On September 19, 2005, TX-TF1 was called back from their second Hurricane Katrina deployment in New Orleans, Louisiana. On September 20, the day after returning from an 8 day deployment to New Orleans, GDEM activated a Type-I and Type-III US&R Task Force, 8 HSARTS, and a Water Rescue Task Force from TX-TF1 in preparation for landfall of Hurricane Rita.

Hurricane Rita was predicted to make landfall along the Texas coast on September 24 as a Category 5 Hurricane. As part of preparations, the State of Texas ESF-9 established a Unified Command, which operated out of Reliant Park Stadium in Houston. Additionally, the FEMA US&R White IST and 7 FEMA US&R Task Forces were activated and staged at Reliant Stadium in Houston, Texas, and 10 FEMA US&R Task Forces were activated and staged in Dallas, Texas.

Hurricane Rita made landfall as a Category 3 Hurricane between Sabine Pass, Texas, and Johnsons Bayou, Louisiana, on September 24, 2005. In response, TX-TF1 conducted search operations and welfare checks throughout southeast Texas. Hurricane Rita was the fourth-most intense Atlantic hurricane ever recorded and the most intense tropical storm ever observed in the Gulf of Mexico. Rita caused $11.3 billion (2005 USD) in damages on the U.S. Gulf Coast.

As teams completed their operational missions and search and rescue operations concluded, all TX-TF1 and FEMA resources were released by GDEM, with all resources demobilized by September 28.