

1999

TENNESSEE VALLEY AUTHORITY



ANNUAL ENVIRONMENTAL REPORT



TVA Vision

Generating Prosperity in the Valley

TVA Goals

Supplying low-cost, reliable power

Supporting a thriving river system

Stimulating economic growth

environment



In 1933, when President Franklin D. Roosevelt first proposed the idea of TVA, he called for an agency “to be charged with the broadest duty of planning for the proper use, conservation, and development of the natural resources of the Tennessee River drainage basin and its adjoining territory.” The language of the TVA Act reflects a deep respect for the natural world, describing the “unity with which nature herself regards her resources—the waters, the land, and the forests together, a ‘seamless web’ . . . of which one strand cannot be touched without affecting every other strand for good or ill.”

These words describing the principles of sustainable development have guided TVA for 67 years, and today

we remain as committed as ever to the values they express. In the 1930s, TVA’s challenge was to reclaim the Valley’s eroded farmlands and forests, control devastating floods, establish a navigable waterway to connect the region to faraway markets, and to provide low-cost electric power to rural areas that until that time had none. TVA became a pioneer in integrated resource stewardship, creating a balance among the recreational, environmental, and industrial uses of the reservoir water behind its dams.

TVA’s challenge in the 21st century lies in maintaining the balance between our mission of supplying low-cost, reliable electric power and our duties as conservators of the region’s natural resources. As you read this first *Annual Environmental Report*, we hope you’ll agree that TVA’s overall efforts in recent years have been commendable. At the same time, we recognize that there is still much to be done.

Emissions are among the top concerns for all power providers. As the nation’s largest single producer of electric power, we recognize that TVA is part of the problem—but it’s also a key part of the solution. Over the years the agency has spent \$2.5 billion to reduce air emissions, and we’re continually working to find cost-effective ways of further improving air quality. Reports on TVA’s approach to these kinds of key environmental issues, including the Environmental Protection Agency’s air-quality enforcement initiative, reportable environmental events, auditing and compliance, and the Toxics Release Inventory, appear on pages 8 to 11.

As a place-centered public power enterprise, TVA has always embraced its responsibility to serve and protect the public interest. Since the agency’s founding, we’ve taken pride in our mission to integrate the management of the Tennessee Valley’s natural resources and protect them for the benefit of generations to come. We know that the consequences of what we do today will be felt tomorrow by our friends, our families, our neighbors, and ourselves. In the coming era of a restructured electric-utility industry, we believe that TVA will play a valuable role in ensuring that utilities, public and private, put as much emphasis on environmental responsibility as they do on the bottom line.

Craven Crowell, *Chairman*
Board of Directors

Skila Harris
Board of Directors

Glenn L. McCullough Jr.
Board of Directors

environmental stewards

A map of the Tennessee River valley shows parts of seven states, but TVA sees those lands and waters as a single 41,000-square-mile watershed.

Last summer marathon swimmer Mimi Hughes dove into the Tennessee River where it starts north of Knoxville, Tennessee, and began a five-year quest to swim its entire 652-mile length. Every August until 2003, she'll cover another 125 miles. The mission of this mother of four: to promote a cleaner river.

In a watershed, the area drained by a stream, river, or lake, every organism exists within an unimaginably diverse and interconnected web of life. But as a river like the Tennessee flows through its multistate watershed, the ecosystems it supports can get entangled in trash and pollutants.

In its management of the watershed, TVA uses a holistic, integrated method that factors water quality with other concerns to achieve a balance among the multiple demands placed on the river system. But TVA doesn't have the authority to regulate water pollution. The EPA and each of the Valley states that share the river set their own pollution regulations and grant discharge permits. Those controls are mostly focused on business and industrial operations located along the river, not on the activities of the general public.

What TVA does to improve water quality is collect and share data, highlight the problems, and promote solutions. The agency's ongoing monitoring program conducts ecological health measurements for major reservoirs, rivers, and streams throughout the watershed. Last year's findings show that extremely dry weather affected reservoir conditions, but TVA's aeration systems and summer minimum-flow levels kept



Mimi Hughes' epic journey highlights water quality issues.

the situation from getting worse. Although no swimming advisories were issued for TVA reservoirs, consumption advisories are in effect for a limited number of fish species at nine reservoirs because of residual concentrations of chemicals.

To help people in communities across the Tennessee Valley actively develop and implement protection and restoration activities in the individual watersheds they call home, TVA formed 11 multidisciplinary Watershed Teams. These teams work in partnership with business, industry, government agencies, and community groups to address non-point-source pollution (like runoff from farms and suburbs), shoreline management, and the protection of stream corridors, wetlands, and clean drinking water. The number of their activities more than doubled from 1997 to 1999, proving that the program is an effective, neighborhood-based means of helping to solve a number of water-quality problems.

Other TVA-sponsored initiatives designed to safeguard the region's water include the Tennessee Valley Clean Boating Campaign, which promotes water-quality protection on the part of recreational boaters, and Kids in the Creek, a program that teaches schoolchildren throughout the Valley about watershed stewardship.

"I want to draw attention to the incredible resource that this river provides for everyone who lives in the Tennessee Valley. I believe it's everybody's responsibility to help keep the river clean," Mimi Hughes says—mirroring TVA's sentiments.

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Resource Planning & Partnerships



The water in a watershed represents only half of its overall ecology. Land and its sustainable management also play a pivotal role in maintaining the watershed's health.

On any given day, there's a lot happening in and around the 293,000 acres of public land managed by TVA. In one part of the watershed, residential developers hoping to build on riverfront property near an acre of public land tour the site. Elsewhere, TVA scientists partner with researchers from state and federal agencies to protect the habitats of endangered plant and animal species along the Tennessee River.

TVA's Land Stewardship Planning program attempts to steer a fair course among these competing demands while maintaining the stability of ecosystems and conserving the Valley's resources for generations to come. The reservoir land-management process systematically identifies the most suitable uses of public land, with particular emphasis on protecting natural resources. Specific plans have already been completed for 141,000 acres of public land; plans for another 65,000 acres are currently under way.

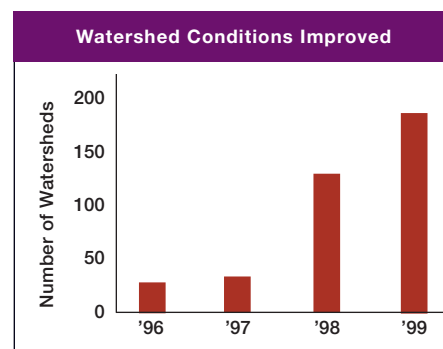
Public involvement plays a key role in this process. TVA recognizes that a fair, comprehensive strategy based on stakeholder opinion is important before it can commit to developing and implementing any management plan that will affect the region's watershed. A section of TVA's Web site, www.tva.gov/river/landandshore/landuse_action.htm, provides information about requests for land use and collects the comments that help the agency apply a plan for the area in question.

The recently formed Regional Resource Stewardship Council provides another avenue for public involvement. This 20-member advisory group will help TVA set priorities concerning the best practices for managing the public assets and natural resources of the Tennessee Valley. Its Web site (www.tva.gov/rrsc/index.htm) offers regular updates of the council's activities and a complete contact list of participating members.

Planning, public input, and partnerships—these are the elements that guide wise and effective use of the environment.

■ *TVA and The Nature Conservancy (TNC) are partners in the Clinch Valley Forest Bank, which helps conserve woodlands. The Nature Conservancy works with property owners to turn land-management rights over to TNC for sustainable forestry, in exchange for an annuity based on a percentage of the timber's value.*

■ *In 1999, TVA's watershed-improvement activities included 197 pollution-reduction projects, 54 habitat restoration and improvement projects, 1,823 site cleanups, and 11 completed reservoir land plans—to name a few.*



pollution prevention & *redu*

Power production can be a dirty business. But TVA is leading the way in showing the electric utility industry how it can clean up its act.

When the first selective catalytic reduction (SCR) system goes into operation at Kentucky's Paradise Fossil Plant this summer, it will mark another significant step TVA is taking to lower fossil-plant emissions.

This system is the first of 13 to be installed as part of a \$750 million to \$800 million emissions-reduction program. SCR controls remove nitrogen oxides (NO_x) by transforming them into harmless nitrogen and water vapor. Once complete, these systems, plus boiler optimization controls and the operation of low-NO_x burners, will reduce TVA's overall ozone-season emissions of NO_x by 70 to 75 percent. The agency is also decreasing its sulfur dioxide (SO₂) emissions by switching to low-sulfur coal and operating scrubbers at three plants.

These actions will have a beneficial effect on ozone levels in major urban areas and environmentally sensitive locations across the Valley. They'll also help reduce acid rain, nitrogen deposition, and visibility

impairment in places like the Great Smoky Mountains National Park, which faces air quality deterioration caused by a variety of sources ranging from industry and motor-vehicle traffic to power production and prevailing weather patterns.

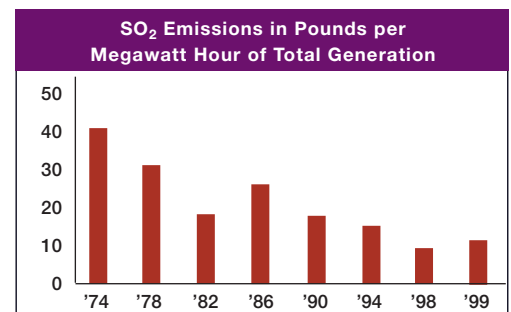
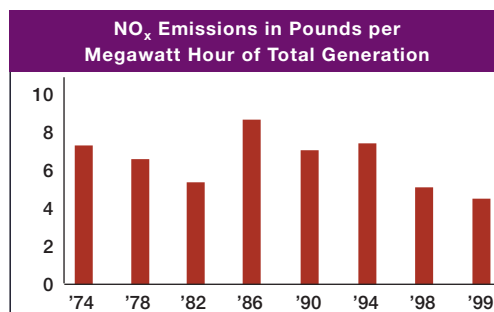
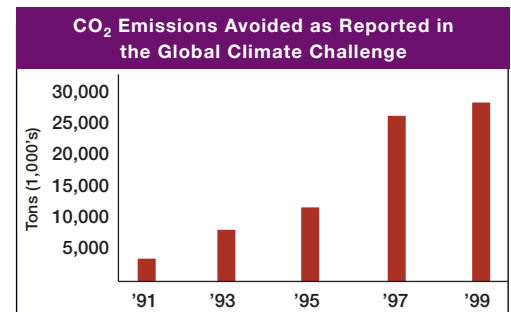
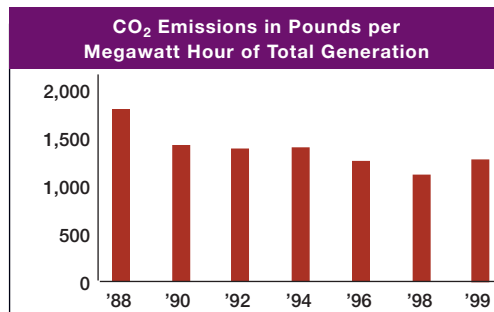
Although TVA is currently in full compliance with Clean Air Act regulations, the agency is aware of its contribution to the region's air-quality problems and is investing in emission controls that will yield the greatest environmental benefit. Fossil-plant improvements like the SCRs are an important method the agency uses to help balance the need to reduce emissions with the increased generation levels brought on by peak power demands during recent summers.

TVA continues to monitor, research, and study data that reveals air quality isn't what it used to be—that in fact, it's better in many ways than it was 20 years ago.

So is TVA a part of the air-pollution problem? Yes. But it's also an important part of the solution.

"TVA and its partners have an impressive portfolio of research on air quality. In addition to such hot-button issues as ozone and acidic deposition in the Great Smoky Mountains National Park, their work also takes in lesser-known areas like toxics and particulate matter in urban areas. Their (our) challenge is to reduce these effects within the context of the rapidly changing utility industry."

Robb Turner Ph.D., Executive Director, Southern Appalachian Man and the Biosphere



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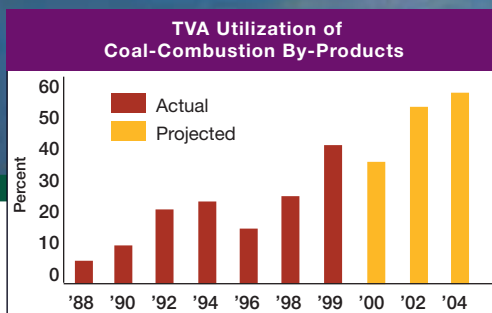
taking care of business

A bottom-ash pond may seem like an improbable site for an industrial facility. But to Appalachian Products Inc., the location at TVA's John Sevier Fossil Plant looked like prime real estate. Appalachian processes the ash from the plant and transforms it into a light-

In its transmission operations, TVA has removed PCB (polychlorinated biphenyl) from almost all of the large equipment in its switchyards and substations. At nearly half of its transmission sites, it has also implemented new oil-containment standards that will help prevent spillage.

In addition to all this, TVA conducts a large-scale recycling program at its major office facilities. And in 1999, as part of its affirmative-procurement program, the agency redirected \$6 million worth of purchases to products containing recycled materials.

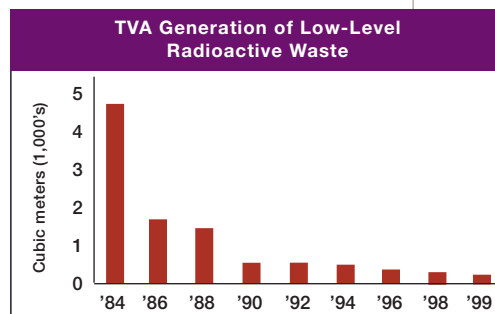
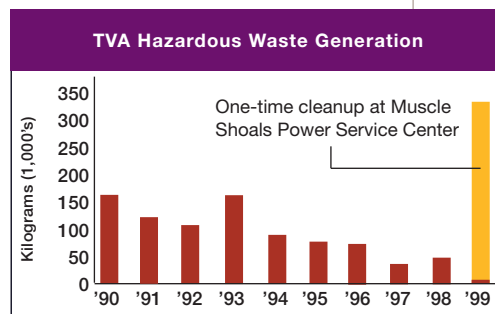
It's actions and choices like these that make pollution prevention and waste reduction business as usual at TVA.



In response to recent increases in measured ozone, TVA has formed a partnership with the National Oceanic and Atmospheric Administration, the University of Tennessee, the National Park Service, and other agencies to work on the East Tennessee Ozone Study. The study's goal is to develop an accurate air-quality forecasting system that can help researchers determine whether local measures and emissions restrictions are succeeding in reducing concentrations of ozone, or whether changes at the regional or national level are called for.

weight aggregate that's an ingredient in the concrete blocks it produces. Officially opened in November 1999, the ash-processing plant represents TVA's latest success in finding uses for the by-products from its fossil plants—fly ash, bottom ash, gypsum, and boiler slag from cyclone units. Over 40 percent of the five million tons of by-products produced by TVA plants each year are sold for beneficial reuse.

TVA helps prevent pollution in other ways as well. At its nuclear facilities, operational improvements have significantly decreased the production of hazardous and radioactive wastes. In fact, the Institute for Nuclear Power Operations has recognized TVA as an industry leader in low-level radioactive waste reduction, thanks to its efforts in the areas of employee education, source reduction, and off-site-vendor reduction.



environmental protection

TVA's efforts to protect the environment go way beyond just taking care of what's there.

TVA's erosion-control policy for the 11,000 miles of shoreline it manages is best summed up in three words: Keep it covered.

In 1994, the agency undertook the ambitious task of classifying erosion along its reservoir shorelines by extent and type. That field assessment, which surveyed almost 6,000 shoreline miles at 22 reservoirs, provided an overall view of the erosion problem. It indicated that 100-plus miles of shoreline, more than 1 percent of the total, was becoming critically eroded.

Fortunately, the solution proved simple. Using native plants suited to each particular site, TVA works to keep the soil around reservoirs in place by constructing conservation buffers—50-foot wide strips of land that remain in permanent vegetation. Scenic beauty and enhanced wildlife habitats are added benefits of these buffers. Between 1996 and 1999, TVA helped stabilize 88 critically eroding sites along 16.3 miles of shoreline throughout the watershed.

To inform waterfront landowners about shoreline soil conservation, the agency has developed a booklet and CD-ROM called *Banks and Buffers*. The package helps users select native plants that are right for specific needs, preferences, and site conditions. It also includes information on where to get the plants, how to grow them, and what aesthetic, economic, or wildlife-related value they have.



TVA watershed teams are on the job—in this case, conducting a stream survey to monitor the health of aquatic species.

“More responsible power-generation and resource-management decisions result because TVA manages the whole watershed. It helps TVA balance the interests among their customers, taxpayers, homeowners, fishermen, boaters, environmentalists, and local officials. A great benefit of this strategy is a shoreline-management zone to promote water quality within each reservoir. The vegetation growing in this 50-foot strip will help control erosion and filter runoff.”

Marty Marina, Executive Director, Tennessee Conservation League

Besides being the delicate point where water, erosion, and pollution runoff meet, shorelines are also prime recreation and land development spots. To protect natural resources while allowing reasonable access to the water, TVA adopted a residential Shoreline-Management Policy in 1999.

Under the new policy, residential access on TVA land is limited to areas where private-access rights currently exist (about 38 percent of Valley shorelines). A “maintain and gain” strategy lets landowners request permission to trade access rights—to give them up at one location in order to gain them at another. The aim is no net loss of public shoreline, and preferably a net gain.

TVA will continue to evaluate requests for building activities and review them to gauge their potential environmental impact. To ensure that future land development will be compatible with environmental-protection goals, the policy also includes new standards for docks and erosion control and requires a buffer zone for newly developed residential areas that border TVA public land.

Shaped by extensive public input, the new Shoreline-Management Policy seeks to balance shoreline development and recreational use issues with resource-conservation needs in order to keep some of the most sensitive ecosystems in the Tennessee River watershed from eroding away.

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Fish-Friendly Reservoirs

The tailwaters below Douglas Dam are teeming with life these days. There are plenty of insects for the fish to eat, and the water contains an ample supply of oxygen to support a variety of aquatic life. Species that had nearly vanished are back again and thriving. In fact, things are looking so good that the U.S. Fish and Wildlife Service, the Tennessee Cooperative Fishery Research Unit, and other agencies have already reintroduced lake sturgeon, spiny riversnails, and some types of mussels. More species, many of them endangered, may follow as experimental populations.

All this is a complete turnaround. In the past, especially during periods of drought, the rivers below high dams sometimes dried out or developed low levels of dissolved oxygen. TVA's Reservoir Releases Improvements program, which began in 1991 and won a habitat-conservation award from the Wildlife Habitat Council in 1999,

installed state-of-the-art aeration equipment like auto-venting turbines, line diffusers, aerating weirs, air compressors, and surface water

pumps to address the problem. Those investments have dramatically increased dissolved-oxygen levels and improved water quality in 300 miles of river. And there's more water too, thanks to year-round minimum-flow levels.

Upstream from the dams, the aquatic habitat is getting better as well. Through its partnerships with Trout Unlimited and the Bass Anglers Sportsman Society (B.A.S.S.), TVA contin-

ues to enhance Tennessee River watershed fisheries. For example, the agency helped restore viable populations of native brook trout in sections of the Tellico River watershed in the Cherokee National Forest. TVA has also made a concerted effort to hold reservoir levels steady during the spring weeks when water temperatures hover at 65 degrees Fahrenheit, the best temperature for fish spawning.

"The best measure of water quality is the response of the animals," says Dick Biggins, fish and mollusk recovery coordinator for the U. S. Fish and Wildlife Service in Asheville, North Carolina. "If something living in the water is doing well, if the fauna is coming back, then you really know the water quality is coming back."



TVA's reservoirs and the land surrounding them provide habitats for threatened or endangered species like the bald eagle. Biologists employed by the agency have identified 56 sites where populations of federally listed species can be found on TVA land. They work to track population trends and to build a base of knowledge that will help protect wildlife.

"The Tennessee River watershed is an incredible source of recreation and other diverse public benefits for local citizens in the Valley. TVA's very effective stakeholder outreach separates it from other agencies. TVA gets stakeholders involved in many agency decision processes and empowers them to find solutions to common problems. Because of this, Tennessee Valley natural-resource stakeholders have a better grasp of the multiple purposes of the integrated system and how valuable all the benefits are."

Bruce Shupp, National Conservation Director,
Bass Anglers Sportsman Society (B.A.S.S.)

reportable environmental events

*Just the facts about TVA's reportable events
and the self-auditing program that helps keep them in decline*

By their very nature, all reportable environmental events (REEs)—occurrences that violate regulatory requirements and trigger notification to or enforcement action by a regulatory agency—are important and taken seriously. An REE may be a spill or other accidental release, a permit exceedance, or a paperwork-related issue. In 1999 TVA experienced 48 REEs, of which seven had the greatest environmental impact.

At two TVA hydropower plants, accidental discharges of lubricating oil from turbine units led to spills into the Tennessee River. A closed valve at one facility caused pressure to rise until a seal ruptured and began releasing oil. Some oil was seen downstream, but TVA workers prevented the release of 1,200 gallons of oil by shutting down the turbine, installing headgates and tailgates, and deploying a containment boom below the dam to recover most of the oil. Improved maintenance procedures have been implemented to ensure that valve settings are correct and prevent overpressurization. At another plant, the failure of a compression fitting caused an oil-line leak and some 800 gallons of lubrication oil spilled onto the powerhouse floor. The break was quickly repaired and less than a gallon of oil actually reached the river. The damaged fitting and potentially faulty fittings on three other turbines were replaced with a welded design that greatly reduces the likelihood of failure.

Ash sluice-line breaks created problems at three of TVA's fossil plants. When lines carrying an ash-and-water



mix ruptured, discharges occurred at unpermitted points instead of in the plants' appropriate ash ponds. In each instance, the piping was repaired; then TVA instituted preventive maintenance procedures and periodic inspections to help avoid future ruptures. It also conducted employee training to help prevent unpermitted discharges.

In TVA's transmission operations, a failure to remove trees and treetops felled during routine right-of-way maintenance caused blockage in a nearby stream. The access road cut to the site was not seeded, and erosion became an issue as well. TVA responded

with appropriate site-remediation measures and personnel training.

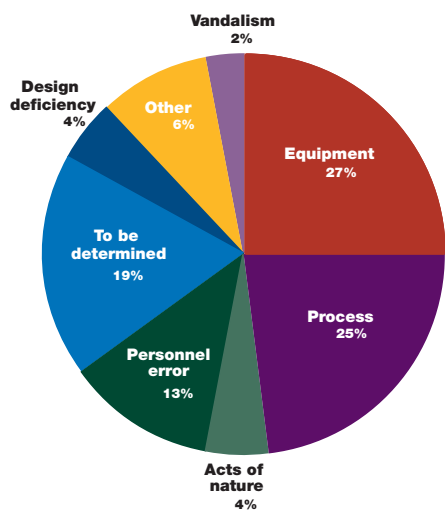
During an environmental audit at one of the agency's hydro facilities, workers noticed oil leaking from one of three plastic-wrapped transformers in the powerhouse loading bay. The transformers had been removed from service and were in temporary storage there, awaiting disposal at an EPA-approved facility. A total of one gallon of polychlorinated biphenyl (PCB) oil, which is used as insulation in older transformers, had leaked from a broken seal. The oil was cleaned up according to EPA spill guidelines, and all waste materials were properly disposed of.

TVA is actively working to decrease the number and severity of reportable environmental events like these. By improving its processes and programs and expanding its training, it has achieved a 59 percent reduction in reportable events since 1995.

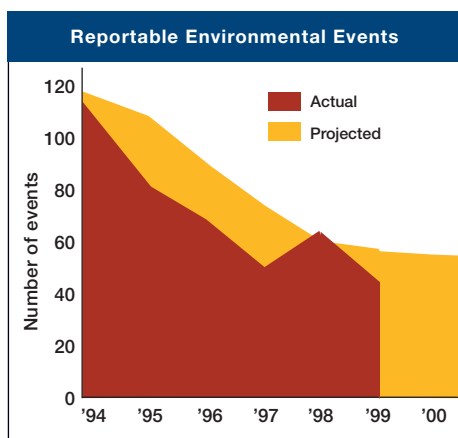
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Self-Auditing Program

Causes of Reportable Environmental Events in 1999



■ *A number of problems can lead to a reportable environmental event, but often easily solved process and equipment flaws are the largest contributing factors.*



TVA's success in reducing the incidence of REEs is partly attributable to its self-auditing program. Since 1995, TVA employees have conducted 220 internal audits designed to support the agency's operations and promote compliance with local, state, and federal regulations. These audits provide TVA management with a means of verifying that environmental controls and processes are in place, that they are working effectively, and that the lessons learned by finding and eliminating the root causes of operational flaws are being shared throughout the agency.

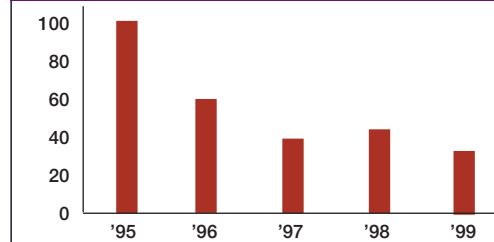
The number of audit findings has fallen by almost 70 percent in the past four years, and the seriousness of those problems has decreased even more. Audits conducted in 1999 showed that effective environmental programs are in place, and more recent audits have primarily identified opportunities for improvement in administrative areas, such as training, labeling, and recordkeeping. Some of these issues could have the potential for environmental impacts if not corrected, so TVA is taking them all seriously

and working to fix them as quickly as possible.

TVA's Office of the Inspector General also conducts internal audits. For instance, an audit of equipment containing polychlorinated biphenyl (PCB), completed in 1999 determined that the agency has had only mixed success in reducing its use of this equipment. A more concerted removal effort may be needed both to eliminate the risks and potential liabilities associated with the remaining equipment and to avoid the expense of PCB management

(particularly spill cleanup). The majority of the PCB-filled transformers and capacitors that could have the greatest impact on the environment have already been replaced or retrofilled (refilled with non-PCB insulation). Work on the rest will be largely completed by 2006, at an estimated cost of \$35 million.

Percent of Audit Findings Compared to 1995 Baseline



toxics release *inventory*

TVA discloses the contents of its fossil-plant emissions and responds to the EPA's Enforcement Initiative.

The Toxics Release Inventory (TRI), an Environmental Protection Agency-maintained database, records the quantities of any of 650 potentially toxic chemicals that are released into the environment, not only by power plants but also by hundreds of industries across the United States. Beginning last year, electric utilities were required to report annual TRI data to the EPA. TVA released its 1998 TRI information first to the public and then to the EPA, on July 1, 1999.

TVA burns approximately 40 million tons of coal per year. Emissions are an inevitable product of such large-scale combustion. The agency's 57 million pounds of releases are characterized in the pie chart shown above at right.

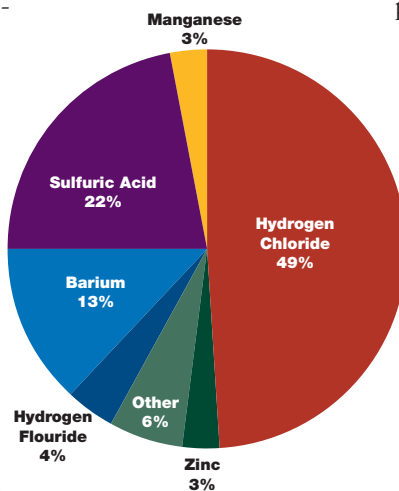
To determine the primary exposure risk to public health, TVA has voluntarily conducted assessments of the inhalation health risk posed by its air emissions. The assessments examine occupational exposures, acute or short-term exposures, chronic or long-term exposures, and potentially cancer-causing exposures. To measure the risk accurately, TVA used nationally recognized guidelines from the

state of California, the American Conference of Governmental Hygienists, and the EPA. Its study was independently verified by Lawrence B. Gratt Ph.D., author of *Air Toxic Risk Assessment and Management*.

The findings showed that the concentrations of chemicals released by TVA posed no significant health risk to any TVA power plant employees or Valley residents living within 50 kilometers of the plants—a conclusion consistent with those of national risk-assessment studies conducted by the EPA and the Electric Power Research Institute (EPRI).

TVA plans to expand its risk assessments in the future. The agency recently established a partnership with EPRI in order to examine the health risks resulting from forms of exposure other than inhalation. The study will take place over a three-year period and TVA will continue to update its assessments yearly to ensure that the most current risk-assessment methodologies and guidelines are employed.

More information about TVA's Toxics Release Inventory can be found on the agency's Web site, at www.tva.gov/power/tri/index.htm.





EPA Enforcement Initiative

The Tennessee Valley Authority and the Environmental Protection Agency share the goal of reducing fossil-plant emissions.

In early 1999, TVA began working with the EPA to develop a cost-effective solution that yields the largest pollution reduction for the investment.

TVA complies with all requirements of the Clean Air Act. It also routinely maintains its generating plants to maximize their efficiency and improve their performance—a practice that supports system reliability and helps keep electricity costs as low as possible. But recently the EPA began viewing this routine maintenance as creating a “new source” of emissions. The EPA’s contention is that such “new sources” must meet the more stringent pollution-control standards applied to newly built generating facilities. This change reflects a dramatic shift in the way the EPA

has interpreted these regulations for the past 20 years.

The EPA now claims that 80 to 90 percent of the utility industry is in violation of its pollution-control requirements and it issued an administrative order against TVA claiming that TVA was in violation of the Clean Air Act’s new source review program. This new interpretation of an old rule could threaten the region’s power supply and impact the cost of power to TVA customers. Unfortunately, after almost a year of efforts to resolve the EPA’s concerns, TVA and the EPA were unable to reach a resolution. To protect the interest of its customers, TVA has petitioned the court to review and stay the administrative order. TVA must be able to continue to maintain its plants while supplying low-cost, reliable power.

While TVA believes that it must continue to reduce emis-

sions, the agency is focusing its resources where they will produce the most substantial environmental improvements. For example, TVA is implementing a plan to reduce nitrogen oxide emissions during the ozone season by 70 to 75 percent at a cost of \$750 million to \$800 million. (For more information about TVA’s air emissions, see the related story on page 4.)



research technology

As a public power enterprise, TVA is uniquely positioned to develop, demonstrate, and deploy new energy technologies for a better tomorrow.

BREAKTHROUGHS IN ALTERNATIVE TECHNOLOGIES



This frostless heat pump was selected as a winner of the R&D Magazine 1999 R&D Awards which recognize the most technologically significant new products of the year. TVA and the Oak Ridge National Laboratory partnered on this project, which reduces outdoor coil defrosting needs and heat operating costs.

Whether it's testing cutting edge power sources like fuel cells and microturbines or developing award-winning innovations like a frostless heat pump that conserves energy through efficient design, TVA's new Public Power Institute (PPI) is always thinking about tomorrow.

The Institute's mission is to bring new ideas and technologies to the world of electric energy by showcasing those that offer the most efficiency to consumers and protection to the environment. Working from TVA's Environmental Research Center campus in Muscle Shoals, Alabama, more than 60 PPI scientists and engineers use the TVA power system as a living laboratory for research on energy-pollution reduction, sustainable and clean energy, industrial ecology, and energy-use improvement technologies. In partnership with EPRI and Valley public power providers, PPI develops, demonstrates, and deploys the most promising of these



PPI is using cutting-edge computer modeling and monitoring to locate areas of high wind potential. It also continues to work with wind turbine designs to decrease cost and maintain high efficiency.

green-energy systems. As an instrument of public power, PPI bridges the gap between institutions engaged in basic research and the marketplace, with its preference for tried-and-true technology. "TVA is uniquely positioned to conduct full-scale, commercially based demonstrations," says PPI Director Anda Ray. "People don't want to invest a lot of money in setting up a business until they see that the risk has been lowered. Through demonstrations that use the TVA power generation and transmission system, we can close that gap."

While helping to introduce new technologies into the marketplace, PPI also looks for ways to reduce or eliminate the environmental effects caused by current methods of energy production, delivery, and use. And it acts as a public power advocate, providing input on regulatory and public-policy issues.

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Wastewater treatment innovations

Recently in northern Alabama, a rapidly growing community needed more housing but couldn't support it. The problem: There was no municipal sewer system, and poor soil drainage ruled out drainfields. In a demonstration project carried out in cooperation with the Joe Wheeler Electric Membership Corporation and the state of Alabama, TVA designed a decentralized wetlands wastewater-treatment system that provides low-cost sewage treatment and requires minimal maintenance.

Wetlands treatment systems are an environmentally friendly alternative to conventional chemical and pump methods. They're also economical to build; they can cost 50 to 90 percent less than traditional wastewater-treatment systems. Custom-designed for specific circumstances, they can serve one house or many, a small livestock operation or a large industry.

TVA owns and operates one of the most sophisticated constructed-wetlands

research facilities in the world. The agency has patented an innovative reciprocating wetlands system in which a series of adjacent water cells are alternately drained and refilled on a recurring basis. Water drained from one cell is used to refill the next, a process that efficiently removes wastewater pollutants by means of the presence (or absence) of oxygen.

TVA operates 20 passive wetlands systems at its fossil plants and reclaimed coal mines that can treat over 40 million gallons of water per day. And it's incorporating this technology into new ammoniated-wastewater treatment systems, which eliminate the ammonia compounds resulting from the fossil plants' installation of new air-pollution controls. These wetlands systems have revolutionized the treatment of acid drainage and other discharges associated with the coal and electric-utility industries.

"TVA's Public Power Institute represents a return to the original vision of TVA as a proving ground for innovation. We see the institute as a place where TVA will seriously address the questions of energy and environment in the future. TVA has an opportunity to provide leadership for the nation at a critical time in the electric power industry's history, but this institute must be bold enough to provide that leadership by not becoming too ingrown and self-serving."

Barbara Simpson, *Secretary and Treasurer, Southern Alliance for Clean Energy*



energy efficiency Renewable

By exploring environmentally friendly power production, energy conservation, and educational programs, TVA generates power for future generations.

When it comes to electricity, the choice is usually limited to on or off. Today, however, many Valley residents are able to decide if they want to go green.

Working with the environmental community, TVA has teamed up with local public power providers in 12 test markets to add new, cleaner energy sources to the Valley's power mix. The initiative, called Green Power Switchsm, will use wind, solar, and landfill-gas technologies to generate electricity. If the test is successful, green power could be offered to all consumers in TVA's service area by 2003.

The green in green power comes from its renewability. Resources like wind and sunlight produce energy today that renews itself tomorrow—like a growing plant. As the market test gets under way, landfill gas will provide the largest proportion of green power. The methane gas that landfills emit as the organic material in them decays can be collected for use as fuel—taking literal advantage of the old adage about one person's treasure in another's trash. A highly developed and mature technology, the conversion of methane to an energy resource also rids the atmosphere of a potent greenhouse gas that ordinarily has to be vented or burned to prevent gas buildup in landfills.

Capturing wind energy creates no air pollution at all and, if the turbines are sited properly, has little environmental impact. TVA's three wind turbines, located on a reclaimed strip mine on Buffalo Mountain in Anderson

County, Tennessee, will produce about six million kilowatt-hours of energy each year—enough to serve more than 400 typical Valley households. Solar power makes use of one of the cleanest energy sources around, and TVA is currently installing photovoltaic panel arrays in the service areas of participating power providers. Although the program's capacity to generate energy from wind and sunlight will be small at first, it will grow as demand increases.

Participation in Green Power Switch will add a little more expense to users' monthly utility bills. Although renewable resources may be free, the technology used to capture the energy they produce is still more expensive than traditional power generation methods. Residents in the test markets are able to buy third-party-certified green power in 150-kilowatt-hour blocks (about 12 percent of a household's monthly energy consumption) for an additional \$4 each. Green Power Switch is also being introduced to commercial and industrial consumers who are being asked to buy numbers of blocks based on the amount of energy they use.

By choosing to pay a little more for green power, consumers invest in the market application of environmentally friendly power generation technologies—a trend that TVA hopes will add up to bring the cost of green power down. In the meantime, making the switch to green power does make a difference. Buying just one block of green power per month for a year is equivalent to avoiding the emissions released by driving a car 1,100 miles.

"In an era of warming climate and unprecedented population growth, renewable energy is one solution to the urgent problems that confront our world. We look forward to TVA becoming a leader in the promotion of clean energy in the years ahead, and to commitment of its use by consumers in the region."

Frances Lamberts, *Chairperson, Natural Resources Committee League of Women Voters of Tennessee*

bles

In-School Programs

The earth itself can provide a source of energy that's kind to the environment. Summer or winter, from one decade to the next, the temperature 20 feet or more below ground stays at a constant 62 degrees in the Tennessee Valley. This unchanging temperature regulator now heats and cools schools, homes, and businesses throughout the region—thanks to geothermal technology.

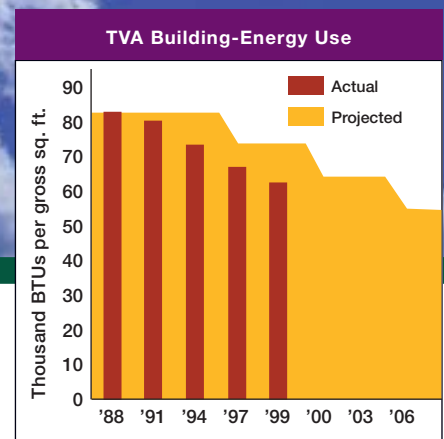
It's a simple concept that uses underground pipes filled with plain tap water to transfer heat. In winter, the water absorbs warmth from below the frost line and carries it to heat pumps above ground. During the summer months, the cooler temperature underground is brought to the surface.

Not only are these systems quiet, reliable, efficient, and compact, they also deliver energy economically, quickly recouping the initial cost of installation. At Daniel Boone High School in Johnson City, Tennessee, a geothermal system has lowered the electrical bill by 40 percent. The school installed a geothermal system because its original heating-and-

cooling system was aging, and TVA offered the county a demonstration incentive to try the alternative energy source. The resulting savings mean that the county can now use more of its operating budget on what matters most: teaching children.

And that's something TVA also has a hand in. Through a program called In Concert With the Environment, TVA and a number of Valley power providers share energy-conservation tips with middle and junior high school students. They monitor their families' household energy use and learn about the links between energy consumption and the environment. One result of this award-winning program is that students and their families adopt almost a third of its energy-saving strategies.

Whether it's tapping the earth's power for the next generation or simply showing them how to use it, TVA keeps its eye on the future.



TVA buildings use less energy than those of any other government entity.

Johnson County Vocational School in Mountain City, Tennessee is another school that benefits from a TVA-sponsored geothermal system. Here, students study aquaculture in its 9,000-square-foot Alternative Farming Center.



a l o o k t o t h e *future*



As part of our background work for this publication, we surveyed TVA stakeholders about the standards by which they might judge this report. Our stakeholders asked us to be an honest broker—to describe the good things we did last year, but also to state where our performance needs improvement. And they asked us to make it clear how they can continue to stay informed about TVA’s environmental performance and help set the agency’s direction for the future.

In 1999, as in all years, resource conservation and watershed protection were the cornerstones of TVA’s sustainable development efforts. In April the TVA Board adopted a first-of-its-kind residential Shoreline-Management Policy that will accelerate the protection of shorelines and riparian areas. Our River Operations Group made additional investments in hydropower technologies that squeeze more power from less water without harming aquatic habitats. In the coming years, the challenges we face will include working to protect water resources and quality of life from the pressures of population growth both within and outside the Tennessee Valley.

TVA continues to set goals for the improvement of air quality in the region. We know that in the future we must find cost-effective ways of producing the electricity that supports the Valley’s growing economy and its residents’ way of life. As we move ahead, we must make technology our ally. Yet both public and private investments in energy research and development stand at a 20-year low. Our plan is to use the Public Power Institute as a means of igniting efforts by which TVA and others interested in enlarging the contributions of public power providers can use science and technology to protect the environment.

Ever-escalating claims for access to TVA’s generating, transmission, and water-control assets are threatening the agency’s customary balance of public benefits. Many of the people, places, and institutions that would gain by a different distribution of these federal resources do not reside within traditional boundaries. Our challenge is to ensure that the benefits continue to serve the sustainable development needs of this region. The year 2000 marks the first meetings of TVA’s Regional Resource Stewardship Council, which will play a pivotal role in helping the agency determine if or how a redistribution of the public benefits it provides would produce a more efficiently integrated resource-management system.

There is no substitute for ongoing communications with the people we serve. We look forward to continuing to serve the public good, guided by the same ideals of sustainable development on which TVA was founded.

A handwritten signature in black ink, appearing to read 'Kathy Jackson'.

Kathryn J. Jackson Ph. D.
Executive Vice President and Environmental Executive
River System Operations and Environment

For more information about TVA's environmental practices or policies, call 865-632-2333 or visit www.tva.gov



FROM TOP: Hikers enjoy the view from the top of Fontana Dam in North Carolina; a red-breasted duck; raccoon paw prints; a junior biologist sorts soil samples at a TVA Kids in the Creek program event.

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