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Declaration of Dr. Ross McCluney
Regarding Environmental and Safety Issues at Nuclear Power Plants
Based on Events at Fukushima and the Findings of the NRC Interim Task Force

I, Ross McCluney, make the following declarations:

Brief Statement of Professional Qualifications

1. My scientific career has spanned three and a half decades and several disciplines. For my B. A. degree earned at Rhodes College in Memphis I studied physics, mathematics, economics, philosophy, English literature, and religion. As part of my undergraduate coursework, I also learned the rudiments of nuclear physics, operated a nuclear particle detector, and briefly studied the health effects of ionizing radiation. My M.S. thesis research at the University of Tennessee in Knoxville dealt with the diffraction of laser light by high frequency sound waves in water. I studied the new field of holography at the University of Rochester's Institute of Optics, then pioneered the use of holographic interferometry for diagnostic tests of optical systems. This work continued while I pursued a Ph.D. degree on both NASA and National Science Foundation fellowships at the University of Miami, developing a complex holographic interferometer for detecting minute changes in gas density inside a test cell made of optically imperfect clear acrylic plastic. I interrupted my physics studies for a year to do a graduate assistantship at the University's Center for Urban and Environmental Studies, working under noted ecologist Arthur Marshall. Upon return to my Ph.D. dissertation research, I studied optical oceanography and completed my Ph.D. dissertation on light scattering by marine phytoplankton.

2. Following receipt of my doctorate in physics, I worked for three years as an optical oceanographer in the Hydrology and Oceanography Branch at NASA's Goddard Space Flight Center in Greenbelt, MD, occasionally working with Jacques Cousteau on joint NASA/Cousteau projects.

3. From 1976 to 2007 I was a Principal Research Scientist at the Florida Solar Energy Center, a research institute of the University of Central Florida.

4. I have authored many publications including:

- *Introduction to Radiometry and Photometry*, textbook published by Artech House, 1992
- *Humanity's Environmental Future: Making Sense in a Troubled World* , SunPine Press, Cape Canaveral, Florida, © 2004
- *Getting to the Source: Readings on Environmental Values,* SunPine Press, Cape Canaveral, Florida, © 2004

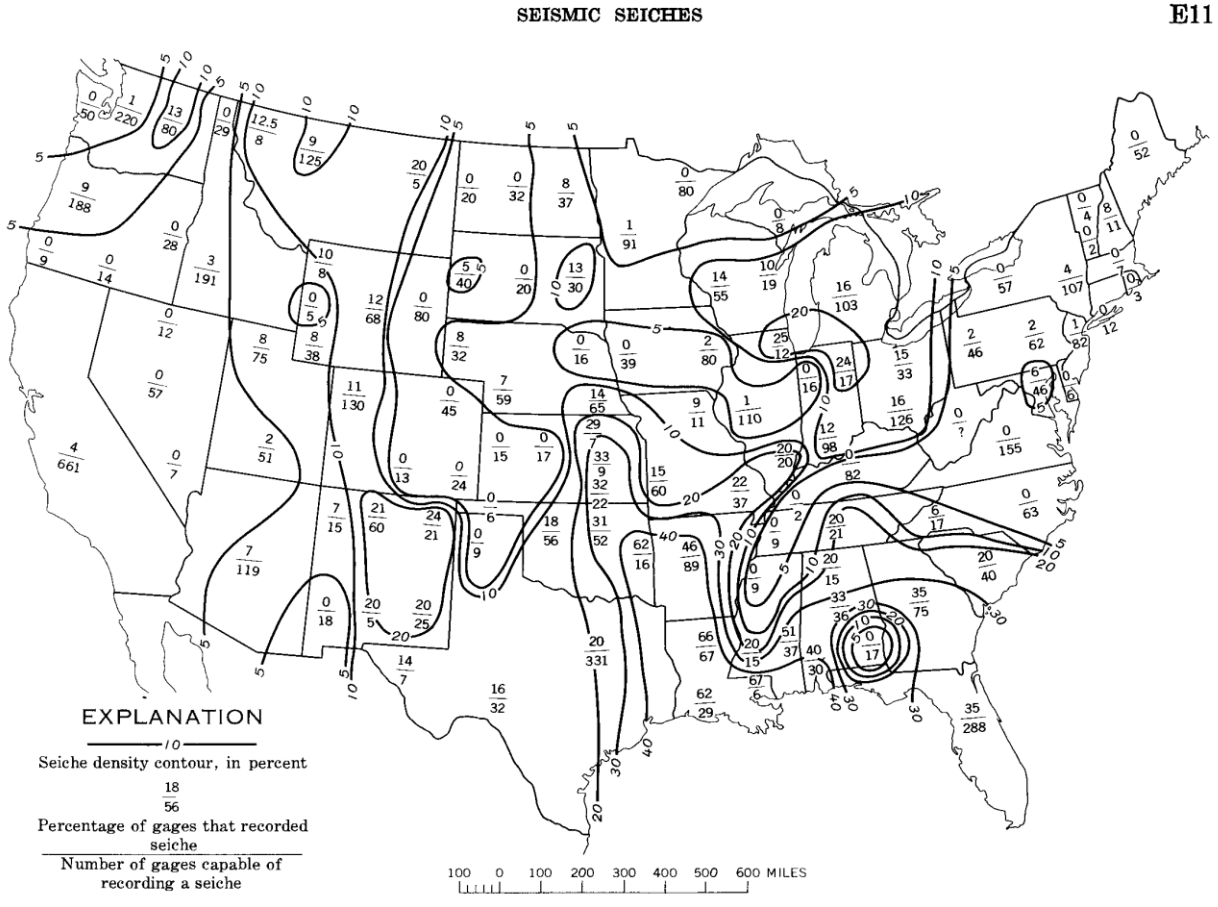
5. Since 2007 I have done technical work at SunPine Consulting and environmental work through the Solar Valley Coalition, the Cherokee Group of the Tennessee Chapter of the Sierra Club, the Southern Alliance for Clean Energy and as a co-founder of the BEST chapter of Blue Ridge Environmental Defense League.

Seismicity, Hydrology and Inland Seiches

6. Seismic seiches are standing waves on rivers, reservoirs and lakes caused by disturbances from tectonic activity and earthquakes. Seismic seiches may occur at great distances from the epicenter of the initiating seismic event; they are continental and even global in their effect on bodies of water.

7. For example, the Alaska earthquake of March 1964 caused seismic seiches in water bodies across North America. The impact on the hydrologic regimen in the coterminous United States was detailed in a 1968 US Geological Survey report.[1] Surface water gauges at 850 stations in North America and 4 in Australia registered seiches from the 1964 quake.

8. The locus of the greatest density of seiches caused by the Alaska Earthquake was the southeastern United States, with the greatest number in the states bordering the Gulf of Mexico. According to the USGS report, seiches as high as 1.8 meters were registered on the Gulf Coast. The prevalence of seismic seiches in the Southeast is illustrated on the map of the United States *infra* on which was recorded the percentage of surface water gauges that recorded seiches subsequent to the 1964 Alaska earthquake.



6.—Map of conterminous United States showing seiche density, in percent, by State and by river basin.

[1] *Seismic Seiches From the March 1964 Alaska Earthquake*, McGarr A and Vorhis RC, US Geological Survey Professional Paper No. 544-E, 1968

9. The geographic pattern of seiches of the Alaska earthquake did not depend on distance from the epicenter. Rather, geologic features were deemed to be the principal factor in determining where and how strong the oscillations of surface waters would be. The most influential geologic features are: thickness of surface sediments, thrust faults and structural basins. The thick surface sediments of the Mississippi Delta promoted seiches in that region. The USGS report identified Georgia's Brevard Fault region, the Arkansas-Oklahoma Ouachita Mountains and the Tennessee-Alabama Valley and Ridge province as having thrust faults conducive to seismic seiches.

10. The 1964 Alaska earthquake was measured at 8.4 on the Richter scale. The 2002 Denali earthquake was one of the largest inland quakes recorded in North America. In the Southeast, an earthquake in 1903 centered in the Savannah River area was recorded at an intensity of VI (Mercalli). In 1924 an earthquake affecting an area of 50,000 square miles shook most of South Carolina. In 1945 a shock centered west of Columbia, SC was felt as far away as Georgia and Tennessee. A magnitude 3.4 (Richter scale) earthquake was centered near Orangeburg, SC in 1971. The Charleston, South Carolina earthquake of 1886 had a magnitude of 7.3 (Johnson, 1996) and was felt over 2.5 million square miles, from Cuba to New York, and Bermuda to the Mississippi River.[2]

11. Earthquakes and lower-power tremors can certainly have serious impacts near to their occurrences, but earth movements can also be produced at substantial distances from the epicenters, as evidenced by the recorded history of seiches outlined above. Subsurface geological conditions at and near nuclear sites in the U.S. can make such sites vulnerable to subsidence, lateral movement, and other potentially disruptive ground disturbances.

12. Additional work is needed to identify potential subsurface threats to plant safety in the event of seismic activity at and around nuclear sites. Karst formations, in particular, should not escape scrutiny, due to their general instability. Engineers responsible for stormwater management are particularly aware of the susceptibility of such formations. Consider the following caution in the Abstract of the 1999 report "Geotechnical Engineering Considerations For Stormwater Management In Karst Terrain" by Mark R. Ralston, and Issa S. Oweis.

> Soluble bedrock (karst) settings can present a unique set of stormwater management challenges to planners and developers. Sinkholes and land subsidence are two common occurrences in such settings, and stormwater management activities often affect the development of these natural phenomena. An understanding of the natural and anthropogenic conditions that can affect the expression of karst features is important to the design and implementation of stormwater management facilities such as stormwater collection systems, stormwater routing, detention/retention basins, sinkhole/subsidence remediation efforts, and other engineering activities.[3]

[2] South Carolina Emergency Management Division has responsibility for the development, coordination, and maintenance of the Earthquake Plan and selected other plans, http://www.scemd.org/news/publications/EQ%20Guide%202008/1886_EQ_New_08.html

[3] Mark R. Ralston, and Issa S. Oweis, "Geotechnical Engineering Considerations For Stormwater Management In Karst Terrain." 1999 Southeastern Pennsylvania Stormwater Management Symposium -- Implementing Best Management Practices, Villanova University, Villanova, Pennsylvania. October 20-21, 1999,

For example, the Bellefonte nuclear generator site on the Tennessee River in northeastern Alabama is known for its nearby Karst formations.[4]

Earthquakes Cannot Be Predicted

13. An earthquake is an unpredictable event. This fact was made clear by the Fukushima disaster which occurred in an area with a known seismic history and to a society well adapted to living on the fault line, but the earthquake and resulting tsunami exceeded expected consequences. It does not take oceanic tsunamis to produce potentially serious localized flooding following geologic shifts, in areas adjacent to or surrounded by rivers, reservoirs, and lakes, including those formed by dams. Even modern science and engineering are no match for tectonic movement:

> An earthquake results from sudden slip on a geological fault. Such fracture and failure problems are notoriously intractable. The heterogeneous state of the Earth and the inaccessibility of the fault zone to direct measurement impose further difficulties. Except during a brief period in the 1970s, the leading seismological authorities of each era have generally concluded that earthquake prediction is not feasible. Richter, developer of the eponymous magnitude scale, commented as follows in 1977: "Journalists and the general public rush to any suggestion of earthquake prediction like hogs toward a full trough... [Prediction] provides a happy hunting ground for amateurs, cranks, and outright publicity-seeking fakers"[5]

14. Charles Richter, California Institute of Technology professor of seismology, spent most of his professional life in this field. He assisted officials in Japan and California with earthquake engineering and safety preparations. His description of earthquake "prediction" needs to be taken seriously by Nuclear Regulatory Commission decision makers.

NRC Task Force Orders Should Preclude Further Action on Reactor Licensing

15. The Near-term Task Force Review[6] provides guidance and recommends specific orders to be implemented by the Nuclear Regulatory Commission. The NRC should execute these orders before allowing any nuclear power plant license to proceed. The three orders recommended by the Task Force which are directed towards seismic and hydrology issues are:

- Order licensees to reevaluate the seismic and flooding hazards at their sites against current NRC requirements and guidance, and, if necessary, update the design basis and SSCs important to safety to protect against the updated hazards. (Section 4.1.1—detailed recommendation 2.1)
- Order licensees to perform seismic and flood protection walkdowns to identify and address plant-specific vulnerabilities and verify the adequacy of monitoring and maintenance for protection features such as watertight barriers and seals in the interim period until longer term

[4] The New World Encyclopedia at http://www.newworldencyclopedia.org/entry/Karst_topography
[5] Geller RJ et al, "Earthquakes Cannot Be Predicted," Volume 275, Number 5306, pp. 1616, 1996, The American Association for the Advancement of Science, http://scec.ess.ucla.edu/~ykagan/perspective.html
[6] Recommendations for Enhancing Reactor Safety in the 21st Century: The Near-term Task Force Review of Insights from the Fukushima Da-ichi Accident, July 12, 2011

actions are completed to update the design basis for external events. (Section 4.1.1—detailed recommendation 2.3)

- Order licensees to provide reasonable protection for equipment currently provided pursuant to 10 CFR 50.54(hh)(2) from the effects of design-basis external events and to add equipment as needed to address multiunit events while other requirements are being revised and implemented. (Section 4.2.1—detailed recommendation 4.2)

In my opinion, these orders should be implemented by the Commission immediately.

11 August 2011

Ross McCluney | Date

Curriculum Vitae of Ross McCluney

Dr. Ross McCluney is a nationally recognized scientist, author, and speaker. His research specialties include optical system design and evaluation, building window solar radiation analysis, solar cooker and solar water distillation system design. He has collaborated with artist Susan Miller on the design and fabrication of artistic sundials for public spaces (www.sunpath-designs.com). Since the first Earth Day in 1970—when he was a leader in the University of Miami's observance of that event—he has been writing and speaking on environmental issues for a variety of audiences.

As an optical physicist McCluney's interests are in the optical and illumination performances of a variety of novel solar lighting systems, including the relatively new tubular skylight products being marketed by several companies.

Dr. McCluney served as technical consultant on the design and construction of the world's largest sundial at Walt Disney World and smaller ones at the University of Texas Pan American Campus in Edinburg and at the Council Bluffs Public Library in Council Bluffs, Iowa. Dr. McCluney provides technical consulting services to private and governmental organizations in a variety of areas.

He has written more than 60 technical papers—including several papers for general audiences on environmental ethics—and four books. He has taught both undergraduate and graduate courses at the college and university levels. He supervised the M.S. thesis research of several students at Florida Institute of Technology in Melbourne.

His primary interest is in the energy and illumination performance of fenestrations systems, but he also pursues work in the optical aspects of solar energy collection as well as issues of energy and environmental policy, including environmental ethics and scientific responsibility. He has served on the Boards of Directors of Indian River Audubon Society and Florida Audubon Society.

Dr. McCluney's research activities in fenestration have received national and international recognition. He is past chairman of ASHRAE Technical Committee on fenestration; a member of the daylighting committee of the Illumination Engineering Society; a member and technical consultant of the U.S. National Committee on Interior Lighting of the International Lighting Commission (CIE), and a past member of the CIE's technical committee on international daylight and solar radiation measurements. He has authored over 70 papers and four books, on both technical and environmental topics. His textbook *Introduction to Radiometry and Photometry* was published by Artech House in 1994.

Dr. McCluney obtained a Bachelor's Degree in physics from Rhodes College in Memphis and his Master's Degree in physics from the University of Tennessee. His research at the University of Tennessee involved the diffraction of light by sound waves. From 1966 to 1967, he worked as a development engineer for Eastman Kodak Company in Rochester, New York, and developed a holographic interferometer for testing optical systems. He used this technique at the University

of Miami in Coral Gables, Florida to develop a ten-pass holographic interferometer for measuring very small changes in optical systems.

Dr. McCluney received his Ph.D. in physics from the University of Miami in 1973. His dissertation research was based on the scattering of light by marine organisms. He worked as a research scientist in optical oceanography in the Hydrology and Oceanography Branch of NASA's Goddard Space Flight Center in Greenbelt, Maryland, from 1973 to 1976. Dr. McCluney's work there focused on the remote measurement of ocean color.

He has served as a consultant to Kenergy Corporation, 3M Company, Syracuse Research Institute, the Dade County Florida Department of Parks and Recreation, Public Works Canada, Synertech Corporation, T. J. Bottom Industries, New York State Psychiatric Institute, Verosol-USA, U. S. Office of Energy-Related Inventions, National Institute of Standards and Technology, Holder Construction Company (builder of the Team Disney Building and North and South America's largest sundial, Lake Buena Vista, FL), BRW Architects, Queens University in Kingston, Ontario, Canada, Kell, Munoz, Wigodsky Architects, San Antonio, Morrison Associates Sundials, the U.S. Department of Justice, and Cardinal Glass Industries.

He currently serves as V.P. of Research and Development and a Director of the Sunflower Corporation of Boulder, CO as well as a member of the Board of Directors of the National Fenestration Rating Council.