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EDITORIAL

Environmental Health Insights into the 2010 Deepwater Horizon (BP) Oil Blowout

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The Deepwater Horizon semi-submersible Mobile Offshore Drilling Unit (MODU), leased to BP (previously British Petroleum, now simply "BP", with the previously-used promotional tagline of "beyond petroleum") suffered an explosive "blowout" on April 20, 2010 which resulted in what is now the largest offshore oil spill in United States (U.S.) history, and currently estimated to be at least the second or perhaps third largest oil spill in global history. At the time of writing of this editorial (July 30, 2010), official estimates by the U.S. Department of the Interior (U.S. Geological Survey) indicated that 12,000–19,000 barrels (500–800,000 gallons at 42 U.S. gallons per barrel or 2–3 million liters) of oil were leaking per day for 87 days, for a current total estimate of 44–70 million gallons (167–265 million liters) spilled prior to placement of the current "secure" cap on July 15 (http://www.doi.gov/news/pressreleases/Flow-Rate-Group-Provides-Preliminary-Best-Estimate-Of-Oil-Flowing-from-BP-Oil-Well.cfm). However, some "unofficial" estimates are much larger, up do 100,000 barrels (4 million gallons or 15 million liters) leaking per day for a total release to date of up to 348 million gallons (1.32 billion liters) prior to July 15. While a significant amount of the oil was captured and recovered (up to 25,000 barrels per day at one point), this is higher than the lower initial estimates of the total daily spill amount, and may have represented less than 25% of the total daily spill amount. Efforts to drill relief wells continue, but unknown amounts of oil continue to leak from the cap and the surrounding seabed due to the tremendous pressures involved (estimated at 11–12,000 pounds per square inch or psi at the wellhead).

To place this in perspective, the amount of oil released was roughly equivalent to the total amount of the 1989 Exxon-Valdez oil spill occurring every 3–64 days (based upon the largest to smallest Deepwater Horizon spill estimates, respectively). The largest known environmental oil release in global history, the intentional opening of valves on several oil tankers at the Sea Island oil terminal by Iraqi forces to slow the invasion of U.S. troops in 1991, released an estimated 520 million gallons (1.97 billion liters) into the Persian Gulf. The second largest release was another Gulf of Mexico (Camphece) exploratory well blowout in 1979, which released

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an estimated 100 million gallons (379 million liters) over a one-year period (http://www.envirowonk.com/content/view/68/1/). This means that the Deepwater Horizon spill rivals the second-largest known environmental oil release in global history, and may perhaps be even larger than current estimates indicate.

A 2003 publication, *Oil in the Sea III: Inputs, Fates and Effects* (http://www.nap.edu/catalog.php?record_id=10388) estimated that the global marine oil seepage from natural sources ranges from 60–600 million gallons (227 million to 2.27 billion liters) per year, with best estimates at 180 million gallons (681 million liters) annually. Natural oil seepage typically far exceeds anthropogenic oil spills, but that is not the case during events such as the Deepwater Horizon spill. In fact, some have suggested that using the term "spill" to describe this event is a misnomer, since it is a continuing discharge of huge amounts of oil similar to (although perhaps far exceeding in volume) the year-long 1979 Camphece blowout event.

It is interesting to compare the public perception of natural environmental disasters such as hurricanes in this region (most recently Katrina and Rita in 2005) to anthropogenic disasters such as the Deepwater blowout. The distinction is becoming less clear, partially due to humans placing themselves "in harm's way" through increased population density in susceptible geographic regions (e.g., coastlines). There also appears to be a shift towards public perception that private insurance or governmental agencies should be responsible for mitigating damages rather than relying on individual, family or community resources, as has been the more traditional practice in the past. One challenge is that while ecological systems have developed an adaptive ability to deal with cyclic natural occurrences, there has been limited opportunity for the environment to adapt to infrequent events such as catastrophic oil spills.

The environmental health implications of the Deepwater blowout are obviously far-reaching, with the clearest and most immediate for many being the affects on wildlife such as birds and aquatic mammals. The "Deepwater Horizon Response: The Official Site of the Deepwater Horizon Unified Command" website currently focuses on efforts to rescue and rehabilitate sea turtles and pelicans as well as including links to Environmental, Community, Assistance, Vessels of Opportunity, Wildlife Distress, Specialty Volunteer Training, Claims and Medical Support Hotlines (http://www.deepwaterhorizonresponse.com/go/site/2931/). Efforts to remediate damage to wildlife are ongoing, but admittedly address only a small fraction of the total volume of oil already released. Less obvious are the underwater effects, with attempts being made to track underwater plumes of oil in the region. The ultimate affects on aquatic organisms and aquatic-dependent organisms such as sea birds and aquatic mammals are currently unknown and difficult to predict.

Unprecedented amounts of the oil dispersant Corexit EC9500 and EC9527A (more than 840,000 gallons or 2.6 million liters as of July 30, 2010) have been used to break up the oil into small droplets, which, theoretically, should enhance natural biochemical and physical/chemical remediation. However, the toxicity of the dispersants has been questioned, with the dispersants used rated as 10–20 times more toxic than other options approved by the U.S. Environmental Protection Agency (USEPA). On May 26, the USEPA and U.S. Coast Guard (USCG) ordered BP to reduced dispersant use volume by 75% (to a total of 15,000 gallons per day) and eliminate surface water use of dispersant entirely unless authorized by the USCG (http://www.epa.gov/bpspill/dispersants.html).

Components of both oil and dispersants are volatile to varying degrees (evaporating at typical ambient "normal" environmental temperatures), which means that they are carried into the atmosphere in vapor form, which may be inhaled by humans and other organisms. There have also been reports of "raining oil" in Florida and Louisiana, perhaps due to a mixture of oil and dispersants being entrained into the atmosphere in aerosol form and carried to the earth by precipitation.

The American Public Health Association (APHA) Environment Section webpage (http://www.apha.org/programs/environment/) includes links to the Centers for Disease Control and Prevention (CDC) Emergency Preparedness and Response site (including "What to Expect from the Oil Spill and How to Protect your Health" and "Information for Coastal Residents" webpages. The latter focuses on food, air quality and water quality concerns for coastal residents. The APHA site also links to CDC Heath Surveillance information among the five Gulf Coast States of Texas, Louisiana, Mississippi, Alabama and Florida well as to the National Institute of Environmental Health Sciences (NIEHS) "Safety and Training of Oil Spill Response Workers" site. Oil spill response workers have reported health issues related to clean-up efforts and response efforts were delayed during hurricane Alex (June 29, 2010). Two independent U.S. Congressional Hearings were held during June 2010 on the Health Effects of the Oil Spill, including a U.S. Senate Committee on Health Education Labor and Pensions on June 15 and a U.S. House of Representatives Committee on Energy and Commerce Hearing on June 16. Both Hearings included testimony of witnesses from the Department of Health and Human Services (HHS), the National Institute for Occupational Safety and Health (NIOSH), the NIEHS, and the Food and Drug Administration (FDA).

It is also unclear what impact the solid waste generated from the blowout and from clean-up operations will have on environmental and public health. Currently, it appears that oil-contaminated solid waste is being diverted to municipal waste landfills. Since the waste may contain components or exhibit characteristics of hazardous waste, it would appear that disposal in a hazardous waste (secure) landfill or perhaps environmentally-responsible incineration in conjunction with energy recovery would be a more appropriate option.

The Deepwater Horizon blowout is one of the largest global oil spills in history, with far-reaching environmental and economic consequences. The environmental health effects of the Deepwater Horizon blowout event are likely to be felt for decades, similarly to the Exxon-Valdez spill. Perhaps the societal impact of the constant media attention on this event, including the unique "live-feed" of video images from the wellhead blowout will help the global community, and the United States specifically, to re-evaluate the environmental health hazards and risks associated with our current oil dependence.