

Summary of NRC Research on Evacuations

Since the terrorist attacks of September 11, 2001, the NRC staff has conducted extensive research into evacuations, including the impact of shadow evacuations on evacuation outcomes. The agency also has published two NRC-sponsored studies¹ that provide information on how the general public actually responds to life threatening circumstances, such as wildfires, chemical fires, malevolent events, and spills. These studies examined over 60 large-scale evacuations that have occurred within the United States since 1998. More than 12 million people were evacuated in the studied events. Although the studies acknowledged the shadow evacuation phenomenon, the NRC concluded that shadow evacuations have no significant impact on traffic movement for the specified evacuee population.

The NRC sponsored an additional study² to research the views of the public and emergency response personnel toward emergency preparedness. The study used telephone surveys and focus groups to determine people's understanding of emergency preparedness and response. In response to a specific question related to shadow evacuation practice, approximately 23% of the respondents indicated that they had been in an emergency that required evacuation of part of their community and had chosen to self-evacuate even though they had not been directed to do so.

Several NRC licensees performed sensitivity analyses on the impact of shadow evacuations of populations beyond the EPZ boundary on the evacuation time estimates for their sites. For example, at the Indian Point Nuclear Generating Station, the nuclear power plant site with the largest nearby population in the nation, assuming that 60% of the population outside the EPZ participated in shadow evacuation, the analysis results showed a maximum increase in evacuation time of about 40 minutes (approximately 6% above the baseline of 11 hours). Areas of smaller populations showed similarly small to negligible impacts of shadow evacuation on baseline evacuation time estimates. From these analyses, the NRC staff concluded that increasing the percentage of population assumed for shadow evacuations does not proportionately increase baseline evacuation time estimates.

Further, there was no significant effect of shadow evacuations on evacuations occurring within the EPZ. There are two principal reasons why a shadow evacuation has limited impact. First, the only impact on evacuees within the EPZ would be if shadow evacuees created congestion on routes used to exit the EPZ. This would need to occur relatively near the EPZ boundary to affect the outbound evacuees before they disperse within the larger roadway network. In addition, the roadway networks expand as the distances increase away from the nuclear power plant site; in other words, there are more roads available as the distance from the plant site increases. This increased roadway capacity reduces the potential for congestion. Second, evidence from the NRC-sponsored studies shows that shadow evacuations occur in a graded manner, with an increased percentage of population nearer the incident and tapering to zero at greater distances from the incident. At some point, typically not too far from the incident, the shadow evacuation approaches zero. For an EPZ evacuation, the shadow evacuation begins at a distance 10 miles from the incident and decreases from there.

¹ NUREG/CR-6864, "Identification and Analysis of Factors Affecting Emergency Evacuations" (2005), and NUREG/CR-6981, "Assessment of Emergency Response Planning and Implementation for Large Scale Evacuations" (2008).

² NUREG/CR-6953, Volume 2, "Review of NUREG-0654, Supplement 3 - Focus Groups and Telephone Survey" (2008).