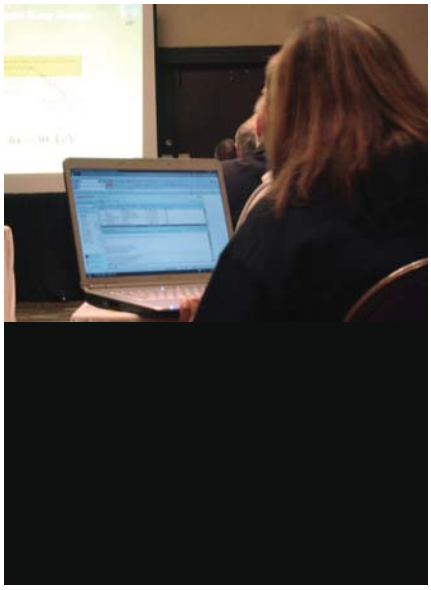
Principles of Radiation Shielding



This 5-day course focuses on the fundamentals of the production and interaction of ionizing radiation with matter and on how to use these fundamental properties to estimate and reduce radiation doses in practical situations. Simplified analytical and computer-based methods are presented for estimating doses from gamma rays, neutrons, beta particles and alpha particles. Both the similarities and differences in shielding methods for different types of radiation are presented. The application of fundamental shielding principles to a wide variety of important radiation protection problems is emphasized. In addition, special approximate techniques applicable for a particular radiation or special geometry are also reviewed. The course is based on the widely used textbook "Radiation Shielding" by Profs. Shultis and Faw. This text and additional supplementary material will be provided to all course registrants.

REASONS WHY YOU SHOULD ATTEND:

- Gain a thorough understanding of the underlying principles used in simplified techniques for practical shield design and dose evaluation, as well as the capabilities and limitations of these methods.
- Strengthen your understanding of practical radiation shielding techniques and how to locate and use much recent shielding data.
- Improve your understanding of recent developments in radiation dosimetric units and their application to real-world situations.
- Develop new computer skills to enable rapid evaluation of simple shielding problems.

Lead Instructor

Nolan Hertel, Ph.D., P.E., is an internationally recognized expert in radiation shielding, transport and spectrometry/dosimetry. He is currently a Professor of Nuclear and Radiological Engineering at Georgia Institute of Technology and has been actively engaged n nuclear engineering education and research for over 30 years. Professor Hertel has extensive experience in radiation transport, measurement and dosimetry. Dr. Hertel has taught courses in Monte Carlo Methods, Radiation Shield Design, and Deterministic Methods of Radiation Transport as well as courses in Radiation Protection and Radiological Assessment. He has performed radiation transport calculations to model benchmark shielding experiments, shield performance, activation product inventories, and instrument response. Dr. Hertel has extensive experience in the use of various discrete ordinates transport codes, point-kernel shielding codes, isotope buildup and depletion (activation) codes, and Monte Carlo codes. He has served as a consultant to a variety of companies, performing shielding, activation and skyshine analyses. Dr. Hertel has graduated 41 MS students and 24 Ph.D. students in nuclear engineering. He was formerly a member of both the ANSI N13 Consensus Committee on Radiation Protection Standards and the N17 Consensus Committee on Research Reactors, Reactor Physics, Radiation Shielding, and Computational Methods. In 2008 he served as the General Chair of the 11th International Conference on Radiation Shielding.

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The American Academy of Health Physics (AAHP) has awarded this course 32 continuing education credits.
Assigned ID Number: 2011-00-016

For further information or assistance, please contact:

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Course Topics

Radiation Types and Interactions
- directly and indirect ionizing radiation
- photon interactions
- neutron interactions
- electron interactions
- stopping heavy charged particles
- nteraction coefficients, cross sections, stopping power

Radiation Fields and Dosimetry
- concept of flux density and fluence
- biological effects of radiation
- various radiological units
- fluence-to-dose conversion factors
- dose standards, occupational and public limits

Radiation Sources and Properties
- neutron sources
- gamma and X-ray sources
- sources for charged particles
- radioisotopes of importance

General Principles of Radiation Shielding
- importance of time, distance and attenuation on dose
- collided and uncollided radiation
- exponential attenuation
- geometric versus material attenuation
- half- and tenth-value layer concept
- charged particle ranges

Special Techniques for Photon Attenuation
- buildup factors
- using the source superposition principles
- dose for simple source/detector geometries
- albedo concepts and duct problems

Special Techniques for Neutron Attenuation
- limitations of buildup factors to neutrons
- attenuation in hydrogenous material
- other calculational methods for neutrons
- attenuation in concrete
- neutron skyshine and duct penetration

Special Techniques for Charged Particles
- charged particle ranges
- spatial distribution of absorbed doses
- beta-particle dose kernels
- application to important problems

Special Topics
Each class will be given special presentations addressing particular needs and interests of the attendees (e.g., reactor shielding, internal dose assessment, limitations and control of particular radionuclides, dose management, special computer codes, etc.)

Computational Techniques
- subroutines for important shielding data and functions
- se of point-kernel codes (e.g. MicroSkyshine, ISOSHLD)
- Codes of special interest to attendees