In 2001and 2003, NOAA scientists conducted geospatial surveys of lingering oil in Prince William Sound (PWS) and used the 2001 data to predict based on extrapolation that about 11 hectares of shoreline remained contaminated with nearly 56,000 kg of subsurface oil from the 1989 Exxon Valdez oil spill (EVOS). Much of the lingering oil was present in subsurface sediments in the middle intertidal zone of the contaminated beaches. Although substantial weathering had occurred, the researchers concluded high concentrations of toxic and mutagenic contaminants were present, suggesting that this lingering oil posed an ongoing threat to organisms that encounter it.

At the 2007 AMOP conference, Exxon-Mobil consultants developed and presented a bioremediation index (BI) based on the degree of weathering of PAHs normalized to conserved biomarkers. They argued that, if the degree of weathering of oil is 70% or more, then further attempts to bioremediate it would be futile and not justified. However, according to the NOAA surveys, the Bioremediation Index did not seem to fully account for the PAH content of the lingering oil. This microcosm study was designed to address the extent to which the lingering oil is biodegradable given varying degrees of weathering.

The objective is to measure the biodegradability of the 19-year lingering oil under conditions where nutrients and oxygen are not limiting. Samples of beach substrate were collected in the summer of 2008 from representative sites in PWS contaminated with oil residues of varying weathering states according to the BI model. The three sites were KN114A (BI of 76%), SM006B (BI of 60%), and PWS3A4 on Eleanor Island (BI of 30%). Enough sacrificial microcosms were set up to accommodate seven treatments (natural attenuation (NA) controls and biostimulation treatments for each of the three oiled sites and a "positive" control). The positive controls consisted of a set of microcosms from a clean portion of the PWS3A4 site to which was added crude oil known to be biodegradable (ANS521) at a concentration of 5 g/kg dry wgt. These microcosms, which were supplied with excess nutrients just like the biostimulation treatments, were sacrificed at the same times as the other treatments above. Results indicated that the lingering oil is still very much biodegradable. Nutrient addition significantly stimulated biodegradation ($p < 0.01$) compared to natural attenuation in all treatments regardless of the degree of weathering. Non-linear regression analyses were conducted to calculate the biodegradation coefficients. The most biodegradable oil was the one most weathered. The surprising finding was the fact that substantial biodegradation occurred in the natural attenuation microcosms. It was found that a high Total Kjeldahl Nitrogen (TKN) content was present that supplied needed nitrogen to the microorganisms. But the primary conclusion was that the reason for most of the observed biodegradation in all microcosms was the presence of excess dissolved oxygen, which was not present in the field. Nitrogen was a limiting factor, but oxygen was the primary one. Results will be presented as a progress review at a meeting of the Exxon Valdez Trustee Council on November 12, 2009, and again to NOAA scientists on November 13, 2009.