



2002 ANNUAL REPORT

U.S. Department of Energy



Environment, Safety and Health



Office of Environment, Safety and Health
June 2003

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The DOE 2002 Annual Environment, Safety & Health Report is available on the Internet at www.tis.eh.doe.gov/paa. If you have difficulty accessing it, please contact the ES&H Information Center, (800) 473-4375, for assistance. Please forward any comments to Frank Russo at (301) 903-8008 or by e-mail at Frank.Russo@eh.doe.gov.

ACRONYMS

ALARA	As Low As Reasonably Achievable
CBD	Chronic beryllium disease
CEDR.....	Comprehensive Epidemiologic Data Resource
DOE.....	Department of Energy
DOL.....	Department of Labor
EEOICPA	Energy Employees Occupational Illness Compensation Program Act
EH.....	Office of Environment, Safety and Health
EM.....	Office of Environmental Management
EMS.....	Environmental management system
ES&H.....	Environment, safety and health
EPA	Environmental Protection Agency
INPO	Institute for Nuclear Power Operations
ISM.....	Integrated Safety Management
ISO.....	International Organization for Standardization
LANL	Los Alamos National Laboratory
LWC.....	Lost Workday Case
NEPA	National Environmental Policy Act
NESHAPs.....	National Emission Standards for Hazardous Air Pollutants
NIOSH	National Institute for Occupational Safety and Health
NNSA.....	National Nuclear Security Administration
NOV	Notice of Violation
OSHA.....	Occupational Safety and Health Administration
NTS.....	Noncompliance Tracking System
PAAA.....	Price-Anderson Amendments Act
QA	Quality assurance
RERF.....	Radiation Effects Research Foundation
TEDE.....	Total effective dose equivalent
TRC	Total Recordable Case
TSR	Technical Safety Requirement
USQ.....	Unreviewed Safety Question
VPP.....	Voluntary Protection Program

ADDRESS FROM THE SECRETARY

The Department of Energy is charged with some of the most important activities of the Federal Government. We promote clean, abundant, affordable, and reliable energy; work to reduce the global danger from nuclear, chemical, and biological weapons while maintaining the U.S. nuclear stockpile; and advance energy-related sciences for the betterment of mankind. This is complicated and sometimes potentially dangerous work. The Department is committed to accomplishing this work in a safe and environmentally responsible manner.

Our commitment starts with keeping workers safe — it is our highest priority. That commitment extends to the general public who live in the communities near our facilities. And it extends to protecting the environment that may be impacted by our operations. We must ensure that our programs operate safely every step of the way. This takes a great deal of planning and forethought, and continued vigilance.

It is important to develop measures to assure our goals are met. Those measures can take many forms, including counting those things that go wrong, and looking at trends and patterns in the types of incidents that occur. But these measures are after the fact. We also need to be proactive. We need to see that the proper systems are in place to provide consistent behavior, and that the proper incentives are developed to drive compliance with those systems. We need to be able to recognize the wrong behavior before an incident occurs, and correct it. This report summarizes some of the measures we used in 2002 to gauge our performance in safety and environmental protection, and take actions to improve performance. The goal is to continuously improve our performance, and accomplish our missions in a safe and environmentally responsible manner, with the best value to the taxpayer.

It is also through these performance measures and indicators that we can make our case to the public. In general, we have good news. Our safe work record can give the Department credibility with the public. However, we can always improve, and we will look at those areas that provide the best opportunity to perform our work better.



In addition, we need to continue to look after the obligations we have to former workers — those who no longer work in our Complex, but who have served the Department and our nation since we began our mission. To this end, we must address the historical health issues of former workers in a cooperative and comprehensive manner.

Building on our experience in the safety and environmental arena allows us to lay the groundwork for the increasingly complex and diverse work I see for the Department on the horizon. Our programs, while in many respects the most promising, are also among the most far-reaching, difficult, and dangerous of any undertaken by the Federal Government. The Department has learned from its past and will strive to prevent future environment, safety and health legacies. We will ensure the right systems and processes are in place to provide a safe and environmentally responsible work arena. But we should all keep in mind that ensuring a safe and environmentally friendly complex is every individual's responsibility.

A handwritten signature in blue ink that reads "Spencer Abraham". The signature is written in a cursive, flowing style.

Spencer Abraham
Secretary of Energy



Major Accomplishments in 2002

- DOE illness and injury rates dropped to a historic low in 2002
- Lost Workday Case and Total Recordable Case rates continue to decline, and are below industry comparables
- Nineteen DOE contractor organizations maintain VPP Star Status; four sites recertified and one site added, the Central Plateau Remediation Project at the Hanford Site
- Behavior-based safety programs established at 15 DOE sites
- Zero Type A (most serious) events; three Type B (less serious) events - a six-year low
- Seven DOE sites have received International Organization for Standardization (ISO) 14001 certification of their environmental management systems
- Five DOE sites have been recognized in EPA's National Environmental Performance Track program
- Shipment of the last truckload of uranium from the Fernald Site, marking 9.1 million pounds shipped to safe storage
- Movement of the 100th shipment of spent fuel from the K Basins into safe storage at Hanford - 63 metric tons containing 433 million curies
- Successful completion of the nation's first radioactive waste vitrification program at West Valley - 275 canisters containing 24 million curies
- Completed decommissioning and dismantlement of the historic Tokamak Fusion Test Reactor at the Princeton Plasma Physics Laboratory within cost and schedule
- Completed demolition of Building 886, the former nuclear criticality laboratory. This is the second major uranium facility demolition completed at the Rocky Flats Environmental Technology Site

MESSAGE FROM THE ASSISTANT SECRETARY FOR ENVIRONMENT, SAFETY AND HEALTH

Last year was an outstanding year for the Department. We accomplished some of our most challenging and hazardous work with a better safety record than in any year in our recent history. I believe our success is a result of the strong support and direction of our senior management and the dedicated efforts of our workers. However, there are still challenges ahead. Our goal is “zero legacies” while achieving our mission. Achievement of this goal would mean no long-term illnesses in our workforce or long-term environmental damage due to DOE operations. This means that we must continually seek opportunities for improvement in all facets of worker, public, and environmental protection with an eye toward more effective operations.

This annual report summarizes the Department’s environment, safety and health (ES&H) accomplishments in 2002 as well as identifying areas needing improvement. It demonstrates that the Department is very focused, and well on its way to achieving the Department’s goal.

2002 ANNUAL REPORT HIGHLIGHTS

Positive Trends in Workforce Safety. Today’s workforce can feel assured the DOE complex is a very safe place to work. Our review of relevant performance indicators shows significant improvement in DOE-wide safe work performance. Both the Total Reportable Case and the Lost Workday Case rates have declined over the past five years. Type A and Type B accident trends show a significant decrease during the last five years. In 2002, we looked at near misses and operating experience event trends to identify areas that require near-term improvement and made these crosscutting issues a high priority for improvement in 2003.

Radiological and Environmental Compliance Success. DOE As Low As Reasonably Achievable (ALARA) programs continue to be effective in limiting radiological exposures. Radiological worker exposure has remained stable over the past five years, despite accelerated cleanup work in some of the most contaminated buildings in the country. Our mission activities have resulted in no significant offsite impacts. The estimated radiation dose to the public continues to be very, very low.

Management System Recognition. In 2002, two additional DOE sites achieved International Organization for Standardization (ISO) 14001 Environmental Management System third-party registration, raising the total number of ISO 14001-registered sites in the complex to seven. Five DOE sites are recognized under the Environmental Protection Agency’s (EPA’s) National Environmental Performance Track for their environmental management system, their record of sustained compliance with environmental regulations, and their commitment to continuous improvement. In 2002, one additional contractor organization achieved Star Status under the Voluntary Protection Program, raising the total number to nineteen.

Price-Anderson Nuclear Regulatory Compliance. In 2002, the number of major Price-Anderson Amendments Act (PAAA) NOV’s continues to decline, and the amount of PAAA civil penalties have also declined over the last three years. The program is seeing a shift from event-related noncompliance reporting to more proactive self-assessment and reporting of programmatic deficiencies. This is an indication that contractors have shown improvement in self-identifying noncompliances as well as taking appropriate actions to correct them.

Key Departmental Initiatives. The Department continued implementation of the Energy Employees Occupational Illness Compensation Program Act (EEOICPA) of 2000. The Secretary has placed a very high priority on fair and effective administration of this program. One part of the program, administered by the Department

of Labor, provides a lump-sum payment and future medical expenses to current and former DOE or contract workers with certain illnesses (radiation cancers, silicosis, and beryllium disease) resulting from their work. The Department works closely with the Department of Labor and the Department of Health and Human Services to implement this program, which has already paid benefits to 6,700 individuals. EEOICPA also established a DOE Worker Advocacy Program run by DOE that assists DOE contract workers apply for State workers' compensation benefits. This part of the program got underway after the required rulemaking was completed in September 2002.

In addition, DOE's first quarterly environment, safety and health reviews were initiated with senior DOE management to discuss operational experiences and disseminate lessons learned across the complex. In December 2002, the Department held the second annual Executive Safety Summit, bringing together senior DOE and contractor executives from across the entire DOE complex, as well as national and international experts from government and private in-

dustry. This Summit resulted in sharing of numerous Best Practices and a commitment to implement ongoing integrated safety management improvement initiatives in 2003, including: completing a redesign of the occurrence reporting system, developing improved performance metrics, self-assessment certification by our contractors, contract reform initiatives, and improved requirements management.

Clearly, safe operations and environmental compliance are good business strategies for the Department of Energy. By reviewing our performance of 2002, we intend to make 2003 an even better year.



Beverly Cook
Assistant Secretary for
Environment, Safety and Health

PURPOSE

This report provides the status of the overall environment, safety and health (ES&H) posture of the Department of Energy's (DOE's) numerous sites and facilities. It presents key information on actual DOE ES&H performance for calendar year 2002 in comparison to previous years, and describes the major ES&H goals and challenges for 2003.

ES&H performance is monitored, measured, and trended by a variety of quantitative metrics and qualitative performance indicators. These performance metrics and indicators are summarized in Appendix B. This report describes major calendar year performance trends in worker safety and health, environmental compliance and pollution prevention, Price-Anderson Amendments Act (PAAA) enforcement activities, as well as crosscutting issues that have been identified as areas requiring additional management focus.

DEPARTMENTAL OVERVIEW

DOE makes a critical contribution to a peaceful and prosperous future by helping to ensure our national security, our energy security, and our position as the world leader in science and technology. We employ approximately 16,000 federal workers and over 100,000 contractors who operate 26 major laboratories and production sites, 4 power marketing administrations, and 24 other major facilities.

Our mission activities utilize some of the most hazardous materials and complex processes and challenges of any enterprise in the world. These activities include conducting research to enhance domestic energy production, developing new and cleaner sources of energy, and improving energy conservation and efficiency. It also includes maintaining the safety, security, and reliability of the nation's nuclear weapons stockpile and managing nuclear nonprolifera-

tion efforts to reduce the threats from weapons of mass destruction. We are also committed to cleaning up contamination resulting from over 50 years of nuclear weapons production and to license and build a suitable geologic repository to dispose of the nation's spent nuclear fuel from civilian nuclear power plants and high-level waste from the nation's defense activities.

INTEGRATED SAFETY MANAGEMENT

Integrated Safety Management (ISM) is the management process DOE uses to ensure environment, safety and health is integrated into the work we perform to accomplish our mission. ISM consists of a work planning and performance cycle: 1) defining the scope of work, 2) analyzing hazards, 3) developing and implementing hazard controls, 4) performing the work within those controls, and 5) providing feedback and continuous improvement.

Our sites have made substantial progress in implementing ISM systems within their business processes. In 2000, all DOE sites received formal verifications to ensure ISM had been initially implemented. Since then, DOE sites have focused on maintaining and improving the effectiveness of their ISM systems.



WORKER SAFETY AND HEALTH

The Department takes a proactive approach to employee health and safety that makes our worksites among the safest in the nation. Employee involvement, job hazards analysis, self-reporting, performance metrics, training, and accountability are all hallmarks of our safety program. Systems are in place to allow contractors to self-report injury and illness data, occurrences, and occupational radiation exposure data. This information is analyzed and trended to identify crosscutting issues that lead to continual improvement in workplace safety.

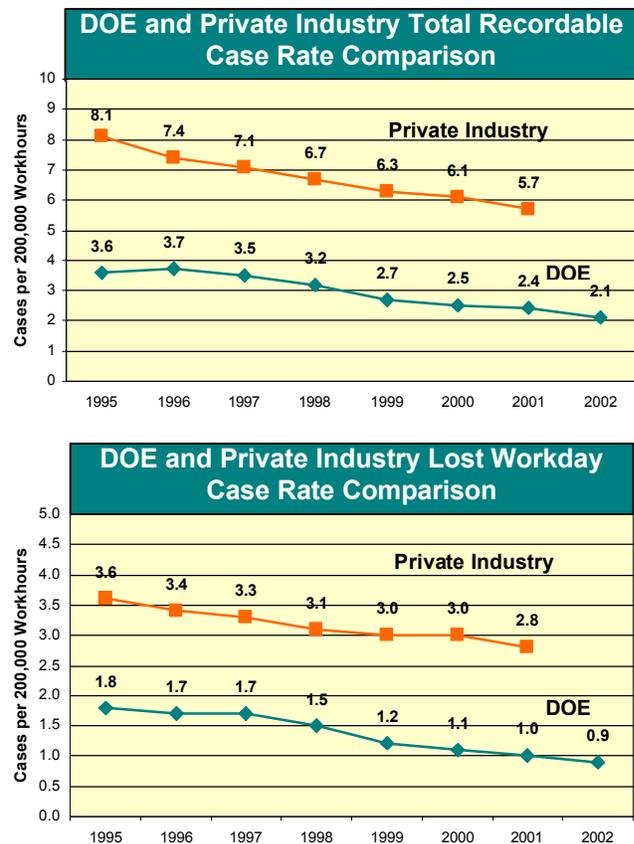
Occupational Safety Performance in 2002. Like private industry, the Department uses two sets of performance indicators to track and evaluate injuries and illnesses to Federal and contractor workers. They include the Lost Workday Case (LWC) rate, which is the rate at which workers incur days of restricted or lost workdays due to injury or illness on the job, and Total Recordable Case (TRC) rate, which includes medical treatment beyond first aid as well as LWC. These case rates are defined by the Department of Labor (DOL), and provide a consistent and regular indication of workplace safety.

The Department has performed much better than the private industry average in TRC and LWC rates over the last seven years (see Figures 1 and 2 respectively). Among sectors in private industry, DOE's TRC and LWC rates were lower than those of the construction, petroleum, chemical, and electric, gas, and sanitary services sectors. We feel that sites and facilities with an average TRC rate of 2.0 and LWC rate of 1.0 demonstrate the potential to become Best in Class, and ultimately, eliminate injuries. Sites that have already achieved these thresholds include Idaho, Richland, River Protection, and Savannah River.

Over the past five years, we have consistently driven worker injuries and illnesses down, particularly since implementing ISM programs.

ISM empowers workers to be responsible for their and their co-workers' safety. As such, we have seen workers consistently use such authorities as "stop-work" when activities appear unsafe or unpredictable. This is important because it demonstrates that our workers understand that their safety is more important than their schedules; and, in fact, accidents delay schedules.

Even though our performance in workplace safety is good, our goal is "zero injuries" to our workers. To achieve this, we must continuously improve through ISM and other proven safety and health excellence programs such as the DOE Voluntary Protection Program (VPP) and behavior-based safety.



Private industry rates were obtained from DOL Bureau of Labor and Statistics. The most recent private industry data available are for 2001.

Figures 1 and 2. Total Recordable Case Rates and Lost Workday Case Rates, 1995 – 2002

About 35 percent of our contractor workforce (37,711) is currently involved in the DOE VPP. Private industry in general uses VPP to achieve unparalleled safety records, thereby improving efficiencies on the job. Nineteen DOE contractor organizations have achieved DOE VPP Star Status (Figure 3), which is the highest level of recognition in the VPP. In 2002, four sites were re-certified, and one site, the Central Plateau Remediation Project at Hanford, achieved initial DOE VPP Star Status certification.



Figure 3. DOE VPP recognized sites

Many DOE sites and contractors have implemented behavior-based safety programs as well. Behavior-based safety uses positive reinforcement to change at-risk behaviors. Even though DOE has no formal requirement to implement behavior-based safety, these programs have been initiated by workers through grassroots efforts, and have resulted in substantially improved safety performance and reduced safety costs.

Radiological Hazards. DOE implements ALARA programs to keep workers who could potentially be exposed to radiation safe. These programs are aimed at managing and controlling dose to these workers as low as can be achieved, while taking into account technical, economic, and practical considerations. Only 17 percent (16,522 out of 99,166) of our workers who were monitored for radiological exposure had any measurable dose in 2001. The annual measured dose to the workers averaged 76 millirem (total effective dose equivalent – TEDE) per year over the past five years (See Figure 4).

In 2001, the average annual measured dose to a worker was 74 millirem, a slight decrease from the 79-millirem average in 2000 (2002 worker dose information will not be available until May 2003). To place this dose in perspective, the average American receives a dose of approximately 300 millirem per year from natural background and medical radiation sources, such as radon, medical X-rays, and cosmic rays.

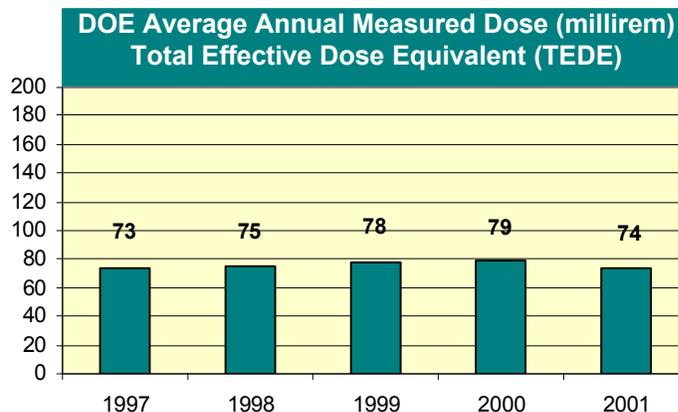


Figure 4. DOE average annual measured dose in millirem, 1997 – 2001

Of those workers with a measured dose, the great majority, 13,428 or 81 percent, received a radiological exposure of less than 100 millirem TEDE in 2001. Most of these workers were involved in decommissioning activities—activities that are non-routine in nature and therefore more difficult to control. Also, there were no exposures in excess of the DOE 5-rem annual limit, and only one exposure of 2 rem (the DOE Administrative Control Level) in 2001 (see Figure 5).

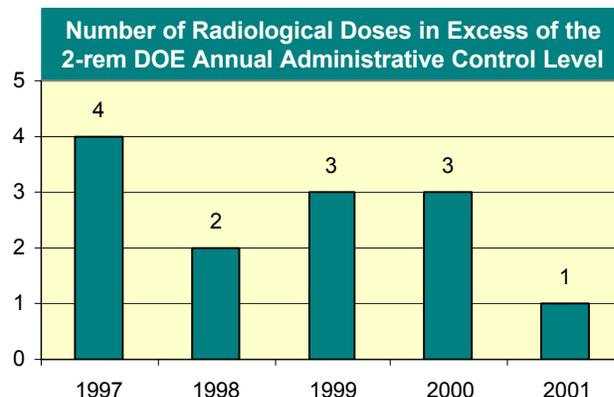


Figure 5. Radiological doses in excess of the DOE annual administrative control level, 1997 – 2001

Even though we are continuing to perform well in this area, we recognize that radiological doses must be minimized. Therefore, we are carefully evaluating all conditions that have resulted in an uptake, and aggressively moving to prevent these occurrences.

Near-Miss Incidents. DOE monitors “near misses” as an indicator of its current safety performance. Near misses are incidents that are considered to have the potential for an injury, accident, or environmental release, and are monitored to help reduce the potential for more serious occurrences.

We continue to experience an average of three to four near misses each week. In 2002, we experienced 198 near-miss occurrences—a slight reduction from 2001—and we averaged 212 near misses over a three-year period. This is a concern to us because we want to avoid situations where only one barrier remains to prevent accidents. Of the near misses in 2002, 13.8 percent actually resulted in minor injuries to our workers; however, these injuries had the potential to be much more serious or life threatening. When looking corporately at the cause of these near misses, we find that over 50 percent of near misses are due to inadequate work planning.

To drive down the number of near-miss occurrences, the Department is placing particular emphasis on safety awareness, and specifically on understanding the hazards and planning the work prior to commencement. We are also focusing on the operating experience from private

industry to reduce near misses associated with electrical safety, hoisting and rigging, and construction safety, for example.

Significant Events. DOE has a formal, structured process in place to evaluate serious accidents called Type A and Type B accidents. As a part of this process, safety managers, workers, and senior officials at the site evaluate the accident to identify underlying causes and corrective actions to prevent recurrence. Upon completion of each accident investigation, an accident investigation report is issued that describes the accident and its causal factors. The results of the accident investigations are communicated throughout DOE through various methods including senior management briefings, published Accident Investigation Reports, and lessons learned.

There were no Type A events in 2002, and there were only three Type B events, fewer than in the previous six years (See Figure 6). The general criteria used to designate Type A and B accidents are provided in Table 1. Type A accidents are the most severe, involving fatalities, major radiation exposures, or damage to property or the environment. Type B accidents have less severe consequences in the same general criteria. Site management can also convene a Type B accident investigation at its own discretion for repeated events that are of management concern.

Table 1. Type A and B Accidents

	Type A	Type B
Hospitalization	3 people, 48 hours or more	1 person, 5 days or more
Single radiation exposure	>25 rem	>10 rem
Environmental release	5 times 40 CFR Part 302 limits, resulting in serious damage	2-5 times 40 CFR Part 302 limits
Property loss or damage	\$2.5 million or greater	\$1 million to \$2.5 million

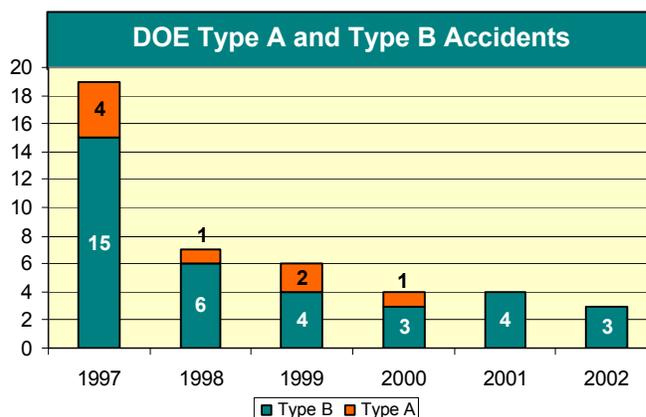


Figure 6. DOE Type A and B accidents, 1997 – 2002

Of the three Type B accident investigations conducted in 2002, two met specific Type B criteria

for conducting investigations. They included a worker falling from a shoring/scaffolding structure at a construction site and a worker receiving a radiation dose above the annual extremity limit. The third Type B investigation met the general criteria for repeated events, and in-

involved a third metal fire during decommissioning work. Even though the number of Type A and Type B events was at an all-time low in 2002, avoiding these accidents remains a major goal of the Department.

HEALTH STUDIES AND DISEASE PREVENTION PROGRAMS

The Department's Health Studies program promotes the health and safety of DOE's workers and communities at and surrounding Department sites, and supports studies to understand the effects of radiation and other hazards associated with the DOE operations.

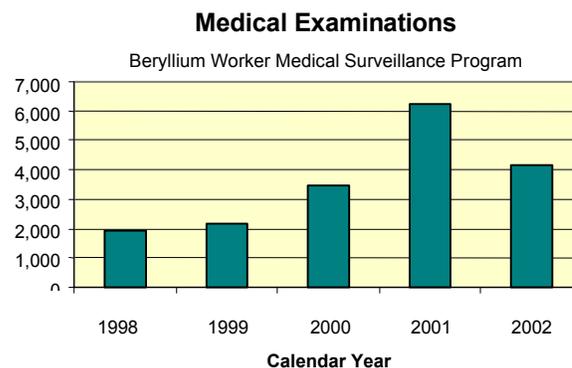
Epidemiologic Surveillance of Current Workers.

The Epidemiologic Surveillance Program conducts ongoing health monitoring of active workers at 12 sites, enhancing DOE's ability to protect worker health and identify potential health risks and occupational illnesses. In 2002, this program tracked over 70,000 workers at 12 sites for injuries and illnesses and completed a "sick building syndrome" investigation at Sandia National Laboratory. Plans for 2003 include bringing two additional sites (Los Alamos National Laboratory and Kansas City Plant) into the program, production of a tri-fold brochure for distribution to the field to raise awareness of the program, and distribution of a roll-up report examining the overall health of the workforce at participating sites over the past five years.

Comprehensive Epidemiologic Data Resource (CEDR).

CEDR is DOE's public-use database that provides internet-based access to health-related data collected during occupational and environmental epidemiologic studies supported by DOE during the last 40 years. It is a mature system in routine operational mode. Especially valuable are the hundreds of files of information that thoroughly document the data to maximize its usefulness. Operating on a 24/7 basis, CEDR responded to an average of 3,000 requests made to its web site (<http://cedr.lbl.gov>) each month in 2002. This facilitated access to CEDR data encourages open and independent scientific inquiry among researchers and other stakeholders worldwide. It is expected that three new datasets will be added in 2003.

Former Worker Medical Screening. For approximately 10 years, the Department has offered medical screening to former workers at risk for occupational diseases. By the end of 2002, over 35,000 individuals had participated in screening, with most reassured that they had not been harmed and those with medical findings assisted with referral for appropriate medical follow-up and/or worker's compensation through the Energy Employees Occupational Illness Compensation Program Act. Of over 30,000 former beryllium workers screened to date for chronic beryllium disease (CBD), approximately two percent had abnormal beryllium lymphocyte proliferation tests (indicating sensitization) and less than one percent had developed CBD. The table below shows the number of medical examinations conducted per year for each of the past five years. Because of increased funding through a supplemental appropriation in 2001, the number of medical examinations for that year exceeded 6,000. Screening of additional former workers will continue in 2003, as will an effort to facilitate research to further our understanding of beryllium-caused disease, state of the art protection measures, and how to better prevent, diagnose, and treat beryllium disease.



CBD Prevention Program. DOE leads the industry in beryllium disease prevention. We have established an action level of 0.2 micrograms per cubic meter. The Occupational Safety and Health Administration (OSHA) permissible exposure limit for beryllium is 2 micrograms per cubic meter. This could improve worker protection in the commercial industry, as OSHA has begun the process of revising its beryllium

standard to provide the higher level of worker protection afforded by DOE's action level.

International Programs. The United States has supported studies at the Radiation Effects Research Foundation (RERF) for more than 50 years on the health effects of radiation on the survivors of the Hiroshima and Nagasaki atomic bombings. Data obtained from these studies is used for radiation risk assessment by various national and international agencies, and is used to establish and update radiation protection standards throughout the world. The current radiation risk estimates rely on a dosimetry system developed in 1986 (DS86). Significant progress was made in 2002 in revising the 1986 Atomic Bomb Dosimetry system, which will be published in 2003 and will refine existing standards. Also in FY 2003, under the direction of the first ever American Chairman, RERF will increase the staffing of epidemiologists and biostatisticians in order to complete the Life Span study by 2020.

Progress was also made in 2002 on the joint U.S.-Russian Health Effects Studies Program initiated in 1994 to determine the risks associated with working at or living near Russian former nuclear weapons production sites. Workers at the Mayak Production Association, the first Russian nuclear weapons production facility, were exposed to chronic gamma, neutron, and plutonium (alpha) radiation in doses 100- to 1,000-fold higher than U.S. nuclear workers. Studying the adverse health effects in the workers and surrounding communities will help to better quantify the health risks associated with nuclear industry work and validate the radiation protec-

tion standards in use in the United States and worldwide. In addition to the four core studies of epidemiology and dosimetry of the Mayak workers and surrounding population, DOE is also sponsoring radiation biomarkers studies and has successfully implemented a tissue repository to be made available for international research use.

The Marshall Islands Program is a response by DOE to the legacy of nuclear weapons testing in the 1940s and 1950s in the Marshall Islands. It addresses the medical needs of the islanders impacted by the testing and develops science-based resettlement strategies for the affected atolls. Accomplishments of the medical program in 2002 included the appointment of a U.S.-trained Marshallese physician to the position of Chief Medical Officer, the negotiation of a special agreement with the U.S. Army to provide mammography services, and the institution of a year-round examination schedule for thyroid ultrasound. Accomplishments of the environmental monitoring program in 2002 included plutonium bioassay testing of 123 individuals and whole body counting of 533 individuals. The bioassay tests demonstrated that the projected lifetime dose for resettlement and agricultural workers is 10 mrem (which is well below cleanup standards) and that annual dietary intakes from cesium-137 in locally grown foods and crabs on these islands were less than 2 mrem (compared to the Nuclear Claims Tribunal limit of 15 mrem).

A list of peer-reviewed publications issued for each of these international programs in 2002 is given in Appendix C.

WORKER ADVOCACY PROGRAM

In addition to providing a safe environment for today's workers and community residents, DOE is committed to meet its obligations to former workers who developed illness as a result of hazardous workplace exposures. The Energy Employees Occupational Illness Compensation Program Act, enacted in 2000, calls on three federal agencies to work together to administer a very complex program to process and review worker claims.

The program has two distinct parts. One is administered by the Department of Labor (DOL), with assistance from DOE and the National Institute for Occupational Safety and Health (NIOSH). Under this part, DOL provides compensation of \$150,000 to current and former workers with certain illnesses (radiation cancers, silicosis, and beryllium disease) resulting from their work. All DOE workers, DOE contractor and subcontractor workers, atomic weapons employees (who worked for firms who contracted with DOE to provide goods and services related to atomic weapons production), and employees of beryllium vendors are eligible to apply for benefits.

DOE plays a critical part in administering this part of the program by searching for and providing the individual employment, medical, and radiation and other exposure records needed to adjudicate claims. With records located throughout the Nation in both DOE and private facilities, all DOE Field Offices are in-

involved in this effort. This program is well underway – as of February 2003, nearly \$484 million has been paid to 6,700 individuals.

The second part of the program (Subtitle D) is administered solely by DOE. Under this part, DOE provides assistance for qualified DOE contractor employees in applying for State Workers' Compensation. Physician Panels appointed by NIOSH review worker claims to determine whether the illness or death of a worker was caused by exposure to toxic substances at a DOE facility. If a Physician Panel's finding is positive, DOE, through its Program Offices, will direct its contractors not to contest the State worker's compensation claim. DOE does not directly provide benefits through this program – benefits are determined within state workers' compensation programs and are specific to each state.

DOE began processing claims with the completion of the rulemaking in September 2002. In preparation for cases being considered by the physician panels, DOE assembles complete case files, including a record of employment, a relevant occupational history (often for multiple sites), any medical records in DOE possession, and medical information provided by the claimant. Streamlining efforts, including applying economies of scale, site profiles, and process improvements will allow DOE to move into full production by August 2003. DOE's goal is to complete processing of all cases within the next five years.

ENVIRONMENTAL PERFORMANCE

The Department is committed to conducting its operations in an environmentally responsible manner. Our performance in this area continues to improve. We have focused our efforts in cleaning up legacy environmental issues, reducing or eliminating the generation of new wastes and pollutants, and recycling materials where possible.

Environmental Compliance Performance. DOE sites reported receiving 38 environmental Notices of Violation (NOVs) from regulators in 2002. Violations range from minor administrative errors, to failure to characterize or to properly label hazardous waste, to self-reported exceedances of air or water pollutant release limits, all of which we strive to eliminate.

Waste Minimization/Pollution Prevention. The Department also generates waste from routine operations (Figure 7) (i.e., newly generated wastes from current ongoing activities such as our production, analytical, and research and development work). We have seen a significant reduction in the generation of routine operations waste since 1994, when the Department established its core values of reducing and eliminating the creation of pollutants. However, for the most recent years (1999 through 2002), the generation of routine operations waste has been fairly stable. We must continue to find ways to reduce or eliminate waste and pollutants generated from routine operations by aggressively

applying innovative approaches to source reduction, reuse, segregation and recycling, and accelerated procurement of environmentally preferable products. The Department's purchasing power also plays an important role in our commitment to environmental stewardship and waste reduction. In 2002, DOE purchases exceeded \$34 million for products containing recycled material.

Wastes from Cleanup and Stabilization Activities. DOE has committed to accelerating its program of restoring the environment by removing, treating, and disposing of legacy wastes and pollutants that were generated by past operations, in compliance with applicable environmental protection requirements. The impact of this accelerated effort results in cleaner and safer sites across the DOE complex. Through its cleanup and stabilization activities, DOE reduced its legacy waste inventory by 805,954 cubic meters during calendar year 2002. Waste generated from these activities increased significantly from calendar year 1993 (see Figure 8), demonstrating our commitment and success at aggressively cleaning up and stabilizing legacy-contaminated areas.

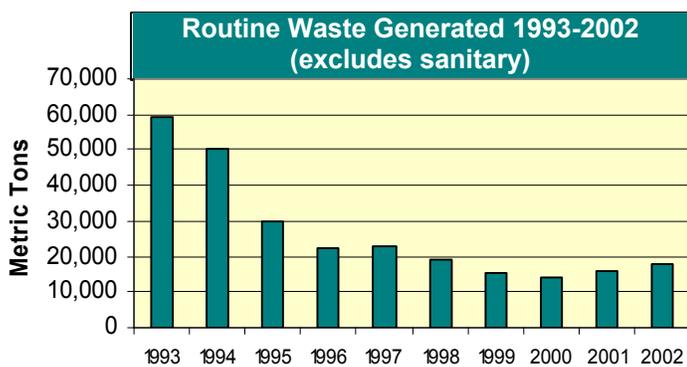


Figure 7. Routine waste generated, 1993-2002

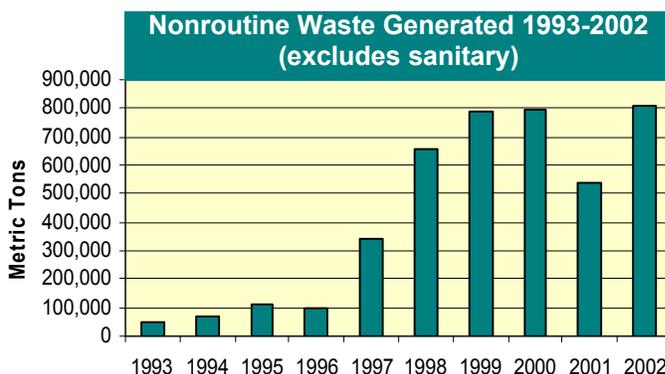


Figure 8. Nonroutine waste generated, 1993-2002

Sanitary Waste. We are also committed to recycling efforts to conserve the country's resources. In fiscal year 2001, we recycled 54 percent of the sanitary waste (109,500 metric tons of material). Much of the materials recycled included concrete, coal ash, and lime sludge.

Toxic Releases. The Department also trends toxic releases as part of ensuring we meet our environmental stewardship commitments. Since 1993, the Department has reduced reported toxic releases by 83 percent and saw only a slight rise in 2001 even though we disposed of 467,707 pounds of heavy metals as part of our environmental restoration program. However, if the Department is to meet its established pollution prevention goals for 2005, we must continue to find ways to reduce toxic releases by aggressively acquiring less toxic materials and recycling where possible.

Estimated Offsite Radiation Dose to the Public. In 2001, the estimated radiation dose to the public due to air emissions was extremely low, and is expected to remain low for 2002. Estimated radiation doses to maximally exposed individuals were well below DOE limits and EPA's National Emission Standards for Hazardous Air Pollutants (NESHAPs). DOE also estimates potential collective dose to the public associated with radionuclide releases from our activities. Despite accelerated cleanup and stabilization activities at contaminated sites such as Fernald, Rocky Flats, Oak Ridge, and Hanford, the estimated collective dose to the public has been negligible and remained essentially constant over the last several years. Radiation releases at DOE sites are tracked through extensive continuous radiological monitoring and surveillance programs.

Significant National Environmental Policy Act Accomplishments. DOE achieved a number of significant milestones under National Environmental Policy Act (NEPA) in 2002. Most noteworthy was completion of the Yucca Mountain Final Environmental Impact Statement, a key component of DOE's site recommendation that enabled the President to recommend, and the U.S. Congress to approve, the development of Yucca Mountain as the nation's permanent high-level waste repository. DOE's NEPA documentation also supported the resumption of the shipments of plutonium from the Rocky Flats Environmental Technology Site to the Savannah River Site, an action necessary to achieve the accelerated cleanup and closure of Rocky Flats.

Environmental Management Systems. All Federal Agencies are required to establish environmental management systems (EMSs) by Executive Order 13148, *Greening the Government through Leadership in Environmental Management*. The Department has been proactive in ensuring all DOE sites have EMSs implemented as a part of their ISM systems. In addition, several DOE sites have sought and obtained independent third-party evaluation of their EMSs from outside organizations, such as ISO 14001 certification.

At the beginning of 2002, five DOE field elements had received third-party registration for conforming to the ISO 14001 standard—Savannah River Site, Kansas City Plant, Waste Isolation Pilot Plant, Brookhaven National Laboratory, and the Strategic Petroleum Reserve. Also, two additional sites (the Idaho National Engineering and Environmental Laboratory and Pacific Northwest National Laboratory) achieved third-party registration to ISO 14001 during 2002. Five of our sites—Kansas City Plant, Strategic Petroleum Reserve, Waste Isolation Pilot Plant, West Valley, and the Western Area Power Administration—have been recognized by EPA's National Environmental Performance Track program for their environmental management systems, their record of sustained compliance with environmental regulations, and their commitment to continuous improvement.

DOE Environmental Initiatives Earn Awards. Reflecting the Department's commitment to environmental issues, 4 out of 26 White House "Closing the Circle" awards went to the following DOE recipients in 2002:



- Sandia National Laboratories, Green Purchasing Team—Affirmative Procurement Award, for their Dedicated Contracts Program

- Hanford Site P2 Program, Hanford Site Outreach & P2/WMin Team—Education and Outreach Award, for their Hanford Site Pollution Prevention Outreach and Education Program
- Pacific Northwest National Laboratory, Green Products Custodial Products Team—Environmental Preferability Award, for their Greening Custodial Products Program
- Los Alamos National Laboratory (LANL), Actinide Process Chemistry Group (NMT-2)—Recycling Award, for their Closing the Circle on One Problematic Nitrate Waste Stream at LANL

NUCLEAR SAFETY

Price-Anderson Enforcement. The 1988 Price-Anderson Amendments Act (PAAA) extended indemnification to DOE operating contractors for the consequences of a nuclear incident. At the same time, Congress required DOE to begin undertaking enforcement actions against those contractors who violate DOE nuclear safety rules. The PAAA, in effect, required DOE to establish an internal self-regulatory process.

DOE's Office of Price-Anderson Enforcement continues to ensure contractors are held accountable for implementing and complying with nuclear safety requirements. In 2002, the Office of Price-Anderson Enforcement continued to conduct investigations and program reviews at selected sites, and worked directly with sites on the effectiveness of their corrective action programs. In addition, in 2002 the Office worked closely with NNSA to establish clear lines of authority and roles and responsibilities, and developed their approach and strategy for enforcing 10 CFR 830 Subpart B.

During 2002, the Office of Price-Anderson Enforcement issued six NOVs encompassing \$453,750 in civil penalties (Figures 9 and 10); issued six enforcement letters; conducted four program reviews; tracked and monitored contractor-identified noncompliances; and provided training to DOE and contractor Price-Anderson coordinators.

The Office of Price-Anderson Enforcement creates and maintains the infrastructure required for contractor compliance with the Enforcement Program; investigates potential violations of enforceable requirements; and, where warranted, initiates and resolves enforcement actions in accordance with the processes and procedures set forth in 10 CFR 820. DOE enforces two substantive nuclear safety rules: 10 CFR 830 (Subpart A, *Quality Assurance* and Subpart B, *Safety Basis Requirements*) and 10 CFR 835, *Occupational Radiation Protection*. Other require-

ments, such as the *Information Requirements* provision in 10 CFR 820.11, may be enforced under the PAAA. Also, under 10 CFR 708, DOE may take enforcement action against contractors that are found to have retaliated against employees for raising nuclear safety concerns.

DOE relies on contractor reporting into the Noncompliance Tracking System (NTS) to demonstrate their efforts on self-identifying and correction of regulatory noncompliances as an incentive to avoid punitive enforcement actions. During the period from 1998 through 2000, the total number of NTS reports per year has steadily increased. More recently, there has been a positive shift from event-related NTS reports to self-assessment NTS reports documenting programmatic or precursor deficiencies. These positive trends are an indication that contractors have shown improvement in self-identifying

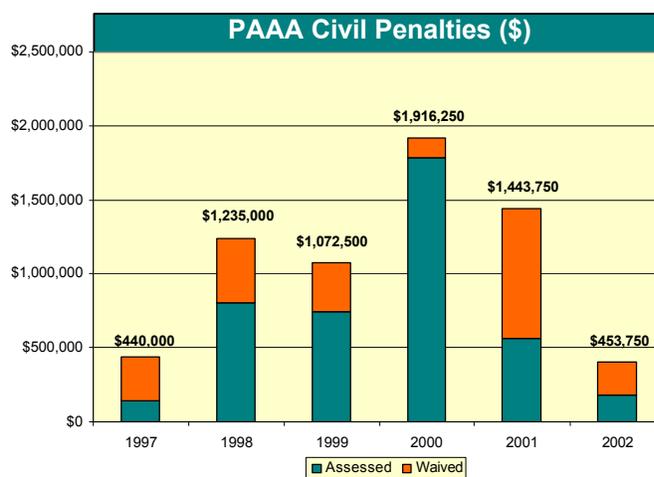


Figure 9. PAAA civil penalties

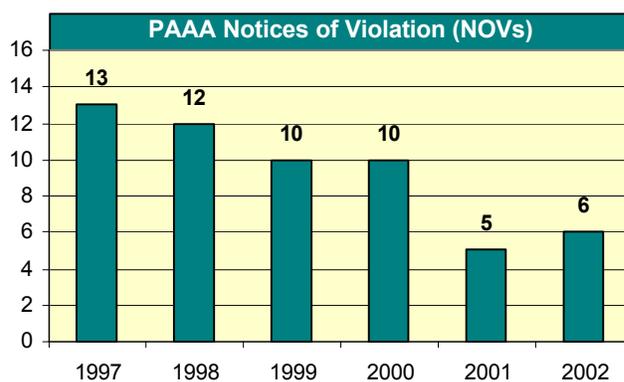


Figure 10. PAAA NOVs

noncompliances and taking the appropriate actions to correct them. However, during 2002 there was a notable decline in reporting, and it is unclear whether this single data point represents an overall improvement in PAAA nuclear safety compliance DOE complex-wide or a negative trend in reporting.

Of the six NOVs issued in 2002, five received mitigation for self-reporting, conducting in-depth investigations, or taking prompt corrective action. The six enforcement letters recognized the self-reporting of the contractors with no enforcement action taken. These noncompliances were investigated, and will be monitored to ensure the effectiveness and timeliness of the corrective actions taken by the contractors.

The most significant NOV issued in 2002, with the largest civil penalty, was the operation of a nuclear facility over a five- to six-year period without a documented authorization basis or formal hazards analysis. Even though the contractor self-identified the problem, the civil penalty was not mitigated due to the untimely notification.

Four program reviews of contractor Price-Anderson Programs were conducted to assist contractors in being proactive in their identification of noncompliances, thereby reducing the risk of civil penalties. These reviews identified both strengths and weaknesses of the contractor programs. A common weakness identified during these reviews is that contractors are not consistently reviewing or trending internally reported PAAA noncompliances for repetitive or programmatic issues. Another common weakness is the tendency of sites to perform limited self-assessments and causal analyses, resulting in the development of ineffective corrective actions that do not preclude potentially significant future events.

Nuclear Criticality Safety. Nuclear criticality accidents are very rare, and none have occurred in the United States in the past 25 years. Notwithstanding, DOE requires that its sites report

noncompliances to nuclear criticality requirements in order that we ensure our work is performed in a safe configuration. In 2001 through 2002, there were approximately 200 occurrences reported related to nuclear criticality noncompliances. Our review of a sample of 108 of these reports concluded that less than seven percent involved a potential degradation of the margin of subcriticality. The overwhelming majority of the reports involved conduct of operations issues such as criticality alarm systems.

Perhaps the most significant criticality safety issue raised during 2001 and 2002 involved the discovery at multiple sites that waste characterization procedures and methods were unreliable and non-conservative. In several cases, rigorous assays made during later handling and storage activities found waste containers to be overloaded with fissile material, in quantities up to 50 percent more than expected. The unexpected greater quantities of fissile material meant that assumptions used in establishing criticality-safe storage configurations might be invalid. In one case, we concluded that gamma-ray self-shielding led to low mass estimates for assays based solely on gamma measurements. The Department is evaluating corrective actions, such as using neutron as well as gamma readings, to estimate the plutonium mass in waste containers.

During 2001 and 2002, DOE completed the last of 30 milestones in its Implementation Plan for the Defense Nuclear Facilities Safety Board Recommendation 97-2, *Criticality Safety*. Concerns about the stability of the Department's Nuclear Criticality Safety Program were addressed when the Secretary committed to have NNSA fully fund the program for fiscal year 2003 and beyond. In 2002, we continued to see improvement in criticality safety.

Safety Bases. Safety bases (i.e., documented safety analyses and hazard controls) provide reasonable assurances that DOE's nuclear facilities can be operated safely in a manner that adequately protects workers, the public, and the environment. They are similar to a license to

operate a facility, and delineate the operating envelope and safety parameters for the facility. The Nuclear Safety Management rule, 10 CFR Part 830, became effective on February 9, 2001, and requires that a generally higher level of safety bases be developed for nuclear facilities by April 2003. A complex-wide effort is currently underway to complete the new safety basis documentation.

The Department uses Unreviewed Safety Questions (USQs) as a formal determination of safety basis deficiencies. In our study of 104 USQs issued DOE-wide between March 2001 and December 2002, we found the most frequent contributors to USQs (i.e., 26 percent) were Technical Safety Requirement (TSR) violations or inadequacies, showing the high importance of TSR controls in maintaining safety basis assumptions. The study found the next leading USQ cause was flawed safety analysis (21 percent). Many of the issues relating to deficiencies in nuclear safety basis are being addressed with the complex-wide effort to meet 10 CFR 830.

During 2001 and 2002, notable programmatic safety basis problems were found at one of our DOE sites. In response to concerns raised by the Defense Nuclear Facilities Safety Board, DOE conducted an independent safety basis assessment that focused on several aspects of nuclear safety management responsibilities, including the adequacy of safety basis documents.

The assessment concluded that many of the site's safety basis documents were outdated and not reflective of the current facility missions, configurations, hazards, or operating organizations. The team found deficiencies in the hazards and accident analyses, including, in some cases, the exclusion of certain hazards and accident scenarios. They also found deficiencies with some technical safety controls. The Department took immediate actions to correct the deficiencies, and is maintaining close oversight of the site's activities.

CROSCUTTING ISSUES

As part of continuous improvement, the Department tracks and evaluates adverse ES&H trends that exist across the DOE complex. Based on these trends, crosscutting issues are identified and consistent, complex-wide efforts are applied to resolve them. This proactive approach to identifying and resolving complex-wide issues before significant events occur has proven effective both in industry and within DOE.

IMPROVEMENT AREAS

Wildfire Safety. During the year 2000, the United States suffered significant losses of private property and natural resources due to wildfires. The Department experienced a number of wildfires at several of its sites. The most notable was the Cerro Grande fire that caused extensive damage to the Los Alamos National Laboratory and the adjoining community.

Based on lessons learned from these fires and recognizing that potential future vulnerabilities existed, the Department undertook a multifaceted fire safety initiative, including the creation of an independent Commission on Fire Safety and Preparedness in January 2001. The 16 Commissioners consisted of nationally recognized fire safety experts. The Commission conducted a series of public meetings; visited several DOE sites and facilities; observed DOE fire safety oversight assessments; and evaluated documentation on DOE fire safety and emergency preparedness. On May 28, 2002, the Commission submitted its recommendations to Secretary Abraham. On May 31, 2002, the Secretary directed his senior management to report on their readiness to respond to wildfires at DOE sites and surrounding communities and their plans for addressing the Commission's recommendations applicable to their operations.

The responses to the Secretary's request revealed that many lessons learned were communicated and implemented. Sites worked to improve their capabilities to respond to wildfires through training, equipment improvements, establishing defensible areas surrounding structures, and developing interagency agreements with wildland firefighting agencies and mutual aid agreements with neighboring fire departments.

During 2002, the nation again experienced severe drought conditions and devastating wildfires in the western states. On June 20, 2002, the Idaho National Engineering and Environmental Laboratory experienced a brush fire that burned approximately 120 acres. The fire was 100 percent contained within approximately three hours. A discarded cigarette was determined to be the cause of the fire. On August 16, 2002, the Nevada Test Site experienced a wildland fire that burned approximately 303 acres and destroyed approximately 1.7 miles of power and communication lines. On August 18, 2002, Nevada Test Site firefighters, the Bureau of Land Management, and the Nevada Division of Forestry contained the fire. Weather conditions were determined to be the cause of the fire.

The Department was fortunate in suffering only minimal losses from wildfires in 2002. This can be attributed to a number of factors such as proper planning, implementing prevention programs, improving response capabilities, and developing mutual aid agreements with local responders. In addition, DOE benefited from the work and recommendations of the Commission of Fire Safety and Preparedness and from the management commitment made by Secretary Abraham and other senior managers within the Department to address this important safety issue.

Quality Assurance (QA) Improvements. Quality assurance of our safety-related work and software was an area previously identified as needing improvement Department-wide. Through joint efforts of the Department's program offices, we successfully developed a Quality As-

surance Improvement Plan, which was signed by the Secretary in November 2002. The Plan focuses on correcting site-specific and complex-wide QA concerns, and contains specific implementation goals and action items. The Plan has particular emphasis on improving the quality and reliability of safety-related software and requires that:

- roles and responsibilities for software QA be identified;
- software QA requirements be established that are consistent with industry standards;
- the status of safety-related software at the DOE defense nuclear facilities be assessed, and
- a central registry to control safety-related software be established.

To continue these efforts, DOE is establishing a separate office responsible for corporate quality assurance activities within the Office of Environment, Safety and Health in 2003.

AREAS NEEDING IMPROVEMENT

Electrical Safety. Electrical events have shown an increase from 2000 through 2002. However, the number of personnel sustaining an electrical shock has been relatively low due to a wider use of personal protective equipment and increased awareness of the hazards. Of greatest concern last year was the rise in electrical events that resulted from intrusion activities (drilling, digging, and cutting, for example). In most cases, these events occurred during construction (52 percent) and decommissioning (24 percent) op-

erations, and most were reported as near misses. Many of the electrical intrusion events were caused by relying on inaccurate drawings of utility locations, using heavy equipment to dig around known hazards when hand-digging was required, and failing to verify that electrical lines were de-energized prior to conducting work. The Department raised the awareness of these events in a number of ways, including senior management meetings and specific operating experience publications. We will continue to track and resolve related electrical issues until our trend is significantly reversed.

Hoisting, Lifting, and Material Handling. The Department also saw a large rise in the number of incidents involving heavy equipment, hoisting and rigging operations, and excavation work over the last three years (67 events in 2000, 98 events in 2001, and 93 events in 2002). Many of these events involved the incursion of construction equipment with other equipment and structures. Nearly half (46 percent) were considered near misses, and nearly half of them (48 percent) were due to human performance errors. While there have been few injuries as a result of these events, DOE's aggressive mission for accelerated decommissioning and decontamination reinforces the need for performance improvement.

Other Adverse Trends. The Department continues to look critically at its operations to detect emerging adverse trends in safety and environmental performance, and as such, maintains a watch list. For 2003, we have already selected a number of focused areas to track, including the impact of deteriorating equipment reliability on safety, vehicular safety, ladder safety, and lock-out and tagout events.

ES&H INITIATIVES

Each of the DOE sites has safety programs run by local management and labor. These programs are charged with addressing workplace safety and environmental protection in a direct and comprehensive way. As the Department's corporate ES&H resource, EH has the responsibility to support these efforts by ensuring that safety and health principles are effectively integrated with core program missions, and by establishing the corporate policies, programs, and services needed to effect improvements. EH has also been designated as the Department's lead office to facilitate implementation of special initiatives that enable the programs to complete their activities safely. Many of the initiatives are focused on feedback and continuous improvement and thus, by nature, are evolving activities. They include, for example:

- Launching and using performance metrics to gauge progress in ES&H
- Re-engineering reporting systems to collect, analyze, and report meaningful data
- Assisting in the elimination of nonvalue-added requirements so that efficiencies can be achieved
- Heightening safety awareness by improving the communication of operating experience and lesson learned
- Facilitating workshops that engage senior leadership in refining the ES&H path forward
- Making more effective use of the contract clauses to manage contractor ES&H performance

ES&H Performance Metrics. In 2002, EH worked collegially with the Program Offices to structure an initial set of metrics that portray the Department's performance in workplace safety and environmental protection. These performance metrics, although still evolving, provide an executive-level understanding of safety performance at major DOE sites. Coupled with the

meetings held quarterly by the Department's senior management team, they provide a proactive view of high-performing areas that should be reinforced and low-performing areas requiring greater management focus to effect change. Through continual refinement and use of these metrics, we expect improved control over Departmental resources, greater accountability for our safety programs, and overall improvement in workforce and environmental protection.

Collect, Analyze, and Report Meaningful Information. A critical part of continuous improvement is the ability to provide senior management and workers with meaningful information regarding ES&H events and occurrences. In 2002, DOE has made significant improvements in re-engineering the reporting system all sites use to notify line management of operational upsets and workplace and environmental occurrences. This reengineering effort, which will be fully operational by July 2003, will not only eliminate nuisance reporting and save valuable resources (\$5 million annually), but will also provide a more effective format for uncovering negative trends before severe events can occur. In 2003, we will begin efforts to consolidate other similar reporting systems to achieve even greater efficiencies and provide management with a more complete view of performance.

Requirements Reduction. In 2002, DOE undertook an extensive review of major DOE Orders that apply to operating contractors. The purpose of the review was to identify and eliminate unnecessary requirements, eliminate redundancy and overlap, and identify opportunities for greater efficiencies and cost benefits (e.g., adopting commercial standards where possible). This effort is expected to be completed in 2003.

Operating Experience and Lessons Learned. We continue to take a broad look at the Department's operations to identify opportunities where we can learn from our experience, adopt best practices, and prevent recurrence of events. To this end, in 2002 EH analyzed all of the Department's reportable occurrences and disseminated information on the more significant oper-

ating experiences and lessons learned on a bi-weekly basis. Feedback from the sites is that this information served as a valuable mechanism in preventing occurrences, and that additional efficiencies should be considered.

In benchmarking the operating experience programs of the nuclear power industry, DOE is confident that the program can become even more effective in improving workplace safety and gaining efficiencies in performing work activities. In 2003, DOE will lead an effort to re-engineer the Lessons Learned program modeled on the Institute for Nuclear Power Operations (INPO) process for the dissemination of relevant operating experience to the commercial nuclear power industry. The objective of this redesign will be to further improve the Department's ability to communicate and track safety improvements associated with the successful implementation of best practices and lessons learned. We are confident this redesign will achieve the kind of efficiencies the Institute of Nuclear Power Operations achieved for the nuclear power industry.

Senior Leadership Safety Summit. Senior leadership within the DOE complex continues to work closely together through interactive conferences to identify the gaps between current performance and expected performance, and to establish a path forward to improve and integrate safety as a business practice. In 2002, the Department held an ISM Workshop with mid- and senior-level managers, and an Executive Safety Summit that included the senior leadership from the Department and its contractors. The Workshop and Summit were focused on identifying and utilizing best practices and performance metrics from within the DOE complex as well as from outside industry organizations

and agencies. Many of these best practices are in the process of being implemented—some at a local level and some across the complex.

Self-Assessment Program Certification. One of the outcomes of the Senior Leadership Safety Conference was an initiative to certify contractor self-assessment programs. This certification process validates that contractors have a robust and effective self-assessment program in place. EH took the lead in this area and established a working group to develop both the criteria for self-assessment programs and the process to achieve certification. The criteria and the process are based on successful programs that INPO developed for the commercial nuclear power industry, and will be a voluntary participation program. Lawrence Berkeley National Laboratory volunteered to be the first site to undergo this certification process. The certification process was initiated in 2002 and should be complete in 2003. Several other organizations have also expressed interest in this program.

Making Contracting Work Better. In 2002, DOE improved contract terms and conditions associated with the conditioning contractor profits to ES&H performance. A new Department of Energy Acquisition Regulation, *Conditional Payment of Fee, Profit, and Other Incentives* contract clause is expected to be issued as a final rule in 2003. The new contract clause connects the potential loss of fee to clearly delineated objectives and performance failures. In addition, potential loss of fee will be proportional to the significance of the performance failure and requires consideration of mitigating factors in fee loss determination. These changes will enhance the use of the contract by DOE managers to convey expectations to our contractors for ES&H performance.

APPENDIX A. GLOSSARY OF TERMS

Behavior-Based Safety. Behavior-based safety is the application of reinforcement theory to foster an increase in “safe behaviors.” Use of behavior-based safety programs is considered an upstream or proactive measure of safety performance. Behavior-based safety is a method to use positive reinforcement to change at-risk behaviors. The elements of behavior based safety systems are: tasks and hazards are analyzed to identify critical safety behaviors, behavior is analyzed based on job observation, feedback about safety performance is used as reinforcement, and the system is usually employee based for continuous improvement. Percent of Safe Acts are measured through observation that provides an indicator of impending safety problems. It also measures the antecedent conditions for incidents. Since 90 percent of all accidents are attributable to human error, behavior-based safety programs are focused on reducing accidents by changing worker behavior.

Collective Radiation Dose to the Public. Collective radiation dose is the sum of the estimated effective dose equivalent (reported in person-rem) to all people located offsite within (typically) a 50-mile radius of all DOE facilities over the course of a calendar year.

Computerized Accident/Injury Reporting System (CAIRS). CAIRS is a database used to collect and analyze DOE and DOE contractor reports of injuries, illnesses, and other accidents that occur during DOE operations.

Integrated Safety Management (ISM). ISM is the management process that was adopted by DOE to foster the integration of environment, safety and health into all aspects of DOE mission activities. ISM consists of a work planning and performance cycle including five core functions: defining the scope of work, analysis of hazards, developing and implementing hazard controls, performing the work within those controls, and providing feedback and continuous improve-

ment. ISM also uses seven guiding principles to ensure work is conducted safely: line management responsibility for safety, clear roles and responsibilities, balanced priorities, identification of safety standards and requirements, hazard controls tailored to the work being performed, and operations authorization.

The International Organization for Standardization (ISO). ISO is a worldwide federation of national standards bodies from more than 140 countries. ISO was established to promote the development of standardization and related activities in the world with a view to facilitating the international exchange of goods and services, and to developing cooperation in the spheres of intellectual, scientific, technological and economic activity.

ISO 14001. ISO 14001 is an international consensus standard that specifies the elements of an environmental management system. ISO 14001 third-party registration is an instrument for increasing corporate accountability for environmental protection.

Lost Workday Case (LWC) Rate. This worker safety and health indicator (is a subset of the TRC Rate) includes cases where the injury/illness results in days away from work, days of restricted work, or both. In order to accommodate differences in the number of work hours, the data is normalized in terms of the number of Lost Workday Cases per 200,000 workhours (or approximately 100 man years).

Millirem (mrem). A millirem is a conventional unit of dose equivalent equal to one thousandths of a rem (See definition below) or 0.001 rem.

Near Miss. Near misses are incidents that are considered to have the potential for an injury, accident, or environmental release, and are monitored to reduce the potential for more serious occurrences. For an incident to be considered a near miss, all safety barriers that would prevent an accident will have been compro-

mised, or only one barrier may remain after all other barriers were compromised.

Noncompliance Tracking System (NTS). NTS is a database used by DOE contractors to self-report non-compliances with the requirement of regulations implementing the Price-Anderson Amendments Act (PAAA) of 1988.

Occurrence Reporting and Processing System (ORPS). ORPS is a database used to document daily operational occurrences at all DOE sites that occur as a result of DOE operations.

Price-Anderson Amendments Act of 1988. The Price-Anderson Amendments Act provides indemnification to DOE contractors who manage and operate nuclear facilities in the DOE complex. The Price-Anderson Amendments Act of 1988, Public Law 100-408, extended the indemnification to DOE operating contractors for the consequences of a nuclear incident. Congress made compliance with safety requirements established by DOE a condition of indemnification. DOE indemnified contractors, subcontractors, and suppliers are subject to potential civil and criminal penalties for violations of DOE nuclear safety rules, regulations and compliance orders. At the same time, Congress required DOE to begin undertaking enforcement actions against those contractors who violate nuclear safety rules to minimize the risks to workers and the public. The PAAA, in effect, required DOE to establish an internal self-regulatory process.

Radiation Exposure Monitoring System (REMS). REMS is a database used to collect DOE, contractor, visitor, and public occupational radiation exposure data for all individuals monitored at DOE facilities.

Rem. Rem is the conventional unit used for a dose equivalent. A rem is equal to an absorbed dose (in rads) times a quality factor. Quality factors are assigned for different types of radiation. An equivalent unit is a sievert (Sv), which is equal to 100 rem. A rad is the acronym for

radiation absorbed dose, and is equal to an absorbed dose of 0.01 joule/kilogram or 100 ergs/gram. An equivalent unit for absorbed dose is a Gray (Gy), which is equal to 100 rads.

Total Effective Dose Equivalent (TEDE). This performance indicator is used to measure the annual radiological dose to DOE workers. This measure is a cumulative sum (in millirem) of the effective dose equivalent for external exposures and the committed effective dose equivalent for internal exposures for all DOE workers with a measurable dose. [Note: Committed Effective Dose Equivalent is the sum of the dose equivalents calculated to be received by various tissues or organs over a 50-year period after the intake of a radionuclide into the body, each multiplied by the appropriate weighting factor.] Deep dose equivalent to the whole body is typically used as effective dose equivalent for external exposures. The internal dose component of TEDE changed from the Annual Effective Dose Equivalent to the Committed Effective Dose Equivalent in 1993.

Total Recordable Case (TRC) Rate. This worker safety and health performance indicator includes work-related death, illness, or injury, which resulted in loss of consciousness, restriction of work or motion, transfer to another job, or required medical treatment beyond first aid. In order to accommodate differences in the number of work hours, the data is normalized in terms of the number of Total Recordable Cases per 200,000 workhours (or approximately 100 man-years).

Type A Accidents. Type A accidents are the most serious events. Examples include fatalities, personnel injuries from an accident requiring hospitalization of 3 or more individuals for more than 48 hours, an unplanned nuclear criticality, or property loss or damage in excess of \$2,500,000 (see table for more details).

Type B Accidents. Type B accidents are less serious than Type A events. Examples include personnel injuries from an accident that results

in the hospitalization of one or more individuals for five days or longer, or property loss or damage in excess of \$1,000,000 (see Table 1 for more details).

Voluntary Protection Program (VPP). The Department of Energy's Voluntary Protection Program (DOE-VPP) recognizes and promotes safety and health program excellence based on management leadership, employee involvement,

worksite analysis, hazard prevention and control, and safety and health training.

Voluntary Protection Program Star Status. Star Status is the highest level of recognition in the VPP program. Designation as a VPP Star Site indicates the site has implemented safety and health systems that meet the highest level of quality in the criteria evaluated.

APPENDIX B. ENVIRONMENT, SAFETY AND HEALTH PERFORMANCE METRICS

Environment, Safety and Health (ES&H) performance is monitored, measured and trended by a variety of quantitative and qualitative Performance Indicators. ES&H performance is evaluated in the following areas in this report:

Worker Safety and Health. Quantitative performance indicators used in this report to assess the occupational safety and health trends of workers, radiological doses, and severe accident frequency are:

- TRC rate
- LWC rate
- Number of Type A and Type B accidents annually
- DOE annual average measured radiological dose – TEDE measured in millirem
- Annual number of internal radiological doses in excess of the DOE administrative control limit of 2 rem

Qualitative performance indicators used in this report to provide trends on near misses, and implementation of programs that encourage excellence in worker safety and health practices include:

- Annual number of reportable occurrences categorized as near misses
- Number of DOE sites achieving DOE-VPP Star Status
- Number of DOE sites implementing behavior-based safety programs

Related to the monitoring of worker safety and health of current DOE employees is the effort to compensate current and former DOE employees

who suffered work related illnesses from exposure to radiological materials or industrial hygiene hazards, such as beryllium. The Workers Compensation Program initiated in response to the landmark EEOICPA of 2000, Public Law 106-398, was established to assist those present and former workers file for this compensation. Qualitative performance indicators used in this report to assess this program's responsiveness include:

- Total number and percentage of employment verifications completed and forwarded to the Department of Labor for processing
- Total number and percentage of worker dose reconstruction records processed and forwarded to NIOSH for processing
- Total number and percentage of state managed compensation claims processed

Environmental Performance. Quantitative performance indicators used in this report to assess environmental compliance trends within the DOE complex include a combination of compliance indicators, waste generation amounts, and estimates of public radiation dose, as follows:

- Number of NOVs issued by regulators
- Amount of high-level, transuranic, radioactive low-level, radioactive low-level mixed, hazardous, and sanitary waste generated per year.
- Estimated collective radiation dose to the public

Qualitative performance indicators used in this report to provide trends on pollution prevention, NEPA activity, and implementation of programs of excellence in environmental management practices are:

- Number of DOE sites recognized by the White House "Closing the Circle" awards

- Major NEPA milestones achieved during the year
- Number of DOE sites with EPA National Environmental Performance Track recognized EMSs
- Number of DOE sites obtaining ISO 14001 EMS third-party registration

PAAA Enforcement. Quantitative performance indicators used in this report to assess the nuclear safety enforcement trends within the DOE complex are:

- Dollar amount of PAAA civil penalties assessed and waived
- Number of PAAA NOVs assessed

APPENDIX C. REFERENCE DATA

- DOE Occupational Radiation Exposure: 2001 Report (DOE/EH-0660)
- 2001 Annual Report, Price-Anderson Nuclear Safety Enforcement Program, Office of Price-Anderson Enforcement, March 2002
- Annual Report of Waste Generation and Pollution Prevention Progress, DOE/EM-0630, June 2002
- The Value Added of the Department of Energy Voluntary Protection Program, DOE/EH-0647, June 2002
- U.S. Department of Energy Commission on Fire Safety and Preparedness: Compendium and Final Report, August 2002
- A Review of Electrical Intrusion Events at the Department of Energy: 2000-2001, June 2002
- The President's Management Agenda, Fiscal Year 2002, Executive Office of the President, Office of Management and Budget
- Computerized Accident/Injury Reporting System (CAIRS) (URL <http://tis.eh.doe.gov/cairs>)
- Occurrence Reporting and Processing System (ORPS) (URL <http://tis.eh.doe.gov/paa/orps.html>)
- International Health Programs Peer-Reviewed Publications
 - Radiation Effects Research Foundation Staff Publications
- Russian Health Studies Program Publications
 - Techa River Population Dosimetry
 - Techa River Population Epidemiology
 - Mayak Worker Epidemiology
 - Mayak Worker Dosimetry
 - Plutonium Microdosimetry in the Lung
 - Mayak Worker Tissue Repository
- Marshall Islands Program Publications

