Abstract. In 2005, disasters of epic proportions occurred in the same year on opposite sides of the world and exposed weaknesses and strengths in the world's ability to respond to needs. The number one need in the aftermath of a disaster is potable water. This session will provide an overview of one relief agency's experiences in providing potable water in the post-Tsunami/Katrina relief efforts. Items that will be covered include minimum water quality/quantity guidelines, water quality testing in a field environment, dealing with government regulations as well as lessons learned and applied.

2004 Tsunami

The 2004 Indian Ocean earthquake was an undersea earthquake that occurred at 00:58:53 UTC on December 26, 2004, with an epicenter off the west coast of Sumatra, Indonesia. The earthquake triggered a series of devastating tsunamis along the coasts of most landmasses bordering the Indian Ocean, killing more than 225,000 people in eleven countries, and inundating coastal communities with waves up to 30 meters (100 feet) high. It was one of the deadliest natural disasters in history. Indonesia, Sri Lanka, India, and Thailand were hardest hit.

Tsunami Related Water Needs

People can survive much longer without food than without water. Thus, the provision of water demands immediate attention from the start of an emergency. The objective is to ensure the availability of enough safe drinking water to meet at least minimal health and hygiene needs, including drinking, cooking, washing, and bathing.

Water Missions International (WMI) is a nonprofit, Christian engineering organization serving the water and sanitation needs of people in developing countries and disaster areas. The organization is best known as the provider of an off the shelf water treatment system capable of treating fresh water at a rate of 10 gallons per minute. The system, known as the Living Water™ Treatment System, fits in the back of a pickup truck, has a rugged design that will withstand rough transportation and harsh operating environments, and is easy to setup and operate. Once on site, it can be operational in 2-4 hours and has the capacity to treat enough water for 3,000 people per day. Operating costs are estimated at $4 per 1,000 gallons ($0.004 per gallon) and the system can treat water from a variety of water sources including streams, rivers, lakes, lagoons and wells.

Prior to the 2004 Tsunami, WMI had responded to many smaller disasters, but was ill-prepared for the needs that surfaced in the aftermath of the Tsunami. The organization was able to scale up appreciably through the use of local volunteer labor and increase production of Living Water™ Treatment Systems from 2 per month to 25 per week (one system requires 37 man-hours to build). Approximately 108 water systems were produced and shipped in response to the disaster.

With the need for a fast response, the first 60 water systems were air-freighted into Sri Lanka and Indonesia. Assessment teams went into both countries to identify needs and specify system locations. The largest single site relief effort occurred in Kalmunai, Sri Lanka where 10 LWTS™s were setup and produced 50,000 gallons of potable water per day from late January through December.

Bureaucratically speaking, the biggest issue associated with working in developing countries is clearing customs. Duties and value-added taxes can be as high as 200-300%. Additionally, the customs clearance process can be extremely time

consuming causing prolonged delays. Typically, in disaster situations, international pressure opens the doors to bypass these issues, and this was fortunately the case in Sri Lanka and Indonesia.

Once in-country, the ability to move the equipment without heavy machinery is critical. Heavy equipment may be available at the port of entry, but typically the locations where the systems are needed do not have access to heavy machinery. Additionally, roads are usually impassable. For this reason, the LWTS™ was designed to be able to be moved manually.

The main drinking water contaminate of concern in a disaster is microbiological related. Disaster related water quality guidelines are written with this in mind. In general, for fresh water sources, water with a turbidity of less than 5 NTU and a free chlorine residual of 0.5 mg per liter should be safe for human consumption.

Lessons Learned - Effectively responding to disasters requires an immediate response. For this to happen, plans and equipment must be in place and ready to be implemented at a moments notice. WMI was not prepared for the Tsunami and as a result has restructured it's LWTS™ production to keep 20 systems built and ready for deployment with 24hrs notice.

Katrina

Hurricane Katrina was one of the five deadliest in the history of the United States. Among recorded Atlantic hurricanes, it was the sixth strongest overall. Hurricane Katrina formed over the Bahamas on August 23, 2005, and crossed southern Florida as a moderate Category 1 hurricane, causing some deaths and flooding there before strengthening rapidly in the Gulf of Mexico. The storm weakened before making its second landfall as a Category 3 storm on the morning of Monday, August 29 in southeast Louisiana. It caused severe destruction along the Gulf coast from central Florida to Texas, much of it due to the storm surge. The most severe loss of life and property damage occurred in New Orleans, Louisiana, which flooded as the levee system catastrophically failed, in many cases hours after the storm had moved inland. The federal flood protection system in New Orleans failed at more than fifty spots. Nearly every levee in metro New Orleans was breached as Hurricane Katrina passed just east of the city limits. Eventually, 80% of the city became flooded including large tracts of neighboring parishes. The floodwaters lingered for weeks. At least 1,836 people combined lost their lives in the actual hurricane and subsequent floods, making it the deadliest U.S. hurricane since the 1928 Okeechobee Hurricane. The storm is estimated to have been responsible for $81.2 billion (2005 U.S. dollars) in damage, making it the costliest natural disaster in U.S. history.

Katrina Related Water Needs

The response to disaster related needs in a developed country does not typically require water treatment. Most municipalities have contingency plans in place for responding to major disasters. These plans entail restoring access to safe water to the local residents in a short enough time frame to prevent water related diseases. However, Katrina was a major disaster, the likes of which we had not witnessed, and it exposed a need for mobile water treatments systems.

While a need for potable water existed, it soon became evident that there were significant hurdles that had to be overcome in order to legally provide access to safe water. USEPA drinking water standards require a permit be in place for any water treatment facility that is distributing water to more than 50 users. As our systems are designed to provide water for up to 3,000 people per day, this presented a problem. In Mississippi, contacts with the governor's office produce a general waiver letter from the governor authorizing WMI to come and assist. In Louisiana, there was no assistance from the state government. WMI responded to needs in both states and ended up deploying 20 LWTS™s and 12 LWTS™ROs (a system developed to treat salt water).

At ground zero, WMI found potable water needs, but the need was not for direct consumption. Tons of relief goods had flooded into the affected areas including pallets of bottled water. Most individuals were using bottled water to meet immediate consumption needs. There was a significant need though in supporting relief camps, feeding centers, shower trucks and emergency medical stations.

Additionally, WMI identified a unique water need that had not been seen before. The need centered on the rural areas of Mississippi near the Louisiana border and was primarily centered around rehabilitating shallow wells. The communities in these areas were quite needy. A thirty foot storm surge swept through the area and destroyed nearly 100% of the existing dwellings. FEMA came in making trailers available to people in the area under two conditions. The first was that they had to have access to power and the second was to have access to water. Power was not a problem because the local electric companies were bringing access; however, water was a problem because it required an investment in a shallow well pump and installation by a plumber. The people in this area had lost almost everything so they had little money. In addition, there was no place to go to buy the equipment as local retailers within a 200 mile radius were closed or sold out.

In response to this need, WMI committed to rehabilitating 400 wells with shallow well pumps and bladder tanks. The response was conducted almost completely with volunteer labor. The project required 6 to10 two-man volunteer crews be in the field for a 4 month period.

Lessons Learned – WMI was aware of the government regulations surrounding water issues but had had little success in attempting to work with the appropriate people to get contingency plans in place. Katrina was a wake up call for a lot of people and that included the South Carolina Department of Health. As a result of the hurricane, WMI has completed work with DHEC to have pre-permitted water treatment systems for disaster use in South Carolina. All states are empowered by the EPA to enforce their own environmental regulations. This means that WMI is required to go through the approval process in each state in order to be able to provide water in the event of a disaster.