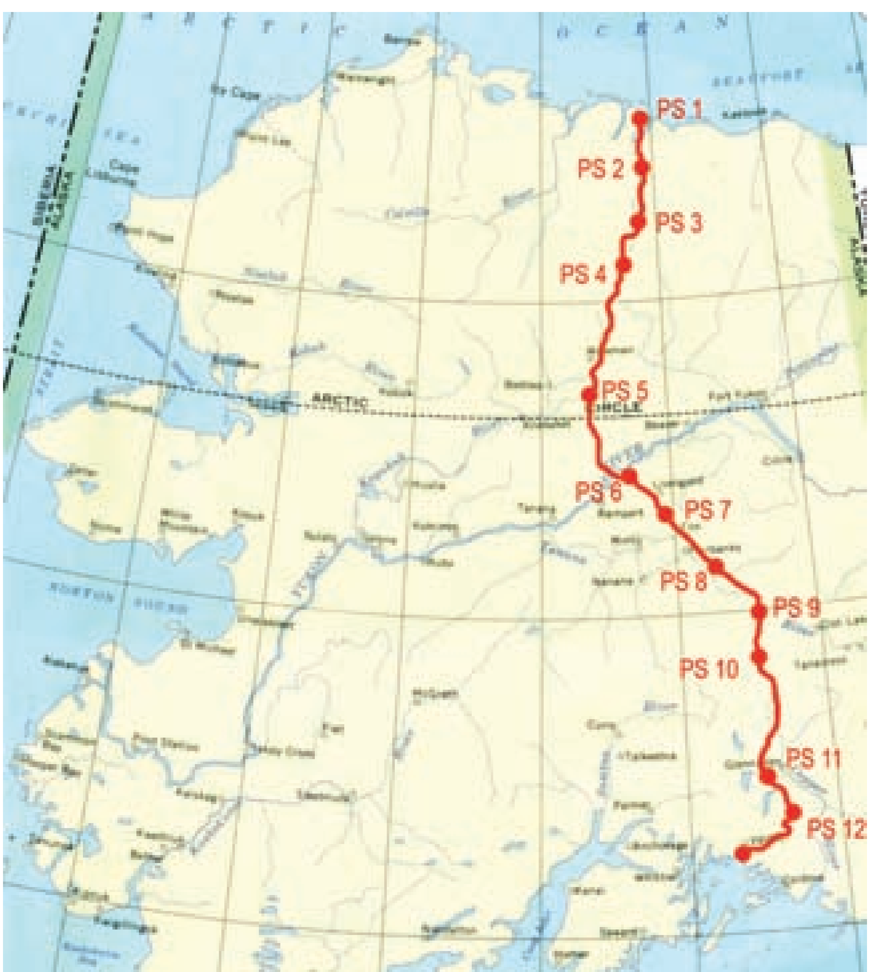
EB-Crosslinked Product Helped Establish U.S. Energy Independence

By Anthony J. Berejka

Advances in electron beam (EB) accelerators and in radiation chemistry are encouraging the greater use of EB processing in a variety of industrial applications—the partial curing of tire components; the high-speed curing of inks, coatings and adhesives; the surface decontamination of food, medicinal and beverage packaging materials; the grafting of films used in separating the poles of small batteries; and in many more areas. But did you know EB was used to crosslink the heat-recoverable tape that has served as the corrosion protection on the below-grade sections of the Alyeska pipeline for more than 30 years?



Map of the Alyeska pipeline showing pumping stations.

Back in the mid-1970s, the U.S. was faced with an embargo of crude oil shipments from Middle East sources resulting in limited supplies of gasoline and long lines at service stations to refuel cars. Before it created the Department of Energy, the U.S. Congress enabled the trans-Alaskan pipeline to be constructed from the oil-rich fields of Prudhoe Bay (on Alaska's northern slope) down to a transport terminal in the port of Valdez, in southern Alaska. This ~1300 km (800 mile) pipeline is 1.2 m in diameter (48 inches) and relies on strategically placed heating stations to raise the temperature of the crude to 60°C (140°F) in order to keep it flowing, as illustrated in the accompanying map. As of 2009, 16 billion barrels of crude oil have been pumped through this system.

What one commonly sees in pictures are sections of the above-grade portion (about half) of this pipeline which is insulated with fiberglass and has an aluminum exterior. These sections are supported

Response to the 1970s' oil crisis—laying a below-grade section of the Alyeska pipeline (1.2 m OD, 605 km soil anchored, 60°C operating temperature) with Berejka's development of an EB-crosslinked, heat-shrinkable tape corrosion protection, Arcticlad II, in operation since 1975.

on stanchions which keep the pipe from heating delicate permafrost terrain. Where the pipeline must go over the rugged slopes of mountain ranges, it is buried and soil-anchored. The corrosion protection on the below-grade sections is an EB-crosslinked, polyethylene tape with a heat-recoverable backing and a creep-resistant, polyethylene (PE) non-crosslinked adhesive. While at Raychem Corporation (now Tyco Electronics), we developed the tape product, Arcticlad II and had technical oversight for all aspects of the manufacture of this product. (The Raychem Corporation has more installed kilowatts of industrial EB capacity than any other company.) Arcticlad II could be unwound in Alaskan temperatures as low as -40° and yet function at +60°C (140°F). At the time, this EB-crosslinked, value-added product garnered sales of ~$26,000,000, including supplemental field service support (~$110,000,000 in 2010 dollars). Shown are pictures of the installation of Arcticlad II on a below-grade section of the pipeline and of me attempting to peel off some of the corrosion protection, EB-crosslinked tape wrap.

The creep resistance of this EB-crosslinked PE tape has maintained its soil anchorage for more than 33 years and the barrier properties of PE have extended the pipeline's life well beyond its design expectations. This represents not only the largest single radiation processing project ever conducted, but also one which has endured and continues to provide a U.S. source for much needed crude oil and energy independence.

Tony Berejka's futile attempt to remove EB-crosslinked, heat-shrinkable tape from the Alyeska pipeline (1975).

—Anthony J. Berejka is president of Ionicorp+, a consulting firm in Huntington, N.Y., and is a co-founder and past president of RadTech International North America.