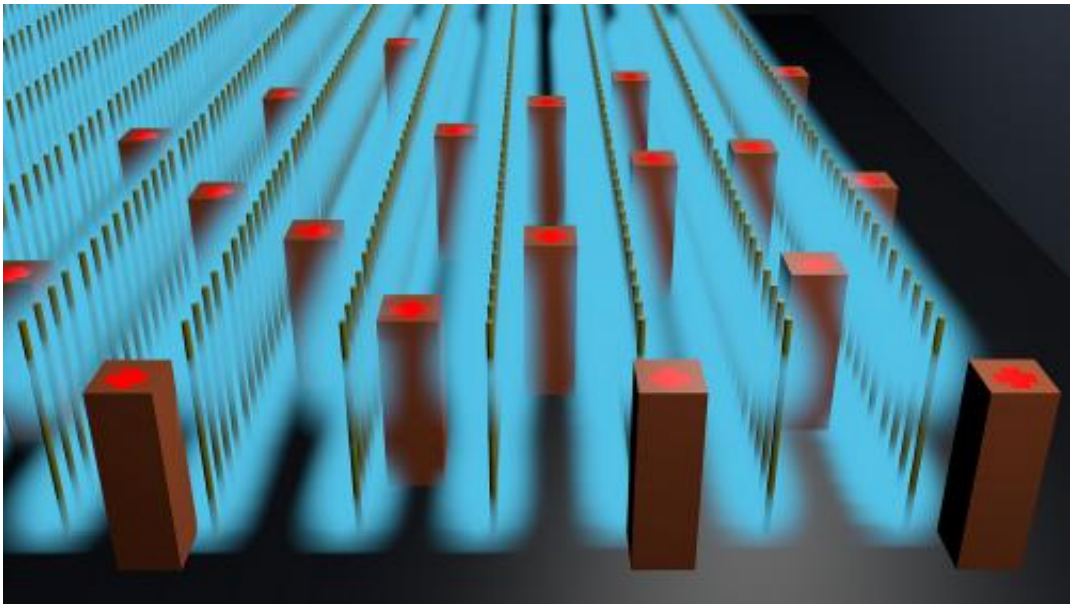
Invention could make spent nuclear fuel useful for irradiation purposes

April 4 2013



A new system developed at Oregon State University would use hundreds of rods containing spent nuclear fuel to provide the gamma rays that, in this example, are irradiating medical supplies to sterilize them. Credit: Oregon State University

A researcher at Oregon State University has invented a way to use spent nuclear fuel to produce the gamma rays needed to irradiate medical supplies, food and other products – an advance that could change what is now a costly waste disposal concern into a valued commodity.

The technology, if widely implemented, might allow each of the 104 nuclear reactors in the United States to create a revenue stream of $10

million a year while providing thousands of new jobs. And by lowering the cost of irradiation, it could become commercially feasible for a wider range of uses.

A provisional patent has been issued on the technology, and commercialization efforts are under way through a private company, G-Demption LLC, created for that purpose.

"This is essentially a way to re-use spent nuclear fuel for a valuable purpose," said Russell Goff, a masters student in the OSU Department of Nuclear Engineering and Radiation Health Physics. "Until now no one really thought to do this. But this approach is safe, practical and economical. Instead of treating all nuclear waste as a disposal problem, we could be putting much of it to good use."

Irradiation is a growing industry, and is commonly used in the sterilization of medical supplies such as bandages or syringes. It's also widely approved for helping to preserve foods – many spices, and some fruits and meat products are irradiated. The use of gamma radiation for these purposes does not make the underlying product radioactive, and generally has no effects on it that are any more pronounced than other sterilization or preservation technologies.

However, the gamma ray sterilization industry is constrained by the need for cobalt 60, the radioactive isotope most commonly used.

"The U.S. already uses about half of the world's supply of cobalt 60 for various types of irradiation, and the process can be expensive," Goff said. "The new system we've created should be significantly less expensive, and as such could open the technology to more routine uses. We could double the world supply of gamma rays with this new technology and still won't come close to meeting the market demand for this valuable resource."

Sterile medical supplies are a huge market for gamma irradiation, Goff said, and increased used of irradiation could reduce the need for sterilization with ethylene oxide gas, which is a highly toxic and flammable gas.

The system Goff has invented adds another level of protection to prevent unwanted fission products from escaping the spent nuclear fuel and entering the environment, but allows gamma radiation to be released in a controlled manner for irradiation purposes. Because recently spent nuclear fuel – less than 12 years old - still has fairly intense levels of radiation, it provides an economical way to irradiate products.

The nuclear waste handling systems needed to use the new technology are similar to those already being used at nuclear power plants, he said, and the process of sterilizing the products is almost identical to processes used in the cobalt 60 irradiation industry today.

Aside from providing a commercial use for spent nuclear fuel, the approach would also reduce the significant expense of otherwise storing it, Goff noted. This system might also have special appeal in developing countries, where refrigeration and other approaches to preserving food, as well as access to sterile medical supplies, are not always readily available.

Provided by Oregon State University