2003 ANNUAL REPORT

ENVIRONMENT, SAFETY AND HEALTH
2003 ANNUAL REPORT

U.S. DEPARTMENT OF ENERGY

JUNE 2004

This report was prepared by the Office of Corporate Performance Assessment within the Department of Energy's Office of Environment, Safety and Health. For additional information, please contact Frank Russo, 301-903-8008, or Internet address Frank.Russo@eh.doe.gov. The report is available on the Web at http://www.eh.doe.gov/paa/annualreports.

TABLE OF CONTENTS

ADDRESS FROM THE SECRETARY 7
ADDRESS FROM THE ASSISTANT SECRETARY FOR ENVIRONMENT, SAFETY AND HEALTH 9
PURPOSE 11
DEPARTMENTAL OVERVIEW 11
INTEGRATED SAFETY MANAGEMENT SYSTEM 11
SAFEGUARDING OUR WORKERS 13
- Occupational Safety Performance in 2003 13
- Quarterly Safety Reviews 13
- The Occurrence Reporting and Processing System 14
- Line Management Expectations and Goals 14
- Voluntary Protection Program and Behavior-Based Safety 15
- Significant Events — Type A and B Accidents 17

HEALTH STUDIES AND DISEASE PREVENTION PROGRAMS 18
- Epidemiologic Surveillance of Current Workers 18
- Comprehensive Epidemiologic Data Resource 18
- Chronic Beryllium Disease 18
- Former Worker Medical Screening 19
- International Programs 20

WORKER ADVOCACY PROGRAM 21
- Energy Employees Occupational Illness Compensation Act 21
- DOE Responsibilities: Part D 21
- The Future of EEOICPA 22

PROTECTING THE ENVIRONMENT 23
- Risk Reduction through Material Stabilization 23
- Waste Minimization/Pollution Prevention 24
- Transuranic (TRU) Waste 24
- Low-Level Radioactive Waste 24
- Low-Level Mixed Waste 24
- Hazardous Waste 25
- Sanitary Waste 25
- Environmental Compliance Performance 25
- Estimated Offsite Radiation Dose to the Public 25
- Significant NEPA Accomplishments 26
- Environmental Management Systems 27
- DOE Environmental Initiatives Earn Awards — White House Closing the Circle Award 28
- DOE Environmental Initiatives Earn Awards — Pollution Prevention 28

TABLE OF CONTENTS (CONT'D.)

NUCLEAR FACILITY SAFETY 29
Radiological Safety 29
Price-Anderson Enforcement 30
Nuclear Criticality Safety 31
Safety Basis Improvement 31
CROSSCUTTING ISSUES 33
Quality Assurance Improvements 33
Suspect/Counterfeit Items 34
Electrical Safety 34
Hoisting and Rigging Events 35
APPENDIX A: GLOSSARY 37
APPENDIX B: REFERENCES 42

ACRONYMS

ALARA ..... As Low As Reasonably Achievable
BBS ..... Behavior-Based safety
BNFL ..... British Nuclear Fuels, Limited
CBD ..... Chronic Beryllium Disease
CEDR ..... Comprehensive Epidemiologic Data Resource
DNFSB ..... Defense Nuclear Facilities Safety Board
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
H&R ..... Hoisting and Rigging
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
NTS ..... Noncompliance Tracking System
OHSAS ..... Occupational Health and Safety Assessment Series
ORPS ..... Occurrence Reporting and Processing System
OSHA ..... Occupational Safety and Health Administration
NTS ..... Noncompliance Tracking System
PAAA ..... Price-Anderson Amendments Act
PFP ..... Plutonium Finishing Plant

P2 ..... Pollution Prevention

QA ..... Quality Assurance

RCRA..... Resource Conservation and Recovery Act

RERF ..... Radiation Effects Research Foundation

SBIS..... Safety Basis Information System

SC ..... Office of Science

S/CI ..... Suspect/Counterfeit Items

SER ..... Safety Evaluation Report

SNL ..... Sandia National Laboratory

SQA ..... Software Quality Assurance

TEDE ..... Total Effective Dose Equivalent

TRC ..... Total Recordable Case

TRU ..... Transuranic (waste)

TSCA ..... Toxic Substances Control Act

TSR ..... Technical Safety Requirement

VPP..... Voluntary Protection Program

ADDRESS FROM THE SECRETARY

In 2003, the Department of Energy continued to meet the Administration's commitment to ensure national defense and safeguard the Nation's energy security. It was a productive year for the Department. We actively pursued basic and applied research to provide critical input to our Nation's economic growth. We led the way in new and emerging energy technologies. We played a key role in national defense by protecting the U.S. nuclear weapons stockpile and reducing global danger. We continued to aggressively reduce the risks at our sites by accelerating the projection of completing cleanup programs by thirty-five years, saving the American taxpayers as much as $50 billion. The Yucca Mountain waste storage project was authorized, and we moved forward toward accepting spent fuel from nuclear power reactors.

The safety and health of our workers and protection of the public and environment during the conduct of work remained our number one priority. This report shows that the Department can get more work done, and do it safely. It also highlights areas for improvement and close monitoring. The first step in improving safety performance is to measure that performance. While this report presents some critical measures of safety performance, more work will be done in the coming year to develop better indicators that are precursors to safety issues. We need to know where we are having problems before they become serious incidents that affect our work force and the communities that surround our facilities.

Safety and environmental management are everyone's job. We must all continue to systematically identify hazards and apply appropriate work practices so that hazards are controlled. We must all maintain a questioning attitude and be accountable for our decisions and actions. Each of us should take the commitment to safety beyond our workplace and into our homes and communities.

Spencer Abraham
Secretary of Energy

MESSAGE FROM THE ASSISTANT SECRETARY FOR ENVIRONMENT, SAFETY AND HEALTH

The Department of Energy continued to see positive trends in worker safety and environmental protection in 2003. Worker protection measures such as Lost Workday Case (LWC) Rate and Total Recordable Cases (TRC) Rate reached historic lows. Over the past six years, both LWC and TRC rates have been cut in half and are now less than 50% of private industry rates. The Department's senior managers also continued to better define and use environment, safety and health (ES&H) performance measures to address emerging issues as part of our overall accident prevention strategy.

The Department's corporate performance assessment activities continued to improve. Lessons learned from NASA's Columbia accident now add emphasis to analysis of less risk-significant occurrences as a means to identify accident precursors and share this experience across the DOE complex. We seek to better understand what our safety systems and performance indicators are telling us. We analyze near-misses to identify trends, common root causes and areas for improvement. In 2003, we focused on hoisting and rigging, lockout/tagout, electrical safety and electrical intrusions events. For 2004, we will further enhance safety goals and measures. We will look to better understand what drives ES&H performance and use our management tools, e.g., contracts, enforcement, rewards and penalties, to greater effect.

On the environmental protection front, eight major DOE facilities have been registered as conforming to ISO 14001, the international consensus standard for Environmental Management Systems. The Environmental Protection Agency recognized five sites for their environmental management systems and sustained performance. Sandia National Laboratory won a prestigious White House Closing the Circle environmental award for Sustainable Design/Green Building construction.

Nuclear safety enforcement actions increased this year, although seven of the ten Notices of Violation were mitigated for contractor self-reporting and prompt corrective action. However, we are concerned that issues are revealed by safety events, and that recurrence of similar events indicates corrective actions may not be adequate.

Hanford demolition

Rocky Flats workers remove the exterior plenum outside Building 444

In 2003, we assumed a significant role in implementing Part D of the Energy Employees Occupational Illness Compensation Act. Following a successful information campaign, we commissioned a study to improve service to claimants and address the overwhelming response to the campaign. We are working with NIOSH to increase the number of physicians serving on the review panel to process claims.

The risk to the public and workers has been significantly reduced through accelerated cleanup of DOE sites and material stabilization. It is critical that this work be performed quickly and safely, to protect our workers and the communities surrounding our sites.

In summary, I am proud of the Department's safety and environmental compliance record, and know that our common goal is to seek continuous improvement. Together we can realize the Secretary's commitment to always protect workers, the public and the environment.

Beverly Cook
Assistant Secretary for
Environment, Safety and Health

PURPOSE

The Environment, Safety and Health (ES&H) Annual Report for 2003 provides a broad view of the Department of Energy's (DOE) record for protecting the worker, environment, and public. The report quantifies our performance using a variety of metrics, summarizes areas for improvement, and describes efforts to maintain continual success in reaching our goals of zero injuries and zero health and environmental legacies.

Areas covered include occupational safety, health studies, worker advocacy, environmental performance, radiological safety, and nuclear safety, as well as crosscutting issues identified as areas requiring additional management focus.

DEPARTMENTAL OVERVIEW

The Department has a wide range of mission activities that enhance our economy and our national and energy security. Those activities include accelerated cleanup of dangerous legacy wastes from former weapons sites; development of advanced coal, oil, and natural gas technologies; spent nuclear fuel and high-level radioactive waste management; and technologies for a new generation of nuclear reactors and cutting-edge scientific research and maintenance of the Nation's emergency supply of crude oil and home heating oil. It also includes maintaining the safety, security, and reliability of the Nation's nuclear weapons stockpile and managing nuclear nonproliferation to reduce the threats of weapons of mass destruction. A major accomplishment in 2003 was risk reduction through nuclear material stabilization.

In order to successfully complete these activities, the Department relies on approximately 11,000 Federal workers and over 126,000 contractors who operate twenty-six major laboratories and production sites, four power marketing administrations, and twenty-four other major facilities.

INTEGRATED SAFETY MANAGEMENT SYSTEM

Despite the safety challenges in the work we do, our safety record — for both Federal employees and our contractors — is consistently better than private industry and continues to improve. Such success comes from a desire by management and employees to do the job right and to effectively apply the principles of the Integrated Safety Management System (ISMS).

Secretary of Energy Spencer Abraham examines a hydrogen-powered vehicle at the Clean Air for the 21st Century exhibit, February 2003

Confinement vessel used in explosive tests at Nevada Test Site aimed at guarding the nuclear stockpile

Integrated safety management defines how we do our work. First, the job is scoped and analyzed for potential hazards or problems. We then focus on eliminating or mitigating the hazards by developing and implementing controls. The work is performed within the prescribed controls by qualified personnel, and feedback on performance is solicited in a variety of ways to drive continuous improvement.

The Department and its contractors have incorporated ISMS within their business practices. Implementation of this safety management system is verified in the field by review teams and DOE senior management.

SAFEGUARDING OUR WORKERS

Occupational Safety Performance in 2003

Worker injuries and illness rates declined in 2003 to a record low, despite accelerated schedules and increased work, often of a type not before attempted or accomplished. In 2003, two universally accepted performance indicators for worker safety continued to decline: Total Recordable Cases (TRCs) and Lost Workday Cases (LWCs). TRCs include injuries and illnesses that are serious enough to result in medical attention, loss of consciousness, restriction of work, or time away from work. LWCs represent the number of work-related injuries resulting in employees missing days of work or returning to work on restricted duty.

As shown in the sidebar, DOE's TRC rate and LWC rate for employees and contractors fell to a best-ever performance. This level of performance is significant when compared to private industry.

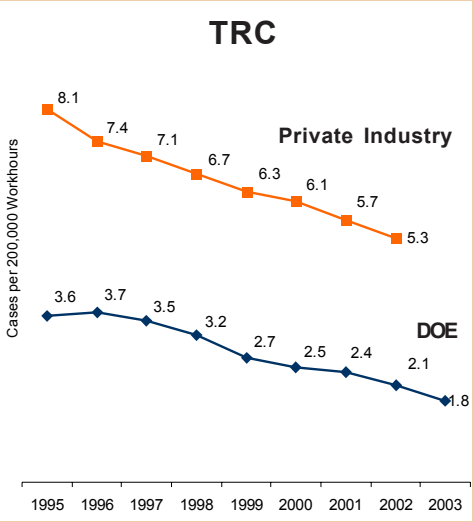
Despite the good news of improved TRC and LWC rates, we are beginning to see an increase in the number of serious injuries that require some type of hospitalization. The events appear to be largely due to procedural noncompliances. These injuries ranged from laser burns to the eye to a fractured pelvis resulting from working without fall protection. Unchecked, this emerging trend will counteract the positive results of the actions we have taken to protect our workforce.

Consequently, the Department has placed greater management attention on occurrences where workers could potentially have been injured, as well as those injuries actually requiring hospitalization, so that the present course can be countered and our "zero injury" goal achieved.

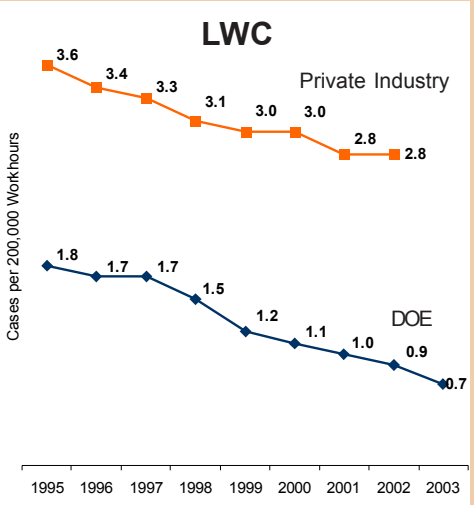
Quarterly Safety Reviews

The Under Secretary for Energy, Science, and the Environment and the Administrator for the National Nuclear Security Administration meet with senior managers for in-depth reviews of mission accomplishments, events, and safety performance metrics. These executive-level reviews of performance provide proactive venues to identify high-performing areas that should be reinforced and low-performing areas requiring greater management focus to effect change. The emphasis is on identifying precursors to serious problems and a course of action to prevent recurrence. Although the core metrics remain the same, additional metrics are currently being evaluated to meet emerging conditions and trends that require more attention.

DOE and Private Industry Total Recordable Case Rate Comparison



DOE and Private Industry Lost Workday Case Rate Comparison



* Private industry rates were obtained from the DOL Bureau of Labor Statistics. The most recent private industry data available are for CY 2002.

DOE Safety Performance Metrics

- Near misses
- Radiological skin contaminations/ uptakes
- Other radiological concerns
- Shipping quality assurance
- Environmental releases/ compliance
- Injuries requiring hospitalization
- Nuclear criticality concerns
- Authorization basis infractions
- Vehicle/ transportation accidents
- Lockout/tagout violations

A Transuranic Package Transporter travels to the Waste Isolation Pilot Plant

The Occurrence Reporting and Processing System

The DOE Occurrence Reporting and Processing System (ORPS) is an electronic database of information about off-normal occurrences at DOE facilities. The system provides a way to submit, track, and retrieve occurrence reports as required by DOE Manual 231.1-2, *Occurrence Reporting and Processing of Operations Information.* Such investigation and reporting enables DOE and its contractors to identify corrective actions that will prevent recurrence and, as a result, protect the health and safety of the public, the workers, and the environment.

In 2003, ORPS was successfully redesigned to 1) improve reporting criteria, 2) eliminate nuisance reporting, 3) enhance the causal analysis process, 4) include periodic performance analysis to identify recurring adverse occurrences, and 5) upgrade the electronic ORPS database.

DOE's system for reporting injuries and illnesses was also enhanced during 2003. The revised Computerized Accident/ Incident Reporting System (CAIRS) Manual incorporates new features agreed upon by DOE in 2003. These features dramatically improve the system's effectiveness and efficiency and include DOE contractor direct electronic reporting into the CAIRS database, a requirement to ensure reconciliation of Contractor OSHA 300 Log injury/illness data with CAIRS submissions, and periodic EH field site checks of injury/illness reporting.

Line Management Expectations and Goals

Many DOE Program Offices have special initiatives unique to their mission to improve safety performance. For example, the Office of Environmental Management is charged with accelerating DOE site cleanup and has initiated a 4.0 safety program, meaning that accidents and injuries will be driven to zero in four areas:

- workplace injuries requiring offsite hospitalization
- lockout/tagout violations
- skin/internal contaminations
- transportation incidents involving hazardous or radiological material

The Office of Fossil Energy's (FE) "Commitment to Environment, Safety , and Health" provides the foundation for its ES&H program and clearly articulates its goals and expectations in performing its mission in a secure, safe, and environmentally responsible manner. Since establishing ES&H excellence as a

core value, the office has achieved historically low accident rates, and many sites completed 2003 with zero injuries and received the Secretary's Perfect Safety Record award. FE has strengthened its focus on worker involvement and behavior safety and achieved dramatic reductions in at-risk behaviors and workers compensation costs. FE continues to work actively with external regulators and organizations in establishing effective ES&H programs and has earned prestigious recognition and certifications from programs such as the Occupational Safety and Health Administration's *Voluntary Protection Program*, the U.S. Environmental Protection Agency's *National Environmental Performance Track*, and the International Organization for Standardization's *ISO-14001*.

The Office of Fossil Energy's key environment, safety, and health challenges for 2004 include fostering a "learning organization," achieving zero accidents, eliminating environmental legacies, preventing injuries in an aging workforce, and obtaining external certification and recognition of ES&H programs and performance. FE will continue to make ES&H an integral part of its business strategy.

DOE's research and development arm, the Office of Science (SC), has established goals for reducing injury and illness rates, enhancing communication among Headquarters and sites and is striving for external verification and certification of its safety programs. The Office of Science has set a goal to reduce worker injuries and to drive performance to the top 10 percentile of the best in class for research institutions. Since this goal has been set, injury rates have decreased more than 35 percent. Open communication among all science sites is a key element in enhancing safety performance. Field sites discuss safety and security issues during weekly senior management meetings, raise common issues of concern, and share lessons learned. The Office of Science has implemented a process in which SC Site Office Managers and Laboratory Directors contact Headquarters regarding significant occurrences and events such as major accidents or environmental spills. On a daily basis, Headquarters identifies significant occurrences that may be of concern to SC management.

The Office of Science is also moving toward external verification and certification of its site safety programs either through the DOE Voluntary Protection Program or receiving registration under the Occupational Health and Safety Assessment Series (OHSAS) 18001 specification. This specification provides requirements for an occupational health and safety management system to enable an organization to control its risks and improve its performance.

Solar technology uses mirrors to focus sunlight onto a thermal receiver

The Office of Nuclear Energy, Science and Technology (NE) is responsible for leading the Government's effort to address critical nuclear issues, contribute to energy supply diversity, and advance the United States' energy competitiveness and security. Ongoing safety and health initiatives include reducing by 20 percent the incidence of near-miss, lost workday, and first aid/reportable case events at NE facilities, with a focus on the Idaho National Engineering and Environmental Laboratory. Also, NE is partnering with the Office of Energy Efficiency and the Office of Fossil Energy to leverage the collective programs' safety and health resources and expertise. In this way, Federal and contractor managers, ES&H specialists, and facility employees can share and discuss data and lessons learned on workplace safety issues, best practices, and cost-effective solutions.

Voluntary Protection Program and Behavior-Based Safety

Worker safety has also been enhanced through the Voluntary Protection Program (VPP), which now involves more than a third of the contractor workforce at DOE facilities. In fact, at the end of 2003, twenty-one contractor organizations had achieved DOE-VPP Star status and of those, seven were awarded Superior Star, and eleven received the Star of Excellence for their safety performance. Private industry, in general, uses VPP to improve existing safety programs and act as a conduit for spreading the message of safety and health. Managers as well as workers strive to ensure that accomplishments made to attain VPP status are ongoing and not one-time initiatives.

Workers at the West Valley Demonstration Project form a human star to celebrate achieving VPP Star Status

The following sites and contractors have achieved VPP Star Status:

- Central Plateau Remediation Project/*Fluor Hanford, Inc.*
- Fast Flux Test Facility/*Fluor Hanford, Inc.*
- Fernald Closure Project/*Fluor Fernald, Inc.*
- Fluor Federal Services, Inc./*Fluor Hanford, Inc*.
- Hanford Site/*Day & Zimmermann PTH and Fluor Hanford, Inc.*
- Hanford Site Operations/*Fluor Hanford, Inc.*
- Idaho National Engineering and Environmental Laboratory/ *Bechtel-BWXT, Idaho, LLC*
- Kansas City Plant/*Honeywell Federal Manufacturing and Technologies, LLC*
- Nevada Test Site/*Wackenhut Services, Inc.*
- Nuclear Materials Stabilization Project/*Fluor Hanford, Inc.*
- Oak Ridge Institute for Science and Education/*Oak Ridge Associated Universities*
- Pacific Northwest National Laboratory/*Battelle Memorial Inst.*
- Savannah River Site/*Westinghouse Savannah River Co.*
- Strategic Petroleum Reserve/*DynMcDermott Petroleum Operations Co., Inc.* — at the Bayou Choctaw, Big Hill, Bryan Mound, and West Hackberry Sites

– Volpentest Hazardous Waste and Emergency Response Training and Education Center/*Fluor Hanford, Inc.*
– Waste Isolation Pilot Project/*Washington TRU Solutions, Inc.*
– West Valley Demonstration Project/*West Valley Nuclear Services Co., LLC*
– Yucca Mountain Project/*Bechtel SAIC Co., LLC*

The Office of Fossil Energy's (FE) sites are the only DOE sites that fall under OSHA jurisdiction and are eligible for the OSHA VPP program; the Strategic Petroleum Reserve has achieved both DOE and OSHA Voluntary Protection Program certification. In addition, the Strategic Petroleum Reserve has achieved OSHA VPP Super Star status for accident rates 75 percent or more below comparable private sector organizations.

Behavior-based safety has been instituted at many of the DOE sites to improve worker safety performance. The process entails workers overseeing other workers, is not punitive, and encourages real-time, on-the-line sharing of experiences to help ensure that mistakes are not repeated. The process has demonstrated results in improved safety performance and reduced costs.

Significant Events — Type A and B Accidents

DOE has a formal process to evaluate serious accidents that occur in the Complex. The events are categorized as Type A or Type B. Type A accidents must meet criteria such as fatality, hospitalization of three or more individuals for more than 48 hours, unplanned criticality, or property loss in excess of $2,500,000. There have been no Type A accidents in the past three years.

Type B accidents, while defined as "less serious," are taken very seriously and meet one or more criteria that include hospitalization of one or more workers for five days or more, or property loss or damage in excess of $1,000,000.

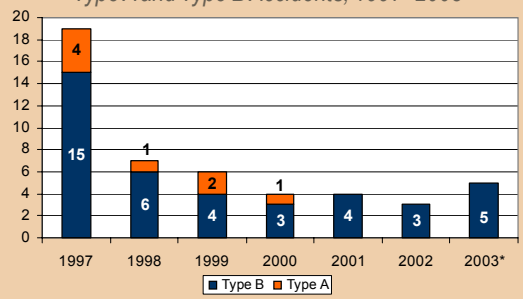
During 2003, the Department investigated five events as Type B. Three of the events fell under published criteria requiring a Type B investigation: a worker's crushed foot when a steel beam fell during lifting operations, multiple head injuries when a worker fell from a defective ladder, and a release of plutonium-238 in a storage room that resulted in two workers receiving radiological doses in excess of 5 rem.

Two events were investigated at management's direction to identify and understand the causes and prevent recurrence. These events were multiple arc blasts that damaged equipment and a worker's anti-contamination coveralls that were burned during welding. No one was injured in these two events.

Criteria for Type A and Type B events

	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 limits of 40 CFR Part 302 resulting in serious damage	2–5 times limits of 40 CFR Part 302
Property loss or damage	$2.5 million or greater	$1 million to $2.5 million

Type A and Type B Accidents, 1997–2003



* Two of the Type B events in 2003 did not meet the criteria for a Type B investigation; however, management directed these investigations as a proactive approach to preventing recurrence.

In FY2003, NIOSH issued three important studies: Mortality Patterns of Portsmouth Gaseous Diffusion Plant Workers; Lung Fibrosis in Plutonium Workers; and Epidemiologic Investigation of Cancer at Rocky Flats. Information is available at local DOE reading rooms for the benefit of workers, management, and all health agencies.

A chemical worker at Fernald uses a glovebox to sample uranium material, April 1970

HEALTH STUDIES AND DISEASE PREVENTION PROGRAMS

Epidemiologic Surveillance of Current Workers

The Epidemiologic Surveillance Program conducts ongoing health monitoring of active workers, enhancing the Department's ability to protect worker health and identify potential occupational illnesses. The National Institute for Occupational Safety and Health (NIOSH) examines, under agreement with DOE, past employment conditions and the morbidity and mortality patterns among workers in the nuclear weapons complex. The resulting studies help managers understand the impact of historical operations and provide information that may be relevant for current and planned operations. This historical information is particularly relevant as buildings and sites undergo decommissioning, since additional risks can then be assessed in pre-job risk analyses. NIOSH has completed more than 40 studies of more than 800,000 workers.

Comprehensive Epidemiologic Data Resource (CEDR)

After the health data is collected, DOE makes it available through the Comprehensive Epidemiological Data Resource, or CEDR, a mature, public-use database providing Internet access to data collected throughout the DOE complex for four decades. Available around the clock, the CEDR website (http://cedr.lbl.gov) received 3,000 new information requests a month during 2003. Three new data sets were added this year: Rocky Flats Dose Reconstruction Visualization, Santa Susana Field Laboratory Worker Study, and Stress and Downsizing. CEDR anticipates adding new file sets in 2004 after they are properly documented. Those studies now in progress pertain to workers at Pantex, Oak Ridge, Hanford, and the Portsmouth Gaseous Diffusion Plant.

Chronic Beryllium Disease

Beryllium, an industrial metal, is noted for its strength and durability and has been used in applications ranging from enriched uranium production to the manufacture of golf clubs and personal body armor.

The dangers of the metal were not always well known; however, when data about the dangers became available, the Department implemented both strict exposure limits and a testing program for former and current workers. The maximum amount of allowable beryllium exposure for a worker over an

eight-hour shift is 0.2 micrograms per cubic meter — a more conservative standard than OSHA's permissible exposure limit of 2 micrograms per cubic meter. This conservative exposure limit places DOE as an industry leader in Chronic Beryllium Disease (CBD) prevention. Ongoing health screenings for CBD are available at all DOE sites. The goal is to identify workers who either have the disease or have developed beryllium sensitivity, which means they could contract the disease later.

In 2002, a Nevada Test Site employee was diagnosed with chronic beryllium disease, and eleven others were diagnosed with beryllium sensitization. After a series of reviews, the National Nuclear Security Administration chartered a comprehensive investigation.

In 2003, the extensive investigation was completed and the report was released. The investigative team determined that the beryllium contamination had been introduced into the buildings from an outside source, most likely the nearby Nevada Test Site, by means of contaminated personal articles, vehicular traffic, and handling of contaminated documents.

The final report addressed broader implications for all DOE sites, since removable contamination often exists from historic activities and can affect the current workforce. The report also noted that the Department has been actively engaged in updating its requirements and reviewing beryllium-related activities and exposures for decades. Completion of the Nevada investigation's corrective actions will result in additional safeguards in the Department's already conservative beryllium safeguards program.

Former Worker Medical Screening

Since the early 1990s, DOE has offered medical screening to former nuclear workers, most notably testing for radiological exposures and beryllium-related disease through the Beryllium-Associated Worker Registry. The DOE Chronic Beryllium Disease Prevention Program (mandated by 10 CFR 850) established the Beryllium-Associated Worker Registry to collect information on beryllium exposure and health data among current employees. The registry's goal is to identify the factors or working conditions related to beryllium sensitization or the development of chronic beryllium disease. Data collection began in 2001.

In 2003, results from approximately 1,500 medical examinations were added to the database, which now includes 4,500 examination results. More than 500 beryllium exposure

measurements were added, for a total of 8,500 exposure measurements. Data are reviewed for completeness and accuracy; additional information is collected every six months.

Most of the workers who are tested have no findings; however, those with positive findings for occupationally caused illness are able to obtain medical follow-up or Worker's Compensation assistance through programs implementing the Energy Employees Occupational Illness Compensation Act.

International Programs

Marshall Islands Testing Program

The Marshall Islands Medical Surveillance and Environmental Program provides special medical care for radiation-related illness to the remaining indigenous people exposed to fallout from the 1954 U.S. thermonuclear "Bravo" test. The program provides environmental monitoring to support resettlement of the four affected atolls and in 2003, provided annual examinations and referrals for cancer diagnosis and treatment for the residents who remain.

This year saw several important steps forward: annual examinations and follow-up care were made available in the patients' home communities, replacing the previous expensive and time-consuming practice of sending them to Hawaii. In addition, a new medical program was designed to consolidate operations, reduce costs, and provide a more secure location for the annual examination. The environmental division of the Marshall Islands Testing Program reported an important finding related to radioactive cesium levels in locally grown food. Although the cesium level has declined dramatically over time through radioactive decay alone, it is now known that environmental processes remove the remaining cesium, making it unavailable for uptake into plants. The resulting 70-year cumulative dose would therefore be about 60 percent lower than predicted. This is good news for people planning to resettle the atolls that received significant fallout. It also explains, to a degree, the very low measured internal depositions of cesium-137 on Enewetak and Rongelap Islands through 2002.

WORKER ADVOCACY PROGRAM

Energy Employees Occupational Illness Compensation Act

The Department is committed to meeting its obligations to former workers who developed an illness as a result of workplace exposure in the production of atomic energy or in its tests. The Energy Employees Occupational Illness Compensation Program Act (EEOICPA) of 2000 requires the cooperation of three Federal Agencies to administer the complex program. That program processes and reviews worker claims for work performed for the Department and its predecessor agencies, including the World War II-era Manhattan Engineering District.

The program has two distinct parts, each administered separately. The Department of Labor (DOL) administers Part B, with assistance from DOE and the National Institute for Occupational Safety and Health (NIOSH). Under this part, the Department of Labor provides compensation of $150,000 to current and former workers with certain illnesses (radiation-induced cancers, silicosis, and beryllium disease) resulting from their work. All DOE workers, DOE contractors and subcontractors, 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.

The records required to substantiate claims are located throughout the U.S. at current and former atomic energy sites and in private facilities. DOE Field Offices play a critical role by searching for and providing individual employment, medical, and radiation and other exposure records needed to adjudicate claims. From the Act's enactment to the present time, the Department of Labor has paid claims of nearly $743 million to 10,000 individuals.

DOE Responsibilities: Part D

The Department of Energy is responsible for administering Part D, which provides assistance for qualified DOE contractor employees in applying for State workers' compensation. NIOSH-appointed Physician Panels review worker claims to determine their validity – that is, whether the claimant's illness or death 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 workers' compensation claim. DOE does not directly provide benefits through this program – benefits are determined within State workers' compensation programs.

DOE began processing claims with the completion of the rulemaking in September 2002. In preparation for Physician Panel review, DOE assembles complete case files, including employment records, a relevant occupational history (often for multiple sites), any medical records in DOE's possession, and medical information provided by the claimant. The information campaign, hotlines, and Traveling Outreach Centers have been a success - applications for consideration in the program arrive at the rate of 160 per week.

The Future of EEOICPA

This year, DOE committed to raising the priority level of worker claims processing in an effort to process more than 20,000 Part D applications and transmit workers' records to the Physician Panel. To that end, DOE asked the Congress for a transfer of $33 million in FY-04 funds. If this request is approved, DOE will be able to hire more case management staff, increase records retrieval from the DOE Field Offices, and complete the backlog within one year.

One of the key components in accelerating case processing is increasing the number of physicians who serve on Physician Panels. DOE is doing two things to help in this area. First, we are working with NIOSH to increase the number of physicians nominated to serve on the panels. Second, we are developing a revision to the Physician Panel Rule that would allow a three-physician panel to reconsider any case that receives a negative decision in its first Physician review.

DOE has established a new Workers Compensation Assistance Advisory Committee to find innovative ways to make the process more efficient. The first committee meeting is planned for spring 2004.

PROTECTING THE ENVIRONMENT

DOE is committed to excellence in environmental performance. Our environmental stewardship is embodied in our goal of zero environmental legacies, and our environmental management systems (EMS) help us achieve that goal. We are also committed to reducing risk by accelerating our cleanup activities.

Risk Reduction through Material Stabilization

One of the Department's key safety initiatives is to reduce risk by stabilizing excess nuclear materials. The estimated life cycle cost to complete cleanup has been reduced by approximately $50 billion, and the estimated time to complete the total Environmental Management project has been reduced 35 years — a significant reduction in risk to an entire generation. Risk reduction milestones in the past year included the following:

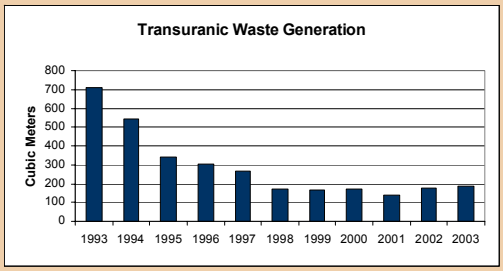
- The Plutonium Finishing Plant stabilized and packaged all residues eight months ahead of schedule
- The Plutonium Stabilization and Packaging System completed operations after processing and packaging 1,895 canisters of plutonium metal and oxide
- All Rocky Flats special nuclear material was packaged into suitable certified containers and shipped to other Department sites
- Idaho shipped 3,100 cubic meters of stored transuranic waste to the Waste Isolation Pilot Plant
- Oak Ridge shipped 9,378 cubic meters of legacy low-level and low-level mixed waste off-site
- The entire inventory of transuranic waste at the Missouri University Research Reactor was shipped to the Waste Isolation Pilot Plant
- The Nevada Test Site disposed of over 3 million cubic feet of low-level waste, an increase of nearly 50 percent over the previous year
- Nearly 800 tons of low-level and low-level mixed concrete and soil were removed in the final cleanup of Rocky Flats contaminated solar evaporation ponds
- Mound completed shipping all legacy transuranic waste to Savannah River for interim storage
- All spent nuclear fuel was removed from West Valley

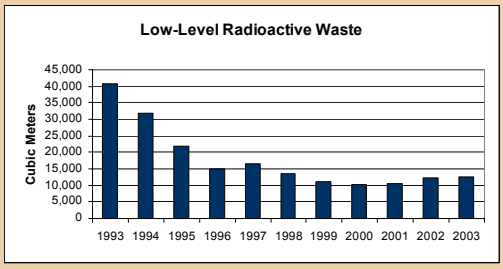
Savannah River Site workers apply Instacote to large equipment as an alternative to size-reduction

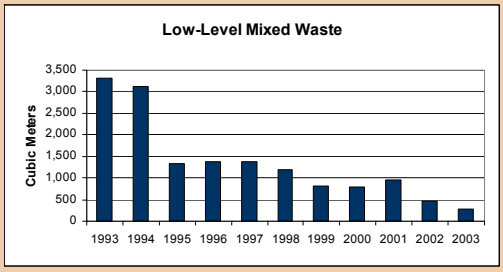
3013 cans used in the Plutonium Stabilization and Packaging process (Hanford and Rocky Flats)

A drum is moved from the Hanford 618-4 burial ground to be overpacked

The Savannah River Site is testing the use of compressed recycled paper pellets to partially replace coal as a source of heating fuel







Waste Minimization/Pollution Prevention

In 1999, the Department established pollution prevention goals for routine generation of transuranic, low-level radioactive, low-level mixed, hazardous, and sanitary wastes. The goals are to be achieved in 2005 using 1993 as the baseline year. Progress toward the 2005 goal is discussed below.

The charts in the sidebar demonstrate the waste amounts generated each year since the baseline year of 1993. Data spikes from year to year can be attributed to programmatic needs such as the initiation or termination of research projects or site stockpiling of wastes until an opportunity arises for safe, cost-effective recycling, reuse, or disposal.

Transuranic (TRU) Waste

Transuranic, or TRU, waste contains alpha-emitting radionuclides with an atomic number greater than 92 (heavier than uranium). Transuranic waste is generated primarily through production of nuclear weapons, although non-defense research activities can also create TRU waste.

Transuranic waste generation has been reduced 74 percent from the 1993 baseline. About half (98 metric tons) of the year's reported transuranic waste came from the Savannah River Site, an Environmental Management (EM) facility. Seventy-six metric tons originated at National Nuclear Security Administration (NNSA) sites, 74 tons of which came from Los Alamos National Laboratory. Collectively, sites will need to achieve an additional reduction of 45 metric tons over the 2003 reduction to achieve the 2005 goal of 142 metric tons.

Low-Level Radioactive Waste

Low-level radioactive waste is generated from the use of radioactive materials in research or production. Low-level radioactive waste dropped 70 percent from 1993. About a third of the low-level wastes came from EM sites being remediated. An additional reduction of 4,229 metric tons of low-level radioactive waste is necessary to achieve the 2005 goal of 8,331 metric tons.

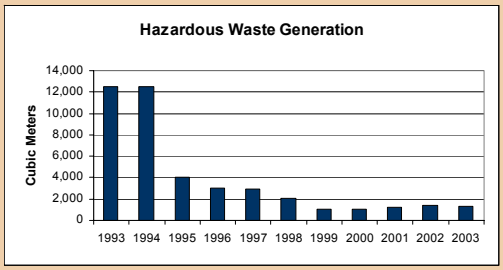
Low-Level Mixed Waste

Low-level mixed waste is low-level radioactive waste that has become mixed with wastes regulated by the Resource Conservation and Recovery Act (RCRA) or the Toxic Substances Control Act (TSCA). The mixing of these wastes can occur when hazardous solvents are used to clean radioactively contaminated surfaces or through research or production activities.

Sites achieved a 92 percent reduction in low-level mixed wastes against the 1993 amount and the 80 percent reduction level established as a 2005 goal. Over half of the low-level mixed wastes were generated at EM sites.

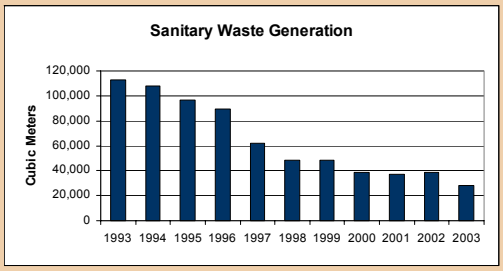
Hazardous Waste

Hazardous wastes are those regulated either by RCRA, TSCA, or state laws because of their potentially harmful effect if improperly managed or released into the environment. They are wastes such as spent solvents, toxic metals, corrosive and ignitable materials, that are generated from a variety of sources, including production operations and routine parts or equipment cleaning activities. Hazardous waste generation dropped 91 percent from the 1993 baseline and exceeded the 2005 90 percent reduction goal.



Sanitary Waste

Sanitary wastes are generated through normal operations such as office work, food service operations, and normal housekeeping services. They are neither hazardous nor radioactive and can be recycled or disposed in regular landfills. Sanitary waste refers to municipal solid waste as defined by the Environmental Protection Agency, and does not include other materials such as construction and demolition debris. In 2003, DOE reduced sanitary waste generation by 77 percent from the baseline year and actually exceeded our 2005 goal.

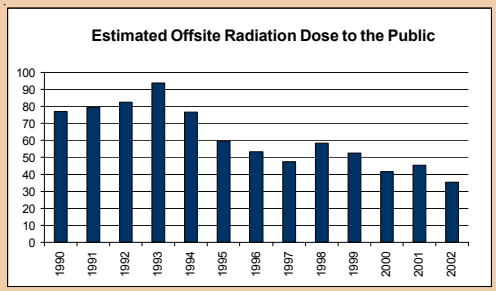


Environmental Compliance Performance

In 2003, DOE sites received thirty-two Notices of Violation (NOV) from State and Federal environmental regulators. This number was comparable to past years. The number of violations cited in these NOVs dropped to approximately half 2002's number.

Estimated Offsite Radiation Dose to the Public

As part of its commitment to the community, DOE tracks estimated radiation doses to the public around its many sites through extensive continuous radiological monitoring and surveillance programs. Despite accelerated cleanup and stabilization activities at contaminated sites, the estimated annual collective dose to the public has been very small and has stabilized at approximately 40 person-rem, well below both the DOE limits and EPA National Emission Standards for Hazardous Air Pollutants (NESHAPs). To put the estimated DOE-wide annual collective dose in perspective, background radiation dose to the population in a large metropolitan area would be more than 2 million person-rem annually, from natural and man-made sources.



Herd of deer grazing, Hanford

Wild turkeys at the Brookhaven Ecological Reserve

Significant National Environmental Policy Act (NEPA) Accomplishments

DOE achieved a number of significant NEPA milestones in 2003 by preparing environmental impact statements for proposals for important DOE projects and activities and issuing guidance to promote effective and efficient NEPA compliance and flexible decision-making.

DOE completed the Final Environmental Impact Statement for Chemistry and Metallurgy Research Building Replacement at the Los Alamos National Laboratory, six statements for Power Marketing actions, and nine draft environmental impact statements. DOE has scheduled approximately a dozen final environmental impact statements for completion in 2004. These will support decision-making by, for example, Environmental Management regarding high-level radioactive waste tank closure, Fossil Energy regarding clean coal projects and international transmission lines, the National Nuclear Security Administration for Defense Programs projects, and the Power Marketing Administrations for transmission facilities.

As an example of Departmental NEPA accomplishments, the Office of Fossil Energy finalized an EIS that allows it to move forward with research on innovative clean energy technologies for the 21st century. The Kentucky Pioneer Demonstration Project will result in the construction and operation of a modified power plant using a blend of coal and refuse-derived fuel to produce power. This project will be a showcase facility for DOE, employing advanced clean energy technologies that benefit the environment, providing low-cost power to spur economic growth, and demonstrating how cities can eliminate municipal solid waste by mixing it with coal to produce electricity.

DOE issued a revised Floodplain and Wetlands Rule (10 CFR Part 1022) to remove unnecessary procedural burdens — streamlining while maintaining protection of sensitive environmental resources. In 2004, DOE plans to update its core guidance document for preparing environmental impact statements and environmental assessments, and to issue guidance on a range of NEPA topics, including responding to environmental impact statement comments and preparing supplement analyses.

Environmental Management Systems

The Department is implementing environmental management systems (EMS) at its sites to provide a systematic framework to identify and address the environmental impacts of our work, ensure regulatory compliance, and identify opportunities for improvement. Such systems help us reduce the amount of waste we produce and release into the environment. DOE is committed to integrate EMS into the existing Integrated Safety Management Systems at its sites.

It is the Department's goal to have environmental management systems in place at all major DOE facilities by the end of 2005. DOE has identified forty-seven sites or organizations to implement these systems. More than three quarters of these sites have taken the initial steps for implementation, and almost one quarter have implemented an EMS. Eight sites have been registered as conforming to ISO 14001, the international consensus standard for Environmental Management Systems. Three of these sites and two others are recognized by the Environmental Protection Agency's National Environmental Performance Track program for their EMSs and their sustained record of environmental performance.

The Office of Fossil Energy has made great progress in implementing EMS programs at its sites and is ahead of schedule for meeting the President's requirement for Federal agencies to implement EMS by December 31, 2005 (Executive Order 13148, *Greening the Government through Leadership in Environmental Management*). FE's systematic and structured approach provides a mechanism to address the environmental consequences of its activities, products, and services. Although several recognized EMS frameworks exist, FE's is based on the ISO 14001 EMS standard. FE's Strategic Petroleum Reserve's (SPR) integration of NEPA and EMS into its business processes earned SPR the FE 2003 Environmental, Security, Safety and Health Achievement Award. SPR also successfully achieved its ISO 14001 triennial recertification as required under the ISO 14001 standard with zero non-conformances identified. In addition, the National Energy Technology Laboratory (NETL), DOE's premier energy research laboratory, became ISO 14001 in 2003.

In 2003, the Department issued detailed implementation guidance for EMS. In the upcoming year, the Department will publish a briefing packet and manager's guide to EMS, highlighting senior management's role in implementation.

"It is my goal...to have Environmental Management Systems in place at all major DOE facilities by the end of 2005."

Secretary Spencer Abraham, Earth Day 2003

Trucks carrying contaminated material pass through a weigh station en route to the Environmental Restoration Disposal Facility, Hanford

Treated, mixed low-level waste is disposed of in RCRA-compliant landfills such as this one at Hanford

DOE Pollution Prevention Awards

Affirmative Procurement Initiative – Hanford Site

Demonstration of a Web-Based Chemical Purchasing and Management System – Oak Ridge National Laboratory

Lasagna™ Soil Remediation Technology – Paducah Gaseous Diffusion Plant

Incorporating Sustainability for New Buildings – Sandia National Laboratories

Pollution Prevention Program – Argonne National Laboratory

DOE's Homeland Defense Equipment Reuse Program – Oak Ridge Operations Office of Assets Utilization

Deconstruction and Recycling of Building 8-8 – Pantex Plant

Gadolinium Nitrate Recycling – Savannah River

Recycling Technical Library Books – Y-12 National Security Complex

EMS Integrates Value Engineering and Data Qualification Objectives Process – Hanford

Unique Solutions to Sanitize Weapons Components for Reuse – Pantex

DOE Environmental Initiatives Earn Awards — White House Closing the Circle Award

The prestigious White House Closing the Circle Awards recognize Federal employees and their facilities for efforts that resulted in significant contributions to environmental stewardship. The competition is open to all Federal departments and agencies and receives hundreds of nominations. The Sandia National Laboratories (SNL), New Mexico, won a Closing the Circle Award in the Sustainable Design/Green Buildings category in addition to winning the DOE Pollution Prevention (P2) award. SNL demonstrated how sustainable design could be integrated at no added cost in facility planning, design, and construction. Incorporating sustainable design in building the Model Validation and Systems Certification Test Center proved so successful that the process has been used and refined for eight other facilities.

DOE Environmental Initiatives Earn Awards — Pollution Prevention

DOE's Pollution Prevention (P2) Awards Program is in its tenth year of recognizing outstanding performance by sites and departmental operations. The program features thirteen award categories related to waste reduction, recycling, sustainable design, and environmentally preferable procurement. Forty-nine nominations were submitted and seventeen pollution prevention awards were granted in 2003 for activities conducted in 2002 (some of these awards are listed in the sidebar).

Other Awards

The Oak Ridge National Laboratory won the national Associated Builders and Contractors *Eagle Award* for its 370,000-square-foot research and office complex that features a green approach to design and construction. For example, the buildings boast a high quantity of recycled material, low-volatile paints and coatings, energy-efficient roofs and windows, and rainwater-fed landscaping. DOE is proud that the energy-efficient facility represents a departure from the region's normal architecture and demonstrates that the Department is serious about the environment.

The Office of Fossil Energy is committed to going above and beyond basic ES&H requirements to achieve excellence. In 2003, Fossil Energy sites were recipients of awards for sustained ES&H performance from State regulatory agencies and professional ES&H organizations, including the Texas Commission on Environmental Quality; Texas General Land Office; Louisiana Quality Foundation for Environmental

Excellence in Management Systems; National Association of Environmental Professionals; and the Western Pennsylvania Safety Council.

NUCLEAR FACILITY SAFETY

The Department focuses primarily on Price-Anderson Amendment Act enforcement and analytical studies to determine how well the DOE is performing from a nuclear safety perspective. However, DOE is re-evaluating its approach and metrics for evaluating nuclear safety. Results from last year's metrics are described below.

Radiological Safety

The keystone to radiological work in the DOE Complex is to keep radiation exposures to workers ALARA — that is, keeping worker doses as low as reasonably achievable within the constraints imposed by work, equipment, and technical conditions. The ALARA concept is accomplished through work planning that considers a worker's time in the area, distance from the work, and required shielding.

The Department monitors workers for radiological skin contaminations, exposures, and uptakes. Administrative control levels are established to manage exposures to workers so that no one exceeds these levels without prior approval from DOE. As shown in the figures to the right, in 2003 one individual received a dose in excess of the administrative control limit of 2 rem and two individuals exceeded the 5 rem annual limit. The word "dose" is used here to mean Total Effective Dose Equivalent (TEDE).

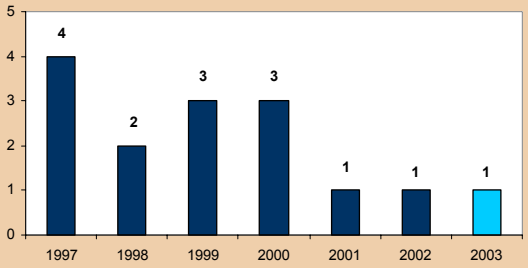
Only 17 percent (17,484 out of 102,509) of our workers who were monitored for radiation dose received a measurable dose in 2003. The average annual measurable dose to a worker was 83 millirem, and the collective dose was 1444.6 person-rem. To place this dose in perspective, the average American receives approximately 300 millirem per year from all natural and man-made sources of radiation.

Of those workers with a measurable dose in 2003, the majority — 13,865 out of 17,484 — received less than 100 mrem TEDE.

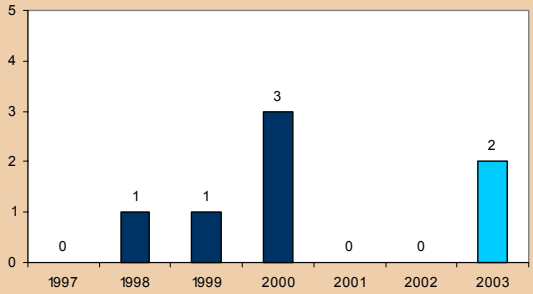
While we take all exposures seriously, placed in the context that thousands of workers perform mission work and highly unpredictable D&D work every day, these events indicate that ALARA controls are in place and working.

ALARA concept – use of Instacote™ instead of size reduction or cutting

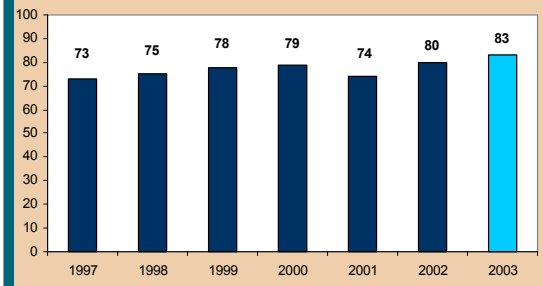
Number of Individuals with Radiological Doses in Excess of the 2-rem DOE Annual Administrative Control Level



Number of Individuals with Radiological Doses in Excess of the 5-rem DOE Annual Regulatory Limit



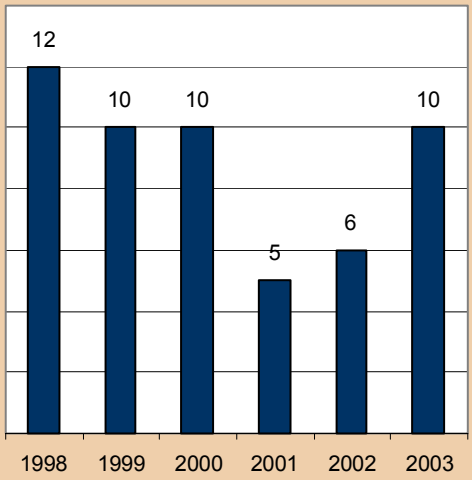
DOE Average Annual Measured Dose (millirem) Total Effective Dose Equivalent (TEDE)



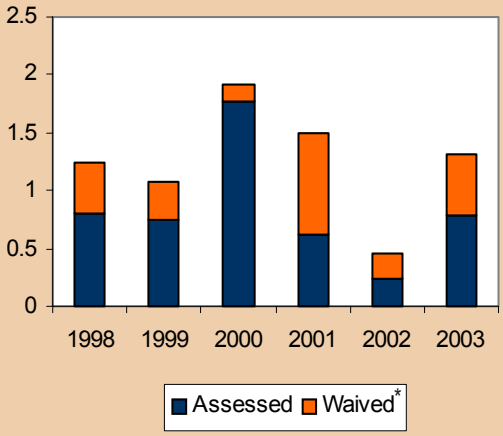
DOE enforces four nuclear safety rules:

- **10 CFR 708**, *DOE Contractor Employee Protection Program*
- **10 CFR 820.11**, *Information Requirements*
- **10 CFR 830**, *Quality Assurance and Safety Basis Requirements*
- **10 CFR 835**, *Occupational Radiation Protection*

PAAA Notices of Violation (NOVs)



PAAA Penalties ($ Millions)



** Due to statutory exemption for specific not-for-profit contractors.*

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 gave DOE the authority to undertake enforcement actions against those contractors who violate DOE nuclear safety rules. The PAAA, in effect, required DOE to establish an internal self-regulatory process.

The Office of Price-Anderson Enforcement maintains that internal self-regulatory program; investigates potential violations; and, where warranted, initiates enforcement action. Those actions are performed 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 requirements found in 10 CFR 820.11, *Information Requirements*, and 10 CFR 708, *DOE Contractor Employee Protection Program,* are also subject to DOE enforcement.

The Office continued to ensure contractor accountability by conducting investigations and program reviews at selected sites. Two concerns have arisen: that issues are sometimes revealed by safety events that could have been prevented by effective performance assessment programs, and that corrective actions may not be effective in preventing recurrence.

DOE developed and maintains the Noncompliance Tracking System (NTS) database into which contractors voluntarily report noncompliances. Because the DOE enforcement policy provides substantial incentives for contractors to self-identify, report, and correct nuclear safety concerns, voluntary reports into the NTS may result in enforcement discretion. That is, DOE may either forego or mitigate enforcement action. Some contractors have begun to move from “event-driven” to “assessment-driven” NTS reports, indicating a proactive approach to identifying issues and taking actions to address them. However, two important goals remain for 2004: continued improvement in contractor performance assessment and a decrease in programmatic or repetitive noncompliances.

During 2003, the Office of Price-Anderson Enforcement issued ten Notices of Violation (NOVs) totaling $1,305,000 in civil penalties. Seven of the ten NOVs were mitigated for contractor self-reporting and prompt corrective action. Contractor-identified corrective actions will be monitored to ensure effectiveness.

During 2003, the Office also conducted six program reviews to assist contractors in identifying, reporting, and correcting noncompliances to reduce the risk of enforcement action. For the first time, the Office conducted a program review that focused on the screening and reporting of weapons-related nuclear safety deficiencies, with generally satisfactory results.

Nuclear Criticality Safety

The Department demonstrated a stable nuclear criticality infrastructure with the 2003 closure of Defense Nuclear Facilities Safety Board Recommendation 97-2, *Criticality Safety*. Fourteen commitments were effectively addressed for this closure, including the following: revise and reissue Standard 3007-93, *Guidelines for Preparing Criticality Safety Evaluations at Department of Energy Non-Reactor Nuclear Facilities*; issue a guide for reviewing criticality safety evaluations; survey site-specific programs and obtain commitments from contractors to implement criticality safety training and qualification programs; establish a Web site to make calculations, studies, and data accessible; develop a formal training and qualification program for Federal personnel performing criticality safety oversight; establish line ownership of criticality safety at sites with the use of the Criticality Safety Officer function. Institutionalizing formal Federal and Contractor criticality safety training and qualification serves as an effective way to maintain a cadre of criticality safety professionals.

The Defense Nuclear Facilities Safety Board suggested 10 improvements that DOE also implemented, including providing clearer guidance on using engineered criticality safety controls rather than administrative ones in new designs; decreasing reliance on administrative controls in existing facilities; establishing a robust process for vertically tracing criticality controls; enhancing configuration management over nuclear criticality safety-related design features; and developing a robust method for reporting criticality safety infractions. All associated Departmental Guidance, Standards, and Orders were revised to support contractor adherence to the new changes.

The newly enhanced criticality safety program is funded and managed by the National Nuclear Security Administration (NNSA).

In addition to the successful closure of the Recommendation, the Department conducted criticality safety assessments at Los Alamos National Laboratory; British Nuclear Fuels Limited (BNFL) in Oak Ridge; and the Hanford Plutonium Finishing Plant (PFP), to verify that the programs are being conducted in compliance with applicable DOE Orders and ANSI/ANS Standards for criticality safety.

Safety Basis Improvement

A facility safety basis is a set of documented controls that provide reasonable assurance that DOE facilities can be operated safely and in a manner that protects workers, the public, and the environment. 2003 marked a significant milestone in improving the safety bases for our nuclear facilities. With the implementation of the DOE Rule 10 CFR 830, Subpart B, *Safety Basis Requirements*, the Department required contractors operating DOE nuclear facilities to submit safety basis documents that meet the requirements of that Rule. In order to meet the April 10, 2003, deadline, contractors had to document the work to be performed, analyze the hazards, and implement controls to protect workers, the public, and the environment from nuclear or radiological hazards. (The content of the safety documents is further dictated by DOE Standards identified in Appendix A of the Rule.) The Department will then apply its own formal review and a performance-based formal enforcement program to ensure that contractors adhere to their documented safety controls. Together with similar Integrated Safety Management requirements, invoked through the DOE acquisition regulations, a sound, enforceable system is in place to ensure adequate protection from nuclear and radiological work hazards.

The Department formally reviews a contractor's safety documentation through a Safety Evaluation Report (SER), which reflects a multi-disciplinary review of the contractor's Safety Basis documentation. In addition to the DOE Program Office reviews, during 2003 the Office of Environment, Safety and Health (EH) reviewed 63 SERs from 11 sites.

The status of DOE nuclear facility safety documentation is formally tracked in DOE's Safety Basis Information System (URL http://www.eh.doe.gov/nsps/basisinfo.html). The data cover 260 DOE nuclear facilities, excluding those facilities with extremely low hazard potential to which the Safety Basis documentation requirements do not apply.

CROSSCUTTING ISSUES

Crosscutting, Complex-wide areas for improvement affect the majority of DOE Program Offices. Details on those 2003 crosscutting issues follow.

Quality Assurance Improvements

In 2003, the Office of Quality Assurance Programs - which resides in the Office of Environment, Safety and Health - was established to provide DOE-wide leadership in the area of quality assurance and to develop necessary quality assurance programs, processes, and procedures.

Results this year are the following:

- developed software quality assurance (SQA) standards and identified improvements for safety analysis software
- established an SQA Knowledge Portal as a central repository for software quality assurance knowledge and reference. The Knowledge Portal includes
  - a Central Registry of Toolbox Codes
  - Criteria Review and Approach Documents
  - a discussion forum
  - SQA training information
  - information on current Directives and those under development
  - SQA lessons learned
- established a Self-Assessment Certification program based on criteria and processes from the Institute for Nuclear Power Operations (INPO) principles for self-assessment, corrective actions, and tracking and trending; it is closely aligned with Integrated Safety Management principles

A Strong Case can be Made for Self-Assessment Certification

- Increases workforce understanding of requirements and performance expectations
- Increases management awareness of performance
- Minimizes unexpected independent findings or violations
- Improves acceptance of changes in work processes
- Lawrence Berkeley National Laboratory volunteered to be the first site to go through the certification process, and successfully completed the Certification review before year's end.
- Sites wanting to obtain further information or to pursue Self-Assessment Certification should contact George Detsis by e-mail at george.detsis@eh.doe.gov.

Suspect/Counterfeit Items

The DOE is committed to ensuring that suspect/counterfeit items (S/CI) are quickly identified and that installed items and components meet their intended functional and operability requirements. A suspect item is a part that may not conform to established Government- or industry-accepted specifications or national consensus standards. A counterfeit item is one that does not meet QA standards, but is knowingly represented as meeting those standards. In either case, such parts may be introduced into safety or mission-sensitive systems. This end result is not acceptable to DOE.

In 2003, forty-six separate suspect/counterfeit item discoveries were reported, many involving multiple parts or fasteners. Although there have been no injuries or known accidents associated with these parts and most of them have been discovered and removed prior to being placed into service, the potential exists for worker injury, particularly when such parts are in lifting devices and container sealing systems.

In 2003, the Department instituted a new DOE-wide process to identify, notify, and investigate S/CI; established a website; and issued two Safety Alerts on S/CI. The Department will undertake a major training effort in 2004.

Electrical Safety

The number of reported electrical near-miss events across the DOE complex has increased since September 2002. These near-miss events involved contact with energized electrical sources or potential contact when only one or no barrier remained. The injuries that did occur were mitigated by the fact that workers were wearing personal protective equipment (PPE), were separated from the source by distance (e.g., using excavating equipment), or were protected by insulated tools.

Electrical safety events are an ongoing problem and we continue to see near misses, primarily resulting from inattention to detail and failure to follow procedures. Disturbingly, many events involved experienced electricians. Although the Department attempted to raise awareness of electrical safety through senior management meetings and specific operating experience publications, it resulted in little improvement. As a result, we have instituted a Complex-wide Electrical Safety Campaign that will continue through 2004, and we will aggressively track and resolve electrical issues until our trend is significantly reversed.

Hoisting and Rigging Events

Safety challenges remain for the Department as hoisting and rigging incidents continue to occur in all types of DOE operations. The level of rigor applied to planning and controlling hoisting and rigging tasks to ensure that they are performed safely was sometimes insufficient and subsequently responsible for many reported events. Performing hoisting and rigging tasks without sufficiently thinking through the entire activity has resulted in a Type B accident in which two personnel were injured by a falling steel beam. Other hoisting and rigging accidents resulted from the use of insufficient or damaged rigging equipment that failed, dropping the load that in some cases narrowly missed workers below.

EH continues to bring these events to the attention of the Complex through numerous articles and studies issued through the Operating Experience and Lessons Learned publications. EH published a special report entitled *DOE Hoisting and Rigging Events* (URL http://www.eh.doe.gov/paa/reports/HR_INPO_Style_FinalDraft_01-20-04.pdf) addressing hoisting and rigging issues and presenting important lessons learned pertaining to safety responsibilities prior to performing lifts. Although there have been few injuries as a result of these events, DOE's accelerated decommissioning and decontamination means more people will be performing potentially dangerous work. Awareness and vigilance are needed to avoid hoisting and rigging injuries during those decontamination and decommissioning activities.

A powerful magnet being lifted by crane at Pacific Northwest National Laboratory

APPENDIX A **GLOSSARY**

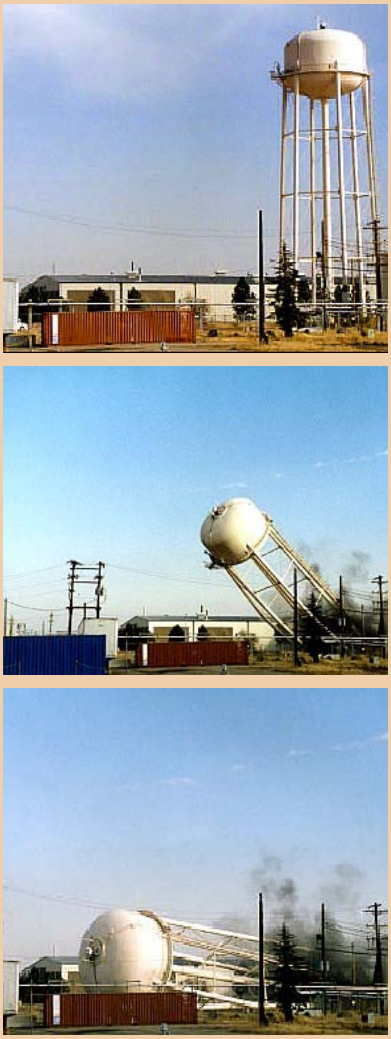
Administrative Control Level (ACL). A radiation dose level that is established below the DOE dose limit in order to administratively control exposures. ACLs are multi-tiered with increasing levels of authority required to approve a higher level of exposure.

ALARA. Acronym for "As Low As Reasonably Achievable," which is the approach to radiation protection to manage and control exposures – both individual and collective – to the workforce and the general public.

Average Measurable Dose. Radiation dose obtained by dividing the collective dose by the number of individuals who received a measurable dose. This is the average most commonly used when examining trends and comparing doses received by workers because it reflects the exclusion of those individuals receiving a less than measurable dose. Average measurable dose is calculated for Total Effective Dose Equivalent, Deep Dose Equivalent, neutron dose, extremity dose, and other types of doses.

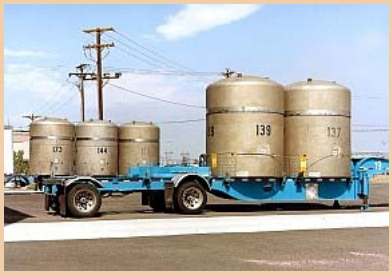
Behavior-Based Safety. Behavior-based safety is the application of reinforcement theory to foster an increase in "safe behaviors." Use of behavior-based safety programs is considered an upstream or proactive measure of safety performance. Behavior-based safety is a method to use positive reinforcement 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 Dose. The sum of the total annual effective dose equivalent or total effective dose equivalent values for all individuals in a specific population. Collective dose is expressed in units of person-rem.



Demolition of the Rocky Flats water tower, a site landmark since 1952

Workers apply polyurea coating to equipment at Rocky Flats



Transuranic waste bound for the Waste Isolation Pilot Plant

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.

Exposure. A measure of the ionization produced in air by x or gamma radiation.

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 improvement. 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 (a subset of the Total Recordable Case Rate) includes cases where the injury or 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 radiation dose equivalent equal to one one-thousandth 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 compromised, 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.

Number of Individuals with Measurable Dose. The subset of all monitored individuals who receive a measurable radiation dose (greater than the limit of detection for the monitoring system). Many personnel are monitored as a matter of prudence and may not receive a measurable dose. For this reason, the number of individuals with measurable dose is presented as a more accurate indicator of the exposed workforce. The number of individuals represents the number of dose records reported. Some individuals may be counted more than once if multiple dose records are reported for the individual during the year.

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.

Removing contaminated soil near the retired reactor areas along the Columbia River

Contaminated sludge from Rocky Flats Building 374 is loaded into a tanker

Price-Anderson Amendments Act of 1988. The Price-Anderson Amendments Act provides indemnification to DOE contractors who manage and operate nuclear facilities and activities in the DOE complex. The Price-Anderson Amendments Act of 1988, Public Law 100-408, was extended to December 31, 2004, by the Bob Stump *National Defense Authorization Act of 2003*. The statute extended 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 citations and 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, or Roentgen equivalent man, is the conventional unit used for a radiation dose equivalent from ionizing radiation to the total body or any internal organ. A rem is equal to an absorbed dose (in rads) times a quality factor, which is assigned for different types of radiation. One rem of any kind of radiation is that amount of the radiation that produces the same damage as absorption of one roentgen of gamma radiation.

TEDE. Total Effective Dose Equivalent is the sum of external whole-body exposure(s) and internal exposure(s).

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 are 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 three or more individuals for more than 48 hours, an unplanned nuclear criticality, or property loss or damage in excess of $2,500,000.

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.

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.

Digging up reactor effluent cooling water piping and surrounding contaminated soil

APPENDIX B **REFERENCES**

Analysis and Trending of Suspect/Counterfeit Items at Department of Energy Facilities August 2003, DOE/EH-0674 (Semiannual Report)

Annual Progress Report: 2003 for Executive Order 13148, *Greening the Government Through Leadership in Environmental Management*

Annual Report to Congress — Department of Energy Activities Relating to the Defense Nuclear Facilities Safety Board, Calendar Year 2003

Comprehensive Epidemiological Data Resource, http://cedr.lbl.gov

DOE Hoisting and Rigging Events, Operating Experience & Lessons Learned Report

Environmental Management System Implementation Status Quarterly Review, December 2003

Nuclear Safety Enforcement Program, http://www.eh.doe.gov/enforce

Public Law 106-398, Title XXXV, Energy Employees Occupational Illness Compensation Act of 2000

Safety Basis Information System (SBIS), http://www.eh.doe.gov/nsps/basisinfo.html

DEPARTMENT OF
UNITED STATES OF