The Disaster after the Disaster

Would it surprise you to hear that the earthquake in Japan was likely not the cause of its nuclear crisis? Or that the devastation in New Orleans was not really the result of Hurricane Katrina?

By Len Garis, Peter Aggus and Ellen Koskinen-Dodgson

We're very good at dealing with the immediate effects of a major disaster. Plans exist to deal with expected disasters from earthquakes to volcanoes, from floods to cyclones. When disaster strikes, we can get aid, food, medical supplies and help to where it is needed.

But sometimes, as in Japan or with Hurricane Katrina, we activate our emergency plans, never dreaming that more horrors are about to occur as a result of factors that we didn't consider.

Nuclear Disaster in Japan

The Japanese probably lead the world in understanding and preparing for the consequences of earthquakes, and their preparations have saved an untold number of lives. However, the biggest lesson for the world to learn from the Japanese earthquake is what happened, and why, at the Fukushima nuclear power plant.

At 2:46 p.m. on March 11, a 9.0-magnitude quake struck off the coast at a depth of about 24 kilometres. The three operating nuclear reactors at the Fukushima I power plant were already in the process of shutting down, as seismic detectors had picked up the precursor P-wave tremor. This worked exactly as planned.

The immense quantity of residual heat in the core was expected and planned for, in the same way that the molten core of a steel works furnace has massive residual heat even after the furnace shuts down. The cool-down process takes days – a factor planned into the shutdown procedure.

Preparations had also been made to supply secure power during the cool-down cycle. Duplicated power feeds were provided, along with batteries and on-site generators with adequate bunkered fuel to do the job. The earthquake happened, power was lost, generators started. So what went so badly wrong?

Approximately an hour after the earthquake, a 14-metre tsunami swept over the 5.7-metre tsunami seawall, inundated the plant and flooded the standby generators. The batteries in the reactor building did their job and bought eight hours of time to solve the unexpected problem.

Understandably, the focus of the disaster response was on people and medical support – nobody made it a top priority to fly in a replacement generator until the batteries failed. As a result, the extremely hot core started splitting water molecules into hydrogen and oxygen. The lighter hydrogen, of course, rose to the roof level where it eventually exploded and blew the roof off.

In hindsight, the emergency planning was good, so long as their basic assumption held: that any tsunami would be no higher than 5.7 metres at the plant site. When the 14-metre tsunami struck, there was no plan for what to do.

The Katrina Effect

Much of the U.S. Gulf Coast from Miami to Houston is prepared to deal with the havoc caused by the inevitable hurricane strike. This planning includes having shelters available for those driven from their homes, having evacuation plans, having supplies of food and medical needs – plus much more.

The Louisiana coast is no exception. In addition, New Orleans faces significant danger from flooding since much of the city is below sea level. It shares this danger with much of the Netherlands, which is threatened by the North Sea, and the solution of dikes and levees employed in New Orleans has much in common with the protection systems in the Netherlands – though without the beautiful windmill-driven pumps.

All this is well known. What is less well known is that when Hurricane Katrina passed over New Orleans, it caused a lot of damage as expected, but all of the plans worked and everyone breathed a sigh of relief.

Then the sting in the tail hit; a breach occurred in one of the levees holding back the expected surge water level caused by the hurricane's low pressure core, causing an unimaginable quantity of water to be dumped into the city.

No plans existed to deal with a breach because it was never expected to happen. Images on TV of helicopters dropping sandbags into a torrent of water tens of metres wide and widening showed clearly that there was no "Plan B" and they had no idea of what to do to stop the problem.

Doing it Right – Apollo 13

When the oxygen tank exploded in the Service Module of the Apollo 13 spacecraft on April 13, 1970, NASA responded to the famous understated crisis call "Houston – we have a problem" in a quite different way.

They assigned not one but two teams to manage the unfolding crisis. The first team was the equivalent of our First Responders in major disasters. Their job was to manage the "now" issues – picking up the pieces and dealing with the immediate problems. The second team was assigned the job of planning the "future" and working out consequences and options – free from the worry of the daily crisis issues.

The rescue plan included using the Lunar Module's resources as a "lifeboat" during the return trip to Earth to conserve batteries and the oxygen needed for the last hours of flight. The crew jury-rigged the carbon dioxide removal system and suffered great hardship caused by limited power, loss of cabin heat and shortage of potable water, but they returned safely to Earth on April 17. NASA called the mission a "successful failure."

NASA's approach differed from that of most emergency response groups; they had a "big picture" planning team operating that took a systems approach to problem solving which operated in parallel to the first response team. Typical emergency response teams are usually so focused on doing a good job

with the “now” issues, that the “what’s coming next” issues are simply ignored until they occur, compounding the effect of the disaster.

Every organization needs to think about their assumptions, identify and investigate every potential failure mode, and develop a Plan B to address it. This information can be used to support a “big picture” team of planners, like the NASA model from the Apollo days, in taking that burden off of the front line responders and anticipating problems and developing solutions before the problems occur.

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