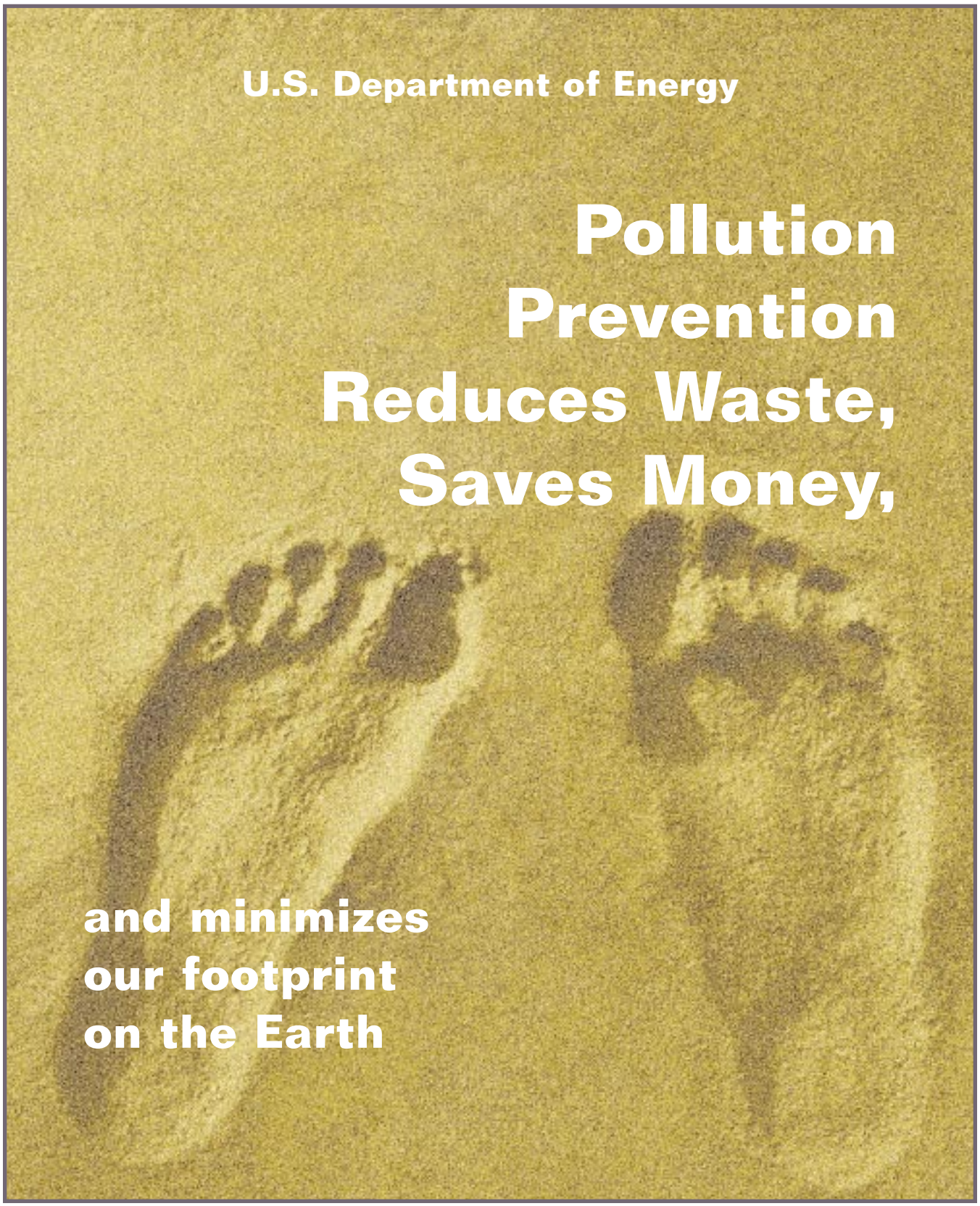
DOE/S-0128

U.S. Department of Energy

Pollution Prevention Reduces Waste, Saves Money,



and minimizes our footprint on the Earth

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DOE Mission

To foster a secure and reliable energy system that is environmentally and economically sustainable, to be a responsible steward of the nation's nuclear weapons, to clean up our own facilities and to support continued United States leadership in science and technology.

Core Values

We value public safety and respect the environment. We place a high priority on the protection of public health and safety in all of our operations. We are committed to the restoration of the environment through cleanup of contamination caused by past operations. We recognize the seriousness of the environmental impacts of our operations, and we develop and employ processes and technologies to reduce or eliminate waste production and pollution in these operations. We will be a leader in improving the quality of the environment for future generations. – **DOE Strategic Plan**

Management Commitment

I am committed to making the Department of Energy a leader in pollution-free, energy-efficient operations in the Federal Government. To become that leader, we must continually improve our facilities to maximize energy efficiency and must strive toward "zero" waste and emissions. – **Secretary Bill Richardson**

Committed to the Challenge

A Message from the Secretary of Energy, Bill Richardson

The Department of Energy (DOE) recognizes that reducing the consumption of natural resources, energy, and manmade materials reduces adverse impacts on the environment, and saves money. As the 21st Century approaches, DOE is integrating cost-effective pollution prevention and energy efficiency measures into the areas of design and construction, research and testing, operations and maintenance, and cleanup and decommissioning. I am proud to share the Department's significant progress over the last five years toward our pollution prevention goals. DOE is committed to continue preventing pollution at the source while achieving environmentally and economically sustainable research operations and leadership in science and technology.

The objectives of this document are the following: (1) to communicate measures that have worked; (2) to explain our priorities for the future; and, (3) to seek opportunities to partner with others in government, the private sector, and the public. We hope to utilize the technological, scientific, and human resources resident in more than 50 major installations with those of industry and academia, thereby achieving improved research, productivity, global competitiveness, and more efficient government.

To lead this effort, I have designated Dan W. Reicher, Assistant Secretary for Energy Efficiency and Renewable Energy, as the Department's Environmental Executive. As the Environmental Executive, Mr. Reicher is responsible for coordinating all environmental programs relating to procurement and acquisition, waste prevention, and recycling. It is clear the Department can lower the future operating costs and liabilities of its mission activities by incorporating energy efficiency and pollution prevention into the design and modification of all facilities and programs.

We look forward to hearing your comments, ideas, and feedback on the Department's pollution prevention efforts via the enclosed comment card. Please reuse this brochure by sharing it with someone else. Thank you for your time and interest in preventing pollution and conserving resources.

Bill Richardson

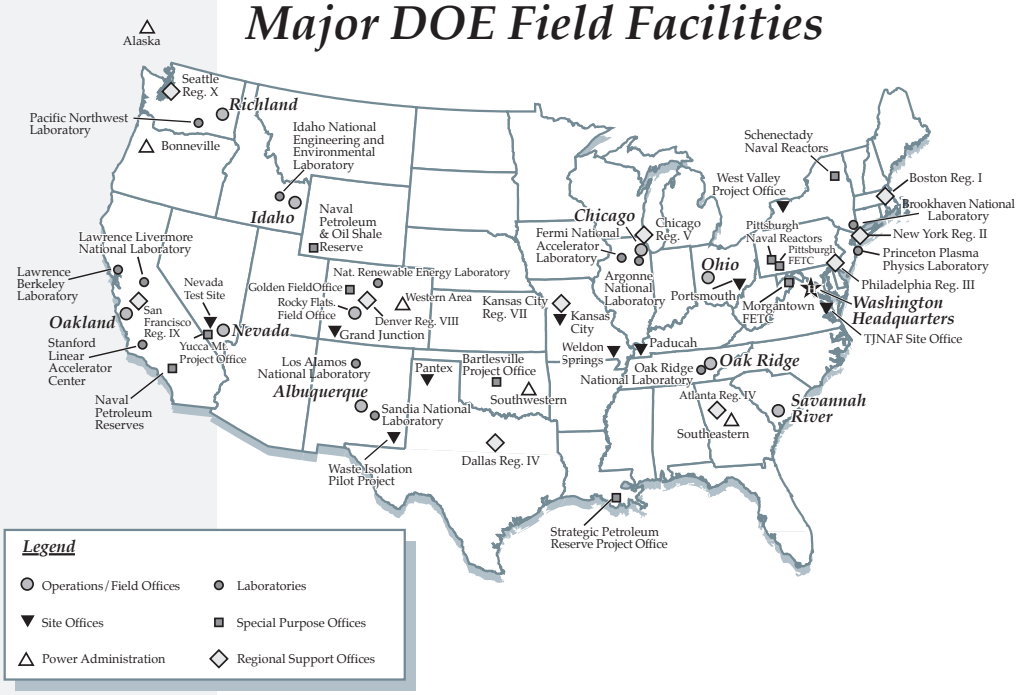
About DOE

The Department of Energy is a major government enterprise. If included among the Nation's Fortune 500 firms, it would rank in the top 50. Its $16.5 billion annual appropriation comprises close to three percent of the total Federal discretionary spending. The Department of Energy (DOE) funds the largest environmental cleanup in history, and research and development that supports the Nation's defense, energy, and economic security. DOE employs over 11,000 Federal employees and about 108,000 contract employees. The DOE owns and manages over 50 major installations located on 2.4 million acres in 35 States and is the fourth largest Federal landowner in the United States.

The DOE performs research and operations in the following four business lines to achieve its mission and benefit the Nation:

- **Energy Resources**—Encourage efficiency and advance renewable energy technologies; increase energy choices for all consumers; and assure adequate supplies of clean, conventional energy.
- **National Security**—Effectively maintain and support a safe and reliable nuclear weapons stockpile without nuclear testing; safely dismantle excess nuclear weapons; and provide technical leadership for global non-proliferation and nuclear safety activities.
- **Environmental Quality**—Reduce the environment, safety, and health risks from DOE operations; safely dispose of civilian spent nuclear fuels and defense-related waste; and develop the technologies for solving environmental problems.

Major DOE Field Facilities



- **Science and Technology**—Use the unique resources of the Department's laboratories and the country's universities to maintain leadership in basic research; advance scientific knowledge; and focus applied research and technology development in support of the Department's other business lines.

DOE's research-related responsibilities have led to distinct scientific and engineering capabilities including: energy and environmental technologies; advanced materials development; advanced manufacturing and process technology; high-performance computing and communications; high energy and nuclear physics; bio-science and biotechnology; and fusion plasma science and technology. Multi-disciplinary research and site operations require the use of raw materials (including natural resources and manmade materials), land, and energy as inputs and result in usable products and scientific discoveries as outputs, as well as emissions, discharges, and waste. The challenge is to reduce the amount of emissions, discharges, and waste while improving the quality and efficiency needed to produce these new products and scientific discoveries.

In accomplishing mission objectives, it is DOE's goal to eliminate waste generation and harmful emissions, giving priority to those that may present the greatest potential risk to human health or the environment. In May 1996, the Secretary of Energy approved several important pollution prevention goals to be met by the end of 1999, using 1993 as a baseline. These 1999 goals are shown on the following page, and new goals for beyond 2000 are currently being developed.

Pollution prevention *is a systematic assessment of materials, processes, or practices that eliminates or reduces the release of pollutants and waste into the land, air, or water.*

Pollution Prevention Reduces Waste

Routine operations waste *consists of normal operations waste produced by any type of production operation; analytical and/or research and development laboratory operations; treatment, storage, and disposal operations; "work-for-others;" or any other periodic or recurring work that is considered ongoing in nature.*

Waste Reduction Goals 1999

Reduce in Routine Operations:

Radioactive waste	*50%*
Mixed low level waste	*50%*
Hazardous waste	*50%*
Nonhazardous waste	*33%*
Total releases and offsite transfers for treatment and disposal of toxic chemicals	*50%*

Recycle in all Operations, including cleanup and D&D activities:

Nonhazardous Waste	*33%*

For affirmative procurement:

Increase procurement of EPA-designated recycled products to 100%, except when items are not commercially available at competitively at a reasonable price, or do not meet performance standards.

Our Progress To Date

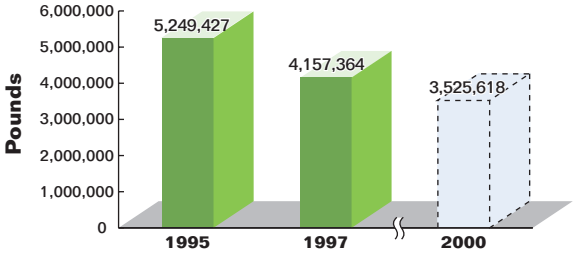
In order to meet the DOE pollution prevention goals, it is important to have an integrated planning effort, a strong implementation program, and a change in culture. The culture within DOE is extremely diverse and consists of technicians, administrators, Nobel-prize winning scientists, engineers, guards, and craftsmen. The most important task is to encourage all DOE and contractor staff and management to think about preventing pollution in all aspects of our work. Implementing a comprehensive pollution prevention program results in significant cost savings, a reduced risk to workers and the community, a reduced footprint on the Earth, and an improved, globally competitive position through enhanced productivity and increased capabilities.

The DOE and contractor staff are making excellent progress towards meeting, or going beyond, the Secretary's pollution prevention goals by the end of 1999. Since 1993, the DOE sites have reduced the generation of hazardous waste by 83%, mixed waste by 64%, radioactive waste by 67%, and nonhazardous waste by 65%. The adjacent figures illustrate DOE routine operations waste generation trends by waste type from 1993 through 1998. The following pages in this report detail specific projects resulting in the tremendous waste reduction achieved to date by the DOE sites.

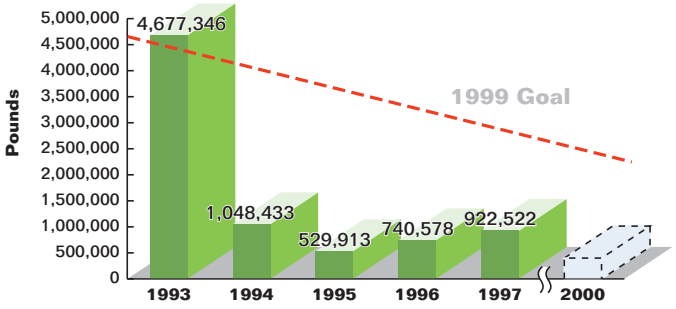
DOE sites reported 922,522 pounds of total toxic chemical releases and transfers under the Toxic Chemical Release Inventory (TRI) for 1997. The adjacent figure shows an 80% reduction using the 1993 baseline. A majority of the reduction is associated with the Naval Petroleum Reserve's implementation of better measurement practices for underground injection of methanol. Source reduction measures such as chemical substitution and process modifications and recycling of excess chemicals can also be attributed to the TRI reduction. In addition, some site operations associated with chemical usage and emissions have ceased since 1993 or production has decreased. In December 1995, the DOE was honored along with 20 private sector companies with an "Environmental Champion" award. The award, co-sponsored by EPA and McGraw-Hill Company's *Chemical Engineering* and *Environmental Engineering World* Magazines, was presented to DOE for reducing TRI chemicals. The Department reduced its use of 17 targeted chemicals by 95% between 1988 and 1993 and was the only federal agency to participate in the program.

Stratospheric ozone depletion is linked to the emission of a particular group of industrial chemicals, primarily halogenated compounds or ozone-depleting substances (ODSs). Federal law

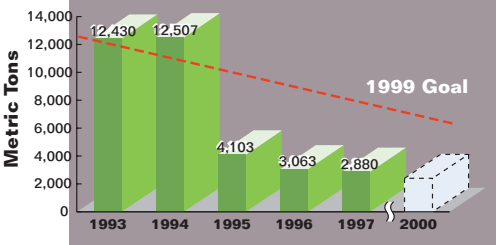
phases out the use of Class I and II ODSs. The Department's remaining usage of ODSs can be categorized in the four applications of air conditioning/ refrigeration, fire suppression, solvents/lubricants, and other special research needs. Data for current and projected inventory of Class I and II ODSs represent 43 DOE sites. It is important to note that the figures represent current ODS usage, current quantities in storage, and purchases. The Department is reducing its usage of ODSs and the resulting inventories. Major progress has been made in replacing or converting/ retrofitting chillers used for air conditioning and refrigeration; however, there is still some use of ODSs for high-precision cleaning and cooling of electronic assemblies.



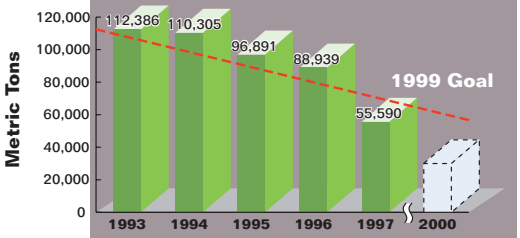
ODS usage and projections



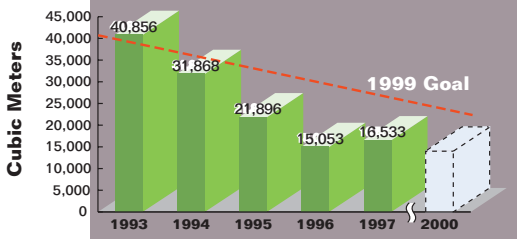
TRI releases and transfers



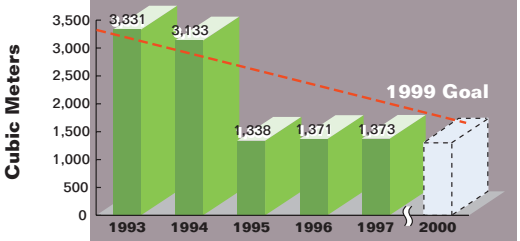
Hazardous Waste Generation (Routine Operations)



Non-Hazardous Waste Generation (Routine Operations)



Low-Level Radioactive Waste Generation (Routine Operations)



Low-Level Mixed Waste Generation (Routine Operations)

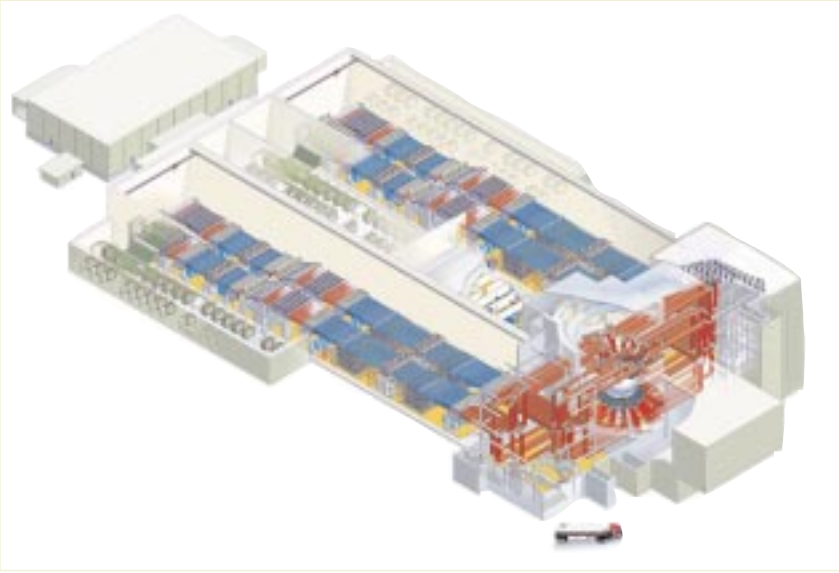
Pollution Prevention Saves Money,

Enhances Productivity, and Increases Capabilities

Key successes resulting in significant cost savings indicate that a positive change towards preventing pollution is taking place within the Department in the cross-cutting areas of: design and construction, research and testing, operations and maintenance, and cleanup and decommissioning.

Design Construction

DOE routinely performs pollution prevention analysis on the waste streams from operating facilities; however, such an analysis can be significantly more effective when it is done during the design phase of a research program or facility. Pollution prevention plans for new programs and facilities are "living" reference documents that guide the research and operations through all phases of the project, from construction through eventual deconstruction. In the final design, energy conservation alternatives are also evaluated for implementation on a life-cycle cost basis and documented in energy conservation reports.



The project team continues to perform pollution prevention analysis during the design and construction of the National Ignition Facility (NIF) at the Lawrence Livermore National Laboratory. NIF will be a national center for inertial confinement fusion and other research into the physics of high temperatures and high densities, and a vital element of DOE's Stockpile Stewardship and Management Program.

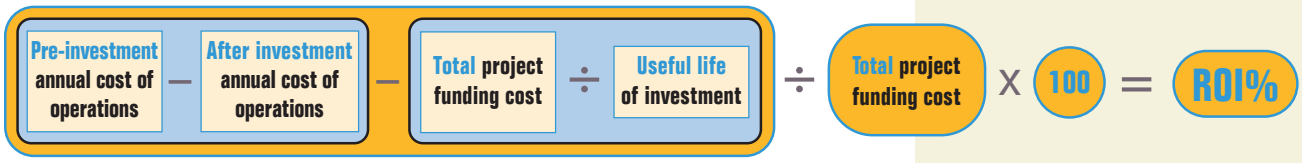
Research and Testing

Performing laboratory research and testing involves a multi-disciplinary approach. Chemistry is one of the disciplines where pollution prevention concepts have been broadly implemented across the DOE Complex since the beginning of the decade. Success has been accomplished by substituting less hazardous solvents and reusing solvents during cleaning operations, minimizing reagent consumption through the use of microscale chemistry, replacing radioactive tracers and analytical methods with nonhazardous substitutes, and incorporating the use of chemical modeling to simulate reactions and avoid the use of chemicals in experimentation.

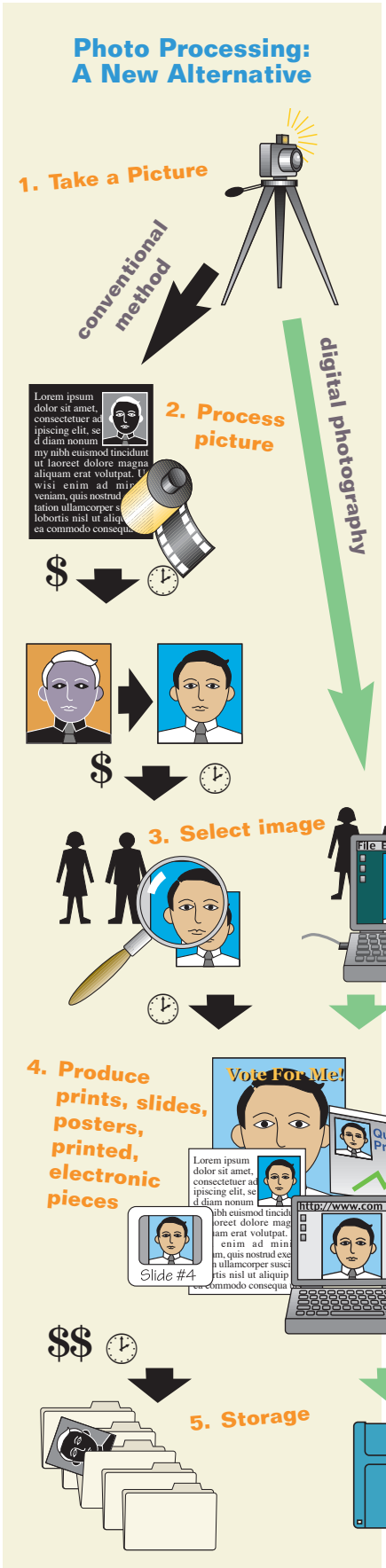
Since 1994, DOE sites have actively pursued Return-on-Investment (ROI) projects and funding. Researchers and engineers team together to design modified processes and evaluate the cost benefit associated with a potential capital investment. These projects are prioritized for funding and typically result in a less than three year payback. The Return-on-Investment program is a valuable tool resulting in enhanced productivity and reduced waste.

At Argonne National Laboratory-East, chemists incorporate the use of microscale chemistry by applying chemical principles and utilizing apparatus at a much smaller scale resulting in reduced volumes of reagents and products.

Researchers at the Lawrence Berkeley National Laboratory use a non-radioactive Luciferase assay method to eliminate their use of tritium in DNA synthesis experiments.



Since 1994, the Albuquerque, Oak Ridge, Oakland, Richland, and Savannah River Operations sites have been leaders in the implementation of a strong Return-On-Investment Program (ROI) with over 250 projects completed to date. The total implementation cost was $19 million with an annual cost savings of over $80 million.



Operations Maintenance

Our goal, as a society, is sustainable development—to meet the needs of the present without compromising the ability of future generations to meet their own needs. One aspect of sustainable operations is stewardship. By this we mean caring for our land, facilities, and equipment so that we pass them on to future generations in better condition than we found them. The Department's assets, with a capital value of $30 billion, include world class facilities and equipment. They range from nuclear reactors to oil reserves, from the world's fastest computer to the most powerful lasers, from storage facilities for dismantled weapons to advanced test areas for cleaner fuels and renewable energy.

The major advantages of using a digital system are: faster turnaround time; elimination of film and chemical processing cost; increased flexibility (i.e. the same digital file can create a variety of products); and inexpensive and easy storage of images.

Routine waste streams, similar to those found at our industrial partner sites, result from many of the common, ongoing maintenance and site operations. The following is a snapshot of some common activities and the corresponding pollution prevention successes.

The Digital Conversion—Photography, Microscopic Analysis, and X-rays

Since 1994, DOE sites have been converting hundreds of facilities used for photography, microscopic analysis, and x-ray operations from wet chemistry to digital processes. During the different stages of research testing and development, there is a need to record a tremendous number of images by using a camera, microscope, or x-ray machine. These images are often shared among researchers who may be spread out over the site or across various continents around the globe. Traditionally, the resultant images were photographs on paper or pieces of film. In the age of the "Information Superhighway," digital images can be enhanced and transmitted across great distances using a phone line and computer equipment. This change has resulted in reduced waste from these facilities by avoiding the purchase of photochemicals, film, and paper. More importantly, digital imaging and processing has drastically increased research capabilities and productivity.

Some Top Shops

Talented craftsmen and engineers operate very sophisticated equipment housed in shops for machining, fabricating, finishing, plating, cleaning and maintaining (mostly metal) parts and components used in DOE research, testing, and production. Numerous changes continue to take place in these facilities across the country. Metal plating and finishing operations are pursuing a near-zero discharge by utilizing cold water evaporators for recycling aqueous waste, scrap copper as anodes, and pressure gauges to monitor and increase the life of plating bath filters. Vapor degreasing operations, mostly used for high-precision cleaning applications in metal finishing, have either been replaced with aqueous cleaning or a closed-loop system designed to recycle the cleaner and reduce its release to the atmosphere. In machining shops, coolant recovery systems are common and many sites are implementing the use of the longer-life synthetic coolants. Some sites have initiated the use of electric discharge machining (EDM) which cuts metals using an electronically charged wire while submerged in deionized water. EDM cleanly cuts the metal so that the scrap pieces are reusable, and it does not require the use of cutting oils.

Another common waste-generating activity is vehicle maintenance. Auto mechanics and technicians are very motivated to try different techniques to reduce their consumption of oils, coolants, rags, cleaners, and tires. Some DOE vehicle maintenance shops have made use of the Smartwasher™, which uses a biodegradable substance for parts cleaning, and have converted to the use of soybean lubricants for hydraulic equipment. Many shops are recycling coolant and oils and using retread tires.

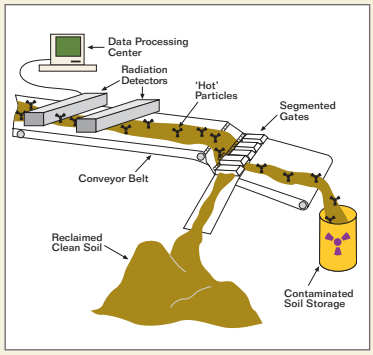
Many trained technicians and scientific staff work within areas designed for radioactive materials usage. Pollution prevention offers a unique opportunity to evaluate program activities, daily maintenance, and eventual cleanup, with the goal of reducing our use of radioactive materials. Multiple sites have completed this evaluation involving radioactive materials and have reduced the size of these special work areas, resulting in reduced waste by avoiding personal protective equipment and daily trash from these areas.

Energy Technology Engineering Center technician uses a diamond concrete cutting saw to cut thin slices along the affected concrete seams to avoid creating additional waste.

Savannah River Site (SRS) facility personnel developed a simple modification which incorporates the valve wrench/handle into the valve port cover to allow remote valve operations during the transfer of liquid wastes between tanks at the SRS High-Level Waste Tank Farm. Their innovation meant that the large valve/jumper box area could be "rolled back" to a contamination-free area resulting in reduced waste.

Hanford Site machinists utilize a parts washer that continually filters and cleans machine solvent. The washer extends the life of the solvent and reduces the procurement of new solvent and the generation of waste.

Pollution Prevention Minimizes "Our Footprint on the Earth"



The Segmented Gate System (SGS) was utilized at the Sandia National Laboratory (SNL) in New Mexico to segregate contaminated soil. The SGS locates, analyzes, and removes gamma-ray emitting radionuclides from soil, sand, dry sludge, and any host matrix that can be transported by conveyor belts. The automated system utilizes an array of sensitive radiation detectors and moving conveyor belts to physically separate and segregate radioactive contaminated material from otherwise "clean" soil. This effort resulted in a 70% reduction in the amount of waste requiring disposal in a landfill and a significant cost savings from the avoided special handling, packaging, and transportation for disposal.

Cleanup

Decontamination Decommissioning Deconstruction

The Department faces many challenges as it focuses on site cleanup and decontamination, decommissioning (D&D) and deconstruction of hundreds of buildings and support structures associated with nuclear weapons production.

During the D&D and restoration of these sites across the country, DOE is confronted with the need to remove and dispose of large quantities of soil, asphalt, concrete, metal, wood, gravel, and other construction materials and equipment. Pollution prevention concepts attempt to salvage usable resources for future projects versus implementing the traditional "dig and haul" techniques, which are expensive, inefficient, and generate large quantities of waste.

After the closure of the Lawrence Berkeley National Laboratory's Bevalac facility, 19,000 metric tons of reinforced, high-density concrete shielding blocks were no longer needed. More than one-third of them were reused at the Brookhaven National Laboratory as shielding. This is equivalent to sixty rail locomotives.

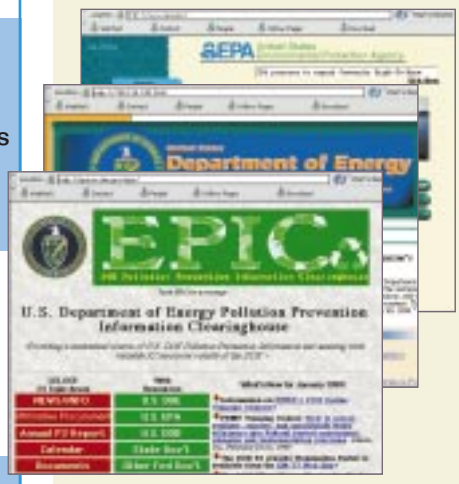
Key Tools and Promoting Resource Conservation

There are key tools and information resources used by staff across the country to increase resource conservation. The DOE Pollution Prevention Information Clearinghouse (EPIC), an easy-to-use Internet-based system, is an extensive source of pollution prevention information related to DOE, other public agencies and the private sector. EPIC provides a DOE pollution prevention listserve which allows for communication among DOE users and access to chemical and equipment exchanges across the DOE.

Communication, training and information exchange with industry and public institutions are further enhanced by intensive workshops held in different locations across the country. Pollution prevention assessments of different businesses are performed by diverse teams. Information regarding pollution prevention opportunities, successes, and failures are communicated with the industry hosts. The DOE also publishes a quarterly newsletter, entitled the *Pollution Prevention Advisor*, which highlights DOE and industry pollution prevention successes.

Goals	Strategies
• Incorporate pollution prevention and sustainability concepts into program planning, site operations and processes, and project design.	• DOE's culture will continue to change and each individual will acknowledge accountability and responsibility for the impacts of our products and ideas from cradle to grave.
• Reduce liability and costs of environmental compliance and program operation by implementing pollution prevention practices.	• DOE leadership will encourage environmental stewardship by seeking out change in our business and research practices and prioritizing available resources to support pollution prevention.
• Develop and use innovative technologies to prevent pollutants and conserve materials and resources to minimize waste from all DOE activities.	• DOE will leverage resources and pursue markets for materials in the understanding that our output materials can be someone else's input materials.
• Encourage pollution prevention through corporate commitment, proactive management, and employee recognition.	• DOE will continue to recognize creativity and innovation in preventing pollution through local and national awards ceremonies.
• Engage in partnerships with other government agencies, academic institutions, and industry to exchange pollution prevention ideas and practices on a national and global scale.	• DOE will join voluntary programs (including EPA's WasteWi$e, Climate Wise and Energy Star programs) and host workshops to foster partnerships and information exchange with industry and academia.
• Participate in educational outreach activities to further the understanding of sustainable business practices and pollution prevention in our schools.	• DOE will assist local schools in environmental education and sustainable business concepts.

Strategies for the Future



Website Links

www.er.doe.gov/epic

www.eren.doe.gov

www.epa.gov/p2

www.usgbc.org

The Princeton Plasma Physics Laboratory invited local elementary school children to participate in an Earth Day poster contest. The theme was "Global Warming Reduction through Pollution Prevention." The 1st place poster is shown above.

Resources

DOE Annual Report on Waste Generation and Waste Minimization Progress Report, 1993

DOE Annual Report of Waste Generation and Pollution Prevention Progress, 1994–97

DOE Pollution Prevention Advisor, January 1994–June 1999

DOE ESAVE, Quarterly Newsletter, September 1999–

DOE Strategic Plan, 1997