

Fireworks Displays: When Is Safe, Safe Enough?

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At a recent meeting of the National Fire Protection Association's Technical Committee on Pyrotechnics, there was a proposal to increase the site size requirement for public fireworks displays from the current 70 feet (21 m) to 100 feet (30.5 m) radius per the largest shell size in inches. It was the consensus of the committee that this was not needed because fireworks displays using the current distances were "safe enough". However, no one was able to substantiate their opinion with data. As part of that discussion the authors offered their own unsubstantiated opinion that it was likely that people were at a significantly greater risk while on the round trip drive to witness a fireworks display, than from the fireworks in the display. After offering some background information, this article presents a calculation of the comparative risks of driving to and attending a fireworks display, estimating that people are at least 7 times more likely to be killed or injured as a result of driving to attend a public display than they are from the fireworks in the public display.

Many dictionaries define the word safe as *free from damage, danger or injury* or *something that involves no risk of mishap or error*. However, according to that definition, no activity ever undertaken by anyone is safe because there is always some chance of injury, mishap or error. To the contrary, most texts on risk management define safe as *when the attendant risks of an activity are broadly considered to be acceptably low*.

One way to evaluate the general acceptability of the risk associated with an activity in question is to compare its risk to the risks of other activities that are demonstrated to be acceptable, based on a general willingness of people to partake in those other activities. For example, people readily accept the risk of driving round trip to attend fireworks displays; thus they obviously find that risk to be acceptable. If the risk of witnessing a fireworks display is of the same order (or less) than that associated with driving to the display, then it can reasonably be concluded that the risk of attending a display is also acceptable (i.e., it is safe).

In determining the risks of driving to and attending a fireworks display a combination of statistics and assumptions must be used. For the calculation of these risks to be accurate, the statistics need to be reliable and the assumptions need to be reasonable. The statistics related to injuries while driving come from the National Highway Transportation Safety Administration (NHTSA). The basic statistic used here is that the overall number of deaths on the highway is 1.50 per 100 million miles (160 million km) traveled. (This is an overall average, independent of the type of road, time of day, and vehicle occupancy load.) The assumptions being made are given below and, in the authors' opinion, those assumptions range from reasonable to quite conservative. (Here conservative is used in the sense of intentionally using assumptions that almost certainly underestimate the fatalities associated with driving to and from public fireworks displays, or over estimating those that occur at displays.) The reason for deliberately using conservative assumptions is try to avoid any argument that the conclusion – viewing a fireworks display presents less risk than driving to attend the display – was merely the result of using assumptions that are favorable to the fireworks industry. Further, anyone wishing to use less conservative assumptions may do so by simply replacing the numbers below with ones of their choosing.

The nature of the assumptions used in this estimate is briefly discussed immediately after each assumption is presented.

- 1) It is assumed that the accident rate driving to and from a public fireworks display is the same as the overall rate reported by NHTSA. (However, displays occur at night and spectators often drink alcoholic beverages on holidays and at displays. Both of these factors can reasonably be expected to raise the accident rate associated with driving to or from a fireworks display. Thus using the overall NHTSA accident rate may be unduly conservative.)

- 2) It is assumed that a typical spectator will travel in a vehicle a distance of 2.5 miles (4 km) to attend a public fireworks display, for a round trip distance of 5 miles (8 km). (This average is thought to be quite low, especially for displays outside of large cities. It has been suggested that an average distance of 5 or 10 miles (8 or 16 km) to a display is a more realistic nationwide estimate.)
- 3) It is assumed that the total number of public fireworks displays in the US each year in the US is 5,000. (This is thought to be a low estimate. It was calculated assuming that each year there is only an average of 100 displays in each of the 50 states. To the contrary, it has been suggested that there are at least 7,000 to 10,000 public displays per year in this country.)
- 4) It is assumed that the average number of persons viewing a public fireworks display is 10,000. (This is definitely thought to be quite low as an average.)
- 5) It is assumed that in recent years, on average one spectator every two years (or ½ person per year) is killed in the US as a result of an accident during a public fireworks display. (Based on the authors' experience and input from knowledgeable industry sources, this is thought to be significantly higher than is actually the case. Nonetheless this will be used for the purposes of this article.)

By combining the highway fatality statistic of NHTSA with assumptions 1 through 4, one can arrive at an estimate of the number of people killed each year driving round trip to public fireworks displays by multiplying 5,000 displays per year, by 10,000 people per display, by 5 miles per person, by 1.5 fatalities per 100 million miles driven. The result is 3.75 fatalities per year associated with driving to view public fireworks displays, as compared with the assumption 5 that

one-half person per year (i.e., one person every two years) is killed by the fireworks while attending the display. Accordingly, in terms of fatalities, the risk of driving to a public fireworks display is more than 7 times greater than the risk of actually viewing the display. (When less conservative assumptions are made, the estimated risk of driving is more like 20 times that of viewing.)

To conclude this calculated estimate of the relative risk of attending fireworks displays, one additional assumption needs to be made.

- 6) It is assumed that the ratio of serious injuries to fatalities is the same for driving and for public fireworks displays. (There seems to be little reason to doubt this approximately correct.)

Thus it can reasonably be concluded that the combined (fatality and serious injury) risk of driving to watch a public fireworks display is more than 7 times the risk of viewing the display. Further, since people readily accept the risk of driving to fireworks displays (i.e., that driving to the display is safe or safe enough) then it must logically be concluded that viewing public fireworks displays – as they are currently being performed – is also safe, or safe enough. That is not to say that efforts to further improve public safety at fireworks displays (or while driving on the highway) should be abandoned, rather that the impetus for substantially tightening the requirements for public fireworks displays needs to be kept in perspective. Changes that are relatively easy to implement or for which there is a substantial increase in safety, should be made. However, changes that are especially burdensome to implement or seriously reduce the public's enjoyment of displays, should be considered carefully before deciding whether they really need to be made.

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