Flooding - Keeping the power on!

by Tony Kingham, Editor, World Security Report

One of the recurring themes that comes up repeatedly at our Critical Infrastructure Protection and Resilience events in Europe and Asia, is that whilst the threat of terror attacks on our critical national infrastructure is an ever present danger, the reality is that for most of us, some sort of natural disaster like flooding, is far more likely to affect our daily lives than a terrorist attack.

Indeed back in 2000 my own home, which at the time was 125 years old, flooded for the first time and the local church which has been around since the 14th Century was also flooded for the first time.

The immediate cause, we were told, was a very biblical 40 days of rainfall, which we had of course noticed, combined with an exceptionally high tide. Being 20 miles inland with only a small stream running through the valley, the high tide issue came as a bit more of a surprise.

Other factors probably added to this “exceptional” event such as the changing of river courses, silting of rivers, greater numbers of houses using outdated Victorian drainage systems etc. but the experience really just confirmed what we already believed and that was that something is changing in our weather system and the local environment, and not for the better.

The UK's Met Office has recently reported that global temperatures are set to rise more than one degree above pre-industrial levels and another report published in Nature, has now officially confirmed that global warming is changing global weather patterns and extreme heat waves and heavy rain storms are happening with increasing regularity worldwide.

Prof Stephen Belcher, of the UK’s Met Office said in delivering his report: “This is the first time we're set to reach the 1C marker and it's clear that it is human influence driving our modern climate into uncharted territory.”

We have surely reached the point when even the most ardent climate change deniers will struggle to maintain their stance, and even if they continue to blame the changes on other causes, they surely can't deny that whatever the cause, doing nothing is no longer an option.

When it comes to rainfall, the equation is really quite simple; higher temperatures mean increased evaporation of the oceans, more evaporation means more cloud and water in the atmosphere and more cloud and water means more storms and rainfall. Add to that the melting ice caps and permafrost and you have a future with increasing extreme storms and flooding.

So what do these changing weather patterns mean to our critical national infrastructure. Well my own experience of what was really only localised flooding shows how vulnerable our national infrastructure really is. Power to the whole village was out for some time, the phone lines as well and the local emergency services were simply overwhelmed.

It also demonstrated the interdependence of all the infrastructure services that we depend on for our daily lives.

According to a report by the UK Parliament - The highly connected nature of NI is a major concern for sector operators trying to improve its resilience. The two main forms of interdependence are Cascade Failure and Single Point of Failure. Infrastructure components often exhibit a chain of dependencies. For example, water companies rely on energy companies for their power supplies and both sectors need communications to coordinate the functioning of their assets. Failure of one component in such a chain will thus propagate to dependents, a process dubbed 'Cascade Failure'. Since neither the extent nor complexity of chains of dependence is well known, cascade failure may represent a significant threat to infrastructure. When a number of components are dependent on a single asset, or type of asset, this becomes a Single Point of Failure (SPF). In this sense Regional Convergence, where multiple infrastructure components are located in the same area, is a form of SPF, and constitutes a risk to resilience by magnifying the impact of localised disasters.

Simply put, if the power goes off, so too might the water treatment and fresh water pumping stations, gas distribution system, phone lines, ISP's, supply chain distribution for fuel and food etc.

Electricity sub stations in particular are a vulnerable part of the power grid system and CNI. Substations take the high voltage power from the main power stations and transform it down to lower voltage power that can then be fed to homes, hospitals and business locally.

They range from very large ones serving around 200,000 homes to very small ones that serve just a few homes and there are over 400,000 substations in the UK alone. So it is easy to see the scale of the problem. National Grid, who are responsible for the power grid system in the UK have identified 7 main substations that are vulnerable to flooding and are

taking steps to protect them but how good are their predictions of vulnerability and how quickly will climate change make current predictions obsolete.

I was interested to watch on television a flooding exercise in the south of England where one of the power suppliers carried out an emergency flood exercise. They arrived at the sub-station with two low loaders of specialist temporary flood barriers and dozens of especially trained staff. They went on to completely surround the substation with barriers within a matter of hours. The exercise was deemed a great success! They then proceeded to take the whole structure down, pack it back on the low loaders and head off back to base with everybody feeling very good about a job well done.

The problem, as far as I could see, was that the whole exercise was based on the premise that they knew the flood was coming, that it was going to be in a localised area, and that they would have sufficient resources to meet the scale of the emergency.

The problem with that premise, is that the problem we are trying to address is the unpredictable nature of nature...if you get my meaning?

The amount of resources, time, manpower and training involved in deploying temporary systems, surely it would have been better if at the end of all that effort that the team had left a permanent or semi-permanent solution to the threat posed to that particular station, which of course is entirely doable.

I'm thinking specifically of an old fashioned berm or perhaps not so old fashioned. Using a modern geotextile-based rapidly deployable cell system a similar number of personnel and equipment, the substation could have been surrounded with a semi permanent solution in only a few hours, leaving only entrances and exits for temporary flood barriers.

Ok this may not be suitable at all sites but a berm has many advantages over temporary systems. Firstly it is as permanent as you want it to be, it can be filled rapidly with locally available material and it can be covered with soil and planted with grass, plants or trees.

It also doubles up as protection against physical attack from terrorists or thieves.

As an example of what can be achieved, in April 2011, the town of Smithland, Kentucky, USA, which is situated at the confluence of the Ohio and Cumberland Rivers had to deal with a record surge in river levels. The Louisville Office of the U.S. Army Corp of Engineers (USACE) requested an emergency installation of a DefenCell Flood Wall system.

Within 24 hours, 3 miles worth of DefenCell Flood Wall units were delivered.

Within an hour of delivery, small teams were able to start placing, connecting and filling the systems. After just two hours, installation was being achieved at a rate of 20+ units per hour, (Equivalent to 22,196 sand bags in the initial three hours after delivery.)

In 34 hours, more than 10,500 linear feet of DefenCell Flood Walls had been installed; over 700 units were filled with more than 4,700 tons of sand, by a willing and enthusiastic but *untrained*, local workforce. The barrier was more than one mile in length, adding an extra four foot of flood protection height to the Smithland levee.

Whilst this barrier was subsequently dismantled, it could just as easily remain as a permanent barrier over time blending into the environment.

In short, our critical infrastructure is overwhelmingly static, so whether it is this type of system or another like it, we should be looking at permanent, multifaceted, economically viable solutions to protecting our infrastructure, not short terms fixes.

If you wish to join the discussion why not join us at Critical Infrastructure Protection and Resilience, Europe, www.cipre-expo.com, in The Hague on 2nd-3rd March 2016 or Critical Infrastructure and Resilience, Asia, www.cip-asia.com, in Bangkok in 16th-17th June 2016. Or maybe both!

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