**First Organizational and Advisory Board Meeting:**
**Center for the Study of the Public Health Impacts of Hurricanes**
**Meeting Minutes - August 21, 2002**

**Advisory Board Members (present):**

**Ms. Doris Brown,** Chief Public Health Nurse, LA Office of Public Health (OPH), LA Department of Health and Hospitals (DHH)
**Mr. Hilton Cole,** East Baton Rouge Parish Animal Control Center
**Dr. Jarrell Mathison,** Medical Director, DHH Region I
**Mr. Lawrence Nichols,** Bioterrorism & Emergency Response Coord., DHH Region I
**Mr. Chris Piehler,** Senior Environmental Scientist, LA Department of Environmental Quality (DEQ)
**Dr. Tony Speier**, Director, Community Services; State Disaster Mental Health Coordinator, LA Office of Mental Health (OMH)
**Mr. Jesse St. Amant**, Director, Plaquemines Parish Office of Emergency Preparedness (OEP)
**Mr. Terry Tullier**, Deputy Fire Chief, City of New Orleans and Director, New Orleans Parish OEP

**Additional Advisory Board Members (absent):**

**Dr. Len Bahr**, Executive Assistant, LA Governor's Office of Coastal Activities
**Mr. Robert Bracamontes,** Director, St. Bernard Parish OEP
**Colonel Michael L. Brown**, Assistant Director, LA Governor's OEP
**Mr. Matt Farlow**, LA Governor's OEP
**Dr. Walter Maestri**, Director, Jefferson Parish OEP
**Ms. Madeline W. McAndrew**, Assistant Secretary, LA OPH
**Dr. Judd Shellito**, Dept. of Pulmonary and Critical Care Medicine, LSU Health Science Center (HSC)

**Presenters (in order of appearance):** (note: to go immediately to the presentation minutes for a specific Principal Investigator (PI), click on the hyperlinks below)

**Dr. Marc Levitan (Hurricane Center Introduction)**
**Dr. Ivor van Heerden (Meeting/Brief Project Introduction)**
**Dr. Jim Diaz**
**Dr. Ivor van Heerden**
**Dr. Nan Walker**
**Dr. Marc Levitan**
**Dr. Brian Wolshon**
**Dr. John Pine**
**Dr. Jeanne Hurlbert**
**Dr. Erno Sajo**
**Dr. John Pardue**
**Dr. Joannes Westerink**
**Dr. Martin Hugh-Jones**
**Mr. DeWitt Braud**
**Mr. Hampton Peele**

**Dr. Marc Levitan**, Director of the LSU Hurricane Center, gave opening remarks and introduced the Hurricane Center. He highlighted the main research goal of the Hurricane Center: to foster collaborative research allowing focus on large-scale, interdisciplinary problems, such as the Health Excellence Fund (HEF) project.

He highlighted some of the participating units/LSU departments and the collaborative research expertise of the center, including hurricane climatology, real-time data analysis for land falling storms; modeling of hurricane impacts on natural, built, and human environments; coastal sciences and engineering; and social science dimensions of disasters.

He also briefly discussed some of the Center's other current research initiatives, including hurricane evacuation and sheltering projects, support for state and local agencies such as the Louisiana Office of Emergency Preparedness (OEP), and education initiatives (e.g., Hurricane Engineering: A New Curriculum for a Planet at Risk, and Disaster Science and Management - a first of its kind interdisciplinary program created at LSU).

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Advisory Board members, Principal Investigators (PIs), and subcontractors were introduced.

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**Dr. Ivor van Heerden**, Project Director for the new ***Center for the Study of the Public Health Impacts of Hurricanes***, discussed the meeting goals: to first, engage the Advisory Board members in the project; and second, to introduce the project and the various PIs. Dr. van Heerden also briefly discussed the vision of the new Center and reviewed the flowchart/outline of the five-year public health project pilot study focusing on greater New Orleans (please refer to "HEF Center Awarded" .pdf file). The study is entitled, "<u>Assessment and Remediation of Public Health Impacts due to Hurricanes and Major Flooding Events</u>." He explained that the research under this project was funded by the Louisiana Board of Regents through the Millennium Trust Health Excellence Fund.

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**Dr. Jim Diaz** of the LSU Health Science Center in New Orleans gave a presentation on public health needs assessment following hurricanes & tropical storms, highlighting many of the specific waterborne diseases that may follow major hurricanes/flooding events.

- He stressed that <u>primary prevention</u> (i.e., diseases and injuries that we can prevent and vaccinate against) would be the main focus for the project in reducing the impact of waterborne diseases. Secondary prevention (screening and surveillance) and tertiary prevention (actual clinical medicine by nurses and doctors) would then follow.
- He discussed global temperature rise, and how a predicted 4º increase in climate would extend the domain for malaria and dengue fever (including other forms of these diseases from Central and South America) from the current 42% to 60% of the earth's land mass. In this scenario, tropical diseases would become endemic to many temperate areas such as the U.S. and Europe. Dr. Diaz has noted current cases of Dengue Fever and Malaria in New Orleans.

- Dr. Diaz stressed that drought, flooding and sea-level rise caused by a global warming scenario would all contribute to an increased incidence of food and waterborne disease (e.g., Vibrio Cholera, Cryptosporidiosis, etc.).
- Of direct concern to this project, Dr. Diaz mentioned that West Nile is a disease that follows heavy rains. In fact, he feels the epidemic of West Nile in Louisiana this year may be directly attributed to the early rainy season. West Nile hot-spots include north of Lake Ponchartrain as well as backyards where freshwater accumulation has favored the dominant freshwater mosquito vector. He also noted that average mean age of West Nile patients is lower than we've seen in the past (currently around 50-60 years of age).
- Dr. Diaz discussed the Pacific Decadal that began in late 2000. It is expected to last for 10-30 years and cause harsher weather patterns with an increased incidence of hurricanes and typhoons as sea levels rise. He set this against a backdrop where Louisiana is losing wetlands and sea-surface temperatures are rising (causing increased strength and impact of storms).
- Some common short term public health impacts Dr. Diaz noted following recent flooding events such as Hurricane Andrew and Tropical Storm Allison included: increased risk of disease due to crowding (or being housed with homeless); water contamination and resulting gastrointestinal disease; increased arthropod and animal vector diseases; snake and animal bites; and injuries (e.g., jumping off of roofs, motor-vehicle accidents). Some of the chronic health impacts included: upper respiratory infections, headache, chronic illness and stress. Of important note to the project is that there is a current asthma epidemic in New Orleans. Dr. Diaz also noted other public health consequences such as carbon-monoxide poisoning from people running their own generators following a loss of power.
- Dr. Diaz reviewed numerous waterborne organisms that have been encountered in the U.S. in both contaminated drinking water (e.g., Cryptosporidium (not killed by chlorine) and E. coli, among others) and recreational waters (e.g., Cholera (bad vaccine); and rotaviruses – of many kinds, which are very stable/stay in the environment for long periods, and which have no vaccines). He also mentioned Naegleria, a deadly protozoan that may be present in warm standing water.
- Dr. Diaz showed a slide of the top etiological agents in the US:

| ➢ <u>Bacterial</u> | ➢ <u>Viral</u> | ➢ <u>Protozoal</u> | ➢ <u>Coccidial</u> |
|---|---|---|---|
| • #1 *E. coli* 0157:H7 | • #1 "Norwalk-like Viruses" | • #1 *Giardia lamblia* | • #1 *Cryptospo-ridium parvum* |
| • #2 *Shigella sonnei* | • #2 Rotaviruses | • #2 *Naegleria fowleri* | • #2 *Cyclospora cayetanesis* |

- He concluded that <u>waterborne gastrointestinal illnesses</u> from fecal wastes (human & animal) and chemical-contaminated drinking water <u>will be the most common type of acquired disease following hurricanes & storms.</u>

- Dr. Diaz's early recommendations to alleviate some of the health impacts mentioned in his presentation include:
  - Ensuring boiled and bottled water advisories are made very early after flooding (before contaminated by petrochemical, crop run-off, etc.)
  - Realizing that petrochemical and similar spills will kill friendly microbes at the wastewater treatment plant and it should be anticipated that this will allow untreated wastewater to contaminate nearby water bodies;
  - <u>Mosquito-control</u> should be a top priority following major flooding events to reduce the incidence of related vector-borne diseases, and;
  - While there are both excellent vaccines and anti-venoms available for tetanus and snake/spider bites, respectively, stocks are currently inadequate. This is something we must try harder to prevent ahead of time since injuries and animal bites are so common following a disaster.

Dr. Diaz made two handouts available to members following his presentation. They included "Public Health Needs Assessment Following Hurricanes" and "Waterborne Diseases Following Hurricanes and Tropical Storms."

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*Following Dr. Diaz's presentation,* ***Dr. Ivor van Heerden*** *(Project Director) noted that the Army Corps of Engineers have estimated that it could take as long as nine weeks to pump out New Orleans under certain hurricane/flooding scenarios. Particularly under conditions of standing water, the human environment could be much more vulnerable to any number of the short and long term public health consequences discussed.*

Following a short break, Dr. van Heerden began to elaborate on the project in further detail. Copies of the project outline/flowchart were distributed.

Dr. van Heerden mentioned that following a major hurricane in New Orleans, he foresaw flooding as the principal public health threat - stranding large numbers of the population for significant amounts of time, while subjecting a vast number of evacuees to crowded and possibly unsanitary conditions.

Referencing the project flowchart of research activities, he discussed the first part of the project and how it will concentrate on creating <u>physical scenarios</u> to best determine "what we will have;" i.e., what the actual situation will be, including:

- Flood modeling and storm surge modeling that will demonstrate, for example, if there will be overtopping of levees;
- Computer modeling to determine other physical aspects of storms (e.g., wind models to determine how many, and to what extent, buildings may be affected);
- Sociologist surveys to work to determine how many people will leave, how they will evacuate and to where, etc;
- Traffic analyses to model evacuation efficiency;
- Digital elevation surface models (DEMs), Light Detection and Ranging (LIDAR) high resolution topography, and high-resolution aerial photography provided by the City of New Orleans, incorporated into a Geographic Information System (GIS). This GIS will be capable of displaying digital data to 1ft. x 1ft. resolution,

and potentially - by merging storm surge data with LIDAR data – allow users to look at flooding street by street;

- Models to determine what is potentially going to be in the water and air. Dr. van Heerden discussed the potential for flooding of chemical plants, and the fact that there are 7 superfund sites located in New Orleans. Inventories will be developed to pinpoint "what's out there," including sewage facilities, pipelines, etc. These will be integrated into airborne and waterborne fate & transport models to determine likely scenarios of "what we will have." Highlighting some areas of current research that he will be contributing as a Principal Investigator on the project, Dr. van Heerden discussed the pipeline inventory, which is one of the many complexities of the project. Two important points of note are that:
    1) the pipeline data is sparse, and
    2) there are weak points where pipelines cross levees that need to be modeled.
- Additionally, ADCIRC Models (see also, Dr. Joannes Westerink) will allow near-real time storm surge predictions when Louisiana is threatened by tropical storms. Dr. van Heerden noted that real-time data (e.g., wave height) from observation stations in the Gulf of Mexico (WAVCIS) can be incorporated into working models and be updated at three hour intervals.

Dr. van Heerden discussed in further detail the GIS being developed by members of the research team. He informed the group that access to this data will be available to all project members (with user name and password) via the internet. Members will be notified as soon as it is online and as new data is added or updated.

Some of the topics Dr. van Heerden hopes to explore utilizing the GIS include: vertical evacuation – is it a good idea, or bad? Also, what physical and sociological impacts can we expect from folks stuck on their roofs for days? By modeling numerous scenarios, he hopes to formulate realistic plans for mitigation and response.

Dr. van Heerden explained that following the modeling scenarios, Dr. Jim Diaz's team will be able to better assess potential physical health/medical impacts, using specific models to help them to determine the most appropriate actions. Social and environmental health impacts will also be better known.

He stressed that as we develop realistic modeling scenarios of the public health impacts of a devastating hurricane/flooding event in New Orleans, the results are likely to strongly support/ be an impetus towards initiatives for coastal restoration. He discussed specific mitigation projects that have already been designed, that if implemented might significantly reduce New Orleans' vulnerability to hurricanes.

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**Dr. Nan Walker** of the LSU Earth Scan Lab (ESL) discussed some of her current research and capabilities in Remote Sensing applications. She discussed the Earth Scan Lab's three different antennae that can receive numerous channels of data from various satellites to track hurricanes, ocean currents, and many other parameters.

Some of the satellite data she discussed included data accessed from NOAA AVHRR; Orbview-2 SeaWiFS – which can be used to map changes in ocean color, (e.g., chlorophyll a and sediment); Terra and Aqua MODIS - which can be used to map water quality parameters, flooded areas, and high resolution air atmospheric data; and Oceansat OCM - which is capable of producing higher resolution color images. GOES-8 GVAR satellite data may be obtained every three hours to obtain satellite images of the earth, with images of the Northern Hemisphere available for hurricane and storm tracking every 30 minutes. Synthetic Aperture Radar (SAR) data is also available from RADARSAT SAR and ERS-2 SAR satellites.

Dr. Walker mentioned that the ESL has a workstation at the Louisiana Office of Emergency Preparedness (OEP) where they often provide remote sensing with MODIS for updates to hurricane tracking.

She noted the ESL, established in 1988, funds a lot of work by providing information to the oil & gas industry, who are very interested in ocean storms in regard to their gulf and ocean pipelines.

Dr. Walker discussed that temperature is a key parameter that may be mapped and used on the public health project in New Orleans. For example, the temperature of the Mississippi River can be mapped (e.g., using Terra MODIS). In other specific applications, day and night temperature differences were mapped while tracking Schistosomiasis (a waterborne parasitic disease) in Egypt. Water temperatures can also be tracked during flooding events. Therefore, such data may be useful when looking at other waterborne diseases that have direct relationships with temperature or moisture.

Turbidity/suspended sediment, another key parameter, can also be seen and mapped utilizing satellite data from Orbview-2 SeaWiFS or MODIS. Different channels may also be used to view additional water quality parameters, such as algal blooms (chlorophyll a).

For higher resolution data, Oceansat OCM is capable of mapping flooded areas, oil spills, fires, vegetation change, harmful algal blooms, coastal circulation and fronts, and water quality. This is particularly useful for emergency response applications (e.g., utilizing thermal channels to detect fire[1], and other visible channels to track smoke plumes and oil spills). Terra MODIS applications can also detect smoke and haze, as well as aerosol detection (e.g, at 250 m resolutions) and thermal detection (e.g., at 1000 m resolution).

MODIS also provides 250m - 1 km resolution imagery to track water mass movement, coastal currents and water clarity, as well as suspended sediments and harmful algal blooms. The high resolution MODIS imagery can detect and track distinct water masses such as the river waters in areas of the Mississippi River diversions. A current project that the Earth Scan lab is involved is the EPA's EMPACT program, where sediment loads from the Davis Pond diversion are monitored and mapped using MODIS data (http://www.esl.lsu.edu/research).

Dr. Walker described true color products that use three channels to produce images similar to what our eyes see.

[1] Fire is often an unexpected but major consequence of extreme flooding events. Fires can be triggered by ruptured natural gas lines, oil slicks, downed power cables, generators, and other ignitable or combustible materials or containers that have been damaged by floodwaters.

She also discussed some of the main radar (X-Band) applications, which are also capable of mapping flooded areas and detecting and monitoring oil spills. Dr. Walker discussed that this is one of the main goals of remote sensing in the public health project. To map flooded areas and oil spills during major flooding events, radar data must be used due to the usual cloud cover during storms that which other satellites are unable to penetrate. Synthetic Aperture Radar (SAR) data specifically works through the use of microwaves to map the defined parameters.

Dr. Walker explained that the ESL will also provide remote sensing data for model validation, with the capability of obtaining real-time data. By using case study events and archived RADARSAT SAR images, they will be working to generate before and after images to determine the spatial extent of flooding vs. time (e.g., rising and falling water). Particularly, using photo-infrared, the ESL will be able to detect and map water vs. land.

Dr. Walker discussed four of the main sources where she will work to obtain/generate satellite data to be used in the public health project, including:

(1) RADARSAT-1 SAR Flood Information which can acquire data from archive OR which can be requested in real-time (8-100m resolution)

(2) Potentially free SAR data from the NOAA ADRO-1 Project: coastal and river flood mapping data access project

(3) ESL SAR direct reception and processing (which should be operational by year 2)

(4) Flood mapping with MODIS and Oceansat data (250-360m pixels)

She discussed that in the future, the ESL will have the capability of receiving and processing X-band high resolution all-weather day/night radar images.

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**Dr. Marc Levitan**, Director of the LSU Hurricane Center, discussed wind and flood damage modeling and some of the research topics he will be addressing for the project. They are specifically: wind damage threats to petrochemical and chemical facilities/ pipelines, and hurricane sheltering issues.

From a structural engineering perspective, Dr. Levitan discussed the contrast between earthquake engineering - which has been widely researched and implemented in state building codes – and hurricane engineering which has not been nearly as funded, researched, or implemented. This has resulted in both the technology and the building codes lagging behind in efforts to ensure industrial and residential structures survive hurricane hazards, such as: storm surge/waves, extreme winds, (often with tornadoes that form on the periphery of hurricanes) extreme rainfall, freshwater flooding, windborne debris, and wind scour (e.g., on pipelines or petrochemical/chemical facilities that have the potential to cause a hazardous chemical release in a major storm event).

Dr. Levitan discussed wind & flood damage modeling of petrochemical facilities. He believes many problems will be faced by the smaller plants since they often lack the organization and infrastructure of the bigger companies.

He stressed that petrochemical facilities are more vulnerable to hurricane hazards than previously thought. First, the wind volume on these often complex structures is not well understood. Second, *flood* threat is rarely seriously considered in their design.

Areas of study that will require additional focus for this study will address "how does wind interact with complex structures," and also, the impact of storm surge on these facilities.

Dr. Levitan also discussed how coastal land loss is "bringing the storms closer in," thus increasing the storm surge beyond what most facilities were previously designed to withstand. Wind speeds are also increasing as the winds move over more open water. Many facilities either were before, or are now, under-designed for the loads and wind speeds they are likely to face.

He went into further detail on the complex aerodynamics of many of these petrochemical and chemical facilities (e.g. open frame structures, pipe racks, and a variation of other factors). In fact, structural engineer's estimates all vary on the aerodynamics and resulting wind loads of even the most basic of these structures.

Dr. Levitan then discussed sheltering issues and potential for loss of life. He noted that schools sometimes perform terribly as shelters. He showed photos of school "shelters" following Hurricane Andrew where the building had collapsed into the interior corridors (where people usually shelter in place); and school gymnasiums where the tall, un-reinforced masonry walls had completely collapsed from high winds.

He stressed that most buildings are not designed to withstand the windborne debris/projectiles of a hurricane. In Category 3-5 storms or tornados, most buildings perform poorly for vertical evacuation. Although they generally do not experience a complete/structural collapse, windows will break out and the wind/rain will penetrate the building. In reality, the first few floors of the building are usually lost (as a shelter) to flooding, the next floors will likely be hard-hit with high-speed debris/projectiles, and now, mean wind speed profiles demonstrate that wind pressures are much larger on the top/higher stories than originally believed. These wind pressures are most often greater than the building was designed for, making the higher floors a poor shelter option as well.

Working with Jim Diaz, Dr. Levitan will work to provide estimates of direct casualties expected due to injury from windborne debris and related wind hazards. To do this, Dr. Levitan will be providing wind and flood damage modeling (to buildings) and provide data to develop models for direct injuries and deaths due to building collapse, flying debris, etc.

Related projects he will be working on include: shelter assessment and design; performance-based design for wind; and tying building codes and flood requirements to hurricanes.

Meeting members broke for lunch.

**Dr. Brian Wolshon**, LSU Department of Civil & Environmental Engineering, discussed Evacuation Traffic Modeling and Analysis and some of his related research areas in transportation. His particular areas of expertise include: traffic flow; highway design; and highway safety to expedite traffic flow and evacuation.

Dr. Wolshon had found during a research survey following Hurricane Georges (1998) that the state Department of Transportation and Development (DOTD) had relatively no role in hurricane evacuations or emergency management at that time. After Hurricane Floyd, this changed dramatically.

Dr. Wolshon distributed the "National Review of Hurricane Evacuation Plans and Policies" brochure (this is also available online at the LSU Hurricane Center website, under transportation engineering publications: www.hurricane.lsu.edu).

He discussed the term "shadow evacuation" which occurred during Floyd (namely, over half of the people who evacuated really didn't need to be on the road). This created undue congestion and tied up interstates along huge stretches of coast.

Some of the areas Dr. Wolshon is currently focusing on for this project, and for other projects, include: maximizing existing transportation infrastructure to maximize flow capacity; improving communication and the transfer of data (both ways, i.e., getting information *in* to decision-makers, and getting information *out* to evacuees); and the idea of "contra flow" or reverse-laning (converting all traffic lanes to outbound), particularly to aid in an evacuation.

Studying evacuation routes out of New Orleans has been an interest of Dr.Wolshon's well before he became a part of the public health project. He discussed some of the current evacuation options for the city, and the use of contra flow for areas such as beyond the spillway on I-10 west. He mentioned that although contra flow seems like a good concept, it has really never been tested except in one or two unplanned scenarios. Some of the main questions with contra flow involve when to begin it, when to end it, and the duration to keep it open.

Dr. Wolshon will be working with traffic flow models/simulations to prepare estimates of the number of vehicles that can move through certain points, how long it takes for traffic to build up in certain areas, and where to anticipate traffic problems/jams. One question he will focus on is how much difference in traffic flow may be expected in a contra flow situation.

He also briefly discussed the benefits of potentially using real-time or near real-time data in the models to anticipate traffic problems. He will be looking into getting this capability developed. He showed an example Traffic Data Recording Station and a USGS Louisiana HydroWatch Data Acquisition Station.

Dr. Wolshon discussed that for traffic flow models/simulations to be useful, they must be valid. Since we have never used reverse-flow before, he acknowledged that this introduces questions with modeling the different conditions (e.g., no signs, no safety devices, people are traveling the "wrong way" in possible hurricane conditions, etc). While validating models is difficult, he discussed that the transportation lab *can* study things like the flow out of a LSU football game in which they do some reverse-laning. Additionally, he can also compare notes with a research student working simultaneously in Washington, DC who is involved in a Federal Highway Administration Study (FHWA) studying traffic flow in and out of the DC metropolitan area.

Dr. Wolshon brought up one possibility that people may get upset and not want to follow directions in a crisis situation.

*Mr. Jesse St. Amant, of the Plaquemines Parish Office of Emergency Preparedness (OEP)***,** *mentioned that emergency preparedness officials are aware of many of these evacuation problems, but that they still need to be addressed, particularly: when to begin and end contra flow if it is used.*

Dr. Wolshon replied that a number one question would indeed be when to start and end contra flow. He explained that during the recent Hurricane Delaney exercise at the Louisiana OEP, this was demonstrated to be a big question, i.e., "should we wait until traffic builds up to a certain point before we begin contra flow, or by that time, is it too late to institute it?" particularly given the estimated two hours delay needed to clear inbound lanes and change everything over.

*Dr. Tony Speier, Louisiana Department of Health and Hospitals (DHH), Office of Mental Health, brought up the seeming "zero-tolerance" by police for accidents in an evacuation. He asked Dr. Wolshon if his traffic models will somehow account for the anticipated high stress environment and unnatural situation drivers will be in, and the likelihood of a much higher number of accidents.*

Dr. Wolshon mentioned this is certainly a concern, and a challenge for the model. He mentioned that state police in Louisiana have a plan set up for "pre-positioned wreckers," and that their main objective is to "move people out," so they will shove any and all obstacles out of the way in order to do so.

*Mr. St. Amant commented that contra flow was an idea originally fought by the OEPs because it is extremely labor intensive. Yet, he believes it is the only solution to get as many people out as possible. He again stressed that timing was a very serious component of evacuation.*

Dr. Wolshon mentioned that the DOTD & U.S. Geological Survey (USGS) are working together on a pilot project system to monitor both traffic and weather called the "Hazard Traffic Management System," and they are in the process of setting up monitoring stations across the state and city.

*Mr. Lawrence Nichols, DHH, Region I, commented that for Hurricane Hugo outside Charleston, SC, there were evacuation problems on interstate I-26 while attempting contra flow, and that this was on an interstate that was a relatively straight shot. As it turned out, over half of the evacuees, even though warned of the hurricane, had not filled up their gas tanks, gas station attendants were gone when evacuees tried to fill up, and/or* *the evacuees did not have money available to buy gas. He said people were therefore stalling and causing many traffic back-ups. In Louisiana, he stated this would be a large problem in the cases where there is no median.*

Dr. Wolshon added that Hugo's poor contra flow situation outside of Charleston may actually have further resulted from people breaking over into the reverse lanes on their own and then having no place to exit in the contra flow.

*Mr. St. Amant described that the OEP's have had similar battles with evacuation issues. He noted an attempt to get a high-speed monorail in New Orleans to no avail.*

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**Dr. John Pine,** LSU Department of Environmental Studies, gave a presentation on vulnerability and consequence assessments for environmental health. He mentioned that he will be teaming up with Dr. Erno Sajo of the LSU Physics Department to model man-made chemical hazards, and with Mr. Hassan Mashriqui in flood modeling.

Dr. Pine commented that some exciting opportunities may be available in linking with Federal Emergency Management Agency (FEMA) and Department of Defense (DOD) modeling efforts.

He began his presentation by saying that while we (in developed countries) are generally doing a good job in saving human lives, we are doing a poor job in preventing personal property losses (the financial toll of disasters) as well as in understanding/responding to human exposure to associated hazards. Death tolls are therefore decreasing, but the hazard consequences are not.

Dr. Pine defined both Risk Assessment - the process of evaluating risk in association with a specific hazard – and Vulnerability Assessment, which looks at the *potential impact* that a hazard can have. In his research he will be looking at both man-made and natural hazards.

He discussed that ultimately, what we need to extract from the many components of the study are the *consequences* we can expect from such threats as chemical or natural hazards. To do this, much more detailed information is necessary, (e.g., how old is a building? What is it made of? etc.).

Dr. Pine also explained Consequence Assessment. Once we have specific information to input into models, we can come up with probabilities (e.g. fatalities, damage to property, etc.). For example, a chemical dispersion model he is working on with Dr. Sajo will provide the probability of impact in terms of people with exposure. By changing the exposure limit in the model, different outcomes will result. Dr. Pine gave a similar example in consequence assessment involving an earthquake model used by FEMA.

Formal definitions:

> <u>Risk Assessment:</u> A process for evaluating risks associated with a specific hazard and defined in terms of its nature and frequency of occurrence, magnitude, severity, and impacts.

Vulnerability Assessment: Determining the potential for loss or the capacity to suffer harm from a hazard as applied to individuals, society, or the environment.

Consequence Assessment: Anticipating the adverse impact (damages) that can be quantified by some unit of measure (often in economic or financial terms including injuries and losses of life, property, environment, and business).

Dr. Pine then discussed the three areas we generally look at in regard to hazards and their impact: social, economic, and environmental. Most studies have focused on the social impacts of hazards, while a few have focused on the economic impacts. Meanwhile, environmental impacts have been virtually neglected. Dr. Pine discussed the types of information that can be obtained and measured to evaluate impacts in all three areas:

- Social – from both census bureau information (e.g., age distribution, disabled or homebound, etc.) and public and mental health records (e.g., the number of people going to clinics, premature births, etc.)
- Economic – from public records, information can be obtained regarding infrastructure, transportation, telecommunications, and utilities (sewer, water, etc), such as business volumes and locations, the number of employees that work on-site, etc. Following disasters, historical data can provide details on business interruption, transportation infrastructure closed or impacted, utilities affected, and property destruction or contamination.
- Environmental – data can be obtained in areas such as air quality (chemical emissions), impacted water features/vulnerability of the local drinking water, impacted fishing areas, forest or agricultural production output, and vulnerable wildlife areas.

Dr. Pine commented that in most cases, people under-estimate their exposure to risk or potential for loss. Additionally, in many cases the public does not prepare well for disasters, and they will rely heavily on emergency response personnel once disasters strike.

He stressed that we need accurate models to determine both vulnerability and consequence. One positive note is that models are getting more and more accurate because of better and more complete data (e.g., we can generate a 3-D image of the New Orleans landscape and count buildings with aerial photography, etc.). For example, he mentioned that the New Orleans and Baton Rouge urban areas have been proposed as beta test sites for the Defense Threat Reduction Agency's (DTRA's) Hazard Prediction and Assessment Capability (HPAC) urban dispersion and chemical facility modeling programs.

Dr. Pine went into further detail about how he is looking forward to the release of other current projects in consequence modeling, such as:

- FEMA's recent Hazard United States (HAZUS), due for release in the fall. This incorporates a flood and storm surge model, and to our luck they have designated New Orleans as the test site.
- DOD's $26 million urban modeling and wind dispersion model (above)

He stressed that communication - getting the right information to the right people at the right time - remains an enormous challenge in his research area.

Dr. Pine closed by saying sustainable communities were the goal.

*Mr. St. Amant brought up the potential value of these models to applications in consequence modeling for terrorism/national security issues and hazards in Louisiana, something they have been working on for years. He looks forward to consequence models that can bring critical information to light, since this would be a great value to decision -makers and the public in terms of security.*

*Dr. van Heerden responded that indeed the public health project and incorporated models were intended to be useful and exportable for terrorism and other public health threat scenarios.*

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**Dr. Jeanne Hurlbert**, of the LSU Department of Sociology and the Louisiana Population Data Center, discussed her current research in social and evacuation issues and how these relate to her role in the project. She is collaborating with Dr. John Beggs and a colleague in Calgary, Canada on the public health project.

Some of the sociological questions her team works to understand include:

- How do social contacts affect how people respond to disasters?
- What are the effects on outcomes? For this project specifically, what are the effects on the non-economic (health) outcomes?

Dr. Hurlbert discussed that her focus is primarily on social networks (which are personal), though they also look at the way in which community level networks have effects. She defined a network as, “basically everybody you know or everyone with whom you are connected with in whatever context.” She went on to describe that networks for most people are large, so for the project Dr. Hurlbert’s team will be sampling only parts of networks using surveys. These surveys might ask participants to describe some characteristics of network members with whom they socialize (e.g., age, education, how close they feel to this person, etc.). With this information, Dr. Hurlbert can then determine both the structure and composition of the participant’s network.

Some characteristics that Dr. Hurlbert looks for in a network include:

- Size
- Density of networks – (e.g., you have a high density network if the people who you know also know each other)
- Range of networks – (the opposite of density, e.g., you have a great range in network in the people you know *do not* know each other).
- Diversity

Being able to describe networks can provide a great deal of insight into how people are likely to respond in a disaster situation and what support they will receive, etc.

- For example, Dr. Hurlbert explained that in dense networks, people in the network have close ties, and are similar to each other. These people will provide social support, and give more *"instrumental" help* (i.e., help getting things done, first aid, fixing the roof, taking care of the dog, etc.) They will also provide "expressive" support such as talking.

- Conversely, people in <u>wider ranging networks</u> – where people are not so familiar or connected – tend to be better at *getting information*. Dr. Hurlbert used the example of the job search. In this situation you might reach out to people with whom you are not so familiar, since they may have access to information or resources that you wouldn't otherwise have access to. People in a wide-ranging network can provide both information and resources that you don't already have (e.g., telephones, transportation, access to FEMA or the Red Cross).

In terms of outcomes – particularly following disasters - Dr. Hurlbert stated that people with strong networks (in both density and range) will be better off psychologically. She also believes that they will have better access to information and other resources/support.

Dr. Hurlbert emphasized that networks are critical for Southern Louisiana.

She also discussed that structures of networks are very important in determining who will get help, and where people will go for help. One question she is looking at is what affect poverty will have on the help a person will receive.

Dr. Hurlbert has studied (and continues to study) social and community networks and their roles following Hurricanes Andrew and Georges, such as how these networks affected the formal support people received (i.e., from FEMA, the Red Cross, or churches).

Her team's primary role in the project is a **survey to assess social and economic resources in the city**.

She also discussed a number of other specific areas of focus for the public health project. One includes evacuation. For example, under Hurricane Georges (which was the biggest evacuation in history), she has studied questions such as, "Did people evacuate?" and "Where did they go?" etc. She is working with Dr. Chester Wilmot, LSU CEE Dept./ Louisiana Transportation Research Center (LTRC), to put together certain hurricane scenarios and survey under what conditions people will and will not evacuate.

Other areas of focus for her team include understanding the population's vulnerabilities, (e.g., the chronically ill, social and mental health (depression), etc.). She will be asking additional questions such as, "Do people have flood insurance?" and, "Do the poor have access to resources?" Dr. Hurlbert will also be studying related sheltering issues.

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**Dr. Erno Sajo** of the LSU Physics Department spoke next on his work to develop models to track the transport and fate of airborne contaminants. His role in the project is specifically: release modeling and uncertainty assessment. He is currently working on spatial uncertainty assessment due to local fluctuations in pollutant concentrations and on dispersion modeling of aerosols.

He will be involved in determining the <u>atmospheric impact of chemical and other hazardous releases</u> to assess the resulting threat to surrounding populations. To do this he will be developing realistic models of source terms that are expected to occur in extreme wind conditions or in related transportation accidents, and then simulating the downwind impact of releases by varying some of the input parameters (such as the type of release, wind speed, wind direction, duration, among others) to gain hazard estimates under different conditions. He aims to properly model both the source and the atmospheric conditions in such scenarios to better anticipate and be prepared for hurricane and other disaster threats.

Dr. Sajo discussed that releases can occur from transportation, storage, and process accidents. He has already started to collect information on typical tank sizes, fill-levels, transportation modes, and related data, to input into fate and transport models. As one of the products of these efforts, he stated that a GIS mapping of the hazard areas will be imperative. To these ends, a close collaboration is maintained with other faculty participating in the project, especially with Dr. John Pine of LSU. He discussed that he will also be working with Dr. Nan Walker of the LSU Earth Scan (Remote Sensing) Laboratory to possibly use historic/archive data to calibrate models.

He briefly discussed the need to study and model the following:

- Various release mechanisms, most notably the type of sheer, or breach on a tank resulting in a disastrous loss of content or in a slow release; the conditions of tank fire and their resultant methods of release.
- The role of atmospheric conditions, particularly the importance of cyclic wind conditions and turbulence intensities, and
- The physico-chemical properties of released substances and their thermal hydraulic behavior while under the influence of the source term, and during dispersion phase.

Dr. Sajo discussed some of the advantages and disadvantages of current models and why they will or will not work for specific tasks. For example, some atmospheric dispersion programs assume that the modeler has all the data needed to determine the source term (such as momentum and buoyancy fluxes) and they are ready for input. In other cases the computer program refers the user to another program to obtain some of the input data. In reality, it is rarely the case that all of the necessary input data are available, and in most cases the real source term is radically different from the source that the model can handle. A further important limitation that most computer models entail is that they are not designed to handle hurricane winds. Even if the model accepts high wind speeds, hurricane meteorology is not implemented in the underlying code.

In this regard, Dr. Sajo briefly discussed the capabilities of the Hazard Prediction and Assessment Capability model (HPAC), and the chemical and climate-specific hazard zone mapping facilities of the Consequence Assessment Tool Set (CATS), both developed by the US Defense Threat Reduction Agency (DTRA). He pointed out that while HPAC, which is the most advanced dispersion model currently available, seems to be suitable for a comprehensive hazard assessment, including uncertainty handling, its data requirements are daunting and it cannot be reasonably expected that most of the needed data are available for the modeler under hurricane conditions. Other models whose data requirement can be met, will not handle uncertainties. Only a couple of models can address aerosol release, which is a predominant release mechanism from tanks under pressure. In those codes, only static aerosol behavior is implemented.

Dr. Sajo's recent work in this field has focused on uncertainty assessment and aerosol dispersion mechanisms. Since the start of this project, an algorithm for ascertaining spatial uncertainties due to local fluctuations in pollutant concentration has been developed and is planned to be implemented on existing dispersion models. In aerosol dispersion, where much of his prior funding was received from the Department of Energy, he is focusing on the dynamic behavior of particles. He is currently developing a computer model that can account for the most important governing phenomena using first principles. Some of the results in this area were presented in this meeting.

Dr. Sajo then ran a series of computer simulations, including a simulation of an actual tank fire that occurred in Harvey, LA as a result of a lightning strike during tropical storm Allison. The model compared the behavior (release rate, temperature, density, etc.) of the source term in actual conditions vs. normal winds. The role of the aerosol formation was also discussed. He pointed out that coagulation may not be neglected when aerosols are formed within the tank, and conversely, in some circumstances there may be a break-up or de-agglomeration of previously coagulated particles depending on the shear stress that high-wind conditions may entail.

*Dr. Lawrence Nichols of the DHH commented that this work is certainly needed in the areas of marine transport (e.g., barges, barge scenarios, and associated types of releases).*

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**Dr. John Pardue**, Director if the Louisiana Water Resources Research Institute (LWRRI), then gave his presentation. He mentioned that although he and co-PI Dr. Danny Reible [Director of the LSU Hazardous Substance Research Center (South and Southwest)], have recently been more heavily involved in such areas as site remediation and hazardous waste, their role in the project will involve water contaminant transport modeling for chemical/hazardous substances (Hazardous waste sites will first be identified by the Louisiana Geological Survey (LGS)). Dr. Pardue and Dr. Reible will work to determine the types of exposures and risks for people trapped in flood waters and for emergency responders on the scene.

One of their additional objectives is to provide estimates of exposures that will occur near spills. This will aid emergency responders in determining in advance the proper level and type of emergency equipment necessary for specific scenarios.

Dr. Pardue discussed some of the specific areas he and Dr. Reible will be focusing on for the project:

- One area involves evaluating the integrity of the water distribution system for the study area. He would like to answer questions such as "How quickly does a contaminant moving into that system result in a lack of clean water?"
- He also stressed that some of the best-documented failures have been in the wastewater arena, prompting many of the large projects we are seeing statewide to rebuild and restructure sewer collection systems. Most often, leaky pipes are being infiltrated with storm water.
- Finally, they will be looking at the types of chemicals stored within the boundaries of the study area, and characterizing their properties (i.e., are they

"sinking" or "floating" chemicals - where will they exist in the floodwaters) to better identify typical human exposure. He made the point that in a flood it is possible to wade blindly into an area not knowing that sinking chemicals (e.g., an acetic acid or chlorinated solvent) is residing near the ground.

Dr. Pardue ran a demonstration of a publicly available modeling tool called EPANET, which can model contaminant transport in a water distribution system. He explained that this model can be used to provide insight on problems system-wide. EPANET takes into account the demand patterns for water at specific "nodes" (e.g., hospitals, schools, homes, etc.). The program can then estimate the period of time it takes for a contaminant to travel through a system; follow how the chemical or other substance moves; and determine the extent to which a chemical is likely to be diluted, among other variables.

EPANET is typically used to determine problems with variables such as pressure, potential leaks, and chlorine residual across a water distribution system. Dr. Pardue mentioned that EPANET may now also be used to support system security issues for homeland security.

He briefly mentioned an upcoming technology that could place camera-like sensors across water systems to monitor microbes. The system would be able to immediately alert operators if the microbes were harmed, indicating a contaminant had entered the system.

Dr. Pardue discussed in detail why wastewater collection/treatment facilities are one of the major problems in the study area, as well as in other major cities. Due to the level of infrastructure involved - and in part due to design - he explained that <u>sewage releases to the community following major storms are certain</u>. In short, regardless of what we do, we are going to have sewage releases to the community following these events. He commented on the Baton Rouge and New Orleans areas particularly - which rely so heavily on pumping stations – that in the event of a power outage we can expect certain releases.

Dr. Pardue discussed how electricity was key to the pumping station problems during Hurricane Floyd in North Carolina.

He discussed some of the water release modeling and exposure scenarios he expects to see. One high priority task is to identify the sinking chemicals, their storage locations in the study area, and other critical chemical properties and interactions. This is important not only for the safety of those walking through flood waters to evacuate, but for emergency responders.

Dr. Pardue identified "floaters" such as diesel and gasoline slicks on the water surface as the most likely chemicals we will see following a major flooding event. He predicts the most common source will be from abandoned tanks, which are both poorly designed and poorly regulated in terms of hurricane risk for spills and contamination. He stated that although some sites have updated spill plans, they usually consist of basic retaining walls that do not prevent releases during major flooding.

Dr. Pardue discussed that he will be using other chemical engineering strategies and models to track the fate and transport of chemicals. He will also be putting together a database of underground storage tank (UST) locations for the GIS, as well as documenting the extent of exposures (e.g., rash, burn, etc.) caused by chemicals common to the study area.

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**Dr. Joannes Westerink,** University of Notre Dame, gave a presentation on the Advanced Circulation Model (ADCIRC) storm surge model, and additional modeling capabilities/software being developed by his team. He is currently working with a related model for the New Orleans District, Army Corps of Engineers.

Dr. Westerink has received much of his funding from the National Science Foundation (NSF), U.S. Army, and U.S. Navy for hydrodynamic model development. He mentioned that much of his global work has been driven by a need to address problems similar to that of the current study (New Orleans public health project).

He gave an overview of the modeling effort in Southern Louisiana. He mentioned that National Weather Service (NWS) modelers are another team that work along the U.S. coast to model hurricane storm surge. He briefly discussed the difference in modeling strategies and therefore capabilities between the two models [The NWS and National Hurricane Center use models such as the "Sea, Lake and Overland Surges from Hurricanes (SLOSH)"].

<u>Discussion of the model</u>

- Dr. Westerink discussed the computational domain of the ADCIRC model which incorporates a large section of the North Atlantic, the Gulf of Mexico, and sections of the Caribbean Sea. He explained that this allows for greater ease in setting boundary conditions, which he identified as a difficult component of modeling;
- At the same time, the model allows for the capture of very complicated physics along the coast/shelf. He showed a bathymetry profile map of the study area and surrounding continental shelves;
- He discussed his teams implementation of the "finite element model" to provide greater local resolution (3D) within the large domain;
- He discussed the model grid structure, and that approximately 85% of the resolution is in Southern Louisiana. The remaining 15% of the resolution covers areas outside, giving his team the ability to specify boundary conditions accurately and easily. Dr. Westerink stressed the importance of boundary conditions, stating, "…you can't come up with accurate computations if you can't specify boundary conditions correctly." He noted that the grid provided course, approximately 25 kilometer (km) resolution in the deep ocean, but much finer resolution along the coast and continental shelves. He explained that with the processes of hurricane storm surge, the complicated physics take place at the shelves, so this is where you need the resolution. He mentioned that the levee systems are incorporated into the model – and are critical to calculations.
- This particular model is "coupled" - the data/computations are 'talking' or tied to each other - unlike a "nested" model, where larger models run smaller models as in many of his other projects.

Dr. Westerink demonstrated the high resolution and greater number of nodes in areas of interest. He used the motto "the solution to correct numerical calculation (for storm surge modelers) is resolution*." (Mr. St. Amant chided that in South Louisiana we also have the motto, "elevation is our salvation!").* Dr. Westerink zoomed in on Lake Pontchartrain and the Mississippi River to demonstrate how the grid structure gets finer and finer in critical areas.

Dr. Westerink then demonstrated historic storm animations (hindcasts) of Hurricanes Betsy (1965) and Andrew (1992) for the group (these animations, along with 2002 storm information and experimental storm surge models for Tropical Storm Isidore and Hurricane Lili in Louisiana, are now available online at: http://hurricane.lsu.edu/floodprediction).

He noted that his team had generated the weather using a planetary boundary layer model specifically developed for the oil industry (which simulates close but not exact conditions) and for the Betsy hindcast, included levees at 1965 height (He noted that the levees were actually raised in response to Hurricane Betsy). He ran timed simulations (in hour increments) of storm surge and flooding during each Hurricane. Dr. Westerink compared the model output to historical flooding maps. He also compared his calculations of the areas flooded and the extent of flooding in the simulation vs. historical records (e.g., hydrographs) of the actual event. The results were nearly one to one for predictions based on the model vs. actual events in many select areas across Southern Louisiana.

He briefly discussed peak surges, response gradients, and some of the more technical/ mathematical fine-tuning involved in calibrating the model for higher resolution. [Please see www.nd.edu/~adcirc/main.html for more detailed information on ADCIRC]. Dr. Westerink invited comment on the overall modeling strategy.

*Mr. St. Amant commented that having information on predicted storm gusts would be a helpful component to the model. He discussed how during Hurricanes Danny (August 1985) and Andrew, the category rating of the storms was not always reflective of the actual damage sustained by certain areas due to the higher wind gusts.*

*Mr. Terry Tullier, New Orleans Parish OEP, agreed that this information would be relevant and helpful. He also asked if Hurricane Georges (1998) could be modeled having not taken the turn to the north [This has been modeled by the LWRRI and the slide is available from Dr. Joe Suhayda or Dr. van Heerden. However, it has not yet been input or simulated by an ADCIRC model].*

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**Dr. Martin Hugh-Jones** of the LSU Veterinary School then discussed epidemiology and animal issues.

He began by saying one of the main problems he foresees in a New Orleans hurricane scenario (from the vantage point of his research area) involves keeping people *out* of the city once they have evacuated. He mentioned that often, people will sneak back to rescue their animals (dogs, cats, horses, etc.). He therefore perceives one of his first priorities to be looking at efficient evacuation strategies that will get people out of the city, and preferably with their animals.

Working through the DHH, Dr. Hugh-Jones and his team will be mapping all 180+ veterinary clinics in New Orleans, and compiling their contact info by contacting them via telephone. Later, using a postal survey and TV ads, he will be working to determine how prepared area vets are for hurricane and flooding disasters. Some of the questions he will be asking in the survey include:

- asking if the clinics have generators for emergency power;
- asking if they have vehicles and/or boats;
- finding out the drug supply & food they typically keep on hand
- determining clinic occupancy;
- asking what type of clinic equipment they have; and
- discussing their expertise in veterinary medicine.

Dr. Hugh-Jones would ultimately like to be able to implement the GIS to locate New Orleans/area veterinary clinics; determine their infrastructure; and then - by demonstrating potentially flooded areas through modeling provided by other researchers on the project – to discuss the possible scenarios with area vets. He would like to see <u>the clinics design and develop their own emergency preparedness procedures and goals</u>. He stressed that it was very important that vets play a large role in the development of any emergency response plan, since they are the ones who are going to be implementing it. Particularly, by demonstrating to them the various disaster scenarios (e.g., possible storm tracks and associated flooding/hazards), he hopes they will work together and volunteer to assist in the capacity that they most able if they cannot stay (e.g., transfer drugs or equipment to another facility, etc.).

Dr. Hugh-Jones mentioned the possibility that in an emergency, humans might need to be moved into vet clinics as a last resort for medical care.

Dr. Hugh-Jones commented that "no one reads instructions." Alternately, he emphasized the need for easy access to possibly web-based information for emergency responders, vets, and the public. He also feels that for vets to be a large part of the solution, not only must they have a large input into the emergency response plan, but there must be collaboration *well before* the day/situation arrives. He would also like to consider other events, ask vets what they *wish* to do, and what they actually *will* do, when the time comes.

He discussed the various animal populations and locations across the study area, including zoos, animal refuges, racetracks, and working farms (e.g., horses, pigs, goats).

He discussed the idea of vet and client training, and "Survival Packs" or "Evacuation Packs" which vets could distribute to their clients far in advance, containing necessary items such as medicine, emergency supplies, and lists of needed to-do items (e.g., the amount of food to store, evacuation or shelter/kennel numbers, etc.).

Prior to conducting a postal survey on the zoographics (companion and animal populations), Dr. Hugh-Jones discussed that his team will look to the models generated by the other researchers on the project to narrow down the areas where they will focus their efforts. One way that they will estimate the animal populations of these and other areas is through census data (e.g., data for numbers of households with animals).

Animals to be included in the survey may also include pets such as snakes, spiders, and others.

Dr. Hugh Jones discussed the proposed National Guard's emergency "tent cities" for household pets and that some shelters may not allow pets or animals. For this reason, people should have plans made far in advance to accommodate their animals. The public will need access to information on the general occupancy and availability of kennels in their area and elsewhere upstate, contact information, and where they can drop off their animals if they need to. He mentioned that if animals will be allowed in such tent cities and shelters, funding needs to be incorporated into these to pay for fresh animal food and management of the animal population (e.g., pet waste, veterinary attention, etc.).

He discussed that if New Orleans floods, there could be months where the city is out of communication, and/or will be involved in a massive clean up. Food and other supplies for animals, unless pre-determined, could be one of the lower priorities following a disaster and should therefore be planned in advance.

He discussed that following disasters, there are "rescue vet teams" sent out to rescue animals. However, Dr. Hugh-Jones noted the sad statistic that 40% of rescued animals are never reclaimed!

*Mr. St. Amant discussed some of the animal issues he and emergency operations personnel have encountered during recent floods. He discussed how some animal rescues are very labor intensive. He also discussed that animal rescues are generally not attempted until humans have been evacuated and rescued. He is aware of some organizations that can help with the animal population following a disaster and encouraged Dr. Hugh Jones to work with or include these groups in mitigation strategies. Mr. St. Amant also discussed his frustration with people who refuse to leave a dangerous area or situation because of their animals. He agreed that practices and plans are needed far ahead of time. One example he gave was an $18,000 prized bull; i.e., what is the response plan for this type of evacuation?*

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**Mr. DeWitt Braud** of the LSU Geography & Anthropology Department Remote Sensing Laboratory, and **Mr. Hampton Peele** of the Louisiana Geological Survey (LGS) were the final presenters of the meeting. This team, along with **Mr. S. Ahmet Binselam** of the LSU Hurricane Center and **Mr. Weiwen Feng** of LGS, are working to develop a Geographic Information System (GIS) that will integrate much of the critical information generated in the New Orleans public health study.

This GIS, employing ARC-IMS, an ESRI web-mapping software system, will soon be accessible to all project members via the internet.

Mr. DeWitt Braud (the principal developer of the Louisiana State GIS CD for the state of Louisiana) gave a short introduction of the ARC-IMS. He highlighted that this application allows web-enabled GIS access and is very user-friendly. He explained that with ARC-IMS there is no need for specific knowledge of a certain GIS program or specialty, nor is it necessary to have a GIS installed on the user's computer. He also discussed that training to use the GIS will be made available for all who are interested shortly after the system is online.

Mr. Braud added that access to the hurricane studies GIS data will be available to project investigators and their associates in real-time through secure login. This will better enable investigators and advisors to keep up with new project data layers as they become available.

Mr. Hampton Peele then discussed the ARC-IMS project GIS capabilities in further detail. He discussed that data-sharing is a big issue and that we will be requesting data from a number of federal and state agencies. He explained the concept of web-enabled GIS and how ARC-IMS allows this cutting-edge capability for the project.

Mr. Peele announced that the web-enabled GIS for the hurricane study would be for the purpose of providing access to data for the various researchers involved in the project. This website's sole purpose will be to share data as they become available. This will reduce the need for data mining. He explained that specific data may be requested and/or downloaded. While individual researchers/investigators will be expected to perform their respective research analyses on their own computers, any additional data they generate can be shared with their colleagues via the web-enabled GIS. Mr. Peele explained that the web-enabled GIS will also serve to show data that we acquire to investigators and any one else.

The web-enabled GIS is intended to be expedient and useful to researchers - but with limited maintenance and administration - to achieve the goals of the project.

A hand out was distributed with an itemization of all data layers available at the time of the meeting. (While waiting for the GIS to go online, if anyone would like an updated list of available data layers, please e-mail Mr. Peele at: hampton@lsu.edu).

Mr. Peele and Mr. Binselam then gave a demonstration of the GIS data layers. They focused in on points within the study area of Greater New Orleans, retrieving database information about various features (i.e., roads, police & fire stations, etc). They demonstrated how easy it will be for researchers to peruse available data acquired for the project and to determine which layers may be of use to them. He added that members will be able to access the GIS online late this year (October/November 02).

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At the close of the meeting, Advisory Board members were asked if they had any additional input or suggestions they wished to discuss with the group.

Meeting members briefly discussed appropriate levels of security for access to the online GIS data (and incorporated models as they became available). As currently arranged, all project members will have access to all data, and may share it with their colleagues at their discretion.[2] All members will have a secure logon ID and password.

[2] Understandingly, all researchers would appreciate the proper crediting/recognizing of appropriate sources if their online data will be shared with outside sources. Additionally, any publications, presentations, etc. that emanate from work supported by this project should please acknowledge: "…this research was supported by the Louisiana Board of Regents through the Millennium Trust Health Excellence Fund, HEF(2001-06)."

*Further down the line, as Homeland Security task forces and procedures are further developed for the nation and state, the Hurricane Center will strive to cooperate with (and support with data if requested) all Federal initiatives towards increased security measures.*

Please contact **Kate Streva**, LSU Hurricane Center (225) 578-4813/0268, or **Dr. Ivor van Heerden** (225) 578-5974, for additional information on the meeting. PI presentations and handouts are also available upon request.