Abstract

This report details the initial research in determining the plausibility of using underwater explosive lensing as a means of sealing a leaking oil pipe, to mitigate the environmental damage of an event similar to the Deepwater Horizon incident. The Deepwater Horizon incident spilled 4.9 million barrels of oil into the Gulf of Mexico over the course of 152 days (Achenbach & Fahrenthold, 2010). A cement plug injected into a nearby relief well successfully capped the leaking well on September-19-2010. It is evident that rapid response systems for incidences such as this are a necessity. This report examines how an explosively generated pipe collapse compares to the critical collapse equations developed by the American Petroleum Institute (API). In this research, we calculated the API critical collapse pressure for three pipes – a 2”, a 4”, and a 6” pipe, each with yield strength of 42,000 psi. To produce the empirical equations, API tests incrementally increased the (external) hydrostatic pressure on pipes until they failed (Kyriadkides and Corona, 2007). Therefore, we expect that the peak (impulsive, not quasistatic) pressure generated from an explosive will need to be substantially higher in order to produce results similar to those from the API tests. We will use the results of the tests to correlate the API critical collapse pressure to an explosively generated pressure. Later, we will use this correlation to determine an explosive lens configuration capable of completely (implosively) sealing the pipe, while reducing the total amount of explosives required to do so.

References:
