

# **SAFETY OVERSIGHT AND THE CONTRACTOR ASSURANCE SYSTEM AT THE LAWRENCE LIVERMORE NATIONAL LABORATORY**

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## **I. OPENING REMARKS**

Mr. Chairman and members of the board, I am the Director of the Lawrence Livermore National Laboratory (LLNL). Thank you for the opportunity to appear before you today to discuss the systems we have in place to assure that work is being performed safely at the Laboratory. These systems also provide support for oversight activities conducted by the Department of Energy's National Nuclear Security Administration (DOE/NNSA) and its Contracting Officer, the Livermore Site Office (LSO), as well as the Defense Nuclear Facilities Safety Board (DNFSB) and others.

Our Laboratory was founded in 1952 as a nuclear weapons design laboratory, and national security continues to be our central mission. As you know, the mission is a very demanding one, and exceptionally important to the nation. It requires a highly talented and specially trained scientific and technical workforce together with a unique array of research capabilities, including category 2 and 3 nuclear facilities. Operations at the Laboratory entail dealing with a variety of hazardous materials.

I am committed to excellence in safety as well as environment and health (ES&H) performance. Work safety has long been a major day-to-day responsibility of mine. My prior positions include serving as the Associate Director for Defense and Nuclear Technologies, responsible for nuclear operations at the most hazardous facilities onsite, and then Deputy Director for Strategic Operations while we were instituting Integrated Safety Management at Livermore. These positions have strengthened my appreciation of the importance of having a deeply-rooted safety culture in the workforce together with systems to assure that proper safety practices are learned and followed by all.

Safety is at the heart of the job of working in the weapons program. The Laboratory has cradle-to-grave responsibility for the nuclear weapons it designs, and an overriding consideration is that the weapons—and all operations involving them—are safe. Each of us is expected to think broadly and systematically not only about our own operations and procedures, but also about how weapons and components are to be built, transported, handled in the field (including possible accidents and abnormal environments), inspected, refurbished, dismantled, and disposed of. As a consequence, Livermore also provides support to help assure safe facilities and operations at NNSA plants. Our weapons-program safety responsibilities foster a culture where employees' ideas to improve safety are not only welcomed, they are expected as an important, integral part of the job.

**Accountability.** Each of us at the Laboratory is accountable to DOE/NNSA, Congress, and the American public for our actions in pursuit of programmatic goals and the performance of day-to-day operations. The health and safety of the public and Livermore employees are of paramount importance—as is environmental quality. As Laboratory Director, I bear special responsibilities because I am ultimately accountable for all activities at Lawrence Livermore. Accordingly, I have set high expectations for the ES&H performance of Laboratory staff, and we put into place effective systems and procedures, which we continually improve, to assure that safety standards are being met.

**Integrated Safety Management.** Livermore’s Integrated Safety Management (ISM) System provides a framework through which the Laboratory has markedly improved safety management procedures and practices and our safety performance. A notable example is the outstanding safety record compiled by the National Ignition Facility construction project, which has logged over 3 million hours of work over the last three years without a lost workday accident. With the Laboratory’s implementation of ISM:

- ES&H roles and responsibilities are defined for work activities, and line-management accountability is clear.
- Necessary and sufficient standards for safety (Work Smart Standards) are used with the controls tailored and applied commensurate with the hazards involved.
- Control processes assure that work is planned, reviewed, and authorized before activity begins and appropriately controlled once it is under way.
- Feedback provides the basis for continuous improvement, self assessments, quality assurance, and actions to correct safety-related problems.
- Expectations about ES&H performance are clearly established, employees are properly trained, and all aspects of ES&H are subject to review and oversight.

**ES&H Self Assessments, Contractor Assurance, and External Assessments and Oversight.** ISM at Livermore includes a comprehensive array of ES&H self-assessment processes at the activity, facility, directorate, and institutional levels. They range from nearly continual formal and informal self assessments at the activity level to formal assessments of each directorate’s and the institution’s implementation of ISM processes and specific safety programs. The directorate assessments are reviewed by the Laboratory’s Assurance Review Office (ARO). Reporting directly to the Deputy Director for Operations, the ARO provides an independent, internal appraisal of the Laboratory’s ES&H policies and their implementation and prepares on an annual basis *The LLNL Self-Assessment Assurance Report*. The ARO is also the central point of contact for external ES&H appraisals conducted by the University of California (UC), DOE, DNFSB, and other entities. The office compiles and tracks institutional and directorate-specific deficiencies and corrective actions that arise from ES&H audits and inspections.

Our self assessments—as well as the results of external oversight activities—help us to continually improve safety management and performance. They also provide the Laboratory and UC assurance that our ISM implementation is effective, that ES&H regulations and DOE orders are being followed, and that safety standards are being met. In addition, because ES&H self assessments are imbedded in the Appendix F framework

of Contract 48, safety experts as well as high-level managers at the LSO, UC, and NNSA are fully apprised of the Laboratory's performance with respect to mutually agreed to ES&H objectives. Accordingly, the LSO and NNSA are able to target their oversight activities in a coordinated, cost-effective, value-added manner by focusing on mutually agreed upon metrics and building on their confidence in our self assessments. These current ES&H performance assurance systems are undergoing improvement so that they meet requirements for a Contractor Assurance System (CAS) that will be an integral element of NNSA's re-engineered management and oversight process.

**Nuclear Activities.** The safety and security of nuclear and high-risk operations at the Laboratory receive the highest level of attention and oversight. Over the last several years Livermore has taken a number of actions to improve the management of nuclear operations. Most importantly, we have consolidated nuclear materials and facilities at the Laboratory—reducing the number of directorates managing nuclear facilities from four to two—and created an organization to support nuclear facility Authorization Basis (AB) activities. The AB Group provides an independent, expert single point of contact for Laboratory programs and external regulators, and it assists in the development of standardized methodologies, AB documents, and training programs. Concurrence by the AB Group is required for any AB submittal, thereby leading to greater consistency and quality across the Laboratory.

As we continue to improve ES&H assurance systems at the Laboratory and move toward a CAS that meets all NNSA requirements, nuclear operations will remain the focus of careful scrutiny in our self-assessment and external oversight activities. Because these operations are subjected to stringent ES&H regulations and DOE orders, they must meet rigorous safety standards. Our level of attention devoted to assurance of nuclear operations will not diminish as NNSA re-engineers.

**Improvements to the Laboratory's ES&H Assurance System.** A variety of ongoing activities are directed at improving the ES&H assurance process in order to meet NNSA's requirements for a CAS. The Contract 48 Appendix F performance assessment framework and the Laboratory's implementation of ISM provide extensive management systems and processes necessary for an effective CAS.

A principal focus of current improvement efforts is the development of formal risk methodology. With an accepted, improved method for assessing ES&H risks, all parties will be better able to focus priorities. Identified highest-risk areas will be subject to rigorous work process controls, documentation, reporting requirements, and assessments and oversight. Conversely, lower-risk activities provide opportunities for streamlining processes, thereby assuring proper resources for high-risk activities and supporting NNSA's re-engineering of NNSA/LSO line management oversight. In addition, our CAS will be strengthened through a restructured UC governance system that includes an external Board of Directors and new oversight committees.

**Safety Professionals.** Dedicated safety professionals at the LSO, the Laboratory, and UC provide expertise, on-site presence, and understanding of site-specific details. They make

the ES&H assurance system work and continually improve it. These safety experts identify necessary and sufficient Work Smart Standards (WSS) for inclusion in the Contract. They also assure that the requirements in these standards are incorporated into the Laboratory's *ES&H Manual*. These efforts are supported by senior managers that work effectively as a team to meet their respective responsibilities of self assessment, assurance, and oversight. There are at least six weekly standing meetings between Laboratory and LSO managers on ES&H issues—two at very senior levels.

Within the Laboratory, as I have mentioned, weapons safety is an important aspect of the stockpile stewardship program and the focus of programmatic work. Livermore experts also provide support at the production plants in the NNSA complex helping to ensure the quality of product and safety of operations. It is an important part of our mission. In addition, many safety professionals and safety-system engineers directly support ES&H control processes within each of Livermore's programs. Others are part of expert discipline teams that provide services to programs such as walkthroughs, specific evaluations, and quality-assurance reviews.

We work hard to retain safety expertise and have hired highly qualified, experienced staff from outside the Laboratory, who bring in best practices from other organizations. We have also contracted with leading safety organizations (e.g., Westinghouse Safety Management Solutions) to provide expertise to strengthen safety in essential areas.

## **II. SAFETY MANAGEMENT AT THE LABORATORY**

**Integrated Safety Management Implementation.** The Laboratory has taken a comprehensive institutional approach to implementing its ISM system for integrating ES&H requirements into the planning and execution of work. The ISM system is explained in detail in *Integrated Safety Management System Description*, which the Laboratory director approves. The document is updated as system improvements are made, and is it now in Version 6.0. It identifies DOE's core requirements for ISM, and it explains the work planning authorization process and safety management system mechanisms. The document contains the requirements for Livermore's *ES&H Manual*.

The *ES&H Manual* formally consolidates in a convenient, on-line package the ES&H requirements that work performed at the Laboratory must meet. The basis of these requirements is a set of Work Smart Standards (WSS) that establish workplace safety controls that are directly associated with all types of work at the Laboratory. Each standard is tailored commensurate with hazards. The WSS set was developed through a collaborative process involving DOE, UC, and the Laboratory. The standards were reviewed by an outside team of ES&H experts prior to approval, and a formal Change Control Process is used to keep the WSS set up to date.

The *Integrated Safety Management System Description* also specifies requirements for directorate implementation. Separate implementing documents are needed because each directorate's programmatic mission is unique and is coupled with different types of facilities, technical work, and hazards. These documents define the safety roles, responsibilities, and authorities for each position-level within the directorate. They serve

to vertically integrate safety planning, execution, best practices, and lessons learned from the activity level, to the facility level, to the institutional level. Horizontal integration of ISM is provided by subject matter experts and ES&H teams in a variety of organizations. The Hazards Control Department, the Environmental Protection Department, the Health Services Department, and the Laboratory Assurance Office constitute a support structure with specialists that interface with all Laboratory programs and organizations.

Further integrative support of ISM is provided by an extensive set of management systems and processes that are in place. Our multiple assessment and quality-assurance activities are discussed subsequently, as are our numerous tracking systems and independent/external/oversight reviews. In addition, training and qualification programs are well established at Livermore. All employees are required to take an annual ES&H training course and additional requirements are commensurate with work assignments. Work authorization is tied to our training database.

**Improved Safety Performance.** The potentially severe consequences of a significant accident involving nuclear materials means that exceptionally high standards of safety performance, demanding self assessments, and rigorous oversight are warranted. High-risk nuclear safety performance at the Laboratory is benefiting from a number of specific actions taken since 2000. We are implementing 13 specific corrective actions in the LLNL Authorization Basis Corrective Action Plan, developing Documented Safety Analysis Reports that are compliant to 10CFR830, and implementing DNFSB Recommendations such as 2000-2 and reduction of legacy nuclear material at facilities.

A number of key top-level measures provide a basis for gauging ES&H performance improvements in other (non-nuclear) areas since the introduction of ISM at Livermore in 1996 (and verified by DOE in 2000). Most significant is the progress made in reducing injury and illness rates. Measures of injury rates have decreased by more than a factor of two. Laboratory performance is now similar to that achieved by corporations with OSHA's Voluntary Protection Program status. In addition, we have achieved roughly order-of-magnitude reductions in the annual number of environmental releases and in the generation of mixed and hazardous waste. Other top-level measures, such as radiation dose to workers, radiation protection of the public, and exposure to chemical and physical agents, have also seen overall improvement (relative to the workload) and are indicative of the Laboratory maintaining a high level of performance.

**Self-Assessment Processes.** Directorate self-assessment activities comprise a major part of the overall ES&H self-assessment programs at the Laboratory. These assessments serve multiple purposes: feedback and continuous improvement (through mechanisms described under Corrective Action Processes, below), analysis of accidents and incidents, evaluation of performance in relationship to ES&H requirements and goals set by the directorate, and quality assurance of ISM implementation and management practices. Each directorate is required to develop a Directorate ES&H Self-Assessment Plan that describes its self-assessment activities, provides a schedule for completing assessments, and identifies the documents to be generated. This plan is reviewed and updated on an annual basis and approved by the cognizant associate director.

Self assessments vary in frequency. They are more frequent and detailed at the activity level with the lessons learned feeding into higher levels of self assessments that are focused on systems and cross-cutting issues. At the activity level, the use of checklists, procedures, and routines by workers is an everyday practice. Very important at this level is the feedback from employees, who are encouraged to provide their ideas on how to improve processes. Walkthroughs and specific evaluations by ES&H subject-matter experts or multidisciplinary ES&H teams are also common. At a higher level, facility managers and facility points-of-contact carry out self assessments and walkthrough inspections. Similarly, program managers are responsible for performance reviews, walkthrough inspections, and operational assessments. These activities are complemented by event-based reviews (e.g., incident analyses) and quality reviews.

At the highest level, every directorate conducts a comprehensive ISM self assessment on an annual basis and provides the results to the Director's Office in a formal report. They are required to assess their implementation of ISM, performance with respect to ES&H and quality-assurance-related requirements, progress in achieving defined goals, and management of corrective actions. These Directorate Annual Self-Assessment Reports are reviewed by the Assurance Review Office (ARO) and compiled into an institutional document, *The LLNL Self-Assessment Assurance Report*, which is provided to associate directors and assurance managers for their information and any management actions. Additional independent, institutional assessments and reviews are conducted by the ARO and the Audit and Oversight Department.

**External Review and Oversight of ES&H.** External review and oversight provide another, independent source of feedback for the Laboratory's effectiveness in implementing its safety program. These evaluations are invaluable to continuous improvement efforts. External reviews range from Lab to Lab Peer Reviews (e.g., criticality safety and waste management reviews) to the LSO Facility Representative oversight to NNSA and DOE/HQ formal reviews to Environmental Regulatory compliance reviews to DNFSB site visits and reviews. It is our goal to uncover and correct issues through effective ES&H programs and self evaluations before they are identified through external review.

One particular independent, external oversight process is particularly valuable to the Laboratory. Contract 48 Appendix F provides a framework that assures balanced consideration of programmatic and operational factors in evaluations of "doing work safely." The Appendix F process, which is discussed in more detail below, is special among external oversight because it combines performance measures for meeting mission goals with measures for meeting those goals safely and protecting the environment. The framework provides our line managers feedback based on a comprehensive view of performance that reflects the ISM principle of "Balanced Priorities."

**Corrective Action Processes.** To improve ES&H in the workplace, results from self assessments and other external or internal reviews are shared so that best practices can be adopted by others and deficiencies can be corrected with the lessons learned applied

elsewhere. Deficiencies identified by self assessments, reviews, audits, and appraisals are reviewed to determine appropriate corrective action. A corrective action process, described in the *ES&H Manual*, is also implemented in response to findings in incident analysis reports. In addition, corrective action plans are developed on the basis of analysis of direct, contributing, and root causes of DOE-reportable incidents. More formal causal analysis processes have been instituted in response to DOE's new Occurrence Reporting requirement.

Issues identified are resolved in a manner that is timely and commensurate with their impact on safety and reliability. A set of severity criteria has been developed and is used to identify the priority assigned to correcting deficiencies. In particular, the Laboratory requires that special attention be given to situations discovered during any assessment and determined to be highly dangerous. For imminently dangerous situations, work is stopped and the deficiency is mitigated immediately.

To track the status of ES&H deficiencies from the time they are identified until they are resolved, the Laboratory established a deficiency tracking system (DefTrack). DefTrack provides a consistent, standardized approach to documenting deficiencies, assigning priorities, tracking corrective actions, and sharing information among directorates. The database is maintained by the ARO, which periodically "rolls up" information from deficiency-tracking databases in each of the directorates. Schedules and criteria for roll-ups are established by the ES&H Working Group, and the process is managed by the ARO. DefTrack information that is rolled up to the ARO is available to the LSO. DefTrack is subject to continuous improvements, including its conversion to an internal web-based application in early 2004. We are also improving procedures to ensure greater consistency in the use of DefTrack across the Laboratory. Other ongoing efforts include merging it into the Laboratory's Issues Tracking System, which is also used to track progress of other types of operational issues (e.g., security) as well as other high-priority, cross-cutting issues and deficiencies of concern to senior management.

**ES&H Staffing.** I am proud of the dedication and professionalism of the Laboratory's ES&H teams and assurance managers. As mentioned, ES&H experts are imbedded in the directorates to provide day-to-day support. Other analysts, technicians, engineers, and specialists in the Hazards Control Department, the Environmental Protection Department, the Health Services Department, and the Laboratory Assurance Office provide support to all Laboratory programs and organizations. Their quality is exemplified by the fact that the Laboratory provides expert help at Pantex in addition to our responsibility to help ensure that the operations involving Livermore-designed weapons are conducted safely. Laboratory experts more broadly participate in safety reviews and provide analytic support for facility safety (e.g., earthquake, fire, and lightning analyses).

Staffing is a challenge, but one that Livermore is largely successful in meeting. We have been able to retain our experienced safety professionals, and we are drawing on Laboratory programs to meet emerging needs, such as safety software quality assurance. In addition, highly qualified, experienced staff have been hired from outside the Laboratory. For example, in the Authorization Basis (AB) area, Livermore staff currently

possess experience that includes the Nuclear Regulatory Commission, commercial nuclear facilities, Los Alamos National Laboratory, Rocky Flats, Pantex, Hanford, and Lockheed. This variety of experience provides different perspectives on how to improve the conduct of AB activities and the handling of issues. We also draw on outside expertise in the AB area by using Westinghouse Safety Management Solutions (WSMS) to provide support. WSMS performed a baseline review of the Laboratory's AB documents and has assisted in preparation of recent Documented Safety Analysis submittals. Expertise from another leading safety organization (Dupont) was brought to the Laboratory to strengthen safety in large-scale construction projects. The result has been an outstanding safety record at the National Ignition Facility construction site.

Our expectations are that staffing requirements will not grow dramatically as we develop and implement a CAS that meets NNSA's requirements. Nuclear operations will remain the focus of careful scrutiny in self assessments and external oversight so that the staff needs will be roughly the same. The burden on the Laboratory's self-assessment and assurance processes will be greater in other areas. However, we expect improvements in overall efficiency and greater opportunities for streamlining processes in low-risk areas.

### **III. ES&H IMPROVEMENT EFFORTS AND THE CONTRACTOR ASSURANCE SYSTEM**

**An Integrated Assurance System.** Assurance of the quality of Livermore's programs and operations is provided by a layered set of systems: the DOE Office of Independent Assessment and Performance Assurance, NNSA oversight (including the LSO as its Contracting Officer), UC governance of the Laboratory, Lab to Lab Peer Reviews, and Livermore's internal management system. To strengthen assurance, NNSA headquarters, the LSO, UC, and the Laboratory are jointly working to better align and integrate these systems. Together with a risk-based approach, alignment ensures a common focus and shared priorities. Integration ensures appropriate transfer of information, well-defined roles and responsibilities, and effective and efficient assurance processes.

The new Contract 48 Appendix F approach to UC management of the Laboratory provides a cornerstone for better integration and improved performance assurance. The revamped performance assessment processes in Appendix F, first used in FY2003, focus on high-level objectives that are mutually agreed upon by NNSA, UC, and Laboratory senior executives. Hence, these objectives closely align with the top priorities of leaders, who substantially benefit from vigorous engagement in the process. It culminates with a Senior Executive Evaluation Meeting, which was held on November 18 this year.

The evaluation and reporting processes that underpin Appendix F are manifold. Activities are sequenced throughout the year to support a mid-year review, the UC Vice President for Laboratory Management's and my preparation of separate performance assessments, the review of these assessments by NNSA, and the Senior Executive Evaluation Meeting. In addition to the previously discussed external oversight activities and the Laboratory's ES&H self assessments, the UC President's Council and its various panels review the Laboratory's performance, and I conduct performance and workforce Director's reviews of the Laboratory's programmatic and operational organizations.



With the first cycle of the new Appendix F process completed, I believe the process helped me in my management responsibilities and was a great success. I am confident that other senior executives concur in this view, and together we are examining ways to build upon the process and make it even better. Improved performance and performance assurance are also key considerations behind other steps being taken by NNSA, UC, and the Laboratory. NNSA is re-engineering its processes for management and oversight. The UC Office of the President conducted an extensive review of options to strengthen its governance of the national laboratories. The University has decided to appoint an external board for the national laboratories, take a number of specific steps to strengthen its internal management and oversight of the laboratories, and partner with selected private-sector management firms to bring in additional expertise. Finally, as discussed below, the Laboratory is improving its self-assessment and assurance systems.

**Improvements to ES&H Assurance and Steps toward a CAS.** Ongoing enhancements to ES&H assurance at Livermore are directed toward making continual improvements, fixing identified weaknesses, and instituting changes to the current system so that it meets NNSA's requirements for a Contractor Assurance System (CAS). The goal of CAS implementation is to build internal and external confidence that the Laboratory is executing mission responsibilities safely and effectively, and is a responsible steward of public trust. The CAS will enhance the ability of the LSO and NNSA to target their oversight activities in a more cost-effective, value-added manner. The system will be an integral element of NNSA's re-engineered management and oversight process.

We are working closely with the LSO and NNSA on CAS. In September 2004, the Laboratory will be submitting material that addresses documentation requirements for our CAS (e.g., system description, validation, and the change control system) and management processes (e.g., quality-assurance processes, training, risk methodology, issues tracking, and performance metrics). We are also examining whether current management systems and processes are adequate. In general, most of the required elements are in place. However, the Laboratory has to add a formal risk methodology to its current system, a need that is further discussed below. With a clear understanding of risks, it is feasible to move to graded assurance processes, where the rigor applied—as well as NNSA's investments in oversight—reflects risk.

We are working to mitigate several weaknesses identified in self assessments and various external reviews. Particular areas of attention include: ensuring greater consistency in self assessments across the directorates, upgrading our corrective-actions and issues-tracking management system, making certain that required procedures and processes are reliably followed at the activity level, and improving the process for job-site hazards analysis and control. The Laboratory is also working to streamline elements within the current system that are inefficient and ensure that systems are better integrated with UC and NNSA oversight roles.

**A Formal Risk Methodology.** Through formal application of risk analysis, NNSA and the LSO, UC, and the Laboratory will be better able to adjust assessment and oversight

resources. For those activities that have higher risks (a combination of likelihood of occurrence and potential consequences), greater process rigor, more stringent controls, and more thorough documentation are necessary. Currently, nuclear and other identified higher-risk operations at the Laboratory receive the highest level of attention and oversight, and that will remain the case. However, for many lower-risk activities, there are opportunities to streamline processes, gain efficiencies, and lower investments. In addition, formal analyses may uncover areas where current assurance and oversight measures are not adequate and more rigorous systems are warranted.

We are working with NNSA and the LSO—as well as UC—on methodology development. Expert judgment and detailed knowledge about operations and ES&H standards are required. Risks must be assessed, risk thresholds established, and the methodology validated. Task groups have been organized to pursue pilot cases.

#### **IV. CLOSING COMMENTS**

What went wrong and what lessons can be learned from the Columbia accident? The answers to those questions are particularly important to those of us working at the cutting edge of science and technology on projects that are vital to the nation and entail significant ES&H risks. At Livermore, a senior management team is taking a careful look at the accident report and will be recommending process improvements to me and to NNSA. Dr. G. Scott Hubbard, Director of NASA Ames Research Center and a member of the Columbia Accident Investigation Board, will be coming to the Laboratory to discuss lessons learned with senior managers and give a presentation to all employees.

One thing is very clear: Rules, regulations, processes, procedures, assurance systems, and oversight are very important; however, they alone do not ensure safety. Safety requires employee awareness and vigilance—keeping processes current because the work constantly evolves in an R&D environment, continuously looking for improvement, and questioning processes and procedures that seem deficient. Safety is integral to one's job at the Laboratory, not merely procedures to be followed. As the Columbia Accident Investigation Board concluded in their report:

*“NASA’s culture of bureaucratic accountability emphasized chain of command, procedure, following rules, and going by the book. While rules and procedures were essential for coordination, they had an unintended but negative effect. Allegiance to hierarchy and procedure had replaced deference to NASA engineers’ technical experience.”*

*“The organizational structure and hierarchy blocked effective communication of technical problems. Signals were overlooked, people were silenced, and useful information and dissenting views on technical issues did not surface at higher levels.”*

As I stressed in my opening remarks, safety is deeply rooted in the culture of our Laboratory because weapons safety is a key part of our cradle-to-grave responsibility for the nuclear weapons designed at Livermore. I have high expectations for the ES&H performance of Laboratory staff, and we put into place effective systems and procedures, which we continually improve, to assure that safety standards are being met.