

Los Alamos National Laboratory

High Explosives Science and Technology Group

Business Overview

Los Alamos National Laboratory (LANL) is owned by the United States Department of Energy (DOE) and operated under contract by the University of California (UC). Established in 1943 as part of the Manhattan Project, LANL's original mission was to design, develop, and test nuclear weapons. As technologies, United States priorities, and the world community have changed, LANL's mission has broadened to enhancing global security by ensuring safety and confidence in the U.S. nuclear weapons stockpile, developing technical solutions to reduce the threat of weapons of mass destruction, and improving the environmental and nuclear materials legacy of the cold war. In addition, the Laboratory applies its scientific and engineering capabilities to assist the nation in addressing energy, environment, infrastructure, and biological security problems. In FY98 LANL employed approximately 7,100 workers divided among 45 division and program offices. Overall LANL funding for FY98 was \$1.36 billion.

The Dynamic Experimentation (DX) Division is a technically diverse organization employing 440 workers at numerous sites comprising approximately 22 square miles, fully half of LANL's land area. The division consists of eight groups, a test office, the Dual Axis Radiographic HydroTest Facility (DARHT) project office and the Division Office. DX Division's principal and historic programmatic activities are in the areas of nuclear weapons research, development and testing (RD&T) and RD&T in support of Department of Defense (DoD) programs. The Division is actively engaged in an aggressive effort to expand its

funding base and utilize its substantial and varied skills pools in other defense- and non-defense-related activities such as environmental monitoring and remediation research, industrial collaborations, and technology transfer opportunities.

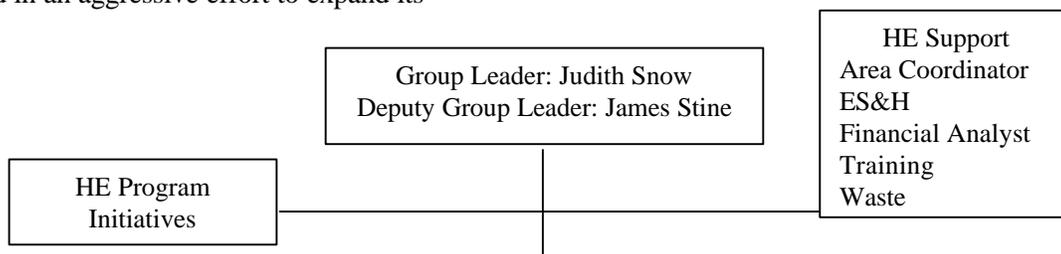
The High Explosives Science and Technology Group, DX-2, is concerned with all aspects of high explosives (HE) from cradle to grave. These aspects include chemistry, engineering, materials properties, and physics related to the synthesis, formulation, performance, and safety of explosives; monitoring and surveillance of explosives in the enduring nuclear stockpile; unique applications of explosives; and environmentally conscious destruction/disposal of explosives and explosive devices.

DX-2 is composed of 75 employees, including guest scientists and students, in four core teams (see Fig. 1).

- HE Chemistry
- HE Engineering
- HE Materials
- HE Physics
- Theoretical Physics
- Theoretical Chemistry
- Analytical Chemistry
- Physics

Employee skills and training include the areas of organic chemistry, inorganic chemistry, physical chemistry, chemical engineering, mechanical engineering, and biology.

For FY98, DX-2's budget was approximately \$12 million, with \$2 million of that total designated to support work in other parts of



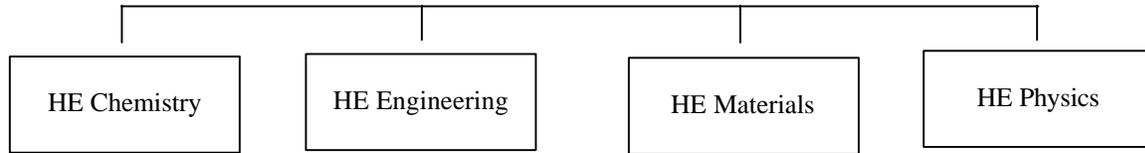


Fig. 1. DX-2 group organizational structure.

LANL. DX-2 funds are used for a combination of RD&T activities as well as several aspects of explosives production work.

Facilities operated by DX-2 include buildings housing traditional chemistry laboratories as well as individual process buildings designed for particular operations such as formulation, synthesis or machining of explosive compounds.

Federal regulatory agencies with oversight for various LANL operations (and thus DX-2 operations) include EPA, DOE, OSHA, and the NRC. The New Mexico Environment Department (NMED) also oversees and regulates LANL activities. Most DX-2 waste is regulated under

- the Resource Conservation and Recovery Act (RCRA),
- the Toxic Substances Control Act (TSCA), and
- the National Pollutant Discharge Elimination System (NPDES).

1. Leadership

The leadership system that supports environmental excellence in DX-2 begins with the director of LANL who, in 1998, issued a vision for a Laboratory that included striving for zero environmental incidents. A comprehensive, proactive, ethics-based system cascades down from this leadership goal.

DX-2 group management includes a group leader, a deputy group leader and team leaders for HE Chemistry, HE Engineering, HE Materials, and HE Physics.

DX-2's management system is based on frequent and open communication. Group managers meet

monthly with the entire organization for formal sessions. These meetings focus on expectations and progress toward goals. The sessions include discussion of environmental issues and waste minimization. Integrated Safety Management (ISM) is also a topic at these meetings. ISM implementation is a major emphasis at LANL and includes—in addition to worker safety and health—environmental protection, pollution prevention, and waste minimization.

DX-2 has embraced the philosophy contained in the Green Zia Environmental Excellence Program. Some portions of the group have already received training in use of the Green Zia tools to evaluate and improve process performance. Through submission of a 1999 Green Zia application for recognition at the commitment level, DX-2 leaders are communicating to group members the importance of pollution prevention and environmental excellence. During the coming year, DX-2 managers will further deploy understanding and use of the Green Zia Program throughout the organization.

Information regarding organizational goals and current progress cascades to individual employees through the management structure. In addition to the monthly group meetings already mentioned, DX-2 leaders meet much more frequently with teams and individual employees on an informal basis. Both the group leader and deputy group leader observe an open-door policy that allows employees easy access. DX-2 uses a variety of methods, including email, to keep employees informed of issues related to the group and maintains a web site with a wide range of available information for employees, customers, and stakeholders. In addition to conducting several documented management walkarounds each month,

the group leader and the deputy group leader walk DX-2 spaces virtually every day.

DX-2's strategic perspective is incorporated in the DX Division strategic plan, as are the group's environmental and waste-management goals. DX-2 senior leaders provide the input for the portions of the division-level plan that directly impact the group. DX-2 does not have an independent strategic plan at this time but expects to develop one this year. The group also has representatives on the Integrated Safety Plan Grass Roots Committee, which is responsible for providing employee input for the ISM implementation strategy. As previously mentioned, ISM includes a strong focus on environmental protection, pollution prevention, and waste minimization.

Because of the nature of DX-2's work there is minimal interaction with the public or the community. DX-2 does sponsor a pilot program that provides opportunities for community teachers and student to participate in summer scientific research activities at DX-2 facilities. Other community interactions take place through the integrated outreach programs of LANL.

2. Planning for Environmental Excellence

LANL has developed and uses as a guiding blueprint a strategic plan for the next five years. The current LANL strategic plan (available online to both the public and LANL employees) sets out major programmatic objectives and strategies. It also identifies environmental objectives related to most LANL major goals. In addition, a major objective of demonstrating operational excellence in all activities specifically calls out the following strategies:

- achieve measurable improvements in safety and environmental stewardship through full implementation of the ISM Program throughout LANL.
- Manage wastes and hazardous legacy materials effectively and accept the challenge of minimizing the generation of hazardous wastes in the future, with a long-term direction toward zero emissions.

Each year LANL also produces an Institutional Plan, a five-year perspective on Laboratory operations. This document (available online to the public and to employees) identifies strategic requirements for LANL organizational units, including DX Division; summarizes strategic, tactical, and programmatic plans; and helps ensure the integration of LANL activities with DOE priorities.

In partnership with DOE, UC has developed specific overall performance goals, contained in

Appendix F of the operating contract, that emphasize results most important to DOE on an annual basis (see Fig. 2). Each year LANL renegotiates with UC and DOE this set of specific performance measures in ten administrative and operational functional areas, one of which is environmental restoration and waste management (see Category 3). DX Division and DX-2 environmental performance goals are linked to LANL's Appendix F goals through the Hazard Control Procedures (HCPs) and Standard Operating Procedures (SOPs). The HCPs and SOPs provide a formality of operation and ensure the measurability of performance.

Based on LANL strategic directions and DOE requirements, DX Division then develops its own strategic plan which includes a strategic vision for DX-2. The DX Division strategic plan includes specific division goals that respond to the LANL environmental strategies cited above. Division level planning requires the development of procedures and subsidiary action plans to ensure safety of employees and to ensure that environmental goals are met. In combination with the leadership system previously described, this effort then sets the stage for development and execution of tactical action plans for the group. Currently, DX-2 develops action plans on a case-by-case basis.

The group has recently begun using the Green Zia tools. With the formulation of a strategic plan in the coming year, DX-2 will encourage the use of Green Zia tools to evaluate the

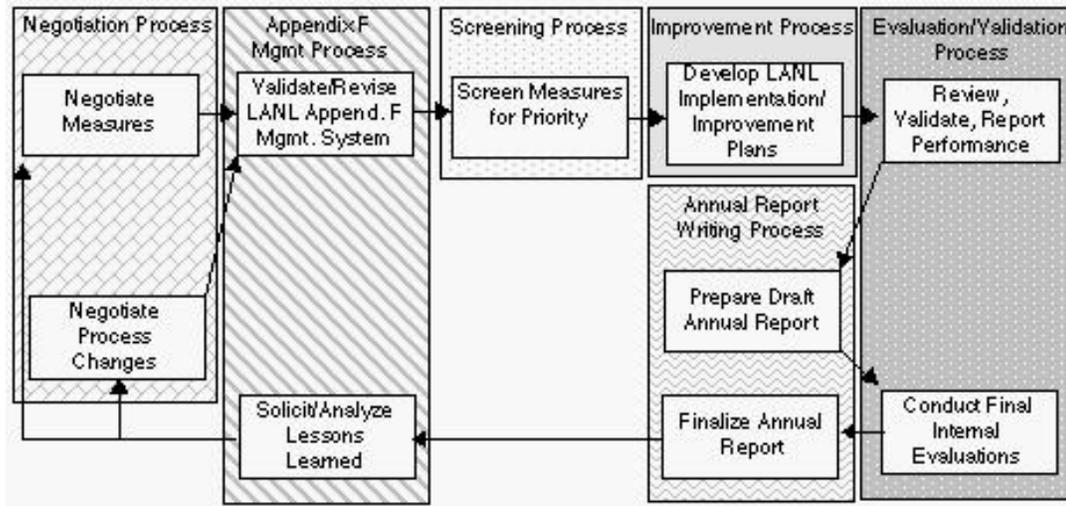


Fig. 2. Appendix F Process (18-month continuous cycle.)

environmental performance of additional processes and to formulate related action plans for performance improvement.

3. Customer, Market, and Stakeholder Focus

Group DX-2 has one primary customer, the US Department of Energy. The group also does a small amount of work for DoD, other government agencies, and industry. The DOE is directly involved in developing environmental performance measures and formulating goals for all of LANL, including DX-2. The performance measures found in Appendix F of UC's operating contract provide clear expectations, increase accountability, and improve customer relations by addressing performance issues that concern DOE. Appendix F contain approximately one hundred specific performance measures and associated goals. Over twenty-four of those measures fall within the functional area of environmental restoration and waste minimization. Many more measures directly related to environmental excellence fall within the functional area of environment, safety, and health. The negotiation steps for these measures, the process to set priorities, the

improvement steps, and the resulting evaluations all help focus resources on key business processes, improve operational quality, and reduce external oversight by sharing performance results with key customers.

Appendix F requires an annual self-assessment and evaluation by both UC and DOE, but LANL senior leaders also meet quarterly with UC and DOE representatives to discuss current progress against goals and to identify any issues. The regular and frequent interaction helps prevent surprises, mitigate problems, and create a cooperative rather than an adversarial atmosphere.

In support of the Appendix F evaluations, DX Division conducts quarterly self-assessments that contain an evaluation of environmental performance and routine waste minimization efforts. This assessment is documented, archived and transmitted to LANL management.

The external stakeholders include DOE and UC and the DX Division external review committee, which critically reviews division activities on a yearly basis. Other DX-2 stakeholders are internal and include DX-2 employees; DX Division, and the Environment, Safety and Health (ESH) Division, which oversees DOE order and CFR compliance.

Interaction with the division review committee is accomplished through yearly multi-day briefings, part of which involve DX-2. The Review Committee evaluates performance based on several key criteria, including programmatic performance and planning

DX-2 uses its world wide web site to communicate with customers, stakeholders, and suppliers. By using text as well as frequently updated statistics, DX-2 keeps all parties well informed of current and projected progress.

To monitor public perception, LANL has since 1990 conducted a quarterly survey of public opinion. The resulting reports profile New Mexico residents' views and identifies results from specific geographic areas around the state. In addition to asking about general perceptions of LANL, the survey specifically asks respondents their opinion of LANL's environmental responsibility. DX-2's environmental performance is included in this larger evaluation.

DX-2 considers employees to also be key stakeholders. The routine interaction with employees has been described in Category 1. A major formal method for determining employee attitudes and the climate in the workplace is an annual Employee Perspective/Checkpoint survey. The survey contains standard types of questions, which allows us to perform comparisons with other operational divisions within LANL and also with other companies. In addition, for the past four years DX-2 has participated in LANL's annual Upward Appraisal Program, which allows employees to evaluate their supervisors. DX-2 managers review the information from these instruments and use it to help establish goals and corrective actions.

DX-2 has two on-site permanently assigned environment, safety, and health coordinators who are involved in the daily activities of the group. They provide guidance to group leaders on environmental and health and safety issues related to short-term operations and long-term plans.

4. Information Analysis

The Appendix F Process (see Category 3) is a key performance indicator of our contractual requirements and also a measure of customer satisfaction. Managers monitor progress related to project and performance goals and use that information to develop and/or modify operational plans and to identify areas for improvement.

LANL's Environmental Management Division maintains extensive databases related to environmental information for LANL as an institution and for individual divisions and groups, including DX-2. This data includes measurement of progress toward goals for waste minimization for various waste type.

Other environmentally related data that is tracked and analyzed includes (see Category 3)

- information from the annual Employee Perspective/Checkpoint Survey, which for the past four years has tracked employee perceptions and concerns in general categories including safety, productivity, and customer focus,
- results from the annual upward appraisal process that allows employees to provide direct feedback to managers regarding the supervisors' behavior and ability in areas such as environment, safety and health; communication; and accountability, and
- information from the quarterly public opinion survey that tracks public perception of LANL's environmental responsibility.

5. Employee Participation

A major goal in DX-2 is that every employee understand his or her role in achieving organization and institutional goals. DX-2 managers are responsible for preparing individual development programs—both short-term and long-term—for each employee on an annual basis as part of LANL's Performance Management System. This system requires DX-2 managers to establish objectives which support the organizational

echelons above them. Objectives for each employee are then designed to ensure that the organizational objectives are met and that the employee has a clear view of how his or her work requirements contribute to the success of the entire organization. The Performance Management System ensures clear two-way communication during the goal-setting phase of the process and provides a focus for ongoing discussion about work objectives and processes. Specific goals include

- DX-2 group goals,
- aligning individual expected results with institutional goals,
- identifying and assessing individual performance results/accomplishments,
- evaluating performance of institutionally defined behaviors,
- describing how individuals helped to meet organizational objectives,
- linking performance to rewards or consequences,
- designing development plans to support improving performance in current jobs and/or increasing impact on the organization,
- enhancing employee/manager ownership of individual and organizational performance,
- improving two-way communication between supervisors and employees.

DX-2 employees may also participate in LANL's institutional career development program, which helps identify skills gaps and excesses. Using available information and training, employees can choose to enhance their existing skills or to further develop other skills that LANL needs now or for future programs.

Training programs are a key component to assuring actions by workers that reflect integrated plans. DX-2 employs two training generalists who work with managers and employees to identify specific training requirements for work being performed, establish appropriate programs, enhance quality, and assure continuity between all aspects of training. Training on standardized practices such as hazardous material management or emergency operations is conducted on a LANL-wide basis.

Site- and task-specific training is also provided for DX-2 projects and facilities.

To assure an adequate safety envelope and compliance with laws and regulations, DX-2 facilities must produce several operations plans. These include

- facility management plans,
- configuration management plans,
- facility safety plans,
- quality assurance plans,
- emergency action plans,
- training program description and job analysis, and
- maintenance implementation plans.

All of the above plans represent a process that is integral to assuring high quality work being conducted on very hazardous material is accomplished with minimal risk to the worker, his peers, surrounding communities, and the environment.

One new key element of the training program is inclusion of the Green Zia tools for environmental excellence. DX-2 is one of the first organizations at LANL to pilot the use of these tools.

LANL senior leaders have chartered the Employee Advisory Committee (EAC). EAC is composed of members from each division, including DX, who are committed to making the Laboratory a better workplace for all employees.. The purpose of EAC is to serve as a communication link providing employee input, feedback, and recommendations to LANL management on existing and proposed LANL policies, practices, operations, and procedures. EAC also identifies issues of employee concern and communicates these issues and possible solutions to LANL management.

LANL leadership has also chartered a Science and Engineering Advisory Committee (SEAC) composed of scientists and engineers who advise senior managers about the status and future direction of scientific activities and programs at the Laboratory. DX-2 has an employee on the SEAC to provide employee input to the technical direction and operations of LANL.

Another mechanism to capture employee input is the annual Employee Perspective/Checkpoint Survey, which for the past four years has tracked employee perceptions and concerns in general categories ranging from safety to customer focus (see Category 3). The annual upward appraisal process also allows employees to provide direct feedback to managers regarding the supervisors' behavior and ability in areas such as environment, safety and health; communication; and accountability (see Category 3).

There are also incentives to encourage staff to work smarter and utilize additional resources to accomplish their work. The Pollution Prevention Awards Program, sponsored by EM Division but open to all LANL employees and subcontractors, is designed to encourage individuals and teams to develop plans, programs, or ideas for minimizing waste; conserving water, electricity or natural gas; reducing air or water pollution; or procuring products with recycled content. Recipients of the awards receive recognition and a cash grant from specially allocated congressional funds. The Los Alamos Awards Program, administered by LANL institutionally but tailored for application at the division or program level, provides a link between the organization's mission and those employees or teams that achieve significant accomplishments toward that mission. DX-2 managers use the program to recognize exceptional contributions and noteworthy achievements by awarding their employees, either individually or as teams, cash awards ranging from \$250 to \$2000.

6. Process Management

DX-2 understands regulatory requirements through the various DOE Orders, federal regulations, state regulations and permitting processes. The New Mexico Environmental Department (NMED) regularly conducts inspections for RCRA compliance. Formal review procedures have been established by DX-2, in conjunction with LANL's ESH Division, to assure compliance with the applicable regulations. One ES&H coordinator and two waste management coordinators reside in the group (see Fig. 1) and are responsible for

supporting environmental compliance. In previous years, ESH Division conducted assessments to prepare DX Division for NMED inspections. In November 1998, DX Division developed its own internal self-inspection program to improve RCRA compliance. The DX Division waste management coordinators, including the DX-2 waste management coordinators, conduct weekly inspections and a formal monthly inspection and report the results to the DX Division Director by the 10th of the following month. These Division programs and the ESH assessment prepare the Division for NMED RCRA inspections and assure compliance.

The cost of permitting, handling, and disposing of waste is a significant fraction of the group operating cost so there is serious motivation to reduce the volume of waste generated. In general, DX-2 plans and manages environmental requirements through the DX Division Standard Operating Procedure Document SOP01, *Waste Management in DX Division*, which requires the evaluation of processes and procedures for waste minimization opportunities. The group evaluates new processes for waste minimization and material substitution opportunities. Using these systematic but informal methods, DX-2 has had some significant successes in waste minimization. These evaluations led to such actions as substitution of propylene glycol for ethylene glycol for laboratory cooling, extensive recycle of surplus and unwanted items, recycle of solder scrap, non-hazardous solvent substitution for TCE, reduction in machine coolant usage, recycle of cooling water, and reduction in material quantities used for performance tests. In an outstanding example of waste reduction, DX-2 was able to modify a process so that the number of manufacturing steps was reduced from 20 to 4 and waste generation was eventually reduced from 1200 kgs of waste per pound of product to 3.7 kgs of waste per kg of product.

In addition, DX-2 conducts risk assessments to assess the risk of generated waste according to the document *Hazard Control Plan, DX Division Operations, HCP-DX-98-01*. These systematic but informal procedures are the current basis for

analyzing processes to identify environmental and safety improvement opportunities.

At the direction of the DX-2 group leader, the organization is working to formally establish both processes and behaviors to achieve waste reductions beyond that required by compliance. The group has used the Green Zia tools to evaluate one manufacturing process and is beginning evaluation of another. Figure 3 shows the process map for one of the explosives manufacturing processes. Figure 4 shows a cause and effect diagram the improvement team used to identify possible reasons for excessive waste generation.

DX-2 group management intends to encourage broader use of the Green Zia tools over the next year to support the formulation of a strategic plan, to set group environmental goals, and to identify process improvement opportunities. Action plans will be developed from the improvement opportunities.

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Fig. 3. General process map for PBX manufacturing process.

Fig. 4. Cause-and-effect diagram used to diagnose pollution causes.

Acronyms

DARHT	Dual Axis Radiographic HydroTest Facility	OSHA	Occupational Safety and Health Administration
DoD	Department of Defense	RCRA	Resource Conservation and Recovery Act
DOE	Department of Energy	RD&T	research, development, and testing
DX	Dynamic Experimentation Division	SEAC	Science and Engineering Advisory Committee
DX-2	High Explosives Science and Technology Group	SOP	standard operating procedure
EAC	Employee Advisory Committee	TSCA	Toxic Substance Control Act
EPA	Environmental Protection Agency	UC	University of California
ESH	Environment, Safety and Health Division		
HCP	hazard control plan		
HE	high explosives		
ISM	Integrated Safety Management		
LANL	Los Alamos National Laboratory		
NMED	New Mexico Environment Department		
NPDES	National Pollutant Discharge Elimination System		
NRC	Nuclear Regulatory Commission		