(A) Project Title:
Analyzing the Impact of Intermodal-Related Risk to the Design and Management of Biofuel Supply Chain

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(G) Project Summary:
US biofuel production is expected to increase in the near future in response to the Energy Policy Act of 2005 and the Energy Independence and Security Act of 2007, which mandate that the annual U.S. ethanol production grow from 10 billion gallons in 2007 to over 36 billion gallons in 2022. Thus, it is expected that production of biofuels will continue to increase, and as a consequence, more biorefineries will be established. Identifying biorefinery locations is crucial for the success of the biofuel supply chain due to two main reasons. First, investments required to establish biorefineries are very high. Second, biomass transportation costs from a supplier to a biorefinery are high due to the low energy density of biomass. Therefore, biorefinery locations should be carefully identified to ensure a cost-efficient and reliable supply chain.

The biofuels industry seems to have a bright future in Mississippi and the Southern Region of USA due to the abundance amount of biomass in the form of agricultural residues, forest products, and forest residues. Other factors, such as, low wages, non-unionized labor, and incentive packages offered by the state, impact a company's decision to locate in the South USA. In a prior study by Eksioglu et al. was noted the location decisions of a biorefinery are affected by the location of intermodal facilities. Intermodal facilities allow biorefineries to have access to cost efficient transportation modes, such as, rail, barge and vessel.

Biorefineries, such as the one located in Vicksburg have figured out the benefits of having access to an intermodal facility. However, the fact is that intermodal facilities are at a higher risk of being damaged and becoming dysfunctional for several reasons. First, intermodal facilities are often the center of terrorist attacks (such as, the train bombing in Madrid in 2004, airport bombing in Moscow in 2011, etc.). Second, weather conditions can impact their operations. For example, after the hurricane Katrina, many ports in the Gulf of Mexico were damaged and became dysfunctional and thus the operations of the biorefineries would become interrupted due to port facility failures.

The *objective of this proposal is to design decision-support tools for identifying biorefinery locations that ensure a cost-efficient and reliable supply chain.* We will build mathematical models which take into consideration the benefits (such as, accessibility to different modes of transportation), as well as, the risk associated with locating a refinery near an intermodal facility. The goal is to design biofuel supply chains that not only perform well under normal conditions but also maximally hedge against losses when not having access to cost-efficient transportation modes due to disruptions at intermodal facilities. Through our experiments we will be able to identify under what conditions locating a biofuel plant near an intermodal facility is advisable, and when it is not.