

Program Elements Important To Successful Evacuation

Todd Smith

**Office of Nuclear Security and Incident Response
Division of Preparedness and Response**

Content

- Background on NRC evacuation studies
- Objectives of the studies

NUREG/CR-6864 “Identification and Analysis of Factors Affecting Emergency Evacuations” (2005)

NUREG/CR-6981 “Assessment of Emergency Response Planning and Implementation for Large Scale Evacuations” (2008)

- Methodology
- Analysis Results
- Conclusions

NUREG/CR-6864

- Background
 - Following 9/11, effectiveness of public evacuations reviewed
 - No previous systematic government studies
- Objectives
 - Assess emergency evacuation process
 - Identify critical factors affecting evacuations

NUREG/CR-6981

- Background
 - Evacuations in 2005 brought to light issues not previously encountered during large scale evacuations
- Objective
 - Assess effectiveness of emergency planning activities

NUREG/CR-6864 Methodology

- Studied evacuations in the U.S. from 1990 to 2003
- All hazards (natural, technological, malevolent acts)
- 230 cases profiled
- 50 case studies selected for analysis
- Data gathered from questionnaire
- Critical factors affecting evacuation efficiency identified through statistical analysis

NUREG/CR-6981 Methodology

- Studied 11 large scale evacuations
- Selection criteria highlighted large scale and unique features of evacuation
- Data collected from literature review, field investigation, and interviews
- Qualitative assessment of planning and implementation

Methodology

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QUANTITATIVE

Evacuation Efficiency

- Decision-making
- Communications
- Notification
- Citizen action
- Traffic control
- Law enforcement
- Re-entry

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QUALITATIVE

Response Elements

- Training
- Public Education
- Communication w/ public
- Communication among emergency responders
- Evacuation
- Special needs
- Shelters

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Analysis Results

- Large scale evacuations occur every two weeks in the U.S.

Hazard Type	Events	Mean time to Decision (hr)	Mean time to Evacuate (hr)	Mean Evacuation Area (km ²)
Natural Disaster	14	105	9.7	708
Malevolent Act	3	0.72	0.7	8
Technological Hazard	33	0.88	2.1	10.5

- Variables statistically significant to **more effective** evacuation:
 - Community familiarity with alerting methods
 - Door-to-door notification

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Analysis Results

- Variables statistically significant to **less effective** evacuation:
 - Traffic accidents
 - Number of deaths from the hazard
 - Number of injuries caused by evacuation
 - Spontaneous evacuations
 - People refusing to evacuate
 - Looting or vandalism

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Analysis Results

Correlations with Law Enforcement Issues

- **Looting and vandalism**

Correlations with Traffic Issues

- **Traffic accidents**
- **People instructed where to go and routes to take**
- **Major roadways unavailable for use**

Evacuation Efficiency

- Decision-making
- Communications
- Notification
- Citizen action
- Traffic control
- Law enforcement
- Re-entry

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Additional Insights

- Efficient evacuations:
 - Utilize multiple communications methods
 - Have high coordination among agencies and community cooperationand
 - Shadow evacuations have little impact on traffic and congregate care center capacity
 - Evacuation of pets/livestock and special institutions requires preplanning

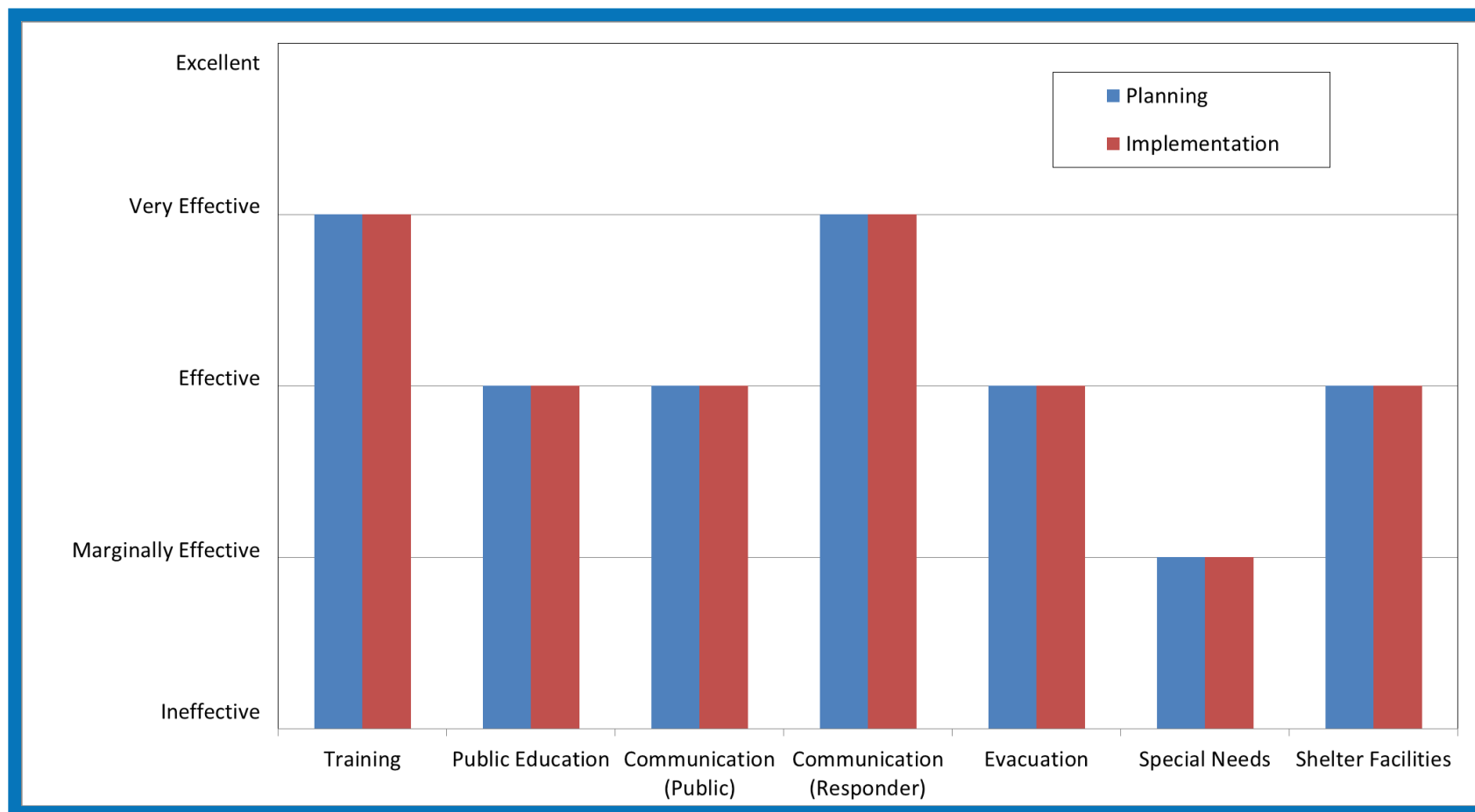
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Additional Insights

- Community preparedness activities:
 - Upgrading emergency response capabilities and communications systems
 - Developing transportation analyses and assessments to improve traffic flow
 - Improving local educational awareness
 - Developing interagency and cross-boundary coordination plans

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Analysis Results



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Analysis Results

- Integrating regional resources into large scale evacuation planning improves evacuation
- Evacuation techniques improve when tested
- Information provided en route improves evacuation
- Enhancements in emergency communications improve response effectiveness
- Greater awareness has developed for special needs individuals not residing in special facilities

Conclusions

- Evacuations saved lives and reduced the potential number of injuries
- Success in implementation is directly related to the level of preparedness
- Preparedness leads to success even in ad hoc situations
- Preparedness can be readily improved through continuous evaluation and application of lessons learned

Questions?

Todd Smith

Emergency Preparedness Specialist

(301) 287-3744

Todd.Smith@nrc.gov