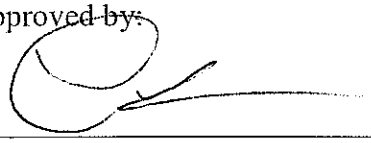
DOE Independent Validation Team
Review of
Lawrence Berkeley National Laboratory
Corrective Action Plan

August 2006

Approved by:



8/2/06

Paul Kruger, Review Team Leader — Date

Executive Summary

A Department of Energy (DOE) Independent Validation Team reviewed Lawrence Berkeley National Laboratory's (LBNL's) Corrective Action Plan (CAP) that emerged from a January 2006 Peer Review of safety performance. The review concluded that the CAP, although having weaknesses, was validated as a step towards improving safety performance at LBNL. The Team also found a strong LBNL commitment to improve LBNL safety performance. While the safety program was not specifically evaluated against safety management attributes, potential fundamental issues with LBNL's Integrated Safety Management (ISM) System were evident. The Team concluded the Peer Review/CAP identified actions necessary to improve safety at LBNL; however, the actions are probably not sufficient to assure continual systematic improvement. The Team thus recommends that BSO/LBNL consider a robust independent assessment of the BSO/LBNL ISM Program. BSO and LBNL have indicated they are receptive to this recommendation and are currently pursuing such an assessment.

Background

On December 22, 2005, the Director of the Office of Science (SC) sent a letter to the University of California Board of Regents expressing strong concerns regarding safety performance at the Lawrence Berkeley National Laboratory (LBNL). The letter highlighted poor performance in FY05 regarding the total recordable case rate (TRC) and the days away, and restricted case rate (DART) for LBNL. This letter was followed by a letter from the Berkeley Site Office (BSO) Manager on December 23 to the University of California (UC), Office of the President expressing concerns about LBNL safety performance during the first quarter of FY06, with specific reference to four safety-related events.

UC responded to these concerns by committing to and then conducting an independent Peer Review of safety management at LBNL on January 17-20, 2006. A report from this review was issued on February 10, 2006. Following analysis of the report and additional issues identified in other studies and assessments, LBNL developed a Corrective Action Plan (CAP), which was submitted to BSO on June 1, 2006.

In order to provide independent validation of the UC Peer Review and CAP process, the SC Chief Operating Officer and the BSO Manager chartered a DOE Independent Validation Team in January 2006. This Team was charged with observing and providing feedback on the LBNL review and CAP development process.

Purpose and Approach

The purpose of this report is to document the results of the LBNL CAP review by the DOE Independent Validation Team.

The members of the DOE Validation Team are as follows:

Role	Name	Affiliation
Team Leader	Paul Kruger	PNSO
Deputy Team Leader	Roger Christensen	PNSO
Team Members	Earl Carnes	EH
	Hattie Carwell	BSO
	Carol Ingram	BSO
	Larry Kelly	ORO
	Ted Pietrok	PNSO

In preparation for this review, the DOE Validation Team sent 3 members to observe the UC Peer Review on January 17-20, 2006. The team members subsequently developed a trip report that was provided to the BSO Manager and the SC COO on February 2, 2006.

The DOE Validation Team also prepared a formal review plan for the review of the LBNL CAP, which was approved by the Team Leader on March 31, 2006. The review plan expectations and criteria were primarily derived from Chapter 5.0 of DOE G 414.1-5, *Corrective Action Program Guide*. Upon receipt of the CAP, the Team performed a review consistent with the expectations provided in the Review Plan. The review specifically focused on effectiveness in meeting 10 criteria. A listing of the criteria and a summary of the results for each criterion is provided in Appendix A of this report.

On June 27 and 28, 2006, the Team conducted a site visit at LBNL to gain additional insights regarding the CAP development process and content of the CAP as well as to provide initial feedback. Although the visit included presentations by LBNL and interviews of selected individuals, the Validation Team did not perform an evaluation regarding the adequacy of the LBNL Integrated Safety Management System against the ISM expectations and attributes contained in DOE G 450.4-1B, *Integrated Safety Management System Guide*. The site visit agenda is provided in Appendix B and the interview results are summarized in Appendix C of this report.

Summary Observations

Based on review of the LBNL CAP (summarized in Appendix A) and interviews with selected management and staff (summarized in Appendix C), the Validation Team identified the following noteworthy areas and areas for improvement.

Noteworthy Areas

Lab leadership commitment to safety improvement

- Interviews with senior management communicated a strong commitment to safety, as well as a commitment to understand and rectify operational safety issues.

UC initiation of independent Peer Review

- Although the Peer Review was not a formal ISM assessment (as indicated in the DOE Validation Team Trip Report), contractor corporate involvement was a good first step and a positive indicator of UC Management's openness to promptly identify and seek resolution of safety performance concerns.

Use of root cause analysis and training of staff in root cause technique

- Application of causal analysis, root cause and extent of condition concepts in determining the appropriate corrective actions will increase their effectiveness in achieving systematic improvement.

Line management involvement

- Involvement of line management in defining the problems and developing the corrective actions is a positive step in ensuring management commitment to practical and enduring solutions.

Collaboration with safety leader in industry (e.g. Intel)

- Benchmarking and using industry leaders will help LBNL establish long-term safety program goals and implement best practices into operational processes.

Areas for Improvement

The overall desired outcome of the CAP is not clear. This lack of clarity of end state definition makes development and implementation of corrective actions (and essential metrics) that will lead to the desired end state, difficult, if not impossible. The interviews conducted also reflected a wide range of variability in the understanding of LBNL's vision for a successful safety management program.

The CAP reflects a variety of weaknesses in LBNL expertise and processes in systematically developing robust corrective actions.

- The CAP does not provide clarity regarding how the 97 individual actions will integrate and contribute to specific improvements of Laboratory systems:
  - There is no tie to Quality systems and processes;
  - Some of the root causes are not clear; and
  - Some root causes do not appear to be adequately addressed by corrective actions;
- The organization of the CAP makes it difficult to identify specific findings and then link them directly to proposed corrective actions
- The CAP does not include discussion of the prioritization logic for implementing corrective actions. For example, actions are not categorized by urgency, importance, or ease of fix.
- The CAP does not clearly define the process by which the collective set of corrective actions will be actively managed to achieve the ultimate desired outcomes.
- The individual outcomes for corrective actions are not specifically stated in measurable terms.
- The process to determine corrective action effectiveness is unclear.

Creditable performance measurement processes need to be established to understand safety management system performance, align performance expectations across LBNL and tailor improvement commitments consistent with system maturity.

- Internal perception at LBNL tended to overstate performance toward safety excellence as at phase 3-4 (see Appendix C interview responses), while identified actions/activities indicate that LBNL is currently at phase 2-3 (see Figure 1). In addition, the concerns identified below further support the conclusion that LBNL is at Phase 2-3:
  - Emphasis on "certified" self assessment program contrasts with data that demonstrates self assessment was less than effective;
  - Appropriate benchmarks (similar to what was done with Intel for permanent employees) have not been identified considering the highest vulnerable population of temporary grad students, post docs and guests;

- A cohesive strategy to address the variety of lab workforce groups is not clearly articulated;
- There was no clearly identified organizational resource dedicated to analyzing and acting promptly to operational data; and
- It is not evident that the lab operates from the perspective of "proving it is safe" versus "proving it is unsafe" and is thus vulnerable to "normalization of deviation" (i.e., it assumes that any hazards will be introduced through expected pathways).

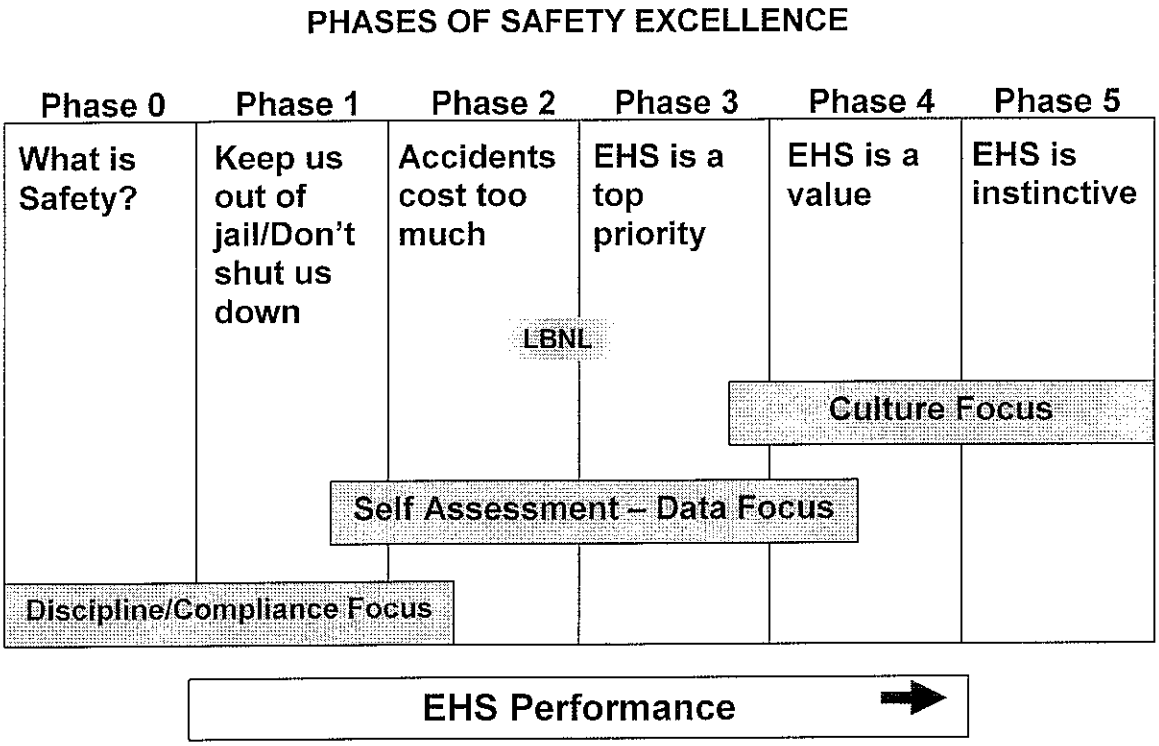


Figure 1

Conclusions

LBNL is in an early phase of building safety excellence.

- Management commitment and recognition of issues needing to be addressed is a key first step to safety excellence.
- While the UC Peer Review was a positive step in understanding high level safety performance issues at LBNL, a more rigorous ISM review using accepted lines of inquiry is needed to fully understand and systematically address the underlying weaknesses.

Keys to reaching the next phase toward safety excellence:

- Strengthened systematic and integrated work planning and control processes
- Increased "systems thinking"
- Open and honest reporting of incidents (reporting culture)
- Proactive investigation of events and analysis of event data (using root cause and CAP methodologies)
- Line accountability for safety
- Continued Management commitment and example
- Robust self assessment and performance measurement processes to include system effectiveness evaluation
- Effective "lessons learned" program that aids feedback and continuous improvement

Recommendations

The LBNL CAP can be accepted as a reasonable starting point if:

- BSO sets the expectations for safety excellence and defines the safety "end state"
- BSO works closely with LBNL to improve the clarity of corrective actions and develop appropriate metrics to evaluate success
- BSO performs oversight to ensure that expectations are being met

To better understand the opportunities for systems improvement, BSO and LBNL should consider performing rigorous self and external assessments of ISMS processes to ensure systematic approaches are in place.

LBNL CAP Review Criteria

Criterion 1

A comprehensive, structured issues management system must be in place that captures program and performance deficiencies and provides for effective analysis, resolution, and tracking. This system must include processes for analyzing deficiencies, individually and collectively, and must enable the identification of programmatic or systemic issues.

- It is not evident that a comprehensive issues management system is in place at LBNL; however, this was mitigated by performance of an ad hoc backlook review and root cause analysis for this effort.
- Although a new LBNL Corrective Action Tracking System is being put in place as part of the corrective actions, it is not clear this will address all of the requirements and concerns related to issues management (e.g., analysis, trending, lessons learned, etc.).
- The LBNL issues management system's ability to capture program deficiencies, and thus identify systemic issues, is limited.
- The issues management system provides for tracking, but analysis and resolution are not effective.
- The discussion of developing more meaningful indicators, particularly leading indicators that appears in the CAP discussion (and was a significant topic of discussion during the Peer Review) has not been captured in the corrective actions.

Criterion 2

The CAP should demonstrate that proper investigation has occurred, to the extent necessary, to demonstrate and document a complete understanding of the deficiency or deficiencies. This includes a determination if the deficiency is isolated or represents a systemic program-related or crosscutting issue.

- It is not obvious that the investigation or review performed by the CAP Development Team demonstrates a complete understanding of deficiencies.
- The supporting documentation does not adequately indicate which deficiencies are isolated, and which represent a systemic program-related or crosscutting issue.

Criterion 3

The CAP should identify a root cause and associated causal factors for each deficiency. The causal analysis methodology used to determine the root cause or causes must be identified and justified using a graded approach, and it must be developed and used in a manner to determine programmatic or generic deficiencies.

- The CAP does identify the processes that were used to identify and analyze root causes and causal factors. The primary tools that were employed included a backlook analysis approach and the use of the TapRoot process for identifying root causes. While Tap Root is a perfectly acceptable causal analysis software system, additional thought may need to be given to what constitutes developing a quality laboratory competence in causal analysis other than training on a software system.

LBNL CAP Review Criteria

- There are numerous root causes which combine several causes into one statement and, in some cases it is difficult to see the relationship between the root cause and the issue.
- Many of the root cause statements could be improved in clarity and reflect the need for refinement in causal analysis and causal thinking (e.g., root cause 6.1.1 does not adequately address issue 6.1).
- The "Proactive Tap Root" approach may have limited the completeness of causal analysis as it relates to the specific safety incidents. The Proactive Tap Root approach was used to analyze the results of the Peer Review and the Back-look review; however, it was not used to further analyze any of the incidents included in the Back-look review. The other reports covered in the Back-look review were assessments (lasers, electrical safety, hoisting and rigging) or analyses of trends (review of illness and injury cases).

Criterion 4

Corrective actions should be clear and concise, executable, have a measure of performance to demonstrate the outcome, can be verified and validated as complete, and address the root cause and contributing causes, as applicable, to prevent recurrence.

- The organization of the corrective actions in the appendices in multiple formats is confusing. A single list of corrective actions, with reference to applicable root causes and ISM Guiding Principles and Core Functions would be more effective.
- The 97 actions, which are rolled up into 18 major corrective actions, are not expressed in the terms of a "systems view" (i.e., it is not clear how these 97 actions will affect or enhance the ISM system or how they relate to an integrated institutional systems approach).
- While most of the corrective actions are understandable, many are stated at a high level and are not clear or specific with respect to how the action will resolve the root cause.
- Most of the corrective actions did not provide adequate wording to indicate the expected outcome or to provide an effective measurement basis that could be used to determine effectiveness.
- Several of the corrective actions do not effectively address the root causes (e.g., root causes 3.2.4 and 4.4.1)

Criterion 5

Corrective actions should include interim corrective actions and/or compensatory measures, where appropriate, to reduce the possibility of event or condition occurrence while longer–term system improvements are being developed.

- Some interim actions were taken and are identified on page 4 of the CAP. However, a serious issue identified during the Peer Review (i.e., non-reporting of events by some staff) has not been addressed in a timely manner.
- The CAP does not include a discussion of the prioritization logic that was applied for implementing CAP actions.

LBNL CAP Review Criteria

Criterion 6

Corrective actions should include appropriate participation by line organizations during development and should identify the organizations and managers responsible for carrying out the corrective action.

- Based on the CAP Development Team Roster, it is clear that the development of the CAP included management and staff from a variety of disciplines (including scientists, facilities, engineering, and EH&S).
- A majority (70) of the 97 corrective actions are assigned to support organizations It should be noted that the Validation Team did not evaluate whether there are sufficient resources and capabilities to meet the commitments according to the proposed schedule.
- It is not clear how much line management and staff involvement will occur in implementation of the corrective actions.

Criterion 7

Completion dates should be clearly established for each corrective action and should be reasonable and achievable given the scope and severity of the corrective actions.

- Completion dates are provided for each of the corrective actions and, while lengthy in some cases, are not beyond reason given the described actions, assuming there are sufficient resources available.

Criterion 8

The CAP should identify a systematic process for tracking and reporting the status of each corrective action to successful completion and should clearly identify responsibilities for management of the CAP.

- While the CAP includes a section defining the responsibilities and process to be used for formal change control, the change control addressed in the CAP appears to address only deviations to the approved CAP. While this is important it does not address how the implementation actions will be staged and managed in appropriate sequence and in a measured way to assure effective implementation. This is the essence of change management in the broader sense and it is not addressed in the CAP.

Criterion 9

The CAP should identify mechanisms to independently validate closure and provide assurance that corrective actions are effective and will prevent recurrence.

- The CAP includes a section describing the process and approach for validation and effectiveness review of the corrective actions; however, the effectiveness review approach is not yet described in the UC Assurance Plan, as indicated.
- A number of effectiveness reviews have been included as corrective actions in the plan, which is good; however, in many cases it is not clear how effectiveness would be measured.

LBNL CAP Review Criteria

Criterion 10

The CAP should be approved by the senior manager authorized to provide the resources to successfully implement the corrective actions within the time specified in the plan.

- The CAP was signed by Dr. Steven Chu, Director of LBNL, David McGraw, Chief Operating Officer, LBNL, and Howard Hatayama, Acting EH&S Division Director, LBNL.

LBNL Site Visit Agenda

Tuesday June 27

8:00-9:00 AM	Team organizational meeting	Bldg. 90 Rm 1099
9:00-9:45 AM	DOE Caucus / BSO Briefing	Bldg. 90 Rm 1099
9:45-10:00 AM	Break – Travel to Bldg. 50	
10:00-12:00 AM	Briefing from LBNL	Bldg. 50 Rm. 5132
10:00-10:05 AM	Welcome – Director Steven Chu	
10:05-10:30 AM	Peer Review – David McGraw, COO	
10:30-11:15 AM	CAP Development Process Overview – Howard Hatayama, EH&S Acting Dir.	
11:15-11:30 AM	Closing – David McGraw, COO	
11:30-12:00 PM	Additional Questions & Answers	
12:00-1:00 PM	Working lunch/general discussion on reactions to the CAP	Bldg. 54 -130B
1:00-3:00 PM	Interviews with DOE Validation Team	

Team Member	**Interview 1** 1:00 – 1:30 pm	**Interview 2** 1:30 – 2:00 pm	**Interview 3** 2:00 – 2:30 pm	**Interview 4** 2:30 – 3:00 pm
Paul Kruger & Roger Christensen	Chu	McGraw	Fleming	Hatayama
Interview Group A	*B50A-4133*	*B50A-4112E*	*B50A-4119A*	*B90-1140A*
Earl Carnes & Hattie Carwell	ALS	Safety Liaisons	Safety Review Committee representatives	CAP Team
Interview Group B	*B90-1099*	*B90-1099*	*B90-1099*	*B90-1099*
Larry Kelly & Ingram	Facilities middle mgrs and WOW	Reps from Radiation Safety Committee, Laser Safety Committee	Reps from Electrical Safety Committee	Safety Coordinators
Interview Group C	*B50-5132*	*B50-5132*	*B50-5132*	*B50-5132*

3:00-6:00 PM	Begin report writing and prepare outbrief slides	

Wednesday June 28

7:30-11:30 AM	Report writing and outbrief presentations	Bldg. 90 Rm. 1099
11:30-1:00 PM	Lunch – Team w/BSO staff	Location TBD
1:00-1:30 PM	Travel to Bldg. 50 - 4205	
1:30-2:00 PM	Outbrief with BSO only	Bldg. 50B Rm. 4205
2:00-3:00 PM	Outbrief with LBNL	Bldg. 50B Rm. 4205
3:30 PM	End of visit	

Site Visit Interview Data

The DOE Validation Team conducted interviews with selected management and staff within BSO and LBNL on June 27 and 28, 2006. While the interviews were limited to a small cross-section of the Laboratory, they did provide valuable insight into what will be required for effective implementation of the CAP.

The interviews focused on gaining a sense of alignment across LBNL in understanding performance against the Intel model for managing change through the 6 phases of safety excellence. Based on the premise that organizations must systematically work through these phases, effective corrective actions should be based on a realistic acknowledgement of current organizational performance. The key lines of inquiry used during the interviews were as follows:

1. Based on 6 phases of safety excellence chart, where is LBNL?
2. What are the top 3 safety issues that LBNL is currently facing? Are these currently the top priorities with respect to corrective actions?
3. What would success look like for LBNL in terms of safety (i.e., what is the ultimate outcome that needs to be achieved)? What are the challenges to getting there? Are resources adequate?

The following table summarizes where each of the interviewees think LBNL is on the safety excellence continuum (in no particular order).

	Phase 0	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
Interviews	What is Safety?	Keep us out of jail/Don't shut us down	Accidents cost too much	EHS is a top priority	EHS is a value	EHS is instinctive
1				LBNL		
2			LBNL			
3					LBNL	
4		Workers	Supervisors		Leadership	
5					LBNL	
6				LBNL		
7				LBNL		
8				LBNL		
9					LBNL	
10						LBNL
11				LBNL		
12					LBNL	

Site Visit Interview Data

As can be seen, the interviewees generally converged on phases 3 to 4, with some pockets above and below this phase. While internal perception tended toward phase 3-4 in terms of safety excellence, the Team found that most of the actions/activities identified in the CAP are focused at phase 2-3.

When asked about the top 3 safety-related issues, the interviewees provided a broad range of responses; however, the following provides a general summary of the issues (in no particular order), many of which were common among the interviewees:

- No single safety system for the entire work environment
- Issues management process
  - Limited resources
  - Early reporting of issues
  - Lack of follow-up on issues
  - Lessons learned not communicated well
- Contractors (i.e., subcontractors) not held to same standards
- Lots of small groups doing own thing – need standardization
- Better and more frequent training is needed (e.g., need GERT training for visitors and employees)
- Need balance between EH&S and getting the job done
- Diverse nature of population makes it difficult to have common safety culture
- Planning jobs with appropriate controls (work planning and control)
- Understanding safety responsibilities and being held accountable
- Non-technical concerns (ergo, slips, trips, falls) need to be better addressed
- Lack of EH&S resources both for and within divisions
- Need award mechanisms
- Need to strengthen self-assessment and assurance processes

When asked what success would look like, many of the responses reflected solutions to the issues identified above. However, there were also a number of responses that reflected a desire to achieve a higher phase of safety excellence by addressing cultural and behavioral aspects of safety. The responses are generally summarized below (in no particular order):

- A 360-degree review would feel very comfortable.
- People would feel secure bringing up issues.
- The lab would be 100% proactive in a formal way
- There would be stability in population/support.
- We'd know who to call, where to go, and what to do.
- LBNL is where people will go to find out how to do something properly, including safely
- Employees' voices are heard.
- Continued better communications across the lab, up and down
- Continued emphasis by managers on safety
- Continued planning of work
- Intuitive engagement at all levels, constantly

Site Visit Interview Data

- Credibility: students have it with staff, and managers have confidence in their staff
- Management follows through, speaks directly and purposefully with the individuals in open and free discussion.
- Safety culture that's not compliance-driven, not focused on rates
- Every employee goes home as well or better than when they came
- Hazards are identified and communicated
- Guidance is available
- People at the lowest level have input
- Managers get out into the facilities on their own, not just for the ISM Plan requirement or a performance measure
- Each individual feels responsible for safety and acts to maintain a safe Environment
- A decision on what needs to be changed is made
- A reward system versus a punishment system exists
- Proper work planning occurs
- Concrete safety improvement planning occurs
- Line Management chain is involved and understands how things work together
- TRC and DART gold rates are met.
- When everyone starts their day thinking safety-everyone has a stake in safety
- ES&H are not the ones driving safety, but in a supporting role
- Research leadership requests safety support
- Doing work safety is more than just low recordable injury rates
- Focus on mind change and not all on injury rates
- No accidents
- Safety is everyone's job; taking responsibility for safety of self and others
- When researchers consider it their safety program; safety coordinators are coaches