

Nuclear Science and Engineering: Stewardship of Nuclear Materials Message from the Program Directors and Program Description

The Colorado School of Mines welcomes you to take a close look at its newest graduate degree offerings in Nuclear Science and Engineering. Expertise from many departments on campus has been combined to provide a comprehensive degree program aimed at educating the nuclear energy professionals of the future. Courses and research opportunities in close cooperation with industry and national laboratories will guarantee the hands-on training required for a successful career. Please feel free to contact us with any questions you might have related to our program.

Uwe Greife, Associate Professor of Physics and Interim Academic Program Director Nuclear Engineering

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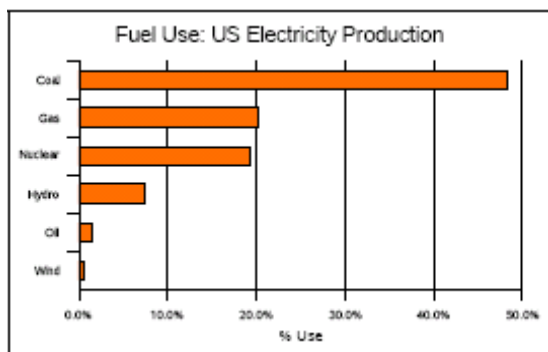
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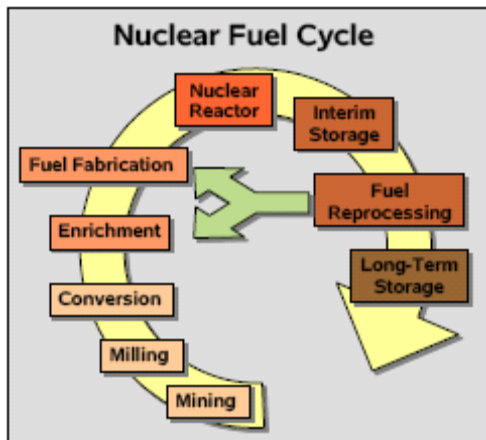
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As concern for the environmental, economic, and political impacts of burning fossil fuels has increased, attention has turned to carbon-free sources of generating electricity. In the US, electricity generation annually produces more than three times the amount of CO₂ emitted by all US automobiles. Renewable technologies such as wind, solar, and geothermal will, in the long term, play a role in producing electricity with greatly reduced CO₂ emissions. For generating electrical power on a scale large enough to have a significant impact in the near term, however, nuclear energy is the only viable carbon-free option based on a mature technology.



Despite renewed interest, electric power generation through the utilization of nuclear energy has well known drawbacks. These include environmental issues related to nuclear waste, safety concerns related to power plant operations and diversion of nuclear technology and materials to opposing states and terrorists. The Nuclear Engineering program at the Colorado School of Mines leverages the Institution's historic strengths to address these concerns by focusing on issues related to the stewardship of nuclear materials throughout their entire lifespan.

Nuclear Engineering at the Colorado School of Mines is an interdisciplinary degree program that draws on substantial contributions from faculty across a broad spectrum of academic disciplines. These include faculty from the Division of Engineering, the Department of Geology and Geological Engineering, the Department of Mining Engineering, the Department of Physics, the Department of Metallurgical and Materials.

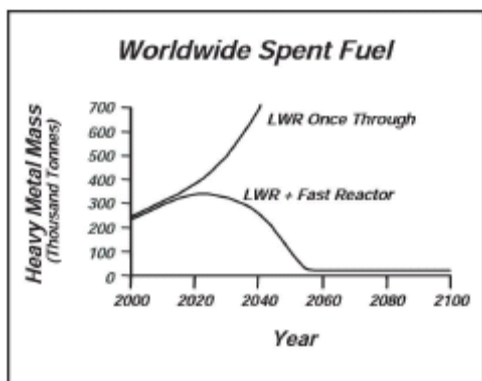


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Engineering, the Division of Environmental Science and Engineering, and the Division of Liberal Arts and International Studies.

Faculty participating in the program have the breadth of expertise to address all aspects of the nuclear fuel life cycle; from fuel exploration and processing, through nuclear power systems production, design and operation, to fuel recycling, storage and waste remediation and radiation damage and the policy issues surrounding each of these activities.



From: A Technology Roadmap for Generation IV Nuclear Energy Systems

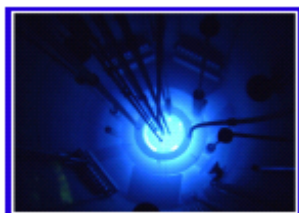
Research Overview

Traditional Nuclear Engineering programs focus on reactor design and operations. Nuclear Engineering at the Colorado School of Mines stresses the nuclear fuel life cycle: from cradle to grave. Faculty at the School of Mines are engaged in research and teaching in areas directly related to all aspects of the nuclear fuel life cycle. These research areas include:



- Nuclear Physics
- Nuclear Materials Refining, Processing and Forming
- Exploration for, Extraction and Milling of Ores
- Recycling and Disposal of Spent Fuel

- Monitoring of Fuel Repository Degradation
- Remediation of Nuclear Contaminants
- Energy Production



- Heat Transport



- Materials Fatigue, Corrosion, and Welding and Joining
- Instrumentation and Control
- Radiation Detection and Measurement

- Environmental Impact
- Health Physics and Risk Assessment
- International Political Economy
- Public policy analysis

Degree Programs

Degrees offered include

- Master of Science, Thesis option
- Master of Science, Non-thesis option
- Doctor of Philosophy

At the MS and PhD levels, in addition to having detailed expertise in a particular component of the nuclear fuel cycle, graduates in Nuclear Engineering are exposed to a broad systems overview of the complete nuclear fuel cycle. This breadth is assured by requiring students to complete a rigorous set of core courses. The core includes courses in;

- Introduction to Nuclear Reactor Physics
- Radiation Detection and Measurement
- Nuclear Reactor Laboratory
- Materials Science and Engineering of Nuclear Materials
- Radioactive Materials Management
- Reactor Design
- Public Policy and Licensing

PhD and nonthesis MS students specialize in a particular aspect of Nuclear Engineering under the guidance of a student advisory committee by selecting additional coursework beyond the required core. The additional coursework may include offerings from all of the academic units participating in the degree program.

Students in research based degree programs, thesis based MS and PhD degrees, are required to complete research credit hour requirements leading to thesis

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and defense. Research is conducted under the direction of a member of CSM's Nuclear Engineering program and could be tied to a research opportunity provided by industry partners.

Additionally, students majoring in allied fields may choose to complete minor degree programs through the Nuclear Science and Engineering Program that indicate specialization in a nuclear related area of expertise. Existing minors include:

- Nuclear Engineering
- Nuclear Materials Processing
- Nuclear Detection
- Nuclear Geosciences

Other minor programs are being developed.

Admissions, Prerequisite and Entrance Requirements

Entering graduate students come from a variety of educational backgrounds, but must have certain fundamental knowledge and skills to successfully complete a degree program in Nuclear Engineering. A baccalaureate degree in engineering or science is required. The necessary prerequisites include;

- mathematics coursework up to and including differential equations
- physics coursework up to and including courses in modern physics and introductory nuclear physics
- engineering thermodynamics, heat transfer and fluid flow or equivalent

Applicants may be accepted conditionally and be required to complete necessary background courses prior to full admission into the program.

Applications into the program must contain official transcripts of all previous college work, three letters of recommendation, Graduate Record Examination (GRE) results, financial affidavit (international students), a statement of intent, and any supporting materials the applicant wishes to provide. International students whose native language is not English must submit scores from an English proficiency examination (TOEFL or IELTS).

Combined BS/MS programs exist for current Colorado School of Mines undergraduates.

Financial Support

Financial aid is available to outstanding students through student teaching and research assistantships and fellowships. TA and RA contracts typically cover one academic year, most are awarded in the Fall and may be renewable. The Application for Admission includes a section regarding financial support. Notification of award is usually done at time of admission.

Federal and CSM student loans are also available to beyond any assistantships and fellowships received. For more information, see http://www.mines.edu/Admin/fin_aid.

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Nuclear Science and Engineering: Stewardship of Nuclear Materials Faculty

Chemistry and Geochemistry

James F. Ranville, Associate Professor. BS Lake Superior State University; MS and PhD Colorado School of Mines. Geochemical influences on metal transport and bioavailability.

Engineering

Terry Parker, Professor and Division Head. BS and MS Stanford University; PhD University of California Berkeley. Optical diagnostics, energy conversion and material synthesis in flames.

Kevin Moore, Gerard August Dobelman Chair and Professor Engineering. BS Louisiana State University; MS University of Southern California; PhD Texas A&M. Instrumentation and control.

Mark Lusk, Professor. BS United States Naval Academy; MS Colorado State University; PhD California Institute of Technology. Computational physics, electronic structure of confined systems and surface-catalytic chemistry.

Ray Zhang, Associate Professor. BS and MS Tongji University; PhD Florida Atlantic University. Source mechanism, time frequency data analysis, dynamic response analysis, reliability analysis of engineering systems and structural damage diagnosis.

Environmental Science and Engineering

Bruce D. Honeyman, Professor. BS, MS and PhD Stanford University. Radiochemistry, radioactive waste disposal, near-and far-field radionuclide and fission product migration behavior, radiometrics and nuclear fuel cycle.

Linda A. Figueroa, Associate Professor. BS University of Southern California; MS and PhD University of Colorado. Microbial interactions with radionuclides as applied to natural attenuation, bioleaching and engineered treatment systems.

John R. Spear, Assistant Professor. BA University of California, San Diego; MS and PhD Colorado School of Mines. Environmental microbiology of heavy metals.

Geology and Geological Engineering

John D. Humphrey, Associate Professor and interim Department Head. BS University of Vermont; MS and PhD Brown University. Nuclear and isotopic geochemistry.

Samuel B. Romberger, Professor. BS and PhD Pennsylvania State University. Chemistry, geochemistry and geology of uranium and associate elements.

Liberal Arts and International Studies

Carl Mitcham, Professor. BA and MA University of Colorado; PhD Fordham University. Science, technology and society studies and policy.

Metallurgical and Materials Engineering

John J. Moore, Trustees Professor, Department Head and Interim Research Program Director of Nuclear Engineering. BS University of Surrey, England; PhD University of Birmingham, England. Synthesis and recycling of nuclear fuels.

Stephen Liu, Professor. BS and MS Universidade Federal de MG, Brazil; PhD Colorado School of Mines. Fabrication of nuclear components.

Brajendra Mishra, Professor. B. Tech. Indian Institute of Technology; MS and PhD University of Minnesota. Hydro, electro and pyrometallurgical processes for nuclear waste remediation. Recycling fuel materials. Aqueous and high temperature-pressure corrosion of materials under reactor conditions. Material selection for reactors. Phase diagram determination for nuclear materials and alloys. Nuclear material separation process. Liquid metal embrittlement of reactor materials.

David K. Matlock, Charles S. Fogarty Professor. BS University of Texas at Austin; MS and PhD Stanford University. Mechanical metallurgy, fracture and failure analysis and metal forming.

David L. Olson, John H. Moore Distinguished Professor. BS Washington State University; PhD Cornell University. Welding and joining science, metallurgy of reactive metals, environmental degradation of materials, advanced NDE alloy microstructural stability.

Nuclear Science and Engineering: Stewardship of Nuclear Materials Faculty

Ivar E. Reimanis, Professor. BS Cornell University; MS University of California Berkeley; PhD University of California Santa Barbara. Mechanical properties of ceramics, composites and metal/ceramic interfaces, properties and processing of functionally graded materials, crack growth studies and numerical simulation.

John G. Speer, Professor. BS Lehigh University; PhD Oxford University. Physical metallurgy.

Patrick R. Taylor, George S. Ansell Distinguished Professor. BS and PhD Colorado School of Mines.

Martin Mataya, Assistant Professor. BS xxxx; MS xxxx; PhD xxxx. xxxxxxxx.

Edgar E. Vidal, Assistant Professor. BS and MS Simon Bolivar University; PhD University of Idaho.

Mining Engineering

Tibor G. Rozgonyi, Professor and Department Head. BS Eger Teachers College, Hungary; MS and PhD Technical University of Miskolc, Hungary. Design and construction of high and low level nuclear waste repositories.

Levent Ozdemir, Professor. BS, MS and PhD Colorado School of Mines. Design and construction of high and low level nuclear waste repositories.

Mark Kuchta, Associate Professor. BS and MS Colorado School of Mines; PhD Lulea University of Technology, Sweden. Surface and underground uranium mining methods.

Physics

James A. McNeil, Professor. BS Lafayette College; MS and PhD University of Maryland. Nuclear theory.

F. Edward Cecil, Professor Emeritus. BS University of Maryland; MA and PhD Princeton University. Magnetically confined fusion plasma diagnostics.

Uwe Greife, Associate Professor and Interim Academic Program Director of Nuclear Engineering. MS University of Munster, Germany; PhD University of Bochum, Germany. Nuclear physics and astrophysics, radiation detector development and radiation safety.

Frederic Sarazin, Assistant Professor. PhD GANILCaen, France. Lowenergy nuclear structure.