



December 10, 2012
NCST Advisory
Committee Meeting

Technical Investigation of the May 22, 2011, Tornado in Joplin, MO

Emergency Communications and Public Response

Erica D. Kuligowski
Investigation Task Leader
Fire Protection Engineer, Fire Research Division

Objective #2

- Determine the pattern, location, and cause of fatalities and injuries, and associated emergency communications systems and public response

Presentation Outline

- Task 2.1: Gathering baseline data
- Tasks 2.2/2.3: Collecting archival records for other areas and Joplin (emergency communications and response)
- Task 2.4: Collecting information from 3rd party sources
- Task 2.5: Analysis and report writing

TASK 2.1

Gather baseline information on the response of individuals to the Joplin tornado.

Data Collection on Response

NIST Interview Recruitment Strategies and Methods

- Tornado survivors, families/friends of victims, building managers/owners
- Recruitment of survivors and families/friends of victims for interviews
 - NIST Tech Beat article (10/14/11)
 - NIST flyer
 - Contacts in Joplin – radio stations, newspapers, public information officer, local emergency managers, faith-based organizations, chamber of commerce
 - In-person and phone interviews



Data Collection on Response

NIST Interview Recruitment Strategies and Methods

- Interview methods (2 phases)
 - Convenience sample to generate specific knowledge about a particular event;
 - Phase 1: Respondents asked to describe their experiences from the time when they first became aware that something was wrong until the moment when they responded to the disaster
 - Phase 2: Unstructured, follow-up or clarification questions about important topics



Data Collection on Response, cont.

- Data collection completed when 2 requirements were met:
 - Certain topics of interest were saturated
 - Experiences with the tornado on May 22
 - Options for protective action
 - Previous experiences with and perspectives on warning systems and tornadoes
 - Sample varied by age, geographic location throughout the damage path (i.e., address), and physical location during the event (i.e., home, business, outdoors, or vehicle)

Data Collected on Response

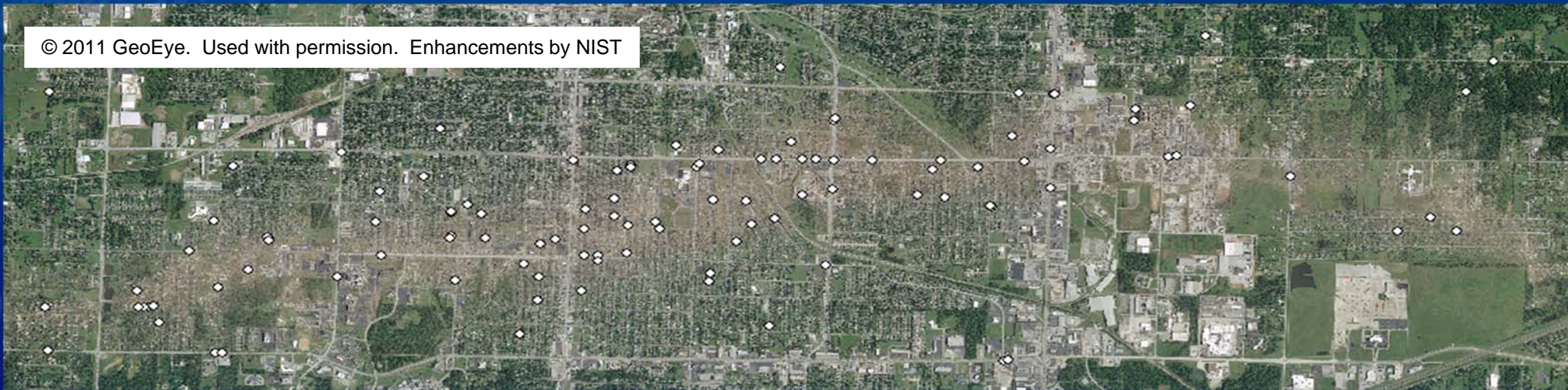
- 165 interviews
 - 17 collected 5 days after tornado hit
 - 148 collected from October 2011 through February 2012
- Sample demographics
 - Age: ranged from 19 to 88, with a mean age of 51
 - Gender: 60% women
 - Authoritative role: 8%
 - Geographic location: well distributed across the tornado path through Joplin



Data Collected on Response, cont.

- Where interviewees were located when impacted by the tornado

© 2011 GeoEye. Used with permission. Enhancements by NIST



Data Collected on Response, cont.

Reported Physical Locations at Tornado Touchdown	% of Sample
Home/apartment (their or someone else's home/apartment)	68
Private businesses (including theater, grocery stores, department stores, restaurants, etc.)	13
Driving or stopped in vehicle	7
St. John's Regional Medical Center	5
Joplin area church	5
Outside (or unknown specific location)	2

- Respondents took protection in various places (homes): tornado shelters, full or partial basements, crawl spaces, the first floors of apartment complexes or duplexes, and internal locations within homes, such as bathrooms, closets, or hallways

Tornado Fatalities – Revised

- 161 fatalities
- Death certificates obtained for all deaths from
 - Missouri Department of Health and Senior Services
 - Oklahoma State Department of Health
 - Kansas Department of Health and Environment's Office of Vital Statistics
- Information obtained (examples)
 - place of injury/death, date of death, cause of injury/death, age, gender, occupation
- Most fatalities were categorized as impact related deaths attributed to the tornado; most deaths occurred the night of 5/22/2011

*Includes some victims whose

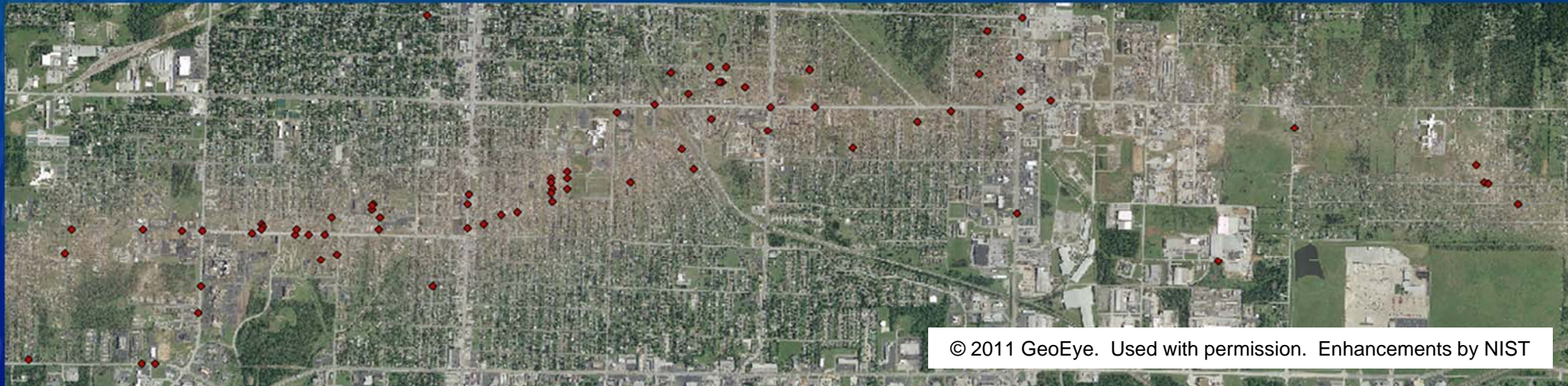
- Non-impact related deaths were attributed to tornado, and/or
- Deaths occurred at other locations, after 5/22/2011

Location at Time of Injury/Death	# of Victims
AT&T store	1
Elks Lodge	4
Full Gospel Church	4
Greenbriar Nursing Home	19*
Harmony Heights Baptist Church	3
Home Depot #3023	8
Meadows Healthcare Facility	2*
Outside (12 in vehicles)	20*
Pizza Hut	5
Residences - apartments	12*
Residences - single family home	62*
Stained Glass Theater	3*
St. John's Regional Medical Center	14*
Walmart Supercenter #59	3



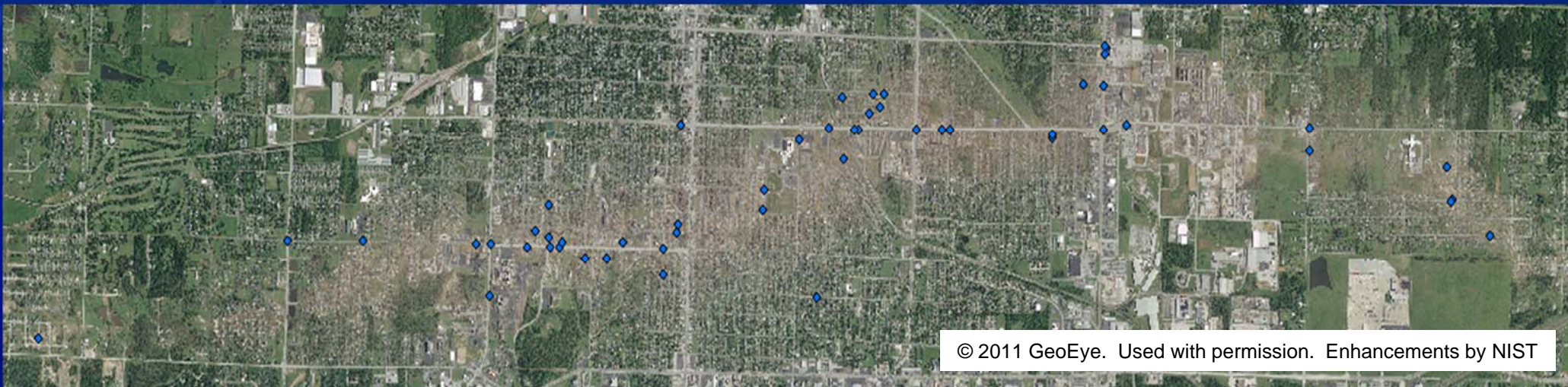
Location of Fatalities

- Location where the injuries that led to death were sustained



Tornado Injuries

- 2 sources of information
 - ESSENCE is syndromic surveillance data (general overview) (Source: MO Department of Health and Senior Services)
 - CDC EPI-Aid Study (87 participants) (Source: MO Department of Health and Senior Services)
- Information obtained (examples)
 - Address where injury occurred, hospital admission history, initial admit diagnosis, ICU admittance, number of days in hospital, pre-tornado risk factors, information about injury/wounds, context surrounding injury



© 2011 GeoEye. Used with permission. Enhancements by NIST

TASK 2.2

Collect archival records relating to prior tornado incidents and associated community responses, and document codes, standards, and practices for tornado warnings.

Codes, Standards, and Practices Collected

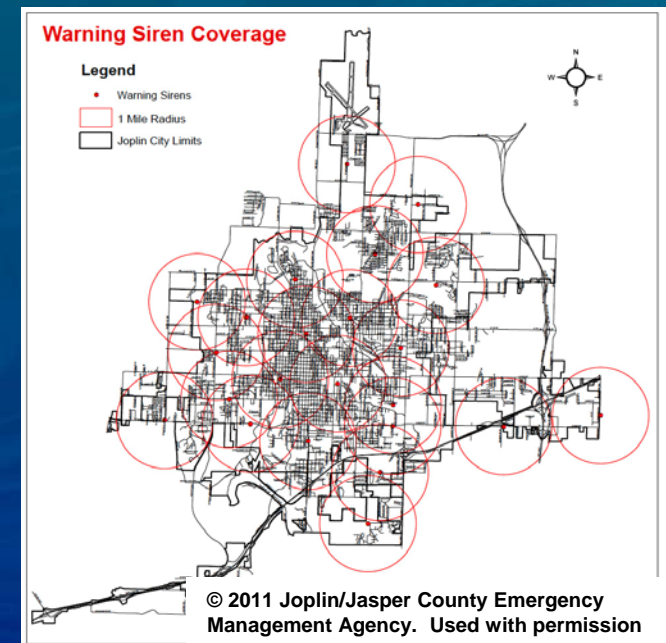
- Codes/Standards applicable to public alerting systems, especially sirens
- Federal Guidance on outdoor warning systems (FEMA 1980, 2006)
- National Weather Service Instruction 10-511
- Current practice in over 75 U.S. counties, cities and towns
- Research on public response to tornadoes

TASK 2.3

Document pre-event archival records for Joplin in relation to tornadoes and the tornado warning system.

Historical Context of Joplin Tornado

- Emergency communications systems
 - Outdoor warning sirens (Source: Joplin/Jasper County Emergency Management Agency)
 - 25 sirens in Joplin “zone,” all tied to the same system (if one activated, they all activated)
 - Tested weekly at 10:00 AM (CDT) on Mondays, sounded for 1 min only
 - Other channels (Source: Joplin/Jasper County Local Emergency Operations Plan)
 - Primary and local Emergency Alert System (EAS) TV and radio stations
 - Reverse 911
 - NOAA Weather Radios



Historical Context of Joplin Tornado

- Procedures for tornadoes

(Source: Joplin/Jasper County Local Emergency Operations Plan)

- Communication

- Warning systems are sounded only after...

- Communications Operator has been notified that a tornado has been sighted
 - Tornado warning is issued by the NWS for Jasper, Newton or Cherokee County
 - Sustained winds are 75 mph or higher

- Sounded for 3 minutes continuously, once, no “all clear”

- Protective Actions

- The burden of heeding warnings - individual communities and citizens
 - No guaranteed safe place during a tornado
 - Some locations are better than others



SOURCE: FEMA

TASK 2.4

Collect information from third-party sources including television interviews and newspaper articles.

Collection of 3rd Party Sources Complete

- Over 100 media accounts of survivor and deceased victim experiences – collected
- Materials organized into database
- Used to develop the probing questions in survivor interviews; analysis of deaths/injuries

TASK 2.5

Analyze the data to study the public response to the tornado, including protective actions.

Qualitative Analysis of Transcripts

- All interviews transcribed
- Used qualitative analysis software
- Code list and code book created

Qualitative Analysis of Transcripts

- Purpose – Trends analysis/theory building
- Accepted practice in comprehensively analyzing qualitative data
 - Identify major themes within the data (code book)
 - Within each theme – identify properties (components or attributes) and dimensions (modes of variation within the category) of the data [Categories]
 - Detect patterns in the data: find/map links and connections between categories
 - Query by pre-storm individual factors and environmental cues (from storm), interpretations, and resulting protective actions
 - Identify trends in data, constant testing with each new data source
 - Conceptual model development of human response to Joplin tornado



General Trends from Interviews

- Survivors' Behavior
 - Sirens – alert rather than warning
 - People did not react until perceiving danger or being told to take action
 - only a few risk averse, hypervigilant
 - Residents delayed taking protection (limiting shelter options)
 - some did not take shelter in time
- Conceptual model developed of human behavior during Joplin, MO tornado



Integration of Objectives 1-4

- Wind speed, building damage, behavioral response (survivors [non-injured], injured, and deceased)
- Causes of deaths and injuries in the following locations in Joplin:
 - Single family homes
 - Vehicles
 - Steel and concrete frame buildings, located at 2727 McClelland Boulevard (St. John's Regional Medical Center)
 - Box-type building, located at 1501 South Range Line Road (Walmart Supercenter Store#59)
 - Unreinforced concrete masonry wall building, located at 2502 South Moffet Ave (Greenbriar Nursing Home)
- Locations chosen because there are sufficient data on wind speed, building damage, and response behavior (from interviews, injury data, and/or fatalities information) for each

Latest Progress/Next Steps

- Tasks 2-4 complete
- Still working with MO DHSS to obtain additional injury data (Task 1)
- Rough draft of objective chapter near complete (Task 5)
- Analysis and report writing in progress on Integration of Objectives 1-4 Chapter with Drs. Lombardo and Phan (Task 5)
- Issues and findings pertaining to survivor response to emergency communications are being developed
- Develop recommendations, as warranted, for potential changes to emergency communications and building and fire codes, standards, and practices to improve life safety in tornado disasters