

Guam Memorial Hospital

WIND *Mitigation*

The U.S. Territory of Guam is the largest and southernmost island in the Mariana Islands archipelago. It is located in the western Pacific Ocean, south of Japan.

The island of Guam, while only 209 square miles in size, is densely populated with 140,000 residents. Many tropical storms, known as typhoons, form in the western Pacific Ocean, and in the past 50 years, more than 25 of these storms have struck the island.

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GUAM

Guam is also in a seismically active zone. The strongest earthquake to hit the island in recent times was of magnitude 8.3, which violently shook the island in 1993.

On December 16-17, 1997, Typhoon Paka, noted as one of the most powerful storms of the 20th Century, directly struck the island of Guam with sustained winds of 150 mph and gusts to 185 mph. Paka's winds impacted the island for a full 12 hours, creating a much longer than usual timeframe for wind, rain, and storm surges to cause damage. The northern and central sections of the island sustained severe and widespread damage to homes, the island's power distribution grid and public utilities, privately owned buildings, and many other structures.

Guam Memorial Hospital (GMH) is the only public inpatient facility on the island. GMH is the only healthcare facility that remains open during and immediately after typhoons. GMS becomes



*Guam Memorial Hospital
before and after
mitigation.*

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the only dialysis unit, the only lab, and the only source of medical oxygen. It also provides temporary lodging for expectant mothers until it is safe for them to return to their homes.

Typhoon Paka impacted GMH's main building and its service delivery. The exterior oxygen storage facility sustained some structural damage from the intense winds. Upper levels of the hospital are accessible by an open stairwell and exterior corridors. Heavy rains and powerful sustained winds generated by Typhoon Paka created an extremely dangerous situation that made the ability to care for the patients on the upper levels difficult and limited. Clean up of this area after the typhoon was time consuming and added to the hazard.

Because of the critical service it provides to the community, and because of the high frequency of natural disasters, GMH is very proactive in its preparedness and mitigation programs.



This photo is an overhead view of the rear courtyard of GMH. This project entails hardening/enclosing the rear courtyard and stairwells of GMH.

The courtyard and stairwells, including the entrance to the emergency room and labor and delivery rooms were exposed to the elements creating a major safety hazard to patients and staff of the only civilian hospital on the island. This structure was designed and constructed to meet wind and seismic code.

HMGP funding for this project, under Typhoon Paka was \$4,321,376. This will result in mitigating an estimated \$5 million dollars in damages per 50 year period within the 50 year life of the structure.

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In the early 1990s, GMH's administration analyzed labor expenses following major typhoons that occurred. Their findings showed that extraordinary expenses from the effects of Typhoon Yuri in 1991 totaled \$145,168 and for Omar in 1992 was \$159,688. Based on utilization of employees and actual costs incurred, a new staffing plan for deploying and rotating staff was developed. This new plan was enacted for Typhoon Paka in 1997.

Following Typhoon Paka, GMH was awarded Hazard Mitigation Grant Program (HMGP) funds to harden the oxygen storage facility and enclose the exterior corridors and stairwells. **By replacing the facility's tin roof with concrete and by building concrete walls around the structure, the hospital eliminated the possibility of storm and debris exposure to the facility and its contents.** HMGP funds were also provided to enclose the exterior corridors on the ground floor and the exterior stairwell in order to provide a safe, protected means of access between the ground floor, the second floor emergency room, and the inpatient units on the third and fourth floors.

Post-disaster analysis showed that the cost of personnel using the new staffing plan, was \$97,999 — a 39 percent reduction in actual extraordinary costs for personnel for Typhoon Omar. Benefits of the staffing plan implemented for Typhoon Paka were that the majority of staff worked regular hours, overtime was reduced, and the relief crew was well rested, thus better able to handle the post-disaster influx of casualties.



Another view of the rear courtyard and stairwells of GMH. This view clearly shows the exposed walkways between the different wings.

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The one-time cost to replace the roof of the oxygen storage facility and the liquid oxygen tank, and to use portable cylinders until the new tank was put in place, was \$988,560. The cost of hardening the oxygen storage facility was \$51,550.

The cost to enclose exterior corridors and stairwells was **\$1,868,062**; federal mitigation funds totalled **\$1,721,671**.

Risk analysis shows the benefit of this work is valued at three times the cost, (**\$4,768,188**).



This is the only civilian, medical grade oxygen storage facility on the island of Guam. It is located at the Guam Memorial Hospital. The original facility was a wood and tin structure. By hardening this crucial structure, with concrete, the safety of the islands medical oxygen supply will be increased tremendously. This structure was designed and constructed to meet wind and seismic codes. HMPG funding for this project under Typhoon Paka totaled \$41,350. This expenditure will mitigate over \$2.5 million in potential disaster costs over the life of the structure.

The benefit/cost ratio for this project is 20 to one. The expectation is that there will be minimal or no damage from the next typhoon and thus no further repair or replacement costs.

More Success in Guam

These photos show a concrete utility pole with the footing encased in concrete being supported during the drying process. These are from the village of Santa Rita, but are indicative of several HMGP projects.

By hardening the electrical distribution system, untold dollars will be saved, as well as protecting the health and safety of the citizens of Guam. HMGP funding for two electrical system hardening projects is \$4,825,544.

This expenditure will result in an estimated savings of over 12.8 million within the 20 year life of the project.



Case Studies