Post Storm Assessment: Hurricanes Gustav and Ike
Executive Summary– July 2010

FEMA

Prepared by:
U.S. Army Corps of Engineers
National Planning Center of Expertise for
Coastal Storm Damage Reduction
National Hurricane Program Office

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POST STORM ASSESSMENT: HURRICANES GUSTAV AND IKE

EXECUTIVE SUMMARY

1. OVERVIEW

Since 1980, the Federal Emergency Management Agency (FEMA's) National Hurricane Program (NHP) has developed Hurricane Evacuation Studies (HES) as a service to State and local emergency managers, to provide a sound technical basis for their hurricane evacuation planning and decision-making. The HES products analyze and provide objective data on the following evacuation planning variables: Hazard, Vulnerability, Behavior, Transportation and Shelter. Following almost every significant storm since 1980 (the exceptions were Hurricanes Katrina and Rita in 2005), a Post Storm Assessment (PSA) of the HES products has been conducted to determine the accuracy of the HES products and foster improvement of their methodologies as warranted. The PSA also serves as a review of tools and products provided by the NHP, to ensure that these efforts are coordinated for maximum effect and efficiency.

PSAs were completed for four states in response to Hurricane Gustav, which made landfall near Cocodrie, LA, as a Category 2 storm (on the Saffir-Simpson Hurricane Wind Scale) on September 1 2008, and Hurricane Ike, which made landfall on Galveston Island, TX, as a Category 2 storm on September 13, 2008. Four separate PSA Reports were published, covering the States of Alabama, Louisiana, Mississippi, and Texas.

Hurricanes Ike and Gustav provided an opportunity to answer several key questions regarding the NHP's products and tools, including:

- Did local and state officials use the products produced in these HES?
- Were HES data regarding storm hazards, vulnerable populations and infrastructure, behavioral characteristics of evacuating populations, shelter information, evacuation clearance times, and other decision making tools accurate and reliable?
- Which NHP products were most useful and which least useful – and what improvements could be made to current methodologies and products?

These PSAs was conducted by interviewing local and State emergency managers who responded to the storm, collecting relevant post-storm data, and analyzing the interview responses and data collected for comparison with existing NHP products and tools. The results of this comparison were used to develop recommendations on how to improve the NHP's service to its stakeholders in the impacted areas.

Study teams consisting of representatives from FEMA, the U.S. Army Corps of Engineers (USACE), and contractor staff met with representatives from local and State government to conduct interviews. The interviews were based on questionnaires that were designed to capture pertinent data. Media

representatives in the impacted areas were also contacted in an effort to analyze how hurricane related information was communicated to the public. Information on meeting locations, attendees, and completed interview questionnaires can be found in the individual PSA reports. Available post storm data related to hurricane impacts, vulnerable populations, population evacuation behavior, sheltering, and evacuations was collected from local, State, and Federal government agencies, as well as universities. All the collected data was analyzed and documented in the reports.

2. RECCOMENDATIONS

Major recommendations from the PSAs are listed below. These recommendations are not listed in any order of priority. Additional recommendations specific to each State can be found in the appendices to this document, as well as the individual PSA reports.

Behavioral Study: Within the study area for the PSAs, most behavioral studies used to determine the percentage of people likely to evacuate during different hurricane scenarios were conducted prior to the 2004 hurricane season. Since 2004 several major hurricanes have impacted the region, including Hurricanes Katrina and Rita, which have likely had a major impact on how the public will respond to hurricane threats. As the behavioral assumptions made in an HES directly impact the calculated evacuation clearance times, it is recommended that new behavioral studies be conducted throughout much of the study area. At this time, behavioral studies are scheduled to be conducted in Fiscal Year 2011 in both Mississippi and Alabama.

Re-Entry Planning: After large scale evacuations and subsequent hurricane impacts, it is often difficult for local governments to determine when it is safe for their residents to return, and how to communicate this information to them so that the return can be executed in an orderly fashion.
The NHP may want to consider developing some type of re-entry planning guidance or re-entry coordination tool to help support state and local governments in this difficult task.

Critical Transportation Needs: State and local governments are often responsible for evacuating populations that are unable to evacuate themselves, such as the elderly and disabled. It is often difficult to track exactly how many people may need assistance in an evacuation, what type of care they may need during and after the evacuation, and what type of resources need to be available in order to execute the evacuation. The NHP may want to consider developing a critical transportation needs planning guidance document that would provide recommendations on how to identify and plan for evacuating these populations. In response to this need, a pilot critical transportation needs study was recently completed in Alabama as a result of the PSA.

NHP Tools Training: The NHP provides tools, such as the HURREVAC and SLOSH software packages, and Hurricane Evacuation Studies, which provide information that can assist state and local governments in their evacuation decision making. While these tools have been largely successful, there are many potential users of these products that are either unaware of them, or require consistent training on how to use them. While it is recommend that the NHP continue classroom training on SLOSH and HURREVAC when resources allow, alternatives for self training using available technology should continue to be explored and develop. Over the past year the NHP has trained It is also recommended that the NHP increase its focus on training users on the HES process and product itself, as many of those interviewed were either unaware of HES or did not

understand how to use the study to their advantage. In response to the HURREVAC training need, over the last year the NHP has trained over 2000 people on the new HURREVAC 2010 software, and has provided training videos and an online user's manual that can be used for self training.

Traffic Management: At one time the NHP supported the ETIS software program, which was used by local, State, and Federal governments to track traffic from regional/multi-state evacuations. The program has not recently been supported as it was not user friendly and did not incorporate real time traffic data. Based on the interview responses there is a desire for a program similar to ETIS to be developed. The tool should operate using real time traffic data from the states, and could leverage infrastructure that already exists in some areas, including cameras, traffic counters, digital road signs, and broadband communication networks, and it should also be able to incorporate location data from cell phones and other GPS enabled devices. While the necessary infrastructure may exist in some areas, it will need to be added in others. In order to obtain additional coverage, the NHP should explore possible partnerships with State and Federal transportation agencies that may be interested in this type of information for other purposes. The investment in this product may also have a use in re-entry after an evacuation.

Storm Surge Communication: In the past, the Safir-Simpson scale for communicating hurricane intensity included expected storm surge heights. Recently, the expected storm surge was removed from the scale, as the hurricane categories in the scale are based on wind speeds. It has become evident that factors beyond wind speed influence storm surge, including radius of maximum winds, angle of approach, forward speed, and offshore bathymetry. Recent experience suggests that in general the public does not understand the difference between possible storm surge and expected wind speeds and feels that they are still connected. It is recommended that the NHP pursue the development of a separate storm surge scale or warning that is independent of wind speed and could be issued in an area where tropical storm force winds and not anticipated and tropical storm/hurricane warnings are not issued. It has been demonstrated that large hurricanes in the Gulf of Mexico, such as Hurricane Ike, can cause significant storm surge impacts to areas that are not expected to receive any tropical storm force wind impacts.

Public Communication: Many respondents from the emergency management community indicated that they are overburdened by the fact that in general the public expects too much from their government in terms of evacuation assistance and hurricane response and recovery. The NHP may want to consider working with State and local governments to develop some type of marketing/communication campaign that encourages people to take responsibility for themselves and the risk that they take by living in a hurricane prone area. The campaign could promote personal/family hurricane planning for securing property, caring for pets, having a pre-planned evacuation destination, etc. It could also encourage residents to expect to be without power and other services for a considerable amount of time. Hurricane recovery can be a long and complicated process, and people who live in these areas should understand this and be prepared in advance. In general the more people that are able to take care of themselves, the easier it is for government to take care of those who can't, and a public communication campaign may help to encourage personal responsibility. The program could be modeled after successful programs that may already exist in some areas.

Shelter Construction: Many respondents indicated that their State or local jurisdiction would like to construct safe room type shelters near the coast that are outside of storm surge zones. This would reduce both the cost of evacuations and the distance that evacuees would have to travel. It could be especially useful for critical transportation needs sheltering. However, the only funding that States

often have available for this purpose is tied to the post-disaster Hazard Mitigation Grant Program, which is administered by FEMA under Section 404 of the Stafford Act. Respondents believe that policy of this program does not allow this type of safe-room shelter construction, as the program is more geared towards protection of property and infrastructure. FEMA may want to consider either revising this policy to allow the construction of safe room shelters, or investigate other possible grant/funding programs that would assist State and local governments in this effort.

Hurricane Liaison Team: Many local government respondents indicated a desire to be more involved in the Hurricane Liaison Team (HLT), and either felt disconnected from it or are not aware of it at all. The NHP should consider reviewing how the HLT communicates with local governments and builds/maintains relationships with important stakeholders during the offseason.

3. CONCLUSION

The recommendations listed in this executive summary and in the State PSA reports, while particularly important to the areas impacted by Ike and Gustav, may also have additional value to the NHP. Many of the recommendations correspond to issues raised during the recent Comprehensive Hurricane Emergency Management Strategy (CHEMS) State/Local listening sessions that the program held throughout the hurricane prone regions of the country. The NHP should consider reviewing these PSA recommendations for their potential to be integrated into the long term CHEMS vision.

APPENDIX A

EXECUTIVE SUMMARY

FROM THE ALABAMA IKE/GUSTAV FINAL PSA REPORT

EXECUTIVE SUMMARY
FROM ALABAMA IKE/GUSTAV FINAL PSA REPORT

Since 1980, the Federal Emergency Management Agency (FEMA's) National Hurricane Program (NHP) has developed Hurricane Evacuation Studies (HES) as a service to State and local emergency managers, to provide a sound technical basis for their hurricane evacuation planning and decision-making. The HES products analyze and provide objective data on the following evacuation planning variables: Hazard, Vulnerability, Behavior, Transportation and Shelter. Following almost every significant storm since 1980 (the exception were Hurricanes Katrina and Rita in 2005), a Post-Storm Assessment (PSA) of the HES products has been conducted under the authority and funding of the hurricane's recovery operations, to determine the accuracy of the HES products and foster improvement of their methodologies as warranted. The PSA also serves as a review of other tools and products provided by the NHP, as well as emergency management data collection and analysis efforts of the Federal government in general, and the FEMA Directorates in particular, to ensure that these efforts are coordinated for maximum effect and efficiency.

This PSA for the State of Alabama was conducted in response to Hurricane Gustav, which entered the Gulf of Mexico early on August 31st, 2008 as a Category 3 storm on the Saffir-Simpson Scale (SSS) and 36 hours later made landfall near Cocodrie, LA, as a Category 2 storm; and Hurricane Ike, which entered the Gulf of Mexico on late on September 9th as a Category 1 storm and 3 ½ days (84 hours) later made landfall on Galveston Island, TX, as a Category 2 storm. Hurricane Ike and Gustav provided an opportunity to answer several key questions regarding major FEMA-Corps hurricane evacuation study planning efforts:

- Did local and state officials use the products produced in these HES studies?
- Were study data regarding storm hazards, behavioral characteristics of the threatened population, shelter information, evacuation clearance times, and decision making tools accurate and reliable?
- Which study products were most useful and which least useful - what improvements could be made to current methodologies and products?

The PSA was conducted by interviewing local and State emergency managers who responded to the storm to obtain data on the utilization of NHP products and tools, including the HES for the area. Study teams consisting of representatives from FEMA, the U.S. Army Corps of Engineers, and Dewberry visited with these communities and individuals throughout the State of Alabama. Media representatives in the storm threatened area were also interviewed to determine the extent of public information provided to the threatened areas and whether they used any of the HES products to alert the public of the approaching storm. A questionnaire covering the NHP's products and tools, including the components of the HES, was developed and utilized to capture pertinent data for the assessment. Internet searches, interviews and contacts with other agencies were also conducted. All the collected data is compiled, analyzed and published in the following report.

Meetings were conducted with representatives from the Baldwin and Mobile County Emergency Management Offices, the Alabama Emergency Management Agency (AEMA) and local TV, radio and print media in Mobile County. These meetings were conducted in each county emergency operating center (EOC) the week of June 22, 2009.

The main issues that surfaced in these sessions were:

Local: A major topic was the use of HURREVAC as a decision assistance tool and the need for additional training for the software. The possibility of retrofitting shelters and critical needs facilities so that critical needs populations can safely be sheltered in place or close to home was discussed. Additional shelter spaces are needed locally along with a state-wide evacuee tracking system, and greater involvement with the HLT during storm events. The importance of the ELT and ETIS were stressed along with the need for real-time traffic data. The heightened expectations of the public for assistance during the evacuation process were a major concern and the importance of better public information and preparedness materials was also a major topic. All expressed a concern with the age of the existing HES and the need for an update.

State: The major issues and topics of discussion during the State agency meeting were the problems associated with sheltering evacuees from other states. Louisiana evacuees were bussed into Alabama and the State was left with the task of providing proper support and services. Many concerns focused on the need for a state-wide evacuee and shelter tracking system.

Media: The media meetings were not well attended and the main issues discussed were the desire of the media to have more access to the EOC and to decision makers. More localized public information materials were also a topic of discussion. Generally, relationships between the emergency management agencies and the media were very good and most conducted and/or participated in annual hurricane expos and public information seminars to kick-off the hurricane season.

A significant amount of data was collected during this assessment on topics related to and issues encountered by the State and Locals during a storm. Included in these topics were: vulnerable populations affected by the storm, the shelters utilized for in-state as well as out-of-state residents, the behavioral tendencies of the threatened populations, how well the transportation networks performed and whether contra-flow was utilized, how evacuation decisions were made, the extent of public information provided to the public, and whether other FEMA programs had a positive or negative effect on the response to the storm.

Some of the main gaps and issues that were raised included:

- The age of the Alabama's most recent HES and the need for a complete update of the HES, including new surge and evacuation zone maps, a new behavioral analysis and an updated transportation analysis.

- The need for a statewide evacuee tracking system that can be monitored in real time and coupled with a statewide shelter data base.

- Requesting coastal states to house evacuees from other coastal states without compromising the capability to house their own residents.

- The fact that public expectations have been raised and how the public has been conditioned to rely on support from the Government in disaster situations. This attitude must be changed.

- The use of contra-flow to facilitate evacuations. It was NOT used during Ike or Gustav but locals must be prepared for the future.

- The need for better communications between state agencies in neighboring states to alleviate the traffic bottlenecks on the east/west corridors.

- Progress has been made in the public information and mass communication arenas but more needs to be done for future storms.

- ETIS, or any new similar tool that is developed, needs to incorporate new traffic flow tracking technologies that have become available.

- The HAZUS and SLOSH models need to be more user-friendly and more training is needed for these tools.

- More training is needed for HURREVAC. With the 2010 version of HURREVAC currently being beta tested, everyone will need training on the new version prior to the start of the 2010 Hurricane Season

- New GIS-based tools containing comprehensive data to assist decision makers and emergency managers are needed.

- Although the sun was out and the storm center tracked well to the south and west, Ike caused higher than normal storm tides along the Alabama Coast. There is concern about how to address this issue so it does not happen again in the future.

- Provider evacuation states must work to become more self-sufficient in sheltering their own evacuated public seeking safe shelter. Instead of farming evacuees out to other states, host states should EMAC shelter management teams to the evacuating state to help manage their shelter capacity capability.

- Elderly populations are not likely to utilize mass bus, plane and train evacuation methods. Generally, this population does not want to seek shelter 100's of mile from their home in a community that is unfamiliar to them. Katrina demonstrated this fact. 85% of all Katrina deaths in LA were over the age of 50. 65% were over the age of 65.

Finally, an analysis of the HES data and products currently available to the emergency managers was conducted. Issues discussed consisted of whether and how HES products were utilized, how accurate they were during these storm events and if the users had recommendations for improving or enhancing the products.

The findings exemplify that the HES data and products, although well known and readily available, are outdated and do not accurately depict how evacuations are issued in the state. For these reasons, the HES data and products were not always fully utilized in the decision making process. Many times, past experiences with previous storm events were the determining factor when making important evacuation decisions. The Governor issued general evacuation orders, leaving local emergency management agencies to decide on more specific locations to be evacuated. The use of the official evacuation zones from the HES was not widespread. In Baldwin County, for example, the official evacuation zones were being revised and new zone maps were not yet approved. More training on the HES products and how to best utilize them is sorely needed.

Major recommendations from this post-Gustav and Ike effort include:

1. Provide an easy-to-use, maintainable GIS Based tool containing the HES and other data that will assist local emergency managers with planning and decision making.

2. Simplify and speed up the mitigation process for retrofitting structures for use as shelters under FEMA's 406 Hazard Mitigation Program.

3. Make it easier to apply for and receive Federal mitigation funds for projects under construction that need design modifications to retrofit for use as shelters.

4. Increase installation of permanent, protected real-time traffic counters.
5. Expand the use of other Intelligent Transportation Systems (ITS) for traffic management programs such as ETIS (Evacuation Traffic Information System) and provide real-time traffic movement data.
6. HLT members need to regain permission from FEMA to contact local EM officials directly during storm events.

7. Develop a national tool/product for storm surge to address potential surge impacts on areas outside of the warned area. The coastal counties of Alabama experienced higher than expected water levels during Hurricane Ike that were not commensurate with observed winds.

8. Keep the *Introduction to Hurricanes* planning courses for EM Directors in Miami at the NHC and consider offering the course more frequently.

9. Improve North and South roads for coastal evacuees. Examples include: Highway 59 in Baldwin County and Highway 98 in Mobile County.

10. Consider use of Southern Link two-way radio and wireless phone as national best practice.

11. Continue to expand the use of culturally modern tools such as Twitter, Facebook and Web blogs, building on actions taken by the Alabama EMA.

12. Inclusion of local EM Directors in state EOC conference calls and communications.

13. Coastal states need to house their own residents to prevent compromising the capability of neighboring States to shelter their own residents. (Example: While housing out-of-state evacuees for Gustav, AEMA could not plan to house Alabama's local residents for Ike).

14. Need FEMA to streamline the Pre-disaster Declarations Program so that host states are able to assist evacuees with Individual Assistance in a timely manner.

15. Language and cultural barriers need to be addressed.

16. Re-entry plans for coastal communities need to be developed.

17. Develop a procedure to allow Event Management Software to accept and display alerts and timetables from HURREVAC

APPENDIX B

EXECUTIVE SUMMARY

FROM THE LOUISIANA IKE/GUSTAV FINAL PSA REPORT

EXECUTIVE SUMMARY
FROM THE LOUISIANA FINAL IKE/GUSTAV PSA REPORT

Since 1980, the Federal Emergency Management Agency (FEMA) and the United States Army Corps of Engineers (USACE) National Hurricane Program (NHP) has developed Hurricane Evacuation Studies (HES) as a service to state and local emergency managers, to provide a sound technical basis for their hurricane evacuation planning and decision-making. The HES products analyze and provide objective data on the following evacuation planning variables: Hazard, Vulnerability, Behavior, Transportation and Shelter. Following almost every significant storm since 1980 (the exceptions were Hurricanes Katrina and Rita), a Post-Storm Assessment (PSA) of the HES products has been conducted under the authority and funding of the hurricane's recovery operations, to determine the accuracy of the HES products and foster improvement of their methodologies as warranted. The PSA also serves as a review of other tools and products provided by the NHP, as well as emergency management data collection and analysis efforts of the Federal government in general, and the FEMA Directorates in particular, to ensure that these efforts are coordinated for maximum effect and efficiency.

This PSA for the State of Louisiana was conducted in response to Hurricanes Gustav, which entered the Gulf of Mexico early on August 31st, 2008 as a Category 3 storm and 36 hours later made landfall near Cocodrie, LA, as a Category 2 storm; and Ike, which entered the Gulf of Mexico on late on September 9th as a Category 1 storm and 3 ½ days (84 hours) later made landfall on Galveston Island, TX, as a Category 2 storm.

Components of the PSA

Given the multitude of storms experienced by the State of Louisiana, FEMA and the USACE initiated a PSA for the Hurricane Gustav and Hurricane Ike landfall areas. Among the data objectives for this PSA are:

- Establishing whether federal, state or local officials used the products developed from these studies;
- Determining the accuracy and reliability of study data regarding storm hazards, behavioral characteristics of the threatened population, shelter information, clearance times and other evacuation decision making variables;
- Ascertaining which products were most and least useful;
- Proposing improvements to current study methodologies and work products; and
- Assessing information on other FEMA programs that were used by state, parish, and local jurisdictions impacted by Hurricanes Gustav and Ike (such as the GAP Analysis Program) and determine how they were used and develop a summary analysis and recommendations for their improvement.

Interview Issues and Highlights

Study teams comprised representatives from FEMA, USACE, and the contractor (PBS&J), visited with local parishes and the Louisiana Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP) officials throughout the directly impacted areas of Louisiana. Interviews and analysis conducted during the PSA revealed the following:

- Participation rates among the permanent population was significant for Hurricane Gustav;
- Most local parishes maintain an excellent working relationship with their local National Weather Service (NWS) Offices;
- Most parishes maintain a good relationship with media outlets and utilize them to disseminate data to the public;
- HURREVAC is the primary decision-assistance tool used by state and local parish officials and was praised for its utility and ease of use;
- Very few of the surveyed local officials knew of or used the Hurricane Liaison Team (HLT);
- Only a few isolated problems with traffic congestion occurred as contra-flow was started early;
- Many parish officials and the public were surprised by storm surge impacting the state in advance of Hurricane Ike;
- Pervasive issues with sheltering operations including: staffing shortfalls; the need for coordinated plans at state and federal level; lack of security; isolated instances of overcrowding; the presence of homeless people; and other resource limitations;
- Communicating with ethnic populations was not a problem for state and local parishes; and
- The Internet and the plethora of weather websites are invaluable for additional information.

Main Data Gaps and Issues

Based on the general observations above, and the wealth of additional information collected from state and local parish officials, the following recommendations are provided as a specific means to improving the products and activities of the NHP for future tropical cyclone events. Some of the recommendations are outside the scope of those normally provided in post-storm analyses. In reviewing the data collected from the local parishes surveyed for this effort, it is apparent that any of the problems that were evident during Hurricanes Gustav and Ike would not be adequately addressed by changes to NHP products or processes alone. Additionally, many of the recommendations contained in this document were based on requests from the state and local parishes interviewed for this effort. Many of these recommendations address the preparedness and response issues observed during Hurricanes Gustav and Ike and previous post-storm studies. The recommendations are proposed corrective actions that apply to fundamental programmatic and policy issues, as well as to the perfunctory government product improvement measures. They are not to be considered all inclusive and are not to be considered weaknesses on the part of FEMA or the USACE.

- Generate new SLOSH (Sea, Lake and Overland Surges from Hurricanes) Maximum Envelopes of Water (MEOWs) and Maximum of the Maximums (MOMs) for use in determining changes to existing hurricane evacuation zones.
- Develop an intensive on-going training program for state and local parish emergency management staff regarding the appropriate use of Storm Tide Atlases, the SLOSH Display Program and evacuation zone maps in evacuation decision making and response operations.

- Develop a comprehensive campaign to impress on the public and local decision-makers alike that the dangers associated with tropical storms and lesser category hurricanes warrant protective actions.
- Review and/or communicate the real missions of the HLT and develop the procedures and technical capabilities to support those roles.
- Create a cadre of representatives (USACE, FEMA and State Program Managers) available for deployment to state and local government Emergency Operations Centers (EOC) to act as on-site technical advisors for hurricane evacuation and response operations.
- Develop a generic version of the Hurricane Risk Profile in HURREVAC that is applicable to all state and local parish governments to increase consistency in decision making during actual tropical cyclone events.
- Develop a training program as part of the HES process that continually educates state and local parish officials regarding the use of study products and tools.
- In concert with the current National Flood Insurance Program (NFIP) Map Modernization Program and other improved mapping efforts, improve the base mapping used in the development of SLOSH model basins and storm tide mapping. (The NFIP enables property owners in participating communities to purchase insurance protection from the government against losses from flooding.)
- Develop an organized training program for HURREVAC to ensure that hands on and operational use classes are made available to key disaster-related staff in all hurricane-vulnerable communities on at least an annual basis.
- Develop a systematic approach to issuing HURREVAC program updates on the same dates every year, or create the capability to automatically feed version upgrades during routine data downloads.
- Provide local emergency management with the ability to readily access sea buoy, coastal tide gauge and IFLOWS (Integrated Flood Observing and Warning System) rain and river gauge data, i.e. incorporating a function that automatically collects and displays that data in HURREVAC. Despite close coordination between local parish emergency management offices and the NWS office, high water levels in many parishes caught waterside populations by surprise. Several parish emergency managers indicated that ready access to open water buoy and tidal gauge information might be of value in alerting them to rising water.
- Expand and re-vamp the entire curriculum for the NHP to include more in-depth training on planning, preparedness, mitigation, and response operations (pre- and post- landfall) for hurricanes.
- Formalize the delivery means for field-based hurricane courses, especially to local officials, to ensure better training coverage and frequency.
- Develop and distribute more training aids to facilitate hurricane response operations and activities at the state and local level.
- The use of point-to-point sheltering was widely lauded and many coastal parishes have now made parish to parish plans for the next event, but the tracking of evacuees needs to be streamlined.
- Develop comprehensive guidance regarding the policies, operational requirements and resources needed to implement an effective people with special needs (PSN) sheltering program at the state and local level.

- Develop a comprehensive training and education program for communities and media organizations alike regarding better methods for integrating their public information operations during hurricanes and other disasters.
- Develop a one-stop comprehensive information webpage, possibly at the HLT site, that assists state and local government representatives in readily gathering all information that specifically relates to hurricane hazards or the overall event.

In addition to these key findings, a number of recommendations were offered by the respondents during the field interview sessions. These recommendations include specific suggestions to the PSA process and to NHP tools, as well as to disaster response in general, and are located in Chapter 7 of this PSA.

Previous HESs conducted in Louisiana were consulted for previous data and findings. An outline of the studies conducted and the parishes affected are displayed in Table ES-1.

Table ES-1

Study Name	Louisiana Parishes Included
Southwest Louisiana Hurricane Evacuation Transportation Analysis (2000)	Calcasieu, Cameron, Jefferson Davis, Vermillion, Acadia, Lafayette, Iberia, Iberville, St. Martin, Terrebonne, St. Mary, Assumption
Southeast Louisiana Hurricane Evacuation Re-Study Transportation Analysis (2001)	Jefferson, Orleans, Plaquemines, St. Bernard, St. Charles, St. John the Baptist, St. James, St. Tammany, Lafourche, Terrebonne, St. Mary, Assumption
Louisiana and Mississippi Bi-State Hurricane Evacuation Study Technical Data Report (2005)	Jefferson, Orleans, Plaquemines, St. Bernard, St. Charles, St. John the Baptist, St. James, Ascension, St. Tammany, Tangipahoa, Washington, Livingston, St. Helena, Terrebonne, St. Mary, Assumption, Lafourche
Southeast Louisiana and Mississippi Clearance Time Updates for the 2006 Hurricane Season (2006)	Ascension, Assumption, Jefferson, Lafourche, Orleans, Plaquemines, St. Bernard, St. Charles, St. James, St. John the Baptist, St. Tammany, Tangipahoa, Terrebonne
Southwest Louisiana Clearance Time Updates for the 2007 Hurricane Season (2007)	Acadia, Assumption, Calcasieu, Cameron, Iberia, Iberville, Jefferson Davis, Lafayette, St. Martin, St. Mary, Terrebonne, Vermillion

Additionally, behavioral studies were reviewed for data necessary for this PSA. The affected parishes, the study conducted, and the firm that performed the work is displayed in Table ES-2.

Table ES-2

Study Name	Conducted By	Louisiana Parishes Included
Pre-Katrina Behavioral Assumptions for Louisiana Coastal Parishes (2005)	Hearn Morrow	Jefferson, Lafourche, Orleans, Plaquemines, St. Bernard, St. Tammany, Terrebonne
Coastal Louisiana Post-Katrina Evacuation Planning Survey (2006)	Hearn Morrow, Gladwin	St. Tammany, Calcasieu, Cameron, Iberia, Jefferson, Lafourche, Orleans, Plaquemines, St. Bernard, Terrebonne, Vermilion, St. Mary

APPENDIX C

EXECUTIVE SUMMARY

FROM THE MISSISSIPPI IKE/GUSTAV FINAL PSA REPORT

EXECUTIVE SUMMARY
FROM THE MISSISSIPPI FINAL IKE/GUSTAV PSA REPORT

Since 1980, the Federal Emergency Management Agency (FEMA's) National Hurricane Program (NHP) has developed Hurricane Evacuation Studies (HES) as a service to State and local emergency managers, to provide a sound technical basis for their hurricane evacuation planning and decision-making. The HES products analyze and provide objective data on the following evacuation planning variables: Hazard, Vulnerability, Behavior, Transportation and Shelter. Following almost every significant storm since 1980 (the exceptions were Hurricanes Katrina and Rita in 2005), a Post Storm Assessment (PSA) of the HES products has been conducted to determine the accuracy of the HES products and foster improvement of their methodologies as warranted. The PSA also serves as a review of tools and products provided by the NHP, to ensure that these efforts are coordinated for maximum effect and efficiency.

This PSA for the State of Mississippi was conducted in response to Hurricane Gustav, which made landfall near Cocodrie, LA, as a Category 2 storm (on the Saffir-Simpson Hurricane Scale) on September 1 2008, and Hurricane Ike, which made landfall on Galveston Island, TX, as a Category 2 storm on September 13. Both storms reached a peak intensity of Category 4 with Gustav producing maximum sustained winds of 135 knots, and Ike producing maximum sustained winds of 125 knots, before weakening upon entering the Gulf of Mexico. Both storms were also notable for their large wind field.

Hurricanes Ike and Gustav provided an opportunity to answer several key questions regarding the NHC Hurricane Evacuation Study planning efforts:

- Did local and state officials use the products produced in these HES studies?
- Were study data regarding storm hazards, behavioral characteristics of the threatened population, shelter information, evacuation clearance times, and decision making tools accurate and reliable?
- Which study products were most useful and which least useful - what improvements could be made to current methodologies and products?

The PSA was conducted by interviewing local and State emergency managers who responded to the storm. Study teams consisting of representatives from FEMA, the U.S. Army Corps of Engineers (USACE), and Dewberry visited with these communities and individuals throughout the State of Mississippi. Meetings were conducted with representatives from the Hancock, Harrison and Jackson County Emergency Management Offices, the Mississippi Emergency Management Agency (MEMA). These meetings were conducted in each county emergency operations center (EOC) the week of June 22, 2009. Media representatives in the storm threatened area were also contacted to determine the extent of public information provided and whether they used any HES products. Three questionnaires were developed and utilized to capture pertinent data. Internet searches, interviews and contacts with other agencies were also conducted. All the collected data is compiled, analyzed and published in this report.

The main issues that were raised during the assessment along with recommendations for their improvement are listed in the following table:

Topic	Issue	Recommendation
Hurricane Evacuation Study	Hurricane Katrina changed the landscape of coastal Mississippi and invalidated much of the data in the 2002 Mississippi HES.	Conduct a complete update of the HES.
	Hurricane study products provide valuable information for evacuation timing and decision making but are sometimes misunderstood or underutilized by local emergency management agencies.	Emphasize the availability of HES study products in the study areas and provide training on their utilization.
	More training is needed for emergency management decision makers due to new technology innovations and turnover at the local level.	Keep the *Introduction to Hurricanes* planning course in Miami and consider offering it more frequently.
Technology and Technical Data Report	The HURREVAC software program is dependent on updated information after completion of a new study.	Hurricane Study Mangers should coordinate with the State to ensure that individual modules in HURREVAC are updated with current HES study data, especially clearance times.
	More training is needed at the State and local levels on HURREVAC, SLOSH and HAZUS.	FEMA and USACE, in cooperation with State and local agencies, should conduct training workshops for HURREVAC, SLOSH and HAZUS. Initiate training and develop training materials for HURREVAC 2010.
	Higher than expected surge heights have been occurring in coastal areas outside of the NHC warned areas.	Develop a tool to display potential surge areas for locations outside of the SLOSH predicted area.
	Currently, emergency managers do not have a method to assimilate the wealth of data in an HES Technical Data Report (TDR) in order to assess community vulnerability and make timely decisions.	Develop an easy to use GIS tool containing HES and other data to assist local emergency managers for planning and decision making.

Evacuation and Decision Making	Risk maps and evacuation zones vary in format and quality between HES study areas depending on the latest guidelines and standards used at the time of the product development.	Federal and State authorities should provide specific guidance for including inland counties in the HES process.
		NHP should develop decision assistance tools and materials to assist communities in the decision making process. LIDAR, GIS applications and FEMA's Map Modernization program should be considered when developing these tools.
Evacuation Roadway Network	Post-storm re-entry requires immense coordination between multiple local, State and Federal agencies and a clear, open line of communication to evacuees.	Update the Mississippi/Louisiana Bi-State Study to investigate the Comprehensive Hurricane Emergency Management Strategy (CHEMS) concept and new technologies to track real-time movement of population and assist with planning for re-entry issues.
	Tracking of population movement in real-time situation is very difficult.	
	Unanticipated traffic flows into Mississippi from Louisiana have caused traffic congestion.	
	Adequate fuel supply for evacuation and re-entry is a problem.	
Communication and Public Information	State and local officials are concerned that many people are still not taking appropriate protective actions, including evacuation in a timely manner, despite a relatively high level of hurricane vulnerability and hurricane history.	Update and expand public education campaigns and stress personal accountability from the evacuating public.
	Public expectations have been raised and the public has been heavily conditioned to rely on support from the Government in disaster situations.	
	Real-time information should be provided to the evacuating public in a timely manner.	Continue to expand the use of culturally modern tools such as Twitter, Facebook and web blogs.
	State and local emergency management seek more communication from the community during storm events.	Increase communication between the Hurricane Liaison Team (HLT), states and locals during the off-season. Provide support for locals to build relationships with states, local weather service offices, and the HLT to better exchange information during storm events.

Sheltering	More facilities should be made available as safe hurricane evacuation shelters in areas closer to the coast following inspections and concurrence by the appropriate parties.	Conduct a behavioral analysis in adjacent states to determine potential shelter needs from out-of-state evacuees and allow states to plan for in-state sheltering of residents.
	Evacuees from adjacent states have taxed shelter availability in the State.	

The findings exemplify that the HES data and products, although well known and readily available, were not always fully utilized in the decision making process. The use of the official evacuation zones from the HES was not widespread. Additionally, interview results indicated that the 2006 evacuation zones and clearance times for Hancock and Jackson counties, created outside of the HES process, were not utilized by local emergency management in their decision making process during Hurricanes Gustav and Ike. Many times, past experiences with previous storm events were the determining factor when making important evacuation decisions. More training on the HES products and how to best utilize them is sorely needed.

APPENDIX D

EXECUTIVE SUMMARY

FROM THE TEXAS IKE/GUSTAV FINAL PSA REPORT

EXECUTIVE SUMMARY
FROM THE TEXAS FINAL IKE/GUSTAV PSA REPORT

Since 1980, the National Hurricane Program (NHP) has developed Hurricane Evacuation Studies (HES) as a service to State and local emergency managers, to provide a sound technical basis for their hurricane evacuation planning and decision-making. The NHP is a multi-agency partnership of Federal agencies, including Federal Emergency Management Agency (FEMA), National Oceanic and Atmospheric Association (NOAA), National Weather Service (NWS), U.S. Department of Transportation (USDOT), and U.S. Army Corps of Engineers (USACE). The HES products analyze and provide objective data on the following evacuation planning variables: Hazard, Vulnerability, Behavior, Transportation and Shelter. Following almost every significant storm since 1980 (the exceptions were Hurricanes Katrina and Rita), a Post-Storm Assessment (PSA) of the HES products has been conducted and funded through Interagency Agreements (IAA) and corresponding Statements of Support between FEMA and the USACE, to determine the accuracy of the HES products and foster improvement of their methodologies as warranted. The PSA also serves as a review of other tools and products provided by the NHP, as well as emergency management data collection and analysis efforts of the Federal government in general, and the FEMA Directorates in particular, to ensure that these efforts are coordinated for maximum effect and efficiency.

Hurricane Ike entered the Gulf of Mexico late on September 9, 2008 as a Category 1 storm and made landfall on Galveston Island, TX, on September 13, 2008 at 2:10 am Central Daylight Time (CDT) as a Category 2 storm generating significant storm surge along the upper Texas Gulf Coast, The purpose of this PSA for the State of Texas is to summarize the impacts of Hurricane Ike and evaluate the performance of the NHP HES products for the three Texas HES study areas where evacuations were undertaken (Sabine Lake, Galveston-Houston, and Matagorda). The PSA presents recommendations to improve NHP products and programs and examines the following key questions:

- Did local and State officials use the products produced in these hurricane evacuation studies?

- Were study data regarding storm hazards, behavioral characteristics of the threatened population, shelter information, evacuation clearance times and decision making tools accurate and reliable?

- Which study products were most useful and which least useful - what improvements could be made to current methodologies and products?

The PSA was conducted by interviewing local and State emergency managers who responded to the storm to obtain data on the utilization of NHP products and tools, including the HES for the area. Study teams consisting of representatives from FEMA, USACE and Dewberry visited with these communities and individuals throughout the State of Texas. Media representatives in the storm threatened area were also interviewed to determine the extent of public information provided to the threatened areas and whether they used any of the HES products to alert the

public of the approaching storm. Local, State and Media questionnaires covering the NHP's products and tools, including the components of the HES, were developed and utilized to capture pertinent data from each group for the assessment. Internet searches, interviews and contacts with other agencies were also conducted. All the collected data is compiled, analyzed and published in the following report.

Meetings were conducted with representatives from the emergency management offices in the counties of Chambers, Liberty, Hardin, Jefferson, Orange, Jasper, Newton, Polk, Tyler, San Jacinto, Harris, Galveston, Brazoria, Matagorda and Fort Bend. These meetings were conducted on the following dates: July 20-23 2009, August 17-19 2009, and September 8, 2009. The Houston TranStar meeting was conducted on September 9, 2009. The media meeting was held in Houston at the Harris County EOC on August 20, 2009 and the State meeting was held in Austin at the State EOC on September 10, 2009.

The main issues that surfaced in these sessions were:

Local: For the coastal counties, a major topic was the use of HURREVAC and SLOSH as decision assistance tools and the need for additional training for both tools. The coastal counties primary concern is the evacuation process as they generally do not shelter evacuees within the coastal counties. The increased expectations of the public for assistance from government during the evacuation process were a major concern and the importance of better public information and preparedness materials was also a major topic. The inland counties expressed their issues with traffic problems and bottlenecks created by the evacuees as they passed through their counties. Greater involvement with the Hurricane Liaison Team (HLT) during storm events was also expressed.

State: The major issues and topics of discussion during the State agency meeting were the problems associated with the state-wide transportation and sheltering programs. The State noted that its point-to-point or "sister city" sheltering system was effective but reported that the existing shelters reached maximum capacity during Hurricane Ike with extremely limited shelter availability for overflow evacuees. The State stressed that there is a definite need for more special needs and medical shelters as these groups were common and even the majority in general population shelters. There was concern surrounding the availability of transportation resources for evacuation assistance and the need for a national system for airbus support.

Media: The main issues discussed by the media were the desire to have more access to the Emergency Operations Center (EOC) and to have direct interaction with evacuation decision makers. More localized public information materials and a consistent set of evacuation zones for the public were major requests. Information is disseminated to the media from the Joint Information Centers (JIC) set up in the local EOCs. Generally, relationships between the emergency management agencies and the media were very good and most conducted and/or participated in annual hurricane expositions and public information seminars prior to the start of hurricane season. Media sources would like to present more information which stresses the impact of the storm rather than the typical the storm category reference.

A significant amount of data was collected during this assessment on topics related to and issues encountered by the State and Locals during a storm. Included in these topics were: vulnerable populations affected by the storm, the shelters utilized, the behavioral tendencies of the threatened populations, how well the transportation networks performed and whether contra-flow was utilized, how evacuation decisions were made, the extent of public information provided to the public, and whether other FEMA programs had a positive or negative effect on the response to the storm. The main issues that were raised during the Hurricane Ike PSA, along with recommendations for their improvement, are listed in the following table.

Topic	Issue	Recommendation
General	Development of new zip-zone evacuation maps without new transportation, behavioral and vulnerability analyses invalidates certain data in existing HESs.	Update the HES for all study areas.
	Hurricane study products provide valuable information for evacuation timing and decision making but are sometimes misunderstood or underutilized by local emergency management agencies.	Emphasize the availability of HES study products in the study areas and provide training on their utilization.
HLT	Inconsistent communication between the Hurricane Liaison Team (HLT) and coastal counties.	Permit HLT members to contact local EMS directly during storm events.
		Increase awareness of the HLT and its value to State/local EMs. Clearly define the HLT's national roles and protocols.
Technological	The HURREVAC software program is dependent on updated information after completion of a new study.	Hurricane Study Managers should coordinate with the State to ensure that individual modules in HURREVAC are updated with current HES study data, especially clearance times.
	More training is needed at the State and local levels on HURREVAC, SLOSH and HAZUS.	FEMA and USACE, in cooperation with State and local agencies, should conduct training workshops for HURREVAC, SLOSH and HAZUS. Initiate training and develop training materials for HURREVAC 2010.

Evacuation and Decision Making	Risk maps and evacuation zones vary in format and quality between HES study areas depending on the latest guidelines and standards used at the time of the product development.	Continue modernizing standard template for HES development and utilize it for re-studies.
		Develop guidance for including inland counties in the HES process.
	The current alert system is based on the Saffir-Simpson scale and does not adequately account for storm surge that can occur prior to landfall of the hurricane.	Train local emergency management on the National Hurricane Center's (NHC) Tropical Cyclone Storm Surge Probabilities product.
Evacuation Roadway Network	Post-storm re-entry requires immense coordination between multiple local, State and Federal agencies and a clear, open line of communication to evacuees.	Re-entry plans should be developed to create transportation re-entry templates and procedures for local governments.
Communication and Public Information	State and local officials are concerned that many people are still not taking appropriate protective actions, including evacuation in a timely manner, despite a relatively high level of hurricane vulnerability and hurricane history.	Update and expand public education campaigns and stress personal accountability from the evacuating public.
	Public expectations have been raised and the public has been heavily conditioned to rely on support from the Government in disaster situations.	
Sheltering	More facilities should be made available as safe hurricane evacuation shelters in areas closer to the coast following inspections and concurrence by the appropriate parties.	Emergency Support Function 6 (Mass Care) agencies at the State and local levels should coordinate with local emergency management agencies to inspect and designate more public buildings along evacuation routes for use as approved American Red Cross shelters.

Post Storm Recovery	FEMA's Federal Coordinating Officers (FCO) do not have full authority to obligate all necessary disaster funds.	Return to the prior FCO structure where the FCO has the authority to make decisions and commit resources concerning temporary housing and logistics.
	There is a high turnover rate of FEMA disaster assistance employees (DAE) assigned to local counties. These representatives are on a rotation schedule that does not provide adequate continuity for local recovery operations.	Encourage FEMA to lengthen the rotation period for reservists so that continuity of recovery operations can be obtained.
		Provide a transitional period of time for overlapping duties to all DAEs in leadership positions in PA, and those assigned to local/state EOCs.
	FEMA DAEs assigned to the state/local EOCs do not have the necessary decision making capabilities	Designated DAEs should have knowledge of hurricanes and the local area. They need to be able to make decisions or have direct access to an FCO or other FEMA manager to quickly receive approval.
	FEMA mitigation funding cannot be used to construct evacuation shelters	Encourage FEMA to change their policy to allow the use of mitigation funding to construct and/or retrofit facilities for use as evacuation shelters. Mitigation funds should be applicable to more than directly damaged facilities.
		Conduct training on Public Assistance paperwork and eligibility.

Finally, an analysis of the HES data and products currently available to the emergency managers was conducted. Issues discussed consisted of whether and how HES products were utilized, how accurate they were during these storm events and if the users had recommendations for improving or enhancing the products. The HES products for each of the three HES study areas are listed along with their dates of completion in the table below.

HES Study Area	Counties in PSA Study Area	HES Completion Date and Title
Lake Sabine (SSA)	Chambers, Hardin, Jasper, Jefferson, Liberty, Newton, Orange	1998—Hurricane Storm Atlas 2002—Hurricane Contingency Planning Guide
Houston-Galveston (GSA)	Brazoria, Galveston, Harris	2004—Texas Hurricane Evacuation Study, Galveston Study Area
Matagorda (MSA)	Matagorda	2002—Hurricane Evacuation Time Estimates for the Texas Gulf Coast* 1998—Hurricane Contingency Planning Guide 1995—Hurricane Storm Atlas
n/a	Fort Bend, Polk, Tyler, San Jacinto	n/a

*MSA clearance times were updated in Lindell M.K., Prater C.S. and Wu J.Y. (2002). *Hurricane Evacuation Time Estimates for the Texas Gulf Coast.* College Station TX: Texas A & M University Hazard Reduction & Recovery Center.