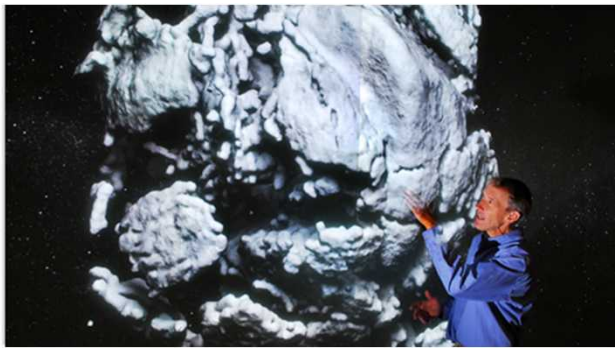
SAND2016-2588PE

Exceptional service in the national interest

Sandia National Laboratories





Hurricane Evacuation Study (HES) Modernization

Jovana Helms, PhD

Lynne Burks, PhD

Sandia National Laboratories

This work is funded by the U.S. Department of Homeland Security Science and Technology Directorate under contract/IA # HSHQPM15X00083-1

U.S. DEPARTMENT OF ENERGY

NNSA National Nuclear Security Administration

HES Modernization Objectives

Sandia National Laboratories

HES modernization effort has 2 main objectives:

1. Modularize and improve efficiency of the existing process

HES Tool will add capability to the existing HES process through linked modeling and simulation. The tool will enhance efficiency and allow for easier collaboration and data sharing.

2. Add advanced modeling and simulation capabilities

The HES Tool will allow for sensitivity and scenario based analysis generating an order of magnitude more data at the fraction of the cost and time. Additionally, it will lead to increased public confidence and more cost efficient evacuations – resulting in lives and dollars saved, respectively.

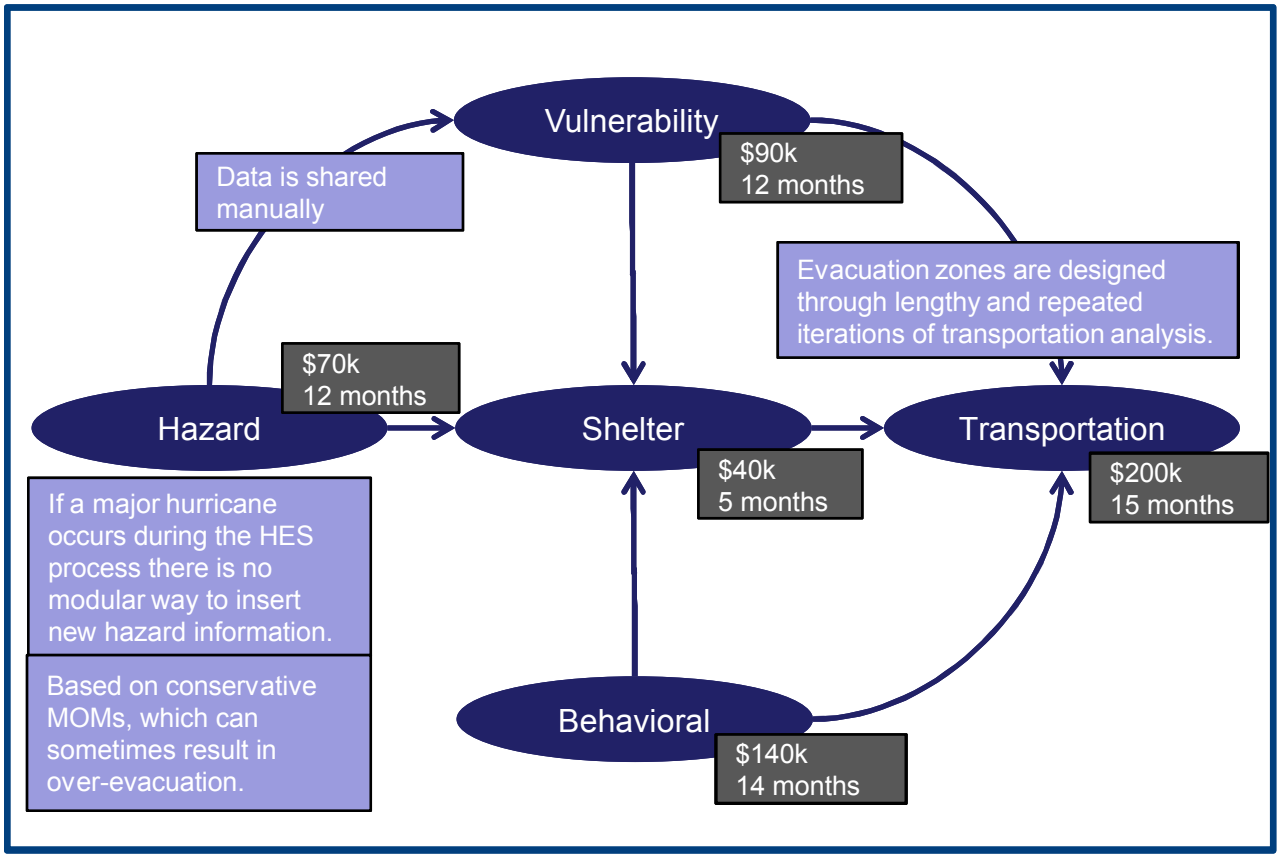
Current HES Process (average)

Sandia National Laboratories

Average Total Cost ≈ $540k Average Total Time ≈ 3-5 years

Updates occur every ~14 years

HES Report



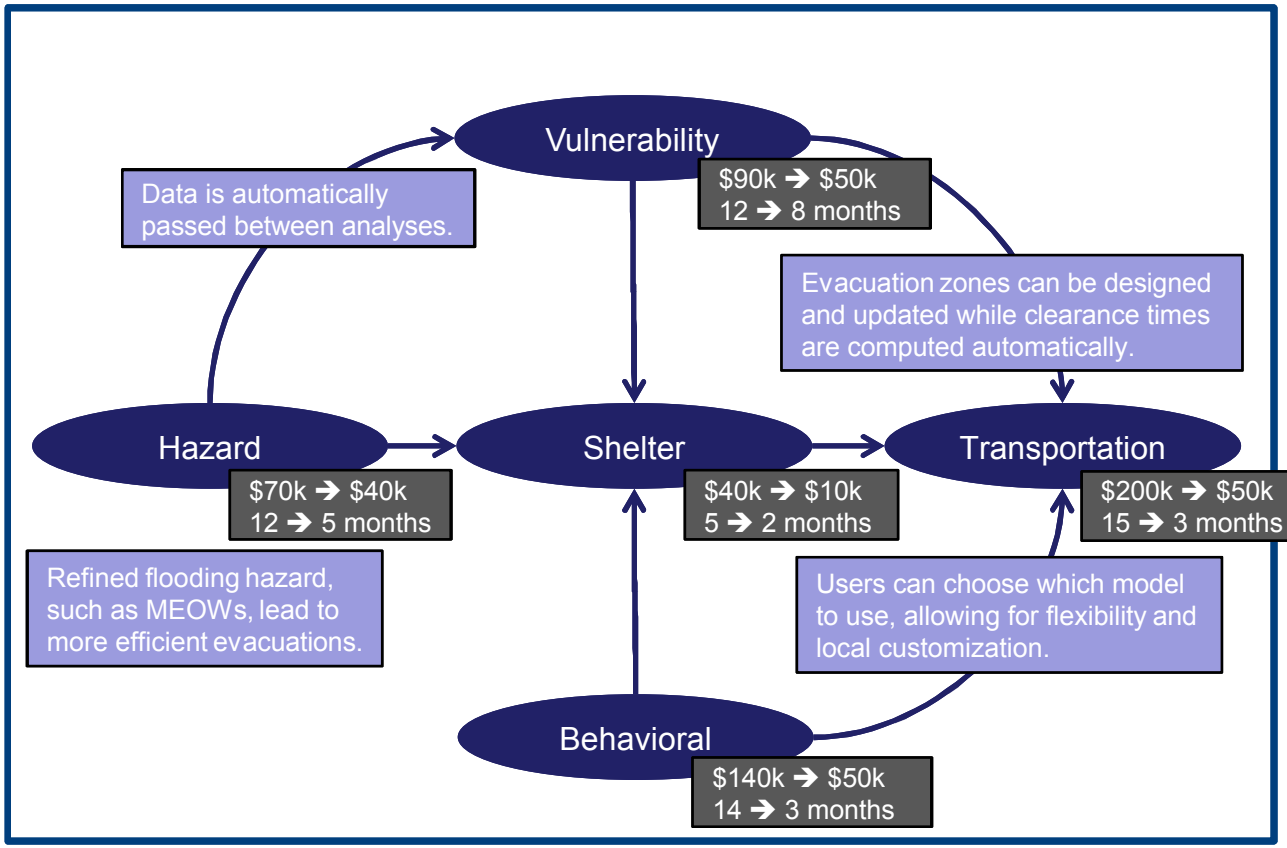
→ Clearance Times and Evacuation Zones

Modernized HES Process

Sandia National Laboratories

Total Cost ≈ $200k Total Time ≈ 1.75 years
Up to 70% Reduction

SHERPA



HES Tool Updates

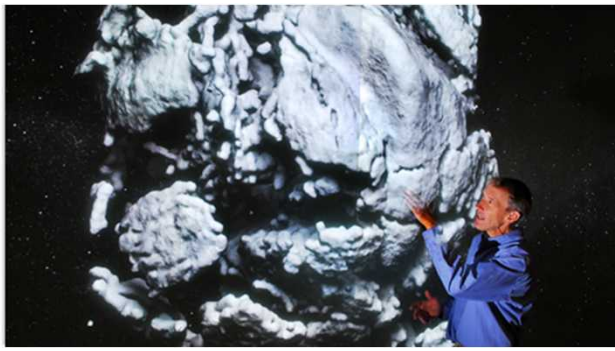
Sandia National Laboratories

- Since the NHP TM Working Group Meeting on December 10 the following capabilities have been added to the HES Tool:
  - Upload USACE high resolution Hazard Maps
  - Multiple evacuation zones encompassing unique behavioral qualities
  - Define or upload multiple polygons within one evacuation zone
  - Linking relevant inputs to table outputs
- Capabilities in progress:
  - Enable user-defined end-points for transportation analysis
  - Automated report generation
  - Extend HES capability to response for increased situational awareness
- Potential future use:
  - Upload P-SURGE for Hazard Analysis
  - Overlay Live Traffic

Exceptional service in the national interest

Sandia National Laboratories





Hurricane Evacuation Study (HES) Modernization

Jovana Helms, PhD

Lynne Burks, PhD

Sandia National Laboratories

This work is funded by the U.S. Department of Homeland Security Science and Technology Directorate under contract/IA # HSHQPM15X00083-1

U.S. DEPARTMENT OF ENERGY

NNSA National Nuclear Security Administration

Pilot Studies

- North Carolina and New York City are partnering with us to conduct pilot studies of the HES Tool.
- Both are engaged in updating their HES using the current process, and we will use the modernized process in parallel.
- The primary objective is to gather requirements and feedback, compare results, and understand discrepancies.

Pilot Studies Progress

Sandia National Laboratories

North Carolina

- HES was initiated in 2012 and is currently in final stages of transportation analysis.
- Provided hazard, vulnerability, and behavioral analyses, along with database of local shelters.
- We visited NC EM in August 2015 to share our progress and learn more about the NC process.

New York City

- Most recent HES was completed in 2009 with an addendum added in August 2015.
- Provided vulnerability and behavioral analyses, along with evacuation zones.
- We visited NYC OEM in October 2015 to share our progress and learn more about the NYC process.
- Large population, along with dependence on public transportation, presents a significant challenge.

NC and NYC process compared to HES Tool

Sandia National Laboratories

Hazard Analysis

- ✓ Storm information
- ✓ Basin ID
- ✓ MOMs and MEOWs at high tide
  - ✓ Above ground level
  - ✓ Above sea level

Behavioral Analysis

Conduct behavioral survey to calculate planning recommendations

Vulnerability Analysis

- ✓ Percent of available vehicles
- ✓ Percent using public transportation
- ✓ Determine flood contours at the county and borough level
- ✓ Upload evacuation zones
- ✓ Identify affected critical infrastructure
- x Calculate vulnerable/special needs populations
- x Shadow evacuation
- x Evaluate population income level

Shelter Analysis

- ✓ Shelter usage rates
- ✓ NC shelter database
- x NYC shelter database

Transportation Analysis

- ✓ Evacuation timing
- ✓ Evacuation rate
- ✓ Calculate clearance times
- ✓ Identify traffic routes
  - ✓ Potential areas of congestion
  - x Measures to relieve congestion
- x Specify evacuation end points

✓ Included
x Not currently included

In addition to required capabilities, the HES Tool includes the option for MEOWs and library of scenarios analysis, which provides a range of outputs for sensitivity analysis.