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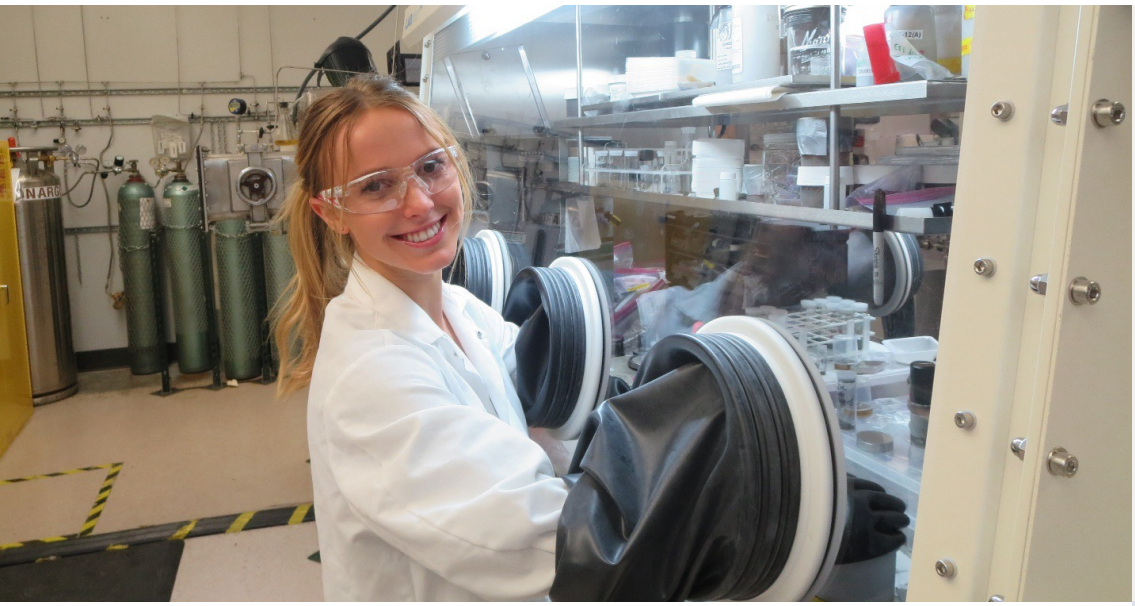

Sarah Cole working in a glove box at Boise State University synthesizing nuclear fuel.

> "I got to work with high-temperature furnaces and ball mills. It made me feel like a real scientist. I was actually working with uranium."

UNLP Fellow Pursues Career in Advanced Nuclear Fuels Research

By Cory Hatch

For Sarah Cole, growing up near Boise, Idaho meant volleyball, fishing and morel mushroom hunting with her family.

Now, Cole is an Office of Nuclear Energy University Nuclear Leadership Program (UNLP) fellow and a grad student in the nuclear science and engineering department at the Massachusetts Institute of Technology (MIT). These UNLP awards are crucial for next-generation workforce development as they attract emerging talent to the nuclear industry and provide them with essential support to advance their careers.

Early involvement in scientific research

Cole's interest in nuclear energy began in high school. A neighbor and family friend, Boise State professor Brian Jaques, directs the Advanced Materials Laboratory, a nuclear energy research group. Jaques offered Cole an internship her senior year.

At the lab, graduate students Kaelee Novich and Tim Phero took Cole under their wing and got her involved in researching sensors for extreme nuclear environments. "They were developing strain gauges for structural nuclear reactor components," Cole said. "I got to test these sensors in a humidity chamber to see how they performed in different environmental conditions." Notably, the now Dr. Novich was also a UNLP fellow.

Sarah Cole, Ph.D. student at Massachusetts Institute of Technology

During Cole's senior year of high school, she participated in Idaho National Laboratory's (INL) Bright Futures in Nuclear competition. Her presentation, which focused on basic metrics of measuring nuclear reactor economics, won the competition. "That was one of the first scholarships I ever won," Cole said. "They supported me, and I asked myself, 'why wouldn't I keep going down this track?'"

INL's early support and mentorship destined Cole to a career involving the nation's nuclear energy laboratory.

Researching accident tolerant fuels

During her freshman year at Boise State, Cole began working with uranium under the guidance Addie Lupercio – former UNLP fellow and now current INL staff scientist – who was working on her Ph.D. at the time. They began creating accident tolerant fuel by fabricating uranium dioxide fuel with ceramic dopants. These dopants are trace elements added to the fuel to modify its properties and are crucial for helping the fuel retain fission gas products, keeping them contained within the fuel for extended periods.

Later on, during Cole's junior and senior years, her work focused on developing advanced nuclear fuels including uranium nitride.

"The reason that project was so cool is because it was so hands on," Cole said. "I got to work in a glove box. I got work with high-temperature furnaces and ball mills. It made me feel like a real scientist. I was actually working with uranium."

Nuclear energy advocacy

The summer of Cole's junior year, she accepted an American Nuclear Society (ANS) internship called the Washington Internships for Students of Engineering.

Sarah Cole meets with Senator Risch on Capitol Hill during her Washington Internship for the Students of Engineering program with the American Nuclear Society.

ANS selected Cole to visit Washington, D.C. and learn about nuclear policy. "I wrote about the HALEU [High-Assay Low-Enriched Uranium] supply chain and devised a policy recommendation for Congress to pass the Nuclear Fuel Security Act," she said.

During her internship, Cole attended Senate Energy and Natural Resources Committee meetings and met with Senator Jim Risch and congressional staffers from Idaho.

Another chance to engage in nuclear advocacy occurred during her senior year at Boise State when she joined the Nuclear Engineering Student Delegation — a group of 15 students from universities around the country who spend a week in Washington, D.C., writing a policy statement. The following year, Cole served as Vice Chair of the program.

"It was the first time I got to advocate in the executive branch," Cole continued. "It cemented my decision to do grad school as a nuclear scientist, not just as a materials scientist who focused on nuclear."

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Working with metallic fuels

Now, during her first year of a five-year program at MIT, Cole is working on metallic fuels, specifically uranium-zirconium fuel, under the guidance of Professor Ericmoore Jossou. Her research supports sodium-cooled fast reactors, such as Terrapower's Natrium reactor, that rely on the same basic technology as the Experimental Breeder Reactor-I at the INL.

Specifically, Cole is working on 3D imaging of irradiated fuel using synchrotron light sources, yet another project in collaboration with INL.

A synchrotron is "a type of particle accelerator that produces high-energy X-rays capable of probing very dense materials like uranium," she said.

Even though MIT is a long way from western Idaho and her family, Cole said she still feels supported.

"The nuclear industry has my back," she said. "They're willing to make an investment in a kid like me to make me a scientist to advance their mission."

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