

## NAPSEISComment Resource

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**From:** Brown, Eugene [efbrown@vt.edu]  
**Sent:** Thursday, May 15, 2008 12:21 PM  
**To:** NorthAnnaCOLAEIS Resource  
**Subject:** comments in support of the North Anna SEIS  
**Attachments:** NRC NAPS3 EIS Hearing Statement-Pierson.doc; NRC NAPS3 EIS Hearing Statement-Ball.doc; NRC NAPS3 EIS Hearing Statement-Brown 3.doc

Dear Sirs:

I have now added the comments provided my other Virginia Tech colleague, Ken Ball, to what which I sent you on May 12th. Here is the complete record of our comments.

efb

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**From:** Brown, Eugene  
**Sent:** Monday, May 12, 2008 1:03 PM  
**To:** 'NorthAnna.COLEIS@nrc.gov'  
**Cc:** Pierson, Mark; Ball, Kenneth  
**Subject:** comments in support of the North Anna SEIS

Please find attached the comments in support of the North Anna SEIS delivered by my colleague Mark Pierson and me at the public meeting in Mineral, Virginia, on April 16<sup>th</sup>, 2008.

efb

Eugene F. Brown, Professor  
Mechanical Engineering  
112 Randolph Hall  
Virginia Tech  
Blacksburg, VA 24061  
V: 540-231-7199  
F: 540-231-9100

**Federal Register Notice:** 73FR13589  
**Comment Number:** 4

**Mail Envelope Properties** (51336CD78F2B2A4DA844865DDFA151DBD43638)

**Subject:** comments in support of the North Anna SEIS  
**Sent Date:** 5/15/2008 12:21:18 PM  
**Received Date:** 5/15/2008 12:21:26 PM  
**From:** Brown, Eugene

**Created By:** efbrown@vt.edu

**Recipients:**  
"NorthAnnaCOLAEIS Resource" <NorthAnnaCOLAEIS.Resource@nrc.gov>  
Tracking Status: None

**Post Office:** elessar.cc.w2k.vt.edu

<b>Files</b>	<b>Size</b>	<b>Date &amp; Time</b>
MESSAGE	765	5/15/2008 12:21:26 PM
NRC NAPS3 EIS Hearing Statement-Pierson.doc		41024
NRC NAPS3 EIS Hearing Statement-Ball.doc		43072
NRC NAPS3 EIS Hearing Statement-Brown 3.doc		49216

**Options**  
**Priority:** Standard  
**Return Notification:** No  
**Reply Requested:** No  
**Sensitivity:** Normal  
**Expiration Date:**  
**Recipients Received:**

TESTIMONY Offered by

Mark A. Pierson, Ph.D.  
Research Associate Professor  
Mechanical Engineering Department  
Nuclear Engineering Programs  
Virginia Tech  
303 Durham Hall (MC 0261)  
Blacksburg, VA 24061  
(540) 231-9112  
[mark.pierson@vt.edu](mailto:mark.pierson@vt.edu)

Good evening ladies and gentlemen and Nuclear Regulatory Commission staff. My name is Mark Pierson. I am a research associate professor associated with the nuclear engineering programs in the Mechanical Engineering department at Virginia Tech. I am also a retired U.S. Navy Commander having spent the majority of my 23-year career in nuclear-powered submarines and related assignments including a tour at the Naval Reactors headquarters in Washington, D.C. I am also a member of the American Nuclear Society and a Member-at-Large on the Executive Committee of the local Virginia section of the American Nuclear Society. I am here today to speak in favor of Dominion Nuclear Power's application for a combined operating license (COL) for North Anna Power Station Unit Three. The environmental impact of this nuclear power plant will be significant -- but in a positive way. Let me explain.

I will first discuss our sources of electrical generation. In 2006, which is the latest published data from the Energy Information Administration, nuclear power provided approximately 19% of the electricity in the United States and about 38% within the Commonwealth of Virginia. For the U.S., the remaining electrical generation sources come from coal at 50%, natural gas at 20%, hydroelectric at 7%, oil at 2% and finally from all other renewable energy resources combined such as geothermal, solar, wind, and biomass at only 2%.

The North Anna Power Station Unit Three reactor plant would provide about 1500 MW of electricity. For comparison, this is equivalent to about 750 to 1000 wind turbines -- more than twice the size of the world's largest wind farm. Additionally, wind turbines have an average output of about 30% of their maximum power capacity, only providing electricity when wind speeds are able to support it. Thus, to consistently provide the same electrical power generation as North Anna Unit Three, it would require about three times as many wind turbines or 2000 to 3000 turbines. I contend the environmental impact of one state-of-the-art modern nuclear reactor is much less than the impact of 3000 wind turbines covering 100 acres per turbine or over 300,000 acres total. Additionally, on a hot, steamy, windless day when power loads from air conditioning are at a peak, wind power would be unavailable. However, North Anna Unit Three would be on line providing 1500 MW of electricity all day.

If we compare a nuclear reactor to solar generation, it would take at least 12,000 acres of solar arrays to produce a maximum electrical power output equivalent. But once again, solar is not always available, especially at night, and the average output is only 20 percent of the maximum capacity. Thus, over 60,000 acres, or just under 100 square miles, of solar arrays would be needed to consistently produce the same output as one nuclear reactor. Of course, the largest solar farm currently planned to be built would only yield 80 MW of electricity at an estimated cost of about half a billion dollars. Note also that most solar facilities are being built in the western United States in the desert where there is no snow and ice. Thus, on an overcast snowy and icy day on the east coast, solar power would be unavailable. However, North Anna Unit Three would be on line providing 1500 MW of electricity day and night.

While I laud renewable energy sources such as solar and wind and believe that we must continue to build more of these kinds of plants, the point I am making is that they just cannot keep up with the current growth in electrical demand compared to other electrical generation sources such as nuclear. Additionally, the size of their footprint leads to an environmental impact that could be much greater than that of a new state-of-the-art nuclear power plant such as North Anna Unit Three.

Let us look at electrical generation costs. Since the year 2000, nuclear power has surpassed coal as the cheapest method of electricity production. In 2006, the average cost to produce electricity from nuclear generation was 1.72 cents per kilowatt-hour. This is compared to 2.37 cents per kilowatt-hour for coal generation and 6.75 cents for natural gas generation. We do admit these costs are based on the current fleet of nuclear power plants which have long since paid off most of their capital costs. However, it is anticipated that the cost to produce electricity from a new nuclear power plant will be approximately 4 cents per kilowatt-hour. However, since global warming has become an issue, there will come a time soon in this country where we will have some sort of carbon emission cap and trade program in place. Under this scenario, the cost of generating electricity from new nuclear power plants will be much lower than the cost from other sources such as coal or natural gas which will have to buy carbon credits from utilities that own nuclear power plants or hydroelectric facilities. This is because nuclear power plants have zero emission of carbon dioxide during production of electricity. In fact, nuclear power provides the largest source of emission-free electricity making up over 73% of the total emission-free electrical generation in the United States. The other primary source of emission-free electricity at 24% is hydroelectric. However, hydroelectric capacity in this country is about tapped out.

We will not be building very many new major dams any time soon given the present regulations protecting our streams and rivers. To put all of this in perspective, it is estimated that the new North Anna Power Station Unit Three would reduce greenhouse gas emissions by the equivalent of taking 1.5 million cars off the road compared to conventional power production sources.

In this discussion, I have stressed the environmental benefits of nuclear power generation. However, it must be noted that every method of electrical power generation has its advantages and disadvantages – some of which were noted above in the case of renewable energy sources. Nevertheless, I personally believe that if one looks at all the facts associated with nuclear power generation, that its advantages by far outweigh any disadvantages, especially in the environmental arena. Regardless of what opinions others may conclude in this regard, we still face the serious issues of both global warming and providing a secure energy supply to meet U.S. demand. Using only one method of electricity generation cannot solve either of these issues by itself. We will need to use all of the technologies available at our disposal such as renewable energy sources, clean coal technology, nuclear energy, nuclear fusion, reduced automobile emissions, conservation efforts, et cetera. While we similarly cannot rely solely on nuclear power as the only resolution, we also cannot ignore it as a necessary part of the solution. Thus, I support Dominion Nuclear Power's combined operating license application for the North Anna Power Station Unit Three as a first step in the battle of fighting global warming.

Thank you, this concludes my remarks.

TESTIMONY offered by:

Kenneth S. Ball, Ph.D., P.E.  
L. S. Randolph Professor and Head  
Department of Mechanical Engineering  
Virginia Tech  
Blacksburg, Virginia Tech

Good evening, members of the community, NRC staff, industry representatives, and other citizens concerned about nuclear power. I am the L.S. Randolph Professor and Head of the Department of Mechanical Engineering at Virginia Tech since August 2004. I have been appointed by the Dean of Engineering to lead a taskforce at Virginia Tech to re-establish a nuclear and radiation engineering and science program, in accordance with our mission of teaching, research, and outreach. I have almost twenty years of experience in research and service in the area of nuclear engineering and science, including public policy related to nuclear waste, weapons, and security. Prior to coming to Virginia Tech, I was a professor at the University of Texas at Austin for 15 years, and I succeeded Dr. Dale Klein, current Director of the NRC, as the Chair of UT's Nuclear Reactor Committee. I was responsible for the safety of the reactor facility and its operations, and ensuring independent oversight of all its related activities. I was also responsible for overseeing post-9/11 changes in security procedures at the reactor. My research experience includes non-proliferation issues surrounding weapons grade plutonium and special nuclear materials, and the preparedness and response to terrorism attacks involving weapons of mass destruction (such as dirty bombs and nuclear devices). I am a member of the American Nuclear Society and the American Physical Society, and I am a Fellow of the American Society of Mechanical Engineers. I am also a registered professional engineer in the State of Texas.

Virginia Tech's new nuclear engineering and science initiative has the strong support of the campus community, administration, faculty, staff, and students. Our new program will be very broad in scope, ranging from traditional areas such as nuclear power generation and non-destructive testing and evaluation, to nuclear medicine (both therapeutic and diagnostic) and materials science and engineering. It involves multiple colleges – the Colleges of Engineering; Science; Veterinary Medicine, Agriculture and Life Sciences, Natural Resources, and even Liberal Arts & Human Sciences – as well as the joint VT/Wake Forest School for Biomedical Engineering and Science. Scholars and researchers recognize the importance of nuclear and radiation science in many fields and technologies vital to society, and also recognize that the benefits far outweigh legitimate concerns about safety, security, and the environment.

The College of Engineering has taken the lead on campus in the development of new programs in nuclear science and engineering. Within the College of Engineering, one of our principal efforts combines outreach, education, and research in partnership with the Commonwealth of Virginia and the Lynchburg-based Center for Advanced Engineering and Research, or CAER. Virginia Tech has partnered with the CAER and Lynchburg-

based nuclear companies including AREVA and BWXT to initiate new research in the nuclear engineering area, and also to offer new educational programs including a Graduate Nuclear Engineering Certificate to accompany the Masters of Engineering degree offered by the Department of Mechanical Engineering. Courses are broadcast to Lynchburg through the Commonwealth Graduate Education Program (CGEP), enabling Lynchburg area residents and employees to obtain a Virginia Tech graduate degree in mechanical engineering.

My colleagues Gene Brown and Mark Pierson will provide more detailed information about these programs. As a department head, I would like to emphasize the wide-spread interest in our new nuclear program among our alumni, students, and their parents throughout the Commonwealth of Virginia. Almost every day, we receive inquiries about our nuclear programs and the opportunities that it presents. Simply “Google-ing” the keywords “nuclear” and “Virginia Tech” yields hundreds of “hits” or links to sites related to our recent activities in nuclear engineering and science. Our initial course offerings in nuclear engineering have been filled to room capacity, as students are very quick to recognize the career opportunities that exist in the field. The nuclear renaissance is real, and it is generating considerable excitement nation-wide. Virginia Tech was one of the first universities to public announce its intention to re-establish a nuclear program about two years ago, but even in that short period of time many other universities have followed our path and are establishing new programs. The Commonwealth of Virginia and its citizens have much to gain by supporting nuclear energy initiatives, and we are well-positioned to be at the fore-front of technological leadership in this area, which will have far-reaching implications for Virginia’s economy.

One of my current responsibilities is to represent Virginia Tech on the Board of Directors for a new consortium of universities, citizen’s groups and economic development partnerships, and industry called SUNRISE, the Southeast Universities Nuclear Reactors Institute for Science and Education. Virginia Tech is a charter member of SUNRISE, which functions with the strong support and cooperation of our nation’s national Department of Energy laboratories, in particular ORNL and SRNL. SUNRISE is dedicated to supporting nuclear science and technology development. The SUNRISE mission is to provide a single point of contact for a broad range of technical support, long-term and short-term research assistance, and workforce development to the nation’s nuclear power industry.

SUNRISE fosters collaborative relationships that help to train the next generation of engineers and scientists. At the same time, companies and laboratories are able to test and develop technologies in a secure and cost-effective manner. With the efforts of SUNRISE, students can find career paths in:

- Energy
- National Security
- Medicine
- Health and Safety
- Environmental Science



- Computational Sciences
- Space Exploration

SUNRISE provides a framework to support the growth and training of the new generation of specialists who can advance and protect our nation's critical infrastructure. Together, SUNRISE partners will advance the level of technical achievement and research and workforce development in the United States and will lead the nation in innovation spurred by research and education.

The list of current university members of SUNRISE include:

- Clemson University
- Georgia Institute of Technology
- Mississippi State University
- North Carolina State University
- South Carolina State University
- University of Florida
- Missouri University of Science and Technology
- University of South Carolina
- University of South Carolina, Aiken
- University of Tennessee
- Virginia Polytechnic Institute and State University

These prestigious universities all recognize the enormous opportunities that exist in nuclear technologies. The citizens of their respective states will benefit from cheaper, cleaner power production as the majority of new nuclear reactors will be built in the Southeast U.S. For Virginia to remain in a leadership position, it is important to support the nuclear power industry as they are key partners and the largest employers of the graduates of our nuclear programs.

In conclusion, I would like to voice my strong support for the combined operating license application submitted by Dominion Nuclear Power for North Anna Power Station Unit No. 3. As a citizen of the Commonwealth of Virginia, and a father of four teenagers, I believe that ensuring that the electric power supply is sufficient to meet the future requirements of the Commonwealth, in an efficient, cost-effective and environmentally responsible manner, is vital to our future prosperity. As a researcher, engineer, and scientist, I believe that nuclear reactors and nuclear power generation must be included in our nation's energy portfolio and that nuclear power generation is extremely safe and environmentally sound.

Thank you for providing me with this opportunity to express my opinions in support of nuclear power.

TESTIMONY offered by

Eugene F. Brown, PhD, PE  
Professor of Mechanical Engineering  
Virginia Tech  
Blacksburg, Virginia

I am a Professor of Mechanical Engineering at Virginia Tech and have taught courses related to energy conversion for almost 40 years. Along with my colleague, Mark Pierson, I am currently managing Virginia Tech's relationship with the nuclear industry cluster in Lynchburg. This involves nearly \$750K in nuclear engineering research supported by Virginia's Department of Housing and Community Development, and the responsibility for the development of a state-wide program in nuclear engineering education. I am a member of the American Nuclear Society and a registered Professional Engineer in the Commonwealth of Virginia.

Nuclear energy is a key ingredient in the Virginia Energy Plan\* which calls for a 20 percent increase in the in-state production of electrical energy by 2017, and a simultaneous 30% *decrease* the level of greenhouse gas emissions by 2025. According to remarks made by Stephen Walz, Chair of Governor Kaine's Energy Policy Advisory Council, conservation and renewable energy targets will only get us half-way to this goal. Research in the use of clean burning coal-fired power plants and nuclear energy is clearly needed to make up the difference.

Virginia Tech is well positioned to be a significant contributor to this effort since we possess strength in all of the 13 energy generation, use, and policy expertise sectors identified by the 2006 CIT *Assessment of Energy-Related Research and Development in Virginia*, and because of the strong support provided by the University to energy research its 2006-2012 Strategic Plan. Specifically, the University has committed itself to become a national leader in the fields of clean coal, fuel cell, bio-renewable fuels, solar, wind, and nuclear energy. Virginia Tech has more than 100 faculty, more than 400 students, 10 educational programs, and 20 research centers working in energy and energy-related scholarship and research. Since 2006, under the auspices of the Dean's Task Force on Energy Security and Sustainability, we have organized an Energy Forum, an Energy Showcase, a Dean's Forum on the Environment, and have hosted the visits to Campus of more than 10 nationally known speakers on energy including Stephen Walz, Robert F. Kennedy, Jr., James R. Schlesinger, and former governor, Mark Warner.

Economic development is one of the five elements of the Virginia Energy Plan. As Stephen Walz said when he was on campus, "In Virginia, energy is the foundation of many parts of our economy."

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\*A legislatively mandated document which reflects input by all major stakeholders in the Commonwealth and has the endorsement of Governor Kaine.

Let's talk a little about the economy and, in particular, about economic development. It is no exaggeration to say that having affordable and secure sources of electrical energy is an essential ingredient of not only the health of Virginia's economy, but the economic well being of the nation as a whole. This is Dominion's goal as well as the goal of my colleagues conducting energy-related research at Virginia Tech. Nuclear energy now represents the nation's (and Dominion's) least expensive source of electrical energy. The need for increased in-state energy production along with the need to reduce green house gas emissions requires serious consideration of the installation of new nuclear power plants such as North Anna's Unit 3 which, of course, is the topic of this meeting.

Virginia is not the only state that has realized this. After 27 years in which no new nuclear power plants were built in the US, the NRC has received requests to build and license 15 new reactors in the past two years. Designing and building these facilities will require large numbers of trained professionals who are in short supply because of the aging nuclear workforce, and because of the limited number of nuclear engineers produced by the small number of nuclear engineering programs in existence today.

In fact, the decline in the number of nuclear engineering programs can be directly attributed to the decline in industry support for nuclear engineering education and research and a decline in the industry's need for nuclear engineering graduates. Times have changed, and now the nuclear industry is in a period of resurgence, resulting in part from fears of global warming and the related need for carbon free electricity production. In the words of Stephen Walz, Chair of Governor Kane's Energy Policy Advisory Council, "Virginia's universities have cut back on nuclear programs over the past few decades. Now is the time to turn this back." My colleagues Mark Pierson and Ken Ball have brought with us this evening, Mr. Paul Rittenhouse, the secretary of Virginia Tech's new student chapter of the American Nuclear Society who, upon graduating this May, will be working at Dominion's North Anna facility.

In 2006, Virginia Tech was given an opportunity to do exactly this with an economic development grant provided by the Department of Housing and Community Development to Region 2000. Region 2000 comprises the 2,000 square mile area incorporating Amherst, Bedford, Appomattox, and Campbell Counties; the Cities of Lynchburg and Bedford; and the Town of Altavista. Virginia Tech's master research agreement with Region 2000 funded by this grant is now in its second year and has resulted in more than \$700K of research being conducted at Virginia Tech to provide technology based economic development for the region's nuclear cluster industries such as AREVA NP, Inc, and Babcock and Wilcox. In addition, in 2007, in response to encouragement provided by Region 2000, the mechanical engineering department at Virginia Tech developed a distance-learning nuclear engineering graduate certificate program. In the first year of offering courses, this program has attracted 20 graduate students and is now delivered by the Commonwealth Graduate Engineering Program throughout the state. In addition our newly-announced undergraduate nuclear engineering certificate program has attracted 40 students.

This is only the beginning. As a result of the success of this research and educational relationship, Region 2000 will shortly submit an application to the Virginia Tobacco Commission for a Nuclear Engineering R&D Center. By providing local industries, research

universities, federal laboratories, and other partners with the physical infrastructure to foster knowledge creation, facilitate technology transfer, and improve the scientific and engineering workforce, the nuclear engineering-based research and educational programs of this \$10M center are expected to return a regional and statewide economic impact of nearly quadruple that amount and produce more than 350 regional and statewide jobs.

We also have an aggressive plan to grow Virginia Tech's undergraduate and graduate nuclear engineering program in the future. Our long term vision is to grow out present certificate program into an undergraduate minor in nuclear engineering and eventually to establish a School of Nuclear Science and Engineering which will encompass the nuclear sciences and medicine as well as nuclear engineering and offer M.S. and Ph.D. degrees in nuclear engineering and science in collaboration with our College of Science and our sister departments in the College of Engineering.

These are exciting times for nuclear engineering. I enthusiastically support the building of North Anna's Unit 3 and the other 14 proposed nuclear power plants in the United States for the secure and affordable source of electrical energy which they promise and the opportunity that this offers to universities like Virginia Tech to provide the workforce and the technological advancements which will make this promise a reality.