

Career *currents*

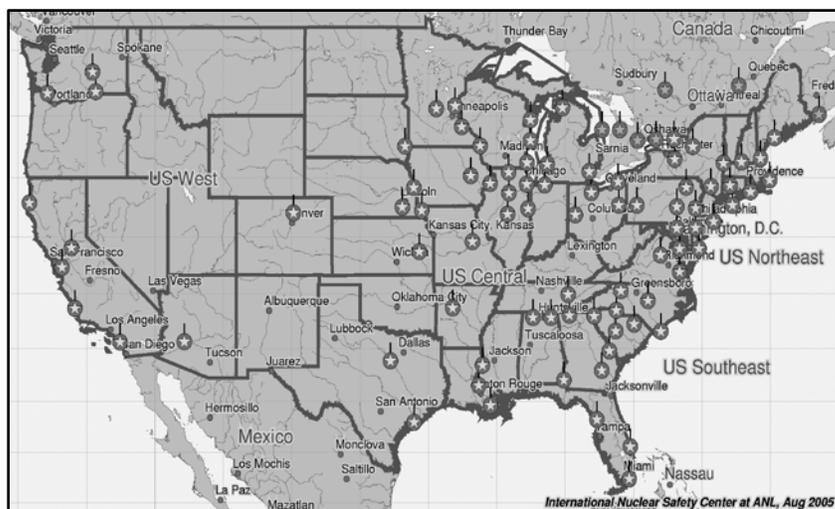
Exploring Today's Energy Careers with the NEED Project

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Career Currents provides educators and students with resources to introduce energy careers. Each issue focuses on a different sector of the energy industry. No single issue is meant to be all-inclusive to either the sector profiled or all careers in energy. This issue focuses on professionals working in the field of nuclear energy.

Nuclear Energy

Current forecasts of population and economic growth indicate that the world's energy consumption is going to continue rising. The Department of Energy projects that by 2030 the U.S. electricity demand will rise by 21%. Many new nuclear power plants will need to be built in order to meet that demand and to keep nuclear energy generating at least 19% of U.S. electricity; as it is currently. Nuclear energy produces no greenhouse gas emissions, which gives many reason to take a closer look at nuclear energy.



Map of U.S. Nuclear Power Plants

Source: International Nuclear Safety Center at Argonne National Laboratory

Today there are 104 operating nuclear reactors located around the United States. Electricity produced at these power plants account for eight-percent of the United States' energy production, and 19% of the United States' electrical generation.

Producing electricity from nuclear energy is appealing to many because it is an emissions-free, base load source of energy. Uranium fuel is so efficient that a fuel pellet about the width of a pencil eraser and just a little longer provides as much energy as 149 gallons of oil, 1,780 pounds of coal, or 17,000 cubic feet of natural gas (statistics from the Nuclear Energy Institute).

The nuclear industry faces many challenges including what to do with spent fuel, the high costs associated with building a new plant, and with security and proliferation risks.

In this issue of *Career Currents* you will read interviews with four people who represent the past, present, and future of the nuclear industry.

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The NEED Project is a 501(c)(3) nonprofit education association providing professional development, innovative materials correlated to the National Science Education Content Standards, ongoing support and recognition to educators nationwide.

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NEED welcomes your questions, comments, and suggestions. Please contact info@need.org.

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Neutropolis: The Nuclear Energy Zone for Students

Office of Nuclear Energy launches student website

The Office of Nuclear Energy (NE) is extending its communication and outreach efforts into the youth sector with a new website geared toward students in grades K-12. The new site features a mythical city known as Neutropolis and is accessible through the existing Office of Nuclear Energy site <http://www.nuclear.energy.gov>, then by clicking on the new "Students Click Here" button.

"Neutropolis: The Nuclear Energy Zone for Students" provides factual information about nuclear energy and its many uses in separate tracks directed at younger, intermediate, and advanced students. It also contains games and challenges appropriate to students of different ages, ideas for science projects, information about colleges that offer studies related to nuclear science, and details about Department of Energy internships and career opportunities. Although the primary audience for the site is K-12 students, there is a section devoted to providing information to classroom teachers, including suggested classroom activities targeted to elementary, middle, and high school students.

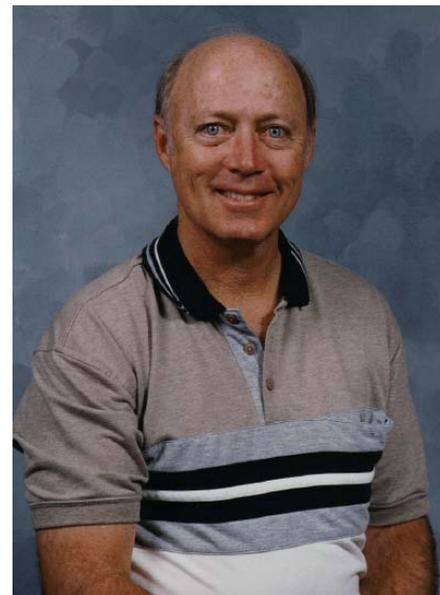
Several whimsical mascots, known as "The Power Pack," have been developed for use on the site. Their purpose is to add interest to the site and make it memorable for students.

"Neutropolis: The Nuclear Energy Zone for Students" has been tested by selected target audiences prior to posting. The site will be a "living" site; with improvements and updates made periodically. The Office of Nuclear Energy hopes this website will set a new bar for quality outreach to students, delivering the message that nuclear energy is an important current and future part of our Nation's energy mix.

NEED Staffer Inducted into Colorado Coaches Hall of Fame

Congratulations to NEED program associate Vernon Kimball, who is being inducted into the Colorado Coaches Hall of Fame at the end of the month. Before joining the NEED national staff last fall, Vernon worked at Bayfield High School as a teacher and coach. Science and coaching have been an integral part of his career.

Over the past 34 years, Vernon coached boys' and girls' teams in a variety of sports earning many coaching accolades. In 2008, he was named Colorado's Teacher-Coach of the year. Congratulations on this special honor, Vernon!



Career Chats: Professionals Working in the Nuclear Energy Industry



**Sue Blacklock,
Former Primary
Chemistry
Manager, SRO,
Limerick
Generating
Station, PA**

Sue Blacklock's education includes a B.S. from Indiana University, and a MBA from University of Pennsylvania Wharton School of Business. In addition, her graduate coursework includes work at Oak Ridge Associated University in General Electric BWR Chemistry and Philadelphia Electric Company Senior Reactor Operator Certification.

How did you get a start in the nuclear industry?

I taught high school chemistry for five years prior to entering the nuclear energy field. I chose to work in the industry during the construction era of the domestic nuclear industry because of the challenge and excitement surrounding the construction of new plants and the mastering of the technology. My nuclear training consisted of learning the plant components during construction, attending graduate coursework, and successfully completing Senior Reactor Operator Certification (SRO) after the plant went commercial. During my career I held a variety of positions: Chemistry Technician, Training Coordinator and Instructor, Start-Up Engineer, Start-Up Manager and Manager of Primary Reactor Chemistry.

Please tell us about your work at the power plant.

A nuclear power plant is a manufacturing plant that manufactures, or generates, electricity. The mechanics of the systems are like a fossil fuel plant with the exception of the source of fuel, which is uranium. I worked at a Boiling Water Reactor plant. The name describes the method of steam generation. Ultra clean water was heated in a nuclear reactor using energy created by nuclear fission. The steam from the water flowed through a steam cycle, was condensed, cleaned, reheated, and sent back to the reactor.

The job of the Chemistry Department was to keep this water as clean as possible. When you have water and steam traveling through massive metal components, corrosion will occur. Corrosion products can plate out on

fuel rods in the reactor causing "hot spots" on the fuel cladding and can lead to cladding cracks and fuel damage. These products (think of rust particles) can also collect in mechanical components such as piping, valves, and pumps. If corrosion is not monitored and chemistry parameters are not met, high capital costs can be incurred when you have to replace large metal components. The solution to minimizing corrosion is to keep the primary water and corresponding systems as clean as possible.

As the Manager of Primary Chemistry, I was responsible for ensuring the cleanliness of the reactor with system, monitoring the plant gaseous and liquid effluents and ensuring regulatory compliance. A team of chemists and technicians reported to me. A typical day would include attending shift turnover meetings, planning and coordinating maintenance windows, reviewing data and recommending adjustments to systems operations. During refueling outages I would coordinate refueling activities and services with the outage coordinator.

Now that you're no longer working in the nuclear energy field, what do you think about it?

I spent 14 years in nuclear energy and left when it appeared that no more U.S. plants would be built. Now, I am passionate about the resurgence of nuclear power, even though I no longer work in the industry.

I believe that nuclear power is a significant component of the energy portfolio that we need to build and sustain in order to battle global climate change while meeting the needs of future generations. Issues that have to be dealt with and addressed include the disposal/storage of spent fuel and international concerns with proliferation. However, if we as a country do not continue to build plants, perform research, reinstitute nuclear engineering programs and train the next generation we no longer have a voice at the international table and will lose our ability to influence and manage important global decisions.

What do you do now?

I currently work as Director of Practice Development at a major law firm. I am also fortunate enough to independently serve as a Nuclear Consultant to the Lenfest Foundation, based in Philadelphia. I manage grant monies that have been awarded to various initiatives that support global climate control and the resurgence of the domestic nuclear power program.

What opportunities or exciting experiences have you had in your career?

In this capacity I have had the opportunity to meet and work with a variety of scientists, professors, and political figures. I have served on the Technical Committee of the Global Roundtable on Climate Control (GROCC) sponsored by the Lenfest Foundation and Columbia University. Through this initiative I have met the President of Iceland, the Prime Minister of Papua New Guinea, the President of Electricite de France International, and Jeffrey Sachs, one of Time Magazine’s Top 100 Influential People.

My most interesting work has been participating in a current initiative that involves a partnership with the Foundation, the Council on Foreign Relations, Washington and Lee University, and NEED.

We need to educate the future generation of stakeholders. The partnership with NEED provides a viable, credible, and technically accurate conduit to science education nationwide. NEED performs such a valuable service to educators and students.

the end of the Cold War, I became very interested in nuclear arms control. These experiences about twenty years ago transformed my life and led to my current career.

While the nuclear navy has been a gateway for many people to work in the commercial nuclear power industry, I am not currently working in this industry. Instead, I am working as an analyst who assesses policy options for nuclear power and examines where the industry appears to be headed. In addition, I research more effective ways for stopping the proliferation of nuclear weapons to countries and to terrorist groups. Thus, I work on public policy development on the peaceful and military sides of nuclear energy.

What subjects, courses, internships, or special training were instrumental in helping you gain your current position?

At the U.S. Naval Academy I majored in physics. When I graduated from the academy, I worked for a few months at the Los Alamos National Laboratory, which is one of the nuclear weapons laboratories. After this experience, I studied nuclear engineering at the Naval Nuclear Power School. I then served on a nuclear powered submarine where I qualified as an engineering watch officer. After leaving the Navy, I decided to become a physics professor and earned my doctorate in physics at Boston University. However, my interest in nuclear nonproliferation and energy issues convinced me to leave the academic physics job track and take a job working on nuclear policy. The analytic training of my physics degree program has been helpful in my current policy work. One of the most influential jobs I had was working as a physical scientist on nuclear safety issues at the U.S. Department of State.

Would you follow the same career path again?

I have had a non-traditional career path that I could not have predicted more than twenty years ago when I started down it. I believe that if I had to start all over again, I probably would follow a similar path. My current career as a nuclear policy analyst has been very satisfying.

What do you think of the nuclear industry now that you work in it?

Since I analyze the industry rather than work in it, I have had the type of job in which I can step back and examine the big picture of the industry. On balance, the industry has made significant contributions to strengthening energy security and to countering climate change. However, there are still significant risks including the potential for terrorist



Charles Ferguson, Philip D. Reed Senior Fellow for Science and Technology, Council on Foreign Relations, Washington D.C.

Charles Ferguson (center in photo) holds a B.S. with distinction in physics from the U.S. Naval Academy, a master’s degree equivalent in nuclear engineering from the Naval Nuclear Power School and a Ph.D. in physics from Boston University. In this interview Charles shares his unique and diverse involvement in the nuclear industry.

How or why did you choose to work in the nuclear industry?

I entered the nuclear industry through my training as a nuclear engineering officer in the Navy. I chose the nuclear submarine service because I thought it would be the most intellectually challenging service within the Navy. I served as a nuclear engineering officer of the watch on a ballistic missile submarine during the last years of the Cold War. As a watch officer, I was responsible for a twelve person crew that operated the power and propulsion systems of the submarine. As a result of the political changes happening at

attacks on nuclear facilities, the possibility that some countries may exploit the peaceful nuclear fuel cycle for military purposes, and the legacy of nuclear waste.

What opportunities or exciting experiences have you had in your career?

As part of my work, I have traveled to more than two dozen countries including China, North Korea, Russia, Saudi Arabia, and Turkmenistan. When I worked at the State Department, I had the exciting experience of helping to secure radioactive materials that could fuel “dirty bombs” and to negotiate a treaty with Russia and other European countries to clean up nuclear waste in Northwest Russia.

What is the most rewarding part of your job?

The most rewarding part is when I have had some influence on public policy either through my writings, testimonies to Congress, or briefings to government officials. For example, a recommendation I made at a congressional hearing in 2007 led to the creation of a government program to improve the security of radioactive materials used in the nuclear industry and other industries.

What advice can you give to a young person considering a career in the nuclear industry?

Be intellectually curious about many things. Read deeply about the nuclear field but also read broadly about a range of subjects especially those on science, politics, the environment, and history. Be disciplined in your studies and always strive to do your best.

Lisa Stiles,
Project Manager, Workforce Planning

Lisa Stiles is a Project Manager of Workforce Planning for Dominion in Richmond, VA. Ms. Stiles has a B.A. in nuclear engineering from the University of Missouri-Rolla and a master’s in nuclear engineering from the Massachusetts Institute of Technology (MIT).

How did you choose to work in the nuclear industry?

Once I decided to major in nuclear engineering I tried to find ways to get extra work and experience outside the classroom. I worked one summer on an undergraduate research project, I spent another summer as an intern at the U.S. Department of Energy’s Office of Civilian Radioactive Waste Management, and another summer as an international exchange student working at the Cadarache nuclear facility in France. I also worked part-time on campus as a health physics technician which gave me experience in radiation protection and a little extra cash as well.

My academic performance, plus all of that experience, helped me land a terrific job with the Defense Nuclear Facilities Safety Board. After working a year at their headquarters in Washington, DC, they sent me to graduate school at MIT to complete a master’s degree (salary and all expenses paid!). After completing my degree, I was assigned to work “in the field” at the Surry Power Station in Virginia. After that I was fortunate to be offered a job working in used fuel management for what was then Virginia Power and is now Dominion.

As a young engineer I got involved in professional societies like the American Nuclear Society (ANS) and the North American Young Generation in Nuclear (NA-YGN). Participating in those organizations helped me to develop leadership skills. As the debate about new nuclear plants increased I was also involved in organizing nuclear advocates to demonstrate their support. My work gained a lot of attention and Dominion loaned me to the Nuclear Energy Institute (NEI) in Washington, DC for 18 months to be the Manager of State Initiatives, Grassroots and Coalitions.

When I returned to Dominion I took the position of Project Manager, Workforce Planning in the Nuclear Business Unit.

Describe what you do.

At Dominion, we’re focused on having a pipeline of workers – engineers, skilled technician jobs and operators, mechanics, and electricians. As we face a wave of retirees



Charles Ferguson (left) tours the Temelin Nuclear Power Plant in the Czech Republic with his wife Catharine (right), and Milan Muzak (center), the director of public affairs at the nuclear plant.

we're looking at how to adapt to the changing demographics and workforce.

Now that I'm a project manager and have people that report to me, my day is a lot different than when I was working in engineering. Sometimes, I spend a lot of time in the office on my computer or phone and sometimes, I am in meetings with my group or with other diverse groups across the company, and sometimes I'm out visiting one of our partnership schools, or at one of our power stations or at an industry meeting. Every day varies and that's very good for me.

What exciting experiences has this career given you?

There are so many! I think refueling outages are exciting. Everything is planned to the minute and everyone comes together as a team to get the work done safely and efficiently so we can get the unit back online making megawatts again.

Organizing advocates for nuclear events is always fun and exciting to me. Local events, like staging a rally at an NRC meeting, have been as interesting as international ones, like organizing a nuclear booth for the 2005 UN Climate Change Conference in Montreal.

As an officer of NA-YGN and International Youth Nuclear Congress (IYNC) and while at NEI I was able to meet people from all over the country and all over the world. I've been to nuclear plants in 10 different states and 7 different countries.

What challenges do you face in your profession?

The challenge I have in my current position is making sure that there are enough skilled workers in the pipeline to replace those that will retire in the next decade and to build new plants. People my age and younger have to be ready to lead the industry as our mentors leave.

Please share some benefits to your profession.

The nuclear industry is one of the highest-paid and, just from my personal experience, the best compensated. The benefits are well above-average as well. There is good job security, too. The industry is poised to expand and these are jobs that can't be outsourced. Plus, there is the knowledge that you're making the world a better place.

What's the most rewarding part of your job?

I've been so pleased to see that the career pipeline programs we're developing really make a difference in the lives of young people. With our community college partnerships we're giving some good kids the opportunity to learn skills that will land them a solid, secure high-paying job in the nuclear industry. I've had parents come up and personally thank me for the opportunity we're giving their sons and daughters. It doesn't get much better than that.

When I was an engineer I provided technical oversight for the fabrication of our used fuel casks. It was always rewarding for me to see, after a year in production, a fuel cask be loaded at the station, sealed up and taken out to our storage pads.

What does your future hold?

In one way or another I expect to be part of building new nuclear power plants. I also plan to continue developing my leadership skills so that I can move up to positions of greater responsibility. I really do believe that if you work hard the sky is the limit in the nuclear industry!

Would you follow the same career path again?

The nuclear industry is the place to be! Nuclear science and technology benefit our society so much in ways that we often don't even realize—in the fields of nuclear medicine, space applications, and industrial applications. Right now, nuclear power plants provide 74 percent of our nation's emission-free electricity. If we are truly to become a "green" nation, nuclear has to be part of balanced portfolio of energy technologies.

Working in the nuclear industry, I know that I'm doing my part to make the world a better place. I would definitely follow the same career path with one change—I would have gone through Operations Training and become a Senior Reactor Operator while in my twenties.

What advice can you give someone considering a career in nuclear energy?

The nuclear industry is a great place for young people that have good math and science skills, are willing to work hard and stay out of trouble and that want to be a part of a growing industry that is important to our society.

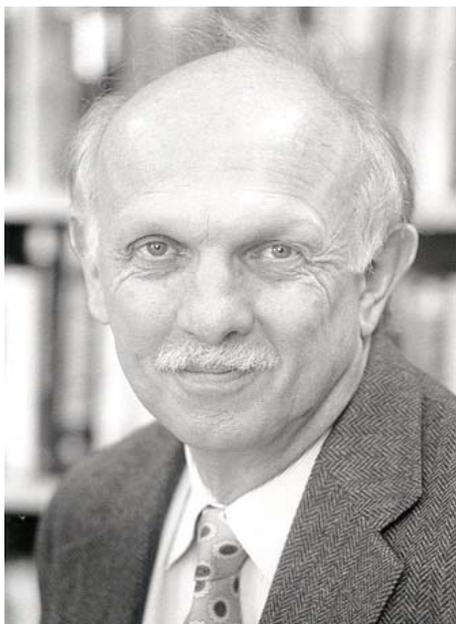
I took the four-year engineering degree route right out of high school. For that, students want to aim to take Calculus their senior year and do Advanced Chemistry or Physics, both if possible. Also, one doesn't have to be a nuclear

engineer to work in the industry! Mechanical, civil, electrical, and chemical engineers are needed, too.

However, a B.S. in engineering isn't the only path. If students aren't ready to make that kind of academic commitment, there are fantastic career opportunities for people that choose two-year technical degrees, shorter certificate programs or that want to learn a trade. For that track, students should have an overall solid GPA and get Cs or better in math and science classes through at least Algebra II and Chemistry or Physics.

Most of all, because of the security checks necessary to work at nuclear power plants, students need to stay out of trouble and be drug-free.

Dr. Frank Settle
Visiting
Chemistry
Professor,
Washington
and Lee
University,
Lexington, VA



Frank Settle has a B.S. degree in Chemistry from Emory and Henry College in Emory, VA and a Ph.D. in Chemistry from the University of Tennessee, Knoxville. Frank has received local, state, and national awards for teaching chemistry, and developed a teaching laboratory for applying robotics to chemical analysis.

Describe your job:

I teach courses in the nuclear age, the role of nuclear power in the global energy portfolio, and the science and politics of weapons of mass destruction.

Why did you choose to work in the field of nuclear energy?

I became interested in nuclear issues after reading Richard Rhodes' The Making of the Atomic Bomb. My interest in things nuclear developed late in my career more as a hobby rather than from formal education or training. My interests in history, people, science, and technology have combined to make my current position most exciting.

What opportunities have you had in your career?

I taught analytical chemistry at Virginia Military Institute for 28 years, worked for the Department of Energy as a consultant where I visited many of the Department's nuclear sites in the U.S., was a program officer in the National Science Foundation's Division of Undergraduate Education from 1995 to 1998, and have been in the chemistry department at Washington & Lee since the fall of 1998. I have also directed the Alsos Digital Library for Nuclear Issues since 2001.

What is the most rewarding part of your job?

Working with students; especially non-science majors. It is fun to get them to see how nuclear science/technology relates to current issues of energy, environment, and government policy. It is also interesting to introduce them to the impact of nuclear science on the political history of the 20th century.

How does your job interact with or impact the public?

The Alsos Library receives over 15,000 visits per month from the U.S. and abroad. I'm also a lecturer on nuclear topics for the American Chemical Society.

What do you expect to be doing in 5-10 years?

Still having fun teaching and purveying information on nuclear issues.

The Alsos Digital Library for Nuclear Issues offers annotated references to articles, books, films, and websites for the study of nuclear issues. Topics include fission and fusion, nuclear power and waste, plutonium and tritium, arms control and proliferation, weapons programs of various countries, particle accelerators, the Manhattan Project, Robert Oppenheimer, Albert Einstein, Enrico Fermi, and hundreds more. Historical and scientific overviews of the Atomic Age are provided. To access this free resource, visit <http://alsos.wlu.edu>.

American and Iraqi scientists working together for nuclear safety

The November 17, 2008 U.S. DOE Pulse newsletter highlights work being done at the Department of Energy's national laboratories. A recent issue reports a partnership between American and Iraqi scientists working towards nuclear safety in Iraq.

By Michael Padilla, Sandia National Laboratory

Scientists at the Department of Energy's Sandia National Laboratory are helping train Iraqi scientists and technicians to clean up radioactively contaminated sites and to safely dispose of radioactive waste as part of the

Iraqi Nuclear Facility Dismantlement and Disposal Program. Initiated by the U.S. Department of State, the program focuses on the Al Tuwaitha nuclear complex near Baghdad (above), which contains major facilities from Saddam Hussein's dictatorship. Sandia National Laboratory provides consultation and hands-on demonstrations to Iraqi professionals from the Iraqi Ministry of Science and Technology — the owner of the Al Tuwaitha complex — and professionals from the Ministry of Environment. Another goal of the program is to engage Iraqi scientists who have been isolated from their counterparts for more than a decade by United Nations sanctions.

To read issues of *DOE Pulse*, visit <http://www.ornl.gov/info/news/pulse>.

