

# A Year After the Spill

## The Consequences of COREXIT



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On April 20, 2010, BP's Deepwater Horizon drilling rig exploded. Seventeen crewmembers were injured and 11 died.<sup>1</sup> Two days later, on Earth Day, the rig sank into the Gulf of Mexico.<sup>2</sup> These events were the beginning of a catastrophic environmental, economic and social disaster. On April 22nd, the agency tasked with responding to the spill determined that there was a leak at the wellhead and that cleanup crews would use chemical dispersants to combat the oil spill.<sup>3</sup> Referring to the decision to use dispersants, the Coast Guard's 8<sup>th</sup> District commander, Rear Admiral Mary Landry stated, "Our goal is to fight this oil spill as far away from the coastline as possible."<sup>4</sup> Was this successful, or did use of dispersants do more harm than good?

To mitigate the disastrous Deepwater Horizon oil spill off the coast of Louisiana, both BP and the U.S. government used two types of COREXIT, a dispersant that was originally developed by Exxon and is now manufactured by Nalco Holding Company.<sup>8</sup> A total of 1.84 million gallons of dispersants were added to the Gulf of Mexico over several months.<sup>9</sup> A combined volume of 1.06 million gallons of COREXIT 9500A and 9527 were sprayed on the surface using planes and boats.<sup>10</sup> A new technique to apply dispersant was also used, adding 0.78 million gallons of COREXIT 9500A directly at the leak in the wellhead, approximately 5,000 feet below the surface of the water.<sup>11</sup>

### What is the cost of spilled oil?

Under the Clean Water Act, the owner and operator of an oil platform faces fines of up to \$1,100 for each barrel of oil spilled.<sup>5</sup> If authorities determined that BP committed gross negligence or willful misconduct, the fine for the Deepwater Horizon spill could be up to \$4,300 per barrel.<sup>6</sup> Based on the government's estimate that 206 million gallons of oil leaked from the Deepwater Horizon blowout, BP could face civil fines alone between \$5.4 billion to \$21.1 billion.<sup>7</sup>

Both the novel application technique and the unprecedented volume of dispersant used make the BP Deepwater Horizon response unique.<sup>12</sup> Many experts remain concerned about the increased use of toxins in the ocean which may lead to longer-term ecological problems and may have unpredictable impacts from use of the chemical underwater.

Dispersants do not eliminate oil from the environment; they break down the oil into smaller, less visible particles and often sink it to the bottom, out of sight. The dispersant and the smaller oil particles remain as toxins in the water.<sup>13</sup> Although dispersants do transfer oil away from the sur-

face of the water, they increase exposure deeper below the ocean's surface and on the seafloor, increasing exposure for fish, eggs, larvae, shrimp, corals and oysters.<sup>14</sup> Dispersants may prevent unsightly masses of oil from washing up on our beaches, but the oil becomes a more persistent presence in the environment, with increased likelihood of long-term ecological effects. The use of dispersants is a trade-off between two bad options: more oil on the shore or more oil in the ocean.<sup>15</sup> It is hard to decide which is worse without sufficient information on possible outcomes. Scientific literature still disputes the usefulness of dispersants on reducing wildlife impacts.<sup>16</sup> A year after the decision to apply large volumes of dispersants to the gulf, including application through the untested underwater technique, scientists are publishing their findings from various studies.

### Profiting from the use of COREXIT in the gulf?

Nalco Holding Company's board of directors includes a former BP executive and board member.<sup>17</sup> This connection between BP and Nalco raises the question as to why COREXIT was exclusively used for the Deepwater Horizon spill, rather than other dispersants that are associated with less ecological damage and that could have performed better on the type of oil spilled into the gulf. Nalco Holding Company has shown tremendous revenue gains since it was announced that cleanup crews in the gulf would use its products. The company reported second-quarter profits of 41 cents per share after the spill, a 215 percent adjusted earnings per share.<sup>18</sup> Second-quarter revenue jumped 19 percent, equaling \$1.09 billion, in part due to \$70 million in dispersant sales to the government and BP.<sup>19</sup>

### How are dispersants regulated?

The Oil Pollution Act of 1990 amended Section 311 of the Clean Water Act to include plans for a National Oil and Hazardous Substances Pollution Contingency Plan (NCP) and delegated authority to the president to manage this plan. The NCP, prepared by the U.S. Environmental Protection Agency (EPA), includes a schedule of dispersants and other chemicals that can be used to mitigate oil spills, lists the appropriate quantities for use, and identifies the waters in which they may be used.<sup>20</sup> To be added to the NCP product schedule, a manufacturer is simply required to determine the product's category and supply data, including recommended use, effectiveness and toxicity. It is the company's responsibility to determine this information, and it is not tested or verified according to any specific government criteria.<sup>21</sup>

### Toxic concerns

A standard method for measuring toxicity is to determine the lethal concentration that kills 50 percent of the sample organisms (in shorthand called "LC50") during a set period of time. The LC50 values for the NCP are based on 48- and 96-hour timeframes. Higher LC50 values indicate lower toxicity. Another method for evaluating toxicity is to measure the effective concentration that causes a specific effect on 50 percent of the sample organisms (known as "EC50") in a set timeframe. The specific effects could include reduced reproduction, decreased movement or reduced ability to obtain food. LC50 is the method used to compare the toxicity levels of different dispersants on the NCP, meaning that death is the only concern of these toxicity tests, and not possible long-term effects. Manufacturers of dispersants submit LC50 toxicity tests for both the dispersant and the oil plus the dispersant to the EPA for their product to be added to the NCP.

Toxicologists question the reliability of this testing method due to the many variables involved, and experts are concerned about whether it can be effectively used to accurately compare impacts from different dispersants.<sup>22</sup> "There isn't any information on what is the environmentally relevant level of dispersant," says toxicologist Carys Mitchelmore at the University of Maryland's Chesapeake Biological Laboratory.<sup>23</sup> Both forms of COREXIT used in the gulf are capable of killing or depressing the growth of a wide range of creatures, from phytoplankton to fish.<sup>24</sup>



President Barack Obama and Lafourche Parish President Charlotte Randolph inspect a tar ball on a Louisiana beach on May 28, 2010 resulting from the BP Horizon oil spill. Photo by Chuck Kennedy.

“EPA was presenting only part of the risk equation.” – Peter Hodson, aquatic toxicologist<sup>25</sup>

One toxic component in crude oil, polycyclic aromatic hydrocarbons (PAHs), gets a great deal of attention in toxicity testing due to its health impacts. PAHs do not make up the bulk of crude oil, but they can remain in the environment longer than other hydrocarbon components of oil.<sup>26</sup> Nalco’s toxicologist, Sergio Alex Villalobos, while speaking of dispersants, stated, “Once it’s mixed with oil, that’s where you get the most impact, that’s where you see most of the toxicity.”<sup>27</sup> This elevated toxicity is due to an increase in accessibility of PAHs in dispersed clouds or plumes of oil. The dispersed cloud of microscopic oil droplets allows the PAHs to contaminate a volume of water 100 to 1,000 times greater than if the oil were confined to a floating surface slick.<sup>28</sup> Large numbers of fish could have been exposed to dispersed oil.<sup>29</sup> Exposure lasting as little as one hour could affect embryonic fish.<sup>30</sup>

## One big experiment

Beginning in late May, plumes of tiny underwater oil droplets were discovered by various university researchers. At that time, BP executives denied that the plumes of oil existed.<sup>31</sup> On June 8, university researchers and the National Oceanic and Atmospheric Administration (NOAA) confirmed that the plumes not only existed, but that at least one of the plumes originated from the Horizon.<sup>32</sup> The dispersant applied to the spill at and below the surface kept oil particles in the deep ocean.<sup>33</sup> One plume found by the University of Georgia was 10 miles long, three miles wide and 300 feet thick at some points.<sup>34</sup> Researchers from the University of South Florida (USF) found a plume 45 nautical miles to the northeast of the well, as wide as 100 feet in some places and at depths of 3,300 to 4,300 feet below the surface of the gulf.<sup>35</sup> David Hollander, a chemical oceanographer at USF, stated, “What we have learned completely changes the idea of what an oil spill is.”<sup>36</sup> Droplets of dispersed oil are more easily absorbed and consumed by marine animals.<sup>37</sup> The plumes are large enough and dissipating so slowly that many animals might be bathed in dispersed oil for an extended time.<sup>38</sup>

Dr. Samantha Joye of the Department of Marine Sciences at the University of Georgia conducted research on the seafloor in the Gulf of Mexico before the Deepwater Horizon Oil spill. Since the spill, her research team has taken samples from the seafloor. In the summer, they recorded thick oil residue on the seafloor. Upon returning in December, the team expected the residue to have been gone, but a large amount remained.<sup>39</sup> A number of factors affect the biodegradation rates of oil, such as water temperature, oxygen content and



Carl Pellegrin (left) of the Louisiana Department of Wildlife and Fisheries and Tim Kimmel of the U.S. Fish and Wildlife Service prepare to net an oiled pelican in Louisiana, one of the many animals affected by the Deepwater Horizon oil spill. Photo by John Miller (U.S. Coast Guard).

the presence of microorganisms.<sup>40</sup> Dr. Joye attributes this unexpected phenomenon to an unknown impediment in the natural system of oil degradation.<sup>41</sup> The impacts from the dispersant application at the subsurface could be to blame.

Speaking about the subsurface application of dispersant, Mani Ramesh, chief technology officer for Nalco, stated, “We do not have any knowledge that would allow us to predict what would happen.”<sup>42</sup>

Dispersants are a mixture of hydrocarbon-based solvents and surfactants.<sup>43</sup> A study to determine the fate of dispersants used in the Deepwater Horizon spill traced dioctyl sodium sulfosuccinate (DOSS), an ingredient in both forms of COREXIT, through the seawater of the gulf.<sup>44</sup> The dispersant applied below the surface appears to have been trapped in the deep layers of the ocean, supporting previous work by other researchers.<sup>45</sup> Dispersant traveled across the water due to the currents and different densities of saltwater layers, with the majority of the higher concentrations of dispersant occurring in the depths between approximately 3,280 and 3,900 feet.<sup>46</sup> The DOSS was not degraded, and was less concentrated mainly from dilution in the Gulf of Mexico.<sup>47</sup> The study concluded that it could not “assess whether the dispersant application was successful in reducing the oil droplet size or in increasing the sequestration of oil in deep water.”<sup>48</sup> The Operational Science Advisory Team (OSAT) at the Unified Area Command released data showing that another component of the dispersant was lingering in the Gulf as well.<sup>49</sup> The continued existence of components from dispersants is unexpected; COREXIT was thought to decompose almost entirely in 28 days.<sup>50</sup> This persistence in the environment raises concerns regarding possible long-term impacts and lengthens exposure times for people and wildlife.

“Basic physiology suggests that dispersed oil will negatively impact the reproductive capabilities of a wide variety of animals.” – Richard Condrey, an associate professor at LSU’s Department of Oceanography and Coastal Sciences who specializes in coastal ecology and fishery management.<sup>51</sup>

Many creatures live in the Gulf of Mexico or migrate through its waters. Deep ocean species have unique daily migration patterns: They move down into the depths during the day, seeking cover in the darkness, and in the evening, they move back up the water column in search of food. While this occurs on a daily basis, currents also move animals and plankton over great distances across the gulf. Such daily migrations increase the likelihood of exposure to contaminants in the water, like oil and dispersant plumes.<sup>52</sup> The oil and dispersant that remain in the environment may have a greater impact on early life stages (eggs or larvae) of fish, which could include many types of commercially caught species.<sup>53</sup> Bluefin tuna would have been breeding in the Gulf of Mexico during the same time the oil and dispersants were added to the gulf, and there is great concern about the future impacts this will have on the already depleted bluefin population.



Fishing boats on the bayou in Delacroix, Louisiana. Photo by Infrogmation of New Orleans.

## Wildlife deaths

In the beginning of March 2011, NOAA declared an “unusual mortality event”: more than 80 dead dolphins found on the shores of gulf states between mid-January and early March 2011.<sup>54</sup> As of April 7, 2011, 153 dead dolphins have washed ashore along the Gulf Coast since the beginning of the year.<sup>55</sup> Sixty-five were stillborn, premature or newborn.<sup>56</sup> Scientists are working to discover the cause of the large number of mortalities and are examining oil, dispersant and cold temperatures as possible factors.<sup>57</sup> It is possible that many marine mammal deaths are still uncounted. A 2011 study suggests that, “the true death toll could be fifty times the number of carcasses recovered.”<sup>58</sup> Taking these potential unknown deaths into account, 7,650 dolphins may have died in the gulf since the beginning of the year. From April 30, 2010 to February 15, 2011 there were also 609 sea turtle deaths reported, with another 46 deaths reported between March 15 and March 30, 2011 along the shores of Mississippi, Alabama and Louisiana.<sup>59</sup> It is likely that many more sea turtles have died, and these fatalities are going unrecorded for various reasons, similar to the dolphin count. All five species of the sea turtles in the Gulf of Mexico were, prior to the spill, already listed under the Endangered Species Act as threatened or endangered.<sup>60</sup> On December 14, 2010 the U.S. Fish and Wildlife Service’s count of dead birds in the area totaled 6,045.<sup>61</sup> A representative of the agency said: “We expect that the number of oiled birds collected may represent only a portion of the total birds affected by the spill.”<sup>62</sup>

## Human health impacts

Researchers remain concerned about the impact on human health from both the dispersant and the oil added to the gulf during the Deepwater Horizon spill. Historically, people have reported assorted detrimental effects from contact with dispersants in oil spill cleanup efforts. COREXIT was one of several dispersants used during the 1989 Exxon Valdez spill in Alaska.<sup>63</sup> Nearly 7,000 cleanup workers from the Valdez spill reported feeling ill with respiratory distress at the time.<sup>64</sup> The reported average age of death for people that worked with dispersants in Alaska is around 50 years old.<sup>65</sup> Despite these red flags pointing to possible human health impacts, dispersants were chosen as a tool to fight the oil spill in the gulf. Unfortunately, officials missed a crucial window for gathering baseline physical health information by not surveying individuals in the area before workers and the general public were exposed to oil and dispersant.<sup>66</sup> All the health studies that try to track the impacts of the Deepwater Horizon spill will suffer from this missing data, but many groups are working to draw the best information possible from this large-scale gulf experiment.

During the BP Deepwater Horizon spill there have been many reported cases of people falling ill. Four men were hospitalized after their boat was accidentally doused with dispersant, just days after nine other cleanup workers reportedly became violently ill near the spill in May.<sup>67</sup> Described symptoms included headaches, nausea and severe respiratory problems.<sup>68</sup> In early August, 361 people in Louisiana claimed spill-related health problems, including headaches and dizziness.<sup>69</sup> Of that number, 275 were oil workers or cleanup workers helping to mitigate the spill.<sup>70</sup> The remaining 84 were members of the general public reporting health concerns related to oil spill exposure.<sup>71</sup>

Louisiana Environmental Action Network (LEAN) tested blood from five people that came in contact with oil and dispersants and had physical ailments.<sup>72</sup> All five individuals had chemicals present in their blood that corresponded to the chemicals found in oil, dispersant or both,<sup>73</sup> some in excess of the National Health and Nutrition Examination Survey 95<sup>th</sup> percentile.<sup>74</sup>

Tulane University's Disaster Resilience Leadership Academy and the Louisiana Bucket Brigade surveyed 954 Louisiana residents to determine the impacts the oil spill had on human health and the economy in coastal communities.<sup>75</sup> The survey, conducted mainly door-to-door, took place in four parishes, 11 days after the well was capped.<sup>76</sup> Forty-eight percent of all respondents reported having an unusual increase in coughing, headaches and skin and eye irritation. The sudden onset of these symptoms, which quickly subsided, is consistent with chemical exposure.<sup>77</sup> Surveyors may have been unable to reach many people who were involved in the oil spill cleanup, due to the door-to-door nature of the survey, which was conducted during working hours. Therefore, the people most likely to have come in contact with oil and dispersant may not be included in the survey results.

“There is surprisingly little information in an organized way about what happens after an oil spill.” – Dale Sandler, Ph.D. chief of the Epidemiology Branch at NIEHS and lead researcher on the NIH health study<sup>78</sup>

Due to the “lack of accepted science in the field” the National Institute of Health (NIH) began a large-scale study to track the health impacts of residents directly exposed to oil and dispersants in Louisiana, Mississippi, Alabama and Florida.<sup>79</sup> The study calls for a total of 55,000 interviews.<sup>80</sup> The initial 20,000 to 25,000 interviews and follow-ups will take place over a 10-year period.<sup>81</sup> Cleanup workers that were trained, but did not take part in cleanup efforts, will serve as a baseline in the study, measured against those that did participate in cleanup activities.<sup>82</sup> Researchers will be tracking health impacts such as neurologic, carcinogenic, respiratory and immunological concerns in an attempt to draw conclusive information about effects from oil and dispersant on the people of the gulf region.<sup>83</sup> NIH has committed \$17.8 million to the study with \$6 million coming from BP (\$4 million less than the \$10 million BP originally planned to contribute to the study).<sup>84</sup>

## Possible economic impacts

The Gulf of Mexico is known as a tourist destination and for its seafood, as well as for oil production. The environmental impacts caused by the oil and dispersants released into the gulf during the Horizon disaster will likely cause negative effects on fishing and tourism long into the future. Tulane University's Disaster Resilience Leadership Academy and the Louisiana Bucket Brigade survey found that 44 percent of those asked felt that the livelihood of the primary provider in their home had been harmed by the Deepwater Horizon oil spill.<sup>85</sup>

In the five gulf states, tourism and commercial fisheries generate more than \$40 billion annually.<sup>86</sup> Three months after the oil spill began, Alabama's tourism was down 50 percent.<sup>87</sup> Wary vacationers canceled trips, avoiding the possible contamination from both the dispersants and the oil that were reported in various locations around the gulf.<sup>88</sup>

In 2008, commercial fishermen in the gulf caught 1.27 billion pounds of fish and shellfish worth \$659 million.<sup>89</sup> Louisiana was the number-one provider of shrimp, oysters and crabs in the United States.<sup>90</sup> The seafood industry in Louisiana was worth \$2.4 billion and employed more than 27,000 people.<sup>91</sup> The state supplied up to 40 percent of U.S. seafood.<sup>92</sup> Even though NOAA reopened 90 percent of the federal waters in the gulf to fishing, it is unlikely the region's seafood can regain this level of popularity anytime soon. Consumers have ongoing concerns about contaminated seafood. Unknown impacts on fish populations that may have come in contact with oil and/or dispersants may prevent the economic recovery of the fishing industry.<sup>93</sup> Animals that may not have come in direct contact with contaminants themselves could still be affected through the contamination of the food chain and the loss of other key organisms.

## Royal red shrimp

On November 24, 2010, NOAA closed 4,213 square miles of the gulf to royal red shrimp fishing, just nine days after the agency had cleared the area for fishing.<sup>110</sup> The closure was due to tar balls found in shrimp-ing nets.<sup>111</sup> Royal reds are the only shrimp caught in the Gulf of Mexico in waters deeper than 600 feet.<sup>112</sup> NOAA analyzed samples of royal red and penaeid shrimp from the area to determine the contamination level of the seafood caught there.<sup>113</sup> It is unclear if these tests separated royal reds from the other, shallower species that would not have been as likely to come in contact with the tar balls. This example helps to outline how difficult it can be to test for seafood safety: If the testing was not species-specific, the shallower shrimp might have been masking the royal reds' true level of contamination when the area was opened.

## Testing for dispersant (and oil)

Ten days after the disastrous oil spill began, government agencies closed 87,481 square miles of state and federal waters in the gulf to fishing.<sup>94</sup> Now, approaching the one-year anniversary of the spill, all but the 1,041 square miles directly around the spill site are open.<sup>95</sup> The original agreed-upon method to reopen waters to fishing consisted of a "sensory test" where a minimum of 10 experts sniffed raw and cooked seafood samples.<sup>96</sup> If at least 70 percent of the experts found the samples to be without contamination from chemicals, then the sample passed.<sup>97</sup>

On October 29, NOAA and the U.S. Food and Drug Administration (FDA) finally unveiled the test that was invented to detect the presence of chemical dispersants used during the spill.<sup>98</sup> The levels of concern set by the agencies are 100 parts per million (ppm) for finfish and 500 ppm for crabs and shrimp.<sup>99</sup>

Some experts worry that the government testing has not been rigorous enough<sup>100</sup> and believe the tests are too limited and may overlook some chemicals with possible health implications.<sup>101</sup> Oil and dispersants have been found lingering in the environment longer than previously expected. From this information, Dr. Susan Shaw, a marine toxicologist on the Department of Interior's Strategic Sciences Working Group, believes we can "reasonably predict that there are going to be more and more findings in the food chain."<sup>102</sup>

Along with concerns about seafood testing, many question the formula used to set allowable contaminant levels for consumers.<sup>103</sup> The FDA placed gulf residents in the top 10 percent of seafood consumers nationally, since there was "no scientifically acceptable survey."<sup>104</sup> A recent survey showed that gulf residents ate 12 times more seafood than the government had assumed, and had especially high rates of shrimp consumption.<sup>105</sup>

It is also problematic that FDA-based consumption levels assume an average body weight of 176 pounds.<sup>106</sup> This body weight is not an accurate factor to determine the amount of seafood that children can safely consume.<sup>107</sup> The Louisiana State Department of Health tested nearly 800 samples between April 30 and November 22 and 37 percent of these samples had trace amounts of various chemicals.<sup>108</sup> Depending on consumption levels and body weight, these trace amounts may not be safe for some consumers. It is no surprise that, despite government assurances, "some citizens continue to doubt the safety of Gulf seafood."<sup>109</sup>

## Conclusion

A year after the BP Deepwater Horizon spill began, we still do not understand the full impact of the oil and dispersants that were added to the Gulf of Mexico. Long-term studies are the only way to fill the gap of knowledge that exists after the government and BP chose to use dispersants as a tool to mitigate the spilled oil.

The decision to use dispersants, especially via untested and unconventional application methods, was done without the full understanding of the "trade-offs" that were being hastily made. Only time and research will tell how the environment, consumers, wildlife and the people of the Gulf Coast will pay for that decision.

## Misplaced priorities for the federal budget?

President Obama's 2012 budget for NOAA — the agency tasked with conserving and managing living marine resources — proposes spending a whopping \$54 million to implement a new controversial fisheries management program that can push smaller-scale historic fishermen out of business, result in lower wages for boat captains and crew, and even hurt the marine environment by encouraging more industrial-style fishing. NOAA's proposed budget also allocates \$4.3 million toward controversial ocean factory fish farming projects. Farming fin fish in the ocean is a widely unpopular experiment, as evidenced by the inability of several administrations to pass legislation allowing it in waters off the U.S. coast. Globally, the experience with ocean fish farming has been disastrous, with millions of fish escaping into the wild annually, as well as the pollution, chemicals and diseases from crowded factory fish farm conditions affecting ocean waters. In contrast, NOAA's proposed budget request for oil spill recovery efforts in the Gulf of Mexico is a mere \$2.9 million. Is it our goal to help our fishermen recover or destroy their livelihood forever?

## Endnotes

- 1 National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling "Deep Water The Gulf oil Disaster and the Future of Offshore Drilling. Report to the President." January 2011 at 191.
- 2 *Ibid.* at 18.
- 3 Restore the Gulf. "About Restore the Gulf." Available at <http://www.restorethegulf.gov/category/about> accessed March 2010.
- 4 National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling. at 143.
- 5 Ramon Antonio Vargas, "Oil is Leaking from Well at Deepwater Horizon Explosion Site," *Times-Picayune*, April 24, 2010.
- 6 Cappiello, Dina. "New BP debate over size of spill could affect fine." *Associated Press*. December 3, 2010.
- 7 *Ibid.*
- 8 *Ibid.*
- 9 Taylor, John. "Gulf Oil Spill: BP Trying to Hide Millions of Gallons of Toxic Oil? BP Embraces Exxon's Toxic Dispersant, Ignores Safer Alternative." May 3, 2010. Operational Science Advisory Team (OSAT) Unified Area Command. "Summary Report for Sub-Sea and Sub-Surface Oil and Dispersant Detection: Sampling and Monitoring" Prepared for Paul F. Zukunft, RADM, U.S. Coast Guard Federal On-Scene Coordinator Deepwater Horizon MC252. December 17, 2010 at 6.
- 10 Operational Science Advisory Team (OSAT) Unified Area Command. "Summary Report for Sub-Sea and Sub-Surface Oil and Dispersant Detection: Sampling and Monitoring" Prepared for Paul F. Zukunft, RADM, U.S. Coast Guard Federal On-Scene Coordinator Deepwater Horizon MC252. December 17, 2010 at 6.
- 11 *Ibid.* at 6.
- 12 *Ibid.* at 6.
- 13 Biello, David "Is Using Dispersants on the BP Gulf Oil Spill Fighting Pollution with Pollution?" *Scientific American*. June 18, 2010.
- 14 National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling "Deep Water The Gulf oil Disaster and the Future of Offshore Drilling. Report to the President." January 2011 at 143.
- 15 Biello, David "Is Using Dispersants on the BP Gulf Oil Spill Fighting Pollution with Pollution?" *Scientific American*. June 18, 2010.
- 16 Judy Woodruff interview with Sylvia Earl. "Gulf Coast Oil Spill Adds 'Insult to Injuries' for Ocean's Health." *PBS*. May 5, 2010.
- 17 Committee on Understanding Oil Spill Dispersants. "Oil Spill Dispersants: Efficacy and Effects." National Research Council, 2005.
- 18 National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling "Deep Water The Gulf oil Disaster and the Future of Offshore Drilling. Report to the President." January 2011 at 143.
- 19 Fingas, Merv. "A Review of Literature Related to Oil Spill Dispersants 1997-2008." For Prince William Sound Regional Citizens' Advisory Council Anchorage, Alaska September 2008 at iii.
- 20 Nalco, Biography of Rodney F. Chase, Director. Available at: <http://phx.corporate-ir.net/phoenix.zhtml?c=182822&p=irol-govBio&ID=139045>
- 21 Nalco. [Press Release]. "News Release: Nalco Reports Second Quarter 2010 Financial Results." July 27, 2010. Calculations on file at Food & Water Watch.
- 22 Nalco. [Press Release]. "News Release: Nalco Reports Second Quarter 2010 Financial Results." July 27, 2010.
- 23 Oil and hazardous substance liability, Clean Water Act. 33 U.S.C § 1321 (2002).
- 24 Environmental Protection Agency. National Oil and Hazardous Substances Pollution Contingency Plan Product Schedule, Subpart J § 300. 915. (May 3, 2010).
- 25 Biello, David "Is Using Dispersants on the BP Gulf Oil Spill Fighting Pollution with Pollution?" *Scientific American*, June 18, 2010.
- 26 *Ibid.*
- 27 *Ibid.*
- 28 Lovett, Richard. "Oil spill's toxic trade-off." Quoting Peter Hodson, aquatic toxicologist at the meeting of the Society of Environmental Toxicology and Chemistry. *Scientific American*. November 10, 2010.
- 29 Lovett, Richard. "Oil spill's toxic trade-off." Quoting Ronald Atlas, microbiologist at the meeting of the Society of Environmental Toxicology and Chemistry. *Scientific American*. November 10, 2010.
- 30 Biello, David. "Doubts on Dispersants." *Scientific American*. August 1, 2010
- 31 Lovett, Richard. "Oil spill's toxic trade-off." Quoting Peter Hodson, aquatic toxicologist at the meeting of the Society of Environmental Toxicology and Chemistry. *Scientific American*. November 10, 2010.
- 32 *Ibid.*
- 33 *Ibid.*
- 34 Sara, Kennedy. "Researchers confirm subsea Gulf oil plumes are from BP well." *McClatchy Newspapers* (St. Petersburg, FL.) July 23, 2010.
- 35 Gillis, Justin. "Plumes of oil Below Surface Raise New Concerns." *The New York Times*. June 8, 2010.
- 36 Dearen, Jason and Sedensky, Matt. "Deep Sea Oil Plumes, Dispersants Endanger Reefs." *ABCNews* May 17, 2010.
- 37 Reilly, Michael. "Giant Underwater "Plumes" of Oil Discovered in Gulf." *Discovery News*. May 16, 2010.
- 38 "Researchers confirm subsea Gulf oil plumes are from BP well." Kennedy, Sara. *McClatchy Newspaper*. (St. Petersburg, FL.) July 23, 2010.
- 39 *Ibid.*
- 40 *Ibid.*
- 41 Gillis, Justin and Rudolf, J. C. "Oil Plume Is Not Breaking Down Fast, Study Says." *The New York Times*. August 9, 2010.
- 42 Borenstein, Seth, Associated Press Science Writer. "Scientist finds Gulf bottom still oily, dead." *USAToday*. February 20, 2011.
- 43 EPA. "Questions and Answers on Dispersants." Available at <http://www.epa.gov/bpspill/dispersants-qanda.html>, accessed on November 2010.
- 44 Borenstein, Seth, Associated Press Science Writer. "Scientist finds Gulf bottom still oily, dead." *USAToday*. February 20, 2011.
- 45 Biello, David "Is Using Dispersants on the BP Gulf Oil Spill Fighting Pollution with Pollution?" *Scientific American*, June 18, 2010.
- 46 Kujawinski, Elizabeth, et al. "Fate of Dispersants Associated with the Deepwater Horizon Oil Spill." *Environmental Science and Technology posted on the American Chemical Society*. January 6, 2011.
- 47 *Ibid.*
- 48 *Ibid.*
- 49 *Ibid.*
- 50 *Ibid.*
- 51 Biello, David "Is Using Dispersants on the BP Gulf Oil Spill Fighting Pollution with Pollution?" *Scientific American*. June 18, 2010.
- 52 McBride, Daniel. "BP's Spill Lesson Draws Criticism." *Daily Comet* (Lafourche Parish, Louisiana). November 14, 2010.
- 53 U.S. Department of the Interior "DOI Strategic Science Working Group Mississippi Canyon 252/ Deepwater Horizon Oil Spill Progress Report 9 June 2010." Released June 9, 2010.
- 54 Westerholm, David, Director, Office Response and Restoration National Ocean Service National Oceanic and Atmospheric Administration. U.S. Department of Commerce. Testimony on Oversight Hearing on the Use of Dispersant in The Deepwater Horizon Oil Spill. August 4, 2010.
- 55 Coleman, Leigh. "Scientists debate cause of dolphin deaths." *Reuters*. March 4, 2010.
- 56 McCarthy, Michael. "Oil spill link suspected as dead dolphins wash ashore." *The Independent* (United Kingdom). March 1, 2011.
- 57 Coleman, Leigh. "Scientists debate cause of dolphin deaths." *Reuters*. March 4, 2010.
- 58 McCarthy, Michael. "Oil spill link suspected as dead dolphins wash ashore." *The Independent* (United Kingdom). March 1, 2011.
- 59 "Oiled dead dolphins washing ashore, 8 months after spill." *Associated Press*. April 7, 2011.
- 60 "Oiled dead dolphins washing ashore, 8 months after spill." *Associated Press*. April 7, 2011.
- 61 Pittman, Craig. "Dead dolphins, turtles still washing ashore along gulf coast." *St Petersburg Times* (Tampa Bay, Florida). April 7, 2011.
- 62 Coleman, Leigh. "Scientists debate cause of dolphin deaths." *Reuters*. March 4, 2010.
- 63 McCarthy, Michael. "Oil spill link suspected as dead dolphins wash ashore." *The Independent* (United Kingdom). March 1, 2011.
- 64 Williams, Rob et al. "Underestimating the damage: interpreting cetacean carcass recoveries in the context of the Deepwater Horizon/BP incident." *Conservation Letters*. (0) 1-6. March 30, 2011.
- 65 NOAA Fisheries Office of Protected Resources "Sea Turtles and the Gulf of Mexico Oil Spill." Available at <http://www.nmfs.noaa.gov/pr/health/oilspill/turtles.htm>, accessed on April 13, 2011.
- 66 "Sea turtles deaths up along Gulf, joining dolphin trend." *MSNBC*. March 30, 2011.
- 67 "Sea turtles deaths up along Gulf, joining dolphin trend." *MSNBC*. March 30, 2011.
- 68 NOAA Fisheries Office of Protected Resources. "Marine Turtles." Available at <http://www.nmfs.noaa.gov/pr/species/turtles/> accessed on April 13, 2011.
- 69 National Park Service. "Sea Turtle Science and Recovery." Available at [http://www.nps.gov/archive/pais/website/sea\\_turtle\\_science\\_and\\_recovery.htm](http://www.nps.gov/archive/pais/website/sea_turtle_science_and_recovery.htm) accessed on April 13, 2011.
- 70 "Bird impact Data from DOI-ERDC Database Download 14 Dec. 2010." United States Fish and Wildlife Service. Accessed on April 13, 2011.
- 71 "Bird impact Data from DOI-ERDC Database Download 14 Dec. 2010." United States Fish and Wildlife Service. Accessed on April 13, 2011.
- 72 "Officials: More Oil Spill Workers Getting Sick." [Television broadcast] ABC News channel 16- WAPT. May 30, 2010.
- 73 "Exxon Valdez disaster facts and figures." *The Times* (United Kingdom). Posted June 11, 2010. Accessed on November 17, 2010.
- 74 "Oil spill update: EPA whistleblower speaks on Corexit, says dolphins, people hemorrhaging (video)" *The Examiner*. July 22, 2010.
- 75 National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling "Deep Water The Gulf oil Disaster and the Future of Offshore Drilling. Report to the President." January 2011 at 193.
- 76 "Officials: More Oil Spill Workers Getting Sick." [Television broadcast] ABC News channel 16- WAPT. May 30, 2010.
- 77 *Ibid.*
- 78 "334 in Louisiana Blame Illness on Oil Spill." *CBS News*. August 3, 2010.
- 79 Louisiana Department of Health and Hospital Oil Spill Resources [Press



- release]. "Louisiana DHH Releases Oil Spill Related Exposure Information." August 10, 2010.
- 70 Louisiana Department of Health and Hospital Oil Spill Resources [Press release]. "Louisiana DHH Releases Oil Spill Related Exposure Information." August 10, 2010.
- 71 *Ibid.*
- 72 Barrow, Bill. "BP oil spill's health effects will be felt for generations, scientist warns." *The Times-Picayune*. February 5, 2011.
- Subra, Wilma. "Evaluation of the Results of Whole Blood Volatile Solvents Testing." *Subra Company for the Louisiana Environmental Action Network*. Accessed February 10, 2011.
- 73 Barrow, Bill. "BP oil spill's health effects will be felt for generations, scientist warns." *The Times-Picayune*. February 5, 2011.
- Subra, Wilma. "Evaluation of the Results of Whole Blood Volatile Solvents Testing." *Subra Company for the Louisiana Environmental Action Network*. Accessed February 10, 2011.
- 74 Barrow, Bill. "BP oil spill's health effects will be felt for generations, scientist warns." *The Times-Picayune*. February 5, 2011.
- Subra, Wilma. "Evaluation of the Results of Whole Blood Volatile Solvents Testing." *Subra Company for the Louisiana Environmental Action Network*. Accessed February 10, 2011.
- 75 "The BP Oil Disaster: Results from a Health and Economic Impact Survey in Four Coastal Louisiana Parishes" Tulane University's Disaster Resilience Leadership Academy and the Louisiana Bucket Brigade. March 2011 at 1.
- 76 *Ibid.*
- 77 *Ibid.*
- 78 Barrow, Bill "Health study on effects of Gulf of Mexico oil spill revs up." *The Times-Picayune*. Updated February 21, 2011.
- 79 *Ibid.*
- 80 *Ibid.*
- 81 *Ibid.*
- 82 National Institute of Health. "NIH to launch Gulf oil spill study. BP will provide additional funds for research." NIH News National Institute of Health. Released September 7, 2010.
- 83 *Ibid.*
- 84 Barrow, Bill "Health study on effects of Gulf of Mexico oil spill revs up." *The Times-Picayune*. Updated February 21, 2011.
- National Institute of Health. "NIH to launch Gulf oil spill study. BP will provide additional funds for research." News National Institute of Health. Released September 7, 2010.
- 85 "The BP Oil Disaster: Results from a Health and Economic Impact Survey in Four Coastal Louisiana Parishes" at 4.
- 86 National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling "Deep Water The Gulf oil Disaster and the Future of Offshore Drilling. Report to the President." January 2011 at 187.
- 87 Bowen, Cynthia. "Oil spill taking a toll on Fla. Tourism." *CBS News*. June 20, 2010
- 88 Jones, Charisse and Jervis, Rick. "Oil spill takes toll on tourism on Gulf Coast." *USA Today*. June 25, 2010.
- 89 National Oceanic and Atmospheric Administration. "NOAA's Oil Spill Response: Fish Stocks in the Gulf of Mexico." May 12, 2010.
- 90 Rickard, Mary "Gulf Coast oil spill chills seafood industry." *Reuters*, May 12, 2010.
- 91 *Ibid.*
- 92 *Ibid.*
- 93 National Oceanic and Atmospheric Administration. "NOAA's Oil Spill Response: Fish Stocks in the Gulf of Mexico." May 12, 2010.
- 94 Operational Science Advisory Team (OSAT) Unified Area Command. "Summary Report for Sub-Sea and Sub-Surface Oil and Dispersant Detection: Sampling and Monitoring" Prepared for Paul F. Zukunft, RADM, U.S. Coast Guard Federal On-Scene Coordinator Deepwater Horizon MC252. December 17, 2010 at 2
- 95 NOAA [Press release]. "NOAA Reopens More Than 8,000 Square Miles in the Gulf of Mexico to Fishing." November 15, 2010.
- 96 FDA. "Overview of Testing Protocol to Re-open Harvest Waters that were Closed in Response to the Deepwater Horizon Oil Spill." July 15, 2010.
- 97 *Ibid.*
- 98 NOAA [Press release]. "NOAA Reopens More Than 8,000 Square Miles in the Gulf of Mexico to Fishing." November 15, 2010.
- 99 *Ibid.*
- 100 Buskey, Nikki. "Is seafood safe? Scientists raise questions." *Houma Courier in Terrebonne Parish, Louisiana* December 13, 2010.
- "Panel challenges Gulf seafood safety all-clear." *MSNBC* updated 12/27/2010 accessed on January 4, 2011.
- 101 "Panel challenges Gulf seafood safety all-clear." *MSNBC* updated 12/27/2010 accessed on January 4, 2011.
- 102 *Ibid.*
- 103 Marshall, Bob. "Safety of Gulf seafood debated 8 months after BP oil spill." *The Times-Picayune* (Louisiana). December 19, 2010.
- 104 Marshall, Bob. "Federal guidelines for Gulf seafood safety questioned." *The Times-Picayune* (Louisiana). December 8, 2010.
- 105 Buskey, Nikki. "Is seafood safe? Scientists raise questions." *Daily Comet* (Lafourche Parish, Louisiana). December 13, 2010.
- 106 Marshall, Bob. "Safety of Gulf seafood debated 8 months after BP oil spill." *The Times-Picayune* (Louisiana). December 19, 2010.
- 107 *Ibid.*
- 108 Marshall, Bob. "Federal guidelines for Gulf seafood safety questioned." *The Times-Picayune* (Louisiana). December 8, 2010.
- 109 National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling "Deep Water The Gulf oil Disaster and the Future of Offshore Drilling. Report to the President." January 2011 at 187.
- 110 NOAA. "BP Oil Spill: NOAA Closes Federal Waters to Royal Red Shrimp Fishing." *Southeast Fishery Bulletin*. November 24, 2010.
- 111 *Ibid.*
- 112 *Ibid.*
- 113 *Ibid.*

**About Food & Water Watch:** Food & Water Watch is a nonprofit consumer organization that works to ensure clean water and safe food. Food & Water Watch works with grassroots organizations around the world to create an economically and environmentally viable future. Through research, public and policymaker education, media and lobbying, we advocate policies that guarantee safe, wholesome food produced in a humane and sustainable manner, and public, rather than private, control of water resources including oceans, rivers and groundwater.

