

BIOSKETCH

KOFI KORSAH

Dr. Kofi Korsah is an R&D staff member in the Sensors and Instruments Research Group of the Engineering Science and Technology Division (ESTD) of Oak Ridge National Laboratory (ORNL). Dr Korsah is an expert in reactor instrumentation and protection systems, and has been or is currently the lead or co-investigator for several Nuclear Regulatory Commission (NRC)-sponsored projects including qualification of microprocessor-based I&C hardware and security of digital safety systems from unauthorized intrusion.

Dr. Korsah is a full member of the Reactor Review Committee for the ORNL *High Flux Isotope Reactor*. This involves reviewing any upgrades/modifications proposed by the Research Reactor Division (RRD) for any safety implications associated with the modifications. As the I&C expert on the review board, Dr. Korsah has on several occasions worked closely with RRD I&C personnel to evaluate the safety of proposed I&C installations.

Dr. Korsah also serves as the project manager on the *Air Force Hydrazine Detector Characterization and Calibration and Characterization Project*, whose objective is to develop an improved (lower uncertainty) and cost-effective methodology for the calibration of Air Force Hydrazine monitors.

Dr. Korsah also has interest in surface-acoustic-wave-based sensor development, and currently holds a patent on a method to extract more information and improve the sensitivity of currently available surface acoustic wave sensors. He is currently the project leader on a Seed Money project that seeks to develop a novel infrared sensor using surface acoustic wave technology.

Dr. Korsah is actively involved in the international community through his numerous presentations at scientific meetings and his participation in recognized standards committees. Specifically, he was an IEEE working Group member for developing IEEE 7-4.3.2-1993, *Standard Criteria for Digital Computers in Safety Systems in Nuclear Power Generating Stations*. He has also served as an IEEE Working Group Member on WG2.0 (for IEEE Std 323, *IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations*). Dr. Korsah is a Senior Member of IEEE and a member of the American Nuclear Society (ANS).

Prior to joining ORNL in 1990, Dr. Korsah served in various nuclear/electronics teaching and research capacities as follows: Ghana Atomic Energy Commission (1974 - 1977 as Scientific Assistant), University of Maine (1982 - 1984 as Assistant Professor in Physics and Electrical Engineering), University of Liberia (1984 - 1986 as Lecturer in Electrical Engineering), University of Ghana (1986 - 1988 as Lecturer in Computer Science), and Tennessee Wesleyan College (1988-1990 as Assist. Professor in Computer Information Systems).

RESUME

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PRESENT POSITION: **Senior R&D Staff**, Oak Ridge National Laboratory [since 1990]

EDUCATION: **B.S. (Electrical Engineering)**, University of Sc. & Tech., Kumasi, Ghana, 1973
M.S. (Nuclear Engineering), University of Missouri, Columbia, Missouri, 1980
Ph.D. (Nuclear Engineering), University of Missouri, Columbia, Missouri, 1983

AREAS OF EXPERTISE: Nuclear/Electronics Instrumentation, Novel applications of surface acoustic wave-based sensors, standards development for nuclear power plant environment.

AREAS OF INTEREST: Development of sensors and measurement systems for applications in energy development and efficiency, nuclear power, harsh environments, and environmental sciences.

SCIENTIFIC AND PROFESSIONAL ACTIVITIES: **Senior Member, Inst. of Elect. & Electronics Engineers (IEEE).**
Past Member, IEEE Working Group (SC6.4) for developing IEEE-7-4.3.2-1993, *Standard Criteria for Digital Computers in Safety Systems of Nuclear Power Generating Stations.*
Past Member, IEEE Working Group (SC2.0) for revising IEEE Std 323, *IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations.*
Member of the Reactor Review Committee, Oak Ridge National Laboratory.
Member of Review Committee: *Title I Review of Spallation Neutron Source – Target Assemblies*

CURRENT RESEARCH ACTIVITIES: **Principal Investigator: *Advanced I&C System Qualification Project***
Sponsor: U. S. Nuclear Regulatory Commission.
Project Leader: *Novel Surface Acoustic Wave Infrared Sensor*
Sponsor: ORNL Seed Money Research Project.
Project Leader: *Air Force Hydrazine Detector Calibration and Characterization Project.*
Sponsor: U.S. Air Force.

PATENTS AND AWARDS: **U.S. Patent No. 6,044,332;** Surface Acoustic Wave Harmonic Analysis.
Best Author Award, *Session: Safety System Upgrades for Nuclear Plants*, 1994 Joint POWID/EPRI Conf., Orlando, FL.
Best Paper Award, Nuclear Radiation Physics Category, American Nuclear Soc. 18th Annual Midwest Student Conf., Iowa State University, 1981.

POSITIONS HELD PRIOR TO ORNL: Served in various teaching/research capacities as follows:
Research Fellow (part time), Nucl. Engr. Dept., The Univ. of TN, (1989-1990)
(Research Activity: Applied neural networks to the analysis of neutron noise data).
Assistant Professor of Computer Science (1988-1990), Tennessee Wesleyan College, Athens, TN. (Courses Taught: BASIC and FORTRAN programming; Database Management Systems);
Lecturer, Department of Computer Science, University of Ghana (1986-1988), Legon, Ghana. (Courses Taught: BASIC and Assembly Language (Intel 8085) Programming, Digital Logic Design).
Assistant Professor of Electrical Engineering, Univ. of Liberia (1984-1986), Monrovia, Liberia. (Courses Taught: Circuit Analysis, Electronic Instrumentation, Analog Circuit Design).
Assistant Professor of Electrical Engineering, Assistant Professor of Physics, University of Maine, Orono, Maine (1982-1984), (Courses Taught: Intro. nuclear engineering, Basic Physics, Instrumentation. Research Activity: Designed instrumentation for radon research).
Engineer, Ghana Atomic Energy Commission (1974-1977), Kwabenya, Ghana. (Designed and serviced various research instrumentation systems).

PUBLICATIONS:

- K. Korsah, R. T. Wood and C. E. Antonescu, "Recommendations on the Qualification of Microprocessor-based I&C Systems for Safety-Related Applications," International Topical Meeting on Nuclear Plant Instrumentation, Controls, and Human-Machine Interface Technologies (NPIC&HMIT 2000), Washington, DC, November, 2000.
- T. J. Tanaka, S. P. Nowlen, K. Korsah, R. T. Wood and C. E. Antonescu, "Technical Findings On The Impact Of Smoke Exposure For Digital I&C," International Topical Meeting on Nuclear Plant Instrumentation, Controls, and Human-Machine Interface Technologies (NPIC&HMIT 2000), Washington, DC, November, 2000.
- Mahbubul Hassan, Christina E. Antonescu, Kofi Korsah and Richard T. Wood, "Insights Into The Relative Risk Significance Of Environmental Stressors Acting On I&C Systems," International Topical Meeting on Nuclear Plant Instrumentation, Controls, and Human-Machine Interface Technologies (NPIC&HMIT 2000), Washington, DC, November, 2000.
- K. Korsah and R.T. Wood, "Application of Microprocessor-Based Equipment in Nuclear Power Plants-Technical Basis for a Qualification Methodology," NUREG/CR- 6741, ORNL/TM-2000/236.
- Isa Saliman, Kofi Korsah, R.T. Wood, "Enhancing the Qualification Process for COTS I&C for Nuclear Power Plants," submitted for publication in *Nuclear Technology*
- Kofi Korsah and Mike Moore, "Results of Tests Conducted on an Artifact Using IEC and MIL-STD Test Methods," ORNL/TM-2001/186.
- T. J. Tanaka, S. P. Nowlen, K. Korsah, R. T. Wood and C. E. Antonescu, "Technical Findings on the Impact of Smoke Exposure for Digital I&C, Invited paper, accepted for publication in *Nuclear Technology*.
- Korsah, Kofi, C. L. Ma, and Bill Dress, □Harmonic Frequency Analysis of SAW Resonator Chemical Sensors: Application to the Detection of Carbon Dioxide and Humidity, □ *Sensors and Actuators B* 50 (1998) 110-116.
- Kofi Korsah, Comparative Analysis of Environmental Qualification Standards: IEEE 323-1983 and IEC 60780 (1998), prepared for the Nuclear Regulatory Commission, ORNL/NRC/LTR-9915.
- Korsah, Kofi., and Christina Antonescu, "Evaluating 'New' Instrumentation and Control Technologies for Safety-Related applications in Nuclear Power Plants," *Nuclear Engineering and Design*, 167 (1997) 251-265. **(Invited Paper)**.
- K. Korsah, "Review of Surveillance and Operating Records," in *The Reactor Operations Review Committee (RORC) 1997 Annual Review of ORNL Reactors*, August 1998.
- Korsah, Kofi, Richard T. Wood, Christina Antonescu, Tina Tanaka, and Mahbubul Hassan, □Effects of Environmental Stress on Microprocessor-Based I&C Systems, □ IEEE Nuclear Science Symposium and Medical Imaging Conference, Albuquerque, NM, November 9-15, 1997.
- Korsah, Kofi, Tina J. Tanaka, Christina Antonescu, and Richard T. Wood, □Technical Basis for Environmental Qualification of Safety-Related Microprocessor-Based Instrumentation and Control Systems in Nuclear Power Plants, □ *Proc. 5th Intl. Conf. On Nuclear Engineering*, □ (ICONE 5), Nice, France, May 26-30, 1997.
- Kercel, Steven W., Kofi Korsah, R. T. Wood, and Paul D. Ewing, □Electromagnetic Compatibility of Digital Instrumentation and Control Systems in Nuclear Power Plants, □ *Proc. 5th Intl. Conf. On Nuclear Engineering*, □ (ICONE 5), Nice, France, May 26-30, 1997.
- Korsah, Kofi, Tina J. Tanaka, Christina Antonescu, and Richard Wood, □Technical Basis for Environmental Qualification of Computer-Based Safety Systems in Nuclear Power Plants, □ *Proc. Intl. Mtg. On Advanced Reactor Safety*, (ARS□97), Orlando, FL, June 1-5, 1997, Vol. 2, pp 754-758. **(Invited Paper)**.

- Kercel, Steven W., and Kofi Korsah, □Susceptibility of Digital Instrumentation and Control Systems To Disruption by Electromagnetic Interference, □ *Proc. Intl. Mtg. On Advanced Reactor Safety*, (ARS□97), Orlando, FL, June 1-5, 1997, Vol. 2, pp 772-778.
- Korsah, Kofi, Tina Tanaka, Thomas L. Wilson , Jr., and Richard T. Wood, □Environmental Tests of a Digital Safety Channel: An Investigation of Stress-Related Vulnerabilities of Computer-Based Safety Systems, □ to be published in *Nuclear Safety*.
- Korsah, Kofi, Tina Tanaka, Thomas L. Wilson , Jr., and Richard T. Wood, *Environmental Testing of an Experimental Digital Safety Channel*, NUREG/CR-6406, Nuclear Regulatory Commission, September 1996.
- Korsah, Kofi, Tina Tanaka, Mahbulul Hassan, and Richard Wood, *Technical Basis for Environmental Qualification of Microprocessor-Based Safety-Related Equipment in Nuclear Power Plants*, draft NUREG/CR-6479, August, 1996.
- Korsah, Kofi, Thomas L. Wilson, Jr., and R. T. Wood, □Environmental Effects Testing of an Experimental Safety Channel, □ *1996 American Nuclear Society International Topical Meeting on Nuclear Plant Instrumentation, Control, and Human-Machine Interface Technologies*, May 6-9, 1996, Vol 2, pp 1203-1212. **(Invited Paper)**.
- Tanaka Tina, K. Korsah, and Christina Antonescu, □Preliminary Studies on the Impact of Smoke on Digital Equipment, □ *Proc. of 23rd Water Reactor Safety Information Meeting*, NUREG/CP-0149, 85-102, March, 1996.
- Moore M. R., K. Korsah, and P. D. Ewing, *Regulatory Guide and Acceptance Criteria for Electromagnetic and Radio-Frequency Interference in Digital Systems*, ORNL/NRC/LTR-95/11, April 1995, Oak Ridge National Laboratory.
- Holcomb, D.E., K. Korsah, and R.T. Wood, *Survey of Advanced Instrumentation with Potential Applicability to Safety-Related Systems at Nuclear power Plants*, ORNL/NRC/LTR-95/23, June 1995, Oak Ridge National Laboratory.
- Tanaka Tina, K. Korsah, and Christina Antonescu, □Preliminary Studies on the Impact of Smoke on Digital Equipment, □ *23rd Water Reactor Safety Information Meeting*, October 23-25, 1995.
- Korsah, K., G.W. Turner, and J. A. Mullens, □Assessing Environmental Compatibility of New Technologies for Use in Nuclear Power Plants, □ *Nuclear Science Symposium and Medical Imaging Conference*, October 30 - November 5, 1994, Norfolk, VA.
- Korsah, K., R. L. Clark, and D. E. Holcomb, "A Methodology for Evaluating 'New' Technologies in Nuclear Power Plants," *Instrumentation, Controls, and Automation in the Power Industry, Vol. 37, p. 131-148*, Proceedings of the 4th Annual ISA/EPRI Joint Controls and Automation Conference, Orlando, FL, June 1994.
- Korsah, Kofi, Robert L. Clark, and Richard T. Wood, *Functional Issues and Environmental Qualification of Digital Protection Systems of Advanced Light-Water Nuclear Reactors*, NUREG/CR-5904, U.S. Nuclear Regulatory Commission, April 1994.
- Korsah, Kofi, and Christina Antonescu, □Environmental Testing of a Prototypic Digital Safety Channel, Phase I: System Design and Methodology, □ *22nd Water Reactor Safety Information Meeting*, Bethesda MD, October 1994.
- Korsah, Kofi, and Christina Antonescu, □Issues Arising with the Application of Optical Fiber Transmission in Class 1E Systems in Nuclear Power Plants, □ *21st Water Reactor Safety Information Meeting*, Bethesda, MD, October 25-27, 1993
- Ewing, P. D., and K. Korsah, *Technical Basis for Regulatory Guidance on the Susceptibility of Digital Systems to Electromagnetic and Radio-Frequency Interference*, NUREG/CR-5941, U. S. Nuclear Regulatory Commission, April 1994.
- Korsah, Kofi, and Christina Antonescu, "Qualification Issues Associated with the Use of Advanced Instrumentation and Control Hardware in Nuclear power Plants," *IAEA Specialists meeting on Experience in Aging, Maintenance and Modernization of Instrumentation and Control Systems for Improving Nuclear Power Plant availability*, Rockville,

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- Hess, C. T., and Kofi Korsah, "Radon in Houses Due to Radon in Potable Water," *Amer. Chem. Soc. (Symposium Series)*, 331/3, 30-41 (1986).
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- Korsah, Kofi, C. T. Hess, and Gerald Burton, *The Model KH-2 Data Logger □ Instrumentation for Radon Research*, Dept. of

Industrial Cooperation, University of Maine, August 1983.

Korsah, Kofi, *Evaluation of Phoenix Associates' Project Management System at the International Economic Relations Division (IERD), Ghana*, United Nations Development Program (UNDP), Service Contract No. SC-88-279, August 1988.

Korsah, Kofi, "Computers in the Development of Industrial Infrastructures," *Indust. Tech. J.*, Vol. 2, 3, 18-25 (1987), (A Journal of the Ministry of Science and Technology, Ghana).

CONTRIBUTIONS TO STANDARDS/REVIEW REPORTS:

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"Application of Commercial Standards to DOE Facility Safety," *Nuclear Safety Assessment*, NEKK315, ORNL/QR/NESA-93/4, Oak Ridge National Laboratory, 4th Quarter Technical Progress Report, 1993.

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Technology Assessment Report: 3-kWe Heatpipe/Stirling Concept for Mars Surface Power Applications," ORNL/SPFT/LTR-004, June 2001

"Concept Evaluation Report: 3-kWe Heatpipe/Stirling Concept for Mars Surface Power Applications," ORNL/SPFT/LTR-003, June 2001