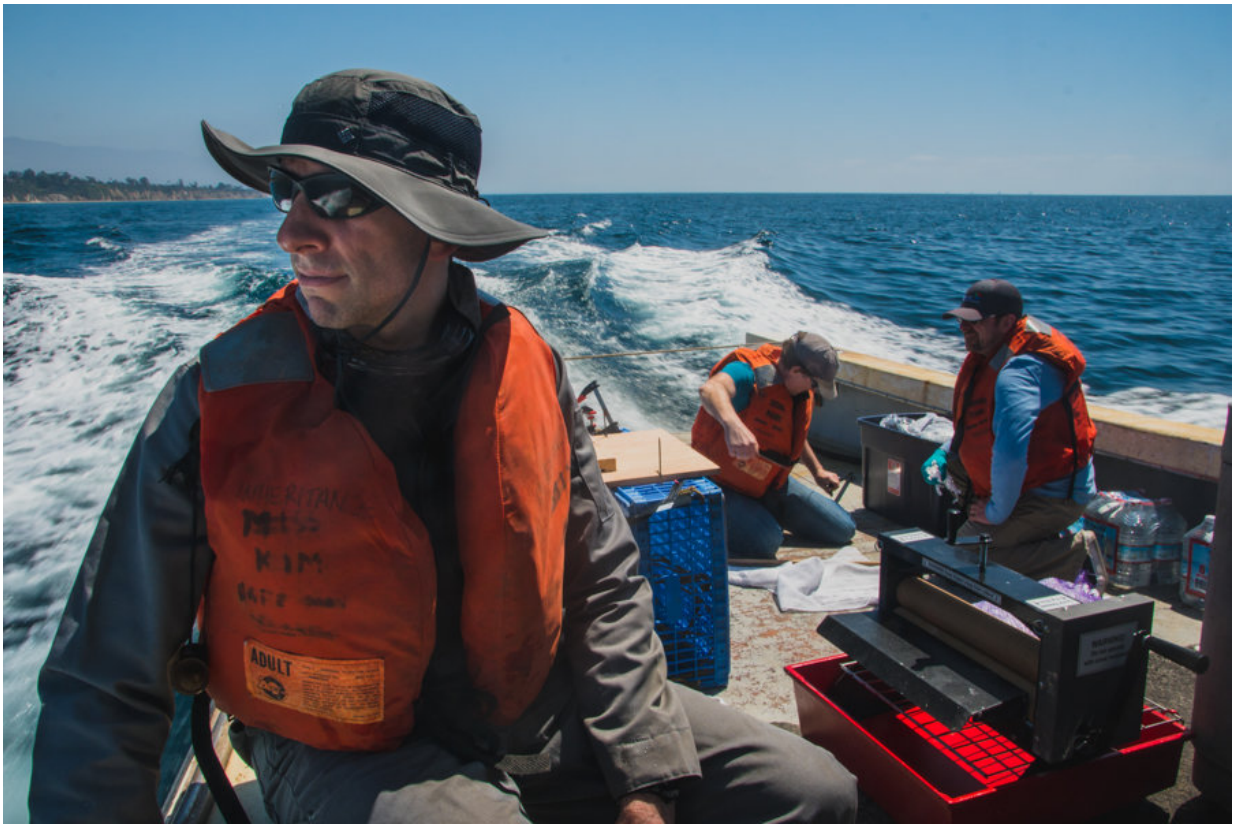
Oleo Sponge successful in real-world conditions off California coast

July 17 2018, by Jo Napolitano



A team of Argonne researchers successfully tested the Oleo Sponge off the coast of Southern California in April. From left to right: Argonne's Seth Darling, Jeff Elam and Ed Barry. Credit: Argonne National Laboratory

The Oleo Sponge, a patent-pending technology to clean oil spills

invented at the U.S. Department of Energy's (DOE) Argonne National Laboratory, has lived up to its promise in an experiment conducted off the coast of Southern California in April.

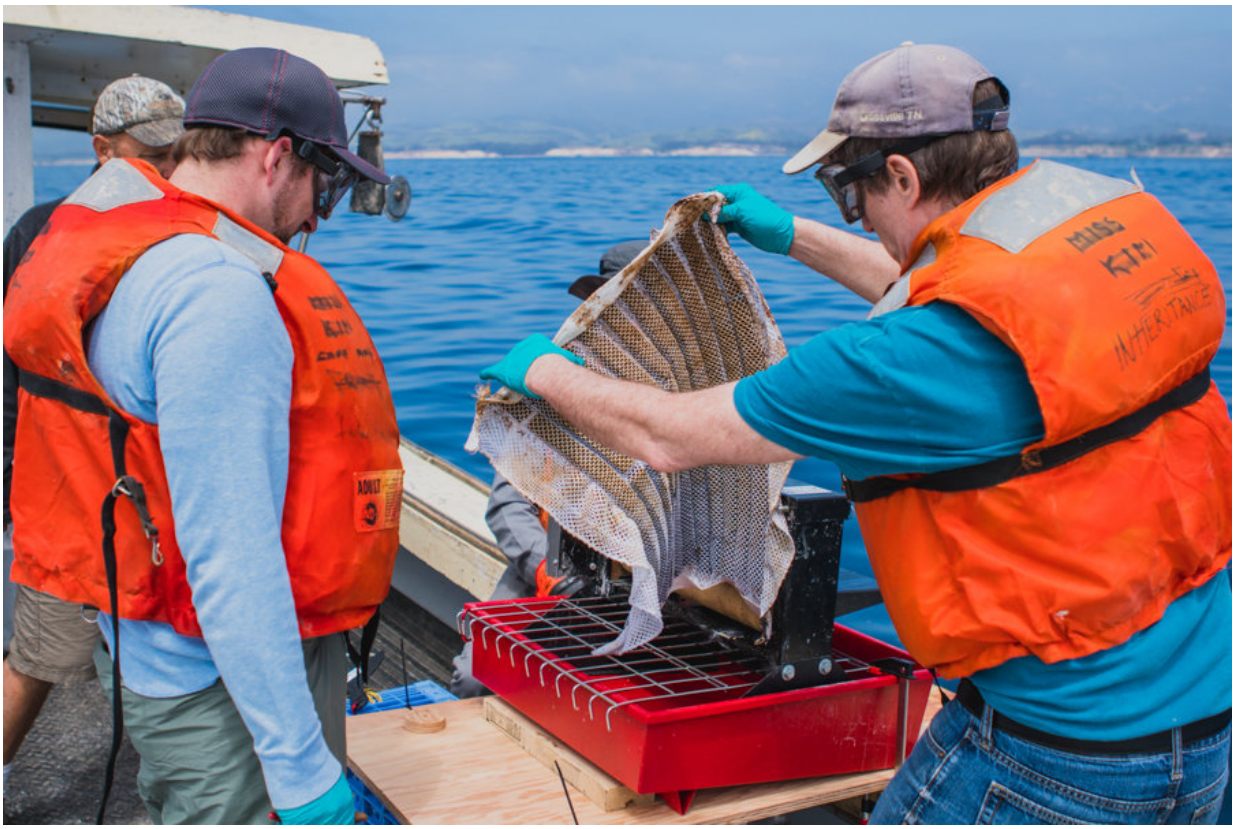
The test, funded by the Palo Alto-based Anthropocene Institute, was meant to validate Oleo Sponge in a setting that mimicked a real-world oil spill. The Anthropocene Institute addresses global resource and energy issues, including ocean conservation, through technology and policy development,

"This technology is so important because, despite the industry's best intentions, oil spills continue to happen, and existing cleanup methods are surprisingly inadequate," said co-inventor Seth Darling, director of the Institute for Molecular Engineering at Argonne.

Darling, who has worked at the laboratory for more than 15 years, is also a scientist at the Center for Nanoscale Materials and a senior scientist at the University of Chicago.

He and a team of scientists started out with common polyurethane foam, the kind used in furniture cushions. It had ample surface area to grab oil and useful mechanical properties, but needed a new surface chemistry in order to firmly attach the oil-loving molecules.

Darling and fellow Argonne chemist Jeff Elam developed a technique called sequential infiltration synthesis, used to infuse metal oxides within polymeric materials, and eventually found a way to adapt the technique to grow an extremely thin layer of metal oxide "primer" near the foam's interior surfaces to tightly bind molecules to capture the oil.



In recent open-water tests, Oleo Sponge worked just as researchers had predicted: It was able to successfully remove oil sheen from the surface of the water, leaving no visible trace behind. Credit: Argonne National Laboratory

The result is Oleo Sponge, which, prior to this latest test in open water, had already been vetted in the laboratory and at Ohmsett, a large-scale seawater tank used by companies and government agencies to evaluate technologies for oil spill response.

Argonne scientists Anil Mane, Joseph Libera and Edward Barry also contributed to the development of the Oleo Sponge, with Barry assisting in the California experiment.

The cleanup method is simple: The sponge is dipped into the water and

then wrung out, the oil collected in containers for potential reuse or safe disposal. After the oil is wrung out, Oleo Sponge can be used again.

Researchers chose the Coal Oil Point Seep Field in the Santa Barbara Channel near Goleta, California, for their experiment. The location remains one of the largest and best studied areas of active marine seepage in the world.

Located in depths of 20-80 meters, the seeps have been active for at least 500,000 years and release roughly 40 tons of methane, 19 tons of other organic gases, and more than 100 barrels of liquid petroleum daily.

Argonne researchers were particularly interested in whether the reusable Oleo Sponge could remove sheen, a layer of surface oil roughly one micron thick that perpetually shimmers on top of the water.

They made a set of 2-foot-by-2-foot Oleo Sponges for this purpose, deploying them for use on a small fishing boat, like those used to help with emergency cleanup efforts after a spill.

The Oleo Sponge worked just as researchers had predicted: It was able to successfully remove oil sheen from the surface of the water, leaving no visible trace behind.

"I was thrilled to see how well it performed," said Darling, "Oil sheen has always been a frustrating challenge for oil spill responders, with no good cleanup option available to date."

Traditional methods of spill mitigation include skimming and *in situ* burns, both of which are less effective—and, in the case of the burns, far less environmentally friendly—than Argonne's technology. And neither can be used with oil sheen because the sheen is too thin to skim or burn.

Chemical-based gelling agents can be applied to spill sites to try and remove sheen, but so much of it is needed that it is an impractical—and environmentally hazardous—solution.

Argonne currently makes Oleo Sponge in small quantities for research studies, using laboratory equipment. Argonne seeks commercialization partners interested in scaling the technology so that it can be manufactured in large quantities.

"This technology has so many applications," Darling said. "We are excited about the opportunities for other environmental remediation applications and beyond, which makes us that much more motivated to keep working on it."

Provided by Argonne National Laboratory