**ENV Certificate Alumna Donna Riley '93**
**Is Assistant Professor at Smith College**

Donna M. Riley is Assistant Professor in the Picker Engineering Program at Smith College in Northampton, M.A. In 1993 she graduated from Princeton University with a B.S.E. in Chemical Engineering and a Certificate in Environmental Studies from PEI. She earned her Ph.D. in Engineering and Public Policy from Carnegie Mellon University in 1998. From 1998 – 2000, she was the Clayton Postdoctoral Fellow in Industrial Ecology at the Center for Energy and Environmental Studies at Princeton University. Professor Riley's work combines methods in engineering and the social sciences to characterize and communicate chemical risk. She seeks to integrate quantitative modeling of chemical risks (from sources to exposure endpoints) with an understanding of the ways in which human beliefs and behavior influence risk. *PEI News* interviewed Professor Riley to explore how the environmental studies program at PEI continues to influence her career, and how the environmental field has changed since 1993.

**As an undergraduate student at Princeton, what prompted you to pursue an ENV certificate?**

Growing up in Los Angeles during the years of its worst air quality ever, the contrast between the smoggy city and California's natural beauty convinced me that I wanted to pursue a career working to improve environmental quality. At that time, environmental studies and environmental science majors were just beginning to emerge and it was unclear what such a degree would mean. As an undergraduate at Princeton, I chose chemical engineering as a path that would help me work on environmental problems, but was disappointed to find there was little connection to environmental issues in my chosen major. So I decided to pursue an ENV certificate to explore my passion and prepare for an environmental career. I intended to take classes in the social sciences and humanities that related to environmental issues anyway, so the certificate was a natural choice.

**Have the classes you took to earn your ENV certificate influenced your career?**

Definitely. In general, the interdisciplinary nature of the ENV certificate allowed me to pursue the ideas I was most interested in, bringing disparate ideas together to address a single question a new way. The ENV certificate helped me to connect chemical engineering, which was presented in a very theoretical way, with its practical applications to environmental problems. More specifically, Frank von Hippel's Science, Technology and Public Policy class introduced me to what would become the focus for my doctoral degree and subsequent research career. Professor von Hippel's class allowed me to place my environmental interest in a broader context of technology and society. It was also my first introduction to risk assessment and risk communication, which has been my primary research focus.

Recently, I revisited a term paper I wrote for Hal Feiveson's ENV 302 class (a social science and humanities introduction to environmental studies) for a book I am writing on Engineering and Social Justice. In the paper, I analyzed the the Green Party's emergence in Europe and the United States and discussed the conflict between "deep" ecologists and social ecologists within the

party. My first exploration of ecofeminist ideas occurred in ENV 302 and I am also revisiting the subject for my book.

Lastly, I did junior independent work and a senior thesis with Valerie Thomas, a research scientist in the Center for Energy and Environmental Studies (then part of the Engineering School, which later became part of PEI). There, I learned about industrial ecology and life cycle assessment, which has been a secondary research interest for me as well as a focal point for teaching ecological aspects of mass and energy balances to engineers.

**What is the most important message you strive to communicate to your students regarding the environment?**

I strive to have my students think holistically, interdisciplinarily and creatively. We can't continue to be shifting environmental problems from one medium to another, and we can't continue to pretend that our environmental problems aren't related to our local and global political and economic systems. The solutions have to come from thinking outside the box, getting away from "paper or plastic" choices that mean little, and really moving to fundamental transformations. Engineers are uniquely positioned to influence this transformation because they have the power to shape the world through technological development.

**Please describe your research, and explain what has surprised you the most as you have worked in various American communities.**

My technical research focuses on the risks of chemical products used in people's homes. I take an interdisciplinary approach, using behavioral science to understand consumers' and experts "mental models" of a product and its risks as well as specific information about how a product is used, then use this research in a chemical-engineering based indoor air quality model to determine the likely exposures that result from different activities. Ultimately this information is used to improve risk communication materials – product warning labels, pamphlets, public service announcements, etc.

I have been struck by just how much control users really do have over chemical exposures in their homes. After banning the most hazardous chemicals, there are still a number of products that can pose large risks when used in certain ways in the home. Often there are simple misconceptions about how a product works that create situations in which people use a product that places them at risk. For example, people often associate strong odors with the idea that a product is working. This might lead people to use mothballs in ways that spread the active chemical (paradichlorobenzene or naphthalene) throughout their house, exposing their family, rather than keeping it contained where it will be most effective at killing moths. Or people see a roach in their kitchen, pick up a can of insecticide, and spray the bug until it dies. This is a gross overuse of pesticide, but consumers have a model in their head – perhaps created through advertising,--of the bug dying on contact with a large amount of spray.

Finally, I think one of the most important reminders that working directly with consumers provides is that the experts are not always right, and there are things they don't know that lay people do – about how to use a product most effectively or most safely. For example, I found people using paint stripper who would leave the chemical on far longer than experts recommended to get a better result. So comparing lay and expert mental models of a process often provides as much new useful information to experts as it does to lay people.

I also have been doing research in the area of engineering education. I received a CAREER award from the National Science Foundation to apply Pedagogies of Liberation, based on the works of Paulo Freire, feminist bell hooks and others in the areas of critical/radical and feminist pedagogy in engineering education. I have been conducting focus groups and interviews with students to understand choices they make about education and career, and creating and evaluating curricular innovations designed to employ these pedagogies. In some ways, this work is similar to the chemical risk work because both are about communicating technical information effectively to people. In both cases, you need to begin with what people's current conceptions and misconceptions are, recognize the expertise they bring, and build on that authority of experience to create more knowledge in a way that they become empowered.

**Your paper entitled "Cultural Use of Mercury in New Jersey" sounds fascinating. Please describe your findings and why they are so significant.**

I studied cultural uses of mercury in Latino and Caribbean communities in New Jersey for several years with environmental health scientists, an anthropologist, and an Afro-Cuban santero. We modified the interdisciplinary approach described above to address indoor exposure to mercury vapor from a variety of cultural and religious uses of elemental mercury among residents of New Jersey.

Because religious uses are often kept secret as part of the Santeria, Palo Mayombe, and other Afro-Caribbean belief traditions, it was difficult to learn what practices were taking place and the details we needed to determine which were most hazardous. We learned that the risks of religious use of mercury lie primarily in its storage and handling. This leads us to believe that some of the more hazardous activities reported in the literature – for example, sprinkling elemental mercury on floors – may have origins in cultural practices that are not explicitly religious, for purposes like warding off evil or for good luck. However, more research remains to be done.

This research enabled us to develop an integrated methodology that applies to risks that have some cultural significance. We combined research methods from anthropology and other social sciences with indoor air quality modeling and measurements to gain a more complete understanding of the problem. We found that a good public process engages the affected communities in meaningful conversation about environmental and cultural values in order to rank the different environmental risks the community faces. To select mercury exposure over other problems in the area, such as urban air pollution, may reflect the researchers' cultural biases rather than improve the environmental health of the community to the greatest extent possible.

In addition, we found that the risks of mercury use are low for most people, but a small number of people who are typically underserved by the health care system and suspicious of government because of policies and attitudes toward recent immigrants, may be at significant risk for mercury exposure. Doing effective outreach about mercury with this community is challenging, because it requires engaging community leaders to address a problem that does not rank very high among a host of problems faced by the community. It is most effective to become involved in addressing the environmental health problems that rank at the top of the list first and establish good working relationships in order to tackle risks further down on the priorities list that may affect a smaller number of people, but in significant ways.

**It is very interesting that as an engineer you have applied the works of French philosopher, historian and sociologist, Michel Foucault, to your research. What inspired you to do this?**

I have used Foucault's work specifically in the engineering classroom in teaching thermodynamics. His approach helps students become more critical in their thinking-- in using liberative pedagogies (which place a greater onus on the student to initiate critical questions) and to learn the thermodynamic material, which defies many conventional notions of what science is supposed to be. In particular, ideas about entropy are difficult for many students to grasp when they engage in a strongly positivist world view or a developmental level that views the world in strictly black and white terms. Foucault really opens up new ways of thinking for students. I assign only a small passage – 3 pages from an interview – in which he speaks about truth and power in science. I have found that this small encounter with Foucault is enough (at least in a liberal arts context like Smith) to open up students to new ways of looking at thermodynamics, and at their own education.

**At one time, you were very involved in working to "green" the engineering curriculum. Are you still working on this?**

Yes. I continue to innovate in my mass and energy balances class to better integrate environmental concepts in what is traditionally an industry-focused chemical engineering class. Similarly, I am working to transform thermodynamics from a 19$^{th}$-century canon focused on the steam engine and the internal combustion engine into something forward-thinking that begins by asking: What do engineers need to know in the 21$^{st}$ century to work on energy?

The engineering program at Smith College considers sustainability one of its defining characteristics, so all of our faculty members strive to incorporate sustainability considerations in our classrooms. Students encounter green design in our design courses, air pollution basics in our fluids course, photovoltaics in our circuits course, and so on.

**What is it like to be an engineering faculty member at a women's college, when you were probably one of a few female engineers during your academic career?**

This is literally my dream job. At some point during my sophomore year at Princeton, it dawned on me that not only had none of my engineering professors been women, but none would be women during my entire undergraduate experience at Princeton. My friend, Laura, always cheery, said perkily, "Well, you'll just have to *become* an engineering professor." I laughed out loud at this, not only because it was all I could do to get through transport phenomena that semester, but also because I had NO desire to teach in what I perceived as the male-centric culture at Princeton. I said to Laura, "Well, maybe if they had engineering at a women's college, I would consider it." So, when the job announcement came out that Smith was starting the first engineering program ever at a US women's college, I had to apply.

Smith is different, not only because it is a women's college, but also because it is one of only a few small liberal arts colleges with an engineering major. The culture is very different from the one I encountered as an undergrad – students are more positive toward the subject area and toward each other, and more integrated into the life of the college community. Students at Smith

tend to see engineering as one way of looking at the world – they have a sense of perspective and an ability to see the world through other lenses that I think is quite different.

One of the best things about teaching here has been that there is nothing like a class of all women to explode your notions of gendered behavior. After spending years as first a student and then a graduate TA in classrooms with few women, I learned to watch for the familiar situation where the men tinker with the lab apparatus and the women hang back, observe, and take notes. Of course, this happens in all-women classes as well – it just doesn't break down along gender lines. And while national statistics show women trending toward chemical and biomedical areas of engineering, at Smith we see large numbers choosing mechanical and electrical engineering areas of concentration. While teaching at coed schools is more likely to reinforce generalizations like "women engineers like to work on problems of humanitarian concern" we see strong counterexamples to those ideas at Smith. Women can do and be anything they want at Smith, and they make it happen. This is a really healthy reminder that we shouldn't let the trends we observe about women in engineering reinscribe gendered notions of what are acceptable subfields for women within engineering.

**What advice would you give to a woman hoping to pursue a career in the environmental engineering field?**

1. Persistence pays off. Sindee Simon, a chemical engineering graduate student while I was an undergraduate at Princeton, gave me the advice on persistence when I arrived at grad school at Carnegie Mellon in Pittsburgh – she was then teaching at the University of Pittsburgh. Simply not going away, hanging in there and not being the one to eliminate one's self from the running, goes a long way for women who tend to doubt themselves so much. I think this applies equally well to women looking to come back into careers that they slowed or took hiatus from to have children or care for aging family members. It may be more difficult to break back in, and women may have it harder for these and other various reasons, but persisting is the key to eventually getting where you want to go.

2. Go with your passion. I've met a lot of environmental engineers who got into the field to address big environmental problems, and feel disillusioned when their day to day work seems to have little to do with what originally inspired them. I think it is really important to keep your passion alive and pursue it however you can. Sometimes you can do this in bold and risky ways, and sometimes you have to be more measured and realistic, but it is important to always remember why you do what you do, and work toward your passion. I have been really lucky to have been rewarded for taking big risks – I'm not sure it always works out well for people pursuing what they love in bold and risky ways – but I think it's important to do so regardless of the outcome. Putting your energy behind your passion will often create opportunities where there weren't any before, and those opportunities can transform your life, your field, or the world.

And

3. Seriously network. My students hear this advice from everyone, we all did and do – but it's a hard-learned lesson for many of us. I didn't heed this advice early on because I often felt marginalized in my field or in other social networks for a variety of reasons. The key for me has been finding the people I genuinely get along with (i.e., not worrying about whether they are the "right" people to network with), and building the relationships I want to foster. Opportunities have grown out of these relationships that I never could have anticipated or expected.

**You have worked in the environmental field since 1993. How has the field changed during that time? Have you witnessed any cultural shifts worth noting?**

The strongest and scariest trend I have witnessed is the censorship of government scientists over the last eight years. A personal anecdote from my time at the EPA – a rumor flew around the office where I worked as an AAAS fellow in 2001 that a White House staffer called the Oil Program and asked them for evidence that domestic oil spills were less harmful to the environment than foreign oil spills. When the scientists in that office politely explained that the origin of the oil wasn't a factor in the environmental impact of the spill, they were told to find the evidence. At the time, it amused the EPA employees. Since then, of course, swaths of language about the effects of climate change were literally blacked out of government reports, and scientists have resigned over issues of White House intervention in the integrity of government science.

Having learned from Frank von Hippel the value of science advisors on the Hill and in the various agencies of the executive branch, I have been horrified by the erosion of respect for science that has occurred under the current administration. I think this erosion began with the dissolution of the Office of Technology Assessment in 1994. I don't know how long it will be before our government can win back the talent it has lost through resignations, intimidation, and the creation of a hostile climate for scientists. This has strongly affected the EPA but it has also affected other agencies working on science and technology issues.

On campuses, there are several positive trends -- toward increased investment in environmental issues educationally and operationally, and a willingness to connect the two as part of the mission of the university or college. There is a big difference between investment in recycling programs in the late 1980s and early 1990s and the kind of comprehensive sustainability initiatives campuses are undertaking now. The integration of community-based learning and the resources allocated to that approach can only benefit environmental education and the work of universities. While it is always hard for academic institutions to transcend disciplinary boundaries, the challenge of environmental problems has created an excellent set of opportunities to strive to work across disciplines, and there are new successes all the time.

A third big cultural shift has been around public awareness of climate change and a willingness to do something about it. It has been a long road, and we have a long way to go, but there is noticeable progress – despite huge obstacles like those described above.

**Please describe the two book projects you are working on.**

I am currently writing a book on engineering and social justice that uses liberative pedagogies to help engineers who want to work for social justice gain the knowledge and skill set they need to work effectively in whatever work they do. Environmental issues figure prominently in the book, along with other social justice issues.

Following that project, I am planning to write a thermodynamics textbook that addresses the reality that thermodynamics is still taught in engineering schools as a 19$^{th}$ century field, focused on steam and internal combustion engines. We have to get away from this and begin to teach a course for 21$^{st}$ century engineers that will work on energy.

***Fast Six Questions***

**What was the most inspiring moment of your career?**

Successfully completing the high ropes course at the Outward Bound Professional School with a small group of tenure-track women engineering faculty supporting me.

**What books have had the greatest impact on you?**

William Faulkner, *The Bear*.
Kurt Vonnegut, *Cat's Cradle*.

**What artist do you admire the most?**

I would have to say Sylvat Aziz, an art professor at Queens University I had the pleasure to meet her a little over a year ago at a conference on engineering and social justice. Through her art, Sylvat raises a variety of questions about social justice, and what it means to be a Muslim woman living in North America in a post-9/11 world. In addition to creating provocative art about contemporary culturally and politically relevant topics, she also works on developing more ecologically sustainable materials and methods for contemporary artists. Her willingness to engage in a conversation about engineering and social justice illustrates her ability to integrate disparate ideas, which I deeply admire.

**What modern day hero do you most emulate?**

I guess I'd say I try to be like Molly Ivins, outspoken and articulate when it counts, and wickedly funny and lighthearted about it all.

**If you could go back in time and do anything over again, what would you chose to do differently?**

I would believe in myself more.