

William E. Irwin, Sc.D., CHP

Curriculum vitae

This document describes my experience, skills and knowledge. I have developed expertise in worker and public health protection for many uses of phenomena in the electromagnetic spectrum as well as magnetic fields. I have studied, measured and helped manage:

- alpha, beta, gamma, neutron and proton ionizing radiation exposures
- low to very high energy machine-generated and materials-produced ionizing radiation
- portable and laboratory benchtop instrument calibrations
- radioactive material experiments and incidents
- reactor, accelerator, university and government health physics
- *in vitro* and *in vivo* bioassay
- extremely low frequency electromagnetic fields
- audio frequencies
- nuclear magnetic resonance
- radio frequency radiation
- ultraviolet, visible, and infrared laser radiation and light

I have developed specialized capabilities in emergency response, initially for radiological exposures, but also for chemical and biological incidents. I have augmented my career-based efforts with community volunteer efforts as a volunteer firefighter and emergency medical technician.

I contribute to numerous voluntary professional efforts, including with the Conference of Radiation Control Program Directors, the Health Physics Society, and the National Council on Radiation Protection and Measurements.

I am a Certified Health Physicist, and a diplomat of the American Academy of Health Physics. My original certification was completed in 1996, and I have recertified in 2000, 2004, 2008, and 2012. I have previously served the American Board of Health Physics as a member of the Part II Panel of Examiners, where I helped create and grade Part II examinations from 1999 to 2002.

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Education

- ✦ **Doctor of Science, Work Environment Engineering**, University of Massachusetts Lowell
- ✦ **Master of Science, Radiological Sciences**, University of Massachusetts Lowell
- ✦ **Master of Business Administration**, Southern New Hampshire University
- ✦ **Bachelor of Arts, Philosophy and History**, Christopher Newport University

Experience

- ✦ **Vermont Department of Health, December 2005-present: Radiological and Toxicological Sciences Program Chief.** Manage a staff of scientists who provide guidance to the public, state agencies and other stakeholders on the health risks and methods of health protection for acute and chronic exposures to ionizing and non-ionizing radiation and toxic materials. Provide guidance to citizens of Vermont and advice to members of Vermont state government on regulated and unregulated radiological and toxicological health matters. Manage environmental surveillance and emergency preparedness for the Vermont Yankee Nuclear Power Station. Expertise employed investigating radiofrequency radiation and extremely low frequency electromagnetic fields, as well as testimony on sound levels from wind turbines.
- ✦ **Harvard University, October 2001-September 2005: Health Physicist, Laser Safety Officer, Associate Radiation Protection Officer.** Directed technical services for environmental health and safety programs at Harvard University. Managed a staff of eight technicians and physicists at the Harvard Medical School and the Faculty of Arts and Sciences. Significant accomplishments included direction of radiological and environmental health activities during the decommissioning of the Harvard Cyclotron Laboratory, and development and initial implementation of the Harvard University Laser Safety Program. Taught courses in laser health physics. Extensive work with magnetic fields and radiofrequency radiation as used in medicine and research.
- ✦ **Massachusetts Institute of Technology, October 1992-October 2001: Health Physicist, Assistant Radiation Protection Officer.** Managed the safe use of ionizing and non-ionizing radiation producing devices for campus research laboratories. Designed safety measures for radiological hazards, taught courses in radiological health protection, performed measurements and calculations for radiological emissions, supervised technicians, and determined doses and potential consequences of radiological exposures. Special projects included leading the MIT-Cambridge Collaboration on Education for the Environment. Extensive training and work with laser radiation, radiofrequency radiation and magnetic fields as employed in research and academia.
- ✦ **Biological, Chemical and Radiological Occupational Health Consultant, 1994-2005:** Praecis Pharmaceuticals; Suntory Pharmaceuticals, Wolfe Laboratories, Inc.; Satori Pharmaceuticals, Inc.; Cubist Pharmaceuticals; Arcturus Pharmaceuticals; Millenium Pharmaceuticals; Kinetix Pharmaceuticals; Animal Rescue League of Boston; W.R.Grace; Sontra Pharmaceuticals, Inc.; Implant Sciences; East Coast Chiropractic; Chemical & Atomic Workers Union; Lasertron; Vizidyne; Duracell; Gillette; Senior Flexonics; Telephotonics; Esdaile, Barret & Esdaile; AT&T Wireless; Bell Atlantic Mobile; Entel; NLS; Omnipoint; Verizon Wireless; Sprint PCS; T-Mobile Communications; the Town of Medfield, MA; the Town of Wrentham, MA; General Dynamics, Inc.
- ✦ **North Atlantic Energy Services, July 1990--October 1992:** Health Physics and Supervisor Training Instructor. Designed, developed and taught courses in health physics, nuclear power plant operations, and supervision. Emergency Responder and Emergency Response Trainer.
- ✦ **Arizona Public Service Company, December 1985 -July 1990:** Health Physics, Chemistry, and Engineering Training Instructor and Supervisor. Designed, developed and taught courses in health physics, nuclear power plant operations, and chemistry. Led the team of instructors who prepared and presented courses in engineering and plant operations, and supervised the team of chemistry instructors.

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- ✦ **Contract Health Physics Instructor and Technician during refueling and maintenance outages, June 1984 -December 1985:** Virginia Power (Surry and North Anna Stations); Southern Nuclear Operating Company (Farley Station); South Carolina Electric & Gas (Brunswick Station); Carolina Power & Light (V.C. Summer Station).
- ✦ **Newport News Shipbuilding and Dry Dock Company, Newport News, Virginia, Radiological Controls Technician. October 1981 –June 1984.** Trained and worked according to the US Navy Training Criteria of NAVSEA 389-0288 on submarines, aircraft carriers and guided missile cruisers.

Professional Certifications

- ✦ **Certified Health Physicist**, certified by the American Board of Health Physics, comprehensive examination passed July, 1996. Re-certified in 2000, 2004 , 2008, 2012.
- ✦ **Hazardous Materials Technician/Specialist/Crew Chief**, Vermont Hazardous Materials Response Team, August 2007.
- ✦ **Firefighter I**, certified by the Vermont Fire Service Training Council, May 2008
- ✦ **Firefighter II**, certified by the Vermont Fire Service Training Council, February 2012
- ✦ **Emergency Medical Technician**, certified by the National Registry of Emergency Medical Technicians, June 2013
- ✦ **AgriSafe Provider**, certified by the University of Iowa Center for Agricultural Safety & Health, July 2013.
- ✦ **Professional Ski Instructor**, certified by the Professional Ski Instructors of America, March 2009

Professional Affiliations

- ✦ **Conference of Radiation Control Program Directors (CRCPD)**, Chair-Elect and Chair (2014-2015), Director Member (2005 – present); Chair of CRCPD Homeland Security/Emergency Response Committee 4 for evaluation of resources for radiological and nuclear emergency response; Advisor to CRCPD Environmental Task Force 43 for radiological data sharing policy development.
- ✦ **National Council on Radiation Protection and Measurements (NCRP)**, Member of Council Committee CC-1 *Radiation Protection Guidance for the United States* and Scientific Committee SC 3-1, *Guidance for Emergency Responder Dosimetry*.
- ✦ **American Academy of Health Physics**, Diplomat, 1996 to present.
- ✦ **American Board of Health Physics**, Former member of the Part II Panel of Examiners, 1999 – 2002.
- ✦ **Health Physics Society**, Plenary Member, 1992 to present.
- ✦ **New England Radiological Health Conference**, Executive Board Member.
- ✦ **Nuclear Decommissioning Citizens Advisory Panel Member**, Appointed by the Vermont Legislature, serving from 2014 to the present.
- ✦ **Vermont State Nuclear Advisory Panel**, Appointed by Vermont Secretary of the Agency of Human Service, 2006 through 2013.
- ✦ **Vermont Firefighters Association**, Member
- ✦ **National Registry of Emergency Medical Technicians**, 2013 to present.
- ✦ **Bakersfield Volunteer Fire Department**, Fire Captain and Rescue Captain, 2006 to present.

Specialized Training

- ✦ **Hazard Prediction and Assessment Capability (HPAC)**, 40 hour course conducted by the Defense Threat Reduction Agency and the Interagency Modeling & Atmospheric Assessment Center on chemical, nuclear, radiological, nuclear and explosive consequence modeling, November 2014.
- ✦ **Turbo FRMAC, Assessment Scientist**, 24 hour course conducted by Sandia National Laboratories on the use of derived response level, derived intervention level and emergency worker protection computer software, July 2013.
- ✦ **Emergency Medical Technician**, 144 hour course with scheduled completion by April 2013.

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- ✦ **Agricultural Medicine and Occupational Safety Training**, 48 hour course on agricultural illnesses, injuries and exposures with a focus on prevention, as well as care presented by the University of Iowa Center for Agricultural Safety & Health and the New York Center for Agricultural Medicine & Health, July 2013.
- ✦ **Computer Assisted Management of Emergency Operations**, 24 hour course conducted by the Environmental Protection Agency, May 2013.
- ✦ **HazCat Field Identification Course**, 32 hour course presented by Haz Tech Systems , Inc., February 2013.
- ✦ **Firefighter II**, 90 hour training and certification provided by the Vermont Fire Service Training Council, February 2012.
- ✦ **Turbo FRMAC, Assessment Scientist**, 24 hour course conducted by Sandia National Laboratories on the use of derived response level, derived intervention leve and emergency worker protection computer software, March 2009.
- ✦ **HazCat Field Identification Course**, 32 hour course presented by Haz Tech Systems , Inc., October 2008.
- ✦ **Small-scale Chemical and Biological Weapons Production**, 40 hour course by Responders Resource Technology, January 2007.
- ✦ **Homeland Security Exercise Evaluation Program**, Vermont Homeland Security Unit, November 2008
- ✦ **Firefighter I**, 160 hour training and certification provided by the Vermont Fire Service Training Council, May 2008.
- ✦ **Hazardous Materials Technician**, Vermont Hazardous Materials Response Team, February 2007-2012.
- ✦ **Hazardous Materials Emergency Responder**. 24-hour course presented by Harvard University, 2001, 2002, 2003, 2004, 2005.
- ✦ **Multi-Agency Radiological Survey and Site Investigation Manual**. 8-hour course presented by the American Academy of Health Physics, July 2004.
- ✦ **Concepts and Methods for Communicating with Responders and the Public**. 8-hour course presented by the American Academy of Health Physics, July 2003.
- ✦ **Medical Management of Patients from Radiological Terrorist Events**. 8-hour course presented by the American Academy of Health Physics, June 2002.
- ✦ **Incident Command System**. NIMS 700, ICS 100, 200, 300, 400, 441 and 449 qualified through courses presented by the Vermont Criminal Justice Training Council through May 2006-September 2014.
- ✦ **Non-Ionizing Radiation Safety: Evaluation and Management Techniques**, 24-hour course presented by Narda Microwave, November 1998.
- ✦ **Radiofrequency Radiation Safety in the Telecommunications Industry**, 8-hour course presented by Narda Microwave, September 1996.
- ✦ **Advanced Laser Safety**, 24-hour course presented by the Engineering Technology Institute, August 1996.
- ✦ **Health Physics at Research Reactors**, 8-hour course presented by the American Academy of Health Physics, July 1996.
- ✦ **Radiation Physics at Accelerators**, 8-hour course presented by the American Academy of Health Physics, July 1995.
- ✦ **Environmental Radioactivity Quantification**, 8-hour course presented by Canberra Industries, June 1994.
- ✦ **Laser Safety**, 32-hour course presented by the Engineering Technology Institute, June 1993.
- ✦ **MIT Reactor Safety Study**, 40-hour course presented by the Massachusetts Institute of Technology, Department of Nuclear Engineering, July 1988.
- ✦ **Arizona Public Service, Instructor Development:** Instructor Platform Skills; Course Documentation; Conducting Topic, Task and Paradigm Analysis; Incorporation of Operating Experiences in Training Programs; Learning Objectives; Evaluating Student Performance; Maintaining Training Materials; Motivating Students and Responding to Student Needs; Advanced Platform Skills; Laboratory instruction.
- ✦ **Arizona Public Service Technical Development:** Management Oversight and Risk Tree Root Cause Analysis; Emergency Planning; Fundamentals of Working Fluids; Chemistry; Mitigating Core

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Damage; Plant Modifications; Instrumentation and Process Controls; Systems, Plant Components and Design Bases; reactor Theory; Plant Operations, Human Performance Evaluation Systems; Hazardous Materials Control; Nuclear Reactor Safety

- ✦ **U.S. Naval Reactors Radiological Controls**, three-month training program presented by Newport News Shipbuilding and Dry Dock Company, October-December 1981.

Publications

- ✦ **Radiation Protection in the United State (draft)**, National Council on Radiation Protection and Measurements (NCRP) Council Committee 1, NCRP, Bethesda, Maryland.
- ✦ **Radiation Emergency Worker Dosimetry (draft)**, National Council on Radiation Protection and Measurements (NCRP), Scientific Committee 3-1, NCRP, Bethesda, Maryland.
- ✦ **Symptoms Associated with prolonged Radio Frequency Radiation Exposure**, Lee, Ernest C., Irwin, William E. and Winters, Thomas H., Environmental Health Perspectives, June 2004.
- ✦ **Radio Frequency Radiation Risk - A Focus on Wireless Telephones**. Dissertation for The University of Massachusetts Lowell, 2002.
- ✦ **New Technology in Art**. Encyclopedia of Occupational Health and Safety, Fourth Edition, International Labour Office, Geneva, Switzerland, 1996.

Software Knowledge

- ✦ **HPAC, RASCAL, TurboFRMAC, RES/RAD, MetPac, and HotSpot** for response and recovery from radiological and nuclear emergencies.
- ✦ **CAMEO** for computer assisted management of emergency operations for chemical releases.
- ✦ **Microshield** for external dose and shielding calculations.
- ✦ **Varskin** for skin dose calculations.
- ✦ **INDOS** for internal dose calculations.
- ✦ **Lazan** for laser nominal hazard zone, MPE and OD calculations
- ✦ **SPSS** for epidemiological statistics and **Stata** for other statistics.
- ✦ **Microsoft Word** for word processing, **Excel** for spreadsheets, **Powerpoint** for presentations, **Access** for databases, and **Project** for project management.

Presentations

- ✦ **Radiological Dispersal Device First Responder Guidance**, New England Radiological Health Conference, Norwich, CT, November 2015.
- ✦ **Vermont's Preventive Radiological/Nuclear Detection Program**, Vermont EMS and Emergency Preparedness Conference, Jay, VT, October 2015.
- ✦ **Radiological Operations Support Specialist**, Health Physics Society, Indianapolis, IN, July 2015.
- ✦ **Radiation Emergency Dose Issues**, International Dosimetry Symposium, Annapolis, MD.
- ✦ **Radiological Operations Support Specialist**, Conference of Radiation Control Program Directors, St. Louis, MO, May 2015.
- ✦ **Radiological Operations Support Specialist**, National Radiological Emergency Preparedness Conference, Sacramento, CA, April, 2015.
- ✦ **Vermont Yankee Decommissioning**, New England Chapter of the Health Physics Society, Boston, MA, May 2014.
- ✦ **Science and Response to a Nuclear Reactor Accident**, National Academies of Science, Washington, DC, May 2014.
- ✦ **Regional Rad/Nuc Exercises**, Conference of Radiation Control Program Directors, Atlanta, GA, May 2014
- ✦ **Chemical and Biological Weapons Exposure**, Vermont Hospital Preparedness Conference, Jay, VT, October 2013.

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- ✦ ***Chemical and Biological Weapons***, Vermont Hazardous Materials Response Team, Colchester, VT, July 2013.
- ✦ ***The Vermont Dairy Air: Formaldehyde Use on Farms***, National Environmental Health Association, Alexandria, VA, July 2013.
- ✦ ***Public Health Response to an Improvised Nuclear Device***. Vermont Emergency Medical Services Conference, Burlington, Vermont, October 2012.
- ✦ ***Public Health Response to an Improvised Nuclear Device***. New England Radiological Health Conference, Burlington, VT, October 2012.
- ✦ ***Public Health Response to an Improvised Nuclear Device***. Vermont Healthcare Preparedness Conference, Burlington, Vermont, June 2012.
- ✦ ***Tri-State Radiological Analysis of Fish***. New England Radiological Health Conference, Burlington, VT, October 2012.
- ✦ ***Vermont Yankee Groundwater Protection and the 2010 Tritium Leak***. Northeast Epidemiology Conference, Meredith, NH, October 2012.
- ✦ ***The CRCPD Radiological/Nuclear Emergency Toolbox for Response and Recovery for an RDD or IND***. Conference of Radiation Control Program Directors, Orlando, Florida, May 2012.
- ✦ ***TMI, Chernobyl, Fukushima and their Impacts on Vermont Yankee***. Vermont Emergency Preparedness Conference, Stowe, Vermont, November 2011.
- ✦ ***The Fukushima Reactor and Spent Fuel Pool Accidents***. Vermont Healthcare Preparedness Conference, Stowe, Vermont, October 2011.
- ✦ ***Situational Awareness and Assessment***. CDC Radiation Emergencies Bridging the Gaps Conference, Atlanta, Georgia, March 2011.
- ✦ ***Vermont Yankee Tritium Release***. International Emergency Management Conference, Portsmouth, NH, December 2010.
- ✦ ***Vermont and Empire 09***. The National Radiological Emergency Preparedness Conference, Chicago, Illinois, July 2009.
- ✦ ***The NERHC 2007 RDD Conference Exercise***. Conference of Radiation Control Program Directors, Columbus, Georgia, May 2009.
- ✦ ***Radiological/Nuclear Emergency Response for EMS***. Vermont Emergency Medical Services Conference, Burlington, Vermont, March 2009.
- ✦ ***The Health Physics of Radon***. Vermont Radon Conference, Bolton, Vermont, January 2009.
- ✦ ***Radiological/Nuclear Emergency Response for Emergency Department Directors***. Killington, Vermont, September 2007.
- ✦ ***Radio Frequency Radiation Risk from Base Stations in the Environment***. Hundreds of Presentations to communities in Massachusetts, Connecticut, Rhode Island, New Hampshire and New York; January 1993 to September 2004.
- ✦ ***Radio Frequency Radiation Risk - A Focus on Wireless Telephones***. Presentation to the Health Physics Society, Washington, DC, July 2004.
- ✦ ***Decommissioning of the Harvard Cyclotron***. Presentation to the Health Physics Society, Washington, DC, July 2004.
- ✦ ***Decommissioning of the Harvard Cyclotron***. Presentation to the New England Chapter of the Health Physics Society, Westford, MA, June 2003.
- ✦ ***Radon in the Home and Laser Safety***. Presentations for the Massachusetts Institute of Technology Independent Activities Period, 1995 - 2000.
- ✦ ***Radiation Safety***, for the Massachusetts Safety Council, Braintree, MA, December 2000.
- ✦ ***Laser Accidents at the Massachusetts Institute of Technology***. Presentation to the North American Campus Radiation Safety Officers, 17th Biennial CRSO Conference, July 1999.

Testimony

- ✦ Testimony before the Vermont Public Service Board on incorporating Health Impact Assessment into the certificate of public good process, July 2014.
- ✦ Testimony before the Vermont Public Service Board relative to the granting of a Certificate of Public Good for the on Vermont Yankee Nuclear Power Station, June 2013.

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- ✦ Testimony before Vermont Legislature on wind turbine sound, radiofrequency radiation from smart meters, Vermont Yankee Nuclear Power Station and radiological program funding from 2009 to present.
- ✦ Testimony on the physics and health impacts of wind turbine sound at the Vermont Public Service Board, February 2011.
- ✦ Testimony on the physics and health effects of electromagnetic field and radio frequency radiation sources:
 - In Massachusetts - Arlington, Barnstable, Billerica, Boston, Boxboro, Braintree, Brighton, Brookline, Bridgewater, Brookfield, Brookline, Burlington, Cambridge, Dedham, Dennis, Dorchester, Easton, Fairhaven, Fall River, Fitchburg, Gloucester, Grafton, Groton, Groveland, Hamilton, Hanson, Harvard, Harwich, Holliston, Hudson, Jamaica Plain, Lancaster, Lexington, Lincoln, Lynnfield, Mansfield, Marblehead, Marshfield, Mattapoisett, Maynard, Medfield, Methuen, Middleton, Millis, Nantucket, Needham, Newton, Norfolk, Northborough, North Dartmouth, Norton, Norwell, Ogunquit, Orleans, Oxford, Peabody, Plymouth, Provincetown, Quincy, Randolph, Reading, Revere, Rochester, Rockport, Saugus, Sharon, Scituate, Stoneham, Sudbury, Sutton, Swampscott, Tewksbury, Tisbury, Townsend, Waltham, Wellfleet, Westborough, Weston, West Roxbury, Westminster, Westwood, Weymouth, Winthrop, Worcester and Wrentham
 - In New Hampshire - Candia, Derry, Goffstown, Hollis, Hudson, Nashua, Sutton and Pelham
 - In New York - Duanesburg and Saratoga Springs
 - In Rhode Island - Barrington, Johnston, Portsmouth, Providence, Middletown, North Providence, North Smithfield, Smithfield, Warwick and Woonsocket.

Teaching Experience

- ✦ **Harvard University, 2001-September 2005, *Laser Safety*:** Two-hour course delivered to research faculty, students and staff on the physics of lasers, biological effects of lasers, engineering and administrative controls for laser safety.
- ✦ **Massachusetts Institute of Technology, 1992-2001, *Radiation Safety*:** Three-hour course to research students, faculty and staff on physics of radiation, biological effects of radiation, radiation detection methods, and radiation protection regulations. ***Laser Safety*:** Two-hour course delivered to research faculty, students and staff on the physics of lasers, biological effects of lasers, engineering and administrative controls for laser safety. ***Occupational and Environmental Law, Radiological Risk Management in High Technology Enterprise, Environmental Health and Safety Case Studies - The Microelectronics and Biotechnology Industries; Comprehensive Environmental Health and Safety Program Design Projects*:** Presentations for the MIT Independent Activities Period, 1999.
- ✦ **North Atlantic Energy Services, 1990-1992, *Team Building*:** As part of the overall management training program, this eight-hour course used a variety of tools to better understand people and how they might be motivated to become part of a highly successful team. ***Kepner-Tregoe Problem Solving and Decision Analysis*:** As part of the management Training Program, this 24-hour course presented a set of tools for systematic analysis of work situations leading to effective decisions and well-planned strategies for work. ***Power Plant Fundamentals*:** Forty-hour course in mathematics, physics and chemistry fundamentals; nuclear fission; electrical power generation; plant systems and components; instrumentation and control; normal and emergency plant operations
- ✦ **Arizona Public Service, 1985-1990, *Nuclear Power Plant Operations*:** Forty-hour course as part of the engineering and chemistry training programs that presented power plant fundamentals, nuclear fission, reactor systems, startup, routine operations, and emergency operations. ***Plant Systems*:** Forty-hour course in all major systems of a nuclear power plant, including the nuclear reactor, steam generation, electricity generation and safety system components.

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Educational Details

- ✦ **University of Massachusetts Lowell, Work Environment Engineering, Doctor of Science:** Doctoral courses in Biostatistics, Epidemiology, Ergonomics, Industrial Hygiene, Environmental Law, Occupational Law, Pollution Prevention, Cleaner Production and Healthy Work Organization Design. Research in occupational cancer policy, recombinant DNA health protection, radio frequency radiation risk and the Environmental Protection Agency. Dissertation: A risk assessment on wireless telephones.
- ✦ **University of Massachusetts, Lowell, Radiological Sciences, Master of Science:** Masters courses in Mathematical Methods, Radiochemistry, Internal Dosimetry, Radiation Shielding, Radiation Dosimetry and Radiation Safety and Control. Research thesis on Gamma Spectroscopy.
- ✦ **Southern New Hampshire University, Masters in Business Administration:** Graduate courses in Managerial Accounting, Finance, Statistics, Economics, Marketing, Management, Business Law, Strategic Analysis, Operations Management, Research Methods, Database Management, Information Engineering, Organizational Behavior and Computer Information Systems. Research in electric utility operations management.
- ✦ **Arizona State University, Business Administration:** Computer Information Systems, Managerial Statistics, Management, Managerial Marketing, Legal Environment of Business, Managerial Accounting, Financial management, Managerial Communications and Macro- and Micro-economics.
- ✦ **Old Dominion University, Physics:** Algebra, Trigonometry, Calculus and Chemistry.
- ✦ **Christopher Newport University, Bachelor of Arts in Philosophy and History:** In addition to the required curriculum for a bachelor's degree, courses in Logic, Ethics, Aesthetics, Epistemology, Metaphysics, Politics, Existentialism, and Chinese, Indian, and Greek Philosophy; American, European, Russian and Asian History. Thesis in Architectural History.