Insights into Beach Risk Assessment - a Fault Tree Analysis Approach

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Abstract

Water Safety Management is the modern way to minimize drowning risk level at a given beach and making beaches safer. Fault Tree Analysis (FTA) is an established safety engineering tool used for safety management. Before a FTA starts, hazards, which are the interactions of human beings with morphodynamics conditions, and their associated consequence(s), must be defined by a coastal scientist. Each event and scenario in the FTA is based on knowledge known to coastal professionals. 80 to 90 % of drowning in the surf in Israel is associated with various types of rip currents. We report in this study a FTA with 32 Basic Events leading to 31 types of drowning as Top Events. The outcomes show that the major human related hazard leading to drowning is the deficiency of knowledge, especially "surf knowledge". In this pioneering analysis we perform the FTA without any consideration of interlocks, i.e. preventative safety measurements. This way we study the "risk potential" of the Israeli Mediterranean beach system, and in addition we create a generic FTA methodology to be used for other coastal regions worldwide.
Our results indicate that the yearly "killing potential" of theoretically uncontrolled 190 kilometers of Mediterranean Israeli beaches associated with annual attendance of fifty million bathers during a six months bathing season is 350 drowning fatalities. Actually, according to the last 40 years long-term statistics, the annual average death toll is 44 drowning per year in the Israeli beaches which only relative small part of them are guarded. Prior to the water safety regulations (since 1964) the drowning number was three folded. We conclude that a) Safety engineering tools such as FTA are crucial for modern Beach Water Safety Management; b) Parameterization of beach morphodynamics and Human factors has to be carried scientifically by coastal professionals and c) Implying professional Safety Engineering tools and methodologies can save many lives.