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BEST PRACTICE

Mass Evacuation Reception Planning: Influx of Evacuees and Transportation Issues after a Nuclear Incident

PURPOSE

This Best Practice provides planners with information on the consequences of an unplanned influx of evacuees for jurisdictions adjacent to the nuclear incident area. This Best Practice also includes an overview of transportation networks' disruption and its consequences for receiving jurisdictions adjacent to an urban area after a nuclear incident.

SUMMARY

A nuclear incident in an urban area could cause a significant, spontaneous mass evacuation from and around the incident area. Many people would likely attempt to leave this area by transiting through jurisdictions adjacent to the urban area. As a result, the adjacent jurisdictions could become critical evacuation routes shortly after a nuclear incident.

The spontaneous mass evacuation from a nuclear incident area could quickly overwhelm the regional transportation system and hinder the movement of people, resources, and emergency assets and personnel. Many jurisdictions adjacent to a nuclear incident area could experience a sudden, major population surge. Further, this mass influx of evacuees could cause a rapid depletion of critical assets and resources in receiving jurisdictions shortly after such an incident.

> A 2009 study by Rutgers University found that 67 percent of the interviewees would "very likely" self-evacuate following an improvised nuclear device attack.

About This Best Practice Document

This Best Practice document provides planners with an understanding of the mass evacuation and transit management issues that jurisdictions adjacent to a nuclear incident area would likely experience after such an event. This Best Practice consists of the following sections:

- About This Best Practice Document
- Description
- Selected Anticipated Consequences of a Spontaneous Mass Evacuation
- Critical Pre-Incident Planning Activities

This document is part of the Mass Evacuation Reception Planning Best Practice series.

The document describes critical issues that planners should consider when developing catastrophic mass evacuation and/or transit management plans or annexes tailored to this specific nuclear scenario. This Best Practice can help planners understand the transportation and mass evacuation issues that jurisdictions adjacent to a nuclear incident area could experience after such an event.

DESCRIPTION

A nuclear incident in an urban area may cause an unplanned mass evacuation of the area and its surrounding jurisdiction for fear of exposure and/or contamination. These evacuees will likely reach and/or transit though jurisdictions adjacent to the nuclear incident area. For example, the Ventura County, CA, Department of Public Health's Ventura County, California, Nuclear Explosion Response Plan Version 3.0 anticipates that up to 2 million people would attempt to transit though Ventura County following a nuclear detonation in Los Angeles County. This spontaneous mass evacuation could cause extensive transportation gridlocks on highways, secondary roads, and local streets.

The influx of evacuees will likely overwhelm receiving jurisdictions' infrastructure, deplete critical resources, and hinder emergency managers' ability to manage the consequence of such an event. An uncontrolled mass evacuation is likely to cause extensive economic disruption, environmental and property damage, and other consequences. A West Virginia University survey reported that nearly 83 percent of Washington, D.C., residents would be "very" or "somewhat" likely to self-evacuate after a nuclear incident in D.C. The report concluded that: "A large-scale spontaneous evacuation would create significant challenges for rural areas through which evacuees would be traveling, and for communities that may need to accommodate a large long or short-term ingress of evacuees."

The first priority for the public immediately after a nuclear detonation should be to shelter in the nearest and most protective structure. The 2011 National Capital Region Key Response Planning Factors for the Aftermath of Nuclear Terrorism states, "Unfortunately, our instincts can be our own worst enemy. Another urge to overcome is the desire to flee the area (or worse, run into fallout areas to reunite with family members), which can place people outdoors in the first few minutes and hours when fallout exposures are the greatest."

Several studies note that a nuclear detonation in an urban area would cause a spontaneous mass evacuation and stress the infrastructure of adjacent, receiving jurisdictions, including:

- The 2010 National Security Council's Planning Guidance for Response to a Nuclear Detonation states that "it is recognized that some self-evacuation will spontaneously occur following a nuclear explosion. Planners should anticipate self-evacuations and be prepared to assist those who self-evacuate to the extent possible."
- The Columbia University Mailman School of Public Health, National Center for Disaster Preparedness' Day Three: Regional Resiliency and Health Challenges in the Aftermath of Nuclear Terrorism states that evacuees from the urban area would attempt to travel at least 10 – 20 miles or more away from the detonation site.
- The U.S. Department of Health and Human Services, Assistant Secretary for Preparedness and Response's State and Local Planners Playbook for Medical Response to a Nuclear Detonation states that many people "will self evacuate" from the Light Damage Zone, located approximately between 3 and 5 miles from the detonation site.

Selected Anticipated Consequences of a Spontaneous Mass Evacuation

Jurisdictions adjacent to a nuclear incident area will likely experience major disruptions as a result of self-evacuation from the urban area. Consequences of an unplanned mass evacuation may include, but are not limited to:

- **Disruption of transportation networks:** The spontaneous mass evacuation from a nuclear incident area would likely make highways impassable and cause the disruption of regional transportation networks. For example, the Ventura County, California, Nuclear Explosion Response Plan Version 3.0 assumes that it would take 4 days—or 2 ½ days with contraflow—for all the incoming evacuees from Los Angeles to drive through Ventura County. As a result, jurisdictions adjacent to a nuclear incident area may be unable

to receive and/or deploy critical supplies and essential personnel following a nuclear incident. Emergency management and response agencies may find it difficult to deploy available personnel at strategic locations; transport victims; establish mobile hospitals, mass care centers, and/or shelters; and distribute relief and response supplies. Scarce resource re-supply could be limited for an extended period of time due to road conditions and greater needs of the disaster area.

- **Influx of exposed and/or contaminated evacuees**: Many of the evacuees traveling though jurisdictions adjacent to the nuclear incident site could be contaminated and/or could have been exposed to radiation. Some of these evacuees may have been exposed to "prompt radiation" at the time of the detonation, while others may have received large doses from "ground shine," radioactive material deposited on the ground, as they evacuate the fallout areas. Depending on the level of exposure, some of these evacuees could start experiencing radiation sickness symptoms within minutes, while others could experience symptoms after days or weeks. National Planning Scenario 1 states that "Tens of thousands will require decontamination and both short-term and long-term treatment" following a nuclear detonation. However, many emergency response organizations responsible for mass screening and decontamination in and around a nuclear incident area may lack the resources needed to perform these functions effectively at the onset of emergency response operations. Further, psychosocial, and behavioral population issues may cause disruptions of evacuation and screening operations. The Tarrant County Advanced Practice Center's PsychoSocial/ Behavioral Response to Radiological and Nuclear Disasters can help public health department, healthcare, emergency medical service personnel, and public health partners manage the behavioral health and psychosocial effects of a nuclear incident.

- **Influx of injured evacuees:** Many survivors who self-evacuate or are transported by family members or other non-medical personnel could enter jurisdictions adjacent to the nuclear incident urban area. Further, evacuees who had left the incident area unharmed could become injured during self-evacuation.

The U.S. Department of Transportation (DOT), Federal Highway Administration's (FHWA) Highway Evacuations in Selected Metropolitan Areas: Assessment of Impediments assesses the mass evacuation plans of 26 high-density U.S. urban areas and identifies route deficiencies likely to hinder mass evacuations. The study found that "almost every city cited daily congestion as one of the greatest impediments to planning for mass evacuations."

National Planning Scenario 1 describes the effects of a 10 kiloton (KT) improvised nuclear device detonation in a large metropolitan area.

The Stanford University, Center for International Security and Cooperation's Analyzing Evacuation Versus Shelter-in-Place Strategies After a Terrorist Nuclear Detonation notes that the unplanned evacuation of even a small fraction of city resident following a nuclear incident in an urban area could cause severe gridlocks. These evacuees would likely be exposed to much greater radiation than they would if they did not self-evacuate and sheltered below ground.

The National Response Framework Mass Evacuation Incident Annex states that "State, tribal, and local officials retain primary responsibility for victim screening and decontamination operations when necessary in response to a HazMat incident. Appropriate personnel and equipment must be available. Without appropriate decontamination and proof of decontamination, neighboring States/ jurisdictions may resist accepting evacuees/ patients that are contaminated."

Emergency response personnel may be unfamiliar with some of the medical effects of a nuclear detonation. For example, a large number of victims with injuries due to traffic accidents or caused by falling or flying glass shards could evacuate to jurisdictions adjacent to the nuclear incident area. A 10 KT nuclear detonation would create a brilliant flash of light that could cause both temporary and permanent blindness to people outdoors up to 5 miles away. Every individual within this area could experience "flash-blindness," regardless of whether they were looking in the direction of the blast at the moment of detonation. This sudden loss of vision could last for several minutes and cause many traffic accidents. In addition, studies show that glass breakage will likely cause various types of severe injuries.

- **Some uncontrolled evacuation towards the disaster area**: Some people may attempt to enter the disaster area out of concern for family members, pets, or personal property. The National Academy of Science's Assessing Medical Preparedness to Respond to a Terrorist Nuclear Event: Workshop Report found that some individuals or groups could attempt to travel towards the nuclear incident area to provide assistance to victims, locate relatives, or for other reasons.

Critical Pre-Incident Planning Activities

Pre-incident evacuation planning is essential to help jurisdictions prepare for an unplanned influx of evacuees following a nuclear incident in an adjacent urban area. The All Hazards Consortium's Mid-Atlantic Region Catastrophic-Event Preparedness Workshop Report found that "evacuation planning and preparedness have not focused on the ingress of large number of people and their impact upon the resources and capabilities of potential host communities." The report recommends that planners evaluate likely evacuation routes and their existing plans to understand the implications for host communities and to support regional coordination, response, reception, and resource management. Further, planners should consider the following issues and activities when planning for such an event.

> The University of Chicago, National Opinion Research Center and the Western New York Public Health Alliance Advanced Practice Center's Urban-to-Rural Evacuation Tool can help planners in rural and suburban jurisdictions estimate the numbers of evacuees expected to transit trough a jurisdiction after a large-scale event. This online, map-based application predicts population surge after several potential types of disasters. This application also provides information on receiving counties' assets. In addition, the Urban to Rural Evacuation Tool Western New York Prototype displays the regional effects of an improvised nuclear device detonation in New York City, New York.

Estimate the Number of Potential Evacuees and Determine Infrastructure Availability

Planners in jurisdictions adjacent to an urban area should estimate the number of potential evacuees that could transit through their jurisdiction after a nuclear detonation. This can help planners allocate scarce resources effectively and efficiently. Further, planners should:

> The U.S. DOT FHWA and U.S. Department of Homeland Security's (DHS) Report to Congress on Catastrophic Hurricane Evacuation Plan Evaluation notes that "an important issue that came to light during evacuations associated with Hurricanes Katrina and Rita is the need for public transportation operators to know where they are going to take evacuees and for officials in these locations to be prepared to accept the evacuees. Transportation operators cannot assume that evacuees can be dropped off anywhere, especially railroads that carry many more passengers than individual buses."

- **Identify the number of secondary homes, hotels, and motels within the jurisdiction**: Studies found that many people select their secondary homes or the homes of family or friends as their primary evacuation destination following a disaster. Hotels and motels represent the secondary evacuation destination option for evacuees. As a result, communities with a large

number of secondary homes or in close proximity to locations with a large number of vacation homes should expect some of the owners to move to or through their jurisdictions. Further, communities with a large number of hotels or motels could receive a significant number of evacuees.

- **Be familiar with public transportation lines**: Public transportation systems in some jurisdictions adjacent to a nuclear disaster area could still provide limited services after an incident. These jurisdictions' residents could decide to use public transportation to move farther away from the incident area. As a result, communities that have access to rail or bus lines should anticipate that some evacuees could use public transportation to arrive in the receiving jurisdiction.

- **Be aware of urban area residents evacuating on foot:** Many urban area residents could attempt to self-evacuate on foot. These people will likely be unable to carry with them essential supplies such as life-saving medications and other critical supplies. The New York State Department of Transportation's Integrating Pedestrian Disaster Preparedness and Mass Evacuations on Foot into Emergency Evacuation Operations, Local Infrastructure Needs and Long Range Transportation Planning provides information on the basic logistical components of a "walk-out plan."

Several studies found that during a spontaneous evacuation of a large metropolitan area, many people could self-evacuate on foot, including:

- The U.S. DOT FHWA's Managing Pedestrians during Evacuation of Metropolitan Areas observes that the September 11, 2001, terrorist attacks, in New York City and Washington, D.C, prompted large mass evacuations. Many individuals began evacuating these densely developed downtown areas on foot before public safety and transportation authorities could deploy assets to manage the evacuations.
- The Stanford University, Center for International Security and Cooperation's Analyzing Evacuation Versus Shelter-in-Place Strategies After a Terrorist Nuclear Detonation models the impact of a 10 KT nuclear device in Washington, D.C. The study concludes that people within approximately 1 mile radius and 38% of people within 1 and 4.5 miles of a nuclear blast site would not have access to a vehicle and thus may attempt to evacuate on foot.

Implement a Regional Approach to Transit that Expands Beyond Standard Regional Constructs

The impact of a nuclear detonation could expand beyond standard regional constructs such as Urban Area Security Initiative (UASI) areas and require extensive regional transit planning. The percentage of people that might attempt to self-evacuate after a nuclear incident may be higher than following other types of incidents. The Population Evacuations in Industrial Accidents: A Review of the Literature about Four Major Events concludes that "a larger percentage of the affected population tends to leave their homes following a radioactive accident compared to a chemical accident. Moreover, the evacuees flee to further distances." Regional mass evacuation procedures tailored to natural disasters and/or other incidents may not be sufficient to manage the movement of evacuees after a nuclear incident. Planners should include adjacent jurisdictions that are typically excluded in regional mass evacuation planning.

The DHS Federal Emergency Management Agency's Responding to Incidents of National Consequence: Recommendations for America's Fire and Emergency Services Based on the Events of September 11, 2001 and Other Similar Incidents recognizes that traffic arteries can become congested very rapidly during a major incident. The report recommends that planners develop a coordinated traffic management plan and regional evacuation plan.

Experts advise planners in jurisdictions adjacent to an urban area to develop a comprehensive regional transit plan or annex tailored to this specific nuclear scenario. This plan or annex can help jurisdictions adjacent to a nuclear incident area broaden the distribution of evacuees among neighboring jurisdictions and minimize the burden on any single community. Regional planning also can help jurisdictions allocate regional resources effectively and compensate for limited local resources and expertise. The plan or annex should be activated immediately after a nuclear detonation in the urban area.

The All Hazards Consortium's Mid-Atlantic Region Catastrophic-Event Preparedness Workshop Report notes that "Regional planners require a common operating picture with consistent regional evacuation plans; improved awareness and continuity of designated evacuation routes and modes; mapping of transportation related resources (e.g., refueling locations); and incorporation of regional assumptions into transportation planning efforts." The report also recommends that jurisdictions within a region:

- Create a common regional map. The map should identify existing evacuation routes, modes of transportation across the region, and regional resources essential to a successful evacuation. These resources can include shelters, points of distribution, fuel, and medical facilities.
- Create a regionally consistent checklist that includes essential contact information, evacuation plans and routes, communications plans, areas of responsibility, and changes from preceding years.
- Develop and distribute evacuation-specific, interoperable tools among regional agencies. These tools should enhance the common operating picture and facilitate planning, training, and exercising.
- Establish a regional network of rest stops to share key regional evacuation information with tourists and travelers.

Specific Transit Procedures and Practices

Jurisdictions adjacent to a nuclear incident site should consider implementing procedures and practices that will facilitate the continued movement of evacuees towards their final destinations. When appropriate and feasible, these procedures could include:

- Deploying resources such as food, water, and sanitation facilities in strategic locations along the evacuation routes. This can help minimize the impact on a community;
- Deploying available aerial assets such as helicopters to evaluate road and evacuation conditions, and fallout plume patterns. Planners in jurisdictions adjacent to a nuclear incident area should establish partnership with Federal and state agencies that have the resources and expertise needed to coordinate and conduct these surveys. Maintaining situational awareness can help responders in jurisdictions adjacent to the nuclear incident area manage the influx of evacuees;

The Transportation Research Board of the National Academies of Science's The Role of Transit in Emergency Evacuation observes that during Hurricane Rita between 1.5 and 2.5 million Houston residents attempted to evacuate Harris County "with predictable results—massive traffic jams and vehicles that ran out of fuel or broke down for a period of 24 hours or more."

The U.S. DOT FHWA and U.S. Department of Homeland Security's Report to Congress on Catastrophic Hurricane Evacuation Plan Evaluation observes that the need for fuel and mass care services along evacuation routes became evident during the 2005 hurricane season evacuations in Florida and Texas. In Florida, the Road Ranger service patrol could not provide many evacuees with fuel and quickly became overwhelmed. In Texas, evacuees were in traffic for hours and necessitated fuel, water, ice, medical assistance, and mass care services.

- Discouraging evacuees, when appropriate and feasible, from stopping at reception points if they do not have urgent needs; and

- Stationing fuel tankers at strategic locations. This will allow emergency response vehicles and/or evacuees to refuel without having to exit their transit routes.

Emergency response agencies in jurisdictions adjacent to a nuclear incident area will likely be unable to provide substantial roadside assistance and deliver essential resources such as fuel and water to evacuees. As a result, many evacuees could decide to abandon their vehicles during the evacuation because they are out of gas or broken down. Experts advise emergency managers and responders to:

- Establish access control to exclude evacuees' traffic from roads designated for the exclusive use of emergency response vehicles;

- Push disabled or out of gas vehicles off the road;

- Do not attempt to stop the traffic flow from or to the disaster area; and

- Do not attempt to screen or decontaminate vehicles in transit.

The Ventura County, California, Nuclear Explosion Response Plan Version 3.0 recommends establishing agreements with local businesses or agencies that have bulldozers. Designated personnel can use the bulldozers if necessary to push disabled vehicles to the side of the road to guarantee traffic flow during a mass evacuation.

Staged or Phased Evacuations to Other Jurisdictions

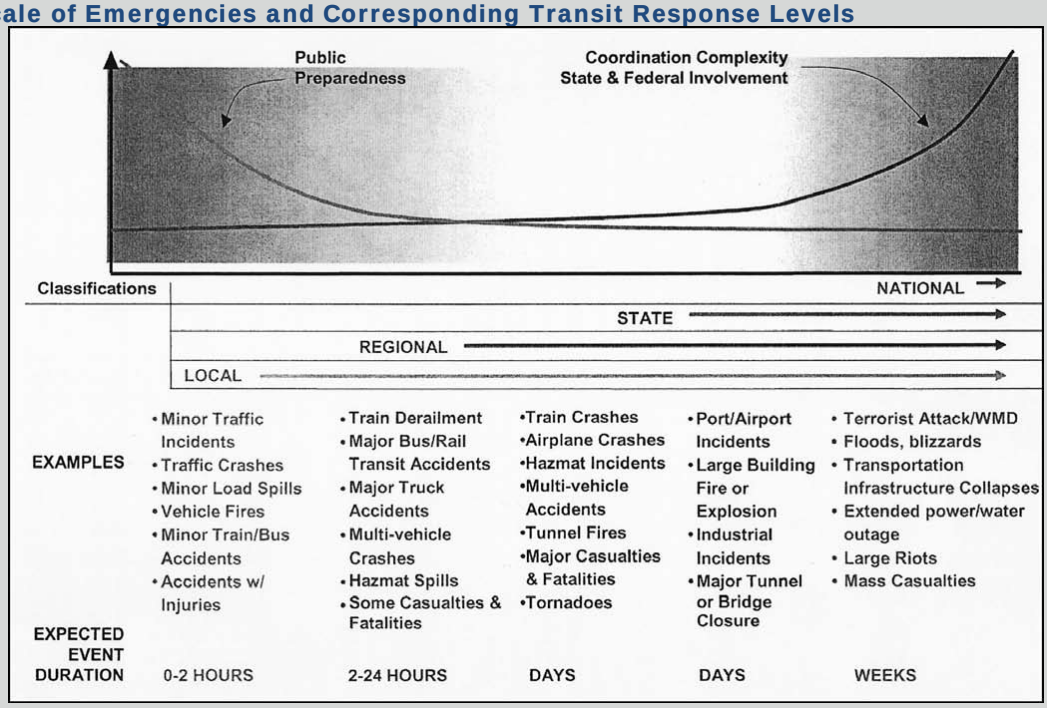
Planners in jurisdictions adjacent to urban areas should consider establishing regional plans for staged movement of evacuees towards jurisdictions farther away from the disaster area. This can help ensure that critical local resources do not become depleted at the onset of emergency response operations.

Planners should consider several issues when prioritizing evacuees' movement towards other, farther away jurisdictions, including:

- Availability of adequate shelters en-route and/or at destination
- Availability of resources such as food and water en-route and/or at destination
- Fallout pattern and radiation intensity
- Medical needs and special population needs, including psychological and behavioral needs
- Modes of transport available to evacuees
- Route conditions and obstacles to mobility such as debris on the road, traffic gridlock, fires, and natural or manmade barriers such as rivers

The Homeland Security Council Interagency Policy Coordination Subcommittee for Preparedness and Response to Radiological and Nuclear Threats' 2009 Planning Guidance for Response to a Nuclear Detonation states: "When evacuations are executed, travel should be at right angles to the fallout path (to the extent possible) and away from the plume centerline, sometimes referred to as 'lateral evacuation.'"

Scale of Emergencies and Corresponding Transit Response Levels



Source: Transportation Research Board of the National Academies of Science. [The Role of Transit in Emergency Evacuation].

Prepare to Communicate with Residents and Evacuees

Providing the public with clear, consistent, and accurate information from trusted sources will be essential following a nuclear incident. However, planners should consider that response organizations will likely encounter difficulties when communicating with the public after a nuclear incident in an adjacent urban area. Damage to regional infrastructures caused by the nuclear detonation and/or the resulting electromagnetic pulse (EMP) could hinder emergency responders' ability to employ some communications systems.

> The Oak Ridge National Laboratory's 2010 [Electromagnetic Pulse: Effects on the U.S. Power Grid] study found that many U.S. communications and control systems, power generation facilities, and power control centers are vulnerable to the effects of an electromagnetic pulse (EMP) generated by the detonation of a nuclear device. An EMP event "can have catastrophic effects, including causing outages to major portions of the U.S. power grid possibly lasting for months or longer."

Lack of critical assets and limited situational awareness could impair the ability of emergency management and response agencies to provide the public with effective protective action information after a nuclear event. The National Security Council's [Planning Guidance for Response to a Nuclear Detonation] states that planners should recognize that following a nuclear incident "normal means of communications may not be available. Mass communication methods and public guidance on stocking of battery powered radios may be appropriate."

Emergency management and response agencies should consider employing "low-tech" mass communications methods, such as in-person announcements via vehicle. The University of Southern California's [Disaster Preparedness in Urban Immigrant Communities: Lessons Learned from Recent Catastrophic Events and Their Relevance to Latino and Asian Communities in Southern California] found that "the most commonly used system of emergency communication involves in-person announcements via vehicle public

announcement systems or bullhorns, which are exclusively the domain of first responders in a disaster, such as law enforcement agencies and fire departments. A county-level service provider reported the use of the public address (P.A.) system as common during emergencies: 'We've had numerous fires where an evacuation consists of deputies roaring into a neighborhood, slamming on the brakes, getting on the P.A. and say, "Get out!" and leaving.'"

Selected Communications Resources

The following resources help with planning to communicate with the public after a nuclear incident in an adjacent jurisdiction:

- The 2010 National Security Council's Nuclear Detonation Preparedness: Communicating in the Immediate Aftermath is intended to assist Federal, state, local, tribal, and territorial officials and emergency responders who will need to communicate with the public and the media after a nuclear detonation. The document includes key messages for the impacted communities and the nation, and anticipated questions and answers for the period immediately following the incident.

- The Centers for Disease Control and Prevention, Emergency Risk Communication Branch's Communicating in the First Hours: Nuclear Weapons: Short and Extended Messages can help public health officials provide the public with essential information during the first hours after a suspected nuclear weapon incident. The short messages include essential information to help minimize the immediate risk to the public. The extended messages include information that can be used to develop messages tailored to a specific scenario.

- The Department of Health and Human Services' Radiological Emergency Medical Management website lists communications resources, tools, and guidelines that can help emergency management and response after a nuclear incident.

RESOURCES

Resources

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