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Gulf Oil Spills: Potential Impacts and Management Strategies for Agricultural Land

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The catastrophic loss of the Deep Water Horizon oil platform due to an explosion and the subsequent high-volume crude oil leak in the Gulf of Mexico southeast of Louisiana are both human and environmental disasters. While the volume of oil escaping from this well is not precisely known, estimates place it as high as one million gallons per day. Crude oil in the fishing waters and reaching the beaches and wetlands is causing severe economic hardship for many residents who live and work along the Louisiana, Mississippi, Alabama, and Florida coastlines. Texas has so far escaped the direct impacts of the oil leak, but many remember the Ixtoc I oil spill in the Gulf of Mexico's Bay of Campeche in 1979. The Ixtoc I well was located about 600 miles south of Brownsville, TX. That well blowout produced the third largest oil spill and the second largest accidental spill in U.S. history. The initial release of oil from Ixtoc I into the Gulf was 30,000 barrels (1.26 million gallons) per day. Various engineering strategies reduced the leak to 10,000 barrels (420,000 gallons) per day, but oil continued spilling into the Gulf for 290 days before relief wells reduced the pressure and Ixtoc I was finally capped. Ultimately, approximately 162 miles of south Texas beaches were directly affected by the oil leak, and tar balls and oily residue contaminated the shoreline as far north as Gilchrist. A Gulf storm that created intense waves and tidal action from September 13 to 15, 1979 removed much of the oil residue from beaches, but not before cleanup crews had removed an estimated 10,000 cubic yards of oil soaked debris.

A major concern for Texas' agricultural producers is what would happen if a hurricane moved significant amounts of an off-shore oil spill inland. Questions exist as to whether a potentially toxic mix of saltwater and crude oil could contaminate soil, vegetation and water on agricultural land if there were a storm surge similar to the one that occurred during Hurricane Ike in 2008. Based on previous experiences with weather-related and other oil releases into the Gulf of Mexico and elsewhere, several possible scenarios exist. Likely outcomes and basic management strategies for agricultural producers are discussed below.

Saltwater intrusion, as experienced with Hurricane Ike, likely would have the greatest impact on agricultural land in the storm surge affected area. The immediate and long-term effects on soils and vegetation would depend on soil texture, the level of soil moisture prior to the surge, and the duration of the saltwater inundation. Methods for evaluating and managing salt-affected soils are described in "Pasture and Soil Management Following Tidal Saltwater Intrusion."

Dilution of the oil and dispersant chemicals by mixing with saltwater and distribution over wide areas likely would reduce concentrations to levels too low to cause significant impacts on soils or vegetation. Heavy precipitation associated with most hurricanes and tropical storms also would serve to dilute and disperse chemical concentrations.

While oil contamination of soil and vegetation can have rapid and substantial negative effects on plants, the extent of the damage is determined primarily by the concentration and composition of the oil. Large scale spills that inundate the soil usually kill the herbaceous vegetation quickly; the effects on trees and shrubs may not be apparent for months. Small scale spills (1 to 5% oil) usually have much less severe effects on the plant community and biodegrade rather rapidly. Lighter, low molecular weight hydrocarbons are more acutely toxic to plants than heavier components of crude oil, but also tend to volatilize and dissipate more quickly.

It should be noted that an estimated 706 million gallons of oil enter the ocean every year, with over half of it coming from land runoff and waste disposal, such as used motor oil. Offshore drilling and production operations and spills or leaks from ships or tankers contribute about 8%, routine maintenance of ships about 20%, hydrocarbon air pollution from onshore about 13% and natural seepage from the ocean floor about 8%. During Hurricane Ike, at least 52 of the more than 3800 oil platforms in the Gulf were destroyed and 32 were severely damaged. As a result, approximately 500,000 gallons of crude oil was released into the Gulf of Mexico off the shores of Louisiana and Texas. However, no significant evidence of the released oil was found on land or along the coastal marsh areas. While undesirable in any situation, oil released in very small amounts or widely dispersed and diluted is often biodegraded fairly rapidly and produces no long-term adverse effects on the environment.

If the characteristics of a storm surge result in significant deposition of oil on inland areas, specific management practices can be used to remediate the damage. Contaminated soil can be reclaimed by promoting decomposition of the oil by naturally occurring soil microbes. The rate of oil decomposition will depend on the concentration of oil present and various soil characteristics, including texture, pH, nutrient content and moisture availability. Where possible, periodic tillage or mixing of the oil with soil is used to dilute the concentration, improve aeration, and stimulate microbial activity. A soil test should be utilized to determine the need for, and appropriate rates of limestone and supplemental nutrients. For best results, soil pH should be between 7.0 and 7.5, the soil carbon to nitrogen ratio should be 20:1 or less, and the soil carbon to phosphorus ratio should be 200:1 or less. Greater oil concentrations may require multiple additions of fertilizer nutrients, with individual application rates not exceeding 100 lbs/acre of either N or P_2O_5. Irrigation or other additions of supplemental water to maintain good soil moisture conditions also will facilitate the decomposition process. Where shallow groundwater exists, care should be exercised to not over-fertilize or apply excess supplemental water such that leaching of hydrocarbons and/or nutrients into the water table occurs.

In the event that vegetation in hay and pastureland areas is coated with oil to a significant extent, the most effective treatment would be use of prescribed fire. Experiences from Hurricane Katrina in Louisiana during 2005 demonstrated great success in using fire to remove excess crude oil. Pasture recovery was good to excellent within five months. State and local regulations regarding prescribed burning should be followed in all cases. In the event that burning is not an option, tillage followed by sprigging or seeding to re-establish vegetation is an alternative strategy.

If contamination of livestock water supplies by oil or saltwater is suspected, testing should be conducted to verify that pollutant concentrations are within acceptable ranges. The AgriLife Extension Service Laboratory in College Station can test livestock water for salt contamination. Various commercial laboratories provide testing services for hydrocarbons. If contamination is detected, alternate water supplies should be provided for livestock.

Finally, livestock producers should remember the catastrophic toll on cattle and horses during Hurricane Ike. Producers should carefully monitor the approach of any tropical storm and be proactive in

removing livestock from areas likely to be impacted by the storm surge to pastures in other counties, or if necessary, to other states for safety. Producers also should recognize the need to remove animals from pastures severely affected by saltwater or petroleum products. If livestock remain in these pastures, it will be critical to provide essential fresh water, and adequate hay and/or feed to meet the animals' nutrient requirements.

For additional information:

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