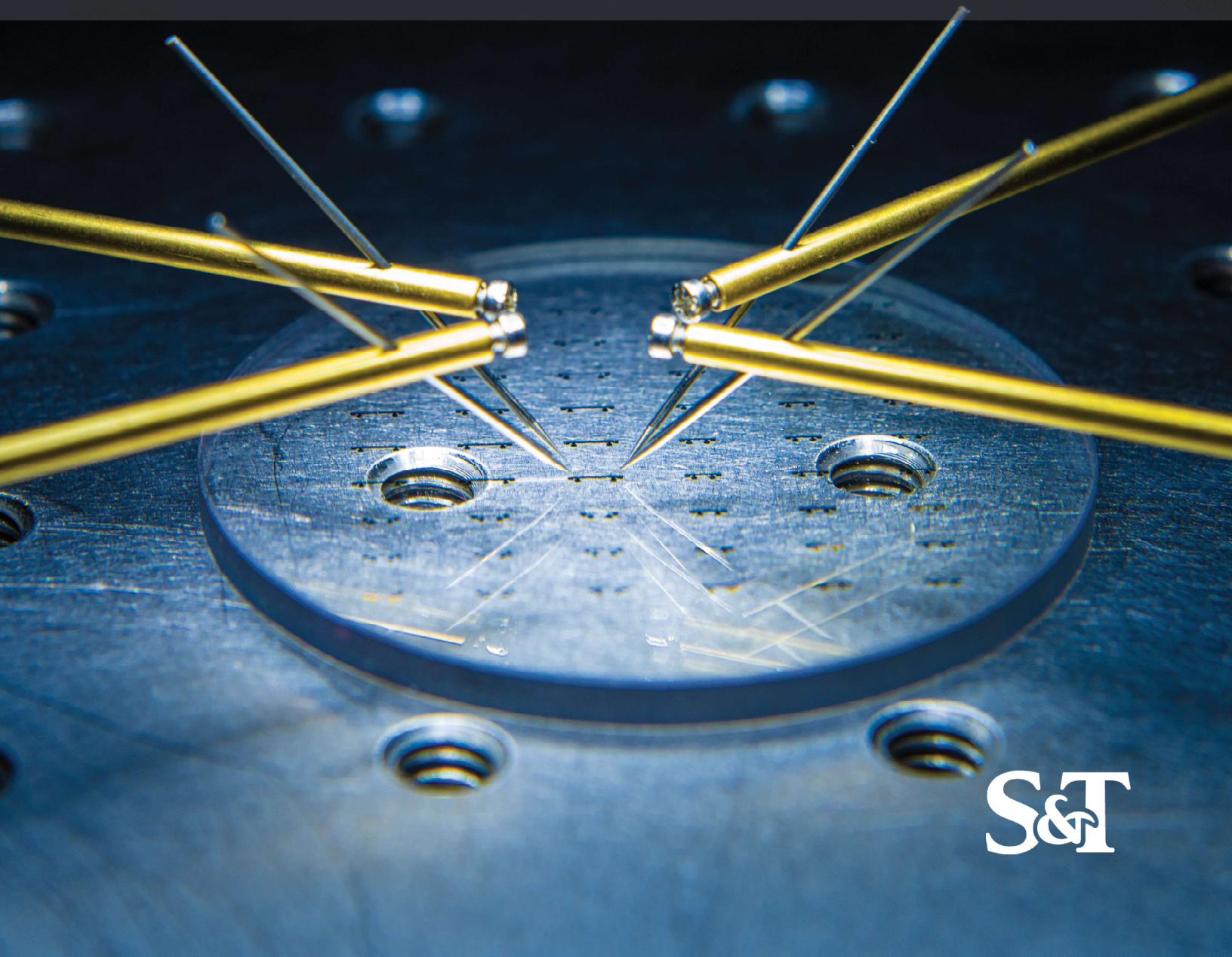


YOUR COMPLETE GUIDE TO MISSOURI S&T'S

NUCLEAR ENGINEERING AND RADIATION SCIENCE UNDERGRADUATE PROGRAM



S&T



WHERE DO OUR GRADUATES GO?

For our nuclear engineering and radiation science students, graduating from Missouri S&T opens up a world of opportunity — Miner alumni can be found on working at top corporations across the U.S. and abroad. Among our most recent graduates, you'll find our nuclear engineering alumni employed by the following industry leaders, to name just a few:

Ameren
Callaway Nuclear Energy Center
Center for Space Nuclear Research (CSNR)
Clinton NPP
Consolidated Nuclear Security, LLC
Curium Pharma
DC Cook NPP
Enercon
Fluor Marine Propulsion
Idaho National Laboratory
Kairos Power
Lawrence Livermore National Laboratory
Missouri University Research Reactor

National Institute for Standards and Technology (NIST)
Naval Nuclear Laboratory
NextEra Energy
Niowave, Inc.
Northern Technologies, LLC
Nutherm International Inc.
Oak Ridge National Laboratory
Omaha Public Power District
Curium Pharma
Radiological Solutions, Inc.
Sandia National Laboratory
SHINE Medical
Wolf Creek NPP

JOB OUTLOOK FOR NUCLEAR ENGINEERING AND RADIATION SCIENCE

There are currently about 100 nuclear reactors operating in the United States, and many more worldwide. In the US, the average age of the nuclear workforce is just over 50 years – this means that many workers are within a few years of retirement. Utilities, vendors, regulators, and others are hiring hundreds of new engineers – nuclear, mechanical, electrical, chemical, and others – each year to maintain the knowledge and skill base that will be lost with these retirements. In addition to the nuclear power industry, many graduates find positions with companies like consulting firms, non-nuclear component companies, and others that support nuclear power facilities. Other students find work outside the nuclear industry where their skills are in demand including medical device manufacturers, industrial measurement manufacturers, etc. Some students continue their education in pursuit of Master of Science or Doctor of Philosophy degrees. Overall about 30% of our students continue to graduate school, another 30% enter the nuclear power industry in some capacity, and the other 40% enter careers with other corporations.

Contact Information:

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Email: nuclear@mst.edu
Website: nuclear.mst.edu

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[Missouri S&T Nuclear Engineering](#)

Follow us on Twitter

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WHAT DO NUCLEAR ENGINEERS DO?

Nuclear engineers develop and promote the utilization of energy released from nuclear fission, fusion, and the decay of radioisotopes. Currently, there are about 100 nuclear power plants operating in the United States producing about 20 percent of our nation's electricity. These plants use nuclear fission to produce energy and are cooled by ordinary (light) water, hence the name, Light Water Reactors. This technology produces about 60% of our nation's carbon-free electricity, reduces the emission of greenhouse gases like carbon dioxide significantly, and contributes to a cleaner environment. In addition, nuclear reactors are used for the propulsion of submarines and aircraft carriers. In fusion power plants, under development, strong magnetic fields contain a plasma fuel of hydrogen isotopes, such as deuterium, at temperatures hotter than the sun. The deuterium extracted from one gallon of water could produce as much energy as burning several hundred gallons of gasoline. Radioisotopes are used in industry and research, and in medicine for diagnostic and therapeutic purposes. The medical use of radioisotopes and X-rays saves hundreds of thousands of lives every year throughout the world. Radioisotopes are also used in small power generators for space flights.

If you choose nuclear engineering, you could work in the areas of nuclear reactor design, plant licensing, plant operation, fuel management and development, radioactive waste disposal, health physics, instrumentation and control, fusion research, space nuclear power, and applications of radioisotopes in industry, medicine, and research. As a nuclear engineer, you might be employed by utilities, reactor vendors, architect-engineering firms, consulting firms, medical device manufacturers, industrial research centers, national laboratories, government agencies or universities.

BY THE NUMBERS

79%

Percentage of Missouri S&T nuclear engineering graduates who report being employed or entering graduate school within 60 days of graduation

300

Number of companies seeking to hire Missouri S&T nuclear engineering students through Handshake



\$67,239

Average starting salary for B.S. in Nuclear Engineering.

\$4,461

Average monthly salary for undergraduate co-ops

\$3,654

Average monthly salary for undergraduate summer interns

NUCLEAR ENGINEERING MISSION

The Nuclear Engineering Program has a primary mission to provide an outstanding and comprehensive undergraduate and graduate education to tomorrow's leaders in nuclear engineering. The program provides well-educated nuclear engineering professionals and leaders to Missouri and the nation, in the commercial nuclear industry, national laboratories, hospitals, graduate schools, and the nation's defense and federal agencies. The objectives of the Bachelor of Science program are to provide each student with fundamental knowledge of nuclear engineering and related technologies, analytical and problem solving ability, ability for technical communications, professional ethics, leadership and interpersonal skills, capability to conduct research, and the ability to recognize the value of and pursue life-long learning.

Nuclear Engineering is committed to a strong engineering program administered by highly motivated and active nuclear engineering faculty; it is the only B.S. Nuclear Engineering Degree program accredited in the state of Missouri. Nuclear Engineering at Missouri S&T, one of the earliest accredited undergraduate programs in the nation, interacts with professional societies, and the nuclear industry to promote continuing education, research opportunities, and public dissemination of information about issues and advances in the field.



WHY STUDY NUCLEAR ENGINEERING AT S&T?

The Nuclear Engineering (NE) program is offered under the department of mining and nuclear engineering. The primary mission of the NE program is to provide an outstanding and comprehensive education to tomorrow's leaders in nuclear science and technology. The objectives of the Bachelor of Science program are to provide each student with fundamental knowledge of nuclear engineering and related technologies, analytical and problem solving skills, technical communication skills, professional ethics, leadership skills, capability to conduct research, and the ability to recognize the value of life-long learning.

The NE program provides well-educated professionals and leaders to Missouri and the nation, in the commercial nuclear industry, national laboratories, graduate schools, and the nation's defense and federal agencies. Nuclear Engineering is a strong and growing engineering program administered by highly motivated and active nuclear engineering faculty; first accredited in 1960, it is one of the earliest ABET accredited undergraduate programs in the nation and is the only B.S. Nuclear Engineering degree program accredited in the state of Missouri. It is also one of the most productive programs in the nation. Faculty interact with professional societies, national laboratories,

and the nuclear industry to promote continuing education, research opportunities, and public dissemination of information about issues and advances in the field.

Laboratory facilities available to nuclear engineering students include a radiation measurements laboratory, a 200 kW swimming pool-type nuclear reactor, a materials analysis laboratory, a computer learning center, a radiochemistry lab, and a neutron generator. The students have access to state-of-the-art computing facilities including personal computers, and numerically intensive cluster computers. The department offices and laboratories are primarily housed in Fulton Hall. The nuclear reactor is housed in its own building.

Nuclear Engineering and Radiation Science at S&T Prepares Students for Success

Health Physics

Health Physicists work across a wide range of industries to develop and implement radiation and protection plans in the workplace. Focusing on health physics, you will learn how radiation affects the human body, how radioactive materials move through the environment, and techniques for measuring and limiting dose to safe levels.

Why study Health Physics?

- Understand radiation hazards and how to prevent or control them.
- Work across a wide range of industries and companies including hospitals, regulators, manufacturing, medical isotope production, etc.
- Develop and implement radiation protection strategies and technologies.
- Potential starting salary: \$65,000 to \$75,000 per year.

Nuclear Engineering at Missouri S&T provides fundamental education on health effects, environmental radiation transport, and radiation measurement and dosimetry. This is enhanced by opportunities to put health physics concepts into practice at Missouri S&T's Research Reactor, in conjunction with the environmental health and safety staff.

Nuclear Fusion

Nuclear Fusion has the potential to generate nearly limitless, clean energy from hydrogen - the most abundant substance in the universe. Studying fusion at Missouri S&T, you will learn about the mechanics of the nuclear fusion process, plasma physics, and engineering for fusion systems.

Why study Nuclear Fusion?

- Perform cutting-edge research on energy technologies.
- Develop new applications for fusion and plasma technology.
- Engage in large-scale collaborative international projects like the International Thermonuclear Experimental Reactor (ITER).
- Careers with national laboratories, private technology development companies, or government agencies.
- Potential starting salary \$65,000 to \$75,000 per year.

At S&T, we can leverage strong plasma physics programs in the Aerospace Engineering and Physics programs, combining this with fusion science and radiation science from Nuclear Engineering to prepare students for productive careers in fusion technology.

Nuclear Medicine

About 1/3 of major medical procedures involve the use of radiation-based technologies, from x-rays and CAT scans to radiation-based cancer treatments like Gamma Knife Therapy. Research laboratories and doctors are continuously searching for new ways to fight disease. A focus on nuclear medicine will help you learn the skills you need to help develop new medical technologies, or prepare you to pursue medical school or graduate degree in Medical Physics after graduation.

Why study Nuclear Medicine?

- Design new diagnostic or therapeutic techniques.
- Prepare for medical school or an advanced degree in Medical Physics.
- Potential starting salary \$65,000 to \$75,000 per year.

Nuclear Engineering at Missouri S&T has developed a unique collaboration with the Medical Physics program at Washington University, allowing students studying nuclear medicine the opportunity for hands-on experience and exposure to potential graduate school options. In addition to this, students have the opportunity to interact with doctors and staff at the Delbert Day Cancer Institute at Phelps Health - a top-level cancer treatment facility.

Nuclear Power

Focusing on Nuclear power will provide you with key background in how nuclear reactors are designed and operated. You will learn about key scientific and engineering concepts behind nuclear reactor performance, discuss the important computer modeling software used in the nuclear power industry, and prepare for a career in reactor design, systems management or reactor operations.

Why Nuclear Power?

- Develop, maintain and operate commercial nuclear power reactors.
- Assist utilities with key challenges in nuclear power related to aging, fuel design and storage, regulatory compliance, and cost-saving measures.
- Careers with reactor vendors and utilities as systems engineers, fuel designers, and operations.
- Potential starting salary: \$65,000 to \$75,000 per year.

S&T is nationally regarded as one of the top universities for nuclear power engineers. The student operator training program at Missouri S&T's research Reactor allows students to earn a Reactor Operator's license as an undergraduate. Callaway Energy Center, the only commercial reactor in Missouri, is only a short drive away and S&T faculty regularly interact with CEC staff to ensure that our students are learning the skills they need.

Nuclear Engineering and Radiation Science at S&T Prepares Students for Success

Nuclear Security

A focus on Nuclear Security allows you to learn about geopolitics, national security, public policy, and other areas at the forefront of international relationships. You will learn how American foreign policy has aligned to restrict the spread of nuclear weapons and promote the spread of peaceful uses of atomic power. This focus area will prepare you for a career in national defense or development of science-based public policy.

Why study Nuclear Security?

- Work with government, the military, and industries to make the world a safer place.
- Prevent the spread of nuclear weapons, monitor potential international problems related to nuclear technology, or advocate for sound government policies in support of advance medical technology, advance nuclear power and other areas
- Careers in national defense, intelligence agencies, and policy development
- Potential starting salary: \$65,000 to \$75,000 per year.

S&T is uniquely suited for this opportunity. There are opportunities for discussions with staff at Fort Leonard Wood. Located a few miles away on Interstate 44, Fort Leonard Wood is the national home of the Army Chemical, Biological, Radiation and Nuclear (CBRN) weapon response training. S&T also works with Y-12 National Security Campus, located in Kansas City, MO.

Reactor Safety

Reactor safety and risk analysis is one of the fastest-growing hiring areas for nuclear engineers nationwide. Studying Reactor Safety will prepare you for careers in national laboratories, nuclear startups, or commercial utilities by providing you with the fundamental science and engineering behind evaluation nuclear accidents. You will also study risk analysis, mitigation and communication.

Why study Reactor Safety?

- Prepare for one of the most important careers for the next decade of nuclear power.
- Learn skills that are in very high demand in then nuclear power industry, as well as many others.
- Accurately understand and communicate the risks associated with a variety modern industrial systems, including nuclear systems.
- Develop and promote flexible, risk-informed regulation strategies to improve safety and reduce cost.
- Careers with reactor utilities and regulators, as well as reactor development startup companies.
- Potential starting salary: \$65,000 to \$75,000 per year.

S&T is one of the few universities to offer in Probabilistic Risk Management as part of their nuclear engineering program. In addition, S&T has unique opportunities to take courses in risk management from the Engineering Management program. S&T faculty also work closely with S&T alumni working on the risk management team at Callaway Energy Center, the only commercial reactor in Missouri, to ensure that students are learning the key skills required for the field.

SUGGESTED COURSE OF STUDY

BACHELOR OF SCIENCE IN NUCLEAR ENGINEERING

The nuclear engineering curriculum consists of three components: general education, mathematics and basic sciences, and engineering topics. The full plan of study is shown on page 7. The students apply the principles of physics, chemistry and mathematics to the study of engineering topics which include statics, mechanics of materials, electronic circuits and machines, thermodynamics, and metallurgy. The knowledge gained in these areas is applied to the understanding of nuclear engineering topics including reactor fluid mechanics and heat transfer, reactor physics, nuclear radiation measurements, radioactive waste management, reactor laboratory and operation, nuclear materials, and nuclear systems design (a capstone design course).

Engineering design is an integral part of a significant number of required courses in the nuclear engineering program. Design topics include but are not limited to reactor cooling systems, radiation protection, structural components, waste disposal and transportation systems, nuclear reactor cores and the design of experiments for radiation detection and measurement. While obtaining experience in these areas the students are prepared for designing a complete nuclear system such as a nuclear plant for electric power generation, space propulsion, desalination, district heating or radioisotope production for industrial, medical or research applications.

EXPERIENTIAL LEARNING REQUIREMENT

All students at Missouri S&T are required to participate in appropriate experiential learning activities. Experiential learning activities are designed to require students to go beyond mastering basic skills and knowledge in the application of that material to problem solving challenges. These activities involve collaboration and reflective learning and allow students to learn in environments that align with their aptitudes.

Examples of activities that fulfill the Experiential Learning requirement include, but are not limited to:

- » Co-ops or internships
- » Undergraduate research
- » Participation in design competition to completion
- » Study abroad program
- » S&T-sponsored service learning
- » Leadership positions with student organizations (ANS, NSDT, WiN).

REACTOR OPERATOR LICENSING PROGRAM

Missouri S&T is unique in that our undergraduate students have the opportunity to become licensed Reactor Operators (ROs) prior to graduation. Students will work with reactor staff, study relevant Nuclear Regulatory Commission (NRC) regulations, learn the fundamentals of how a nuclear reactor works, spend time in the control room, and take the NRC reactor operator's exam. Some students may also have the chance to complete Senior Reactor Operator (SRO) licensing.

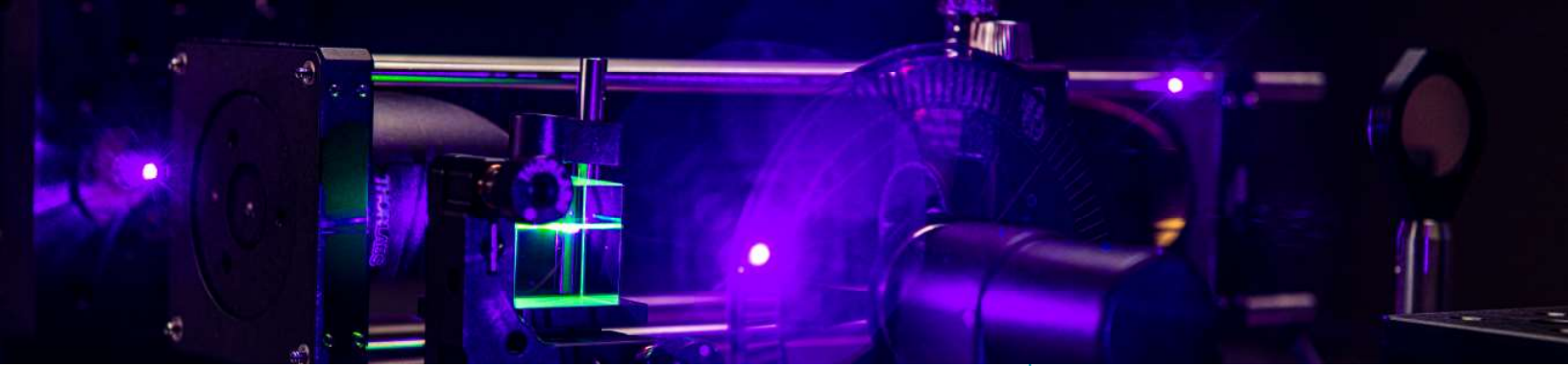
Students who are interested in the program should contact Ethan Taber (etaber@mst.edu)

General application deadlines:

- Fall Semester - July 15
- Winter/Spring Semester - December 15
- Summer Session - May 1

EDUCATIONAL OBJECTIVES

1. Fundamental knowledge of nuclear engineering and related technologies: Our graduates will continue to demonstrate a sound fundamental knowledge of nuclear engineering and related technologies as members of their professional community.
2. Analytical and problem solving ability: Our graduates will continue to use logical, creative, collaborative, analytical and problem solving abilities to address emerging multidisciplinary endeavors.
3. Technical communication and interpersonal skills: Our graduates will continue to demonstrate technical communication and interpersonal skills, enabling them to excel in their profession.
4. Leadership and professional ethics: Our graduates will continue to demonstrate leadership with an understanding of, and a commitment to, professional ethics.
5. Capability to conduct research: Our graduates will continue to demonstrate the capability to conduct research enabling them to contribute to meeting the needs of their profession.
6. Pursuit of life-long learning: Our graduates will continue to demonstrate a recognition of, and a desire for, the pursuit of life-long learning that will foster their ability to adapt to change.



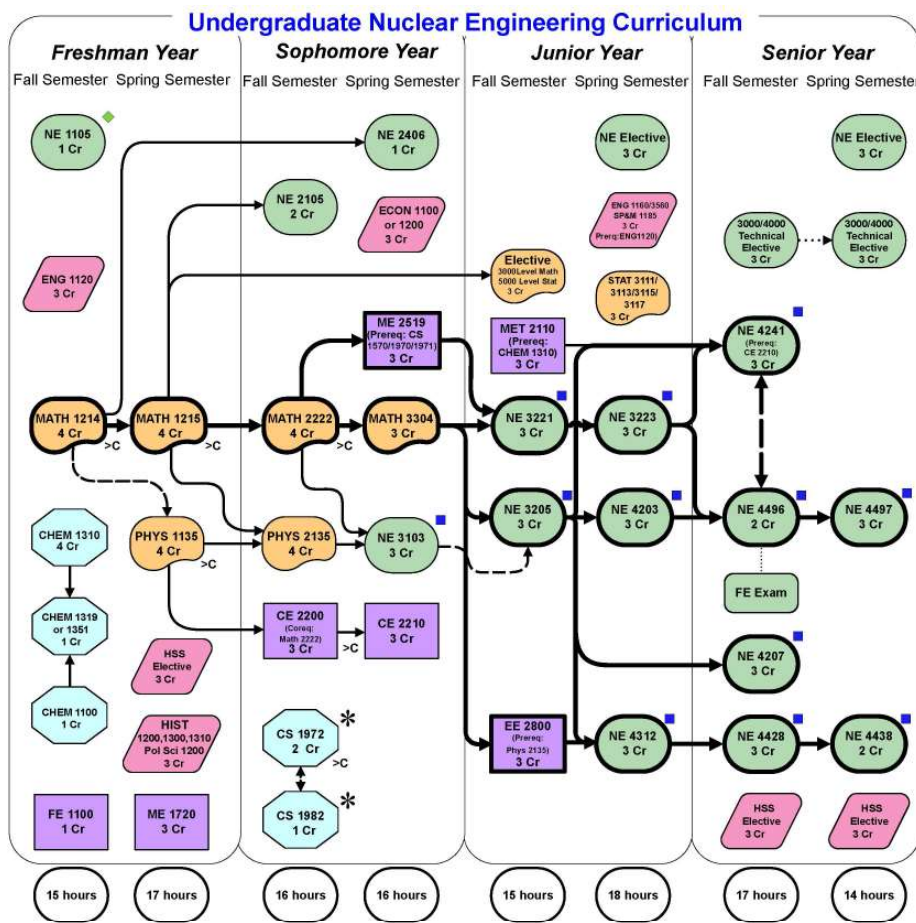
NUCLEAR ENGINEERING AND RADIATION SCIENCE CURRICULUM BY DISCIPLINE

ENTRANCE REQUIREMENTS

The Catalog states that students may transfer from Freshman Engineering to departments with up to two of the common freshman year courses not yet completed, provided departments will accept them. The following guidelines are used in evaluating applications for admission to the Nuclear Engineering degree program:

1. A cumulative GPA > 2.0

Students may take sophomore-level Nuclear Engineering courses in order to satisfy the admission requirements and re-apply for admission. However graduation from the Nuclear Engineering program expects official admission to the program prior to beginning the Junior-year Nuclear Engineering courses.



- Nuclear Engineering
- Engineering
- Math/Physics
- General Education
- Science

- These courses are only offered once every year
 - * Other scientific programming languages might suffice
 - ◆ NE 1105 is waived for transfer students and for Nuclear Summer Camp attendees
One additional credit must be taken to maintain the 128 credit hour requirement
 - Course in the Critical Path
 - Critical Path
- Smooth program completion requires attention to the critical path because of prerequisite course requirements.
Deviation from Critical Path Options:
1. Meet with advisor for getting back on track
2. Summer program to catch up

Minimum Graduation Requirements
128 Credit Hours
FE Exam
Pre-Requisites – Out of Department Courses
Chem 1310, 1319, 1100 / Phys 1135, 2135 / CS 1972, 1982
Math 1214, 1215, 2222, 3304, CE 2200, 2210, Met 2110, ME 2519, EE 2800

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PROFESSIONAL & HONOR SOCIETIES

AMERICAN NUCLEAR SOCIETY (ANS)

The American Nuclear Society (ANS) is a not-for-profit, international, scientific and educational organization. ANS has a diverse membership composed of approximately 11,000 engineers, scientists, administrators, and educators representing 1,600 plus corporations, educational institutions, and government agencies. It is governed by four officers and a board of directors elected by the membership.

Vision: ANS will be the recognized, credible advocate for advancing and promoting nuclear science and technology.

Mission: ANS provides its members with opportunities for professional development. It also serves the nuclear community by creating a forum for sharing information and advancements in technology, and by engaging the public and policymakers through communication outreach. Mission components can be found in the ANS strategic plan.

Purpose: The core purpose of ANS is to promote the awareness and understanding with regard to the application of nuclear science and technology.

The ANS Student Chapter at Missouri S&T is a student-led professional organization. The mission of the Missouri S&T American Nuclear Society is to promote understanding in, and advancement of, the sciences pertaining to the atomic nucleus in our community, especially those for peaceful applications. The chapter was founded in 1967. The organization creates opportunities to experience Nuclear Engineering outside of the class room and open doors to professional relationships and networking by providing the opportunity to travel to ANS conferences, national laboratories, and so on.



Nuclear Science Week ANS BBQ



High school students with Cloud Chambers

WOMEN IN NUCLEAR (U.S. WiN)

U.S. Women in Nuclear (U.S. WiN) is the premier network of over 8,000 women and men who work in nuclear- and radiation-related fields around the country. The U.S. WiN has following strategic objectives:

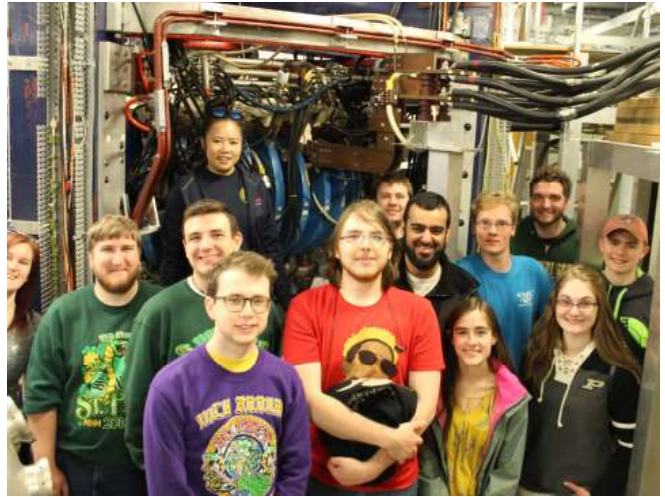
- To support an environment in nuclear energy and nuclear technologies in which women and men are able to succeed
- To provide a network through which the women and men in these fields can further their professional development
- To provide an organized association through which the public is informed about nuclear energy and nuclear technologies.

U.S. WiN members participate in networking, professional development and outreach activities through local chapters, regional organizations, and the national organization.

Membership is open to both men and women at Missouri S&T. We strive to help provide a network for members to further their professional development, inform the public about nuclear energy and technology, and encourage women and diversity to participate in the nuclear, engineering, and energy fields.



Flamingo Flocking University Parking (WiN)



WiN trip to UIUC

NUCLEAR SCIENCE DESIGN TEAM

Missouri S&T design team experience prepares students for success in whatever endeavor they may choose. These student-led teams learn the organizational problem-solving process essential for the successful development of a market-ready product. Design team members network with industry professionals and students from competing schools alike, forming personal and professional relationships that can lead to rewarding careers.

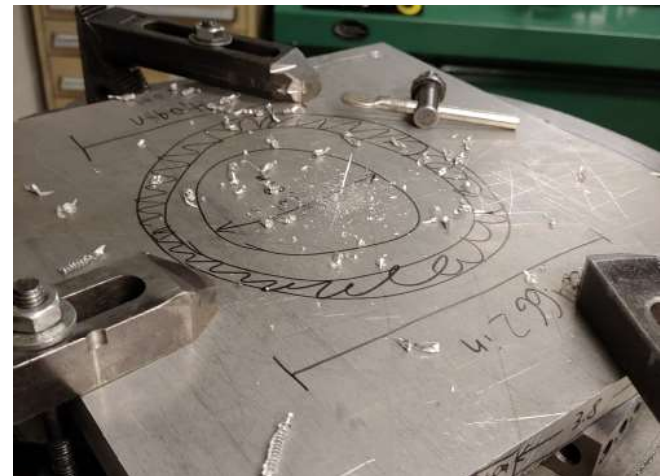
The Nuclear Science Design Team (NSDT) develops original ideas or concepts related to nuclear science and technology. Final designs or papers are submitted to national competitions, including the yearly ANS student design competition. The purpose of the organization is:

1. Research, design, and build nuclear devices
2. Participate in American Nuclear Society competitions
3. Promote technological advancement, particularly in nuclear fields
4. Expand members' knowledge of classroom concepts
5. Increase awareness of environmental protection and health safety throughout all aspects of developing NSDT next project
6. Develop skills that will prepare members for leadership roles in industry
7. Promote cooperation between multiple scientific and engineering disciplines
8. Promote the University through ANS competitions and public outreach programs

Past projects include construction of an Inertial Electrostatic Confinement (IEC) fusor. The team is always looking for new members. All students are welcome. Any major and no experience required.



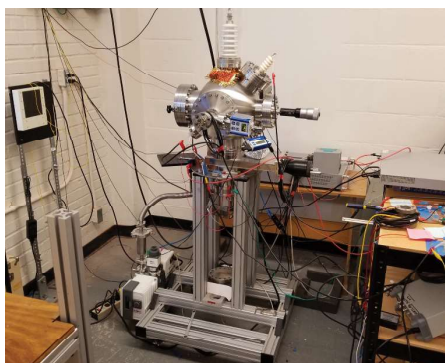
Nuclear Design Team



Nuclear Design Team

OUR RESEARCH AND LAB FACILITIES

Advanced Radiography and Tomography Laboratory



Radiation imaging has been the most successful and useful method of early cancer detection as well as a highly helpful nondestructive testing method for various industrial applications. In the ARTLAB, we are developing innovative radiation imaging systems for medical and industrial purposes. We develop and utilize a wide range of new tools, from x-ray sources for radiation imaging to sophisticated algorithms for image processing and computed tomography (CT) reconstruction. One such example is the ongoing project of developing a stationary CT for real-time 4D imaging that will be useful both in medicine and industry. For the stationary CT, a new type of x-ray tubes for fast imaging is under development. Also, we develop machine learning algorithms for radiation image analysis and automatic radioisotope detection for homeland security and defense applications. The lab is equipped with a homemade benchtop 3D CT, a clean room for x-ray tube experiment and a high-performance computer server with COMSOL software for simulation studies.

D-D Neutron Generator Laboratory



The D-D generator uses Deuterium gas and a microwave to generate plasma as an ion source to induce nuclear fusion. This results in a relatively high-flux source of fast and epithermal neutrons useful for prompt gamma neutron activation analysis, neutron activation analysis, and radiography. Using Deuterium rather than radioactive Tritium, as well as an “open-vacuum” construction, allows the system to be easily reconfigured for experiments.

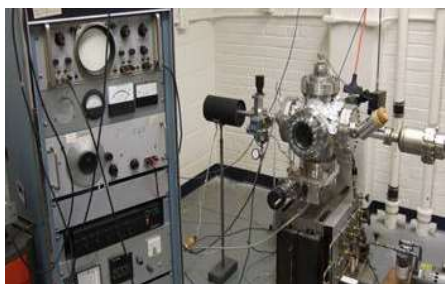
Thermal Hydraulics Experiment, Modeling, and Engineering Simulation (THEMES) Laboratory



The Thermal Hydraulic Experiment, Modeling, and Engineering Simulation (THEMES) Laboratory is designed as a modular, multipurpose facility capable of supporting a wide variety of multiphase flow experiments, simulations, and modeling efforts. The central feature of the THEMES Laboratory is a modular test facility designed to support up to six concurrent experiments by effectively utilizing existing infrastructure. This allows for rapid deployment of experiments, lets projects to progress rapidly to the construction and testing phases, and reduces the cost to the sponsor. A 30 hp pump provides up to 1000 gpm of water flow at 90 ft of head, while a 50 hp compressor provides up to 270 acfm of compressed air at a pressure of 200 psi. Flow is measured using pressure transducers, rotameters, a laminar flow element, a vortex flow meter, a magnetic flow meter, and other state-of-the-art instruments. Robust four-sensor electrical conductivity probes for multiphase flow measurements are constructed and characterized in-house, with unique software for enhancing data processing performance.

RESEARCH AND LAB FACILITIES CONTINUED

Vacuum Technology and X-Ray Generation Laboratory



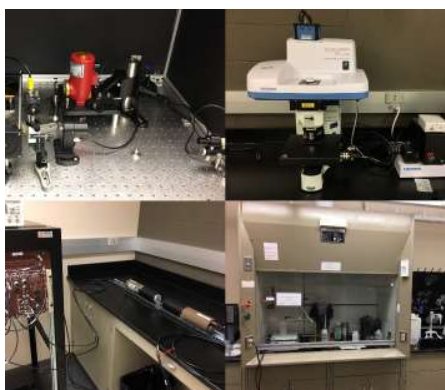
Located in Fulton 213 this lab has facilities to produce and work with vacuum technology up to 10^{-9} Torr. The equipment includes roughing mechanical pumps, ion pumps, turbo pumps, glass vacuum chambers, steel vacuum chambers with programmable ramp-heating capabilities, Residual Gas Analyzer-RGA200, and a variety of pressure gauges, ion guns, and radiation detectors and other measurement equipment. Total area is 561 sq ft.

Nanotechnology, Nuclear Forensics and Radiochemistry Laboratory



The Radiochemistry and Nanotechnology Laboratory is located in Fulton 218 and houses a fume hood with wet chemistry capabilities, a two seat glove box, chemical waste disposal, safes for radioactive materials, UV-Vis Spectrophotometer, analytical balance, centrifuges, vacuum filtration and drying system, furnace, stereo microscope, ultrasonicators, with a total area of 466 sq. ft.

Nuclear Materials Laboratory



The Nuclear Engineering department is home to two laboratories with specialized equipment for characterizing the effects of radiation on solids at the atomic and microscopic scales. Equipment available includes a Confocal Raman Microscope, a Positron Annihilation Lifetime Spectrometer, a Modulated Photothermal Radiometer, a Three-Omega system configured for thermal diffusivity measurements and a Four-Terminal Resistivity Station. The facilities of the campus Materials Research Center are also available for nuclear materials related research. These facilities include state-of-the-art Scanning and Transmission Electron Microscopes, X-ray Diffractometers, a Nanoindenter, Atomic Force Microscope and X-Ray Photoelectron Spectrometer among other tools. Ample opportunities exist for Nuclear Engineering students to collaborate with students and researchers in the campus Materials Science and Engineering Department.

RESEARCH AND LAB FACILITIES CONTINUED

Missouri S&T Reactor (MSTR)



The Missouri S&T Reactor (MSTR) is located on the Missouri University of Science and Technology campus in Rolla, Missouri. MSTR provides facilities for experimental research, undergraduate training, and learning about reactor physics and other aspects of nuclear engineering. It is a 200 kW pool-type reactor, and is integral to the education of Nuclear Engineering students through hands-on laboratory activities. The reactor was initially licensed in 1961, and was converted from high-enriched uranium (HEU) to low-enriched uranium (LEU) in 1992.

Recently MSTR has gone through a number of changes. A new active cooling system capable of removing up to 400 kW of heat was installed using funding from the Department of Energy in 2013. In 2014 new digital control room systems were installed, replacing the original systems from 1961 and allowing MSTR to serve as a testbed for new digital reactor control technologies. A distance education system, also installed in 2014, allows our faculty and staff to provide online training through distance education for students around the world. Additional modifications are planned over the next several years, including the installation of new digital recording systems to replace paper records.

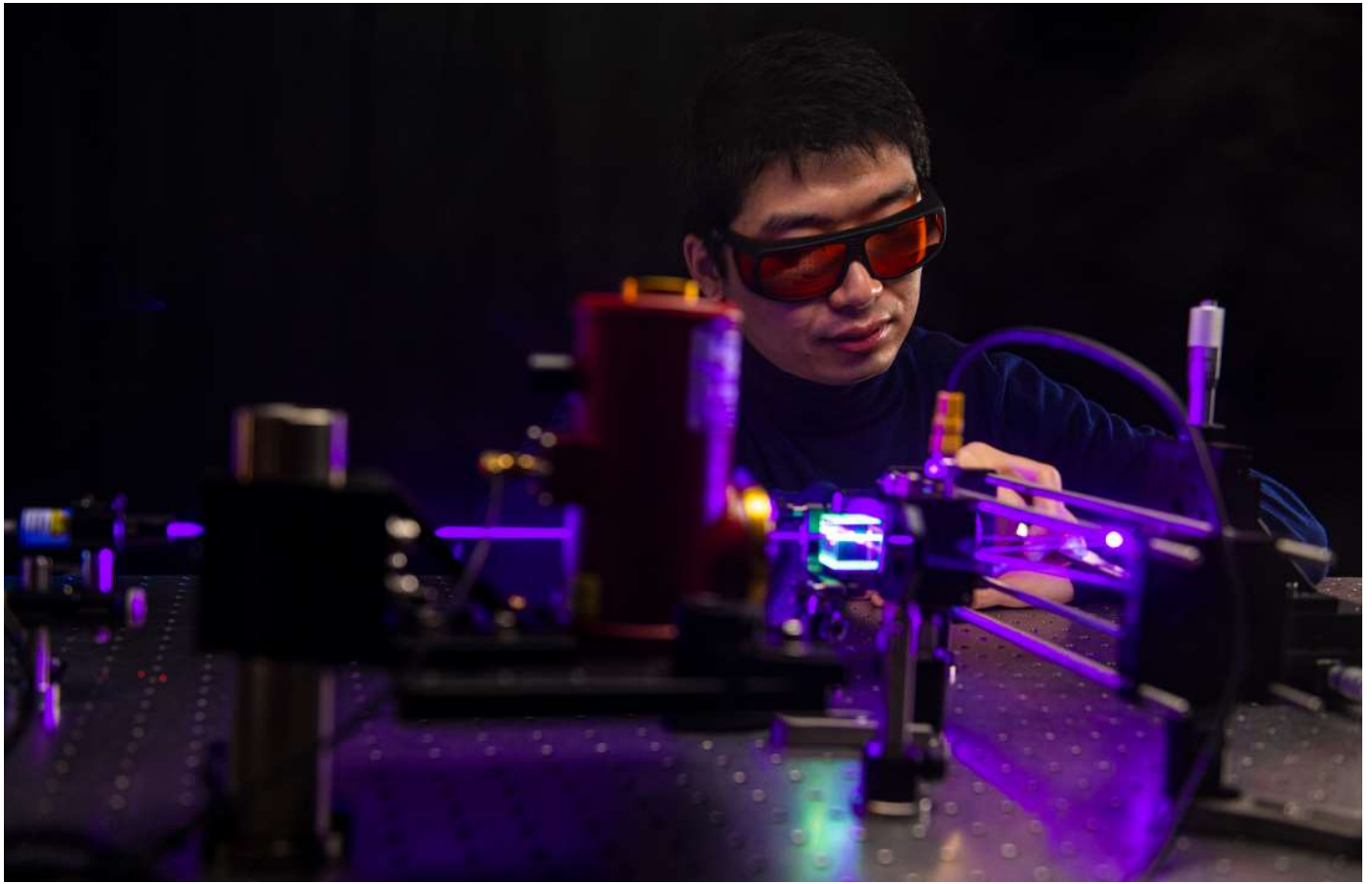
Research facilities, experimental capabilities and services available at the reactor include:

- A neutron beam port for neutron radiography, tomography and ex-core neutron irradiations
- Thermal column for experiments involving thermal neutrons
- Pneumatic transfer tubes for in-core irradiation experiments and Neutron Activation Analysis (NAA)
- Isotope production elements and void tubes for in-core irradiations
- Internet accessible hot cell facility for high-activity sample irradiation and counting
- Subcritical assembly for teaching the fundamentals for reactor physics
- Gamma spectroscopy systems equipped with NaI and High Purity Germanium (HPGe) detectors
- Liquid scintillation counter for alpha and beta spectroscopy
- State-of-the-art distance education system for broadcasting reactor labs to outside universities and organizations

Radiation Measurements and Spectroscopy Laboratory



RMSL is a teaching lab mainly for education and training of undergraduate nuclear engineering students. Three identical workstations for alpha particle, beta particle, and gamma-ray spectroscopy can provide “hands-on” training in radiation detection and measurement for 18 students at a time. The five internet-accessible digital signal analyzers allow 50 remote users to participate in nuclear spectroscopy and measurement and collection of spectra data via an internet connection at any given time. When the RMSL is not in use for education or training, it is open for faculty and graduate students to conduct research. The lab was significantly renovated with support from DOE and is equipped with state-of-the-art radiation detectors and signal processing systems.



SCHOLARSHIPS

A number of need and/or merit based scholarships or research awards are available to NE students. Female and minority students qualify for additional scholarships. Over 90% of NE students receive some kind of financial support. Sophomores and Juniors with summer work experience in the nuclear industry can receive scholarships from the National Academy for Nuclear Training (NANT). Sophomores and Juniors can also apply for American Nuclear Society (ANS) or Nuclear Regulatory Commission (NRC) scholarships for the following year. These scholarship may include service requirements, such that you must work in the nuclear industry for a certain amount of time (usually 6 months) per year of support. The following are NE-specific award opportunities:

- » National Academy for Nuclear Training (NANT): \$2,500/yr, renewable for 3 years
- » OURE: \$500-\$1000/yr
- » ANS Scholarships (NEED, Minority, Women): \$1000-\$4000/yr
- » NE Program Scholarships: \$500-\$1000/yr
- » NE Research Award: \$500-\$1000/yr
- » NRC Scholarships: Up to \$3000/yr; generally undergraduates with GPA > 3.0 qualify

The NE awards and NRC Scholarships (which are administered by the program) are awarded based on the program's scholarship application.



NUCLEAR ENGINEERING AND RADIATION SCIENCE SUMMER CAMP

IF YOU ARE INTERESTED IN NUCLEAR ENGINEERING, THIS ONE-WEEK SUMMER PROGRAM WILL INTRODUCE YOU TO THE FASCINATING WORLD OF NUCLEAR POWER AND THE OUTSTANDING OPPORTUNITIES IN NUCLEAR ENGINEERING.

- » Eligibility: For rising 11th, 12th graders and graduating seniors
- » Capacity: Space is limited to 40 students (if the camp is full you can request to be placed on a waiting list).
- » Registration Fee: \$800 (includes room and board)

Camp Experiments

- » Natural Radioactivity
- » Nuclear Forensics
- » Reactor Operations
- » Shielding

Tours

- » Missouri S&T's Research & Training Reactor
- » Ameren UE's Callaway Nuclear Power Plant
- » Phelps Health medical Radiology & Oncology

Transportation Policy

» Participants must provide their own transportation to and from Missouri S&T. USA Express provides shuttle service from Lambert-St. Louis International Airport to campus. The shuttle service schedule is available online, or you can call toll free at 1-800-872-9399.

MEET THE FACULTY



JOSEPH W. NEWKIRK

Chairman and Professor

Areas of Interest

Nuclear and aerospace materials, materials for extreme conditions, advanced manufacturing technology, manufacturing systems, and materials processing. Additionally, workforce development, systems design, societal impact of technology and space exploration.



AYODEJI B. ALAJO

Associate Professor and Nuclear Engineering Program Director

Areas of Interest

High Fidelity Nuclear Systems Design and Modeling, Advanced Fuel Cycles, Radioactive Waste Management and Nuclear Systems Safety.



SYED ALAM

Assistant Professor

Areas of Interest

Monte Carlo, Deterministic and Nodal Diffusion methods for reactor physics analysis; Modeling techniques & design of advanced reactor core; Multiphysics modeling; Data Science; Computational physics; CFD; Code development and Nuclear data.



CARLOS H. CASTANO GIRALDO

Associate Professor

Areas of Interest

Energy, Nuclear Materials, Plasma Materials Interactions, Hydrogen in Materials, Radio-Electromechanical Effects and Nanotechnology.



JOSEPH GRAHAM

Associate Professor

Areas of Interest

Radiation Effects in Ceramics, Radiation Solid Interactions, Nuclear Fuel Properties and Nuclear Waste Forms.



JOSHUA P. SCHLEGEL

Associate Professor

Areas of Interest

Two-phase Flow Experiments and Modeling, Nuclear Reactor Thermalhydraulics, Heat Transfer and Fluid Mechanics.



SHOAB USMAN

Associate Professor

Areas of Interest

Radiation Transport, Radiation Protection, Radioactive Waste Management.

JOINT APPOINTMENT FACULTY



MUTHANNA AL-
DAHHAN

Professor in Chemical & Biochemical Engineering



JOHN GAHL

Professor in Electrical and Computer Engineering at University of Missouri-Columbia



JOSEPH SMITH

Professor in Chemical & Biochemical Engineering



HAIMING WEN

Assistant Professor
Materials Science & Engineering

STAFF



ANGELICA HENDRIX

Administrative Assistant

Specialization:

Assistant to the program director, day-to-day operation of the department, department budget, grants, payroll, travel authorizations, faculty travel, eRecruit, faculty, student, post doc and visiting scholar hiring, non-PO vouchers, undergraduate &

graduate studies, departmental website, publications, textbook requests, course leaf, summer camp, experiential learning, senior assessment, undergraduate advisors, & department accreditations.



ETHAN TABER

Reactor Manager

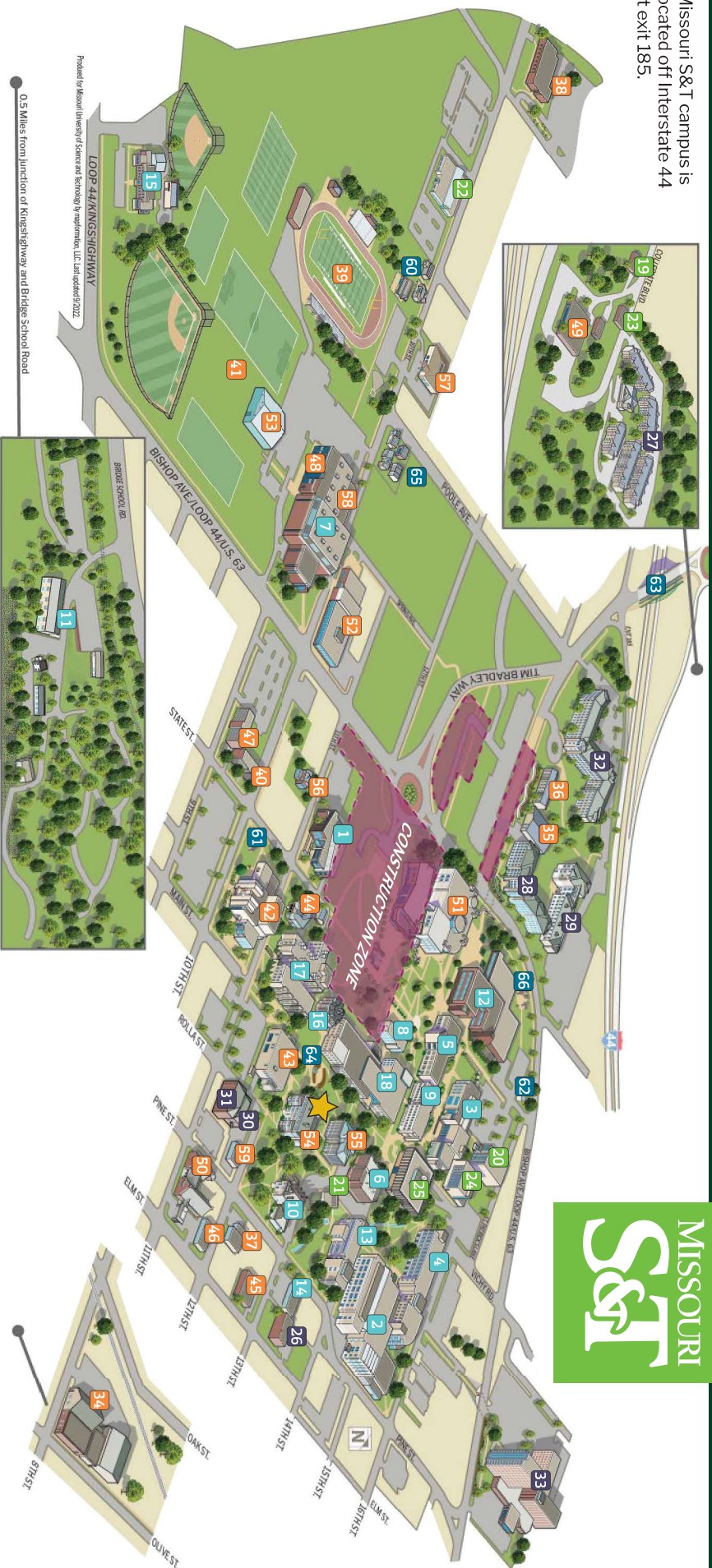
Specialization:

Responsible for the day-to-day operation of the facility, including implementation of the emergency, operator requalification, and physical security plans under the facility license and technical specifications, manages finance, personnel, and equipment, schedules, plans, reviews, and conducts experiments in the reactor facility, supports facility modifications and engineering analyses as well as licensing document preparation and review, maintains a senior reactor operator license, authorizing the supervision of reactor operations, member of the radiation safety committee, responsible for review and approval of the usage of radioactive materials across the S&T campus as well as oversight of the reactor, lab instruction for reactor-based lab classes (e.g., NE 2406 and NE 4428) & training operator candidates.

Notes:

Missouri S&T campus is located off Interstate 44 at exit 185.

MISSOURI
S&T



GET TO KNOW OUR CAMPUS

Can't find what you're looking for? 800-522-0938

CLASSROOMS/LABS

- 1 James E. Bertelsmeyer Hall
- 2 Butler-Carlton Civil Engineering Hall
- 3 Computer Science Building
- 4 Emerson Electric Company Hall
- 5 Engineering Management Building
- 6 Fulton Hall
- 7 Gale Bullman Multi-Purpose Building
- 8 Harris Hall
- 9 Humanities and Social Sciences Building
- 10 Interdisciplinary Engineering Building
- 11 Kennedy Experimental Mine
- 12 V.H. McNutt Hall
- 13 Physics Building

- 14 Pine Building
- 15 Rock Mechanics and Explosive Research Center
- 16 Rolla Building
- 17 Schrenk Hall
- 18 Toomey Hall

RESEARCH/SUPPORT FACILITIES

- 19 Compressible Flow Laboratory
- 20 Engineering Research Laboratory
- 21 MSTR
- 22 Technology Development Center
- 23 Temporary Research Facility
- 24 Straumann-James Hall
- 25 Curtis Laws Wilson Library

CAMPUS/STUDENT SUPPORT

- 34 209 E. 8th St. (Printing and Mail Services, North Warehouse, and South Warehouse)
- 35 710 W. Tim Bradley Way
- 36 800 W. Tim Bradley Way
- 37 1200 N. Pine St.
- 38 PCRMC Annex

STUDENT HOUSING

- 26 1303 N Elm St. (Townhouses)
- 27 Miner Village
- 28 Residential Commons 1
- 29 Residential Commons 2
- 30 Rolla Suites Building 1
- 31 Rolla Suites Building 2 (Department of Residential Life)
- 32 University Commons
- 33 Thomas Jefferson Residence Hall

CAMPUS LANDMARKS

- 39 Allgood-Bailey Stadium
- 40 Altman Hall
- 41 Athletic Fields
- 42 Castleman Hall
- 43 Centennial Hall
- 44 Chancellor's Residence
- 45 Child Development Center
- 46 Custodial and Landscape Services Building
- 47 Farrar Hall
- 48 Fitness Center (Located at the Gale Bullman Multi-Purpose Building)
- 49 General Services Building
- 50 Hasselmann Alumni House (Miner Alumni Association)
- 51 Havener Center
- 52 Kummer Student Design Center
- 53 Miner Dome Indoor Practice Facility
- 54 Norwood Hall
- 55 Parker Hall
- 56 Student Diversity Initiatives Center
- 57 Student Health Complex
- 58 Student Recreation Center (Located at the Gale Bullman Multi-Purpose Building)
- 59 University Police
- 60 Eco Village
- 61 Millennium Arch
- 62 Observatory
- 63 Pedestrian Bridge
- 64 Jack Carney Puck and Plaza
- 65 Solar Village I
- 66 Stonehenge



Visitors Center (campus tours start here)