Dr Christina Baxter, of EmergencyResponseTIPS.com, is joined by a special guest to relook at old cases

Lessons worth sharing

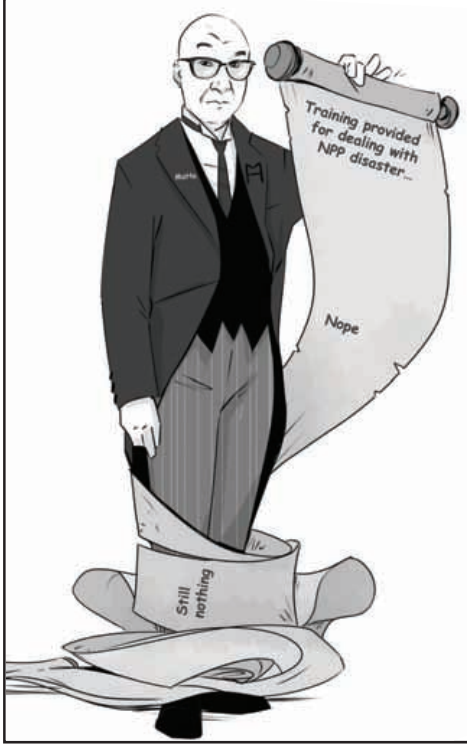
This series takes a fresh look at historic events to see how responses would be different today, using what we have learned and new technologies. Here, we're focusing on the 2011 Fukushima Daiichi disaster in Japan.

The Fukushima nuclear power plant incident [Do watch The Days on Netflix, Ed.] was the worst radiological event since Chernobyl in 1986. The Tohoku earthquake set off a giant tsunami that devastated Japan's east coast. Flooding severely impacted power systems at the plant, so it was unable to cool its reactors, resulting in a hydrogen explosion in reactor units 1, 3 and 4, despite best efforts by the staff. Over 6,000 people were evacuated from the region and a multi-year decontamination programme began. Although nearly 20,000 people were killed, and over 200,000 displaced by the tsunami/earthquake, another major incident was occurring…

General Masahiko Hamada, was among the responders at that incident.

"In spring 2011, I was deputy commandant of Japan's Ground Self-Defence Force (GSDF) chemical school and responsible for CBRN matters, including radiation protection. The school provides specialised advice to the GSDF and related organisations.

Since the Commandant of the school at the time had a background in artillery, I was responsible for the CBRN's specialized fields, including radiation protection.



Responding to a nuclear power plant (NPP) accident is not the original mission of either the ministry of defence or the GSDF. No other government agency, such as the nuclear regulation authority, could respond to such a serious accident, however, so the GSDF received a nuclear disaster dispatch order. CBRN troops were sent to the site despite a complete lack of training on how to respond to an NPP accident. Since the Cold War, they had been preparing for fallout from nuclear explosions, so some aspects were helpful.

Hamadori near the Fukushima NPP saw 1,000 CBRN troops from 13 units, gather from all over Japan. Their duties include measuring dose rates around the plant, creating iso-intensity lines on maps, decontaminating nearby residents and vehicles, and spraying water to cool unit 3, which caused a hydrogen explosion.

[Our first lesson learned] was don't believe in safety myths. Absolute safety does not exist. Instead, we must consider how best to make a risk based response. It is also important for CBRN experts to advise senior commanders of the basics. In this case, the three principles of radiation protection - distance, time, shielding - what radionuclides are present, their characteristics, the structure and function of NPPs, etc.

Lessons Learned: Fukushima

There were also difficulties in decontaminating caesium. Contamination on the surfaces of helicopters and armoured vehicles was particularly troublesome. Standards for how far decontamination should go were also unclear, with issues over managing the radiation exposure of personnel and dealing with iodine.

In 2011 the GSDF did not have reliable drones, so we had to board personnel on a Chinook to check the dose rate in the air above units 3 and 4 before the water spray operation. Furthermore, the flow of radioactive clouds after venting and hydrogen explosions was not predictable at the time, causing evacuees to flee to the northwest, conversely increasing their exposure doses."

It's impossible to over emphasise the need for pre-planning in conjunction with your interagency response partners and understanding the site's emergency arrangements. Prior coordination between the site, radiological SMEs, law enforcement, fire, emergency medical services, public health, etc is critical to a successful outcome. Lead and support agencies should be identified. Consider the potential for multiple and simultaneous competing events. Fukushima saw an extensive disaster and loss of life from the earthquake and tsunami, which challenged all available emergency resources. Emergency planning and response cannot be considered in isolation, it's part of a much bigger disaster response that requires planning, coordination, communication and prioritisation of resource allocation plus stress and fatigue management. For Fukushima, this extends to defining dosimetry and dose constraint policies for responder groups including site responders.

Command and control

Standardised incident management including the use of the incident command organisational structure can be helpful for continuity of leadership, command and control. Consider site management as well as interactions with national and international agencies. Integrate trained safety, liaison and public information officers into the operations alongside industry and national and international arrangements.

In shifting from emergency response to recovery, the specific groups within each section may change. Incorporating internet based command and control systems will help to provide a common operating picture minimising issues with regionalised response efforts, task management, accountability, shift changes and staff turnover.

Training for these low frequency, high consequence events can be problematic due to competition for time, staffing, and costs. However, it is important that the credible scenarios incorporating complex events requiring multiple agency response. Scenarios must include long duration events, personnel changes, subject matter expert (SME) engagement, just-in-time training techniques, and specialist resources. It is critical that the site, its owners and the regulators evaluate industrial pre-plans for credibility and effectiveness.

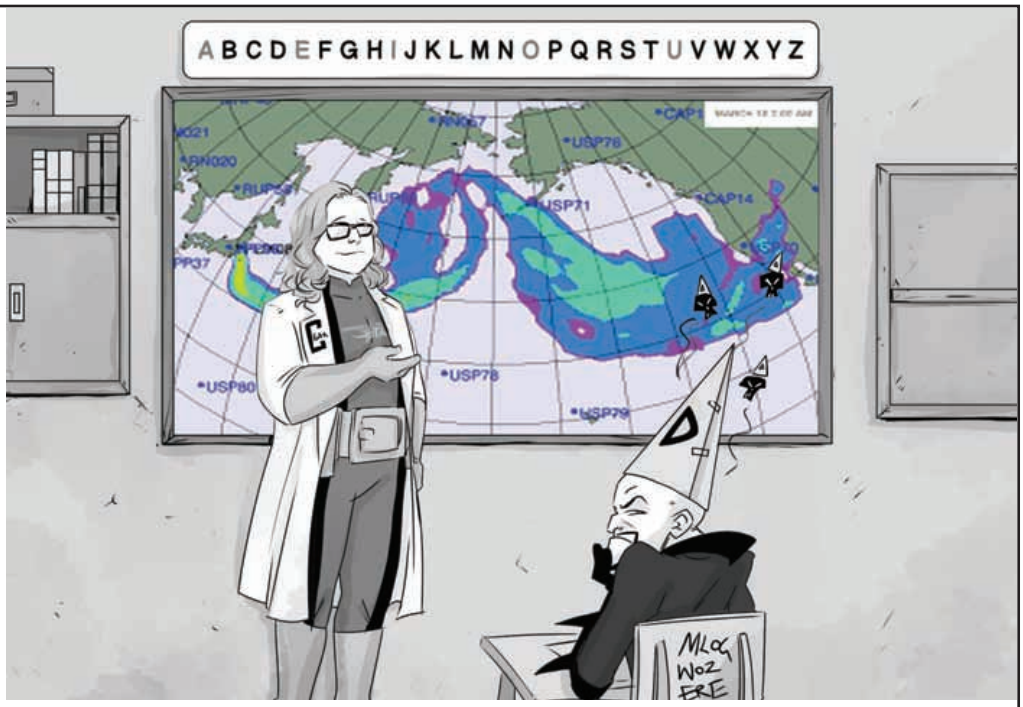
Just-in-time training focuses on immediate needs and required outcomes, so a responder using a particular detector for the first time simply needs an introduction to its operation and a 'cheat sheet'. SMEs support this approach, which can improve productivity during a disaster and reduce information overload.

Exercising

Successful resolution depends on exercising plans, command structures, and operational response. Events like Fukushima reveal a major gap in emergency response exercises, since most exercises run for hours while major events take from days to years. Short exercises miss many of the major strategic, operational, and even tactical issues that have been observed including decision making, communication, coordination, logistics, long term command and control, trained staff availability/turnover, and information sharing. Even if large scale exercises are not possible, a focus on change of shift Situational Reports (SITREPs) including one-page briefing reports and 15-minute turnover briefings should be exercised regularly.

Disparate technologies

Dosimetry, detection, mapping, mitigation, etc, are required at events like Fukushima as there will be an interagency response. Prior to field sampling and surveying, agree with radiological SMEs on how best to survey the scenes, operational dose constraints, results interpretation, units of measurement, and conversion factors you'll apply. Standardise control zones levels and action levels at each incident site. Once these are settled, map contamination spread using the interagency team approach also involving radiological SMEs. Detection tools (e.g., USA FEMA RadResponder Network and similar products) now exist that allow near real-time monitoring feeds to be securely incorporated into a geospatial format providing for enhanced situational awareness for data analysis, plume verification and responder tracking. Unlike plume modelling alone, visualising radiological data provides operational realism as there might be multiple release sources, as occurred at Fukushima.



Reaching the public

Scientific facts and figures can confuse the general public, while visual aids and maps showing real-time data on contamination levels would help in supporting communities.

Remember - preplan with your response partners to identify suitable detectors, respiratory and skin protection approaches, and mitigation strategies to protect the community, along with decontamination and medical strategies. Most importantly, practice together!

Images are courtesy of Phil Buckenham *https://philbuckenhamart.wixsite.com/philbuckenham*