

# SOUTH CAROLINA TSUNAMI RESPONSE PLAN

## APPENDIX 11 ATTACHMENT B

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### ATTACHMENT B – Tsunami Background Information

- A. Tsunamis are infrequent, high impact events that can cause a considerable number of fatalities, inflict major damage, and cause significant economic loss to large sections of the U.S. coastlines.
- B. Tsunamis cause extensive damage and loss of life within a span of minutes near their source, and within hours across an entire ocean basin. The devastating tsunami in the Indian Ocean, that occurred on December 26, 2004, killed more people than any other tsunami in recorded history. Because of this earthquake-induced tsunami more than 297,248 people were either killed or listed as missing and presumed dead, and 1,126,900 were displaced by the tsunami. Estimated economic losses exceeded \$10 billion.
- C. The shape and characteristics of a tsunami are similar to wind-driven waves, but the potential impact of a tsunami is devastating. As the tsunami crosses the deep ocean, its length from crest (top of the wave) to crest may be a hundred miles or more, and its height from crest to trough (bottom of the wave) will only be a few feet or less. They cannot be felt aboard ships nor can they be seen from the air in the open ocean. In the deepest oceans, the waves will reach speeds exceeding 600 miles per hour. When the tsunami enters the shallow water of coastlines in its path, the velocity of its waves diminishes and the wave height increases. It is in these shallow waters that a large tsunami can rapidly rise to heights exceeding 100 feet and strike with overwhelming force.
- D. Depending on the distance from the point of origin and various other factors, a tsunami may only appear as a brief, discrete elevation increase of the water level, noted primarily by tide gauges. Or, on the end of the spectrum is the ‘mega-tsunami,’ which can reach heights of several hundred feet.
- E. A tsunami striking a coastal area is influenced by the tide level at the time of impact, i.e., a high tide will exacerbate inundation effects. Tsunamis are not ‘tidal waves’ since they are the result of earthquakes, and less commonly caused by landslides, volcanic eruptions and, in rare cases, a large meteorite impacting the ocean. Tsunamis are not generated by tides.
- F. The first wave is almost never the largest; successive waves may be spaced tens of minutes apart and continue arriving for many hours. The speed of the tsunami waves increases with the depth of the water. In deep water (greater than 600 feet), tsunamis are rarely over three feet, and will not be noticed by ships due to their long period (time between crests). As tsunamis propagate into shallow water, the wave height can increase by a factor of ten or more. The wave heights vary greatly along the affected coastline and can be amplified by shoreline and bathymetric (sea floor) features. A large tsunami can flood low-lying coastal land over a mile from the coast.

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- G. There are three direct factors that determine the destruction from tsunamis: inundation; wave impact on structures; and erosion.
- H. Flooding due to tsunami waves can extend up to one mile inland from the coast.
- Once a tsunami impacts the shoreline, it behaves very much like a flash flood, tearing through large buildings, carrying other buildings away, sweeping automobiles and people away, and battering them with debris that the flood has picked up. Being in front of a tsunami is not much different than being in the path of a dam that has broken - a person can be struck by a wall of water carrying trees, rocks, automobiles, boats, and construction debris. Floating debris, including boats, causes considerable damage. Cars can become dangerous projectiles that may crash into buildings, break power lines, and could start fires. Fires from damaged ships in ports or from ruptured coastal oil storage tanks and refinery facilities can cause greater damage than that inflicted directly by the tsunami.
- I. Access to the coast could be greatly impeded by changed shorelines, washed out roads, debris, and isolated islands created by erosion channels as water runs off the land. Of increasing concern is the potential effect of tsunami draw down, when receding waters uncover cooling water intakes of nuclear power plants.
- J. Survivability for victims caught in a tsunami is quite low. Many victims often are beaten and battered by the debris, and then drown. Those who survive do so by: climbing high enough to avoid the main thrust of the current; being deposited by the wave on higher ground; or by grabbing branches and buildings and pulling themselves from the water. Bystanders have rescued some victims, but this a rare occurrence because of the forces involved and the event.