

# Putting the Brakes on Carbon Emissions

## Energy Department Report Cites Role of Increased Output from Nuclear Plants

**M**ore is less—especially when it comes to nuclear energy and emissions of carbon dioxide, the major greenhouse gas.

Significantly higher electricity production at the nation's 103 nuclear power plants in 1999 helped slow the rise in carbon dioxide emissions, according to the Energy Department's Energy Information Administration.

Last year, 82 percent of U.S. greenhouse gas emissions consisted of carbon dioxide released through the combustion of energy fuels—coal, petroleum and natural gas. EIA estimates that carbon dioxide emissions from the U.S. electric power sector were 1 percent higher than the 1998 level—half the average annual increase in CO<sub>2</sub> emissions since 1990.

If nuclear energy production had not

reached record highs in 1999, EIA estimates that carbon dioxide emissions from fossil-fired electricity generating plants would have been higher by 11.7 million metric tons of carbon equivalent. That would be like having an additional 9.5 million passenger cars on the nation's highways for a whole year.

Thanks to nuclear energy, those virtual cars never hit the road.

# Notes from the Netherlands

## Nuclear Energy a Valuable Carbon Reduction Tool, Say Supporters

**T**HE HAGUE—Strong congressional support for nuclear energy and effective representation of the industry by young nuclear professionals from around the world were among the highlights of the two-week global climate change talks in the Netherlands.

With Holland's misty rain and exquisite art and architecture serving as the backdrop for the United Nations' COP6 (Conference of the Parties) negotiations, thousands of delegates, diplomats, journalists and special-interest groups swarmed in and around The Hague's Congress Centre from mid-November through Thanksgiving.

One of the principal issues of discussion was whether the delegates would draw up a formal list of technologies to reduce carbon and other greenhouse gases, or whether nations would have the flexibility to select technologies that best fit their needs. Nuclear energy is the most effective means to provide both large-scale electricity and avoid carbon and other air emissions in the United States, and is an advanced technology that can be used to improve the standard of living and improve air quality globally.

A contingent of more than 40 young

*Continued on page 2*



PHOTO COURTESY OF LEILA MEAD/ISD

**South Korea's nuclear energy program is an example for developing nations to emulate, according to young nuclear professionals at The Hague.**



## Climate change from page 1

nuclear professionals—united under the Young Generation banner and hailing from locales as close as Belgium and as distant as Canada, Japan and the United States—discussed the clean air benefits of nuclear energy with delegates to the U.N. summit, erected an arch of 900 blue balloons to symbolize the technology's environmental benefits, and conducted a presentation to educate attendees about successful nuclear waste management techniques.

Supporters of nuclear energy from the U.S. Senate and House of Representatives also made their presence felt—even when they weren't physically on hand—by pointedly urging the Clinton administration and its negotiators to advance technology-neutral policies that would assure that nations of the world can use nuclear energy as a tool to help them fulfill their greenhouse gas emissions targets established in the 1997 Kyoto Protocol.

"The global economy—both developed and developing nations—must have unfettered access to all technologies that can reduce or avoid the production of greenhouse gases, and provide the tools for economic development necessary to improve worldwide standards of living," three leading U.S. senators stated in a Nov. 17 letter to President Clinton.

"No technology that reduces or avoids the production of greenhouse gases should be excluded or underutilized," said Energy and Natural Resources Committee Chairman Frank Murkowski (R-Alaska), Environment and Public Works Committee Chairman Bob Smith (R-N.H.) and Environment and Public Works Subcommittee on Clean Air Chairman James Inhofe (R-Okla.).

Days later, when nearly a dozen members of the U.S. Senate and House of Representatives arrived in The Hague, U.S. negotiators heard similar sentiments voiced face to face.

Meanwhile, attempts by anti-nuclear activists to portray nuclear energy's climate change prospects as fading were belied by statements made repeatedly by U.S. negotiators to depict American progress in curbing greenhouse gas emissions.

At press briefings—in a statement that became virtually a U.S. mantra—top American negotiators provided a context when they said that over the past two years, the U.S. economy grew by 8 percent while U.S. greenhouse gas emissions increased by only 1 percent.



## WORLD CONFERENCE CLIMATE CHANGE 2000 THE HAGUE

"We arrive here, I am happy to say, able to report that...we are making steady and significant progress in our effort to reduce greenhouse gas emissions at home, even at a time of unprecedent-

ed long economic growth," said Frank Loy, head of the U.S. delegation and the under secretary of state for oceans and international environmental and scientific affairs.

Neither Loy, nor Assistant Secretary of State David Sandalow before him, explicitly credited nuclear energy for the U.S. progress. But NEI's Maureen Koetz, director of environmental programs, noted that "nuclear energy avoided 168 million metric tons of carbon in 1999—more than any other electric technology—and is responsible for nearly half of all voluntary carbon reductions by U.S. industry under a 1992 federal program."

## Stewards of the Environment

**W**ind Over Wings—a rehabilitation center for raptors and large water fowl—has dedicated an American bald eagle in its care to Northeast Utilities. NU operates the Millstone nuclear power plant in Connecticut.

The eagle, named Denali by NU employees and their children, was injured when she fell out of her nest. She was dedicated to NU in recognition of the support the company and its employees give to Wind Over Wings.

"NU's support has provided a vital link to reaching about 33,000 people annually with our education programs featuring bald eagles, hawks, ravens, blue herons and owls that were injured in their natural habitat," said Hope Douglas, president of Wind Over Wings.

"We are honored to have played a small role in the recovery of this and other noble birds in WOW's care," said Michael Morris, president, chairman and CEO of NU.

### FERMI NUCLEAR PLANT RECOGNIZED

Detroit Edison Co.'s Fermi nuclear power plant is a Michigan Clean Corporate Citizen. That's the designation given to the plant by Gov. John Engler, according to Russell Harding, director of

the state's Department of Environmental Quality.

"I congratulate the Fermi 2 team for its achievement and dedication to responsible environmental management," said Engler. "This commitment to a safe and sustainable operation makes the Fermi staff and management... environmental leaders in the production of electricity."

Fermi was recognized for its environmental management system, which includes a site-wide recycling program.





# Consolidation Continues

## More Nuclear Plant Sales, Merged Operations Expected

The three nuclear generating units at New York's Indian Point nuclear plant may soon be under a single owner—for the first time in their 25-year operating history.

Earlier this year, New Orleans-based Entergy Corp. agreed to buy Unit 3, together with the James A. FitzPatrick nuclear plant, from the New York Power Authority. That sale was closed in November. The same month, Entergy reached agreement with Consolidated Edison on the purchase of Indian Point 1 and 2. Unit 1 has been shut down and in safe storage since the early 1970s.

Under the agreement, Entergy will pay Consolidated Edison \$502 million for units 1 and 2, three natural gas-fired turbines and other assets at the plant. Entergy also agreed to pay book value—estimated at about \$100 million—for the nuclear fuel. In addition, Entergy has agreed to sell the electricity generated at Unit 2 to Consolidated Edison through 2004.

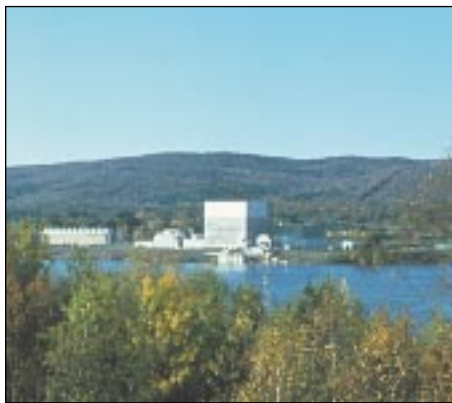
With the acquisition of Indian Point 2, Entergy will have four operating nuclear generating units in the northeast. The company bought the Pilgrim plant in Massachusetts last year.

### HIGHER BID FOR VERMONT YANKEE

Vermont regulators are considering a new offer from AmerGen Energy Co. for the Vermont Yankee nuclear power plant. After the state's Public Service Board said the company's initial offer of \$10 million was too low, AmerGen came back with a much better offer—\$93.8 million, which includes \$61 million for the plant and property, for the costs of an upcoming refueling outage and for new fuel.

Under the new proposal, which has been accepted by Vermont Yankee's owners, AmerGen would sell electricity to 61.5 percent of the owners.

In late November, Entergy Corp. unexpectedly threw its hat into the ring to buy the plant. The company—which had unsuccessfully bid against AmerGen for Vermont Yankee a year ago—told state regulators that it wanted an opportunity to submit an "improved offer" for the plant.



Two companies are vying for the Vermont Yankee nuclear power plant.

### MIDWEST NUCLEAR OPERATOR GETS BIGGER

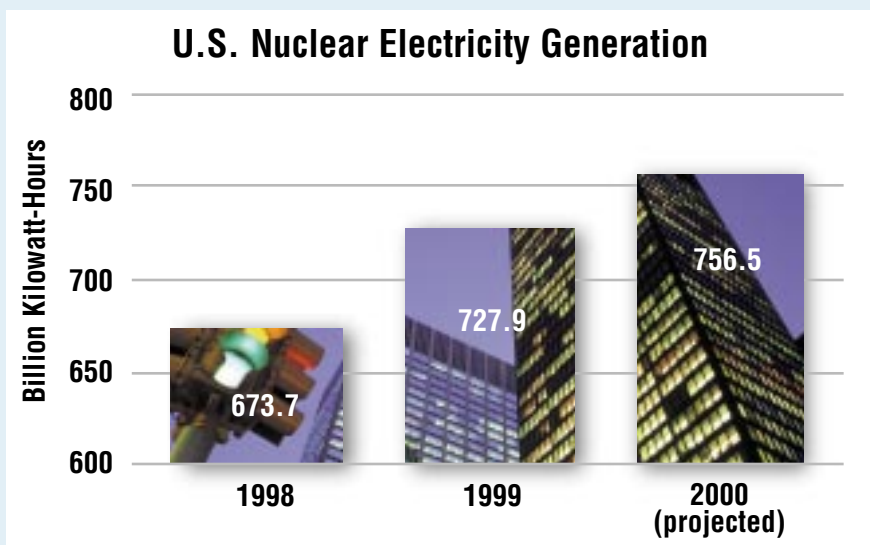
Consumers Energy has approved the transfer of operating responsibilities for its Palisades nuclear plant to the Nuclear Management Co. (NMC). When completed, the transfer will make NMC the sixth largest nuclear power plant operator in the United States.

Nuclear Management Co. operates seven nuclear generating units at five plant sites—Kewaunee and Point Beach in Wisconsin, Monticello and Prairie Island in Minnesota and Duane Arnold in Iowa.

## Nuclear Plants Light the Way

This year, U.S. nuclear power plants are projected to produce even more electricity than last year's record pace. Nuclear output for 2000—if the projection is borne out—will be 4 percent higher than last year, and a whopping 12.3 percent higher than 1998.

That 12.3 percent increase translates into enough electricity to meet the needs of 6.3 million customers—residential, commercial, industrial and public. And the 4 percent increase would supply power to 4.1 million customers.



Sources: EIA Annual Energy Overview  
EIA Short-Term Energy Outlook (November 2000)

# U.N. Report on Radiation Is 'Scientific Consensus'

## Document is Comprehensive and Unbiased, Say Participants

The latest publication issued by a United Nations committee on the sources and effects of radiation is a weighty tome—in every sense of the word. “It’s unique—the scientific consensus bible of what’s happening in the field of ionizing radiation,” says Fred Mettler of the two-volume, 1,120-page report. Mettler heads the University of New Mexico’s radiology department, and represents the United States on the committee.

Every year, says Mettler, thousands of articles and reports are written about radiation. Most countries cannot synthesize all this information, he says. That’s where the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) comes in.

“Governments and organizations around the world rely on the [UNSCEAR] evaluations of the sources and effects of radiation as the scientific basis for estimating health risk, establishing radiation protection and safety standards and regulating radiation sources,” says Burton Bennett, a recently retired member of the committee’s scientific staff.

The committee is the one of the grand-daddies of the United Nations. Formed in 1955 because of concern about the effects of atmospheric weapons testing, UNSCEAR focused its first two reports on this issue—and was instrumental in bringing about the atmospheric nuclear test ban in 1963, says Bennett. One reason for its authority, he says, is its independence.

UNSCEAR has issued reports periodically since then, gradually broadening the scope and depth of its review of data and studies on radiation from all over the world.

The report offers facts, says Mettler, but it gives no guidance. That’s the task of the International Commission on Radiation Protection (ICRP), which examines the UNSCEAR reports and recommends exposure limits to protect the public and workers who use radioactive materials. In its 1988 report, UNSCEAR revised its estimates of radiation risk, mainly because of new data from ongoing studies of survivors of the Hiroshima atomic bombing.

As a result, the ICRP recommended a reduction in the amount of radiation to which the public and workers can be exposed.



The risk estimates evaluated in the 2000 report “largely substantiate those derived in the 1988 report,” says Bennett.

The 2000 report—prepared by 131 people representing 21 countries—addresses both the sources and effects of ionizing radiation. Among its key findings:

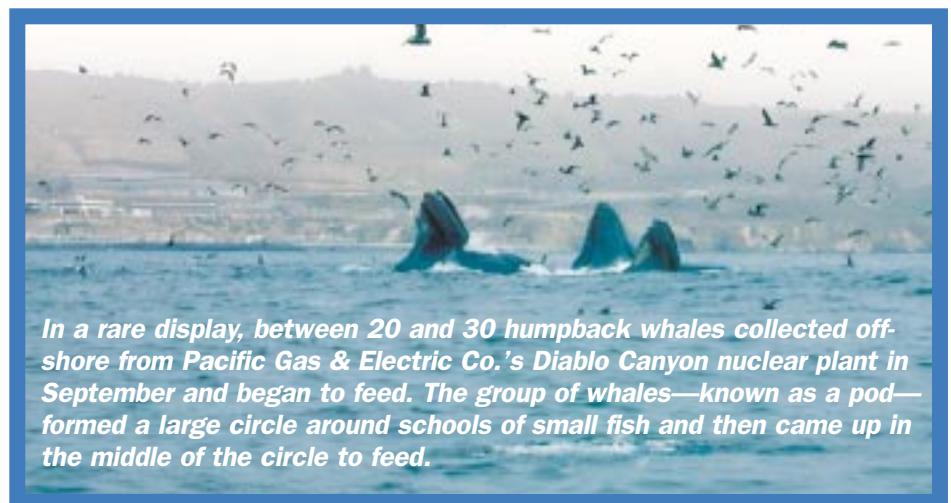
- The global average exposure to natural sources of radiation is about 240 millirem a year, with a typical range of 100 mrem to 1,000 mrem

annually. (The average American receives a total of about 360 mrem a year from natural and man-made sources of radiation.)

- Medical uses of radiation constitute the largest man-made source of the public’s exposure to radiation, accounting for a global average exposure of about 40 millirem a year. The report estimates average annual exposures from nuclear power plant operation to be less than 0.02 mrem a year. By way of comparison, the report notes that the exposure from a typical chest X-ray is 10 mrem.

- Until uncertainties about effects of exposure to low levels of radiation are resolved, the most scientifically defensible approximation of the body’s response to these low levels is that the risk of cancer increases proportionally with the level of exposure—what is known as a linear relationship. However, a strictly linear response should not be expected in all cases.

For a copy of the report, *Sources and Effects of Ionizing Radiation, UNSCEAR 2000 Report to the General Assembly, with Scientific Annexes*, contact U.N. Publications at 212.963.8302 or 800.253.9646, or [publications@un.org](mailto:publications@un.org).



*In a rare display, between 20 and 30 humpback whales collected off-shore from Pacific Gas & Electric Co.’s Diablo Canyon nuclear plant in September and began to feed. The group of whales—known as a pod—formed a large circle around schools of small fish and then came up in the middle of the circle to feed.*

PHOTO COURTESY OF JEFF LEWIS

# Health Effects of the Chernobyl Accident:

## Increased Cancer Incidence Will Be Difficult to Detect, Says U.N. Committee

The most current and comprehensive assessment of the health effects of the Chernobyl accident is included in the latest report by the United Nations Scientific Committee on the Effects of Atomic Radiation.

Apart from a “substantial increase” in thyroid cancer after childhood exposure observed in Belarus, Russia and Ukraine, “there is no evidence of a major public health impact related to ionizing radiation 14 years after the Chernobyl accident,” states the report. For some cancers, no increase would have been anticipated as yet, given the latency period of around 10 years for solid tumors.

The assessment is based on draft documents prepared mainly by two experts—Dr. Per Hall from Stockholm’s Karolinska Institute and Dr. Andre Bouville from the National Cancer Institute of the U.S. National Institutes of Health. Hall and Bouville reviewed most English-language published studies on health effects and also relied on colleagues from the former Soviet Union to obtain data from those countries’ mortality and cancer incidence registries as well as information on radiation doses. The committee’s 131 members thoroughly reviewed successive versions of the assessment.

According to the final report, the workers who participated in cleanup activities after the accident and the population groups living nearest the Chernobyl plant site received the highest radiation exposures and have been monitored for health effects that might be related to those exposures. Research on the accident’s health effects is focused on—but not limited to—the study of leukemia among workers involved in the accident and of thyroid cancer among children.

The number of thyroid cancers in individuals exposed in childhood, particularly in the severely contaminated areas of Belarus, Russia and Ukraine, “is considerably greater than expected based on previous knowledge,” according to the UNSCEAR report.

The risk of leukemia has been shown in epidemiological studies to be clearly increased by

radiation exposure. “However, no increased risk of leukemia linked to ionizing radiation has so far been confirmed” in children, cleanup workers or the general population of the former Soviet Union, according to the report.

The Chernobyl accident caused long-term changes in the lives of people living in the contaminated areas, since measures intended to limit radiation dose included resettlement, changes in food supplies and restrictions on the activities of individuals and families. These changes were accompa-

nied by significant economic, social and political changes in the affected countries because of the disintegration of the former Soviet Union.

The report notes that “there is a need for well-designed, sound analytical studies,” especially of cleanup workers from Belarus, Russia, Ukraine and the Baltic countries. However, because the majority of exposed individuals received low doses of radiation, “any increase in cancer incidence or mortality will most certainly be difficult to detect in epidemiological studies.”

## NASA’s Mission to Mars

### Nuclear Technology Will Keep Rovers Warm

Is there water on Mars?

That’s a question NASA hopes to answer when it sends two rovers to the red planet in three years, thanks to help from nuclear technology. A key task of these mobile explorers will be to look for evidence of water beneath Mars’ surface. With two rovers, NASA will be able to study different regions of the planet as part of the same mission.

During the martian day—which lasts a little more than 24 hours—the rovers are capable of traveling up to 100 meters. Solar panels will provide the power they need to roam the surface and conduct geological studies using a sophisticated set of instruments.

But during the martian night—when temperatures plunge to 124 degrees below zero—the rovers need to keep some of their electronic components from freezing. How? They’ll have radioisotope heater units, which contain nonfissionable plutonium-238

that gives off heat. Each rover will have seven of these heaters, producing a total of 7 watts of heat.



GRAPHIC COURTESY OF NASA, JPL

**NASA’s Mars rover (on the left in an artist’s concept), to be launched in 2003, may be followed in 2007 by a mobile science laboratory (on the right).**

# From Russia With Determination

## Nuclear Engineering Student Adapts to Life in America

Ivan Tchebeskov gives new meaning to the term “adaptable.” Just two years ago, he was living in Russia. Now, he’s a nuclear engineering student at Texas A&M University who begins his e-mails with the salutation “howdy.”

To “get a feel” for nuclear power plant operations, Tchebeskov is spending the fall semester as a co-op student at Entergy’s Grand Gulf station in Port Gibson, Miss. “Working at the plant will help me understand the practical side of nuclear engineering better,” he says. And because Tchebeskov expects to spend his career in the field of nuclear engineering, he wants to know what’s going on in the industry. “The co-op program was the best opportunity to get this experience,” he says.

When Tchebeskov arrived in Texas in 1997, he came face to face with a different language and a different culture. To improve his English skills and “get used to life in the United States,” he enrolled in a community college that first year. He admits he also wanted more discipline in his life. So after he transferred to Texas A&M for his sophomore



**Co-op programs offer engineering students “hands-on” experience at a nuclear power plant.**

year, he joined the university’s Corps of Cadets—an organization that seeks to prepare its members for leadership through academic excellence and character development. “I wasn’t sure I could do it all—classwork, the corps and a student job in the Nuclear Engineering Department,” says Tchebeskov. But he did. “Thanks to the corps, I learned not to quit something I had started.” The corp also taught him how to improve his study skills and manage his time better.

It’s a lesson that’s been reinforced at Grand

Gulf. Tchebeskov admits he was a little surprised to find a “really strong work ethic” at the plant. “I thought the engineers would be laid back,” he says—given the stereotype of life in the deep south.

But in the plant’s “very professional environment,” Tchebeskov says he acquired greater personal discipline as a member of the engineering department’s safety analysis group. He’ll return to Grand Gulf next summer for another stint as a co-op student.

When he completes his studies at Texas A&M, Tchebeskov wants to enroll in a nuclear engineering graduate program. And after that? “I’d like to work on some of the problems—such as weapons material disposition—that the United States and Russia are dealing with now,” he says.

Tchebeskov believes that his knowledge of both countries—and of nuclear engineering—will be invaluable in his career.

## Speaking of Nuclear Energy...

As the global climate change talks got under way in the Netherlands in November, Donald Johnston, the secretary-general of the Organization for Economic Cooperation and Development, said that nuclear energy has a key environmental role to play.

“Having examined the best evidence available to me, I have concluded that, if we are to hand on to future generations a planet that will meet their needs as we have met ours, it can only be done by incorporating the nuclear energy option,” Johnston told a Washington D.C. audience.

On the first day of the talks in The Hague, Robert Watson, the chairman of the U.N.’s

Intergovernmental Panel on Climate Change, said that “significant reductions” in greenhouse gas emissions were technically and economically feasible, using an “extensive array” of technologies.

Watson named five technological options for achieving “cost-effective” reductions in greenhouse gas emissions:

- “more efficient” conversion of fossil fuels
- switching from “high-carbon” to “low-carbon” fossil fuels
- decarbonization of flue gases and fuels, coupled with carbon dioxide “storage”
- increased use of renewable energy sources—biomass, micro-hydro, wind, solar
- increased use of nuclear power.

Watson said that nuclear energy is clearly a carbon dioxide-free energy source, and thus represented “an option that governments may want to consider.”

Speaking on behalf of the International Atomic Energy Agency, David Waller told delegates to The Hague talks that “...the exclusion of any technology with clear climate benefits can only limit options, flexibility and cost-effectiveness.” The IAEA deputy director general asked delegates to consider nuclear energy “in terms of its impact on [limiting] future climate change.”

# Yucca Mountain Science: Facing the Future

## DOE Builds a Case for the Safety of a Used Fuel Repository

As the year-end nears, the Energy Department remains on track to meet a major milestone in its study of the suitability of a Nevada site for disposing of used nuclear fuel—the release of a site recommendation considerations report. The report, expected in December, will examine the effects of repository features and design processes on the repository’s long-term performance.

In its assessment of how an underground repository would behave over thousands of years, DOE will explore such factors as the seepage of water into repository tunnels, the performance of the nuclear fuel container and the ability of the mountain to retard the movement of radionuclides. With the release of the report, the agency will satisfy an important deadline in preparation for a presidential decision next year. This decision is required by Congress for the project to proceed from the study to the licensing phase.

Among those reviewing DOE’s report will be the Nuclear Waste Technical Review Board—an independent oversight body established by Congress to scrutinize DOE’s work.

The board has told DOE that the agency’s safety case has three “critical weaknesses.” One is called coupled processes—the effect of the heat from the used fuel on the repository rock. “This is an area of great uncertainty,” says Jared Cohon, the board’s chairman. Although DOE’s model isn’t strong in this area, the agency “has some good experiments under way, which will teach them more in the future,” he says.

A second weakness, says Cohon, is the fuel container itself. The metal DOE is planning to use to encase the fuel—the alloy C-22—is one that would “last a very long time, even under difficult conditions.” But there’s “great uncertainty” associated with its performance, he says.

Cohon noted that if DOE were to propose a cooler repository design, it could help to address these two critical concerns.

“It’s our understanding that DOE has been working on a cooler repository design, and we look forward to seeing the results of those efforts when the agency releases its site recommendation considerations report,” says Steven Kraft, NEI director of fuel supply and used fuel management.

The board also is concerned about uncertainty in DOE’s long-term assessment of repository performance, says Cohon. “DOE has to predict how the repository will behave for thousands of years,

Radioactive Waste Management.

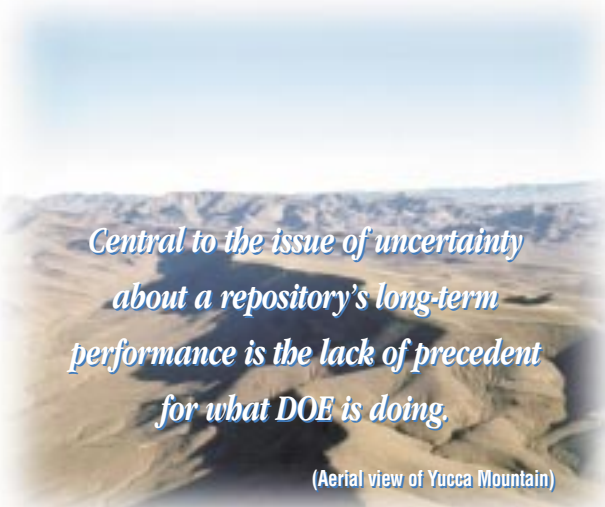
The latest independent analysis by the Palo Alto, Calif.-based EPRI research institute suggests that DOE’s strategy is viable. “We’ve reviewed DOE’s work on coupled processes and we tend to agree that they don’t really affect hydrogeological processes in the tunnel rock,” says EPRI’s John Kessler.

“We appreciate that there are uncertainties, and part of an appropriate strategy for DOE is that it tends to err on the side of maximizing assumptions,” he says. EPRI’s analysis, just completed, concludes that the “performance of many of the [proposed repository’s] natural barriers is likely to be very much better than some of the current DOE models suggest.”

Central to the issue of uncertainty is the lack of precedent for what DOE is doing. Says Cohon: “I don’t believe we’ve ever attempted to predict performance over such a long period of time.” He suggests that DOE look for examples of other complex problems in which uncertainty has been quantified. A “current and very lively” exam-

ple is global climate change, where an attempt is being made “to inform decisions that have to be made about a very uncertain problem.”

DOE’s approach to meeting the challenge of supporting its safety case will weigh heavily in next year’s decision on whether to go forward with the Yucca Mountain site. But the quest for more information on uncertainties is not expected to end there. “The nuclear industry agrees that scientists must put uncertainties into perspective for decision makers,” says NEI’s Kraft. “This was the original intent when Congress called for a three-step licensing process—Nuclear Regulatory Commission approval of construction, operation and final closure—to follow the presidential decision. We encourage the Nuclear Waste Technical Review Board to continue to question DOE throughout this process.”



*Central to the issue of uncertainty about a repository’s long-term performance is the lack of precedent for what DOE is doing.*

(Aerial view of Yucca Mountain)

and that’s unavoidably uncertain.” How can the agency make a “clear and compelling case” for Yucca Mountain and characterize the associated uncertainty, so those who need to understand it can do so, asks Cohon.

DOE will address uncertainty in repository performance in two ways. First, its safety case is conservative, with multiple lines of evidence supporting the central assessment of repository performance. In addition, the safety case will address those uncertainties that can be characterized, DOE says in its 2000 Repository Safety Strategy document. The agency has asked the National Academy of Sciences’ National Research Council to look at how DOE’s decision-making process could be taken step by step. With such an approach, the agency can reverse itself “at any step in the process,” said Ivan Itkin, head of DOE’s Office of Civilian

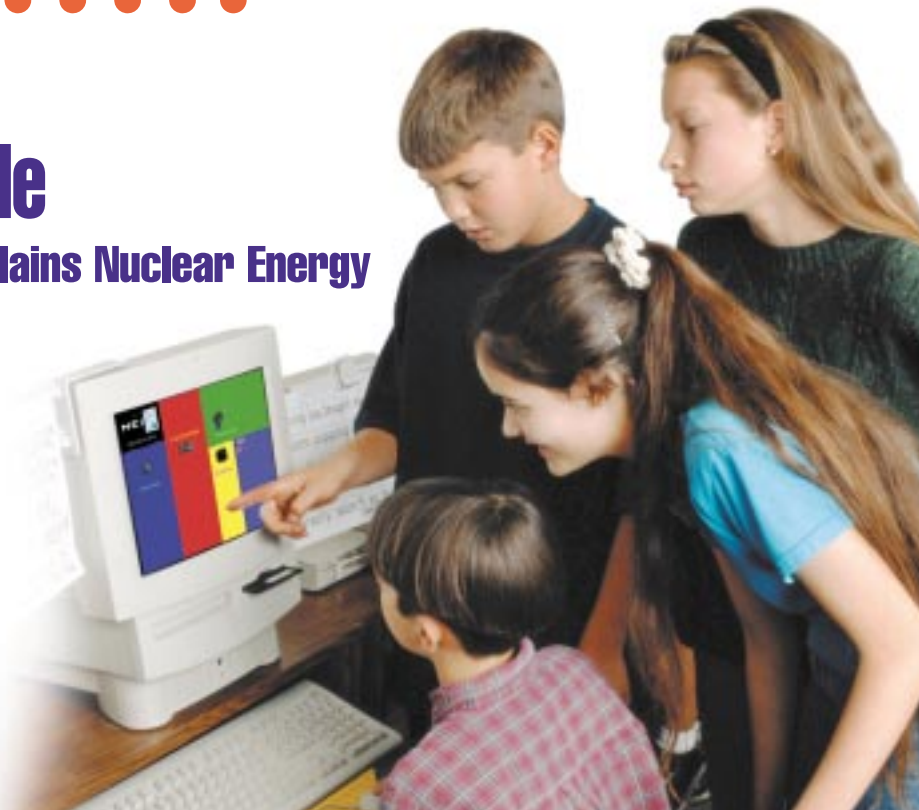
# Making the Grade

## Web Site for Students Explains Nuclear Energy

It's nearly the end of the school term for America's students. That means homework, and probably a challenging class project. If the subject is nuclear energy, help is just a click away. NEI's new Science Club has facts, figures and photos on everything from nuclear power plants to unmanned spacecraft.

In the Nuclear World section, animations tell the story. Students working on special assignments can find answers to their questions in For Your Class Project. And there are resources for teachers, too.

Explore the amazing world of nuclear technologies at [www.nei.org/scienceclub/index.html](http://www.nei.org/scienceclub/index.html)



# in sight

NUCLEAR ENERGY

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**Editor**  
Alice Clamp

**Contributing Editors**  
Alexandra Jacobs  
Steven Kerekes  
Lynne Neal  
Richard N. Smith

**Graphic Design**  
Rafy Levy



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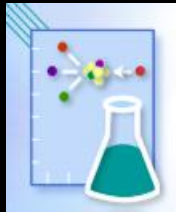
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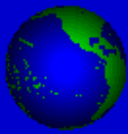
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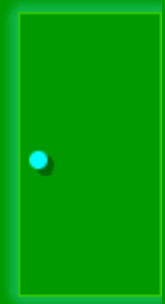


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Nuclear World

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