manager for ISM implementation, and to make other leadership changes. Recommendations were made to LMITCO to establish "Senior Supervisory Watches" to provide shift coverage of plant/facility work activities. Finally, ID concurred with a contractor Three-Phased approach (see Appendix D) to work control, from stand-down and incremental restart through complete implementation of ISM. An outcome of this phased approach and the Site Operations Director's initial plan of action will be a consolidated INEEL Maintenance Manual/Procedures; ID will approve LMITCO's Maintenance Manual/Procedures. In addition, ID requested EH Headquarters to perform an INEEL safety management evaluation.

ID actions to support expedited implementation of ISM include the establishment of an ISM Project Office. Project Office responsibilities include the creation of an ISM Project Management Plan that will identify ID personnel's role in ISM implementation. ID Annual Operating Plans will be revised to incorporate organizational responsibilities reflected in the approved ISM Project Plan. The 1999 Performance Evaluation Plan (award fee plan) is being modified to more clearly emphasize ISM implementation, corrective action closure, and the integration of the necessary elements of operational excellence, such as Voluntary Protection Program (VPP), enhanced work planning (EWP), self-assessment, and performance feedback and improvement, as site priorities. In addition, ID is factoring ISM expectations into the upcoming INEEL Request for Proposal, and is defining actions for transition to the site's new contractor. ISM implementation is being accomplished and expedited through ID and contractor ISM project office development, issuance, coordination, and tracking of actions necessary to meet the implementation and verification milestones.

3.6.2.2.1 Description of Corrective Action Resulting from ID Causal Analysis

In response to the needs identified in the ID causal analysis, ID will complete an evaluation to understand the current status of ID with respect to awareness and institutionalization of management principles/expectations, definition of roles and responsibilities, staffing sufficiency, self-assessment processes and technical training. ID will perform an analysis to understand the identified deficiencies and take near-term action to resolve the deficiencies.

3.6.3 LMITCO

3.6.3.1 Background and Analysis

In April 1998, a core team was established to develop a plan that would integrate the five core functions and eight guiding principles of ISM into LMITCO's work processes (LMITCO has added "Worker Involvement" to the seven guiding principles in DOE's ISM policy). The SMS Implementation Plan has been submitted to DOE, and full implementation is scheduled for August 1999. LMITCO has completed a gap analysis to determine the differential between the existing INEEL safety management system and ISM. The gap analysis identified the actions necessary to migrate from the current system to ISM. Appendix B provides more details of the SMS Implementation Plan.

LMITCO will expedite implementing ISM using a three-part approach. The three parts are (1) addressing the gaps in company-level management systems; (2) strengthening the commitment to VPP; and (3) establishing a disciplined work control process at the work level.

The first part is defined in the SMS Implementation Plan (see Appendix B). The plan provides the actions and assignments to address gaps in the company's management systems including:

- Requirements management
- Procedures
- Work control
- Priorities and resources
- Assessments and feedback
- Issues management

The second part, strengthening LMITCO's commitment to VPP, is critical to ISM implementation. VPP provides the behavior and culture necessary to positively affect worker safety (see Appendix G). LMITCO has been working the issues of behavioral change through the VPP for the past 2 years. Major progress has been made, especially in the areas of employee involvement and creating an actively caring safety culture. More work remains to accomplish the goals of VPP in areas such as management leadership and presence.

The third part is focused on establishing the ISM core functions and guiding principles at the work level. It addresses the work planning and control process, including identification of hazards, and addresses the establishment and communication of standards for disciplined, safe operations and for holding workers and managers at all levels accountable for conducting disciplined, safe operations. The establishment of the Director of Site Operations (see Appendix C) will accelerate the work planning and control, management presence, and cultural initiatives necessary for attaining ISM implementation.

This three phased approach will address the judgment of need, related contributing and root causes, and the following LMITCO identified causal factors:

- Management needs to be effective in communicating its standards for discipline, safe operations, and holding itself and its subordinates accountable for conducting disciplined safe operations

- Line managers at INEEL need to be held accountable for consistent implementation of work processes and safety and health standards

- Management needs to send a consistent message that safety is top priority. This needs to be reflected in their actions as well as words.

3.6.3.2 Description of Corrective Actions

The LMITCO corrective actions follow this three-part approach:

1. Gaps in the company-level management systems will be addressed as described in the SMS Implementation Plan gap analysis (see Appendix B). The commitment to complete implementation by August 1999 is now captured as a corrective action in this response report.

2. LMITCO will continue VPP activities that support ISM implementation, including:

    - Developing a mentoring program to improve the effectiveness of management field presence

    - Establishing processes to improve worker feedback on hazard identification and mitigation

    - Training in Stop Work Authority

    - Developing processes for worker evaluation of management

    - Attainment of VPP Star status.

    When workers at all levels enhance their commitment to the 5 major tenets of VPP, an improvement in safety culture will be manifested by their understanding and implementation of ISM.

3. The implementation of the five core functions and eight guiding principles will be accelerated at the work level through the implementation of the DSO Action Plan for increased rigor and disciplines in operations and maintenance. The work control initiatives in the first months of this plan (part of the Site Maintenance Plan) address this objective and accelerate the application of the ISM core functions to work activities

    Organizational behavior change is also addressed by the DSO Action Plan which embraces and integrates the VPP initiatives, including behavioral change.

    Increased leadership and management presence in the field is one of the objectives of the DSO plan and initiatives described in Appendix C. This increased presence will be achieved in part through requiring increased ownership and accountability for discipline and rigor in Conduct of Operations and Conduct of Maintenance for managers of operations and facilities. The increased ownership and accountability will flow down from the DSO to Site Area Directors and subordinate managers and stimulated by visible metrics that measure the effectiveness of individual managers and organizations toward achieving rigor and disciplines in operations and maintenance.

In summary LMITCO will expedite the implementation of the ISM policy by accelerating the application of ISM core functions to all work activities. The INEEL will stay the course of VPP to promote effective organizational behavior change, improve management leadership and foster worker involvement. The DSO initiatives will drive ISM through management presence and disciplined work execution.

3.6.4 Corrective Action Milestones and Schedule

Table 3.6-1. Scheduled corrective actions.

	Corrective Action	Responsibility and Organization	Due Date
3.6.4.1	Complete all ID compensatory measures	Manager, Idaho Operations Office, J. Wilcynski	Complete 9/98
3.6.4.2	Establish ID ISM Project Office	ID Assistant Manager, Office of Program Execution; J. Lyle	Complete 10/98
3.6.4.3	Modify 1999 Performance Evaluation Plan (award fee)	Manager, Idaho Operations Office; J. Wilcynski	10/98
3.6.4.4	Establish ISM ID Project Management Plan	ID Assistant Manager, Office of Program Execution; J. Lyle	11/98
3.6.4.5	Revise FY-99 ID Operating Plans to incorporate organizational responsibilities reflected in the approved ISM project plan.	Deputy Manager, Idaho Operations Office; W. Bergholz	11/98
3.6.4.6	Incorporate ISM requirements and specifically define expectations of the new contractor in the INEEL contract Request for Proposal	Chief Financial and Administrative Officer; D. Hamer	12/98
3.6.4.7	Perform Phase I ISM Verification	ID Assistant Manager, Office of Program Execution; J. Lyle	1/99
3.6.4.8	Perform an EH safety management evaluation	ID Assistant Manager, Environment, Safety, Health and Quality Assurance; W. Sato DOE HQ-EH	7/99
3.6.4.9	Perform Phase II IMS Verification	ID Assistant Manager, Office of Program Execution; J. Lyle	9/99
3.6.4.10	Approve LMITCO Maintenance Manual/Procedures	ID Assistant Manager, Office of Program Execution; J. Lyle	8/99

	Corrective Action	Responsibility and Organization	Due Date
3.6.4.11	Transition safety management structure and ISM path forward to new contractor	ID Assistant Manager, Office of Program Execution; J. Lyle	8/99
3.6.4.12	Complete an evaluation and gap analysis to identify roles and responsibilities deficiencies, and implement near-term corrective actions	Deputy Manager, Idaho Operations Office; W. Bergholz	8/99
3.6.4.13	Complete SMS Implementation Plan actions	President, LMITCO	8/99
3.6.4.14	Define the path forward for maintenance integration and work planning and control by issuing the Site Integrated Maintenance Plan	Director, Site Operations; W. Gay	11/98
3.6.4.15	Standardize the site work control process by issuing the Integrated Site Maintenance Manual.	Director, Site Operations; W. Gay	1/99
3.6.4.16	Implement Site Integrated Maintenance Plan including job/function applicability and training.	Director, Site Operations; W. Gay	4/99
3.6.4.17	Assess the effectiveness of the Site Integrated Maintenance Plan through independent and self-assessments.	Director, Site Operations; W. Gay	8/99
3.6.4.18	Measure and rank sites according to effectiveness in implementing the Site Integrated Maintenance Plan	Director, Site Operations; W. Gay	6/99
3.6.4.19	Assess the current compliance status with conduct of operations policy at all INEEL Sites by independent assessments	Director, Site Operations; W. Gay	12/98
3.6.4.20	Define the integration of conduct of operations with ISM and VPP by issuing the updated Conduct of Operations Manual.	Director, Site Operations; W. Gay	6/99
3.6.4.21	Complete Conduct of Operations chapter training.	Director, Site Operations; W. Gay	6/99
3.6.4.22	Verify compliance with the integrated Conduct of Operations Policy by independent and self-assessments.	Director, Site Operations; W. Gay	9/99
3.6.4.23	Develop and implement a mentoring program that will create a positive feedback process and reinforce workers roles and responsibilities.	Director, Site Operations; W. Gay	3/99
3.6.4.24	Continue implementation path of VPP and evaluate submittal of VPP application for Star status.	Director, Site Operations; W. Gay	6/99
3.6.4.25	Present the Conduct of Operations, Conduct of Maintenance, ISM System, and VPP philosophy to all employees utilizing video and other communications media.	Director, Site Operations; W. Gay	12/98

	Corrective Action	Responsibility and Organization	Due Date
3.6.4.26	Benchmark Stop Work Authority with other Star sites.	Director, Site Operations; W. Gay	12/98
3.6.4.27	Develop and implement training on Stop Work Authority at the employee level, management level and the Safety and Health Professional level.	Director, Site Operations; W. Gay	4/99
3.6.4.28	Develop and implement a process for employees to evaluate management performance	Vice President, Human Resources; J. Kuck, acting	4/99
3.6.4.29	Establish requirements regarding the time that line management spends at the job site with emphasis on routinely overseeing work, assessing safety conditions, and obtaining informal employee feedback	Director, Site Operations; W. Gay	12/98
3.6.4.30	Benchmark VPP Star companies for their supervisory training programs emphasizing internal management systems awareness and understanding. Report recommendations and implement as appropriate.	Director, Site Operations; W. Gay	1/99

NOTE: Corrective Action scheduled completion dates:

Immediate & prompt actions	Completed before response report issued
Near-term actions	Scheduled for completion on or before 1/99
ISM-integrated actions	Scheduled for completion on or before 8/99
Long-term actions	Scheduled for completion

3.7 Procedure System Enhancements Management

3.7.1 Judgment of Need

LMITCO needs to strengthen the contribution of procedures to safety management and consistent implementation of safety requirements and policies through accelerated updating and quality improvement, field validation, and a deliberate approach to assure consistent use and application. (Investigation Report, pp. vii and 65)

3.7.2 Background and Analysis

In 1994, LMITCO was awarded the contract at the INEEL and was tasked with consolidating five separate contractors into one. Early in the contract, LMITCO began developing a single set of company procedures. Because this was such a large task, it was decided to use a two-phase approach for accomplishment. The first phase developed a consolidated set of procedures; the second phase, which has not been completed, was to improve procedure flowdown and integration.

The procedure consolidation effort resulted in less specific procedures. An unintentional result was procedures that were inconsistently applied. The implementation of these procedures was further complicated by the use of the graded approach concept that sometimes led employees to believe that procedural compliance was optional rather than mandatory.

This judgment of need was supported by LMITCOs root cause analysis which identified the following related causal factor:

> The procedure development process needs to be strengthened to ensure that procedures meet the LMITCO standard for disciplined safe work practices.

In order to establish a culture in which disciplined operations are a way of life. LMITCO must continue improving the management systems that identify all applicable ES&H requirements (ref. judgment of need 3.1 Requirements Identification and Flowdown) incorporating them in Company documents, integrating them into the work control processes that flow down to the worker, and then ensuring consistent use and application. Upfront employee involvement in the development of procedures and accountability for their implementation will be the key to strengthening the contribution of procedures to Safety.

3.7.3 Description of Corrective Action(s)

The specific actions required to correct the issues identified in this judgment of need are contained in the SMS Implementation Plan (see Appendix B), Gaps 2 and 20, and in the DSO Initiatives (see Appendix C).

The corrective actions for SMS Implementation Plan, Gap #2, “Company Level Procedures are Not Always Followed or Enforced” will (a) establish senior management commitment to use procedures with all levels of management and employees; (b) provide managers with a tool they can use to determine which procedures apply to their work; (c) ensure employees are aware of what procedures apply to their work; (d) develop and implement human behavior logic structure to change the belief and attitude structure so that procedure compliance becomes the accepted norm; and (e) conduct a study to correct the reasons for procedure noncompliance.

The corrective actions for Gap #20 will force the updating of procedures at specified intervals with provisions for more frequent updates on an as-needed basis. The process will also direct field validation of, and training on, working level and operating procedures prior to implementation. Consistent use and application of procedures will be enhanced by (a) consistent requirement interpretation and promulgation; (b) worker involvement in procedure development; (c) procedure impact analysis with the development of procedure implementation plans prior to procedure implementation; (d) training on procedures prior to procedure implementation; and (e) field validation prior to implementation.

In addition to the corrective actions in the SMS Implementation Plan, LMITCO will strengthen the contribution of procedures to safety management by establishing work standards and training employees at all levels on both the work control process and performance expectations.

3.7.4 Corrective Action Milestones and Schedule

Table 3.7-1. Scheduled corrective actions.

	Corrective Action	Responsibility and Organization	Due Date
3.7.4.1	Establish work standards through integration of Conduct of Operations and Conduct of Maintenance	Director, Site Operations; W. Gay	3/99
3.7.4.2	Train employees on work processes and performance expectations.	Director, Site Operations; W. Gay	6/99
3.7.4.3	Establish a Site Document Committee and Site Training Committee.	Director, Site Operations; W. Gay	4/99
3.7.4.4	Implement corrective actions from SMS Implementation Plan, Gap #2—Company level procedures.	Director, Site Operations; W. Gay	8/99
3.7.4.5	Implement corrective actions from SMS Implementation Plan, Gap #20—Integrating ES&H into work planning.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	8/99
3.7.4.6	Perform independent assessment of integration of ESH&QA requirements into work planning and execution.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	8/99

NOTE: Corrective Action scheduled completion dates:

Immediate & prompt actions	Completed before response report issued
Near-term actions	Scheduled for completion on or before 1/99
ISM-integrated actions	Scheduled for completion on or before 8/99
Long-term actions	Scheduled for completion

3.8 Monitoring of Gaseous Fire Extinguishing Systems

3.8.1 Judgment of Need

LMITCO needs to verify that all gaseous agent fire extinguishing systems (i.e., CO_2, Halon, FM-200, Inergen, etc.) are monitored for discharge in accordance with NFPA Standard 72, National Fire Alarm Code. This monitoring should be configured to assure positive notification to building occupants in sufficient time to allow evacuation of the protected area prior to system discharge. With respect to total flooding CO_2 systems, the combination of a discharge pressure switch and a mechanical discharge delay should be considered. (Investigation Report, pp. viii and 42)

3.8.2 Background and Analysis

LMITCO has relied on employee notification being initiated by the detection system associated with the various gaseous agent fire extinguishing systems. This method was used based on the simplicity of the design, maintenance, and codes.

The existing design for the TRA-648 fire alarm system requires a valid initiation signal in the form of a high-heat, smoke detection, or manual-pull signal. The way the notification system in TRA-648 is designed, all notification (i.e., audible alarm) to occupants is based on a fire alarm signal being processed through the fire protection system alarm panel. The panel sends a signal to an audible alarm horn in the TRA-648 building space. For this system to supply an audible alarm, the fire protection system alarm panel must receive a fire signal. This did not happen in the subject accident situation. A LMITCO project team (see Subsection 3.10) is determining the cause for this apparent panel malfunction. The judgment of need points out the necessity of having the audible or alarm notification system actuated by sensing the actual release from the storage cylinders. By redesigning the fire protection suppression system to measure or sense the actual CO_2 release phenomenon, the fire protection notification system will signal positive notification to building occupants. This design principle measures the actual flow or energy source that the occupants need to know about in the event of an actual release.

3.8.3 Description of Corrective Action(s)

LMITCO will ensure that a predischarge alarm will sound when employees may be subject to possible injury, death, or adverse health consequences caused by an extinguishing agent. The predischarge employee alarms will give employee's time to safely exit the discharge area before the system discharges. This will be accomplished by installing additional monitoring and mechanical delays for all in-service CO_2 systems. The monitoring and mechanical delays will notify occupants of a CO_2 discharge before the agent is released into the area.

LMITCO will institutionalize the installation of the mechanical delays and associated pressure switch by including a requirement for their installation in the ID AE Standard.

3.8.4 Corrective Action Milestones and Schedule

Table 3.8-1. Scheduled corrective actions.

	Corrective Action	Responsibility and Organization	Due Date
3.8.4.1	Install pressure switches with feedback loop and mechanical delays to ensure positive notification on all CO_2 systems before placing them into service.	Vice President, Site Services; B. H. Childers	5/99
3.8.4.2	Propose that the ID AE Standard be revised to provide a section that defines the design requirements for gaseous fire suppression systems, including requiring mechanical delays, isolation valves, and electrically monitored pressure switches on all CO_2 total-flooding systems.	Vice President, Site Services; B. H. Childers	1/99
3.8.4.2	Evaluate all other gaseous fire suppression systems for personnel safety hazards.	Vice President, Site Services; B. H. Childers	1/99
3.8.4.3	LMITCO will implement a process that requires designers to incorporate direct monitoring of equipment status, rather than monitoring of signals intended to set equipment status, in system designs when such monitoring is performed for safety purposes (see Subsection 1.5.1).	Vice President, Site Services, B. H. Childers	1/99

NOTE: Corrective Action scheduled completion dates:

Immediate & prompt actions	Completed before response report issued
Near-term actions	Scheduled for completion on or before 1/99
ISM-integrated actions	Scheduled for completion on or before 8/99
Long-term actions	Scheduled for completion

3.9 Maintenance of Fire Protection Systems Drawings

3.9.1 Judgment of Need

"LMITCO needs to update fire protection systems drawings and keep them updated to reflect modifications for the as-built plant." (Investigation Report pp. viii and 42)

3.9.2 Background and Analysis

The drawings at the INEEL are divided into two categories, essential/key and other. Essential/key drawings are required to be updated and maintained to reflect the current configuration per MCP-2377 (i.e. they are required to be as-built). These drawings are defined as essential/key because it has been determined per MCP-2377 that their use is "essential" to the safe and efficient operation and maintenance of facilities, structures, systems, and components. Essential/key drawings are to be maintained in the as-built condition and are normally selected and identified on the basis of their importance for emergency response; training; troubleshooting facility conditions, systems, and equipment; and as needed for safe facility or system operation and maintenance. Not all drawings are categorized as essential/key. Drawings that fall below the threshold used to define a drawing as essential/key are not as-built.

As the TRA 1996-97 modifications were completed, construction and piping drawings that had been identified as essential/key were as-built. In addition, fire alarm drawings required for the LMITCO Life Safety Systems (LSS) organization for maintenance and operation were as-built. The LSS drawings were as-built, even though they are not categorized as essential/key drawings. A total of 259 drawings affected by the modification project were as-built or inactivated. In 1998, the drawings that were superceded were categorized as inactive in the LMITCO Document Management Control System. This information is detailed in the drawing history provided in the TRA Project History Engineering Design File (EDF-752). Other drawings that were not part of this modification, but that are still related to the TRA-648 CO_2 fire protection system, were not as-built because they are not categorized as essential/key drawings.

The Type A Accident Investigation Team concluded its investigation and presented its findings. LMITCO, in preparing its response, reviewed company procedures addressing document controls for preparing, reviewing, and approving company drawings. In addition, response team discussions and reviews of work control procedures for Engineering Change controls were performed. It was determined that adequate controls exist for the preparation, review, and control of drawings (MCP-2377). The majority of the drawings deemed to be essential/key drawings at TRA are mission related (e.g., safe operation and maintenance of the reactor facility). Not all of the life safety system alarm and fire protection drawings are categorized as essential/key, (i.e., they are not required to be maintained in an as-built condition). The fire alarm system drawings, although routinely updated, are not formally classified as essential/key drawings.

Drawing controls for system designs and modifications are defined in MCP-2811, "Engineering Change Control." This procedure is used to identify the responsible engineer for the structures, systems, and components being changed, and the different disciplines that will comprise the independent review team. The Engineering Change forms implemented by MCP-2811 track the status of the essential/key drawings to ensure that they are as-built before project turn over or closure.

The thrust of this judgment of need is to update the fire protection system drawings and keep them updated to reflect modifications for the as-built plant. This can be accomplished by controlling the fire protection drawings as essential/key drawings in accordance with existing document control procedures, MCP-2377 and MCP-2811. Full implementation of MCP-2811 for system designs will ensure drawings

are in the as-built condition at project turn-over. LMITCO will expand the scope of this judgment of need to include other safety systems. The definition of "essential/key" in MCP-2377 appears to be adequate; however it needs to be more consistently applied to fire and life safety systems.

3.9.3 Description of Corrective Action(s)

LMITCO will review the definition of "essential/key" drawings as defined in MCP-2377 and determine how it is being interpreted and applied to each facility. Controls for implementation of essential/key drawings will be established and applied to each facility.

LMITCO will formally evaluate fire protection and safety system drawings and determine which ones meet "essential/key" criteria per MCP-2377. Fire alarm and protection systems that lack current drawings will be identified. Drawings of these systems will be generated as required. The Fire system drawings that are to be designated as essential/key will be as-built and controlled per MCP-2377 by the Document Management Control System. LMITCO will review other safety systems and identify any other drawings that need to be controlled as essential/key drawings. These drawings will be as-built and controlled as essential/key drawings.

MCP-2811 will be fully implemented. This is to be achieved by continuing training activities to ensure that personnel involved in the design and facility modifications fully understand the process and procedure. A program is to be implemented to periodically assess the effectiveness and use of MCP-2811. The implementation will include the development and tracking of metrics and feedback/improvement mechanisms.

3.9.4 Corrective Action Milestones and Schedule

Table 3.9-1. Scheduled corrective actions.

	Corrective Action	Responsibility and Organization	Due Date
3.9.4.1	Formally review the definition of essential/key drawings as defined by MCP-2377 and how it is being applied to each facility. Establish controls for the consistent interpretation and implementation of essential/key drawings at each facility.	Vice President, Applied Engineering and Development Laboratory; W. Guyton	12/98
3.9.4.2	Formally evaluate fire protection drawings and designate those that meet MCP-2377 criteria for essential/key drawings	Vice President, Site Services; B. H. Childers	3/99
3.9.4.3	Develop as-built drawings for fire protection systems where they currently do not exist.	Vice President, Site Services; B. H. Childers	12/99
3.9.4.4	"As-built" all fire protection drawings designated to be controlled as essential/key drawings and enter them into the document management control system	Vice President, Site Services; B. H. Childers	8/99
3.9.4.5	Define and review other safety systems to identify any other drawings that need to be as-built and controlled as essential/key drawings	Vice President, Site Services; B. H. Childers	4/99

	Corrective Action	Responsibility and Organization	Due Date
3.9.4.6	Define and review "As-built" other identified safety system drawings designated to be controlled as essential/key drawings	Vice President, Site Services; B. H. Childers	12/99
3.9.4.7	Fully implement MCP-2811. This is to be achieved by continuing the training activities to ensure LMITCO personnel involved in the design of facility modifications fully understand the applicable processes and procedures. See Subsection 3.2	Vice President, Applied Engineering and Development Laboratory; W. Guyton	Started 5/98 Complete 1st round 6/99 On-going
3.9.4.8	Implement a program to periodically assess the effectiveness and use of MCP-2811. See Sec. 3.2	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	8/99

NOTE: Corrective Action scheduled completion dates:

Immediate & prompt actions	Completed before response report issued
Near-term actions	Scheduled for completion on or before 1/99
ISM-integrated actions	Scheduled for completion on or before 8/99
Long-term actions	Scheduled for completion

3.10 Identification and Elimination of TRA-648 CO_2 Discharge Accident Initiation Mechanism(s)

3.10.1 Judgment of Need

LMITCO needs to determine the specific mechanism by which the CO_2 system in TRA-648 discharged on July 28, 1998, and take actions as appropriate to avoid a recurrence in the future. Until this is done, the CO_2 system in TRA-648 should remain out of service and compensatory fire protective measures implemented, as appropriate. (Investigation Report pp. viii and 42)

3.10.2 Background and Analysis

There was a newly installed Notifier Model AFP-200 fire alarm discharge panel in TRA-648. This panel was installed in 1997, to replace the older CO_2 discharge panel that was no longer compatible with the new fire system upgrade installation. A summary of this upgrade project appears in Appendix F.

The Board found that, "The CO_2 discharge was not mechanically or manually initiated (i.e., there was no valid initiation signal). The mechanical releases on the releasing control heads were both in the normal position with tamper seals in place. The manual releasing stations inside the building were both in the normal (nonactivated) position. The light emitting diode indicators on the manual releasing stations both indicated system normal, despite the fact that the system had discharged. Both of the releasing heads appear to have been electronically operated. This suggests that the discharge was initiated by the CO_2-releasing system as a controlled actuation, or as a consequence of an induced or imposed current on the releasing circuits. The building fire alarm panel did not initiate the discharge in the normal manner (i.e., in response to a recognized alarm signal processed in accordance with the system program). The panel history shows no alarms, commanded outputs, or malfunctions. In addition, both fire alarm panel releasing circuits were intentionally disabled via software control at the time of the accident." (Investigation Report, p. 37)

We have reviewed and concur with the Board, "…the system program identified no obvious programming errors." (Investigation Report, p. 37) The program is very simple and has only a few lines. The program was down loaded to the mock-up panel and the software was validated.

The first reenactment suggested, as indicated by the Board, " the design of the Notifier Model AFP-200 control panel allows power supply transients (such as those resulting from opening 4160 volt breakers or 110 volt AC contacts) to bypass the system program/logic and energize the releasing circuits." (Investigation Report p. 38) As part of the Response Team's efforts, LMITCO initiated a project to identify the exact mechanism by which this discharge occurred as requested by the Board.

The people involved in the accident reported that the CO_2 discharged about the time Breaker No. 23 was opened on the day of the accident. During the first reenactment of the accident it was determined and reported by the Board that: "While the CO_2 system appeared to discharge when Breaker No. 23 was opened on the day of the accident, it actually occurred with the opening of Breaker No. 13, which was earlier in the sequence. This was due to the 25-second mechanical delay to the CO_2 system discharge." (Investigation Report, p. 38)

In view of the Boards findings and this judgment of need, LMITCO is taking the following actions to determine the specific cause of the malfunction and to rectify the problem in this and similar fire suppression systems.

3.10.3 Description of Corrective Action(s)

3.10.3.1 Immediate Corrective Actions To Eliminate Hazards.

The following immediate corrective actions were taken to eliminate the TRA-648 CO_2 hazard and identify the accident discharge initiation mechanism:

- As requested by the Board, LMITCO sent the mechanical delay device to the manufacturer (Fenwal) for testing. This device was accompanied by a LMITCO Fire Protection Engineer. Fenwal tested the device and confirmed that the time delay worked and was within the allowable tolerances of the device. This documentation can be found in EDF-755 "Testing of Mechanical Delay for CO_2 System in TRA-648."

- For personnel safety and to ensure no additional accidental discharges occur at TRA, LMITCO had the fire alarm panel in TRA-648 placed out of service and compensatory measures implemented until the problem is fully understood.

- A fire watch was instituted with instructions to immediately notify the Advanced Test Reactor shift supervisor if a fire was detected. Once contacted, the shift supervisor was to notify and set in motion emergency response and ensure entrance controls and combustible loading limits were in place. All fire system impairments at TRA that did not have detailed operating instructions were suspended. These instructions had to include detailed steps such as valve closure, fire alarm panel manipulations, and inspections. These steps were included in or with the work package.

- Egress paths were cleared of any obstructions that would impede occupant's ability to promptly exit the facility.

- Additional ABC fire extinguishers were placed in TRA-648 and TRA-663. All hot work in TRA-648 will require preapproval by the Fire Protection Engineer.

These compensatory measures are on file with the INEEL Fire Department.

3.10.3.2 LMITCO Corrective Actions To Identify Discharge Mechanism.

To identify the accident discharge mechanism LMITCO established a subteam to investigate the Notifier Model AFP-200 panel and selected fire alarm circuits in TRA-648. Test plans were developed to perform multiple tests on a mock-up panel prior to testing the incident panel. A Notifier Model AFP-200 panel was set up and configured to be used as a TRA-648 mock-up. The Team then performed tests on the mock-up panel, attempting to recreate the events of the accident. The Team also corresponded with the panel manufacturer to isolate any panel vulnerabilities that the manufacturer was willing to disclose.

An industry expert has been hired to provide input to the LMITCO Team. The services of an independent electrical forensic testing laboratory has also been acquired to help identify and verify the failure mechanism.

3.10.3.3 Major Actions Taken.

1. 07/30/98: Notifier Model AFP-200 panel history retrieval—LMITCO personnel entered TRA-648 and uploaded the Notifier Model AFP-200 panel history information, for the first

time, onto a laptop computer. The 120 Vac power supply was off line, but the 24 Vdc power supply was maintained by battery backup to the Notifier Model AFP-200 panel.

2. LMITCO personnel developed a test procedure (Test 1) to reenact/test the system to discern what may have caused the unexpected release of CO_2. The Board arrived, provided input to test plan, and the test plan was revised and approved by the Board.

3. 08/14/98: Test 1 performed—The test procedure was as "identical" as possible, excluding the monitoring equipment, to the preaccident activities, based on documentation and input from those involved. The test reproduced the unexpected actuation of the CO_2 solenoids with ID, the Board, and LMITCO representatives present. Following the test, the Notifier Model AFP-200 panel power supply (120 Vac and 24 Vdc) was completely isolated from the Notifier panel to obtain a second history file per the Notifier Model AFP-200 panel user's manual. EDF-737 was written to provide a record of monitoring equipment test results.

4. The Board left the INEEL—LMITCO personnel, developed a second reenactment test procedure (Test 2) to obtain additional information.

5. 09/01/98: Test 2 performed—Replication of the CO_2 solenoid activation was not achieved. The differences between Test 1 and Test 2 were as follows: (a) a sequential difference in opening the breakers, (b) the location of measuring/monitoring equipment, and (c) software enabling of the CO_2 solenoids. Approved test plan options were executed to reproduce the first test (removal of monitoring equipment, changing breaker opening sequence, software disabling the solenoids); however, the CO_2 solenoids still did not actuate. EDF-750 was written to provide a record of monitoring equipment test results.

6. LMITCO, accident investigation team, and a CO_2 systems consultant initiated development of a "testbed or mock-up" of the TRA-648 CO_2 system, to further analyze possible causal factors to the inadvertent CO_2 release.

7. LMITCO conducted simulator experiments, which reproduced the CO_2 solenoid actuation but not repeatedly. These preliminary results suggest stray voltages "noise" from the battery charger in conjunction with the Notifier Model AFP-200 logic circuits, actuated the solenoids. EDF-756, "Notifier Model AFP-200 Mockup Investigation," has been written to document results of simulator testing.

8. 9/14/98: Applied Engineering and Development Laboratory began computer modeling and simulation of the system in TRA-648. The results are similar to those found with the testing simulator. These results are recorded in EDF-753.

9. To validate the findings of the LMITCO team on the failure mechanism, MET Laboratories, Inc., Baltimore, MD, an independent nationally recognized testing lab (NRTL), has been retained. MET Laboratories, Inc. will test the TRA-648 simulated fire alarm control panel and associated devices, and provide an independent report on the failure mode if identified. Their report will be documented in an EDF report. In addition, if the lab work identifies a system failure mode, MET Laboratories, Inc. will be brought to the facility to conduct testing on the system involved in the accident. These results will be identified in an EDF report.

3.10.3.4 LMITCO Long-Term Corrective Actions:

The LMITCO team identified several longer-term corrective actions to inform others of the hazards in hopes of preventing this type of failure. The last corrective action will ensure the existing CO_2 systems at the INEEL have been mitigated.

To inform other sites and professionals, a Red Lessons Learned notice will be distributed. This notice will describe the accident failure mechanism and discuss the hazard of using software locks and the possible problems with modern-day electronics on hazardous systems.

The LMITCO Chief Engineer, after consultation with the office of General Counsel, will notify Underwriters Laboratory (UL) and Factory Mutual (FM) of any findings concerning potential problems associated with the Notifier Model AFP-200 fire alarm panel. This will allow UL and FM to review their listing and take appropriate actions.

There are other Notifier Model AFP-200 fire alarm releasing panels at TRA. These panels are in a similar but different configuration. These remaining panels do not release CO_2. The extinguishing agent is Halon. It has been verified that the concentration of Halon with a release would be nonhazardous. These panels will be evaluated and modifications to upgrade or replacement implemented to prevent false operation.

A Site-wide evaluation is under way to determine the final disposition of CO_2 systems. At present all CO_2 systems on the INEEL have been physically disconnected.

3.10.4 Corrective Action Milestones and Schedule

Table 3.10-1. Scheduled corrective actions.

	Corrective Action	Responsibility and Organization	Due Date
3.10.4.1	Establish a team to identify the specific mechanism by which the CO_2 discharged in TRA-648 (see Subsection 3.10.3 for details).	Vice President, Site Services; B. H. Childers	Complete
3.10.4.2	Use an outside agency to validate and verify results obtained from testing and discovery for the accident initiation mechanism. (EDF-737 and EDF-750)	Vice President, Site Services; B. H. Childers	1/99
3.10.4.3	Issue a red lessons learned notice and distribute throughout the DOE system.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	1/99
3.10.4.4	Notify Underwriters Laboratory of any findings concerning potential problems associated with the Notifier Model AFP-200 fire alarm panel.	Vice President, Applied Engineering and Development Laboratory; W. Guyton	1/99
3.10.4.5	Notify Factory Mutual of any findings concerning potential problems associated with the Notifier Model AFP-200 fire alarm panel.	Vice President, Applied Engineering and Development Laboratory; W. Guyton	12/98

	Corrective Action	Responsibility and Organization	Due Date
3.10.4.6	Review findings of failure mechanism for existing Notifier Model AFP-200 releasing panels.	Vice President, Site Services; B. H. Childers	6/99
3.10.4.7	Evaluate and disposition the existing CO_2 systems.	Vice President, Site Services; B. H. Childers	12/98

NOTE: Corrective Action scheduled completion dates:

Immediate & prompt actions	Completed before response report issued
Near-term actions	Scheduled for completion on or before 1/99
ISM-integrated actions	Scheduled for completion on or before 8/99
Long-term actions	Scheduled for completion

3.11 DOE-HQ Improvement of Standards for CO_2 Fire Protection Systems

3.11.1 Judgment of Need

DOE needs to actively campaign to improve consensus standards and in the interim should consider strengthening Orders and policies related to fire protection and worker safety to clearly define lockout, to limit occupancy in CO_2 flood areas, and to prevent use of fire system impairments as a means of personnel protection.

3.11.2 Background and Analysis

DOE Order 1300.2A (5/19/92), "Department Of Energy Technical Standards Program," establishes DOE policy for application of technical standards in DOE facilities, programs, and projects and provides for participation in nongovernment standards bodies (NGSBs). DOE Order 1300.2A states, "Adherence to appropriate NGSs in the design, construction, testing, modification, operation, decommissioning, decontamination, and remediation of DOE's facilities and activities is necessary for the successful implementation of the Department's policies."

The NFPA code is a nongovernment, national standard for fire protection that is required for DOE facilities by DOE Order 5480.4, "Environmental Protection, Safety, And Health Protection Standards," and DOE Order 5480.7, "Fire Protection." Title 29 CFR 1910, "Occupational Safety and Health Standards" (OSHA) regulations for worker protection are also required at DOE facilities by DOE Order 5480.4. Review of this judgment of need and discussion with ID, DOE, and LMITCO subject matter experts in fire protection resulted in agreement that DOE should actively campaign to improve consensus standards to clearly define lockout, to limit occupancy in CO_2 flood areas, and to prevent use of fire system impairments as a means of personnel protection. Such actions would be consistent with DOE Order 1300.2A, which states, "It is the policy of the Department to encourage participation in NGSBs. Consideration of participation shall be given if such activity is (a) deemed to be in the pubic interest, and (b) compatible with the Department's mission, authorities, priorities, and budget limitations."

DOE Order 1300.2A further notes that, "No matter how carefully conceived and properly developed, technical standards cannot address all eventualities" and states, "It is the policy of the Department to establish a DOE Technical Standards Program which ensures the development of DOE and DOE limited standards when NGSs are not available or appropriate for use, or reference the NGS with necessary tailoring when the NGS does not fully satisfy the DOE requirements." Accordingly, ID and LMITCO further agree that DOE-wide standards should also be established in this area and that interim actions are necessary at the INEEL to implement the recommendations in this judgment of need until DOE or consensus standards can be updated.

3.11.3 Description of Corrective Action(s)

ID requested EM-1 and EH-1 to address this JON in memorandum OPE-AIT-01-98, dated September 28, 1998, "Request for Action Related to Judgments of Need from TRA Type A Accident Investigation Report," which asked for DOE-HQ assistance in the complex wide resolution of this judgment of need. The EH Fire Protection Engineer stated during a telephone interview that EH would actively pursue this issue. In the interim, ID will direct LMITCO to institutionalize requirements to clearly define lockout, to limit occupancy in CO_2 flood areas, and to prevent use of fire system impairments as a means of personnel protection, and will reflect these requirements in a ID "requirements document" (see corrective action 3.3.4.4.)

The ID Fire Protection Engineer is a voting member of the DOE Fire Safety Committee chaired by DOE-EH 51. As issues arise within the DOE complex, the Fire Safety Committee determines how the DOE complex will address any actions determined to be necessary. Such issues are also addressed at the annual DOE Fire Safety Conference. To bring the fire protection aspects of this accident before a broad audience of DOE fire protection professionals, the ID Fire Protection Engineer will request that the agenda of December Fire Safety Committee meeting and the 1999 DOE Fire Safety Conference include a discussion of the INEEL CO_2 accident and potential implications to the DOE Complex.

Obtaining an additional voting member on a committee governing an NFPA standard directly affecting operations at the DOE complex would improve DOE's ability to obtain needed changes in the code. In prior fiscal years, the ID Fire Protection Engineer has identified the need for applying for committee membership on NFPA codes and standards committees, but ID did not pursue committee membership. ID will nominate an ID individual for committee membership to a NFPA standard development committee in a topic area directly affecting operations at the DOE complex.

3.11.4 Corrective Action Milestones and Schedule

Table 3.11-1. Scheduled corrective actions.

	Corrective Action	Responsibility and Organization	Due Date
3.11.4.1	Request HQ assistance in addressing this judgment of need.	ID Assistant Manager, Office of Program Execution; J. Lyle	Completed 9/98
3.11.4.2	Direct LMITCO to institutionalize requirements to clearly define lockout, to limit occupancy in CO_2 flood areas, and to prevent use of fire system impairments as a means of personnel protection.	ID Assistant Manager, Office of Program Execution; J. Lyle	11/98
3.11.4.3	Reflect these requirements in Subsection 3.11.4.2 in a ID "requirements document" (see corrective action 3.3.4.4)	ID Assistant Manager, Office of Program Execution; J. Lyle	8/99
3.11.4.4	Request that the TRA-648 CO_2 fatality be addressed in the December Fire Safety Committee meeting and the 1999 DOE Fire Safety Conference.	ID Assistant Manager, Office of Program Execution; J. Lyle	10/98
3.11.4.5	Nominate an ID individual for committee membership on a NFPA standards development committee in a topic area directly affecting operations at the DOE complex.	ID Assistant Manager, Office of Program Execution; J. Lyle	8/99

NOTE: Corrective Action scheduled completion dates:

Immediate & prompt actions	Completed before response report issued
Near-term actions	Scheduled for completion on or before 1/99
ISM-integrated actions	Scheduled for completion on or before 8/99
Long-term actions	Scheduled for completion

3.12 Positive Lockout Mechanisms for Gaseous Fire Suppression Systems

3.12.1 Judgment of Need

LMITCO needs to ensure that all total flooding gaseous fire suppression systems at INEEL are equipped with an OSHA compliant positive lockout mechanism that is electrically supervised by the releasing system. DOE needs to consider implementing a similar policy across the complex. (Investigation Report, pp. viii and 27)

This judgment of need is listed as the second contributing cause of, "failure to use physical (lockout/tagout) and administrative barriers (current procedures and work planning and control processes) that implemented regulatory requirements." (Investigation Report, p. viii)

3.12.2 Background and Analysis

The only total flooding gaseous fire suppression systems at the INEEL are CO_2 and Halon systems.

When the CO_2 fire suppression system was installed in TRA-648 in 1971, positive lockout mechanisms were not included. In the 1980's and the early 90s, a number of internal and external technical experts reviewed the status of fire and life safety across the INEEL, including TRA, resulting in a list of deficiencies. Multi-year line-item construction projects were formulated to correct the highest priority deficiencies. TRA deficiencies were and are being corrected by these line-item construction projects: "INEEL Fire and Life Safety Improvements (FY-92), and "TRA Fire and Life Safety Improvements," (FY-95). The extensive internal and external expert effort did not identify the need to install a method for positively locking out the TRA-648 CO_2 system. During the period of the fire protection system enhancements, ID AE Standards did not contain the requirement to consider equipment isolation capability for system design or modification, nor did LMITCO design and design review procedures or practices. Because the fire systems status review did not identify the need for positive lockout mechanisms, and the design and review process did not ensure equipment isolation capability considerations were incorporated into the 1996 CO_2 system modification design, a positive lockout was not installed. Safety barriers that were installed in the system include a 30-second electronic delay and a 25-second mechanical delay. The electronic delay is a software-controlled function of the fire alarm system; the mechanical delay is a component installed in the CO_2 manifold. A separate but related issue is that LMITCO MCP-1059, "Lockout and Tagout" does not specifically identify CO_2 total flooding gaseous fire suppressions systems in the definition of hazardous energy source.

The AE Standard was updated in September 1997 to include the requirement to consider equipment isolation capability for system design or modification. See corrective action 3.2.4.8 for actions to strengthen the design and review processes.

The Halon total flooding gaseous fire suppression systems at the INEEL are subject to and comply with different regulatory requirements (OSHA, NFPA) than CO_2 systems. One regulatory employee protection difference is based on the percent of Halon in air during a release. When the percent of Halon is below regulatory maximum allowable levels, the area is not considered by regulations to be a hazardous environment for occupants. The Halon systems at the INEEL were reevaluated (completed - 08/12/98) to verify the concentrations during a release. It was determined that only one system at the Waste Experimental Reduction Facility (WERF), the PER-609 Baghouse, would exceed the safe concentration for employee occupancy. However, entry into the PER-609 Baghouse, a piece of unoccupied process equipment, is controlled by MCP-2749, "Confined Spaces," which requires mitigation of all hazardous energy sources, including Halon.

During INEEL maintenance and servicing activities, Halon systems are positively isolated by removing the initiating device from the storage cylinder. This method of isolation is common industry practice for fire suppression systems and described in LMITCO system specific technical procedures, however, isolation details are not specified in the company-wide procedure for lockout/tagout. MCP-1059, "Lockout and Tagout" presently prohibits software/electronic control disabling as a means of positive lockout. To ensure consistency throughout the INEEL, positive isolation of Halon systems will be mandated thought revision of MCP-1059, "Lockout and Tagout."

MCP-585, "Managing Fire Protection Impairments" is used as the company-wide procedure for disabling fire suppression systems. This procedure will be revised to distinguish between when a fire system impairment is appropriate, verses when a positive lockout is required in accordance with MCP-1059, "Lockout and Tagout."

3.12.3 Description of Corrective Action(s)

ID initiated action to address this judgment of need by issuing memorandum OPE-AIT-01-98, dated September 28, 1998, "Request for Action Related to Judgments of Need from TRA Type A Accident Investigation Report" which asked for DOE-HQ assistance in the complex-wide resolution of this judgment of need. The DOE-EH Fire Protection Engineer said that EH would actively pursue this issue during a telephone interview. In the interim, ID will direct LMITCO to ensure that all total flooding gaseous fire suppression systems at INEEL (including leased facilities) are equipped with a means of OSHA compliant positive isolation. Where valves are used, they will be electrically supervised by the releasing system and ID will reflect these requirements in an ID requirements document (see corrective action 3.3.4.4). ID will also review the contractor's completed evaluations of gaseous fire suppression systems for positive lockout devices.

The ID Fire Protection Engineer is a voting member of the DOE Fire Safety Committee chaired by DOE-EH 51. As issues arise within the DOE complex, the Fire Safety Committee determines how the DOE complex will address any actions determined to be necessary. Such issues are also addressed at the annual DOE Fire Safety Conference. To bring the fire protection aspects of this accident before a broad audience of DOE fire protection professionals, the ID Fire Protection Engineer will request that the agenda of December Fire Safety Committee meeting and the 1999 DOE Fire Safety Conference include a discussion of the INEEL CO_2 accident and potential implications to the DOE Complex.

LMITCO has evaluated all total flooding gaseous fire suppression systems for positive lockout devices. Actions will be taken to deal with each CO_2 system by adding a positive lockout mechanism which is electronically supervised, or by removing the system from service.

Currently all CO_2 total flooding systems have been physically removed from service. These systems will not be returned to service without the completion of corrective actions.

MCP-1059, "Lockout and Tagout" will be revised to include "total flooding gaseous fire suppression systems" in the definition of *Hazardous Energy Sources*.

LMITCO will institutionalize positive isolation of Halon systems at the INEEL by revising MCP-1059, "Lockout and Tagout" to mandate specific isolation steps for Halon system release initiating devices, both solenoids and squib connectors.

MCP-585, "Managing Fire Protection Impairments" will be revised to differentiate between when a system impairment is appropriate verses when positive lockout is required in accordance with MCP-1059. "Lockout and Tagout."

3.12.4 Corrective Action Milestones and Schedule

Table 3.12-1. Scheduled corrective actions.

	Corrective Action	Responsibility and Organization	Due Date
3.12.4.1	Request HQ assistance in addressing this judgment of need.	ID Assistant Manager, Office of Program Execution; J. Lyle	Completed 9/98
3.12.4.2	Request that the TRA-648 CO_2 fatality be addressed in the December Fire Safety Committee meeting and the 1999 DOE Fire Safety Conference	ID Assistant Manager, Office of Program Execution; J. Lyle	10/98
3.12.4.3	Direct LMITCO to ensure that all total flooding gaseous fire suppression systems at INEEL are equipped with a means of OSHA compliant positive isolation.	ID Assistant Manager, Office of Program Execution; J. Lyle	11/98
3.12.4.4	Reflect these requirements in an ID requirements document.	ID Assistant Manager, Office of Program Execution; J. Lyle	8/99
3.12.4.5	Review LMITCO completed evaluations of all total flooding gaseous fire suppression systems for positive lockout devices.	ID Assistant Manager, Office of Program Execution; J. Lyle	8/99
3.12.4.6	Evaluate all total flooding gaseous fire suppression systems for positive lockout devices.	Director, Site Operations; W. Gay	Complete 10/98
3.12.4.7	Install a positive lockout mechanism that is electrically supervised by the releasing system on CO_2 total flooding, gaseous fire suppression systems, or remove the system from service.	Vice President, Applied Engineering and Development Laboratory; W. Guyton	8/99
3.12.4.8	Revise MCP-1059 to include “Total flooding gaseous fire suppression systems” into the definition of Hazardous Energy Sources.	Director, Site Operations; W. Gay	1/99
3.12.4.9	Revise MCP-1059 to include specific steps for positive isolation of Halon systems.	Director, Site Operations; W. Gay	1/99
3.12.4.10	Revise MCP-585 to differentiate between use of fire system impairments verses positive lockout per MCP-1059.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	1/99

NOTE: Corrective Action scheduled completion dates:

Immediate & prompt actions	Completed before response report issued
Near-term actions	Scheduled for completion on or before 1/99
ISM-integrated actions	Scheduled for completion on or before 8/99
Long-term actions	Scheduled for completion

3.13 Work Control System Improvements

3.13.1 Judgment of Need

LMITCO needs to improve the work control system by providing additional guidance on the performance of hazard evaluations to include the importance of capturing all potential and credible hazards associated with the work or workspace and the significance of risks created by the hazards; requiring utilization of the Job Requirements Checklist process for applicable preventive maintenance tasks that have not yet been through the process; and expediting the training and qualification program for work planners (in the interim, ensure only qualified personnel are used for this function). (Investigation Report, p. viii and 57)

3.13.2 Background and Analysis

Before the accident, LMITCO wrote and implemented MCP-2798, "Maintenance Work Control" to standardize the maintenance process Site-wide. They also recognized the need for a single, Site-wide computerized maintenance management system, and had started to use PASSPORT as that system. Even though MCP-2798 defines a work control process, improvements are needed in the procedure to better address the requirements for identifying the hazards associated with work performance and the surrounding area, and to better define the responsibilities and training requirements for personnel performing key functions in the work control process. One LMITCO focus is implementing the Enhanced Work Planning Process as a means of addressing work planning and control deficiencies, but this process is not yet fully implemented Site-wide. In addition, MCP-2798 was written in a way that allowed interpretation differences in how the procedure was to be implemented. Examples of this are determining when the Job Requirements Checklist (JRC) needs to be completed or how a Job Hazard Analysis (JHA) must be performed. At the time of the accident, hazard identification and mitigation efforts associated with planning a work order were primarily focused on hazards directly related to the work being done (e.g., electrical work). Facility-specific peripheral hazards and their significance in the surrounding area were not always considered.

The Investigation Report identifies areas for improvement in the LMITCO work control system, such as identifying, evaluating, and controlling hazards. LMITCO's supplemental causal factors analysis determined a need to comprehensively identify the facility specific hazards at INEEL facilities to ensure that appropriate mitigation and control measures will be identified and implemented. While LMITCO MCP-2727, "Performing Safety Reviews" provides guidance for performing hazard evaluations, it does not provide specific mechanisms for identifying facility-specific hazards such as a CO_2 fire protection system. The procedure requires that hazards evaluations identify work activities, affected personnel, hazards, significance of risks, and mitigative actions to protect workers. MCP-2727 is difficult to follow in that it lists options for completing safety reviews. Furthermore, the procedure is not in a format that managers can follow to ensure that all safety review items are completed. This leads to an inconsistent application of the safety review process. This coincides with ISM System Gap #25, "There is not a consistent, integrated process that uses a standardized graded approach to identify hazards and risks, and to establish and apply safety controls."

The JRC is a tool used to identify input and approval requirements for a job or work order. Specific criteria, in the work control procedure, are used to determine if the JRC needs to be completed. Although the JRC was not intended to function as safety review or capture all hazards associated with the work or facility hazards, it does force the person performing the JRC to consider all the aspects related to the job, such as hazards, that might otherwise be overlooked. LMITCO currently uses a combination of methods such as the JRC, Health and Safety Plan (HASP), and safety permits (e.g., RWPs) to identify, evaluate, and mitigate hazards.

The JRC applies a graded approach in addressing the significance of risks by incorporating requirements and trigger levels from other DOE and company programs such as exposure assessments, hazardous material storage, and abandoned lines, systems, or equipment. Risk is also addressed by a classification of "dangerous" to physical, chemical, biological, and electrical hazards. These higher risks require review and approval of work documents by safety and health professionals and strongly recommend team planning and walkdowns. More significant risks require additional reviews and approvals. Hazard identification and risk analysis could be enhanced to better address the fixed hazards within a facility or area where the work is to be performed. Workers are expected to rely on the warning signs, barriers, access training, and other engineering controls provided within a facility to inform and protect them from fixed facility hazards such as a CO_2 system. Planners, crafts workers, and ES&H personnel entering a facility to plan or conduct work may not be aware of the significance of risks created by hazards inherent to the facility. This condition becomes a more significant risk when one or more of the affected personnel are unfamiliar with the facility. A need has been identified to create a database which includes a list of all known risks and a discussion of their significance and appropriate mitigation barriers. This list should be available to all involved in the work planning and control process.

The Investigation Report identifies the need for additional guidance/training pertaining to hazard identification and control associated with work and the associated risks to the worker. LMITCO's supplemental causal factors analysis determined that the work planning process needs to be strengthened to ensure that work planners have adequate knowledge of sites, organizations, facilities, processes, and hazards associated with the job they are planning. Currently, a training program is being developed. The first phase, of this program, a planner qualification test-out program, has been developed and over 300 personnel involved in the work planning process have been tested. The results of this test out program show that many people involved with the work planning process need additional training. A remedial training program to address these needs has been developed.

In summary, LMITCO will strengthen its hazard evaluations. Emphasis will be placed on ensuring all potential and credible hazards associated with the work or workspace are identified and that the significance and potential consequences of each hazard are clearly understood and adequately mitigated. More specific and tighter guidance, as to when a JRC needs to be performed, will be developed, implemented, and applied to all preventive as well as corrective work orders. Personnel involved with the work planning process get further training in the areas of work control and hazard identification and mitigation.

3.13.3 Description of Corrective Action(s)

The objectives of the corrective actions for this judgment of need are to implement an "Integrated Site Maintenance Manual" that will consistently implement a Site-wide work control process consistent with the principles of ISM. Successfully implementing such a manual will establish increased rigor, discipline, accountability, and consistency in maintenance performance at the INEEL, and provide a single comprehensive reference for everyone involved in the work control process. This will help LMITCO ensure its personnel understand the importance of hazards identification, the significance of the risks created by those hazards, and how to mitigate them. It will also increase the use and effectiveness of the JRC.

LMITCO will develop a training program for those involved in the work control process.

To address the issues raised in the background and analysis section, LMITCO will develop an Integrated Site Maintenance Manual. This manual will provide "one stop shopping" for personnel involved in the work control process (safety, ISM concerns, VPP attributes, facility authorization basis guidelines, lessons learned from DOE observations and Operating Experience Weekly Summary). It will

also define the work control process, delineate responsibilities, and establish relationships between operations, maintenance, and support organizations. The Integrated Site Maintenance Manual will require annual preventive maintenance (PM) work order reviews. In situations when the PM period exceeds one year the PM will be reviewed before each use. PMs will also be reviewed when safety or configuration changes occur. This manual will:

- Establish a well-defined process for performing hazard evaluations and structure the process for capturing all potential and credible hazards for both the work and the surrounding area
- Clearly define the parameters for maintenance use of the JRC in the planning process work orders (including preventive maintenance)
- Address and or clarify minor maintenance, workability reviews, walkdowns, signatory responsibilities, accountability, conditions, and approvals
- Ensure that applicable key drawings and documents are updated when modifications are made to structures systems or components, and that the latest revision of these updated drawings and documents are available to everyone involved in the work control process
- Revise the Prejob Briefing Checklist to include a discussion of escape routes and the importance of keeping paths clear during the performance of the work
- Provide a means to identify and stress the significance of hazards associated with the work being performed, and also those hazards in the surrounding area.
- Ensure workers are involved in work planning.

LMITCO will develop or improve tools to help the planner identify hazards on the work order, and provide a means for mitigating all potential and credible hazards. This effort will include:

- Developing controlled lists or similar databases of all known potential and credible hazards associated with the systems, structures, and components in each INEEL facility
- Incorporating a written list of the potential and credible hazards into each work order, and required mitigation barriers for the job and work area
- Revising the JRC to make it a better planning tool for identifying potential and credible hazards, thereby taking advantage of the company information available via intranet to standardize the process for identifying hazards. Additionally this revision will provide criteria regarding when to include Emergency Preparedness input review and approval.
- Developing a checklist to assist in hazard identification that a planner will take with him when walking down a job. This checklist will be used by the planning team as an aid when performing walkdowns of the work area prior to completing the JRC. This will ensure that the planning team has sufficient information to perform an adequate hazard evaluation and prejob briefing for the planned activity.
- Provide planners with adequate guidance to improve their understanding of planning activities and provide a consistent and more complete approach for developing work orders

- List standardized hazard mitigation barriers for identified potential and credible facility hazards.

LMITCO will implement a Site-wide Computerized Maintenance Management System (CMMS) system that will enable LMITCO to standardize the work order format and provide a tool for maintaining the lists of hazards associated with each building/facility. This coincides with implementation of ISM System Gap #21, "Company-wide CMMS that has not been completed…"

LMITCO developed and performed a maintenance planner's test-out program to identify those qualified to perform planner activities. This program included a formal task and needs analysis and used a modular test to assess core knowledge as well as facility specific sections. Only those who passed the test or have completed the remedial process are allowed to plan work. In addition to this test out program, LMITCO is enhancing its a training program for planners, and will develop training programs for Site Area Directors, maintenance supervisors, foremen, crafts, and supporting ES&H personnel. This training will include the work control process; the lessons learned program; the identification, mitigation, and control of hazards; and will emphasize the principles of ISM.

The DSO (See Appendix C) will independently assess the progress of implementation of the corrective actions identified in this section.

To increase the level of awareness of all employees and to assist the safety professionals in identifying work place hazards, LMITCO will train "groups" of employees in hazard identification. These groups will learn hazard identification, barrier analysis, and mitigation before being allowed the opportunity to conduct work-place assessments. This will continue on a rotational basis to raise the knowledge base of all employees on hazard identification.

LMITCO will develop a matrix showing how the Integrated Site Maintenance Manual and the SMS Implementation Plan will address work control/maintenance related issues identified in the Investigation Report and the following LMITCO Management and ID assessments:

- LMITCO Integrated Safety Management System Description Document and Implementation Plan, August 31, 1998

- Lockheed-Martin Risk Management Assessment of LMITCO Work Control Activities at the INEEL, September 7-18, 1998

- Assessment Report, Department of Energy, Idaho Operations Office Followup Review of Corrective Actions to LMITCO Work Control Program management Assessment ARM/PA 97-03, Report No. ARM/PAD 98-01, August 14, 1998

- LMITCO Independent Performance Assessment, Lockout/Tagout, Site-wide, 98-IS-018, August 19, 1998

- LMITCO Independent Performance Assessment, Conduct of Operations Assessment of Water Reactor Research Test Facility, performed February 23 and 24, 1998, 98-OP-003

3.13.4 Corrective Action Milestones and Schedule

Table 3.13-1. Scheduled corrective actions.

	Corrective Action	Responsibility and Organization	Due Date
3.13.4.1	Develop an Integrated Site Maintenance Manual that: Requires annual PM reviews, or in situations when the PM period exceeds one year reviews before each use, and reviews when safety or configuration changes occur. A process to ensure that (a) hazard evaluations are effectively and consistently conducted, (b) all potential and credible hazards are captured, and (c) the significance of risks are understood; and workers are involved in planning process. Clearly defines the parameters for maintenance use of the JRC in the planning process work orders (including preventive maintenance) Addresses and or clarifies minor maintenance, workability reviews, walkdowns, signatory responsibilities, accountability, conditions, and approvals.	Director, Site Operations; W. Gay	12/98
3.13.4.2	Ensure that applicable key drawings and documents are updated when modifications are made to structures systems or components and that the latest revision of these updated drawings and documents are available to everyone involved in the work control process.	Vice President, Applied Engineering and Development Laboratory; W. Guyton	2/99
3.13.4.3	Revise the Prejob Briefing Checklist to include a discussion of escape paths from the area where work is being performed, with a requirement to ensure that clear escape paths are maintained throughout the job. And establish criteria, including a job site walkdown, that will identify the existing hazards in an area that could pose a serious threat to life and health.	Director, Site Operations; W. Gay	12/98
3.13.4.4	Develop and implement requirements to maintain a controlled list (hazards analysis database) of known building or area specific hazards, and standardize mitigation barriers for each INEEL building/facility. Require planners to incorporate the applicable information from the list into each work order.	Director, Site Operations; W. Gay	8/99

	Corrective Action	Responsibility and Organization	Due Date
3.13.4.5	Revise the Job Requirements Checklist (JRC) to include criteria regarding when to include emergency preparedness input, reviews, and approval; standardize the process for identifying potential and credible hazards for the job; and enable the JRC to provide general directions for hazard mitigation requirements.	Director, Site Operations; W. Gay	3/99
3.13.4.6	Develop and implement the use of a Site-wide standardized job walkdown checklist.	Director, Site Operations; W. Gay	12/98
3.13.4.7	Adequately guide planners to enhance their understanding of work planning activities and to standardize the approach for developing consistent work orders.	Director, Site Operations; W. Gay	12/98
3.13.4.8	Establish a standardized maintenance work order package format, to include identification of applicable job and work-site hazards, for all LMITCO facilities at the INEEL.	Director, Site Operations; W. Gay	12/98
3.13.4.9	Implement a Site-wide CMMS at all facilities.	Director, Site Operations; W. Gay	8/99
3.13.4.10	Develop and perform a maintenance planners test-out program to identify those qualified to perform planner activities. This program will include: • Performing a formal task analysis • Performing a formal needs analysis • Developing a modular test to assess core knowledge as well as facility specific sections for each facility • Remedial activities for those who do not successfully test out.	Director, Site Operations, W. Gay	Completed
3.13.4.11	Complete training of maintenance planners that were identified during test-out to require remedial training.	Director, Site Operations, W. Gay	11/98

	Corrective Action	Responsibility and Organization	Due Date
3.13.4.12	Develop and implement modular INEEL and facility-specific training for planners, foremen, crafts, and supporting ES&H personnel on applicable aspects of the Integrated Site Maintenance Manual. This training will cover how to access and use the lessons learned data, perform prejob briefings and postjob reviews as well as, how to identify, mitigate, and control maintenance work hazards and plan work orders using ISM System principles. Include exams in each modular training session.	Director, Site Operations, W. Gay	4/99
3.13.4.13	Independently assess the implementation progress of the corrective actions identified in this section of the response to the judgments of need in the Investigation Report.	Director, Site Operations; W. Gay	7/99
3.13.4.14	Implement teams of employees to identify work place hazards in each facility. Benchmark companies using this concept. These teams will be used as a tool to build and maintain building hazard inventories as discussed in 3.5.4.8 and 3.13.4.4.	Director, Site Operations; W. Gay	4/99
3.13.4.15	Implement the Integrated Site Maintenance Manual.	Director, Site Operations; W. Gay	4/99
3.13.4.16	Develop a matrix, showing how the Integrated site Mainenance Manual and the Site Integrated Maintenance Implementation Plan will address work control/maintenance related issues from the Investigation Report and other LMITCO and ID assessments identified in Subsection 3.13.3.	Director, Site Operations, W. Gay	12/98

NOTE: Corrective Action scheduled completion dates:

Immediate & prompt actions	Completed before response report issued
Near-term actions	Scheduled for completion on or before 1/99
ISM-integrated actions	Scheduled for completion on or before 8/99
Long-term actions	Scheduled for completion

3.14 Assuring Work Control System Effectiveness

3.14.1 Judgment of Need

LMITCO needs to provide additional management attention to assure the effectiveness of the work control system. This includes direct involvement of knowledgeable managers in reviewing work and coaching individuals on implementation of the system. (Investigation Report, pp. viii and 57)

3.14.2 Background and Analysis

During fiscal years 1997 and 1998, LMITCO chartered a Site-wide team to implement the concepts of EWP into work control processes at the INEEL. The LMITCO program controlling maintenance work provided a standardized approach for the safe and efficient completion of maintenance tasks performed at the various facilities. Facility specific EWP teams were established to evaluate and improve the work control process. The work control process applies a graded approach that focuses management's attention on those activities considered to have the highest risk potential. Added management attention should also be applied to those activities previously accepted as routine to ensure all possible hazards are identified and mitigated.

The procedures that apply to work activities at the INEEL, (e.g., Work Control, Safety reviews, prejob and postjob briefings, work priority, safety requirements, radiological requirements, etc.) are contained in many company manuals and MCPs. It would be better for the work control process if all of the procedures relating to INEEL work activities were available in a single manual. This would enable management to better coach individuals and assess the effectiveness of the work control system, if all of the procedures relating to INEEL work activities were available in a single manual.

3.14.3 Description of Corrective Action(s)

As discussed in Appendix C, LMITCO has established a DSO. This initiative will achieve the added level of management attention to work control called for in this judgment of need. The DSO has initiated steps to address this issue. To this end, the objectives of the corrective actions for this judgment of need are to institutionalize a site culture change in the way work is planned and performed at the INEEL. Key attributes of this culture are as follows:

- Management must emphasize clear measurable standards, requirements, and expectations
- Management must continue to communicate these standards, requirements, and expectations to employees
- Employees need to understand the standards, requirements, and expectations
- Management needs to know what employees are doing and the associated risks
- Management needs to accept, evaluate, and appropriately implement feedback
- Employees at all levels need to be accountable for their actions.

To achieve these attributes, the DSO has commissioned the development and implementation of an Integrated Site Maintenance Manual, to consistently implement a Site-wide work control process consistent with principles of ISM. Additional details about this manual are included in subsequent paragraphs in this section. This manual will provide a foundation for management to identify and

communicate their standards, requirements, and expectations to employees involved in performing work at the INEEL. To ensure that these standards, responsibilities, and expectations are communicated by management and understood by employees, employees involved with performing work at the INEEL will be trained in the work control process and in other relevant areas, including competency. This requires a comprehensive training program in which trainees demonstrate their understanding by passing tests. To ensure that management knows what employees are doing and understand the associated risks. LMITCO will establish criteria regarding the time that management spends at the work site and what they do and look for during this time. To instill the concept of continuous improvement, a process for soliciting, evaluating, and implementing feedback will be established. Finally, after employees understand management's standards, requirements, and expectations the performance assessment process will be enhanced such that employees at all levels will be accountable for their actions.

Before the accident, LMITCO began to incorporate the principles of EWP in the work control process. An important part of the EWP process includes a feedback mechanism that allows craft personnel to communicate problems and concerns. Facility specific EWP teams have been established to evaluate and improve the work control process. Many of the actions discussed in Subsection 3.13 also apply to ensuring work control effectiveness. Appendix C talks about establishing the function of Director of Site Operations and developing an Integrated Site Maintenance Manual. This manual will provide "one stop shopping" for personnel involved in the work control process (safety, ISM concerns, VPP attributes, facility authorization basis guidelines, lessons learned from DOE observations, and operating experience weekly summaries). Among other things it will define the work control process, delineate responsibilities, and establish relationships between operations, maintenance, and support organizations. This manual will ensure adequate guidance for performing hazard evaluations and stress the importance of capturing all potential and credible hazards for both the work and the surrounding area. Site Area Directors will participate directly in writing this manual, the Site Integrated Maintenance Plan, and a Site Integrated Maintenance Implementation Plan. The Site Area Directors' direct involvement in writing these documents will result in increased understanding and ownership by management of the work control system and create a "one stop shop" for workers associated with the work control process. The previous section (Subsection 3.13) also discussed establishing training requirements and responsibilities for everyone involved in the work control process, and the other actions discussed in Subsection 3.13.

At present, LMITCO has implemented the "Site Area Director" concept which positions mature, experienced, knowledgeable managers, who are responsible for their facilities and all work that is performed within them, directly in the review and approval process before work can begin. This concept will require Site Area Directors, managers, supervisors, and all employees to better understand facility-specific hazards and their safety roles and responsibilities, including the vigilant adherence to procedures and work control documents. The Site Area Directors will be well versed in the Integrated Site Maintenance Manual, the lockout and tagout procedure, and the outage coordination process. The Site Area Directors will hold a daily Plan of the Day meeting. This meeting will provide a forum for discussing all work to be performed in the area and provide a means for the integration of resources and coordination of work activities. This Site Area Director concept significantly increases the direct involvement of knowledgeable managers in reviewing work. The Site Area Directors have as a major focus coaching individuals on implementation of the work control system.

The DSO will establish requirements specifying the amount of time that line-management (managers, supervisors foremen, technical leads) spend at the job site, with emphasis on routinely overseeing work, assessing safety conditions, and obtaining informal employee feedback. After implementation, the Site Area Directors will assess the effectiveness of this action and associated impacts at their facilities. Appropriate adjustments will be made. This action will include preparing a procedure(s) to clearly define the roles and responsibilities of the recently created Site Area Director

position, making them responsible to ensure that the work control process is effective. LMITCO has established a Senior Supervisory Watch, where a member of line management oversees maintenance activities in progress. At the direction of the DSO, the Senior Supervisory Watch will remain in effect until the Site Integrated Maintenance Implementation Plan is completed.

LMITCO will establish an independent review process for work orders determined to be highly hazardous or complex. Criteria will be established to determine when this independent review is required. The independent review will consist of different personnel from the same disciplines used in developing the original work order, and will be completed before obtaining authorization to perform the work.

To increase the effectiveness of the work control system, LMITCO will standardize maintenance processes to include using only members from a core group of facility specific, trained planners to perform final planning activities for all written maintenance work orders. LMITCO will also establish training requirements and responsibilities and develop training modules for everyone involved in the work control process (i.e. planners, foremen, supervisors, ESH&Q support personnel, facility engineers, and facility operators).

LMITCO will continue to provide VPP Supervisor and Management Training in conjunction with training supervisors and managers on applicable conduct of operations and maintenance modules to enable them to achieve a clear understanding of their roles and responsibilities.

Employees need to have regular feedback to improve the way they perform their job. To this end, all employees will receive regular feedback, making accountability a process rather than an event. LMITCO will develop and implement an accountability tool for bargaining unit personnel. Nonrepresented employees will be held accountable through the established performance appraisal process. This change will open the lines of communication within the company.

To measure the effectiveness of implementing the corrective actions detailed in this section, LMITCO will perform an independent assessment to document implementation and determine if the implementation of the corrective actions has achieved the intended result.

These corrective actions are designed to address issues related to this judgment of need in the Investigation Report and the following LMITCO management and ID assessments:

- LMITCO Integrated Safety Management System Description Document and Implementation Plan, August 31, 1998
- Lockheed-Martin Risk Management Assessment of LMITCO Work Control Activities at the INEEL, September 7-18, 1998
- Assessment Report, Department of Energy, Idaho Operations Office Followup Review of Corrective Actions to LMITCO Work Control Program management Assessment ARM/PA 97-03, Report No. ARM/PAD 98-01, August 14, 1998
- LMITCO Independent Performance Assessment, Lockout/Tagout, Site-wide, 98-IS-018, August 19, 1998
- LMITCO Independent Performance Assessment, Conduct of Operations Assessment of Water Reactor Research Test Facility, performed February 23 & 24, 1998, 98-OP-003.

3.14.4 Corrective Action Milestones and Schedule

Table 3.14-1. Scheduled corrective actions.

	Corrective Action	Responsibility and Organization	Due Date
3.14.4.1	Establish the Site Operations Directorate.	President, LMITCO; W. J. Denson	Completed
3.14.4.2	Develop an Integrated Site Maintenance Manual. (See implementation action in 3.13.4.15)	Director, Site Operations; W. Gay	12/98
3.14.4.3	Implement and enforce a management training program to achieve a clear understanding of roles and responsibilities in conjunction with work orders and associated management systems. (See additional training action in 3.13.4.12.	Director, Site Operations; W. Gay	4/99
3.14.4.4	Clearly define the roles and responsibilities of the recently created Site Area Director positions, making them responsible to assure that the work control process is effective.	Director, Site Operations; W. Gay	Completed
3.14.4.5	Establish line management field involvement criteria and incorporate it into the self-assessment process.	Director, Site Operations; W. Gay	12/98
3.14.4.6	Establish the Senior Supervisory Watch to directly oversee maintenance activities in progress at the job site based on the risk and complexity of the task.	Director, Site Operations, W. Gay	Completed
3.14.4.7	Establish an independent review process for work orders determined to be highly hazardous or complex.	Director, Site Operations; W. Gay	12/98
3.14.4.8	In the Integrated Site Maintenance Manual, standardize LMITCO maintenance processes to include using only members from a core group of, facility specific, trained planners to perform final planning activities for all written maintenance work orders.	Director, Site Operations; W. Gay	12/98
3.14.4.9	Establish training requirements and responsibilities for everyone involved in the work control process.	Director, Site Operations; W. Gay	12/98
3.14.4.10	Continue VPP Supervisor and Management training on a quarterly basis.	Director, Site Operations; W. Gay	Completed
3.14.4.11	Enhance the accountability/performance appraisal process by implementing an accountability tool for the bargaining unit.	Union presidents	12/98

	Corrective Action	Responsibility and Organization	Due Date
3.14.4.12	Enhance the accountability/performance appraisal process by establishing more rigorous and measurable performance standards for management and nonrepresented employees.	Vice President, Human Relations; J. Kuck, acting Director, Site Operations; W. Gay	11/98
3.14.4.13	Perform an independent assessment of the progress of implementing the corrective actions identified in this section.	Director, Site Operations; W. Gay	7/99

NOTE: Corrective Action scheduled completion dates:

Immediate & prompt actions	Completed before response report issued
Near-term actions	Scheduled for completion on or before 1/99
ISM-integrated actions	Scheduled for completion on or before 8/99
Long-term actions	Scheduled for completion

3.15 Outage Planning Process Improvements

3.15.1 Judgment of Need

LMITCO needs to provide additional guidance in the outage request procedure to assure documentation of any controls associated with outages that may impact safety and to provide additional guidance to assure that appropriate personnel such as the fire protection engineer are included in the outage planning process when appropriate. (Investigation Report, pp. viii and 57)

3.15.2 Background and Analysis

The LMITCO outage procedure (MCP-2, "Outages") is used to provide a consistent method for approval, coordination and notification of outages to prevent a significant reduction or interruptions to operations that would result from removing a system or item from service. Outages must be initiated, performed, and recovered in a safe, controlled manner.

A LMITCO review of MCP-2 indicated that the Outage Request form could be improved to provide a section that documents the controls that may impact safety and need to be in place throughout all phases of an outage. The procedure describes the process that the outage coordinator follows to initiate an outage. It also contains the Outage Request form, which lists disciplines that may be required to approve the outage, and provides space for the inclusion of disciplines that are not listed. The form also lists organizations that may need to be notified when the outage occurs. Enhancements can be made to the criteria regarding when a particular discipline needs to be notified or included in the planning and approval process. The procedure must also stress the point that the outage request form is a notification document only, not a work document for either maintenance or construction activities.

3.15.3 Description of Corrective Action(s)

LMITCO reviewed MCP-2, "Outages" and the Outage Request form and determined that provisions need to be made to document controls that might impact safety associated with each phase of the outage. LMITCO further determined that additional rigor and discipline need to be applied when and to what extent organizations, such as Life Safety Systems, Security, Fire Protection Engineer, Emergency Preparedness, etc., participate in the outage planning and approval process.

LMITCO will revise MCP-2 and the Outage Request form to include (a) provisions for the outage coordinator to identify and document safety impacting hazards associated with the outage; (b) the controls that need to be established for each phase of the outage;. (c) criteria for when and to what extent the outage coordinator needs to involve other support organizations as opposed to making a decision themselves; (d) clarification that Outage Request forms are notification documents, not work control documents; (e) specific instructions that the planner, not the outage coordinator, will be responsible to establish the controls that are identified and documented on work orders and outage request forms; and (f) a statement that any employee reviewing or receiving the outage notification can and has the authority and responsibility to "stop work" on the outage until all of their concerns are satisfied.

MCP-2 and the Outage Request form will be added to the Integrated Site Maintenance Manual.

3.15.4 Corrective Action Milestones and Schedule

Table 3.15-1. Scheduled corrective actions.

	Corrective Action	Responsibility and Organization	Due Date
3.15.4.1	Revise MCP-2 and the Outage Request form to include the following provisions for documenting safety controls that need to be established for each phase of the outage: • Include a checklist/table that reviews and identifies hazards related to the outage for the responsible line manager and personnel responsible for planning the work. • Provide criteria specifying when the outage coordinator needs to involve other support organizations in the approval process (e.g., Security, Fire Protection, Emergency Preparedness, Engineering etc.). • Include notification and approval for the fire protection engineer, Fire Department, and incident response team, etc., if hazardous work or operations are involved; include briefings to these groups. • Evaluate the impact on Emergency Control Center operations and the affected vital/essential systems and components. • Make it clear that the Outage Request form is an outage notification document, not a work control document.	Director, Site Operations; W. Gay	12/98
3.15.4.2	Include the revised MCP-2 and Outage Request form in the Integrated Site Maintenance Manual.	Director, Site Operations; W. Gay	12/98

NOTE: Corrective Action scheduled completion dates:

Immediate & prompt actions	Completed before response report issued
Near-term actions	Scheduled for completion on or before 1/99
ISM-integrated actions	Scheduled for completion on or before 8/99
Long-term actions	Scheduled for completion

3.16 Training on CO_2 Hazards

3.16.1 Judgment of Need

LMITCO needs to institutionalize training and incorporate information about CO_2 hazards into INEEL training programs. This should include:

- CO_2 hazard recognition (including predischarge alarm recognition)
- Emergency preparedness and immediate response and rescue to CO_2 discharges
- Egress requirements and CO_2 evacuation drills for all personnel performing work in buildings protected with CO_2 flood systems
- Clarification on the limitations of system impairments for personnel protection, and the use of lockout/tagout.

3.16.2 Background and Analysis

At the time of the accident neither ESH&QA training nor the INEEL site access training, both of which are part of the General Employee Training, addressed CO_2 hazards. Fire suppression systems that employ hazardous agents such as CO_2 are used only in a few INEEL facilities where access is controlled. Therefore, it would be appropriate to include training on these hazards with site access training for the facilities that use these fire suppression systems.

Along with training on CO_2 hazards there may be other hazards (i.e., oxygen deficient environments, corrosiveness, reactivity, flammability, etc.) that need to be incorporated into either the ESH&QA training for hazards that affect large groups of employees or INEEL site access training for hazards limited to specific facilities. As a part of the corrective action described in Subsection 3.13.4, a facility hazard database will be established. By regularly drawing from the hazard database, the training organization will be able to ensure that hazards are identified and incorporated into the appropriate training programs at the INEEL.

Lockout/tagout training is based on MCP-1059, "Lockout and Tagout." However, this MCP does not address the use of impairment tags since they are not permitted at the INEEL for personnel protection. In addition, MCP-1059 does not clearly address the requirements for the use of lockout/tagout when work is being performed in the vicinity of, but not on, a hazardous energy source. Therefore, training on lockout/tagout did not specifically address the need for locking out and tagging out systems like the TRA-648 CO_2 fire suppression system.

3.16.3 Description of Corrective Action(s)

Training on CO_2 hazards will be provided to employees that are involved in the work planing process and those who perform regular or occasional work in areas protected by CO_2 fire suppression systems. As a minimum, this training will address CO_2 hazard recognition (including predischarge alarm recognition), emergency preparedness and immediate response and rescue to CO_2 discharges, egress requirements, and CO_2 evacuation.

CO_2 fire suppression systems training will be implemented in two stages. In the first stage, the CO_2 hazard training will be developed and presented to the individuals who are involved in the work planing process or who perform routine or occasional work in areas protected by CO_2 fire suppression

systems. CO_2 systems will remain out of service until training has been completed. Personnel who do not successfully complete this training will not be allowed to perform work in areas protected by a CO_2 fire suppression system unless a trained individual temporarily escorts them until they can be trained. Managers will be required to add CO_2 training to the Individual Training Plan for each person required to enter these areas. This training would be tracked on the TRAIN system. In the second stage, the appropriate portions of CO_2 hazard training will be incorporated into the ESH&QA and INEEL site access training programs.

The current ESH&QA training and the INEEL site access training program will be reviewed to ensure that training is included on existing hazards (i.e., other gases that could result in an oxygen deficient environment, corrosiveness, reactivity, flammability, etc.). This will be accomplished by comparing the hazards covered in the training curriculum with those in the facility hazard database. Training will then be provided to all required personnel on the items identified from the review, that are not in the current ESH&QA and the INEEL site access training programs. This training will be tracked on the TRAIN system. Identified hazards will be incorporated into the appropriate sections of the initial and continuing ESH&QA and INEEL site access training programs. A standard job-specific new employee checklist will be developed. This checklist will be used to enhance awareness of the work area, procedures used on the job, and job specific hazards, etc.

Lockout/Tagout training on MCP-1059 will be updated to include the changes made to MCP-1059, in response to this accident. This training will address the requirement that impairment tags are not to be used for personnel protection in lieu of lockout/tagout.

An Operations Training group has been established as a part of the Training Department reorganization. This group is responsible to develop or enhance and integrate Site-wide and facility specific training programs supporting the Conduct of Operations and the Site Integrated Maintenance Program for the INEEL as described in Appendix C. These changes provide the basis for effective corrective action implementation. This group will be responsible for the development or enhancement, integration, and implementation of the training discussed in these corrective actions.

3.16.4 Corrective Action Milestones and Schedule

Table 3.16-1. Scheduled corrective actions.

	Corrective Actions	Responsibility and Organization	Due Date
3.16.4.1	Develop the training and exam for CO_2.	Director, Site Operations; W. Gay	10/98
3.16.4.2	Develop guidance for managers to identify the target audience attendees for CO_2 training.	Director, Site Operations; W. Gay	10/98
3.16.4.3	Identify personnel who require training on CO_2 systems. Track in TRAIN system.	Director, Site Operations; W. Gay	10/98
3.16.4.4	Conduct CO_2 training and administer exams.	Director, Site Operations; W. Gay	10/98
3.16.4.5	Remediate exam failures on CO_2 hazards training.	Director, Site Operations; W. Gay	11/98

	Corrective Actions	Responsibility and Organization	Due Date
3.16.4.6	Incorporate the appropriate portions of CO_2 hazard training into the ESH&QA and INEEL site access training programs.	Director, Site Operations; W. Gay	2/99
3.16.4.7	With assistance from ESH&QA, conduct a review of the ESH&QA training program to ensure that training on existing hazards is included.	Director, Site Operations; W. Gay	10/98
3.16.4.8	Develop and provide training on any additional hazards identified from the review of the ESH&QA training program.	Director, Site Operations; W. Gay	12/98
3.16.4.9	Incorporate any additional hazards identified in the review into the ESH&QA training program.	Director, Site Operations; W. Gay	2/99
3.16.4.10	Conduct a review of the INEEL site access training to ensure that all required training on facility specific hazards is included.	Director, Site Operations; W. Gay	1/99
3.16.4.11	Develop and provide training on additional facility specific hazards identified from the review of the INEEL site access training to applicable personnel.	Director, Site Operations; W. Gay	1/99
3.16.4.12	Incorporate any additional facility specific hazards identified in the assessment into the INEEL site access training.	Director, Site Operations; W. Gay	5/99
3.16.4.13	Develop and implement a standard format for a job-specific new employee checklist that includes items such as tour of work area, procedures used on the job, job specific hazards, etc.	Director, Site Operations; W. Gay	4/99
3.16.4.14	Develop and conduct training for required personnel on revisions to MCP-1059 regarding impairment in lieu of lockout/tagout.	Director, Site Operations; W. Gay	12/98
3.16.4.15	Reorganize the Training Department to include an Operations Training Group responsible for training on the Conduct of Operations and the Integrated Site Maintenance Manual.	Director, Site Operations; W. Gay	Complete

NOTE: Corrective Action scheduled completion dates:

Immediate & prompt actions	Completed before response report issued
Near-term actions	Scheduled for completion on or before 1/99
ISM-integrated actions	Scheduled for completion on or before 8/99
Long-term actions	Scheduled for completion

3.17 Training on Industry Standards Related to CO_2 Hazards

3.17.1 Judgment of Need

LMITCO needs to provide training for work planners, fire protection engineers and safety engineers in industry requirements related to CO_2 including personal protection, warning signs, clear exit pathways and preparations for immediate rescue. (Investigation Report, pp. viii and 47)

3.17.2 Background and Analysis

Before the accident, LMITCO had chartered an ESH&QA Personnel Development Integrated Product Team (IPT) to define and implement a professional excellence program management plan. The purpose of this program is to establish a standards-based training and qualification program that relies on a documented process. The IPT will establish an ESH&QA General Technical Base Qualification Standard. The General Technical Base Qualification Standard has several categories (including industry requirements, codes, and standards) for each of the identified disciplines (including Fire Protection and Safety Engineers) wherein personnel will be required to demonstrate competency.

The training and qualifications for the Work Planners is addressed in judgment of need 3.13 "Work Control Systems Improvements" and judgment of need 3.14 "Assuring Work Control System Effectiveness." The corrective actions for this judgment of need address the training for work planners on industry standards and requirements related to CO_2 fire suppression systems including personal protection, warning signs, clear exit pathways, and preparations for immediate rescue.

3.17.3 Description of Corrective Actions

The corrective actions for this judgment of need will insure that planners, Fire Protection engineers, and Safety engineers are trained and competent in using industry standards related to CO_2 fire suppression systems, personal protection, warning signs, clear exit pathways, and preparations for immediate rescue. This training will be accomplished by identifying applicable industry standards e.g., NFPA STD 12, 70, and 72, developing the curriculum, and conducting the training. To ensure that personnel obtain the desired knowledge, they must satisfactorily complete an exam.

A professional excellence program will also be established to ensure that fire protection engineers and safety engineers are qualified. This standards-based training and qualification program will rely on a documented process for ESH&QA personnel in both support and line organizations, and will ensure that these individuals are competent in using the codes and standards applicable to their discipline including those associated with other hazards, such as oxygen deficient environmental, corrosiveness, reactivity, flammability, etc.

Facility-specific training will be provided by the appropriate directorates to augment each discipline's specific qualification standard. ESH&QA program managers will implement the qualification program. The IPT will recommend the appropriate mechanisms for implementing the professional excellence program and will oversee the documentation of those mechanisms in appropriate policies, plans, checklists, procedures, etc.

The four deliverables identified for the Professional Excellence Program are (a) knowledge and skills of ESH&QA professionals, including CO_2 industrial standards for fire protection and safety engineers; (b) discipline-specific qualification standards; (c) training materials required by the Technical

Base Qualification Standards; and (d) implementation and maintenance of a professional excellence program.

3.17.4 Corrective Action Milestones and Schedule

Table 3.17-1. Scheduled corrective actions.

	Corrective Actions	Responsibility and Organization	Due Date
3.17.4.1	Develop training on industry standards applicable to CO_2 fire suppression systems.	Director, Site Operations; W. Gay	11/98
3.17.4.2	Conduct industry standards training (applicable to CO_2 systems) for work planners, fire protection engineers, and safety engineers who work on CO_2 systems.	Director, Site Operations; W. Gay	11/98
3.17.4.3	Conduct make up sessions as required for industry standards applicable toCO_2.	Director, Site Operations; W. Gay	12/98
3.17.4.4	Remediate exam failures on industry standards applicable to CO_2. systems.	Director, Site Operations; W. Gay	1/99
3.17.4.5	Incorporate CO_2 training into the initial and continuing training programs for Work Planners who plan work on CO_2 systems (See Subsection 3.13 and 3.14). Track on TRAIN system.	Director, Site Operations; W. Gay	2/99
3.17.4.6	Determine knowledge and skills for each ESH&QA discipline, including the knowledge and skills associated with the codes and standards as they apply to each discipline.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	12/98
3.17.4.7	Develop and obtain approval of the Technical Base Qualification Standard for each discipline.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	4/99
3.17.4.8	Identify, obtain, or develop training materials required by the Technical Base Qualification Standards.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	4/99

	Corrective Actions	Responsibility and Organization	Due Date
3.17.4.9	Conduct/administer training in accordance with the Technical Base Qualification Standards.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	7/99

NOTE: Corrective Action scheduled completion dates:

Immediate & prompt actions	Completed before response report issued
Near-term actions	Scheduled for completion on or before 1/99
ISM-integrated actions	Scheduled for completion on or before 8/99
Long-term actions	Scheduled for completion

3.18 Training on Lessons Learned from the TRA-648 CO_2 Discharge Accident

3.18.1 Judgment of Need

LMITCO needs to conduct Site-wide lessons learned training on the root causes and corrective actions associated with this accident, including those related to the level of hazard, protective lockout, emergency preparedness and immediate response. (Investigation Report pp. ix and 47)

3.18.2 Background and Analysis

This judgment of need addresses Site-wide training specific to this accident. LMITCO reviewed this issue and concluded that there was a second aspect of lessons learned of a broader nature. From the specific view, LMITCO recognized the need to share with company personnel the lessons learned on this accident concerning hazards, use of protective lockout, emergency preparedness, and immediate response as soon as practical after the occurrence. This early communication is detailed below, including actions complete and those planned for the future.

LMITCO also concluded that from the broader view, enhancements should be made to the current Lessons Learned Program. These changes are directed at improving the collection, screening, and dissemination of information, and capturing lessons learned in company documents that control the performance of work. As described below, some of these changes are complete, and others are scheduled for completion after issue of this response report.

3.18.3 Description of Corrective Action(s)

The first formal sharing within LMITCO of Lessons Learned from the TRA-648 accident occurred at 6:34 p.m. on July 30, 1998. A "Management FYI" bulletin was electronically sent to all company supervisors and above. This bulletin contained a link to the text of the initial ORPS Occurrence Report issued at 6:02 a.m. on July 29, 1998.

Multiple training sessions were presented to a wide selection of LMITCO, ID, and subcontractor personnel. The target audience, selected by Area Directors and their subordinate managers and supervisors, included those personnel likely to encounter work situations which could benefit from the lessons learned and details of this accident. This training was based on the information extant following the briefing of INEEL management by the DOE Board. A lessons learned training plan was developed by TRA management and provided to Area Directors, who in turn provided the training to their subordinates. The training began on August 24, 1998, and by August 28, 1998, approximately 1,131 personnel had been trained by their management. By September 23, 1998, this number had reached 2,235. LMITCO organizations represented in the audience included the INEEL Institute; Human Resources; Business Management; Environmental Management; Applied Engineering and Development; Nuclear Operations; Site Services; and ESH&QA. Training was performed using the lesson plan, WCHR0098, "Work Control & Hazard Recognition—Preliminary Lessons Learned From the July 28, 1998 Fatality at the Test Reactor Area." This training covered the level of hazard, protective lockout, emergency preparedness, and immediate response to the extent they were understood. The attendance at these initial training sessions was analyzed to ensure that appropriate audiences were being reached. It was determined that there were additional personnel who needed the training. A second round of this training will be evaluated. The target audience will be identified and this training will be completed by October 31, 1998.

LMITCO recognizes a longer-term need for additional general training for a broad target audience. This training will be provided by January 31, 1999. The purpose will be to:

- Provide a general understanding of the root causes and corrective actions associated with this accident.

- Connect these accident-specific topics with general topics such as the ISM System, hazard identification, and conservative general work practices.

The target employees will include all LMITCO personnel, plus DOE, and subcontractor personnel selected by their management in positions of management, staff and craft. This training will incorporate the information contained in the DOE Board's Investigation Report and the response to it prepared by LMITCO and ID. A video tape will be prepared to support this presentation and to provide future training to LMITCO, DOE, and other contractors.

The Lessons Learned Program will be restructured. Internal/Site requirements will be developed to provide a more efficient, user friendly structure that will have less involvement by the worker. A plan to restructure the program will be developed for and coordinated with the Site Operations Directorate. The program will collect lessons learned information from a variety of sources, review and filter the information for pertinence to the work being performed at the sites, and disseminate only the lessons learned information that relates and will enhance the employees' job function.

When applicable to LMITCO facilities and activities, the lessons learned will be incorporated into company work control documents such as procedures and drawings. These document changes will be tracked in a computer based system until complete.

Until the Lessons Learned Program can be restructured, the current program will continue as it currently exists today.

Lessons Learned tools are directed at improving access to past lessons learned. The current system allows for searches of lessons learned information from several sources covering DOE, the commercial nuclear industry, and other industries. Currently, these searches must be performed by the Office Assistant at the Lessons Learned Office. By year's end, LMITCO personnel will be able to access lessons learned reports from a local Intranet homepage and perform word and text searches.

Training will be prepared for Lessons Learned Program personnel, management, and the users of the system. Expedited training will be provided to alert work planners when the enhanced lessons learned word and search capability become available. A test will be used to measure the effectiveness of this training to ensure the audiences have been trained.

Lessons learned process enhancement will be focused upon the effective capture of information on a long-term basis. As noted above, the issues management system will be used to document the actions necessary to capture lessons learned. To ensure permanent capture, lessons learned that cause the revision of LMITCO documents will be treated similar to external technical requirements. A computer database using RDD-100 software will be used to capture the lessons learned source and the identity of the implementing documents to ensure permanent capture and for future reference.

3.18.4 Corrective Action Milestones and Schedule

Table 3.18-1. Scheduled corrective actions.

	Corrective Action	Responsibility and Organization	Due Date
3.18.4.1	Complete initial training to a target audience of personnel from LMITCO, ID, and subcontractors to cover the accident events, lessons learned on the root causes, and immediate corrective actions.	Director, Site Operations; W. Gay	9/98 (complete)
3.18.4.2	Analyze the attendance at the initial accident training and complete makeup training to those in the target audience not in attendance.	Director, Site Operations; W. Gay	10/98
3.18.4.3	Prepare a video tape for usage in Site-wide lessons learned training on the accident.	Director, Site Operations; W. Gay	11/98
3.18.4.4	Prepare and complete Site-wide training for personnel from LMITCO, ID, and subcontractors on the July 28, 1998 TRA accident.	Director, Site Operations; W. Gay	1/99
3.18.4.5	Prepare and provide the requirements to restructure the Lessons Learned Program.	Director, Site Operations; W. Gay	12/98
3.18.4.6	Coordinate and prepare a plan to restructure the Lessons Learned Program.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	2/99
3.18.4.7	Implement the newly restructured Lessons Learned Program	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	5/99
3.18.4.8	Provide intranet access to lessons learned archive file and include text search capabilities.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	12/98
3.18.4.9	Complete general employee and managers training and testing on the lessons learned program when it is revised.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	6/99
3.18.4.10	Complete training and testing on the revised Lessons Learned Program to work planners and their support personnel	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	6/99

	Corrective Action	Responsibility and Organization	Due Date
3.18.4.11	Complete training and testing on the revised lessons learned program to the program staff including the coordinators.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	6/99
3.18.4.12	Revise MCP-192, "Lessons Learned" or other LMITCO procedures, as required, to describe the capture of changes to LMITCO documents caused by lessons learned.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	6/99

NOTE: Corrective Action scheduled completion dates:

Immediate & prompt actions	Completed before response report issued
Near-term actions	Scheduled for completion on or before 1/99
ISM-integrated actions	Scheduled for completion on or before 8/99
Long-term actions	Scheduled for completion

3.19 Issues Management Process Improvements

3.19.1 Judgment of Need

ID and LMITCO need to strengthen the INEEL issues management process to ensure effective prioritization and tracking of issues, identification and resolution of management system weaknesses, and field follow-up, performance-based validation, and closure of corrective actions. (Investigation Report pp. ix and 65)

This judgment of need is derived from the contributing cause, "Failure of LMITCO to take corrective actions and apply lessons learned from previous ID and LMITCO to exercise sufficient monitoring and feedback of this process to ensure correction of major safety deficiencies that are impacting work safety." (Investigation Report, p. 64)

3.19.2 Background and Analysis

DOE-ID

There are no DOE standards that provide complex-wide guidance on issues management. However, some requirements for issues management processes and systems are identified in DOE Orders 225.1A, "Accident Investigations;" 5700.6C, "Quality Assurance;" 231.1A, "Occurrence Reporting;" and 425.1, "Startup and Restart of Nuclear Facilities." The DOE-HQ Safety Management Implementation Team is developing recommendations for complex-wide line management to increase the effectiveness of tracking and follow-up activities with a target completion date of December 1998. Recently, the Defense Nuclear Facilities Safety Board issued Recommendation 98-1, which advises DOE to improve its issues management process.

The Accident Investigation Report states "Prioritization, tracking, analysis and closure for issues and commitment at ID and LMITCO are disjointed and lack effectiveness." It is this lack of effectiveness that is the real problem. ID management has not committed to holding itself responsible for tracking issues and ensuring that they are resolved.

The ID Notice on Issues Management does not address all the components identified by this judgment of need. The Notice identifies the Issues Management Electronic Database (IMED) as the ID tracking system for safety and health related issues. ID management and staff commonly do not use this system. Issues identified by Policy and Assurance Division line and independent appraisals and by other sources have not been routinely entered into this tracking system. ID does not periodically review the substance or status of IMED items in management meetings. Items have been closed without effective resolution of the problems.

The ID Notice on ESH&QA Oversight defines requirements and criteria "for monitoring contractor and ID corrective actions and milestones and assessing their effectiveness." The requirements of this Notice have not been fully or effectively implemented and need to be further clarified. Emphasis (i.e. management engagement, organizational accountability, staff implementation) needs to be placed on causal analysis, evaluating the adequacy of corrective actions, field follow-up, and performance-based validation. The issue management system has not been integrated with the overall technical information system addressed in Subsection 3.23. Additional problems with the oversight process are addressed in Subsection 3.23.

In summary, deficiencies are:

- ID's management has not enforced accountability for resolving ESH&QA issues.
- ID's management has not established an issues management system that addresses risk-based prioritization, root cause analysis, field follow-up, performance-based validation, and closure.
- The IMED software currently used by ID is difficult to use and is used as an excuse for lack of issue management.
- ID is not adequately evaluating, field checking, or objectively validating the closure of contractor corrective actions.
- The ID issue management process is not integrated with the overall technical information system.

LMITCO

The issues management processes of the previous INEEL contractors were extant at the time of contract turnover to LMITCO in 1994. It was necessary to consolidate the separate processes into a single process. Goals of the consolidation were to provide a single streamlined electronic process based upon management accountability, and a graded approach to issues management rigor based upon risk.

Some of these goals were met. The streamlining was achieved by utilizing the company's intranet software as a tool to control the entire issues management process from the initiation of process deficiencies through closure. This issues management system software was called "ICARE," and contained several modules, including ones for process deficiencies and safety concerns. ICARE greatly accelerated the administrative portions of the issues management process by providing a paperless system. Also, the electronic software is very efficient in generating reports.

However, LMITCO also experienced difficulties with the new consolidated issues management systems. This was confirmed by the LMITCO supplemental root cause analysis of the Investigation Report. It was found that the issues management process needs to be improved to provide managers with accurate feedback about the effectiveness of corrective actions. Managers need to hold themselves and their subordinates accountable for effective implementation and closure of corrective actions. Other weaknesses were present in the following areas: issues prioritization, root cause analysis, corrective action planning, timeliness of corrective actions, corrective action validation and verification, review of the issues management process during independent assessments, issues management training, and performance metrics. These difficulties are reflected in this judgment of need as reported by the Board, LMITCO independent assessments, and in assessment activities reported to LMITCO by ID. These weaknesses were the result of the consolidation of the issues management processes in combination with limited management involvement in monitoring, directing, and controlling the issues management process. The nature of these problems and the need to focus management attention on them led to the comprehensive changes discussed below.

The changes discussed below will also resolve two areas of concern for the full implementation of the Integrated Safety Management System. These are ISM Gaps 14 and 16 of Appendix B.

3.19.3 Description of Corrective Actions

DOE-ID

In its conclusions, the Accident Board stated that "Management at all levels must place a higher priority on obtaining realistic performance feedback and on proactive identification and correction of systemic weaknesses if further accidents are to be avoided."

The ID Deputy Manager has initiated actions to revitalize the existing Issues Management process and to enforce accountability. He has requested monthly meetings with the Director of the Policy and Assurance Division to review the status of appraisal findings and the resulting corrective actions. He has also requested commitments from different ID tracking systems to review the status of these items with the AM's at the routine weekly staff meetings. ID has established a new position to manage the issue management process. The Deputy Manager currently meets with each AM periodically to review Operating Plan status. ID will expand the agenda of these meetings to include the status of issues associated with significant risk as well as a report on issues management performance measures, such as number of overdue issues, percent of issues overdue, average number of days overdue, etc. In addition, ID will incorporate the compliance with specific requirements for use of the ID issue management process into each Director's and AM's performance agreement as a critical element. The Deputy Manager will meet periodically with LMITCO Senior Management to discuss status of corrective actions in this consolidated response plan and issues identified by the SORB.

ID will use a requirements-based analysis to change the ID issue management process to incorporate all the elements of an effective program as identified in this Judgment of need. When guidance is available from the DOE Safety Management Implementation Team and in the response to DNFSB Recommendation 98-1, the ID processes will be updated to incorporate the new guidance. ID personnel will be trained on the new process and their role in ensuring its successful implementation. At a later date, a new software tool may be adopted to support issue management. Until that occurs, ID will use the existing IMED system. Existing issues will be reviewed and appropriate issues will be entered into the database as necessary. Issues tracked will be prioritized based on risk, assigned to the correct level of management, analyzed for cause as appropriate, corrective actions will be developed or checked, and closed based on performance.

The issue management process will be connected to the other processes identified as part of the overall technical information system. (More information on corrective actions for technical information systems is included in Subsection 3.23.)

In conjunction with the corrective actions identified in 3.23 to improve the ID oversight process, ID will improve its rigor and discipline in adequately evaluating, field checking, or objectively validating the closure of contractor corrective actions. Corrective actions addressing the need to train and implement the changes are contained in Subsection 3.23.

The Assistant Manager, Office of Program Execution is responsible for the completion of corrective actions identified in this Consolidated Response Plan. The Assistant Manager, Environment, Safety, Health and Quality Assurance is responsible for evaluating the effectiveness of the corrective actions. The effectiveness of ID's issues management system will be independently evaluated in 6 months to ensure it is on the right track and to provide input for continuous improvement.

LMITCO

LMITCO will rebuild the company's issues management system to provide surety of the process from issue identification through closure. Goals will include an efficient process with increased involvement of management at all levels. These changes will be reflected in a major revision to procedure MCP-598, "Process Deficiency Resolution," organizational modifications, and personnel training. To ensure that the corrective actions of this response report receive special management attention, they will be handled separately to ensure proper implementation and closure while the issues management process is being rebuilt. The corrective action plans from the past two Type A Accidents will be reviewed to identify any additional action required, and a site operations self assessment program will be established to effectively identify issues in the future. These actions are detailed below.

3.19.3.1 Organizational Modifications

Organizational modifications will be made for two purposes with respect to this judgment of need. First, a CAPO will be established to ensure that the corrective actions from this response report are properly implemented. This office will be used to provide more management oversight of the issues management process, and ensure adequate closure while the normal issues management process is being revised, as discussed elsewhere in this section. The manager of this program office will track and monitor the timely and effective implementation of the corrective actions of this response report, and will be accountable for this function to a new senior management group, SORB. The SORB will consist of the President of LMITCO (chairman), the Director, Site Operations, and the Vice-President and General Manager of Environment, Safety, Health and Quality Assurance. The CAPO will compile and integrate a detailed implementation plan for the corrective actions of this response report, providing schedule, logic, resource loading, and method of verification of completion. This plan will be approved by the SORB and submitted by November 30, 1998 to ID for approval. Another responsibility of the CAPO is to direct the validation that each corrective action is effective in preventing recurrence of the associated problems. Validation will be performed by the company's independent assessors within 90 days of closure of the corrective plan.

The second purpose for organizational modification is to provide support for the revised issues management process. These modifications are discussed below and consist of a new directorate for independent oversight and trending, area review boards, and a program office for the issues management program.

A new directorate, Independent Oversight and Trending, was formed in late August 1998. This organization will contain the Independent Oversight Department and the Trending Center Department. Through the Independent Oversight Department, increased audit sampling of the issues management system has been accomplished. Quarterly audits have been scheduled to assess recently closed corrective actions. This department will also perform independent verification of closure on all corrective actions for deficiencies specified "significant" through the prioritization process. Finally, Independent Oversight will assess the effectiveness of the corrective action process and report the results to the Corrective Action Review Board (CARB) and SORB during March and September of 1999. The new Trending Center Department is responsible for developing and establishing a system of performance measures for the company, and using the information collected to evaluate performance in management systems, identify trends and significant issues, and to report the results to senior management. The Trending Center, with support from the Quality Assurance Directorate, will establish the set of performance measures for the issues management system. The Trending Center will collect, monitor, and analyze the performance of the system and provide monthly reports to senior management beginning at the end of 1998.

The Quality Assurance directorate will establish a Program Manager for Issues Management by November 15, 1998. The Program Manager will be responsible for developing, establishing, and implementing the revised issues management system and for monitoring the effectiveness of the system through the various applicable assessments and performance measures. The manager will be responsible for maintenance of the issues management procedure, including its supporting processes of root cause analysis and prioritization, and will prepare and provide training to all system users. Results will be provided to management through the Quality Assurance Director and other communications paths within LMITCO. The Program Manager will also be responsible for training on the issues management system.

LMITCO will charter two types of management boards to focus attention on the issues management process, and to improve direction and control. The objective of the actions of these Boards is to drive accountability to the managers responsible for issues management actions. These include root cause analysis, prioritization, corrective action planning, implementing corrective actions, capturing records, and timeliness of activities.

First, CARBs will be established for all site areas. Each CARB will be chaired by the Area Director, and staffed by the Operations Manager, and the senior representatives of area quality assurance, engineering and procurement. Other staffing may be added as necessary to support the Board. The CARB will meet at least monthly to review and evaluate the issues management process at the area. Process deficiencies will be reviewed for adequacy of prioritization, root cause analysis and corrective action planning, timeliness of processing, and corrective action verification and validation. The CARB will direct the responsible managers to correct any problems in this process. CARB results will be documented and reported to the Senior Operations Review Board. The SORB will also review corrective actions from the 1998 DOE and ID assessments of LMITCO work control, corrective action and procurement.

LMITCO will charter a Senior Operations Review Board consisting of the President (Chairman), the Site Operations Director and the Vice-President and General manager of Environment, Safety, Health and Quality Assurance. Other management will be asked to participate as required to support the Board in its functions. The Director of Quality Assurance will be a key support.

The SORB will review the work of the CARBs to ensure that the Issues Management Program is properly functioning and that management is accountable for their assigned issues management responsibilities. The SORB will consider input from ID and LMITCO assessment reports, trending reports, and other sources to augment the CARBs' reports. The SORB will perform the functions of a CARB for company-wide issues on topics such as procurement or broad programs such as Quality Assurance or Training. The SORB will review the corrective actions from the two 1996 Type A accidents and direct further actions by management as necessary to complete the applicable issues management activities and provide verifiable records of completion. The SORB will also ensure that any actions from the previous Type A accidents related to this accident are properly closed at the same time or before their counterparts of this accident.

3.19.3.2 Procedure Revision

The company wide procedure MCP-598, "Process Deficiency Resolution," will be revised to incorporate the following system improvements:

- Incorporate the functions of the CARBs and the SORB
- Incorporate the function of the Issues Management Program Manager

- Revise the definition of "significant" deficiencies to be clearer and more specific
- Require independent verification of the corrective actions on "significant" deficiencies
- Require a documented root cause analysis for all "significant" deficiencies
- Require subject matter experts in the appropriate ESH&QA discipline to perform or lead the performance of prioritization, root cause analysis, and corrective action verification for the responsible manager for the deficiency. This person will also assess the corrective action plan for adequacy in resolving the deficiency and preventing recurrence.
- Establish a validation process for the corrective action plans of "significant" deficiencies to ensure prevention of recurrence.
- Establish new standards for timeliness of performing activities within the issues management system, including revising due dates.

3.19.3.3 Issues Management System Training

The Issues Management Program Manager will establish and provide training on the issues management system upon its revision, and on a permanent recurring basis for system users. This training will include training on root cause analysis, prioritization and the result of benchmarking the Oak Ridge Laboratory ICAR/WECAR programs. It will be provided to preselected target audiences and will be developed according to the company's training procedures for formal or tailgate training as appropriate.

3.19.3.4 Surety of Corrective Actions from Past Type A Accidents

Two actions will be performed to ensure the surety of the corrective action plans from the 1996 Type A accidents. First, the judgments of need, root causes, and contributing causes from those accident responses will be reviewed to identify those which were relevant to preventing this accident. The associated corrective actions that were ineffective will be analyzed to determine the reason for this, and further actions will be taken as appropriate to support the corrective actions from this accident and to further ensure against a recurrence. Of particular interest will be any actions which are not adequate to resolve the associated causes or judgments of need; and actions which were not adequately performed. This review will be directed and managed by the SORB.

The SORB will also direct and manage an assessment of the corrective actions from the 1996 Type A accidents to ensure that the issues management process was followed to completion of the actions. These actions will be assessed for adequacy and timeliness of completion and verification, and for complete records as objective evidence of the actions execution and verification. The Board will direct the responsible management to take any supplemental actions necessary. The results of this action will also be reported to upper management through the LMITCO Compliance Review Board.

3.19.3.5 Site Operations Self Assessment Program

A self-assessment program will be needed by the DSO to ensure adequacy in a variety of attributes, including Conduct of Operations, Conduct of Maintenance, implementation of the ISM System, environmental compliance, implementation of the Quality Assurance Program, housekeeping, work control, and other appropriate topics. The DSO will establish this program at each INEEL area and staff its activities with line management leadership and participation by operations workers and ESH&QA professionals.

3.19.4 Corrective Action Milestones and Schedule

Table 3.19-1. Scheduled corrective actions.

	Corrective Action	Responsibility and Organization	Due Date
3.19.4.1	Initiate routine status reporting on ID open issues.	ID Assistant Manager, Environment, Safety, Health and Quality Assurance; W. Sato	10/98
3.19.4.2	Initiate periodic accountability meetings with Assistant Managers.	ID Deputy Manager; W. Bergholz	10/98
3.19.4.3	Initiate routine DM meeting with the LMITCO Senior Management on SORB issues.	ID Deputy Manager; W. Bergholz	11/98
3.19.4.4	Incorporate issue management as a critical element for Directors and AM's performance agreements	ID Chief Financial Officer; D. Hamer	11/98
3.19.4.5	Review existing issues for inclusion into IMED.	ID Assistant Manager, Environment, Safety, Health and Quality Assurance; W. Sato	12/98
3.19.4.6	Define the requirements of an issue management process	ID Assistant Manager, Office of Assurance and Resource Management; D. Ferri	8/99
3.19.4.7	Design an issue management process	ID Assistant Manager, Office of Assurance and Resource Management; D. Ferri	8/99
3.19.4.8	Complete training of personnel on the process	ID Assistant Manager, Office of Assurance and Resource Management; D. Ferri	8/99
3.19.4.9	Complete implementation of the issue management process.	ID Assistant Manager, Office of Assurance and Resource Management; D. Ferri	8/99
3.19.4.10	Identify improvements to the issue management oversight process. (Perform in conjunction with corrective actions in 3.23.)	ID Assistant Manager, Office of Professional Execution; J. Lyle	8/99
3.19.4.11	Establish the Independent Assessment and Trending Directorate	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	8/98 (Complete)

	Corrective Action	Responsibility and Organization	Due Date
3.19.4.12	Publish first monthly Trending center report to management.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	12/98
3.19.4.13	Establish Program Manager, responsible for developing, establishing, and implementing the issues management system and for monitoring the effectiveness.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	11/98
3.19.4.14	Charter and establish Corrective Action Review Boards (CARB) at INEEL facilities and areas.	Director, Site Operations; W. Gay	11/98
3.19.4.15	Establish the Senior Operations Review Board.	President, LMITCO; W. J. Denson	10/98
3.19.4.16	Review the results of the LMITCO issues management process for the past two Type A accident reports. Report the results to the SORB.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	3/99
3.19.4.17	Review the results of the LMITCO issues management process for the 1998 DOE and ID assessment/surveillance reports of work control activities, corrective action and procurement. Report the results to the SORB.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	9/99
3.19.4.18	Revise the LMITCO issues management procedures to incorporate the improvements of Subsection 3.19.3 of the LMITCO response to the Investigation Report.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	1/99
3.19.4.19	Measure the effectiveness of the Corrective Action review Boards through oversight of activities and records review, as appropriate. Report to the SORB.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	3/99
3.19.4.20	Establish performance metrics to measure the effectiveness of the issues management process.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	1/99

	Corrective Action	Responsibility and Organization	Due Date
3.19.4.21	Establish a Trending Center to capture, monitor, analyze and report the results of the issues management system, including the Lessons Learned program.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	11/98
3.19.4.22	Prepare and provide the initial training on the revised issues management system to users.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	1/99
3.19.4.23	Provide the initial training to potential responsible process deficiency managers and their supporting ESH&QA subject matter experts on the prioritization and root cause analysis techniques used in the revised issues management procedures.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	1/99
3.19.4.24	Perform assessments of corrective action effectiveness and report to CARBs and SORB in March and September of 1999.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	9/99
3.19.4.25	Prepare integration plan to correlate the actions and completion dates of this response report and the SMS Implementation Plan for LMITCO	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	11/98
3.19.4.26	Establish and implement the Site Operations Self-Assessment Program at all INEEL area.	Director, Site Operations; W. Gay	1/99
3.19.4.27	Prepare integrated resource-loaded schedule for those corrective actions and all other major actions of other INEEL improvement initiatives	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	1/99

NOTE: Corrective Action scheduled completion dates:

Immediate & prompt actions	Completed before response report issued
Near-term actions	Scheduled for completion on or before 1/99
ISM-integrated actions	Scheduled for completion on or before 8/99
Long-term actions	Scheduled for completion

3.20 Rescue and Response to CO_2 Discharges

3.20.1 Judgment of Need

LMITCO needs to ensure the ability to accomplish immediate rescue and response to planned and unplanned CO_2 discharges, including the capability to deal with mass casualties having insufficient oxygen. (Investigation Report pp. ix and 21)

3.20.2 Background and Analysis

This judgment of need specifically addresses the need to respond effectively to accidents involving CO_2 discharges. Review of the Accident Board report and the LMITCO review of its capabilities to respond to this type of accident identified issued relating to (1) the potential shortage of oxygen bottles in response vehicles, (2) staging of SCBAs and training of individuals in their use, (3) the timeliness of the response of area incident response vehicles and trained personnel, (4) the availability of response equipment staged in the TRA Emergency Control Center, and (5) the adequacy of LMITCO planning for mass casualty accidents. Going beyond the concerns raised about response capabilities for CO_2 accidents, LMITCO also reviewed response and rescue capabilities for more general types of accidents. This review identified issues relating to (1) staging of various types of emergency response/rescue equipment and training individuals in its use, (2) definition and trigger points for prestaging emergency equipment and Fire Department personnel for "High Risk" work, (3) revising Memo of Understandings (MOUs) to include Life Flight Helicopter Operations, and (4) evaluation, procurement, and use of "personal" escape equipment.

LMITCO and ID will carefully evaluate the corrective actions identified in this subsection to ensure that LMITCO has the capability to accomplish immediate rescue and response to planned and unplanned CO_2 discharges.

3.20.3 Description of Corrective Action(s)

The Fire Department and medical staff provide the foundation for INEEL emergency response and rescue. Integrating the Fire Department's trained personnel with "Higher Risk" operations and maintenance tasks by prestaging them "at" the job site will provide immediate rescue capability. Area incident response teams will be assessed against NFPA 600. Team training levels, equipment, size, critical backshift minimum staffing levels, and overall team capability will be included in the assessment. Results will be reported to the Director of Site Operations.

For Site-wide consistency in determining trigger points for prestaging emergency equipment and Fire Department personnel, "High Risk Work" definition will be established and proceduralized. Also an assessment of need will be conducted to determine if an increase in INEEL response capability is required. This assessment will include prestaging of Fire Department personnel, number of engine companies, crew sizes, and dealing with mass casualties.

Currently LMITCO emergency medical responders are trained to EMT and AEMT levels. The level of training for emergency medical response will be evaluated for appropriateness and recommendations given to LMITCO and ID senior management for disposition.

LMITCO emergency functions and services will be evaluated to determine if consolidation under a single organization would improve effectiveness.

There is an existing MOU between the DOE and local hospitals. This MOU will be revised to include Life Flight Helicopter Operations and Landing Zones at the INEEL. Training of Fire Department and Security personnel to work safely with Helo Operations will also be provided.

"Immediate" escape capability can be significantly improved through the evaluation, procurement, training, and distribution of new technology "personal" escape equipment. An evaluation of equipment, procurement, distribution, and training prior to issue/use will be accomplished.

The three operational CO_2 systems, prior to July 28, 1998, were all unoccupied and administratively controlled. The lock on the TRA-648 south door was broken, fortunately, which allowed co-workers to gain entry from the outside of the building and rescue a downed utility operator who had tried to get to the door. A facility review of existing administrative procedures including access control will be completed. If CO_2 systems remain in use at the INEEL, O_2 monitors will be deployed at entrance doors. Subsection 3.13 addresses prejob briefing changes, including emergency egress walkdowns, facility-specific training, escape routes, and emergency drill performance. Subsection 3.16 addresses CO_2 training, CO_2 system operation, alarms, and hazards. This will be done with a video and given at the prejob briefing. Also 29 CFR 1910 Subpart L and Lockheed Martin Corporate policy require that an action plan be established to identify and to abate workplace hazards. These action plans will be developed for all remaining CO_2 protected buildings. Emergency action plans will be approved by LMITCO and ID Emergency Preparedness personnel.

Additional portable oxygen units are being procured. Once received, each Fire Truck will be equipped with one. This will increase the oxygen delivery capability by 25%. Four is the maximum number currently possible with only 4 trained rescue responders with each engine company. (An engine company is 1 ambulance and 1 fire truck. Each ambulance can currently carry oxygen for treatment of 3 patients.) This action will also include a reevaluation of the existing daily emergency vehicle maintenance testing and supply stocking checklists.

The Accident Board recognized a failure to have SCBAs immediately available for rescue. An evaluation will be performed and concluded with issue of a report addressing Site-wide staging, ownership, maintenance, training, program oversight responsibility, and guidance given to Area Directors regarding SCBA recommendations for their area.

Three site areas, Idaho Nuclear Technology & Engineering Center (INTEC), TRA, and Test Area-North, have area incident response vehicles. An assessment will be performed to ensure we have year around reliability and availability of these units. This assessment will also include quality of vehicles, staging location, frequency of drills to operate and time checks to area buildings, communication checks of IRT members and on-board equipment and supplies. The Test Area-North and INTEC incident response vehicles are currently parked outside year around. The TRA ECC rollup door operator mechanism is being replaced.

Emergency Control Centers were set up for activation at any time. Standard Practice SP 10.3.1.35 has been written to the Reactor Program Standard Practice, "Performing Outages" to leave the diesel operational during planned area power outages.

The medical emergency response plan (medical mass casualty plan) was last updated on April 20, 1997. It does not specifically address oxygen supply, positioning ,or ready access to area dispensary oxygen supplies in mass casualty accidents. The medical emergency response plan is undergoing review and revision. Area dispensary portable oxygen supplies have been repositioned to make them more available for retrieval by security personnel during off shift.

3.20.4 Corrective Action Milestones and Schedule

Table 3.20-1. Scheduled corrective actions.

	Corrective Action	Responsibility and Organization	Due Date
3.20.4.1	Review IRT Team capability, training, equipment vs. need, and staffing levels to requirements of NFPA-600. Provide results to Area Directors.	Director, Site Operations; W. Gay	2/99
3.20.4.2	Identify "High Risk Work" definition and trigger points for prestaging emergency equipment and Fire Department personnel.	Director, Site Operations; W. Gay	12/98
3.20.4.3	Assess the need to increase Fire Department critical minimum response capability to meet area need for prestaging of personnel and equipment.	Director, Site Operations; W. Gay	3/99
3.20.4.4	Evaluate the training/certification level of our emergency medical responders.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	12/98
3.20.4.5	Assess consolidation of INEEL Emergency Management services and functions	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	1/99
3.20.4.6	Revise existing ID MOU with local hospitals to include Life Flight Helicopter Services.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	3/99
3.20.4.7	Train Fire Department and Security personnel to work with Life Flight helo operations.	Vice President, Site Services; B. H. Childers	3/99
3.20.4.8	Evaluate and procure new technology "personal" escape equipment.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	3/99
3.20.4.9	Train prior to issue and deploy new personal escape equipment.	Director, Site Operations; W. Gay	4/99
3.20.4.10	Review and incorporate consistent administrative controls to the remaining CO_2 protected areas.	Director, Site Operations; W. Gay	11/98
3.20.4.11	Install remote sensing O_2 monitor at each CO_2 protected entry door than can be read prior to entry.	Director, Site Operations; W. Gay	3/99
3.20.4.12	Develop an Action Plan for all active CO_2 protected buildings/areas.	Director, Site Operations; W. Gay	1/99

	Corrective Action	Responsibility and Organization	Due Date
3.20.4.13	Add portable oxygen units to all fire engines and reevaluate daily emergency vehicle inventory checklists.	Vice President, Site Services; B. H. Childers	11/98
3.20.4.14	Perform Risk Benefit Analysis for SCBA staging, deployment, training, ownership, consistent routine maintenance and number needed by area for occupational and emergency. Issue report upon completion to Site Operations Director.	Vice President, Environment, Safety, Health & Quality Assurance; J. VanVliet	2/99
3.20.4.15	Perform assessment of area incident response vehicles and provide report to Area Directors.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	6/99
3.20.4.16	Write Standard Practice to change TRA Diesel Generator Operating Procedure (SP 10.3.1.35).	Director, Site Operations; W. Gay	11/98
3.20.4.17	Replace TRA ECC Rollup door operator with an opener that can manually be opened and closed without power.	Director, Site Operations; W. Gay	11/98
3.20.4.18	Review and update the medical mass casualty plan.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	12/98
3.20.4.19	Position portable oxygen units at area dispensaries to make them more readily available for mass casualties and Security Guard retrieval on backshifts.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	10/98

NOTE: Corrective Action scheduled completion dates:

Immediate & prompt actions	Completed before response report issued
Near-term actions	Scheduled for completion on or before 1/99
ISM-integrated actions	Scheduled for completion on or before 8/99
Long-term actions	Scheduled for completion

3.21 Management of Safety Infrastructure

3.21.1 Judgment of Need

ID and LMITCO need to improve analysis and control of incremental reductions in funding for safety infrastructure, including individual as well as cumulative impacts on safety management and emergency preparedness. (Investigation Report, pp. ix and 65)

3.21.2 Background and Analysis

DOE-ID

ID and the contractor do not have a management system that can track changes in the level of incremental funding/resource loading for ES&H activities; assess adverse impact; and ensure that the individual and collective impacts do not compromise necessary safety infrastructure. INEEL cross-cutting ES&H expectations and work scope are not consistently factored into program baselines. There is not a mechanism to ensure safety issues are communicated prior to program planning efforts, and the expectation that certain safety issues be addressed in programmatic work scope is not clear. The ability to institute a management system that can track incremental changes in ES&H infrastructure activities is complicated by the Department's system for funding separate programs and projects without clear delineation of ES&H infrastructure requirements. The approach taken in the following corrective actions will create a local mechanism for stating safety expectations and will provide for modifications in the ID administered change control processes. Program/project specific screening thresholds will be established based on the predetermined safety infrastructure necessary to support the program/project in question. In addition, the approach taken here will systematically baseline the infrastructure to determine core infrastructure requirements, implement risk based analyses to identify potential impacts, and elevate reallocations decisions to appropriate levels of senior management. The processes and products derived from this action will be incorporated, as appropriate, into the ES&H Management Planning budgetary program.

LMITCO

LMITCO has an extensive program of assessments and measures to monitor safety performance; however, none of these specifically monitor the well being of the safety infrastructure. Since safety is a combination of cross-cutting and programmatic elements, it is not feasible to have one individual responsible for the total safety infrastructure. Thus, there is only limited information about how past funding changes have affected the safety infrastructure and little or no information to use to assess the impacts of proposed funding changes. There is also no analysis of trends in the well being of the safety infrastructure. All of this makes it difficult to identify and correct potential vulnerabilities and adverse trends.

LMITCO performed an analysis of functional costs for FY-94 through FY-98 to understand trends in safety and health funding at a company level. During the time frame evaluated, total funding decreased and safety and health functional costs decreased at a slightly reduced rate. However, lack of a monitoring system for the safety infrastructure makes it difficult to determine what effects, if any, these funding reductions have had on core safety capabilities.

The contributing cause driving this judgment of need is related to both DOE identified root causes for the July 28, 1998 accident (insufficient requirements management for CO_2 hazard, management acceptance of unstructured work controls). LMITCO has identified the following additional causal factors related to this judgment of need:

- Decisions about safety and health expenditures need to be made by line managers, at an appropriate organizational level, who are fully aware of applicable standards and requirements.

- Managers need to be held accountable for ensuring that funded activities supporting the safety infrastructure are actually accomplished.

- When budget decisions are being made, sufficient time needs to be allotted for a comprehensive analysis of the impacts of proposed budget reductions on the safety infrastructure.

- In establishing standards to ensure an adequate level of safety, management needs to recognize that the applicable codes standards and requirements should be interpreted in a conservative manner and that measures beyond minimal compliance with them may be required.

In summary, the INEEL safety infrastructure has possibly been influenced by funding reductions. However, without a monitoring capability it is difficult to determine the significance of this influence.

3.21.3 Description of Corrective Action(s)

DOE-ID

ID corrective actions focus on modifying and enhancing existing planning and control systems. The actions are targeted at ensuring that INEEL programs factor ES&H requirements and expectations into their planning efforts. They are also intended to ensure programmatic changes (scope, cost, and/or schedule) include an analysis of ES&H ramifications prior to executing a program change action. These actions are applicable to both direct and indirect funded work scope. Interim actions will be taken to modify direct and indirect control processes to include an analysis of ES&H ramifications.

A joint ID and contractor team will be established to identify core INEEL ES&H infrastructure necessary to support INEEL programs/projects. It will develop and recommend a solution for improving analyses and control methods to ensure that budget/staffing submittals, and resource allocations/ reallocations conform to agreed upon core infrastructure needs. In addition, the team will recommend change control process modifications that allow for the screening of resource reallocation decisions that potentially encroach upon core infrastructure. This change control process will ensure that individual and cumulative reallocation impacts are prospectively determined and factored into management decisions that may reduce resource below core levels. Procedures and review processes will be implemented to ensure current year program development, of both direct and indirect funded activities, and incorporate safety infrastructure baseline requirements into a Safety Authorization Basis or equivalent process. The processes and products will be incorporated into the ES&H Management Plan.

The infrastructure will be incorporated into an INEEL baseline and procedures developed to enable efficient management of the baseline. These corrective actions establish a mechanism for integrating safety requirements into program work scope, and provide a mechanism for analysis of the ES&H impacts of proposed programmatic change control actions.

LMITCO

Two actions will be implemented to improve the analysis and control of incremental reductions in funding for the safety infrastructure.

1. Define and monitor a safety infrastructure base. This is that "sacred" level of safety infrastructure that must be maintained to provide an adequate margin of safety above minimum compliance. It will be a broad range of resources, policies, and programs in diverse areas, such as Industrial Safety, Emergency Preparedness, Fire Protection, Radiation Protection, and Nuclear Safety. The elements of this action include:

    a. Charter a joint ID and LMITCO team to identify core ID and LMITCO ES&H and nuclear safety infrastructure necessary to support INEEL programs and projects

    b. Define measures for each element of the infrastructure

    c. Perform assessments to assure the safety infrastructure remains healthy.

2. Specifically address consideration for safety infrastructure in the baseline planning and change processes as follows:

    a. Prepare new procedures documenting the prioritization process for the various funding streams. Each one of these procedures would include consistent clear direction to address ES&H and nuclear safety issues concurrently with task prioritization.

    b. Modify the Indirect Budget Upload/Resource Summary Sheet to require work package manager consideration of ES&H requirements.

3.21.4 Corrective Action Milestones and Schedule

Table 3.21-1. Scheduled corrective actions.

	Corrective Action	Responsibility and Organization	Due Date
3.21.4.1	Direct modification of existing change control processes to include analysis of ES&H ramifications (until 3.21.4.3 through 3.21.4.5 are completed).	ID Assistant Manager, Office of Program Execution; J. Lyle	11/98
3.21.4.2	Modify the direct and indirect change control processes to address ES&H issues concurrently with work package modification (interim measures 2a and 2b).	Vice President, Business Management; P. Baker	3/99

	Corrective Action	Responsibility and Organization	Due Date
3.21.4.3	Charter a joint ID and contractor team to identify core INEEL ES&H infrastructure necessary to support programs/projects and identify the process for monitoring the infrastructure.	ID Assistant Manager, Environment, Safety, Health and Quality Assurance; W. Sato Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	11/98 (Charter) 8/99
3.21.4.4	Incorporate the core INEEL ES&H infrastructure and change control process into the Safety Authorization Basis or parallel ISM Safety Authorization Agreement and ES&H Management Plan.	ID Assistant Manager, Office of Program Execution; J. Lyle Director, Site Operations; W. Gay	8/99
3.21.4.5	Develop and implement procedures and review processes to assure current year program development incorporates core INEEL ES&H infrastructure baseline requirements.	ID Assistant Manager, Office of Program Execution; J. Lyle Vice President, Business Management; P. Baker	8/99

NOTE: Corrective Action scheduled completion dates:

Immediate & prompt actions	Completed before response report issued
Near-term actions	Scheduled for completion on or before 1/99
ISM-integrated actions	Scheduled for completion on or before 8/99
Long-term actions	Scheduled for completion

3.22 Risk Benefit Analysis of Continued Use of CO_2 Fire Suppression Systems

3.22.1 Judgment of Need

LMITCO needs to conduct a risk benefit analysis on the continued need for CO_2 fire suppression systems at INEEL and to evaluate the necessity of using total flooding CO_2 for fire suppression in occupied spaces. Where alternatives are not practical for cost or other reasons, facilities should comply with NFPA 101, Life Safety Code, requirements for high hazard industrial occupancies and all safety related requirements of NFPA 12, CO_2 Extinguishing Systems, should be strictly enforced. DOE needs to consider implementing a similar policy across the complex, including reevaluation on a risk-benefit basis as the mission or status of facilities change. (Investigation Report, pp. ix, 42, and 65)

3.22.2 Background and Analysis

LMITCO is contractually obligated to comply with DOE Order 5480.7A. This order mandates that complete automatic fire suppression systems designed in accordance with applicable NPFA standards be provided as follows: "In all structures having a maximum possible fire loss in excess of $1,000,000…" With the shutdown of the Engineering Test Reactor, TRA-648 became a normally unoccupied space, LMITCO recognizes the benefit of performing risk benefit analyses of the need for CO_2 fire protection systems in occupied and unoccupied areas. Hazard and risk management analysis will be used to identify and control the risk from CO_2 or other potentially hazardous systems.

3.22.3 Description of Corrective Action(s)

ID requested EM-1 and EH-1 to address this judgment of need in memorandum OPE-AIT-01-98, dated September 28, 1998, "Request for Action Related to Judgments of Need from TRA Type A Accident Investigation Report." The EH Fire Protection Engineer stated during a telephone interview that EH would actively pursue this issue. ID will also review cost benefit analyses for CO_2 and Halon systems and for special hazard fire suppression systems performed by LMITCO. This review will be reflected in an ID requirements document (see corrective action 3.3.4.4.).

LMITCO is conducting a risk/benefit analysis of the existing CO_2 systems in use at the INEEL. Systems exist at the TRA-648 (accident location), the East Butte Communications Facility (normally not occupied), and the Test Area-North Hot Cell (normally not occupied). The risk/benefit analysis will include (a) the need for the systems, (b) the possibility of replacing the existing system with another type, and (c) the need to modify the existing systems to assure the systems can be operated safely. The need to modify the existing CO_2 systems will be directed by a process hazards analysis (PHA) with a human factors analysis.

LMITCO will also evaluate and perform risk-benefit analysis for existing special hazard fire suppression systems for their worker protection requirement at the INEEL. The evaluation will be documented using the Engineering Design File Process.

A similar risk benefit analysis will be performed for special hazard fire suppression systems that may be installed. A PHA will be performed to ensure that the suppression systems, CO_2 or other type, can be operated safely. This will be proceduralized and proposed to ID for incorporation into ID AE Standards (see Subsection 3.8).

LMITCO will develop a risk-based process to ensure that PHAs are performed on other existing hazardous systems on the site. The PHA process will also be implemented in the design and design

change process to ensure that the tools are used to adequately identify hazards and specify controls to ensure personnel safety.

LMITCO will perform a risk/benefit analysis on the existing hazardous systems at the site. This activity will be performed in conjunction with 3.5.4.8.

LMITCO will ensure that, when alternatives to a CO_2 fire suppression system are not practical for cost or other reasons, facilities shall comply with NFPA 101, "Life Safety Code" requirements for high-hazard industrial occupancies, and all safety related requirements of NFPA 12, "CO_2 Extinguishing Systems." This will be proceduralized and proposed to ID for incorporation into ID AE Standards.

3.22.4 Corrective Action Milestones and Schedule

Table 3.22-1. Scheduled corrective actions.

	Corrective Action	Responsibility and Organization	Due Date
3.22.4.1	Request HQ assistance in addressing this judgment of need.	ID Assistant Manager, Office of Program Execution; J. Lyle	Completed 9/98
3.22.4.2	Review risk benefit analyses for systems identified in LMITCO actions 3.22.4.3 and 3.22.4.5.	ID Assistant Manager, Office of Program Execution; J. Lyle	8/99
3.22.4.3	Perform a risk/benefit analysis on the existing CO_2 systems.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	12/98
3.22.4.4	Make system changes as necessary to support the results of the risk benefit analysis.	Director, Site Operations; W. Gay	6/99
3.22.4.5	Evaluate and perform risk-benefit analysis for existing special hazard fire suppression systems.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	8/99
3.22.4.6	Institutionalize the requirement to perform a risk/benefit analysis on all special hazard fire suppression systems that may be installed.	Director, Site Operations; W. Gay	1/99
3.22.4.7	Develop a risk-based process for ensuring that process hazard analyses are performed on other hazardous systems at the site. This includes design and design change processes	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	1/99
3.22.4.8	Perform a risk/benefit analysis on the existing hazardous systems at the site. This activity will be performed in conjunction with 3.5.4.8.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	8/99

	Corrective Action	Responsibility and Organization	Due Date
3.22.4.9	Ensure that CO_2 fire suppression systems are designed to comply with NFPA 101, Life Safety Code, and safety related requirements of NFPA 12.	Vice President, Environment, Safety, Health and Quality Assurance; J. VanVliet	12/98

NOTE: Corrective Action scheduled completion dates:

Immediate & prompt actions	Completed before response report issued
Near-term actions	Scheduled for completion on or before 1/99
ISM-integrated actions	Scheduled for completion on or before 8/99
Long-term actions	Scheduled for completion

3.23 Technical Information Flow and Analysis

3.23.1 Judgment of Need

ID needs to improve technical information flow and analysis to assure that management decisions are made with an adequate understanding of the assumed risks, resulting in balanced priorities.

3.23.2 Background and Analysis

As discussed in Subsection 1.3, ID performed a causal analysis of the events related to the accident and the Accident Board judgments of need. The intent of this analysis was to determine the underlying causes associated with the ID organization which, if corrected, would help prevent accidents in the future. The analysis identified two major areas stated in the judgment of need above. This section addresses the area of technical information flow and analysis, specifically, ID oversight and data collection; the second area, Issues Management, is discussed in Subsection 3.19 of this Plan. The team identified the following three activities, along with specific recommendations, for improving ID oversight and data collection:

1. Institute a global approach for ID assessments

    - Establish formal ESH&QA procedures with consistent criteria, for the conduct of oversight
    - Develop training for oversight personnel that includes data gathering and risk/hazard assessment

2. Use trending and analysis to identify assumed risks

    - Develop consistent and formalized procedures for the conduct of trending and analysis that include methods for communicating the trending and analysis data to ID management.
    - Develop criteria to guide management decisions on what should be done with the results of the trend and analysis.

3. Establish or clarify the roles and responsibilities of Federal employees that impact safety

    - ID facility and program management need to periodically evaluate trending and analysis data to ensure that goals and priorities are based on an adequate understanding of assumed risk
    - Promulgate management expectations in Position Descriptions and/or Performance Agreements.

A Process Improvement Team (PIT) convened in April 1995 to address several needs/issues associated with the ID Oversight program. The Team recommended several new initiatives, including the development of ID Notice 450.A. Revision A2 describes the current ID Oversight Program. It was assumed that the program enhancements resulting from the PIT adequately addressed the needs and issues at that time; however, several of those needs have once again been identified in the conclusions of the ID supplemental causal analysis team for this accident. This led to the conclusion that the original objectives from the 1995 PIT Team have not been fully met. The root cause of failing to implement an effective oversight system needs to be further analyzed to ensure corrective actions to be taken as a result of this accident are sufficient to ensure institutionalization of an effective oversight program by ID.

Integral to the ID Oversight and Data Collection program is the process that addresses trending and analysis of data. Trend and analysis reports have been inconsistently used by ID's ESH&QA personnel, Operations Management, ESH&QA Management, and Senior Management. However, the production of these reports is viewed as an administrative exercise or burden by operations staff, primarily because there are no mechanisms or expectations for ID programs and facilities to factor the issues raised into their program baselines. The majority of staff and management in the ID office have not been aware of ID N 450.A2 and do not acknowledge (recognize) applicability to their area. Therefore, trending and analysis information has not been used as a management tool outside of the facility operations arena, and an inclusive (ID-wide) understanding of assumed risk is not secured. Additional observations associated with the trending and analysis process include the following:

- ID N 450.A2 describes the process for Trending and Analysis of INEEL ES&H performance. SMEs are aware of the need to engage but, in reality, contribute inputs as a lowest priority duty. SMEs do not view the trending and analysis process as value added to their area (because of their intimacy with their discipline area), and they do not see ID management using the information to manage contractor performance.

- Perception regarding the ID N 450.A2 trending and analysis process is that the process generates data, but yields limited effective analysis. Therefore, the process does not generate sufficient information to identify precursors to operational incidents.

- Line and Senior management endorse, but inconsistently use ESH&QA trending and analysis results for information, and sometimes actions are promulgated as a result of Trending and Analysis reporting. However, the criteria that triggers when an action will be taken by management are not clear, and the communication path conveying what actions are being taken is undefined.

Management expectations associated with trend and analysis information have not been adequately defined. As a result, use of the information across the ID Operations Office has been inconsistent and, in some cases, nonexistent. For example, ID Facility and Program management needs to periodically evaluate the trend and analysis data to ensure that goals and priorities are based on an adequate understanding of assumed risk and to determine if programmatic work scope should be modified based on that evaluation. Also, Senior Management must assume responsibility for making decisions or initiating action on the results of trend and analysis efforts. These expectations should be captured in a "requirements document."

3.23.3 Description of Corrective Action(s)

The following corrective actions will be completed to improve and ensure institutionalization of the ID oversight and data collection:

1. Complete an analysis to determine the causes of past failures in implementing an effective ESH&QA oversight system.

   Primary focus will be placed on determining why the original objectives and recommendations of the 1995 Process Improvement Team were not fully implemented.

2. Enhance the existing ESH&QA Oversight system based on the results of the evaluation of past failures in implementing an effective ESH&QA program and the need to articulate management expectations.

At a minimum, the existing system will be evaluated to review current data gathering, conduct of oversight, and trend analysis processes. The system should also be enhanced by incorporating a process for more formal risk/hazard assessment, inclusion of criteria for identifying significant trends and/or issues, and specific definition of the roles and responsibilities of FM/PMs and Senior Management for using trend analysis information.

3. Develop and institutionalize a training program for ID personnel involved in oversight of contractor ESH&QA activities that would include the proper tools of data gathering and risk and hazard assessment.

   Once the enhanced ESH&QA Oversight program is established, ID will conduct training for appropriate ID personnel to ensure they are aware of the requirements governing the Oversight program and what their roles and responsibilities are relative to the program. The intent of the training will be not only to foster a broader and deeper level of understanding across the ID organization of the Oversight program, including where each employee fits in the program, but also to develop specific technical skills to enable each employee to meet management's expectations.

3.23.4 Corrective Action Milestones and Schedule

Table 3.23-1. Scheduled corrective actions.

	Corrective Action	Responsibility and Organization	Due Date
3.23.4.1	Complete an analysis to determine the causes of past failures in implementing an effective ESH&QA oversight system.	ID Assistant Manager, Office of Program Execution; J. Lyle	12/31/98
3.23.4.2	Prepare/revise applicable "requirements documents," incorporating the results of corrective action (1), to: • Establish criteria for the identification of significant ESH&QA trends and/or issues • Incorporating a process for more formal risk/hazard assessment • Clarify the roles and responsibilities of FM/PMs and Senior Management to require the use of trend analysis data • Develop criteria for management decision making, related to the trend and analysis reports.	ID Assistant Manager, Office of Program Execution; J. Lyle	8/99
3.23.4.3	Develop and institutionalize a training program for ID personnel involved in oversight of contractor ESH&QA activities which will include, at a minimum, the proper tools of data gathering, trend analysis, and risk and hazard assessment.	ID Assistant Manager, Office of Program Execution; J. Lyle	8/99

	Corrective Action	Responsibility and Organization	Due Date
3.23.4.1	Complete an analysis to determine the causes of past failures in implementing an effective ESH&QA oversight system.	ID Assistant Manager, Office of Program Execution; J. Lyle	12/31/98
3.23.4.2	Prepare/revise applicable "requirements documents," incorporating the results of corrective action (1), to: • Establish criteria for the identification of significant ESH&QA trends and/or issues • Incorporating a process for more formal risk/hazard assessment • Clarify the roles and responsibilities of FM/PMs and Senior Management to require the use of trend analysis data • Develop criteria for management decision making, related to the trend and analysis reports.	ID Assistant Manager, Office of Program Execution; J. Lyle	8/99
3.23.4.3	Develop and institutionalize a training program for ID personnel involved in oversight of contractor ESH&QA activities which will include, at a minimum, the proper tools of data gathering, trend analysis, and risk and hazard assessment.	ID Assistant Manager, Office of Program Execution; J. Lyle	8/99

NOTE: Corrective Action scheduled completion dates:

Immediate & prompt actions	Completed before response report issued
Near-term actions	Scheduled for completion on or before 1/99
ISM-integrated actions	Scheduled for completion on or before 8/99
Long-term actions	Scheduled for completion

4. GLOSSARY

potential and credible hazard. Any hazard that, if not appropriately mitigated or controlled, has a substantial probability of causing death or serious physical harm.

nuclear facility. A nuclear reactor or any other activity or operation that involves radioactive and/or fissionable materials in such form and quantity that a nuclear hazard potentially exists to the employees or the general public.

institutionalize. Formally incorporated into a requirements document procedures or work controls.

lockout. The placing of a locking device on an isolation device according to the lockout/tagout procedure. Ensuring that the isolating device and the equipment being controlled cannot be operated until the lockout device is removed.

tagout. Placing a tag on an isolation device, in accordance with the lockout/tagout procedure to indicate that the isolation device and the equipment being controlled shall not be opened until the tag is removed.

non-nuclear. Non-nuclear facilities or facilities that do not meet the DOE definition of a nuclear facility.

5. TEAM SIGNATURES AND APPROVAL

Signature of ID Response Team Members

The preparers of the ID response listed below agree with the conclusions and corrective actions stated in this report:

Brian S. Anderson, Team Leader — 10/15/98 Date

Mark M. Holzmer, Deputy Team Leader — 10/15/98 Date

Elizabeth M. Bowhan, Feedback/Lessons Learned — 10/15/98 Date

Ralph A. Hartline, Training/Competency; Feedback/Lessons Learned — 10/15/98 Date

Carol S. Henning, Safety Culture — 10/15/98 Date

Greg A. Hula, Hazard Identification and Control — 10/15/98 Date

Keith A. Lockie, Work Planning and Control — 10/15/98 Date

John R. Martin, Management Systems — 10/15/98 Date

Patrick N. Smith, System Design; Emergency Management — 10/15/98 Date

I agree with the conclusions and corrective actions stated in this report.

John M. Wilcynski, Manager
DOE-ID Operations Office — 10/15/98 Date

Lockheed Martin Idaho Technology Corporation

Prepared by:

Eugene M. Balsmeier, Team Leader
Hazard Identification and Control

James A. Brown, System Design

Jay Danielson, Training/Competency

Francis J. Miceli, Work Planning & Control

W. D. Altman, Facilitator

Gary W. Braun, Emergency Management

Sharon C. Chivers, Safety Culture

Wallace G. Keltner, Feedback/Lessons Learned

Kate O'Donnell, Management Systems

Jay N. Davis, Corrective Action Planning

Reviewed by:

James A. VanVliet, Vice President and General Manager, ESH&QA

William W. Gay III, Director, Site Operations

Approved by:

W. John Denson, President

Appendix A

Response Report Team Listing

APPENDIX

RESPONSE TEAM

TEAM LEADERSHIP

Brian Anderson, Team Leader - DOE-ID
Mark Holzmer, Deputy Team Leader – DOE-ID
Eugene Balsmeier, Team Leader – LMITCO
William Altman, Team Facilitator and Advisor – LMES
John Hockert, Consultant
Jay Davis, LMITCO

STEERING BOARD

Walter Sato, DOE-ID
Jim VanVliet, LMITCO
William Gay, LMITCO
Tom Lee, LMITCO
Paul Yela, LMITCO

ADMIN. SUPPORT

Teresa Horkley, DOE-ID
Jan Ulrich-Garner, LMITCO
Barry King, LMITCO
Penny Simon, LMITCO
Trina Pettingill, Subcontractor

WORK PLANNING & CONTROL

Keith A. Lockie, Subteam Leader - DOE-ID
Francis Miceli, Subteam Leader – LMITCO
Scott Hawke, LMITCO
Lee Fife, LMITCO
Mark Craft, LMITCO
Robert Bull, LMITCO

MANAGEMENT SYSTEMS

John Martin, Subteam Leader - DOE-ID
Kate O'Donnell, Subteam Leader – LMITCO
Robert Hoffman, LMITCO
Wray Landon, LMITCO
Kally Barker, LMITCO

HAZARD ID. & CONTROL

Greg Hula, Subteam Leader - DOE-ID
Eugene Balsmeier, Subteam Leader – LMITCO
Pete Scobby, LMITCO
Mark Brooks, LMITCO
Dave Griggs, LMITCO
Tammy Thatcher, LMITCO
John Johnson, LMITCO

TRAINING & COMPETENCY

Ralph Hartline, Subteam Leader, DOE-ID
Jay Danielson, Subteam Leader – LMITCO
Leslie Chapman, LMITCO
Gene Hinsley, LMITCO
Charles Cornell, LMITCO
Terry Betz, LMITCO

SAFETY CULTURE

Carol Henning, Subteam Leader - DOE-ID
Sharon Chivers, Subteam Leader – LMITCO
Bowen Huntsman, LMITCO
Brian Morris, LMITCO
Dave Fox, LMITCO
Shane Bush, LMITCO
Delwin Allred, LMITCO
Bryan Parker, LMITCO
Charlene Johnson, LMITCO
Doug Spiers, LMITCO

SUPPLEMENTAL ROOT CAUSE
Thomas Wichmann, DOE-ID
Donald Shadley, DOE-ID
Ray Fursteanau, DOE-ID
Charles Jones, DOE-ID
Nancy Makey, LMITCO
Scott Earl, LMITCO
Terry Hathaway, LMITCO

EMERGENCY MANAGEMENT
Patrick N. Smith, Subteam Leader - DOE-ID
Keith Lockie, Subteam Leader - DOE-ID
Gary Braun, Subteam Leader – LMITCO
Don Whittaker, LMITCO
Wayne Smith, LMITCO
Scott Schum, LMITCO
Todd Lewis, LMITCO
William Belk, LMITCO
Joyce Fleischman-Gay, LMITCO
Jim Downes, LMITCO

FEEDBACK/LESSONS LEARNED
Elizabeth Bowhan, Subteam Leader- DOE-ID
Ralph Hartline, DOE-ID
Walter Keltner, Subteam Leader, LMITCO
Ron Crossley, LMITCO
Lyn Parlier, LMITCO
Pui Kuan, LMITCO
Paul Roth, LMITCO
Mike Edgett, LMITCO
Joe Maedgen, LMITCO
Frank Stees, LMITCO
Marge Keating, LMITCO
Mary Hubbard, LMITCO

RECORDS
Carol Jones, LMITCO
Maxine Feist, LMITCO

SYSTEM DESIGN
Patrick N. Smith, Subteam Leader - DOE, ID
James Brown, Subteam Leader- LMITCO
Kent Wells, Subteam Leader – LMITCO
Charles McKnight, LMITCO
Terry Julius, LMITCO
Kevin Clayton, LMITCO
Lannie Workman, LMITCO
Robert Thompson, LMITCO
Robert Hill, LMITCO
Jerry Phillips, LMITCO
Bruce Stewart, LMITCO
John Nation, LMITCO
Larry Johnson, LMITCO
Soli Khericha, LMITCO
Mike Cates, LMITCO
Wally Carnes, LMITCO
Dennis Tuckness, LMIICO

Appendix B

LMITCO Integrated Safety Management System Program Description, Status, Matrix, and Implementation Plan Excerpts

INTEGRATED SAFETY MANAGEMENT SYSTEM DOCUMENTATION

The Department of Energy (DOE), Idaho Operations Office (ID) issued a contract modification to Lockheed Martin Idaho Technologies Company (LMITCO) by letter OPE-OS98-041, dated April 2, 1998. The subject of the letter was "Transmittal of Contracting Officer Guidance on Integrated Safety Management System Description Document Development and Implementation for Contract DE-AC07-94IDI3223." The referenced letter set several milestones for LMITCO to meet for developing and implementing a Safety Management system (SMS) at the Idaho National Engineering and Environmental Laboratory (INEEL). This document is hereafter called the INEEL SMS Implementation Plan (SMSIP).

Using a systems engineering process developed and implemented by the Systems Engineering directorate, LMITCO has developed an SMS that is fully compliant with the requirements of Department of Energy Acquisition Regulation (DEAR), Clause 970.5204-2, Integration of Environment, Safety, and Health into Work Planning and Execution (June 1977), and Clause 970.5204-78 Laws, Regulations, and DOE Directives (June 1977). LMITCO will implement the SMS by August 31, 1999, to manage and perform work at the INEEL. The SMS is documented in the SMS Description Document (SDSDD). The SMSDD, which is a companion document to this SMSIP, will be updated annually.

LMITCO developed the SMSIP through the systems engineering approach. The first part of the process was to create the SMSDD, also a milestone document required by the DOE-ID contract modification letter OPE-OS-98-041. LMITCO has prepared its SMSDD through: (1) a careful evaluation of the current ways and means of conducting business by each of its operational programs; (2) a determination of the ideal means of conducting business in a truly integrated manner, including a comprehensive study of applicable DOE, federal, and state requirements; and (3) analyzing differences, or gaps, between current and ideal practice. The SMS described in the SMSDD is the ideal, integrated means of conducting business; it will be fully implemented after the completion of the LMITCO SMSIP.

LMITCO identified 25 gaps to the ideal process described in the SMSDD. Each gap has an action plan that will bring LMITCO to the ideal level of environmental compliance and safety performance for current operations. Several of the action plans also integrate key complementary initiatives (such as ISO 14001). Each of the action plans was developed with the key objective for ensuring worker safety through consistent work planning and performance with safety as an integral element. The 25 gaps are presented in Section 3 of this document.

The SMSIP is a consolidation of the LMITCO action plans to ensure complete integration of the SMS into the business strategy supporting the INEEL. The process to develop the SMSIP included: (1) after all the gaps between the current and ideal practices were identified, responsible line management validated the actual differences providing clarification to ensure effective methodologies would be applied to resolving the gaps; (2) these gaps were then analyzed for applicability to all LMITCO business management systems; this review was to ensure that all the SMS process steps were being applied in a consistent manner and opportunities would be found to standardize the business practices for integrating the SMS; (3) the individual action plans were consolidated into one action plan as the SMSIP. Upon completion of the commitments in the SMSIP, SMS will be fully implemented at LMITCO; and (4) the Vice Presidents of Operations will review the action plans contained in this document and tailor a branch-specific plan as needed.

The SMSIP was prepared with the assistance of members of operations, maintenance, research, construction, and environmental remediation/decommissioning and dismantlement, the ES&H (including radiation protection and emergency preparedness) branch, a steering team of senior managers, and a core team. Meetings were regularly attended by representatives from the pertinent program offices at DOE-ID, and their advice and counsel was incorporated.

Status

LMITCO has created a project office for ISM implementation that includes a project manager with a project team. The project office will include a deputy, and six project leads (ISM, worker involvement, VPP, project management, procedures, and training). The individuals assigned to lead these various efforts will be responsible to facilitate implementation and to track corrective actions for closure pertaining to their function. The project team will review the corrective actions to the judgment of needs identified in this accident investigation and will incorporate them as needed into the ISM implementation plan. The program manager has been assigned and is in the process of selecting his project team.

In January of 1999 DOE-ID will be conducting the ISM Phase I verification. This verification will review the documents presented to DOE-ID to determine if they meet the requirements of the April 2, 1998, DOE-ID letter that transmitted the DOE Contracting Office ISM Guidance Letter.

By August 31, 1999, the implementation of ISM at the INEEL is to be complete. At that time DOE-ID will conduct the Phase II verification to ensure that ES&H has been fully integrated into the work planning and execution processes at the INEEL.

Matrix

The attached matrix shows the relationship between the Type A Investigation Report Judgments of Need and the gaps identified in the ISM Gap Analysis.

JUDGMENTS OF NEED/GAP ANALYSIS MATRIX

JUDGMENT OF NEED	ISM GAP ANALYSIS
JON 3.1 Protection from Releases of Toxic Agents from Energized Systems	ISM Gap 1: Linkage and flowdown of ES&H requirements ISM Gap 20: Integration of ES&H requirement into work planning and execution
JON 3.2 Independent Verification of System Design Modifications	ISM Gap 24: The Quality level systems are not uniformly understood or followed
JON 3.6 Implementation of Integrated Safety Management	ISM Implementation Plan
JON 3.7 Procedure System Enhancements	ISM Gap 1: Linkage and flowdown of ES&H requirements ISM Gap 2: Procedures not followed ISM Gap 20: Integration of ES&H requirements into work planning and execution
JON 3.13 Work Control System Improvements	ISM Gap 25: Standard approach to hazard identification, risk evaluation, and hazard control
JON 3.19 Issues Management Process Improvements	ISM Gap 14: Senior Management oversight of corrective actions ISM Gap 16: ORPS and ISM do not effectively use ICARE
JON 3.21 Management of Safety Infrastructure	ISM Gap 6: ES&H issues addressed concurrently with prioritization of tasks and allocation of resources ISM Gap 7: Structured process for proper consideration of ES&H needs in indirect funded activities.

LMITCO INTEGRATED SAFETY MANAGEMENT SYSTEM PROGRAM IMPLEMENTATION PLAN EXCERPT

The portion of the INEEL SMS Implementation Plan contained in this Appendix is for information and reference only. The gaps included are referred to in this Response Report. Because the INEEL SMS Implementation Plan is a living document, the corrective actions and schedule information in this Appendix are subject to change.

15. ACTION PLANS

This section summarizes the actions committed to by line management. For the most detail on these actions, see the appropriate ICARE action item.

GAP NUMBER

GAP # 1

GAP TITLE

Linkage and flow down of ES&H requirements contained in the Functional Area Manuals to the individual facility operating procedures and work instructions have not been fully established.

GAP OWNER

G. Ellis

DESCRIPTION OF GAP

Identified Functional Area Managers are expected to promulgate contractual requirements into policies, procedures, and training for the appropriate portions of the workforce, then the work control document is expected to implement and integrate the appropriate company level policies and procedures. If a facility or organization maintains its own set of facility or organizational procedures, full agreement is expected between those procedures and company-wide policies and procedures.

These expectations are not always met within the LMITCO document management system.

ISM STEP and CRITERIA

All 19 steps are affected by this gap.

SECTION OF SMSDD

Paragraph 5.3.1

CORRECTIVE ACTIONS

1. The requirements management organization will verify that Functional Area Managers are identified for all requirements in the LMITCO contract.
   Completion Date: 10/01/98

2. Each Functional Area Manager will ensure that contractual requirements are promulgated in policies, procedures and training programs.
   Completion Date: 12/15/98

3. The line management for a facility or organization will ensure that company level policies and procedures are implemented into each appropriate facility or organizational work document.

   NOTE: For a facility/organization developed procedures, the facility/organization will verify that all company requirements are incorporated and there is a process to incorporate future revisions.

Completion Date: 06/01/99

4. The requirements management function will be modified to ensure the traceability of the flow-down of requirements is maintained as requirements and field procedures are changed. Completion Date: 06/01/99

GAP NUMBER

GAP # 1

GAP TITLE

Linkage and flow down of ES&H requirements contained in the Functional Area Manuals to the individual facility operating procedures and work instructions have not been fully established.

GAP OWNER

G. Ellis

DESCRIPTION OF GAP

Identified Functional Area Managers are expected to promulgate contractual requirements into policies, procedures, and training for the appropriate portions of the workforce, then the work control document is expected to implement and integrate the appropriate company level policies and procedures. If a facility or organization maintains its own set of facility or organizational procedures, full agreement is expected between those procedures and company-wide policies and procedures.

These expectations are not always met within the LMITCO document management system.

ISM STEP and CRITERIA

All 19 steps are affected by this gap.

SECTION OF SMSDD

Paragraph 5.3.1

CORRECTIVE ACTIONS

1. The requirements management organization will verify that Functional Area Managers are identified for all requirements in the LMITCO contract.
   Completion Date: 10/01/98

2. Each Functional Area Manager will ensure that contractual requirements are promulgated in policies, procedures and training programs.
   Completion Date: 12/15/98

3. The line management for a facility or organization will ensure that company level policies and procedures are implemented into each appropriate facility or organizational work document.

NOTE: For a facility/organization developed procedures, the facility/organization will verify that all company requirements are incorporated and there is a process to incorporate future revisions.

Completion Date: 06/01/99

4. The requirements management function will be modified to ensure the traceability of the flow-down of requirements is maintained as requirements and field procedures are changed. Completion Date: 06/01/99

GAP NUMBER

GAP # 2

GAP TITLE

Company level procedures are not followed or enforced.

GAP OWNER

TBD

DESCRIPTION OF GAP

Failure to follow procedures is the most frequently cited root cause when events occur or when environmental non-compliances are identified. For example, 82% of the 466 open environmental issues at INTEC in December 1997 were determined to be caused by failure to use/follow/enforce procedures.

ISM STEP and CRITERIA

All 19 steps are affected by this GAP.

SECTION OF ISMDD

Paragraph 5.4.4

CORRECTIVE ACTIONS

1. Establish LMITCO senior management commitment of the use of procedures. Emphasize that if individual considers the procedure or other documentation defining the planned work to be inadequate to ensure the safety of the employee and other workers, then stop the work and review and resolve the concerns so the work can be safely performed.

   NOTE: The purpose of this action is to establish an environment that THOUGHTFUL, COMPLETE compliance with company procedures is the ethical way to do our work. This action is complete by issuance of DENSONGRAM No.37, on August 7, 1998.

   Completion Date: 08/15/98

2. Immediate manager conducting training for each LMITCO employee which emphasizes that procedural compliance is the ethical approach to perform work safely at LMITCO facilities and to achieve mission success.

   NOTE: INEEL Institute develop training package; complete not later than 09/30/98.

   NOTE: Executive VP present to vice-presidents week of 10/5/98; all employees trained by 11/15/98.

   Completion Date: 11/15/98

3. Develop, implement, and complete activities for all employees which will make them familiar with the procedures which apply to their work tasks. Use approaches similar to those used for the VPP program, such as: (1) An incentive for all members of the work group identifying and then reviewing all procedures applicable to their tasks; and (2) A "Safety Bowl" type competition using questions based on procedures which implement ISMS Guiding Principles and the five Core ISMS Functions.

   NOTE: Due date is for completion of all activities; interim milestones to be established and published separately.

   Completion Date: 08/15/99

4. Facilities/organizations conduct review of the company-level actions of this plan and determine what facility/organization specific actions must be taken prior to August 31, 1999 to: (1) establish a culture in which procedural compliance is accepted as the ethical approach to safety perform work; and (2) verify by management assessment that work is being done by thoughtful, complete compliance with procedures.

   NOTE: Completion of this action item is defined as action plan(s) to establish culture and for verification of achievement which has been developed, approved, and funded within the Branch.

   Completion Date: 09/30/98

5. Update Procedure Awareness training materials – "Awareness Training" for all employees and "Manager Procedure Awareness and Application" for all management personnel. Place these training materials on INTRANET for easy access. Maintain training materials up-to-date as new procedures are published or existing procedures canceled.

   NOTE: This action is designed to provide LMITCO managers with the tool(s) so they can determine which LMITCO which procedure apply to their work.

   NOTE: This action is complete when the updated training material is available on the INTRANET.

   Completion Date: 10/15/98

6. All employees complete updated "Awareness Training."

   NOTE: Therefore, all employees should redo this awareness training to be aware of the procedures for their scope of work.

   Completion Date: 11/20/98

7. All managers complete updated "Manager Awareness and Application" module.

   NOTE: It is essential that all managers take the updated course.

   Completion Date: 11/20/98

8. Incorporate “Awareness Training” into new employee indoctrination.

   NOTE: By completing this training during new employee indoctrination, each employee will understand the company’s position with regard to procedural compliance and will receive a listing of procedures for use as reference.

   Completion Date: 11/20/98

9. Establish completion of “Awareness and Application” as a pre-requisite to assignments to new positions in management (either promotion or lateral).

   NOTE: This action defined complete when requirement is promulgated by Human Resources.

   Completion Date: 11/20/98

10. Develop and publish an index/cross-walk between company procedures.

    NOTE: Publication of an index/cross-walk between company procedures will provide a sound basis for managers and employees to have confidence they are aware of all potentially applicable procedures.

    Completion Date: 04/15/99

11. Implement a “prompting” system so that managers and workers are personally notified when procedures applicable to their work are changed.

    NOTE: The “prompting” system, is End User Notification System. End user training will be available beginning 8/24/98 through 10/31/98. This action considered complete upon completion of this training period.

    Completion Date: 10/31/98

12. Review Management Control Procedures for redundancy; eliminate overlapping MCP’s.

    NOTE: There is a strong perception within the work-force there are “too many” procedures. This action will validate the need for retaining the necessary procedures and recommend deletion of redundant documents.

    Completion Date: 07/15/99

13. Brief/train all managers (from foreman up); address their questions and concerns regarding company standard for procedural compliance.

    NOTE: Briefings will be facility specific. Briefings will begin approximately 10/15/98 when “Awareness” materials are ready. Briefings will emphasize use of procedures is an ethical approach toward work. The briefings will be based on the “Awareness” training materials.

    Completion Date: 11/20/98

14. Develop and obtain senior management concurrence on a logic structure which can be used to assess the motivation for observed behaviors.

NOTE: The anticipated long term result of this logic structure will be a change in the belief and attitude structure such that procedural compliance has become the accepted norm.

Completion Date: 10/31/98

15. Brief Vice Presidents on the principles and application of the "Just" Culture. Provide VP's with support to use and apply these principles within their Branch.

    NOTE: This information provided for use within each Branch as deemed appropriate by the cognizant Vice President.

    Completion Date: 11/15/98

16. Conduct a study to determine the rational for current level of procedural non-compliance.

    NOTE: Determination of reasons as to why procedural non-compliances have occurred will be based on interviews, observations at work site, etc.

    Completion Date: 11/20/98

17. Assess findings from procedural non-compliance study; develop conclusions and provide recommendations to senior management.

    NOTE: Recommendations should emphasize employment of (or revision to) existing LMITCO management processes rather than invention of "new" processes.

    Completion Date: 12/15/98

18. Develop appropriate action plan(s) to implement appropriate recommendations from non-compliance study within respective Branch. Fund and implement action plan.

    NOTE: This action is defined as complete when respective Branches have each implemented their respective action plans to address the recommendations from the study.

    Completion Date: 02/01/99

19. Develop ISMS General Awareness Training for INEEL employees.

    NOTE: This action is in response to the need to have everyone at the INEEL generally familiar with the principles, functions and objectives of ISMS.

    Completion Date: 01/07/99

20. INEEL employees complete ISMS General Awareness Training.

    Completion Date: 07/15/99

GAP NUMBER

GAP#6

GAP TITLE

The company-level process does not require ES&H issues to be addressed concurrently with the prioritization of tasks and allocation of resources.

GAP OWNER

S. Scobby

DESCRIPTION OF GAP

The current prioritization process used in EM needs to be formally documented to demonstrate the weight given to safety. Focus on prioritizing safety in work planning can be increased.

ISM STEP and CRITERIA

1.4 Prioritize Tasks and Allocate Resources: An integrated SMS should include a process for prioritizing and allocating work.

SECTION OF ISMDD

Paragraph 5.1.4

CORRECTIVE ACTIONS

1. Prepare a new MCP documenting the EM Prioritization process and responsibilities.

   NOTE: This procedure will only address EM. A single company-wide system to address relative priorities will not be instituted. A prioritization system only works where the work is competing for funds. EM has this situation where over 112 projects compete for limited funds. Other projects need to prioritize within their project funding constraints, but not against each other.

   Completion Date: 01/30/99

2. Add a requirement as part of baseline planning process to address ES&H issues concurrently with prioritization of tasks within individual projects.

   NOTE: Program Controls is modifying current MCPs to improve requirements traceability and increase user-friendliness of procedures. This will be worked as part of the overall initiative.

   Completion Date: 03/31/99

3. Conduct a self-assessment of work initiated once these changes are made to ensure that work is being planned in accordance with procedures.

   Completion Date: 07/01/99

GAP NUMBER

GAP#7

GAP TITLE

A consistent structured prioritization process does not exist for proper consideration of ES&H needs in indirect funded activities.

GAP OWNER

M. Virtue

DESCRIPTION OF GAP

Potential exists for indirect funded activities to be performed without adequate consideration for ES&H needs.

ISM STEP and CRITERIA

1.4 Prioritize Tasks and Allocate Resources: An integrated SMS should include a process for prioritizing and allocating work.

SECTION OF ISMDD

5.1.4

CORRECTIVE ACTIONS

1. Incorporate electronically, a verification block (a required field) on the cover sheet of the Indirect Budget Upload/Resource Summary Sheet reflecting certification by the work package manager that budget consideration has been given to ES&H needs.

   NOTE: The modification of the Summary Sheet will occur by the identified due date; however, the FY 1999 indirect baseline is currently near completion. The worksheet will be available for all work packages prepared after December 1, 1998.

   Completion Date: 12/01/98

GAP NUMBER

GAP # 14

GAP TITLE

Senior management oversight functions (e.g., CRB, ISRC, QST, etc.) are not integrated into a cohesive management system. These functions are not fully effective at managing oversight activities or prioritizing company corrective actions.

GAP OWNER

J. Carter

DESCRIPTION OF GAP

LMITCO Senior Management assessment functions such as the Compliance Review Board, Assessment Review Board, Independent Safety Review committees, Operational Readiness Review, Quality Steering Teams, Internal Corporate Audit, and Lockheed Corporate Assessment are not integrated into a cohesive management system; therefore, these functions and the independent/self-assessment activities that seek to support them are not fully effective at managing oversight activities or prioritizing Company corrective actions.

ISM STEP and CRITERIA

5.2 Identify Improvement Opportunities: An integrated SMS should evaluate feedback and oversight information into recommendations for improvement.

5.3 Make Changes To Improve: An integrated SMS should contain processes for management to consider and dispose of recommendations for improvement.

SECTION OF ISMDD

Paragraphs 5.5.2 and 5.5.3.

CORRECTIVE ACTIONS

Ref. JVV-40-98, Attachment Pg. 12, Corrective Actions No. 3.L.a-1, 2, 3, & 4

GAP NUMBER

GAP # 16

GAP TITLE

The ORPS and Lessons Learned processes do not effectively utilize ICARE.

GAP OWNER

J. Carter

DESCRIPTION OF GAP

Prioritization, tracking, analysis, and closure for issues and commitments at DOE-ID and LMITCO is disjointed and lacks the effectiveness to support a fully functional, integrated oversight system.

ISM STEP and CRITERIA

5.2 Identify Improvement Opportunities: An integrated SMS should evaluate feedback and oversight information into recommendations for improvement.

5.3 Make Changes To Improve: An integrated SMS should contain processes for management to consider and dispose of recommendations for improvement.

SECTION OF ISMDD

Paragraphs 5.5.2 and 5.5.3

CORRECTIVE ACTIONS

Ref. JVV-40-98, Attachment, Corrective Actions on Pg. 13-14

GAP NUMBER

GAP # 20

GAP TITLE

There is not a readily understood process for integrating ES&H requirements into work planning and execution.

GAP OWNER

J. VanVliet

DESCRIPTION OF GAP

Although many processes exist to implement requirements into the company, there is not an integrated process being utilized to consistently implement ES&H requirements into work planning and execution.

ISM STEP and CRITERIA

1.3 Provide for Integration: An integrated SMS should invoke integrated ES&H management processes into work activities.

3.2 Identify Controls to Prevent/Mitigate Hazards: An integrated SMS should include a process for identifying and tailoring administrative controls, safety controls, safety programs, and other conditions that affect the work to be performed.

SECTION OF ISMDD

Paragraphs 5.1.3 and 5.3.2

CORRECTIVE ACTIONS

NOTE: Compliance Integration Model (CIM) and Environmental Compliance Project Management Plan has been completed and the Program Description Document (PDD) in Manual 8 "Environmental Compliance" has been revised. This revision describes the integration of environmental compliance requirements, work planning, and execution.

1. Develop pilot procedures in Manual 8 using the CIM: a PRD for Temporary Storage of Hazardous Wastes and MCPs for SAAs and TAAs.

   Completion Date: 09/30/98

2. Develop pilot facility specific procedures at INTEC and RWMC to implement the pilot PRD and MCPs described in Corrective Action # 1 above.

   Completion Date: 12/30/98

3. Develop and implement all other necessary documents in Manual 8 using CIM and all other necessary facility specific procedures for environmental requirements.

   Completion Date: 06/01/99

4. Revise CIM to address the integration of safety and health requirements into work planning and execution.

   Completion Date: 09/30/98

5. Develop or revise necessary documents in Manuals 14 and 15 using the revised CIM.

   Completion Date: 12/15/98

6. Develop or revise facility specific procedures and work instructions to implement safety and health requirements according to the revised CIM.

   Completion Date: 06/01/99

7. Perform assessment of integration of ES&H requirements into work planning and execution.

   Completion Date: 07/31/99

GAP NUMBER

GAP # 24

GAP TITLE

The Quality Level System and the procedures that implement it within the company are not uniformly understood or followed.

GAP OWNER

J. Carter

DESCRIPTION OF GAP

Misunderstanding of quality levels leads to confusion with regard to their application.

ISM STEP/ CRITERIA

3.3 Establish Safety Controls: An integrated SMS should include a process to establish and document administrative controls, safety controls, safety problems, and other conditions that affect the work to be performed (guiding principle 6).

SECTION OF ISMDD

Paragraph 5.3.3

CORRECTIVE ACTIONS

1. Revise Quality Assurance Program Description, PDD-1, to reflect the additional level that is exempt (Non-Q).

   NOTE: See also GAP l(flow down of requirements into local procedures and work processes) and GAP 2 (compliance to procedures) for other actions that will aid in resolving this concern.

   Completion Date: 12/15/98

2. Complete required reading of MCP-540 to ensure company managers/supervisors/quality engineers are informed of changes to Q-Level System.

   NOTE: See also GAP l(flow down of requirements into local procedures and work processes) and GAP 2 (compliance to procedures) for other actions that will aid in resolving this concern.

   Completion Date: 12/15/98

3. Line ESH&QA organizations will validate the correct assignment of quality levels through review of purchase requisitions flowing into the procurement cycle for purchase of items and services.

   NOTE: This action is also contained in Price-Anderson Amendments Act NTS report, NTS-ID-LITC-LITCOSITEW-1998-0002, Procurement Program Quality Deficiencies, Corrective Action 5.

   Completion Date: 12/1/98

GAP NUMBER

GAP # 25

GAP TITLE

There is not a consistent integrated process that utilizes a standardized graded approach to identify hazards and risks and to establish and apply safety controls.

GAP OWNER

J. VanVliet

DESCRIPTION OF GAP

There is a lack of a process to integrate hazard evaluation and controls from multiple disciplines into work control (Operations, Maintenance, Construction, D&D, and Research). Safety controls sometimes are contradictory:

Lack of a process, tools, or methods to standardize and integrate ES&H into hazard evaluations and controls.

Safety controls sometimes are contradictory:

– several methods for applying graded approach to hazard identification and controls

– inconsistent approaches used to recognize and mitigate the same hazard

– side by side tasks may be evaluated using different approaches

– several similar procedures for performing hazard evaluations

– several forms/checklists implement safety controls

ISM STEP/ CRITERIA

2.1: Identify Hazards,

2.2: Analyze Hazards,

2.3: Categorize Hazards,

3.2: Identify controls to prevent/Mitigate Hazards

3.4: Implement Controls

SECTION OF ISMDD

Paragraphs 5.2.1, 5.2.2, 5.2.3, 5.3.2, and 5.3.4

CORRECTIVE ACTIONS

1. A multidisciplinary and organizationally cross-cutting corrective action team will review and evaluate existing processes to determine the best process.

   Completion Date: 10/31/98

2. Using the result of the ESH&QA review and evaluation, develop a company-wide system that provides a consistent, integrated process.

   Completion Date: 01/31/99

3. Perform and document ES&H personnel training on the company-wide system implemented to provide consistent integrated process.

   Completion Date: 03/31/99

4. Implement the process within LMITCO and evaluate the progress of the implementation.

   NOTE: The implementation target completion is 04/01/99 with the evaluation completed by 07/31/99.

   Completion Date: 07/31/99

SITE SERVICES

5. Revise MCP-2798 and MCP-2799 to ensure all work orders and PMs receive adequate hazard evaluation and safety review at least every 12 months except as exempted in accordance with "Graded Approach to JRC."

   NOTE: Revision to be completed by 11/01/98 and training completed by 12/01/98.

   NOTE: Due date dependent on that assigned for TRA Accident Hazard Assessment and Evaluation Action Plan.

   Completion Date: 12/01/98

6. Revise MCP-2798 minor maintenance criteria to improve objective criteria to ensure higher risk work is not performed as minor maintenance.

   NOTE: Revision to be completed by 11/01/98 and training completed by 12/01/98.

   NOTE: Due date dependent on that assigned for TRA Accident Hazard Assessment and Evaluation Action Plan.

   Completion Date: 12/01/98

9. Revise MCP-2798 to strengthen foreman and worker understanding when hazard evaluations are invalid and must be re-performed.

   NOTE: Revision to be completed by 11/01/98 and training completed by 12/01/98.

NOTE: Due date dependent on that assigned for TRA Accident Hazard Assessment and Evaluation Action Plan.

Completion Date: 12/01/98

10. Perform and document training (required reading) on the above changes.

    NOTE: Due date dependent on that assigned for TRA Accident Hazard Assessment and Evaluation Action Plan.

    Completion Date: 12/01/98

11. Revise MCP-2727 to clarify what hazard evaluations and safety reviews require documentation and those that do not.

    NOTE: Revision to be completed by 11/01/98 and training completed by 12/01/98.

    NOTE: Due date dependent on that assigned for TRA Accident Hazard Assessment and Evaluation Action Plan.

    Completion Date: 12/01/98

12. Revise MCP-2727 to clarify that hazard evaluations and a safety review includes review of environmental along with safety and health concerns.

    NOTE: Revision to be completed by 11/01/98 and training completed by 12/01/98.

    NOTE: Due date dependent on that assigned for TRA Accident Hazard Assessment and Evaluation Action Plan.

    Completion Date: 12/01/98

13. Perform and document training (required training) on the above changes.

    NOTE: Due date dependent on that assigned for TRA Accident Hazard Assessment and Evaluation Action Plan.

    Completion Date: 12/01/98

14. Perform management self-assessment of field implementation of revisions and completion of required reading.

    NOTE: Due date dependent on that assigned for TRA Accident Hazard Assessment and Evaluation Action Plan.

    Completion Date: 01/30/99

Appendix C

Director, Site Operations Initiatives to Improve Rigor and Discipline in Operations and Maintenance

LMITCO Integrated Conduct of Operations and Maintenance Initiatives

This Appendix describes a series of initiatives that will enhance Lockheed Martin Idaho Technologies Company (LMITCO) management and operating practices at the Idaho National Engineering and Environmental Laboratory (INEEL). This information is presented to provide an overall context for the individual corrective actions discussed in Section 3 of the response report. These initiatives incorporate many of the corrective actions and are directly supportive of the infrastructure that resolves fundamental issues.

The LMITCO initiatives include an organizational realignment, integration of the conduct of operations and maintenance at all INEEL sites, and integration of INEEL Site Environmental, Safety, and Health protection (ES&H) programs into facility operations. These policy and procedure changes, and supporting training activities, focus on supporting the INEEL workers in the field who actually perform the work. This includes facility management, operators, facility engineers, ES&H support organizations, and craft workers. This appendix addresses these initiatives as individual actions, however; they should be considered in their entirety to understand the full impact on the workforce.

The key element to this transformation is an organizational realignment that (a) clarifies roles and responsibilities; (b) aligns the organization for more effective performance; and (c) enhances disciplined operation and accountability. The position of Director, Site Operations (DSO) has been filled after being open for over one year. The DSO reports to the LMITCO President and has been designated as the INEEL Site Integration Officer for Conduct of Operations and Maintenance Management. The DSO is implementing processes to increase the rigor and discipline of Conduct of Operations and Maintenance Management and to accelerate the implementation of Integrated Safety Management (ISM) at all levels of the workforce.

The reorganization establishes Site Area Directors for each of the INEEL sites. The Site Area Directors report to the DSO for conduct of operations and maintenance management issues, plus are responsible for the safe operation of their facilities. They provide leadership and direction in the implementation of the Integrated Safety Management (ISM) system. The Operations Training organization within the LMITCO Training organization has been realigned to report to the DSO. It is responsible for developing site/facility/program/craftsmen training programs, including the development of examination systems supporting the conduct of operations and maintenance management initiatives.

The DSO is also supported by a Site Maintenance Coordinator, a Site Operations Coordinator, a Site Program Coordinator, a Site Document Coordinator, and a Site Initiative Coordinator. The Site Maintenance and Operations Coordinators work with line management to ensure consistent implementation of maintenance management and conduct of operations practices, respectively, at all areas throughout the Site. The Site Document Coordinator oversees Site document control activities and ensures that revisions to Site-wide documents receive proper review and implementation prior to becoming effective. Much of this review will be accomplished through a Site Document Committee with representatives from each major facility. The Site Initiatives Coordinator works with the line managers to assess and coordinate the assessment of the impacts of proposed new initiatives on Site operations and to successfully implement current initiatives.

As a part of this reorganization, INEEL Site Program Managers have been established to support the line managers in the consistent implementation of Site ES&H programs, such as radiation control, occupational safety, industrial hygiene, and fire protection. The Program Managers are responsible for ensuring that the ES&H professionals who support the line organization in their program areas meet and maintain compliance with, applicable training and qualification requirements. Within their program areas, the Program Mangers are also responsible to:

Ensure that applicable ES&H requirements are appropriately and consistently incorporated into INEEL manuals, procedures, and other governing documents

Be responsible for the technical competence of individuals directly supporting the program

Propose LMITCO ES&H policies for senior management review

Provide line management with guidance on, and interpretations of, ES&H requirements.

A second element in the LMITCO initiatives to improve management and operation of the INEEL, is the implementation of a Site Integrated Maintenance Program to increase the rigor, discipline, and consistency in maintenance performance at the Site. This program involves the development of a Site Integrated Maintenance Plan, an Integrated Site Maintenance Manual, and a Site Integrated Maintenance Implementation Plan. The Site Integrated Maintenance Plan will (a) identify the schedule, including milestones, for the implementation of the Site Integrated Maintenance Program; (b) document the resource requirements; and (c) identify the commitments made in this response report that must be incorporated in the Site Integrated Maintenance Program. The Integrated Site Maintenance Manual (the Manual) will specify the work planning and control process for preventive and corrective maintenance from the time that the need for maintenance is identified through the completion of the maintenance activity. The Manual will consolidate the technical and ES&H requirements and standards for maintenance activities (e.g., work control process, occupational safety and health requirements, and facility authorization basis requirements) into a single resource to be employed by all facilities at the INEEL. Thus it will provide a single comprehensive reference (referred to by the DSO as "one-stop shopping") for everyone involved in the work control process, and will require use of a consistent work control process at all facilities throughout the INEEL. The Site Integrated Maintenance Implementation Plan will identify the jobs and functions that require training in each chapter of the Manual and provide the bases for the Operations Training organization to develop and deliver modular training on the Manual chapters. The Site Integrated Maintenance Plan, the Manual, and the Site Integrated Maintenance Implementation Plan are being developed by a task force consisting of all Site Area Directors, work control subject matter experts, safety professionals, craft workers, trainers, and representatives of the ISM System, the Voluntary Protection Program (VPP) team, and the LMITCO team that helped develop this response report. The drafts are scheduled to be completed by the November 1998. The DSO, in coordination with ID will lead a thorough review of these drafts, with emphasis on the Manual, to ensure they meet ID and LMITCO standards for rigor and discipline. LMITCO personnel and outside experts, including ID personnel, will support the DSO in the performance of this review. The review and any required revisions are expected to be complete by late November, 1998. After review and approval by ID and LMITCO management, the LMITCO Document Control System will issue the draft Manual for training purposes. Upon completion of the training, the Manual will become effective, at which time, appropriate work control procedures and manuals will superceded and cancelled. Upon issuance of the draft Manual, Operations Training will develop the training modules for workforce training on the manual. These modules will be used as the initial element of a Site Training Library. Personnel who are identified in the job matrix in the Site Integrated Maintenance Implementation Plan as requiring training on the Manual to perform their duties, will be trained on the applicable modules by the Operations Training organization, with the active support of the Site Area Directors. These personnel will be required to score 80% or above on the module examination(s) in order to perform work in the area(s) covered by the training module(s). Line managers at the individual facilities will focus their self-assessment programs on the newly implemented maintenance program and provide feedback to the responsible Site Area Director and the DSO. To validate its effectiveness, the Site Area Directors will

perform field verifications of the work control process under the newly implemented maintenance program. The DSO will complement these self-assessments and field verifications with assessments of each Site Area Director's organization, employing the LMITCO Independent Performance Assessment

(IPA) organization. The DSO will also conduct unannounced walk-arounds during normal and off-shift hours to assess the effectiveness of the implementation of the program. Finally, ID will perform assessments of LMITCO maintenance management. These tiered assessments will provide feedback about areas for possible improvements in the design and implementation of the program and will provide a basis for holding line managers from the DSO through the first line supervisors accountable for maintenance management performance. The sites and the responsible Site Area Directors will be ranked based upon their effectiveness in the implementation of the Site Integrated Maintenance Program. This ranking will be considered in their personnel performance appraisals.

Once the Site Integrated Maintenance Plan, the Site Integrated Maintenance Manual, and the Integrated Maintenance Operation Plan have been developed, the initiative to enhance the Site-wide rigor and discipline of the conduct of operations will commence. This is scheduled for late November, 1998. The initial action will include a two-week assessment, on an individual facility basis, of compliance with the LMITCO Conduct of Operations Manual. An informal report will be developed for each facility and provided to them for use in training. The assessment results will also be used to establish the priorities for the subsequent training and review led by the DSO. During the first week of each month, the DSO will meet with the facility operations managers to review a chapter of the LMITCO Conduct of Operations Manual. During this review, the DSO will articulate the ID and LMITCO performance expectations in each area. The review will also include revision and update of the Conduct of Operations manual, where appropriate, including modifications to reflect changes in the organization or facility operations. Appropriate members of the Operations Training organization will also attend these sessions to develop training modules for each chapter of the Conduct of Operations manual. This material, including a training examination, will be developed within two weeks of the review session. The facility operations managers will then be required to pass the examination for the module covering the material that was discussed two weeks earlier. A passing grade on the examination for the operations manager will be 90%. The operations managers or their designated representatives will train the operators in their facilities during the month after each Conduct of Operations Manual chapter training module becomes available. The modules will be used for the initial operator training and retained as an element of a Site Training Library. The operators will be required to pass the examination on each module with a score of 80% or higher. This review and training process will continue until all chapters in the LMITCO Conduct of Operations Manual have been addressed, which will be about six months. The Operations Training organization will provide training to those individuals other than operators and operations managers (e.g., craft workers and support organization personnel) who require training on specific aspects of the Conduct of Operations Manual. Applicable portions of this training will be provided to craft workers after they have completed the Integrated Maintenance Program Training. A passing grade on the examinations for craft workers will be 80%. The training process for facility technical support personnel will be same as that employed for craftsmen.

The Site Area Directors will perform selected interviews with participants and observe operations practices to verify training adequacy and provide feedback to their operations managers. The DSO will complement these reviews with assessments of the each of the Site Area Director organizations, employing the LMITCO IPA organization. The DSO will also conduct unannounced walk-arounds during normal and off-shift hours to benchmark conduct of operations performance. Finally, ID will perform assessments of LMITCO conduct of operations. These tiered assessments will provide feedback about areas for possible improvements in the design and implementation of the program and will provide a basis for holding line managers from the DSO through the first line supervisors accountable for conduct of operations performance. The sites and the responsible Site Area Directors will be ranked based on

their conduct of operations performance. This ranking will be considered in their personnel performance appraisals.

Beginning in approximately March of 1999, the DSOwill lead evaluations of the ES&H program manager activities. Teams of LMITCO personnel and outside experts will conduct these evaluations. They will focus on how effective program managers are in (a) ensuring that applicable ES&H requirements are appropriately and consistently incorporated into INEEL manuals, procedures, and other governing documents; (b) supporting line management with guidance on, and interpretations of, ES&H requirements; (c) ensuring that the ES&H programs reflect and appropriately implement Integrated Safety Management (ISM) and Voluntary Protection Program (VPP) requirements and concepts; and (d) ensuring that ES&H technical support personnel training and qualifications are maintained current. These assessments will provide feedback about areas for possible improvement in the ES&H program manager activities and provide a basis for holding the program mangers accountable for their performance. The thrust of this initiative is to improve the effectiveness of these programs in integrating their energies to support the facility workforce in effectively achieving facility missions while maximizing worker safety.

Although ISM and VPP implementation activities will be an integral building block of the conduct of maintenance and conduct of operations enhancement initiatives, they will become a prime focal point beginning with the March 1999 assessments of the ES&H program activities. Based on the results of these assessments and the progress made in ISM implementation commitments, the DSO will focus management attention and emphasis on those activities needed to ensure that ISM implementation commitments will be met on schedule. By the end of July 1999, senior management will make a final decision whether to attempt to achieve VPP Star status at the INEEL under LMITCO management.

The combination of the initiatives described in this section, the corrective actions presented in Section 3 of this report, and ongoing ISM and VPP implementation activities define the ID and LMITCO path of continuing improvement over the next year. These initiatives will be the major focus of LMITCO improvements through the remainder of its tenure managing the INEEL. ID and LMITCO senior management will commit the energy and resources needed to successfully complete these priority activities.

Appendix D

Maintenance and Operations Improvement Plan

LOCKHEED MARTIN

Lockheed Martin Idaho Technologies Company

INTERDEPARTMENTAL COMMUNICATION

Date: August 26, 1998

To: All LMITCO Vice Presidents, Directors, and Area Directors

From: G. E. Ellis MS 3898 6-4642

Subject: MAINTENANCE AND OPERATIONS IMPROVEMENT PLAN – PHASE II, GEE-129-98

This letter provides specific direction for beginning Phase II of our Maintenance and Operations Improvement Plan. The plan is summarized in Attachment 1. The Plan, commencing with Phase II, will delegate to the Area Directors the authority to approve resumption of specific maintenance tasks.

Please note that these maintenance tasks are those included in the following definition of maintenance from Management Control Procedure (MCP-2798) Maintenance Work Control:

> *Maintenance: Day-to-day work, including corrective, preventive, and predictive maintenance, that is required to maintain and preserve plant and capital equipment in a conditions suitable for it to be used for its designated purpose. Maintenance activities may include shop fabrication.*

A list of tasks performed by the maintenance organization, but not classical maintenance and repairs are defined by MCP-2798 as Maintenance Related Work. These tasks are not included.

Area Directors may move their areas from Phase I to Phase II of the Maintenance and Operations Improvement Plan upon written approval from this office. Requests for approval should be submitted through the respective Vice Presidents and include the following documentation:

1. Statement that the Area Director understands the roles and responsibilities of the position as outlined in the Area Director Program Plan, approved June 10, 1998.

2. Summary of the system established for the Area Director briefing for all personnel involved in the preparation, planning, review, execution, and oversight of maintenance work orders on Work Control and Hazard Mitigation (TRAIN No. WCHR0098). All personnel do not have to have completed the briefing to begin Phase II, however, it is a prerequisite to their involvement in any of the activities indicated above for any work order submitted for approval to the Area Director.

3. Summary of the system established for implementing the Senior Supervisory Watch as described in Attachment 1. This should include guidelines the Area Director will utilize in the

decision to assign the watch to cover one specific work order full time, several work orders on a roving basis, or delegate oversight to the normal facility/activity supervision.

4. Statement summarizing the progress and future plans within the Area for helping personnel to understand and utilize the functions and guiding principles of Integrated Safety Management for improving work.

As a review, the five functions are:
1) Define the Work Scope
2) Identify the Hazards
3) Develop and Implement Hazard Controls
4) Perform Work Within Controls
5) Provide Feedback and Continuous Improvement

and the eight guiding principles are:
(1) Line Management Responsibility for Safety
(2) Clear Roles and Responsibilities
(3) Competence Commensurate with Responsibilities
(4) Balanced Priorities
(5) Identification of Safety Standards and Requirements
(6) Hazard Controls Tailored to Work Being Performed
(7) Operations Authorization
(8) Employee Involvement.

5. Statement that the following personnel: (work order primary owners; environmental, safety & health, or quality assurance reviewers; maintenance supervisors and foremen) have completed Enhanced Work Planning Level III training (TRAIN 00TRN300) or will have completed it, prior to signing any Work Order utilized in Phase II.

6. Statement that the following Enhanced Work Planning documents are being followed for all work, as applicable:
- Maintenance Work Control – PRD-177, PRD-178, MCP-2798
- Performing Safety Reviews – MCP-2727
- Performing Pre-Job Briefings and Post-Job Reviews – MCP-3003
- Job Safety Analysis – MCP-3450
- Lock-out/Tagout – MCP-1059
- Reporting and Resolving Employee Safety Concerns and Suggestions - MCP-2722

7. Summary of the system being utilized by the Area Director for assessing work control problems and handling recommended actions. One option is to utilize the Job Review Checklist developed by the Enhanced Work Planning initiative. A copy of that checklist is included as Attachment 2.

As noted above, in Phase II, approval for each Work Order is delegated to the Area Directors. Each approval is to be documented by completing the Maintenance Work Review & Approval Form (PC Form 433.25, Revision 01, dated 08-26-98). A copy of that Form is included as Attachment 3 to this letter.

Plans are now being developed for Phase III of our Maintenance and Operations Improvement Program. As indicated in Attachment 1, Phase I included the chartering of a LMITCO Accident Investigation Team. The results of their investigation, including root cause analysis of the accident as well as our analysis of other information concerning weaknesses in safety performance (including audits, assessments, and performance measures), will be included in Phase III of our Plan. Please encourage your personnel to actively participate in this plan, and provide ideas for improvement. As our Voluntary Protection Program states, our goal is to create and maintain a workplace free of injuries and illnesses using employee involvement and management leadership.

Our efforts to substantially and quickly improve the INEEL maintenance, operations and safety posture are critical to the future of the site. You must give it your top priority. If you have questions, please contact this office.

Attachment 1	Maintenance and Operations Improvement Plan presentation dated August 24, 1998
Attachment 2	Job Review Checklist, dated August 26, 1998
Attachment 3	Maintenance Work Review & Approval Form, Revision 01 dated August 26, 1998

JND

cc: J. N. Davis
J. L. Lyle, DOE-ID
R. M. Stallman, DOE-ID
R. A. Taft, DOE-ID

INEEL Maintenance and Operations Improvement Plan

Presentation to LMITCO personnel
by Area Directors

Objectives

- Review steps being taken to improve hazard identification and work control at the INEEL
  - **STOP WORK ORDER from Exec VP**
  - **Three phase Maintenance and Operations Improvement Plan**
- Summarize steps completed in Phase I
- State requirements to begin Phase II
- Invite discussions/questions/comments to improve our program

STOP WORK ORDER

(by Executive Vice President, Aug 18, 1998

- Held site-wide meeting, required managers to stop all work until they were personally certain work was properly planned and could be safely conducted. Emphasized line management ownership, responsibility and accountability, hazards recognition and mitigation, Enhanced Work Planning, integrated safety management, and verbatim compliance with procedures
- Formally stopped all maintenance work managed and/or performed by Facilities, Utilities and Maintenance (FUM) personnel as of August 18, 1998.
- Details provided in Exec. VP notegrams, Aug. 19 and 20
- Provided process (Maintenance Work Review & Approval Form) to authorize specific required maintenance work

Maintenance and Operations Improvement Plan Phase I Actions (completed)

- STOP WORK ORDER issued by Executive Vice President
- Specific essential maintenance work resumed by Exec VP approval on Maintenance Work Review & Approval Forms
- Area Director Program implemented
- Meetings held with Area Directors and with ESH&QA Managers to discuss responsibilities and to begin to develop Maintenance and Operations Improvement Plan

Maintenance and Operations Improvement Plan (con't.) Phase I Actions (completed)

- Briefing to Senior LMITCO Management from Exec VP on Aug 24th, emphasizing their responsibility to be personally involved in work under their cognizance, including their physical presence at the job sites.
- Charter LMITCO Accident Investigation Team
  - (to include Root Cause Analysis)
- Briefings to Area Directors by Vice Presidents on Aug 24 to summarize the Three Phases of the Maintenance and Operations Improvement Plan, including Work Control and Hazard Recognition briefing.

Maintenance Work Review & Approval Form (now in use)

- Authorizes resumption of specific work orders
  - to comply with Tech. Specs. and safe operations
  - to maintain stable facility conditions or for emergency response.
- Requires specific steps in addition to facility/activity rqts.
  - 1. Certification that work meets above criteria
  - 2. Following MCP 2798 (Maintenance Work Control) for all work
  - 3. Job site walk-down for all work
  - Special review and certification by Work Order Manager, Work Order Primary Owner, Planner, S&H Professional(s) Supervisor/Foreman, Responsible Director and Vice President
  - Final approval given by Executive Vice President on each Form

Maintenance and Operations Improvement Plan - Phase II Requirements

- Completion of All-Hands Briefings by Area Directors
- Implementation of Senior Supervisory Watch for maintenance work
- Letter certifying Phase II readiness of their organization from Vice Presidents to Exec VP.
- Maintenance work resumption in accordance with Maintenance Work Review & Approval Form, Rev. 01

Maintenance and Operations Improvement Plan - Phase II (con't)

- Letter from Exec VP on Aug 25th will detail requirements and guidelines for Phase II:
  - Guidance for Senior Supervisory Watch
    - Conditions under which Area Director should assign Watch
    - Conditions of special interest to be observed by Watch personnel
    - Minimum training and qualifications of Watch personnel
  - Guidance on specific personnel to receive briefings prior to work resumption
  - Guidance for leading indicators which will demonstrate changes are having positive effect
  - Guidance on assuring safety management is integrated into work
  - Requirements for Vice Presidents to certify to Exec VP their organization's readiness to transition from Phase I to Phase II

Maintenance and Operations Improvement Plan -Phase II
(continued)

- Phase II will utilize revised Maintenance Work Review & Approval Form (PC Form 433.25, Rev. 1)**
  - Authorizes resumption of specific additional maintenance work deemed necessary by respective facility/activity manager
  - Still requires all maintenance work to meet requirements of Enhanced Work Planning process (MCP 2798)
  - Requires Senior Supervisory Watch in-place for maint. work
  - Requires completion of specific Work Control & Hazard Recognition briefing by Area Director for all personnel to be assigned responsibilities for work planning and execution
  - Final approval given by responsible Area Director on each Form

» **Copy attached to this handout

All Hands Briefings
(by Area Directors)

- Each briefing includes work planning and control, hazard identification, integration of safety into work, use of procedures, and lessons learned from TRA 648 CO_2 release
- Basic presentation prepared (copy attached to this handout)
- Area Directors have been trained by Vice Presidents on briefing content and requirements.
- Area Directors will brief personnel involved in work planning and execution within their area:
  - Different levels for Foremen and Crafts, Engineers, Planners, ESH&QA Professionals, Supervisors, Managers

Senior Supervisory Watch

- Roving or job specific watch within a facility or geographical area to assess maintenance and or operations work
- Area Director will determine areas/specific jobs for which Watch is to be established and assignment of Watch personnel based on guidelines in Exec VP letter of Aug 25th
- Responsible for providing independent overview of work control, hazard identification, safety integration, walk-downs, use of procedures, Lockout/Tagout, etc.
- Attend pre-job briefing and ensure ESH&QA issues are understood by all workers prior to start of work

Senior Supervisory Watch
(Continued)

- Perform in-progress walkdowns to evaluate job safety, work control and proper use of procedures
- Assure deficiencies identified are properly being addressed by maintenance supervision and findings reported to Area Director
- Watch will remain in place until comprehensive maintenance and operations improvement plan indicates otherwise.

Maintenance and Operations Improvement Plan - Phase III

- Plan being developed
- Obtain DOE-ID concurrence of Plan by Sept 16
- Incorporate results of Root Cause Analysis investigation, lessons learned from other abnormal events at INEEL and other sites.
- Revise site and facility work control documents to assure standardized incorporation of EWP principles
- Train personnel on revised policies, procedures and on integrated safety management functions and principles
- Complete Independent Assessments of each facility & activity to validate that EWP process is fully implemented

Summary

- **Aggressive action is being taken in a three phase plan to significantly improve**
  - **hazard identification and mitigation**
  - **maintenance and operations work control**
  - **standardized implementation of EWP**
  - **integration of safety culture into all work**
  - **senior management involvement in ongoing work review and execution**
  - **personnel training and qualification**
- **LMITCO is making final preparations to transition from Phase I to Phase II**

Work Control & Hazard Recognition

Preliminary Lessons Learned from the July 28, 1998 Fatality at the Test Reactor Area

Today I would like to talk about and discuss some of the preliminary lessons learned from the TRA July 28 fatality. This presentation will provide you with an overview of the event as well as what we have been presenting to the workforce at the INEEL.

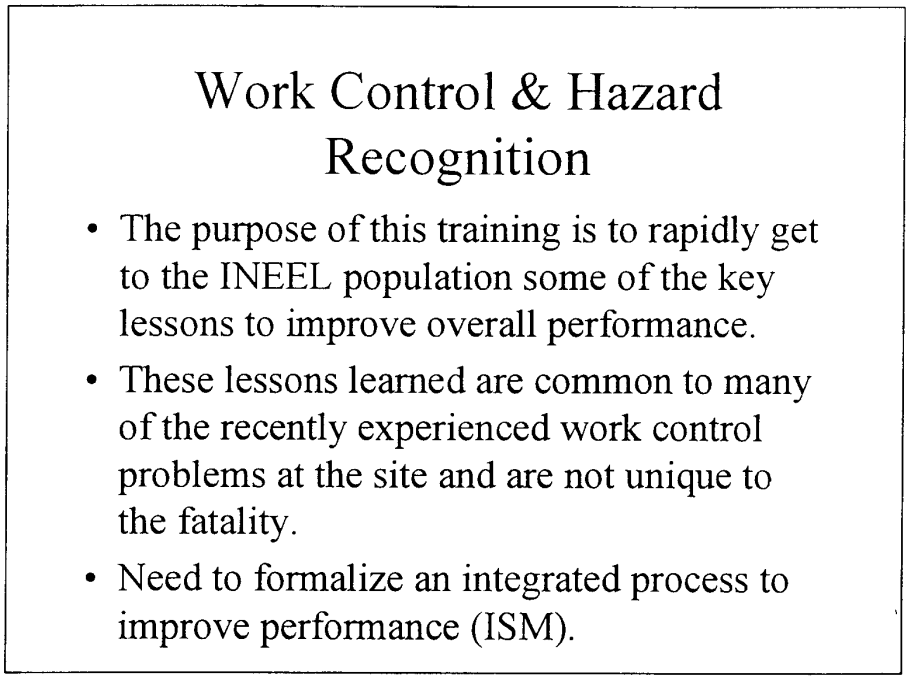
This event has been extremely difficult for many people; from the people involved that evening to the people in the organizations responsible for planning, reviewing, and executing the evolution. All feel an overwhelming responsibility for this event. I share this with you not to make excuses or seek your sympathy, but to help you understand that it has taken some time for many of us to come out of denial and start to recognize that there were real and concrete measures that could have been taken to prevent this event and related fatality. As I once heard said, the truth shall make you free, but first it will make you madder than hell! As we start to understand the truth and the anger that goes with it, we start to make real progress in making sure that another fatality or serious injury never again happens at the INEEL.

We can probably say that we met the letter of the law with regards to OSHA and NFPA related to LO/TO, but that doesn't help our dead team mate Kerry Austin because OSHA and NFPA only provide the minimum requirements for protection of the worker. We have an obligation to do whatever is necessary to protect all of our team mates. We failed in a number of areas. It is these areas that I would like to discuss today.

Event Description

- On July 28, 1998 personnel from Site Services and the Reactor Programs Operations, Maintenance, and ESH&QA organizations were preparing to perform electrical breaker maintenance in building TRA 648. A formal pre-job brief was performed. Fire suppression systems, including sprinklers and the CO2 system, were impaired. While opening electrical breakers to establish plant conditions, the CO2 system solenoid firing valves were activated releasing nearly three tons of CO2 into the work space. Thirteen workers were in the work area at the time the CO2 system activated without warning. Eight workers escaped under their own power, five were overcome by the CO2. Rescue efforts by co-workers resulted in removing three of the five downed workers from the CO2 filled building. The remaining two were rescued by fire department personnel. The accident resulted in one fatality and three critically injured personnel.

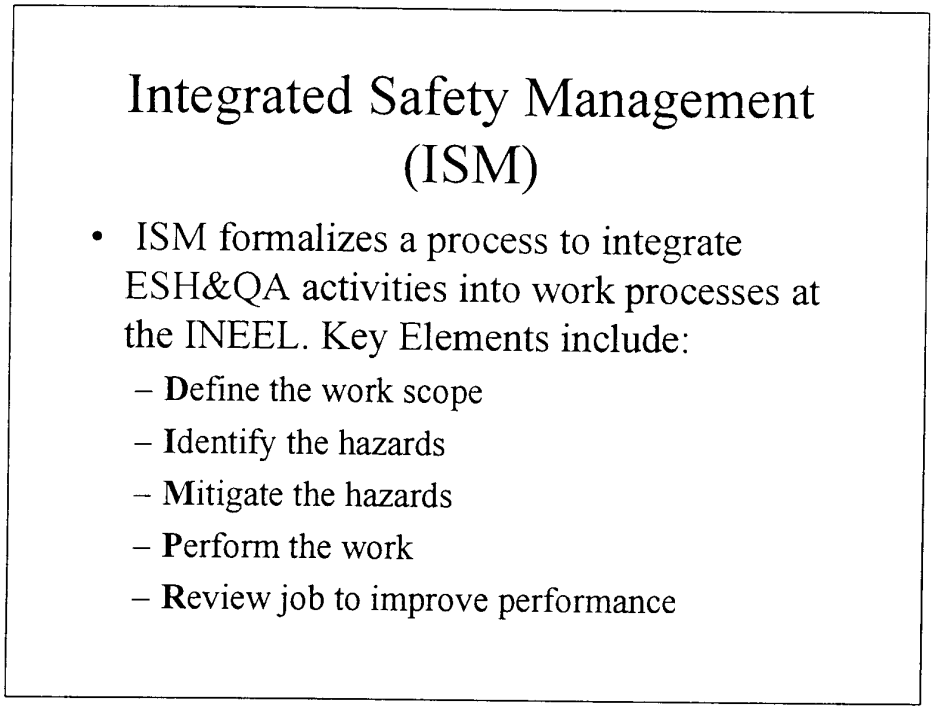
I would like to briefly discuss the event before moving into the lessons learned.



The purpose of this training is to rapidly get to everyone at the INEEL the preliminary lessons from the July 28 fatality at the Test Reactor Area. It is imperative that we learn rapidly and make step changes in our work control performance.

These lessons are not unique to the fatality. They are in fact common to many of the recently experienced work control problems around the site. I know a number of you are setting in here saying to yourself that it can't happen to me or to my facility. Believe me it can and it will if you do not take actions to improve your work control performance.

The goal today is to rapidly get out to everyone preliminary lessons learned and to quickly formalize a process to integrate ESH&QA activities into our work processes and achieve the step change in performance mentioned above. The process we will talk about is ISM.



ISM is the process we will use to integrate ESH&QA activities into our work processes.

Every person involved in any aspect of the five work processes (Operations, Maintenance, Research, Construction, & D&D/Remediation) needs to learn and understand the five key elements of ISM.

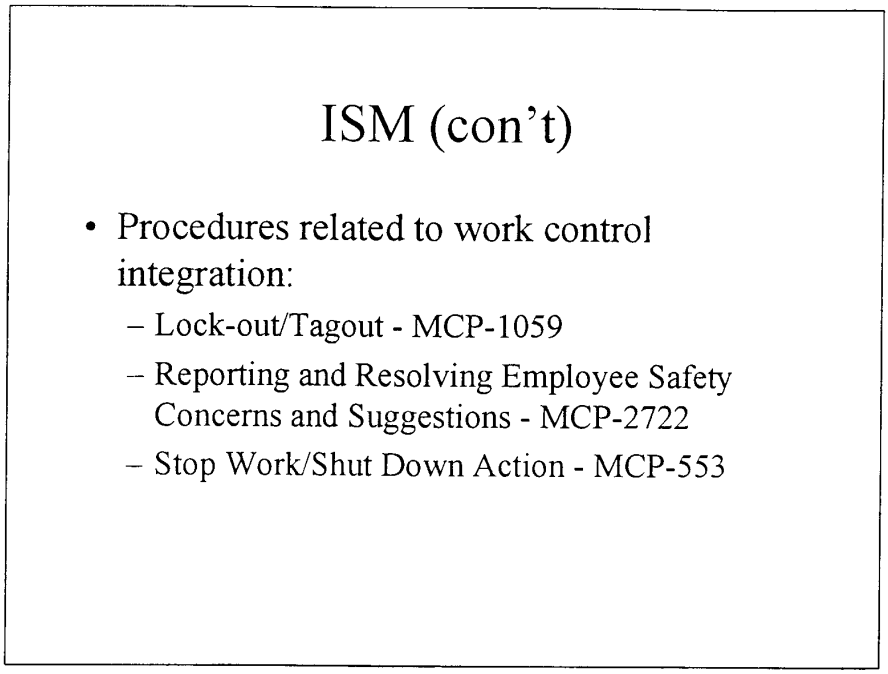
The key elements are:

Define, Identify, Mitigate, Perform, and Review

ISM (con't)

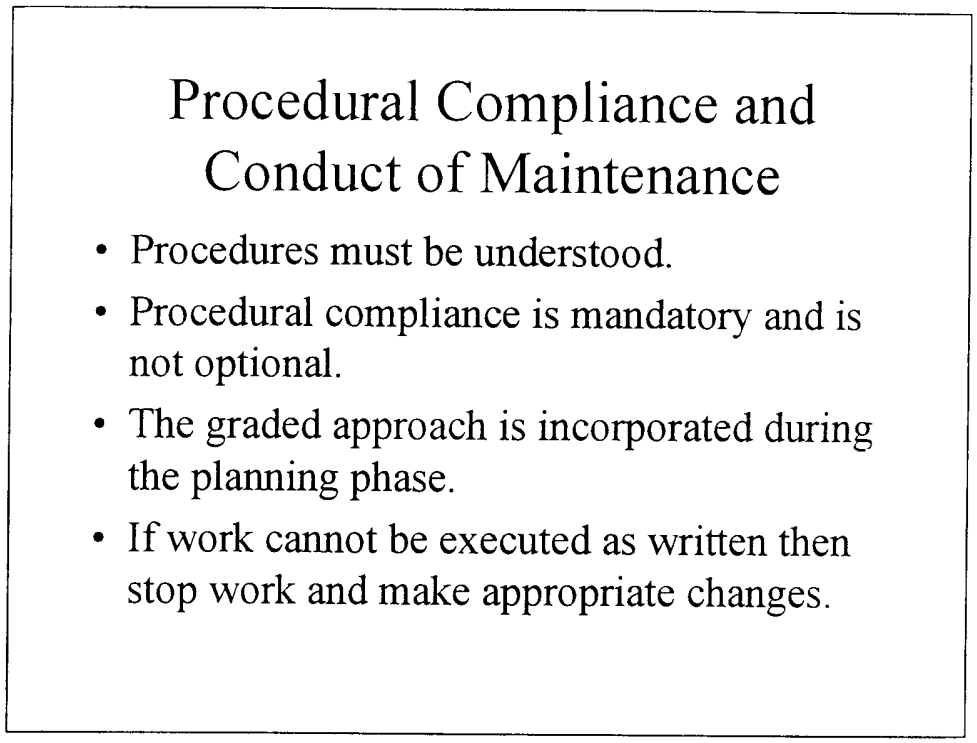
- Procedures related to work control integration:
  - Maintenance Work Control - MCP-2798, PRD-177, PRD-128
  - Performing Safety Reviews - MCP-2727
  - Performing Pre-Job Briefings and Post-Job Reviews - MCP-3003
  - Job Safety Analysis - MCP-3054

There are a number of procedures related to work control. The following list are a few of those procedures.



More procedures.

Procedures define the process by which we do business.

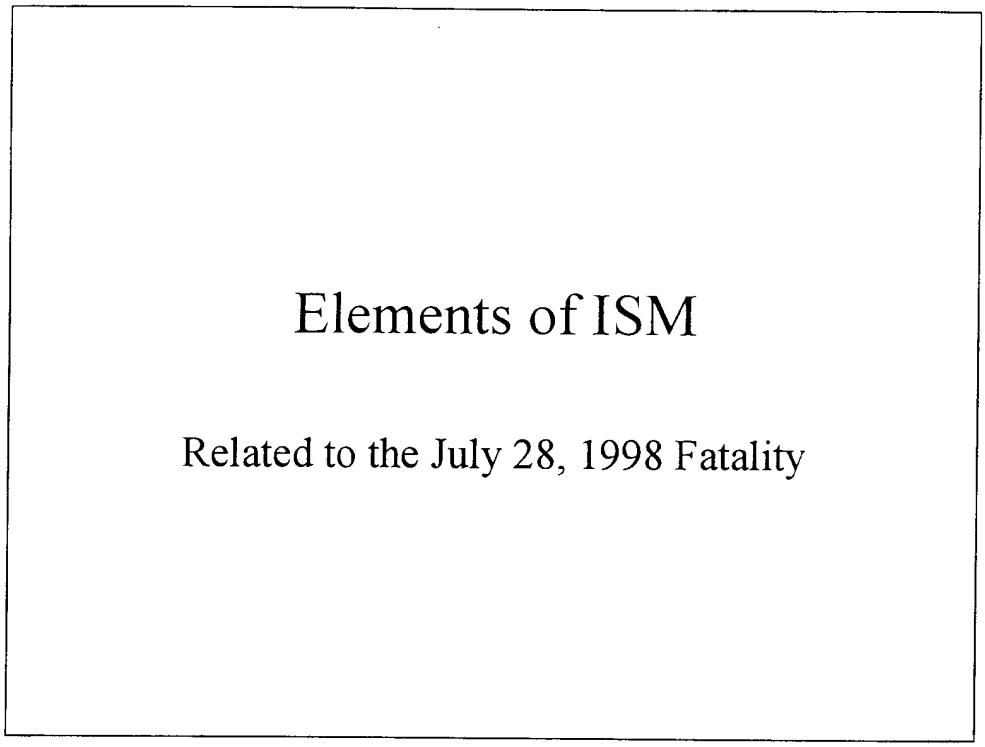


What is important to understand is that the procedures must be understood as well as followed. Our own company procedures state that compliance with procedures is mandatory.

Procedural compliance is not an option!

The graded approach will be built in during the planning phase and incorporated into the procedure. In other words, the detail and complexity of the procedure is planned in up front and the resulting work package will be executed as written.

If the package at the work site cannot be executed as written, then work stops and the work package is changed as required by company procedures.



Now I would like to talk about the elements of ISM and how they related to and may have prevented the fatality on July 28.

Define the Work Scope

- Electrical Switch-gear Maintenance
  - No team review as described in MCP 2798.
    - Even though 13 different people and 4 different organizations were involved, it was determined that this work did not meet the requirements of MCP 2798 for Team Planning.
  - Personnel involved believed job was well planned and scoped.
    - However, up-front planning and procedure development failed to identify and mitigate all hazards in the work area.

The maintenance was pretty straight forward and we thought it was fairly well defined. It was considered routine, periodic maintenance which did not even require the filling out of a JRC. It was also not considered high risk or complex and therefore required no team planning as discussed in MCP 2798.

The job however involved no less than 13 different people from two different directorates and 4 different departments. It also required a significant change in plant condition and system status requiring a major power outage that secured electrical power to a significant portion of the Test Reactor Area.

Up-front planning and procedure development failed to identify and mitigate all hazards existing in the work area.

Define the Work Scope (con't)

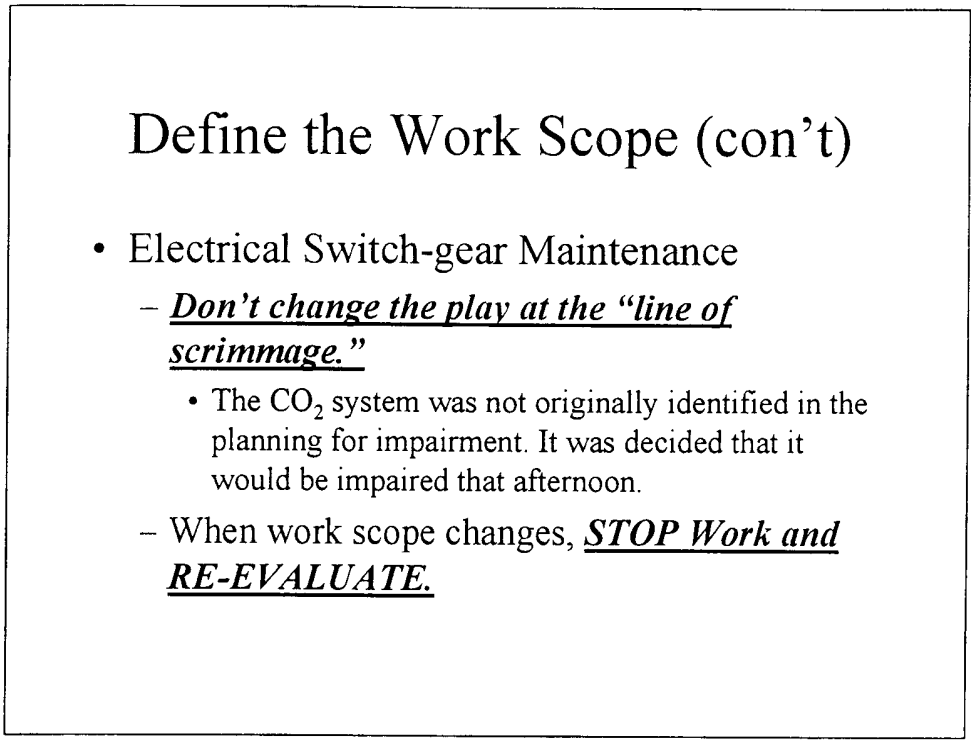
- Electrical Switch-gear Maintenance
  - A formal pre-job brief was performed but not required.
    - CO_2 Hazards were discussed with one worker asking about the removal of the CO_2 solenoid firing valves.
    - Worker was told that the system would be impaired and that it would not activate.

A formal pre-job brief was conducted but was not required by procedure. Everyone thought they were going the extra mile on this job.

- CO2 hazards were discussed with one worker even asking about the removal of the solenoids.

- The worker was told that the CO2 system would be impaired and the there was no way that the system would activate.

There was an opportunity here to use the synergy of the pre-job brief to mitigate the CO2 hazard but group think kicked in and we talked ourselves out of doing the right thing. The worker was told that the system would be impaired and that it would not activate



Don't change the play at the "line of scrimmage."

The CO2 system was not originally planned for impairment. When work scope changes, stop and re-evaluate. Get appropriate supervision involved.

Re-emphasize that our company procedures state that compliance with procedures is mandatory.

Procedural compliance is not an option!

The graded approach will be built in during the planning phase and incorporated into the procedure. In other words, the detail and complexity of the procedure is planned in up front and the resulting work package will be executed as written.

If the work documents cannot be executed as written, then work stops and the documents are changed to meet the actual conditions as required by company procedures.

Identify the Hazards

- Keep the big picture in mind.
  - Understand the entire work area and related systems.
- Better use of and more strict compliance with MCP 2727 & MCP 3450 would have improved the hazard identification & documentation process.

We have to keep the big picture in mind. Understand the entire work area and its related systems and all of the hazards in the area

Better use of and more strict compliance with MCP 2727 & MCP 3450 would have improved the hazard identification & documentation process.

Identify the Hazards (con't)

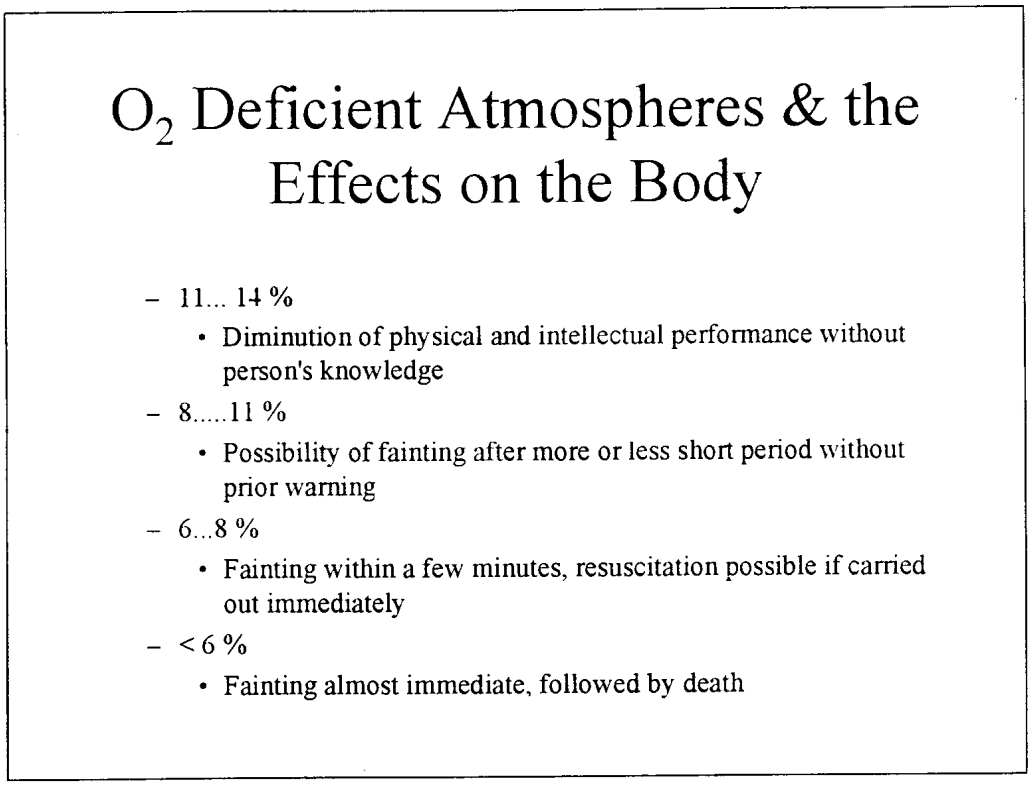
- Did not identify **ALL** potential and credible hazards (MCP 2727, Safety Reviews).
  - Electrical, fire & resulting smoke, CO_2, lighting, tripping, blocked passageways and lifting hazards.
- Did not understand the significance or magnitude of the potential/credible hazards (MCP 2727, Safety Reviews).
  - Only a single barrier between workers and nearly three tons of CO_2.

MCP 2727 is clear on making sure that all potential and credible hazards are identified. In addition, MCP 2727 requires that the significance and magnitude of hazards be evaluated.

While there were supposed to be a number of administrative barriers, there was only a single physical barrier in the form of solenoid valves between the workers and nearly three tons of CO2.

All of us knew that the CO2 system was their. But I don't believe that we were aware of the significance of the CO2 hazard and how quickly it would drive visibility to whiteout conditions and oxygen to deadly levels.

Ask the "what if" questions



This slide represents various O2 levels and the related health effects

With almost three tons of CO2 filling the work space, oxygen levels were driven almost immediately to the 6% level. In addition, the breathing of CO2 rapidly exchanges with the oxygen in the blood.

Mitigate the Hazards

- Consider all points raised during job related discussions.
- Provide ***physical/mechanical barriers*** to mitigate hazards (engineering controls) as the primary means of control.
- Use administrative controls/barriers as a secondary measure.
  - Escape pathways
  - Facility, equipment, and system familiarization
  - Training
  - Personnel accountability

Consider all points raised during job related discussions and take actions to mitigate.

Consider the question related to removal of the solenoid valves and how easy it would have been to remove them and tag them out.

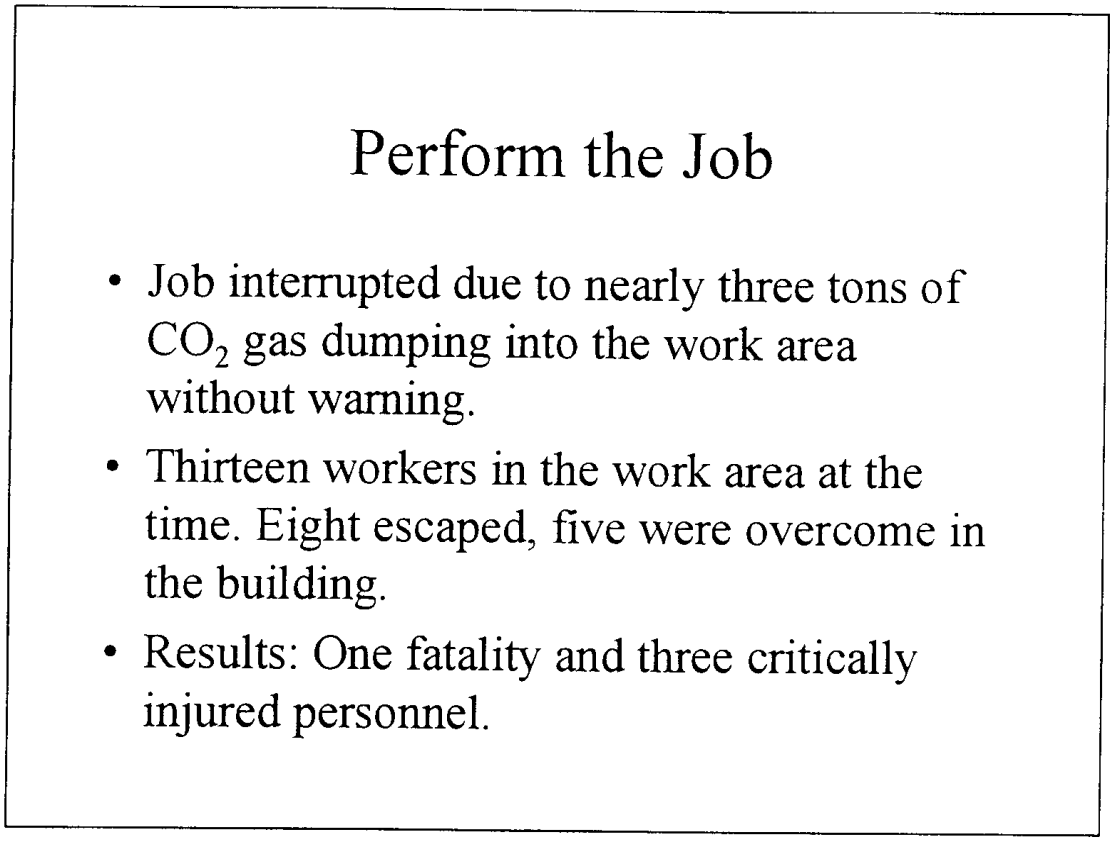
Understand the hierarchy of barriers. Engineering controls, administrative controls, and finally the use of PPE.

Mitigate the Hazards (con't)

- Use personal protective equipment (PPE) as the least desirable means for personnel protection.
- Consider staging emergency equipment for the "Unplanned Event."
  - Emergency vehicle
  - SCBA's
  - First aid kits
  - Fire extinguishers

Use PPE as the last control for personnel protection.

Consider staging emergency equipment for the "unplanned event."



While establishing plant conditions to perform the job, it was interrupted to to the almost three tons of CO2 dumping into the work area without warning.

Post Job Review

- Because of the inadequacies in performing the first three steps, we are doing a post-accident review instead of a post-job review. However, the goal is to perform a post-job review to:
  - Critique the job, which provides feedback for continuous improvement.
  - Allows next job to be performed faster, cheaper, better, and **SAFER**.

Refer to slide.

Summary

- Integrated approach allows for:
  - Better definition & description of the work.
  - Better identification & understanding of hazards.
  - Better control of hazards
  - Improved job performance.
  - Continuous improvement through post-job reviews.

It is imperative that we immediately start using this integrated approach. The benefits are obvious. More discipline is needed in the preparation and execution of our work procedures. I can only try and describe the devastating impact that this type of event has on everyone. I can tell you that it is not an event that I ever want to again experience again.

Attachment 2
GEE-129-98
August 26, 1998

INEEL Maintenance Job Review Checklist

Facility _____ Person Completing Checklist_____ Date_____
Work Order (s) /Procedure Numbers included:
_____
_____

The INEEL Maintenance Job Review Checklist provides a means to assess and capture information to provide independent overview of work control, hazard identification, safety integration, and procedure compliance for maintenance and operation work. Please check the appropriate boxes on areas reviewed and note any deficiencies.

1. ESH&Q

- ☐ Identification of potential hazards
- ☐ Safety Hazards/Precautions
- ☐ Personal Protective Equipment (PPE)
- ☐ Hazard Analysis Mitigation
- ☐ Environmental Precautions
- ☐ Waste Minimization
- ☐ Permits
- ☐ Emergency Response Planning

Problems _____
_____
Recommended Action _____
_____
Other Comments_____
_____

2. Work Package/Procedures

- ☐ Instructions/Prerequisites
- ☐ Readability
- ☐ Testing
- ☐ Team Planning
- ☐ Drawings
- ☐ Constructability/Maintainabilty
- ☐ Job Site Walkdown
- ☐ Detail
- ☐ Tools/Materials
- ☐ Scope
- ☐ Craft Involvement
- ☐ Minor maintenance
- ☐ JRC
- ☐ Ease of Operation

Problems _____
_____
Recommended Action_____
_____
Other Comments_____
_____

3. System or Component Readiness

- ☐ System Equipment Status
- ☐ System Turnover
- ☐ Lock & Tag Out
- ☐ Supporting Documentation
- ☐ Emergency Response Equipment
- ☐ Configuration Management
- ☐ TSR/OSR/LCO

Problems _____
_____
Recommended Action_____
_____
_____
Other Comments_____
_____

4. Support Coverage

- ☐ Multiple Craft Coordination
- ☐ Communications
- ☐ Planning/Scheduling
- ☐ Radiation Protection
- ☐ Work Delegation
- ☐ ESH&Q
- ☐ Transportation
- ☐ Engineering
- ☐ Primary Owner
- ☐ Operations

Problems _____
_____
Recommended Action_____
_____
_____
Other Comments_____
_____

5. Conduct of Operations

- ☐ Review/authorization
- ☐ Communications
- ☐ Pre Job Briefing
- ☐ Roles and Responsibilities
- ☐ Sys/Component Knowledge
- ☐ Supervision
- ☐ Procedure Compliance
- ☐ Configuration control
- ☐ Component Labeling
- ☐ PersonnelQualification
- ☐ Primary Owner
- ☐ Log Keeping
- ☐ Emerg. Notification
- ☐ Turnover

Problems _____
_____
Recommended Action_____
_____
Other Comments_____
_____

6. Other Observations

- ☐ _____
- ☐ _____
- ☐ _____

Problems _____
_____
Recommended Action_____
_____
Other Comments_____
_____

433.25
08/26/98
Rev. 01

MAINTENANCE WORK REVIEW & APPROVAL FORM

Policy

The Maintenance Work Review and Approval Form will be used in addition to all existing LMITCO work control requirements to authorize the maintenance work (process and nonprocess) managed and/or performed by the Facilities, Utilities, and Maintenance Directorate personnel or Fire and Life Safety Systems personnel until superceded by instructions from the office of Mr. G. E. Ellis, LMITCO Executive Vice President and Chief Operating Officer. For emergency work, the form will be completed after action is taken to stabilize the facility or activity.

Steps

1. List and provide the unique numbers for the specific Work Order(s) included in this approval.
   (1). _____
   (2). _____
   (3). _____
   (4). _____
   (5). _____
   (6). _____
   (7). _____
   (8). _____
   (9). _____
   (10). _____
2. Follow Management Control Procedure (MCP-2798) Maintenance Work Control for all work, including preventive maintenance. If any of the requirements of MCP-2798 are in conflict with the requirements of MCP-2799 Preventive Maintenance, or with any facility/activity specific policies or procedures, follow MCP-2798 and document the difference in the Work Order
3. For work assumed to be minor maintenance, perform a job site walkdown in addition to the criteria spelled out in MCP-2798 to ensure the work is minor maintenance as defined in MCP-2798.
4. For all other work orders, follow MCP-2798 including conducting a job site walkdown. (The options exempting walkdowns listed in MCP-2798, steps 4.4.2.11 and 4.4.2.12 are not to be used). Involvement of S&H professionals during this walkdown is required for work that has identified hazards.
5. Certify that all personnel who will be involved in the planning, review, walkdown, execution, or oversight, of these Work Orders have attended the Work Control & Hazard Recognition briefing (TRAIN No. WCHR0098) by an Area Director.
6. Comments: (Provide any comments considered pertinent to these work packages.)

_____
_____
_____
_____

MAINTENANCE WORK REVIEW & APPROVAL FORM

7. Certifications:

I have reviewed the listed Work Orders in accordance with MCP-2798 and consider them safe for use. In conjunction with this review, I certify that the work control process follows:

(a) the following **five functions** of Integrated Safety Management: Define the Work Scope, Identify the Hazards, Develop and Implement Hazard Controls, Perform Work Within Controls, Provide Feedback and Continuous Improvement,

(b) the following **eight guiding principles** of Integrated Safety Management: Line Management Responsibility for Safety, Clear Roles and Responsibilities, Competence Commensurate with Responsibilities, Balanced Priorities, Identification of Safety Standards and Requirements, Hazard Controls Tailored to Work Being Performed, Operations Authorization, and Employee Involvement.

Responsible Work Order Manager Printed Name	Responsible Work Order Manager Signature	Date
Work Order Primary Owner Printed Name	Work Order Primary Owner Signature	Date
Planner Printed Name	Planner Signature	Date
Safety & Health Professional (if applicable) Printed Name	Safety & Health Professional (if applicable) Signature	Date
Safety & Health Professional (if applicable) Printed Name	Safety & Health Professional (if applicable) Signature	Date
Supervisor/Foreman Printed Name	Supervisor/Foreman Signature	Date
Responsible Facility/Activity Manager Printed Name	Responsible Facility/Activity Manager Signature	Date

8. Approval:

The above Work Orders are hereby approved for release to the operations manager for execution in accordance with the appropriate procedures for the operations manager's facility/activity. The required Senior Supervisory Watch coverage in accordance with G. E. Ellis letter of August 26, 1998, for these Work Orders is as follows:

- ☐ Full Time while work execution is in progress
- ☐ Roving Coverage
- ☐ Oversight by normal facility/activity management, no Senior Supervisory Watch Required

Senior Supervisory Watch Assignment(s) made by Area Director:

Printed Names: _____ _____ _____

Responsible Area Director Printed Name	Responsible Area Director Signature	Date

_____ Chronological Number assigned by the area director's office.

Appendix E

LMITCO Occurrence Reports for the TRA-648 CO_2 Release

LMITCO Occurrence Reports for the TRA-648 CO_2 Release

The Appendix contains the sequentially issued ORPS occurrence reports that document the accident, its immediate corrective actions and follow on actions and lessons learned. The final occurrence report is expected to be issued by November 25, 1998. To date, the following reports have been issued under report number ID—LITC-TRA-1998-0010.

Date Time	Type of Report/Content
07/29/98 1602 MTZ	Notification Report – Initial report on the accident with information extant during the first 24 hours after the vent.
07/30/98 0845 MTZ	Initial Update – Same content as Notification report
08/03/98 1600 MTZ	Update – Added new information regarding the hospitalization of three employees
08/25/98 1634 MTZ	Update – Provided a revision to "Description of Occurrence" with more details of the occurrence and the associated fire protection system hardware; more detailed list of "Immediate Actions Taken and Results;" more details on "Evaluation;" and new section on "Lessons Learned"
10/06/98 0842 MTZ	Update – Minor revision to "Description of Occurrence" regarding fire protection alarms; revision of "Evaluation" to note the issue of the Type A Accident Investigation Board Report

OCCURRENCE REPORT

Test Reactor Area
(Name of Facility)

Balance-of-Plant
(Facility Function)

Idaho National Engineering Lab. / Lockheed Idaho Technologies Company
(Name of Laboratory, Site or Organization)

Name: Wayne Mikesell
Title: TRA Facility Operations Tech Lead Telephone No.: (208)533-4423
(Facility Manager/Designee)

Name: WAYNE, KATHLEEN A
Title: ADMINISTRATIVE SPECIALIST Telephone No.: (208)533-4642
(Originator/Transmitter)

Name: Kathleen Wayne Date: 08/25/1998
(Authorized Classifier (AC))

1. OCCURRENCE REPORT NUMBER: ID--LITC-TRA-1998-0010
Personnel Fatality And Multiple Injuries Resulting From Release Of Carbon Dioxide in TRA-648 (ETR Electrical Building).

2. REPORT TYPE AND DATE:

	Date	Time
[ ] Notification	07/29/1998	1602 MTZ
[ ] Initial Update	07/30/1998	0845 MTZ
[X] Latest Update	08/25/1998	1634 MTZ
[ ] Final		

3. OCCURRENCE CATEGORY:
[X] Emergency [ ] Unusual [ ] Off-Normal [ ] Cancelled

4. NUMBER OF OCCURRENCES: 1 ORIG. OR:

5. DIVISION OR PROJECT: TRA Site Services

6. SECRETARIAL OFFICE: NE - Nuclear Energy

7. SYSTEM, BLDG., OR EQUIPMENT:
Test Reactor Area (TRA) 648 - Electrical Switch Gear

8. UCNI?: No

9. PLANT AREA: Test Reactor Area

10. DATE AND TIME DISCOVERED:
07/28/1998 1755 (MTZ)

11. DATE AND TIME CATEGORIZED:
07/28/1998 1905 (MTZ)

12. DOE NOTIFICATION:

07/28/1998 1920 (MTZ)	Duty Operations Officer	DOE-HQ

13. OTHER NOTIFICATIONS:

07/28/1998 1902 (MTZ)	Arnie Preece	DOE-ID
07/28/1998 1900 (MTZ)	Raymond Furstenau	DOE-ID
07/28/1998 1845 (MTZ)	Pena notification req.	DOE

14. SUBJECT OR TITLE OF OCCURRENCE:
Personnel Fatality And Multiple Injuries Resulting From Release Of Carbon Dioxide in TRA-648 (ETR Electrical Building).

---

15. NATURE OF OCCURRENCE:
03) Personnel Safety
A. Occupational Illness/Injuries

---

16. DESCRIPTION OF OCCURRENCE:
At approximately 1815 hours on July 28, 1998, an accident occurred at Test Reactor Area (TRA) 648, Engineering Test Reactor (ETR) Electrical Building, when fire retardant carbon dioxide (CO2) was accidentally released during preventive maintenance (PM) operations. The PM activity included the impairment of the CO2 fire protection system and shutdown of the electrical power system. Upon CO2 activation, five of the thirteen workers in the building were not able to escape the CO2 atmosphere and were subsequently retrieved by rescuers. The incident resulted in one fatality and several serious injuries.

A multi-discipline team consisting of thirteen operations, fire safety, electrical crafts and supervisory personnel were present in TRA-648 to perform and/or coordinate the electrical outage and PM after normal working hours. The PM activity involved providing temporary lighting to TRA-648, locking and tagging out the 13.8 KV switchgear that supplies power to the ETR building complex, then performing the scheduled PM on the numerous downstream electrical breakers. At approximately 1815 hours, coincident with the de-energization of the last 4160 KV circuit breaker, the CO2 system activated.

The workers attempted to immediately evacuate the building when the CO2 discharged. Visibility within the building became poor due to a fog caused by the CO2 release, preventing five workers from exiting. Co-workers were able to retrieve three of the five still within the building. The Central Facilities Area (CFA) Fire Department and TRA Immediate Response Team (IRT) responded upon notification. The two remaining workers were then retrieved by rescuers wearing self-contained breathing apparatus. Cardiopulmonary resuscitation (CPR) was administered to two of the five workers. CPR efforts performed on one worker were unsuccessful and the individual died from oxygen deprivation.

Twelve of the workers were transported to Columbia Eastern

16. DESCRIPTION OF OCCURRENCE: (continued)
Idaho Regional Medical Center in Idaho Falls and Bannock Regional Medical Center in Pocatello by air rescue helicopter and INEEL ambulances. Two other security employees later drove to a hospital for evaluation and were released. Three employees remained hospitalized overnight. All three of the employees have since been released and two have returned to work. One employee is still undergoing rehabilitation as a result of injuries sustained during the event.

The fire protection system for TRA-648 consists of a Notifier AFP-200 control panel, two electric solenoid actuating valves and fifty-five 100-lb CO2 cylinders. The control panel is approximately two years old and is supplied by a 24 volt battery-backed system. The solenoid valves that control the release of the CO2 are designed such that power is required to actuate them. The system is also designed to activate local fire alarms for approximately 30 seconds prior to CO2 discharge followed by an additional 25 second delay for system pressurization. Preliminary findings do not indicate that local alarms provided any warning prior to discharge.

17. OPERATING CONDITIONS OF FACILITY AT TIME OF OCCURRENCE:
Maintenance

18. ACTIVITY CATEGORY:
Maintenance

19. IMMEDIATE ACTIONS TAKEN AND RESULTS:
1. At 1857 hours, the event was initially categorized as an Unusual Occurrence, based upon the limited information available at the time. As additional information became available the event was upgraded to an Emergency Alert at 1905 hours.

2. Notified appropriate LMITCO management and DOE representatives.

3. Activated the INEEL Emergency Operations Center (EOC), CFA Emergency Command Center (ECC) and TRA ECC to coordinate emergency response activities and plant recovery efforts. EOC personnel made the required notifications to DOE-HQ, the State of Idaho, counties and tribes.

4. The ETR building complex was ribboned off to preserve the scene for investigation.

5. LMITCO management instituted an INEEL maintenance standdown, with exceptions requiring approval of the LMITCO Vice President/General Manager.

6. LMITCO initiated the development of a recovery plan for

19. IMMEDIATE ACTIONS TAKEN AND RESULTS: (continued)
investigation of the event.

23. DESCRIPTION OF CAUSE:
Will be provided in the final report.

24. EVALUATION: (By Facility Manager/Designee)
This occurrence is currently under a Type A Accident Investigation by the DOE-HQ Office of Environment, Safety and Health. A LMITCO team has also been established to perform troubleshooting activities and re-creation of events in conjunction with the DOE-HQ team to enable a determination of causes for the CO2 release. The LMITCO team will ensure high priority is placed on implementation of the corrective actions generated by the DOE-HQ Accident Investigation Team's final report. Other work control, system operation and training issues are also being investigated.

Investigation and subsequent issue of the final ORPS report is expected to be complete by October 1, 1998.

25. IS FURTHER EVALUATION REQUIRED?: Yes [X] No [ ]

IF YES - BEFORE FURTHER OPERATION?: Yes [ ] No [X]

BY WHOM?:

BY WHEN?:

26. CORRECTIVE ACTIONS:
(* = Date added/revised since final report was signed off)

01) See Field 19, Immediate Actions Taken and Results.

TARGET COMPLETION DATE: 07/29/1998 COMPLETION DATE: 07/29/1998

27. IMPACT ON ENVIRONMENT, SAFETY AND HEALTH:
Will be provided in the final report.

28. PROGRAMMATIC IMPACT:
Will be provided in the final report.

29. IMPACT UPON CODES AND STANDARDS:
Will be provided in the final report.

30. LESSONS LEARNED:
Although the cause of the accident is still under investigation, the following potential issues have been disseminated by the DOE-HQ Accident Investigation Team to encourage evaluation of high-pressure CO2 fire suppression systems in other DOE facilities.

-Use of physical isolation versus electronic impairment.

-Potential for initiation of a CO2 fire suppression system from a spurious signal and the failure to receive a 30-second evacuation alarm prior to activation.

-Training of employees on CO2 fire suppression systems, CO2 evacuation alarms and subsequent emergency response, and the conduct of CO2 evacuation drills.

-Availability and access to self-contained breathing apparatus near or in facilities with CO2 systems to facilitate escape or search and rescue.

-Analysis of the CO2 hazard in facilities with respect to escape pathway obstacles, locked entrance doors that would impede search and rescue, effects of CO2 zero visibility conditions, personnel protective equipment (PPE), personnel accountability following building evacuation, and normal, emergency and exit lighting.

Lessons learned from the investigation will be provided in the final report.

31. SIMILAR OCCURRENCE REPORT NUMBERS:
1) Will be provided in the final report.

OCCURRENCE REPORT

Test Reactor Area
(Name of Facility)

Balance-of-Plant
(Facility Function)

Idaho National Engineering Lab. / Lockheed Idaho Technologies Company
(Name of Laboratory, Site or Organization)

Name: Wayne Mikesell
Title: TRA Facility Operations Tech Lead Telephone No.: (208)533-4423
(Facility Manager/Designee)

Name: WAYNE, KATHLEEN A
Title: ADMINISTRATIVE SPECIALIST Telephone No.: (208)533-4642
(Originator/Transmitter)

Name: Kathleen Wayne Date: 07/30/1998
(Authorized Classifier (AC))

1. OCCURRENCE REPORT NUMBER: ID--LITC-TRA-1998-0010
   Personnel Fatality And Multiple Injuries Resulting From Release Of Carbon Dioxide in TRA-648 (ETR Electrical Building).

2. REPORT TYPE AND DATE:

	Date	Time
[ ] Notification	07/29/1998	1602 MTZ
[ ] Initial Update	07/30/1998	0845 MTZ
[X] Latest Update	08/03/1998	1600 MTZ
[ ] Final		

3. OCCURRENCE CATEGORY:
   [X] Emergency [ ] Unusual [ ] Off-Normal [ ] Cancelled

4. NUMBER OF OCCURRENCES: 1 ORIG. OR:

5. DIVISION OR PROJECT: TRA Site Services

6. SECRETARIAL OFFICE: NE - Nuclear Energy

7. SYSTEM, BLDG., OR EQUIPMENT:
   Test Reactor Area (TRA) 648 - Electrical Switch Gear

8. UCNI?: No

9. PLANT AREA: Test Reactor Area

10. DATE AND TIME DISCOVERED:
    07/28/1998 1755 (MTZ)

11. DATE AND TIME CATEGORIZED:
    07/28/1998 1905 (MTZ)

12. DOE NOTIFICATION:

07/28/1998 1920 (MTZ)	Duty Operations Officer	DOE-HQ

13. OTHER NOTIFICATIONS:

07/28/1998 1900 (MTZ)	Raymond Furstenau	DOE-ID
07/28/1998 1902 (MTZ)	Arnie Preece	DOE-ID
07/28/1998 1845 (MTZ)	Pena notification req.	DOE

14. SUBJECT OR TITLE OF OCCURRENCE:
Personnel Fatality And Multiple Injuries Resulting From Release Of Carbon Dioxide in TRA-648 (ETR Electrical Building).

---

15. NATURE OF OCCURRENCE:
03) Personnel Safety
A. Occupational Illness/Injuries

---

16. DESCRIPTION OF OCCURRENCE:
At approximately 1755 hours on July 28, 1998, an accident occurred at the Test Reactor Area (TRA) Building 648 at the Idaho National Engineering and Environmental Laboratory (INEEL) when fire retardant carbon dioxide (CO2) was accidentally released during routine maintenance operations. The routine preventive maintenance (PM) involved providing temporary lighting to the TRA-648 Electrical Building, tagout and lockout of 13.8 KV switchgear that supplied power to the Engineering Test Reactor (ETR) building complex and then performing scheduled 4-year PM on the numerous downstream electrical breakers.

A multi-discipline team consisting of 13 Operations, Fire Safety, electrical crafts and supervisors were present in TRA-648 to perform and/or coordinate the electrical outage and PM after normal working hours. The TRA-648 building is protected from fire by a Notifier AFP-200 control panel fire extinguishing system consisting of a control panel, two electric solenoid actuating valves and fifty-five 100-lb CO2 cylinders. The control panel is approximately one year old and is supplied by a 24 volt battery backed system. The solenoid valves that control the release of the CO2 are designed such that power is required to open the valves. The loss of power to the Notifier AFP-200 panel or solenoid valves should not have activated the CO2 fire protection system. The system is also designed to activate local fire alarms and buzzers, and provide an approximate 30 second delay prior to CO2 discharge. Due to lock down of the ETR building complex to preserve evidence and absence of key individuals who were in the building, it is not possible to determine an exact sequence of events, but preliminary findings do not indicate that local fire alarms provided any warning that a CO2 discharge was about to occur.

When the CO2 discharge occurred, workers attempted to immediately evacuate the building. Visibility within the building became poor due to a fog caused by the CO2 release.

16. DESCRIPTION OF OCCURRENCE: (continued)
All but five people were able to make their way out of the building. Co-workers were able to retrieve three of the five people that were unable to get out of the building on their own. Security notified the Central Facilities Area (CFA) Fire Department and the Advanced Test Reactor (ATR) Shift Supervisor (SS) of the event. The CFA Fire Department responded immediately and the ATR SS requested that the TRA Immediate Response Team (IRT) respond. The two remaining workers could not be retrieved without self-contained breathing apparatus. Cardiopulmonary resuscitation (CPR) was administered to two of the five people. CPR efforts performed on one worker were not successful and the individual died as a result of his injuries.

Upon arrival of the CFA Fire Department and Medical personnel, the injured received emergency medical treatment and were transported to Columbia Eastern Idaho Regional Medical Center in Idaho Falls and Bannock Regional Medical Center in Pocatello by ambulances and by Air Idaho Rescue helicopters. Two other security employees later drove to a hospital for evaluation. Three employees remained hospitalized overnight. Of those who remain hospitalized, two employees are in critical condition, one is in serious condition.

Update (August 3, 1998) - Two of the employees have been released from the hospital and the remaining employee has been upgraded to serious condition.

17. OPERATING CONDITIONS OF FACILITY AT TIME OF OCCURRENCE:
Maintenance.

18. ACTIVITY CATEGORY:
Maintenance

19. IMMEDIATE ACTIONS TAKEN AND RESULTS:
Appropriate LMITCO line management and DOE were notified of the event. At 1857 hours, the event was initially categorized as an Unusual Occurrence, based upon the limited information available at the time. As additional information became available the event was upgraded to an Emergency Alert at 1905 hours.

The LMITCO Emergency Operations Center (EOC), CFA Emergency Command Center (ECC) and TRA ECC were activated to coordinate emergency response activities and plant recovery efforts. EOC personnel made the required notifications to DOE-HQ, the State of Idaho, Counties and Tribes.

A recovery plan is currently under development. The ETR building complex has been ribboned off to preserve the scene for future investigation. LMITCO line management has limited

19. IMMEDIATE ACTIONS TAKEN AND RESULTS: (continued)
maintenance work at the INEEL until further notice, pending development and implementation of a recovery plan. Exceptions will require approval by the LMITCO Vice President/General Manager.

24. EVALUATION: (By Facility Manager/Designee)
Lock/tag out, other work control issues, and system operation of the CO2 fire protection system must be investigated. A Type A investigation of this event by DOE is anticipated.

25. IS FURTHER EVALUATION REQUIRED?:	Yes [X]	No [ ]
IF YES - BEFORE FURTHER OPERATION?:	Yes [X]	No [ ]
BY WHOM?:	LMITCO Management	
BY WHEN?:	08/29/1998	

OCCURRENCE REPORT

Test Reactor Area
(Name of Facility)

Balance-of-Plant
(Facility Function)

Idaho National Engineering Lab. / Lockheed Idaho Technologies Company
(Name of Laboratory, Site or Organization)

Name: Wayne Mikesell
Title: TRA Facility Operations Tech Lead Telephone No.: (208)533-4423
(Facility Manager/Designee)

Name: WAYNE, KATHLEEN A
Title: ADMINISTRATIVE SPECIALIST Telephone No.: (208)533-4642
(Originator/Transmitter)

Name: Kathleen Wayne Date: 07/30/1998
(Authorized Classifier (AC))

1. OCCURRENCE REPORT NUMBER: ID--LITC-TRA-1998-0010
Personnel Fatality And Multiple Injuries Resulting From Release Of Carbon Dioxide in TRA-648 (ETR Electrical Building).

2. REPORT TYPE AND DATE:

	Date	Time
[ ] Notification	07/29/1998	1602 MTZ
[X] Initial Update	07/30/1998	0845 MTZ
[ ] Latest Update		
[ ] Final		

3. OCCURRENCE CATEGORY:
[X] Emergency [ ] Unusual [ ] Off-Normal [ ] Cancelled

4. NUMBER OF OCCURRENCES: 1 ORIG. OR:

5. DIVISION OR PROJECT: TRA Site Services

6. SECRETARIAL OFFICE: NE - Nuclear Energy

7. SYSTEM, BLDG., OR EQUIPMENT:
Test Reactor Area (TRA) 648 - Electrical Switch Gear

8. UCNI?: No

9. PLANT AREA: Test Reactor Area

10. DATE AND TIME DISCOVERED:
07/28/1998 1755 (MTZ)

11. DATE AND TIME CATEGORIZED:
07/28/1998 1905 (MTZ)

12. DOE NOTIFICATION:

07/28/1998 1920 (MTZ)	Duty Operations Officer	DOE-HQ

13. OTHER NOTIFICATIONS:

07/28/1998 1845 (MTZ)	Pena notification req.	DOE
07/28/1998 1900 (MTZ)	Raymond Furstenau	DOE-ID
07/28/1998 1902 (MTZ)	Arnie Preece	DOE-ID

14. SUBJECT OR TITLE OF OCCURRENCE:
Personnel Fatality And Multiple Injuries Resulting From Release Of Carbon Dioxide in TRA-648 (ETR Electrical Building).

---

15. NATURE OF OCCURRENCE:
03) Personnel Safety
A. Occupational Illness/Injuries

---

16. DESCRIPTION OF OCCURRENCE:
At approximately 1755 hours on July 28, 1998, an accident occurred at the Test Reactor Area (TRA) Building 648 at the Idaho National Engineering and Environmental Laboratory (INEEL) when fire retardant carbon dioxide (CO2) was accidentally released during routine maintenance operations. The routine preventive maintenance (PM) involved providing temporary lighting to the TRA-648 Electrical Building, tagout and lockout of 13.8 KV switchgear that supplied power to the Engineering Test Reactor (ETR) building complex and then performing scheduled 4-year PM on the numerous downstream electrical breakers.

A multi-discipline team consisting of 13 Operations, Fire Safety, electrical crafts and supervisors were present in TRA-648 to perform and/or coordinate the electrical outage and PM after normal working hours. The TRA-648 building is protected from fire by a Notifier AFP-200 control panel fire extinguishing system consisting of a control panel, two electric solenoid actuating valves and fifty-five 100-lb CO2 cylinders. The control panel is approximately one year old and is supplied by a 24 volt battery backed system. The solenoid valves that control the release of the CO2 are designed such that power is required to open the valves. The loss of power to the Notifier AFP-200 panel or solenoid valves should not have activated the CO2 fire protection system. The system is also designed to activate local fire alarms and buzzers, and provide an approximate 30 second delay prior to CO2 discharge. Due to lock down of the ETR building complex to preserve evidence and absence of key individuals who were in the building, it is not possible to determine an exact sequence of events, but preliminary findings do not indicate that local fire alarms provided any warning that a CO2 discharge was about to occur.

When the CO2 discharge occurred, workers attempted to immediately evacuate the building. Visibility within the building became poor due to a fog caused by the CO2 release.

16. DESCRIPTION OF OCCURRENCE: (continued)
All but four people were able to make their way out of the building. Co-workers were able to retrieve three of the four people that were unable to get out of the building on their own. Cardiopulmonary resuscitation (CPR) was administered to two people, while an operator notified security of the event. CPR efforts on these two workers continued until transported to the hospital. Security notified the Central Facilities Area (CFA) Fire Department and the Advanced Test Reactor (ATR) Shift Supervisor (SS) of the event. The CFA Fire Department responded immediately and the ATR SS requested that the TRA Immediate Response Team (IRT) respond. A fourth worker could not be retrieved without self contained breathing apparatus. The fourth worker was retrieved with assistance from the CFA Fire Department. CPR efforts performed on the fourth worker were not successful and the individual died as a result of his injuries.

Upon arrival of the CFA Fire Department and Medical personnel, the injured received emergency medical treatment and were transported to Columbia Eastern Idaho Regional Medical Center in Idaho Falls and Bannock Regional Medical Center in Pocatello by ambulances and by Air Idaho Rescue helicopters. Two other security employees later drove to a hospital for evaluation. Three employees remained hospitalized overnight. Of those who remain hospitalized, two employees are in critical condition, one is in serious condition.

17. OPERATING CONDITIONS OF FACILITY AT TIME OF OCCURRENCE:
Maintenance.

18. ACTIVITY CATEGORY:
Maintenance

19. IMMEDIATE ACTIONS TAKEN AND RESULTS:
Appropriate LMITCO line management and DOE were notified of the event. At 1857 hours, the event was initially categorized as an Unusual Occurrence, based upon the limited information available at the time. As additional information became available the event was upgraded to an Emergency Alert at 1905 hours.

The LMITCO Emergency Operations Center (EOC), CFA Emergency Command Center (ECC) and TRA ECC were activated to coordinate emergency response activities and plant recovery efforts. EOC personnel made the required notifications to DOE-HQ, the State of Idaho, Counties and Tribes.

A recovery plan is currently under development. The ETR building complex has been ribboned off to preserve the scene for future investigation. LMITCO line management has limited maintenance work at the INEEL until further notice, pending

19. IMMEDIATE ACTIONS TAKEN AND RESULTS: (continued)
development and implementation of a recovery plan. Exceptions will require approval by the LMITCO Vice President/General Manager.

24. EVALUATION: (By Facility Manager/Designee)
Lock/tag out, other work control issues, and system operation of the CO2 fire protection system must be investigated. A Type A investigation of this event by DOE is anticipated.

25. IS FURTHER EVALUATION REQUIRED?:	Yes [X]	No [ ]
IF YES - BEFORE FURTHER OPERATION?:	Yes [X]	No [ ]
BY WHOM?:	LMITCO Management	
BY WHEN?:	08/29/1998	

OCCURRENCE REPORT

Test Reactor Area
(Name of Facility)

Balance-of-Plant
(Facility Function)

Idaho National Engineering Lab. / Lockheed Idaho Technologies Company
(Name of Laboratory, Site or Organization)

Name: Wayne Mikesell
Title: TRA Facility Operations Tech Lead Telephone No.: (208)533-4423
(Facility Manager/Designee)

Name: WAYNE, KATHLEEN A
Title: ADMINISTRATIVE SPECIALIST Telephone No.: (208)533-4642
(Originator/Transmitter)

Name: Charlie Brooks Date: 07/29/1998
(Authorized Classifier (AC))

1. OCCURRENCE REPORT NUMBER: ID--LITC-TRA-1998-0010
Personnel Fatality And Multiple Injuries Resulting From Release Of Carbon Dioxide in TRA-648 (ETR Electrical Building).

2. REPORT TYPE AND DATE:

	Date	Time
[X] Notification	07/29/1998	1602 MTZ
[ ] Initial Update		
[ ] Latest Update		
[ ] Final		

3. OCCURRENCE CATEGORY:
[X] Emergency [ ] Unusual [ ] Off-Normal [ ] Cancelled

4. NUMBER OF OCCURRENCES: 1 ORIG. OR:

5. DIVISION OR PROJECT: TRA Site Services

6. SECRETARIAL OFFICE: NE - Nuclear Energy

7. SYSTEM, BLDG., OR EQUIPMENT:
Test Reactor Area (TRA) 648 - Electrical Switch Gear

8. UCNI?: No

9. PLANT AREA: Test Reactor Area

10. DATE AND TIME DISCOVERED:
07/28/1998 1755 (MTZ)

11. DATE AND TIME CATEGORIZED:
07/28/1998 1905 (MTZ)

12. DOE NOTIFICATION:

07/28/1998 1920 (MTZ)	INEEL EOC has the names	DOE-HQ

13. OTHER NOTIFICATIONS:

07/28/1998 1902 (MTZ)	Arnie Preece	DOE-ID
07/28/1998 1900 (MTZ)	Raymond Furstenau	DOE-ID
07/28/1998 1845 (MTZ)	Pena notification req.	DOE

14. SUBJECT OR TITLE OF OCCURRENCE:
Personnel Fatality And Multiple Injuries Resulting From Release Of Carbon Dioxide in TRA-648 (ETR Electrical Building).

---

15. NATURE OF OCCURRENCE:
03) Personnel Safety
A. Occupational Illness/Injuries

---

16. DESCRIPTION OF OCCURRENCE:
At approximately 1755 hours on July 29, 1998, an accident occurred at the Test Reactor Area (TRA) Building 648 at the Idaho National Engineering and Environmental Laboratory (INEEL) when fire retardant carbon dioxide (CO2) was accidentally released during routine maintenance operations. The routine preventive maintenance (PM) involved providing temporary lighting to the TRA-648 Electrical Building, tagout and lockout of 13.8 KV switchgear that supplied power to the Engineering Test Reactor (ETR) building complex and then performing scheduled 4-year PM on the numerous downstream electrical breakers.

A multi-discipline team consisting of 13 Operations, Fire Safety, electrical crafts and supervisors were present in TRA-648 to perform and/or coordinate the electrical outage and PM after normal working hours. The TRA-648 building is protected from fire by a Notifier AFP-200 control panel fire extinguishing system consisting of a control panel, two electric solenoid actuating valves and fifty-five 100-lb CO2 cylinders. The control panel is approximately one year old and is supplied by a 24 volt battery backed system. The solenoid valves that control the release of the CO2 are designed such that power is required to open the valves. The loss of power to the Notifier AFP-200 panel or solenoid valves should not have activated the CO2 fire protection system. The system is also designed to activate local fire alarms and buzzers, and provide an approximate 30 second delay prior to CO2 discharge. Due to lock down of the ETR building complex to preserve evidence and absence of key individuals who were in the building, it is not possible to determine an exact sequence of events, but preliminary findings do not indicate that local fire alarms provided any warning that a CO2 discharge was about to occur.

When the CO2 discharge occurred, workers attempted to immediately evacuate the building. Visibility within the building became poor due to a fog caused by the CO2 release.

16. DESCRIPTION OF OCCURRENCE: (continued)
All but four people were able to make their way out of the building. Co-workers were able to retrieve three of the four people that were unable to get out of the building on their own. Cardiopulmonary resuscitation (CPR) was administered to two people, while an operator notified security of the event. CPR efforts on these two workers continued until transported to the hospital. Security notified the Central Facilities Area (CFA) Fire Department and the ATR Shift Supervisor (SS) of the event. The CFA Fire Department responded immediately and the ATR SS requested that the TRA Immediate Response Team (IRT) respond. A fourth worker could not be retrieved without self contained breathing apparatus. The fourth worker was retrieved with assistance from the CFA Fire Department. CPR efforts performed on the fourth worker were not successful and the individual died as a result of his injuries.

Upon arrival of the CFA Fire Department and Medical personnel, the injured received emergency medical treatment and were transported to Columbia Eastern Idaho Regional Medical Center in Idaho Falls and Bannock Regional Medical Center in Pocatello by ambulances and by Air Idaho Rescue helicopters. Two other security employees later drove to a hospital for evaluation. Three employees remained hospitalized overnight. Of those who remain hospitalized, two employees are in critical condition, one is in serious condition.

17. OPERATING CONDITIONS OF FACILITY AT TIME OF OCCURRENCE:
Maintenance.

18. ACTIVITY CATEGORY:
Maintenance

19. IMMEDIATE ACTIONS TAKEN AND RESULTS:
Appropriate LMITCO line management and DOE were notified of the event. At 1857 hours, the event was initially categorized as an Unusual Occurrence, based upon the limited information available at the time. As additional information became available the event was upgraded to an Emergency Alert at 1905 hours.

The LMITCO Emergency Operations Center (EOC), CFA Emergency Command Center (ECC) and TRA ECC were activated to coordinate emergency response activities and plant recovery efforts. EOC personnel made the required notifications to DOE-HQ, the State of Idaho, Counties and Tribes.

A recovery plan is currently under development. The ETR building complex has been ribboned off to preserve the scene for future investigation. LMITCO line management has limited maintenance work at the INEEL until further notice, pending development and implementation of a recovery plan. Exceptions

19. IMMEDIATE ACTIONS TAKEN AND RESULTS: (continued)
will require approval by the LMITCO Vice President/General Manager.

.
.
1905 hrs the event was declared an emergency

24. EVALUATION: (By Facility Manager/Designee)
Lock/tag out, other work control issues, and system operation of the CO2 fire protection system must be investigated. A Type A investigation of this event by DOE is anticipated.

25. IS FURTHER EVALUATION REQUIRED?:	Yes [X]	No [ ]
IF YES - BEFORE FURTHER OPERATION?:	Yes [X]	No [ ]
BY WHOM?:	LMITCO Management	
BY WHEN?:	08/29/1998	

OCCURRENCE REPORT

Test Reactor Area
(Name of Facility)

Balance-of-Plant
(Facility Function)

Idaho National Engineering Lab. / Lockheed Idaho Technologies Company
(Name of Laboratory, Site or Organization)

Name: Wayne Mikesell
Title: TRA Facility Operations Tech Lead Telephone No.: (208)533-4423
(Facility Manager/Designee)

Name: WAYNE, KATHLEEN A
Title: ADMINISTRATIVE SPECIALIST Telephone No.: (208)533-4642
(Originator/Transmitter)

Name: Kathleen Wayne Date: 08/25/1998
(Authorized Classifier (AC))

1. OCCURRENCE REPORT NUMBER: ID--LITC-TRA-1998-0010
   Personnel Fatality And Multiple Injuries Resulting From Release Of Carbon Dioxide in TRA-648 (ETR Electrical Building).

2. REPORT TYPE AND DATE:

	Date	Time
[ ] Notification	07/29/1998	1602 MTZ
[ ] Initial Update	07/30/1998	0845 MTZ
[X] Latest Update	10/06/1998	0842 MTZ
[ ] Final		

3. OCCURRENCE CATEGORY:
   [X] Emergency [ ] Unusual [ ] Off-Normal [ ] Cancelled

4. NUMBER OF OCCURRENCES: 1 ORIG. OR:

5. DIVISION OR PROJECT: TRA Site Services

6. SECRETARIAL OFFICE: NE - Nuclear Energy

7. SYSTEM, BLDG., OR EQUIPMENT:
   Test Reactor Area (TRA) 648 - Electrical Switch Gear

8. UCNI?: No

9. PLANT AREA: Test Reactor Area

10. DATE AND TIME DISCOVERED:
    07/28/1998 1755 (MTZ)

11. DATE AND TIME CATEGORIZED:
    07/28/1998 1905 (MTZ)

12. DOE NOTIFICATION:

07/28/1998 1920 (MTZ)	Duty Operations Officer	DOE-HQ

13. OTHER NOTIFICATIONS:

07/28/1998 1900 (MTZ)	Raymond Furstenau	DOE-ID
07/28/1998 1902 (MTZ)	Arnie Preece	DOE-ID
07/28/1998 1845 (MTZ)	Pena notification req.	DOE

14. SUBJECT OR TITLE OF OCCURRENCE:
Personnel Fatality And Multiple Injuries Resulting From Release Of Carbon Dioxide in TRA-648 (ETR Electrical Building).

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15. NATURE OF OCCURRENCE:
03) Personnel Safety
A. Occupational Illness/Injuries

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16. DESCRIPTION OF OCCURRENCE:
At approximately 1815 hours on July 28, 1998, an accident occurred at Test Reactor Area (TRA) 648, Engineering Test Reactor (ETR) Electrical Building, when fire retardant carbon dioxide (CO2) was accidentally released during preventive maintenance (PM) operations. The PM activity included the impairment of the CO2 fire protection system and shutdown of the electrical power system. Upon CO2 activation, five of the thirteen workers in the building were not able to escape the CO2 atmosphere and were subsequently retrieved by rescuers. The incident resulted in one fatality and several serious injuries.

A multi-discipline team consisting of thirteen operations, fire safety, electrical crafts and supervisory personnel were present in TRA-648 to perform and/or coordinate the electrical outage and PM after normal working hours. The PM activity involved providing temporary lighting to TRA-648, locking and tagging out the 13.8 KV switchgear that supplies power to the ETR building complex, then performing the scheduled PM on the numerous downstream electrical breakers. At approximately 1815 hours, coincident with the de-energization of the last 4160 KV circuit breaker, the CO2 system activated.

The workers attempted to immediately evacuate the building when the CO2 discharged. Visibility within the building became poor due to a fog caused by the CO2 release, preventing five workers from exiting. Co-workers were able to retrieve three of the five still within the building. The Central Facilities Area (CFA) Fire Department and TRA Immediate Response Team (IRT) responded upon notification. The two remaining workers were then retrieved by rescuers wearing self-contained breathing apparatus. Cardiopulmonary resuscitation (CPR) was administered to two of the five workers. CPR efforts performed on one worker were unsuccessful and the individual died from oxygen deprivation.

Twelve of the workers were transported to Columbia Eastern

16. DESCRIPTION OF OCCURRENCE: (continued)
Idaho Regional Medical Center in Idaho Falls and Bannock Regional Medical Center in Pocatello by air rescue helicopter and INEEL ambulances. Two other security employees later drove to a hospital for evaluation and were released. Three employees remained hospitalized overnight. All three of the employees have since been released and two have returned to work. One employee is still undergoing rehabilitation as a result of injuries sustained during the event.

The fire protection system for TRA-648 consists of a Notifier AFP-200 control panel, two electric solenoid actuating valves and fifty-five 100-lb CO2 cylinders. The control panel is approximately two years old and is supplied by a 24 volt battery-backed system. The solenoid valves that control the release of the CO2 are designed such that power is required to actuate them. The system is also designed to activate local fire alarms for approximately 30 seconds prior to CO2 discharge followed by an additional 25 second delay for system pressurization. Investigation determined that no warning was provided by either of these alarms prior to the CO2 discharge.

17. OPERATING CONDITIONS OF FACILITY AT TIME OF OCCURRENCE:
Maintenance

18. ACTIVITY CATEGORY:
Maintenance

19. IMMEDIATE ACTIONS TAKEN AND RESULTS:
1. At 1857 hours, the event was initially categorized as an Unusual Occurrence, based upon the limited information available at the time. As additional information became available the event was upgraded to an Emergency Alert at 1905 hours.

2. Notified appropriate LMITCO management and DOE representatives.

3. Activated the INEEL Emergency Operations Center (EOC), CFA Emergency Command Center (ECC) and TRA ECC to coordinate emergency response activities and plant recovery efforts. EOC personnel made the required notifications to DOE-HQ, the State of Idaho, counties and tribes.

4. The ETR building complex was ribboned off to preserve the scene for investigation.

5. LMITCO management instituted an INEEL maintenance standdown, with exceptions requiring approval of the LMITCO Vice President/General Manager.

6. LMITCO initiated the development of a recovery plan for

19. IMMEDIATE ACTIONS TAKEN AND RESULTS: (continued)
investigation of the event.

23. DESCRIPTION OF CAUSE:
Will be provided in the final report.

24. EVALUATION: (By Facility Manager/Designee)
This occurrence was investigated as a Type A Accident by the DOE-HQ Office of Environment, Safety and Health. A LMITCO Response Team was also established to perform troubleshooting activities and re-creation of events in conjunction with the DOE-HQ Accident Investigation Team (AIT) to enable a determination of causes for the CO2 release.

The Type A Accident Investigation Board Report was issued on September 21, 1998. A LMITCO/DOE-ID Steering Board was established on September 23, 1998, to assist the LMITCO Response Team in coordinating corrective actions to the Judgments of Need established in the DOE-HQ AIT Report.

The final ORPS report is expected to be completed and issued by November 25, 1998.

25. IS FURTHER EVALUATION REQUIRED?: Yes [ ] No [X]

26. CORRECTIVE ACTIONS:
(* = Date added/revised since final report was signed off)

01) See Field 19, Immediate Actions Taken and Results.

TARGET COMPLETION DATE: 07/29/1998 COMPLETION DATE: 07/29/1998

27. IMPACT ON ENVIRONMENT, SAFETY AND HEALTH:
Will be provided in the final report.

28. PROGRAMMATIC IMPACT:
Will be provided in the final report.

29. IMPACT UPON CODES AND STANDARDS:
Will be provided in the final report.

30. LESSONS LEARNED:
The following potential issues were disseminated by the DOE-HQ AIT to encourage evaluation of high-pressure CO2 fire

30. LESSONS LEARNED: (continued)
suppression systems in other DOE facilities.

-Use of physical isolation versus electronic impairment.

-Potential for initiation of a CO2 fire suppression system from a spurious signal and the failure to receive a 30-second evacuation alarm prior to activation.

-Training of employees on CO2 fire suppression systems, CO2 evacuation alarms and subsequent emergency response, and the conduct of CO2 evacuation drills.

-Availability and access to self-contained breathing apparatus near or in facilities with CO2 systems to facilitate escape or search and rescue.

-Analysis of the CO2 hazard in facilities with respect to escape pathway obstacles, effects of CO2 zero visibility conditions, personnel protective equipment, and normal emergency and exit lighting.

Final lessons learned from the investigation will be provided in the final report.

31. SIMILAR OCCURRENCE REPORT NUMBERS:
1) Will be provided in the final report.

Appendix F

Notifier Fire Protection Panel Information

Summary of the Project to Establish Requirements, Design, Procure, and Install the Notifier Panel AFP-200 in Building TRA-648

Introduction

The history file for the project that installed the Notifier AFP 200 fire alarm panel to control the C02 fire suppression system in Building TRA 648 (Engineering Design File #752) was reviewed for evidence of compliance with the existing, applicable INEEL design, procurement, and installation requirements. There was no information identified that would indicate that any of these requirements were violated. This appendix provides a summary of the information provided or referenced in that file.

Background

The fire alarm system upgrade at the Test Reactor Area (TRA), which included replacement of the fire alarm panel in TRA-648, was part of a line item project entitled, INEEL Fire and Life Safety Improvements, FY-92. This was part of $75M in line-item upgrade for fire and life safety improvements of facilities at the Idaho National Engineering and Environmental Laboratory (INEEL). This overarching upgrade included three line item projects. The first project upgraded the Idaho Chemical Processing Plant (ICPP) (now called Idaho Nuclear Technology and Engineering Center [INTEC]). The second project was referred to as INEEL Fire and Life Safety Improvements, FY-92. The third project was entitled TRA Fire and Life Safety Improvements, FY-95.

These line-item construction projects were authorized by the United States Congress for ID to resolve the fire and life safety system deficiencies at the INEEL in the areas of fire alarm systems, fire water systems, emergency lighting, and exit and egress paths. The individual projects were developed by identifying, listing, and prioritizing deficiencies across the INEEL complex to determine which deficiencies could be eliminated within established budgets. The INEEL complex areas upgraded included Idaho Falls facilities, the Central Facilities Area, INTEC, the TRA, the Power Burst Facility, Test Area North, and the Radioactive Waste Management Complex. The fire and life safety deficiencies corrected included those: (a) contained on lists compiled from 1991 to 1998, (b) identified by DOE and Factory Mutual audits, (c) found during Tiger Team inspections, and (d) identified during routine operations and listed as deficient maintenance items deficiencies, Authority Having Jurisdiction items, and management deficiency list items.

The TRA-648 upgrades were performed under a contract entitled, TRA Fire and Life Safety Improvements, FY-92. This contract primarily corrected fire alarm deficiencies throughout TRA by replacing the entire fire alarm system. The TRA Engineering Test Reactor complex consists of buildings TRA-642, -647, -648, -644, -643, and -663. Under this upgrade, two fire alarm panels were installed in this complex, one managing general fire alarms, and one that managed only the CO_2 fire suppression system for TRA-648.

The project, TRA Fire and Life Safety Improvements, FY95, was initiated to correct Uniform Building Code (UBC), Life Safety Code (NFPA 101), and fire protection system deficiencies at TRA. Some of these upgrades are still in progress. In particular, some emergency lighting upgrades have not yet been completed.

Upgrade Process

The specific upgrades to be accomplished were selected employing a project management approach consistent with the requirements of DOE 4700.1. The identified deficiencies were prioritized, upgrades were designed, and specific construction packages were developed to accomplish the upgrades. The project design process included many biweekly and monthly meetings to make decisions to prioritize which deficiencies were to be corrected within the available project funds. The lists of deficiencies to be fixed within individual projects were submitted to ID for review. Specifications were established for materials and equipment based upon applicable codes and standards. Materials and equipment meeting these specifications were procured in compliance with the INEEL procurement requirements. Design specifications and other aspects for the upgrades were submitted to ID for review.

Selection of the Notifier Panel

The selection of the alarm panel for TRA 648 was critically influenced by a change in the overall fire alarm system concept that was implemented as part of the upgrade. Prior to the fire alarm upgrade projects, the INEEL fire alarm system concept was to have the alarms at all sites report to the THORNE TDX 6000 fire alarm computer at the Central Facilities Area through a communication network. This computer controlled the actuation of the fire alarms in the reporting building and made auxiliary announcements to all other buildings. The upgrade revised this system concept to have each fire alarm panel first annunciate locally and then alert the Central Facilities Area Fire Department as an auxiliary function. This ensured that the local fire alarm would sound, even if the communication network between Central Facilities Area and TRA were lost. This change in alarm system concept was an important factor in the selection of the Notifier Panel.

In late 1992 and early 1993, when the upgrade was being designed, a study was conducted of 27 different fire alarm equipment manufacturers. Only six manufacturers of fire alarm panels were identified as being capable of networking a large, multiple fire alarm panel system into one fire alarm communication network. These were Kidde/Thorn, Cerberus Pyrotronics, AutoCall, Notifier, Honeywell, and Edwards. Each manufacturer was evaluated based upon: system capabilities; actual number and performance of operating systems; availability of replacement equipment in the western states; training required to operate and maintain the system; availability and cost of spare parts, system maintainability, and compatibility with the systems installed at the INEEL. Cost was evaluated but not considered a top priority. Rather, the most important considerations were the ability of the equipment to meet functional and compatibility requirements. Cost competitive bidding was encouraged to prevent DOE and the INEELfrom being dependent upon a single manufacturer. The two fire alarm systems selected and preapproved in the bid were Cerberus Pyrotronics and Notifier Fire Alarm Systems.

Pyrotronics was used on site at the INEEL and the design team and Life Safety Systems organization were familiar with its capabilities. In order to fully investigate the Notifier system capabilities, members of the design team including representatives from Engineering, Life Safety Systems, and the TRA Facility Fire Protection Engineer traveled to New York and met with the owner of a large Notifier fire alarm system. This new Notifier system had replaced an existing Honeywell system in a large high-rise building (Metropolitan Life building in New York City). The building is one of the largest buildings in New York City and has over 2 million square feet of floor space with all types of occupancies including manufacturing. The team examined the installation of the system and interviewed the building owner, the installation and maintenance personnel, and the individuals responsible for operating the system. All people interviewed gave favorable reviews of the system and the installation looked good.

This team also traveled to the Notifier factory in Northford, Connecticut. After touring the facility, 31 questions were discussed and submitted to Notifier for written response. The design team concluded that the capabilities of the Notifier system would satisfy the requirements of the TRA fire alarm needs. The Notifier hardware was added to the approved list of suppliers with the concurrence of the ID Authority Having Jurisdiction for Fire Protection through a January 9, 1995 letter to the manager of LMITCO Life Safety Systems.

TRA 648 Upgrade Project

The TRA 648 upgrade project design was formally reviewed by affected organizations including the TRA Facility Fire Protection Engineer, LMITCO Cognizant Professional For Fire Protection, Advanced Test Reactor Operations, TRA Industrial Hygiene, Construction Management, TRA Safety, TRA Quality Engineering, Project/Construction Management Safety, Project/Construction Management Quality Engineering, TRA RADCON, TRA Systems Engineering, TRA Security, TRA Maintenance Operations, Life Safety Systems, TRA Environmental, TRA Waste Minimization, Quality Inspection, TRA Landlord, Landlord Environmental, Architectural Engineering Design, and Cost Estimating. The TRA 648 upgrade project design was also transmitted to ID TRA Facility Manager, ID Project Management, and ID Authority Having Jurisdiction for Fire Protection for review. The construction was managed by LMITCO Project and Construction Management under formal project controls, including Quality Control with formal acceptance of all the systems installed. As the FY-92 project was constructed, tested, and put into service, the project updated or deleted a total of 259 drawings and approximately 82 procedures. These drawings were completed in 1997.

The Facility Change Form generated for this project listed all key and affected drawings and has been signed off by all personnel, except the last signature. This final approval was in progress before the Type A accident occurred. The final hold point was the confirmation that all superseded drawings had been deactivated.

Appendix G

LMITCO VPP Program Description and Status

The DOE Voluntary Protection Program has been established to promote and recognize highly effective safety and health programs. Through VPP, management, labor, and DOE have established a cooperative relationship in which:

Management operates an effective program that exceeds mere compliance

Employees actively participate in the program and work with management to ensure a safe and healthful work site.

DOE VPP gives recognition to the sites whose S&H programs go beyond DOE and Occupational Safety and Health Administration (OSHA) standards. DOE encourages all contractor sites to strive toward continuous improvement of occupational safety and health.

VPP enhances the safety and health program through encouraging voluntary improvement and expansion of worker protection systems by incorporating five key elements:

1. Management Commitment to safety and health must be demonstrated throughout the organization. The site must have a strong working safety policy that is integrated into all aspects of the company's operations. Management must be visible and accessible to employees. Employees must believe that management's commitment is genuine.

2. Employee Involvement goes beyond simple awareness and compliance with established safety and health requirements. Employees, including management, must have an active and meaningful way to participate in and contribute to the structure and operation of the safety and health program. This involvement results in "ownership" of the safety and health program by all employees.

3. Work Site Analysis includes analysis of new facilities and processes, comprehensive safety and health surveys, routine self-assessments, a reliable system for an employee to report hazards, and an accident/incident investigation system and trend analysis. All of these systems together bring comprehensive understanding of potentially hazardous situations and the ability to recognize and correct hazards as they arise.

4. Hazard Prevention and Control details the site's program for removing and/or controlling hazards. Written safety rules and safe work practices must be in place. Preventative maintenance and a system for hazard tracking and correction should be detailed in the written program. The medical program should be integrated into safety and health, with full use of occupational health physicians and nurses in hazard analysis or identification and control.

5. Safety and Health Training is the final DOE VPP component. Employees at all levels must be familiar with their responsibilities and how to carry them out. Employees should be properly trained in safety and health protection before they are assigned to a job that may expose them to safety and health hazards. Employees should also know their responsibilities in emergency situations.

In order to facilitate this organizational behavioral change at the INEEL, a goal has been established to implement the VPP criteria. The goal of VPP is to create and maintain a workplace that is free of injuries and illnesses using employee involvement and management leadership.

LMITCO has proceeded well along this pathway which is demonstrated by the following accomplishments:

Passport to Success - Employees completing actions to obtain a better understanding of INEEL safety expectations.

Establishment of a communication infrastructure (VPP Units)

Total Safety Culture training of essentially all employees

Functional company-level Employee Safety team and associated Unit level teams

Implementation of safety and health personal action plans in performance appraisals

Establishment of Safety and Health goals at the Company and branch Directorate level

Implementation of a Safety Concerns process and tracking system

Quarterly Safety and Health training of supervisors and managers (SAM)

Safety recognition and award programs for employees

Increased employee awareness of safety hazards at work and home

Participation in community safety awareness, i.e., Safety EXPO 1998

Improved partnering between employees and management

Hosting of VPP Conferences and visits from external entities such as: J.R. Simplot, State of Idaho Transportation Department and Weyerhauser Paper company

- Coordination of several external assessments to baseline implementation
- increased employees participation in inspections and walkthroughs

- LMITCO scored 11 points above national norms on protection for Safety and Health hazards in the annual employee survey

- Higher degree of employee participation and knowledge of safety programs and issues.

These accomplishments are documented through the following vehicles; the VPP Implementation Plan, the LMITCO Safety and Health Program Description Document, Individual Performance Plans, the 1998 LMITCO Employee Survey Results, Independent Assessment Results, and various company procedures.

The attached "Star Map" has been developed to pictorially display the events that will take place over the next fiscal year. These events are planned with a specific purpose. They will communicate and develop the cultural as well as the technical aspects of maintaining a work environment free from injuries and illnesses.