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Anthropogenic Degradation of the Environment

# The Deepwater Horizon Oil Spill

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The Deepwater Horizon oil spill (also known as the BP oil spill) is an industrial disaster that began on April 20, 2010, in the Gulf of Mexico on the BP-operated Macondo Prospect. Offshore-oil-drilling company Transocean was the owner and the operator of the Deepwater Horizon rig, and leased by Oil Company BP, which was set in the Macondo oil prospect in the Mississippi Canyon, a valley in the continental shelf. On the night of April 20 a surge of natural gas blasted through a concrete core recently installed by contractor Halliburton in order to seal the well for later use. When it was released by the fracture of the core, the natural gas traveled up the Deepwater rig's riser to the platform, where it exploded and killed 11 workers and injured 17. The rig capsized and sank on the morning of April 22, rupturing the riser, through which drilling mud had been injected in order to counteract the upward pressure of oil and natural gas (1). Without any opposing force, oil began to discharge into the gulf. It is, therefore, considered the largest marine oil spill in the history of the petroleum industry. The volume of oil escaping the damaged well was estimated by U.S. government officials to be at more than 60,000 barrels per day, totally 4.9 million barrels of oil spilled into the Gulf. After several failed efforts to contain the flow, the well was declared sealed on 19 September 2010.

Vast areas of the Gulf of Mexico were contaminated with oil, including deep-ocean communities and over 1,600 kilometers of shoreline. Multiple species of pelagic, tidal, and estuarine organisms; sea turtles; marine mammals; and birds were affected, and over 20 million hectares of the Gulf of Mexico were closed to fishing. Several field efforts were executed, such as valuations of shoreline and wildlife oiling and of coastal waters and sediments (2). There was an assumption that a spike in cetacean strandings and deaths beginning in February 2010 was further exacerbated by the spill. Usual reasons of these widespread fatalities, such as morbillivirus and toxins from red tides, were excluded, and there was an uncommon incidence of Brucella infection in stranded dolphins and researchers believed that  contaminants from the spill had made cetaceans more vulnerable to other environmental dangers. On 12 April 2016, a research team reported that 88 percent of about 360 baby or stillborn dolphins within the spill area "had abnormal or under-developed lungs", compared to 15 percent in other areas (3). Birds were particularly vulnerable to the oil's effects, and many perished—from ingesting oil as they tried to clean themselves or because the substance interfered with their ability to regulate their body temperatures. The impacts on smaller species were more difficult to determine. Numerous species of fish and invertebrates spawned in the gulf, and it was thought likely that some would surrender to the toxic effects of the oil. The larvae of commercially important fish species, including tuna, likely developed heart defects after exposure to polycyclic aromatic hydrocarbons (PAHs) from the oil (4). Damage to the ocean floor especially endangered the Louisiana pancake batfish whose range is entirely contained within the spill-affected area (5). By June 2010, 143 spill-exposure cases had been reported to the Louisiana Department of Health and Hospitals; 108 of those involved workers in the clean-up efforts, while 35 were reported by residents. Chemicals from the oil and dispersant are believed to be the cause (6).

Containment, dispersal and removal were the three fundamental strategies to address the marine oil spill. It was estimated that 4.9 million barrels (780,000 m3) of oil was released from the well and 4.1 million barrels (650,000 m3) of oil went into the Gulf (7). 75% of oil has been cleaned up by Man or Mother Nature; however, only about 25% of released oil was collected or removed while about 75% of oil remained in the environment in one form or another. The spill was also noteworthy for the volume of Corexit oil dispersant used and for application methods that were "purely experimental". Corexit use during the BP oil spill had amplified the toxicity of the oil by 52 times (8). Additionally, Containment Booms were criticized for washing up on the shore with the oil, allowing oil to escape above or below the boom, and for ineffectiveness in more than three to four-foot (90–120 cm) waves. The three basic methods to remove the oil from the water were: combustion, offshore filtration, and collection for later processing. Oil was collected from water by using skimmers. In total 2,063 various skimmers were used. For offshore, more than 60 open-water skimmers were deployed, including 12 purpose-built vehicles (9). On beaches the main procedures were sifting sand, removing tar balls, and digging out tar mats manually or by using mechanical devices. Moreover, oil –eating microbes were used (10). Microbial communities present in the Gulf of Mexico rapidly responded to the Deepwater Horizon oil spill. Genetically modified Alcanivorax borkumensis was added to the waters to speed digestion (11). Dispersants are alleged to enable the digestion of the oil by microbes. Mixing dispersants with oil at the wellhead would keep some oil below the surface and in theory, allowing microbes to digest the oil before it reached the surface. Several threats were identified and evaluated, in particular that an increase in microbial activity might reduce subsea oxygen levels, threatening fish and other animals (12).

The basic issue in this incident was that every global company operates in the context of a mix of national, state, and local regulations. In the case of deep-water drilling in the Gulf of Mexico, US requirements were not strict enough to prevent this environmental disaster. Since the 2010 Deep Water Horizon disaster in the Gulf of Mexico, the U.S. regulators have tightened and enhanced regulatory oversight in the offshore and particularly the Arctic. The regulations establish design and operational requirements for critical well control equipment used in offshore oil and gas drilling operations, revising existing rules while incorporating latest industry standards. When endorsed, there will be new minimum standard requirements for the design, manufacture, repair, and maintenance of blowout preventers (13). Although more could be done, these actions have made offshore oil and gas activities a safer proposition.

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