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

Lessons worth sharing

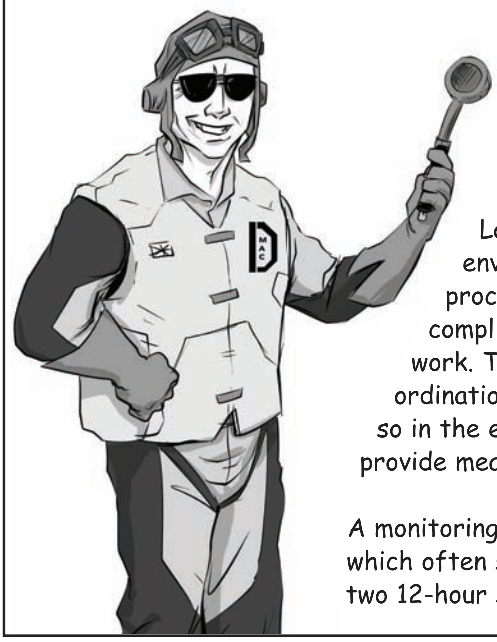
This is the first issue in our new Lessons Learned series. The goal of the series is to look at historical events with a fresh perspective and see how response objectives would be different today with the added knowledge of past events and the inclusion of new technologies. For this issue, we will focus on the lessons learned from the investigation surrounding the assassination of Alexander Litvinenko using Polonium-210 in London.

Alexander Litvinenko was a former FSB officer who defected to Britain after falling out with Vladimir Putin. His book, Blowing up Russia, accused Putin of involvement in the 1999 apartment bombings. On their third attempt, the assassins Lugovoy and Kovtun, managed to poison him with Po-210 in his tea. Po-210 is a powerful alpha emitter, and once inside the body it is highly toxic and difficult to detect. Later the Po-210 would be traced back to one plant in Russia. Lugovoy and Kovtun managed to get Po-210 on themselves, as well as Litvinenko, and left a trail of contamination across 40 sites in London and Europe. All sites needed to be cleaned and remediated, while many more had to be ruled out.

Materials that emit alpha radiation include the naturally occurring uranium, radium, thorium, and actinium as well as the artificially produced polonium, americium, curium, and californium. Alpha radiation is the least penetrating type of radiation, but it is the most damaging due to its effects on internal tissues. The large, heavy particles only travel short distances making the primary hazard ingestion while inhalation, ocular absorption, and wound contamination can also occur. Alpha particles cannot penetrate the skin and are generally only considered a health concern when inside the body.

DMac (Duncan McClure) was with the Health Protection Agency when Litvinenko was poisoned, and part of the team that needed to investigate the trail of contamination around the city.

"In radiation emergencies my principle role and that of my group, is to coordinate and control field monitoring teams. This involves the deployment of our teams, plus others from national assets with the necessary expertise. Alpha radiation monitoring is highly specialised.



One of the agency's key roles in a radiation emergency is public protection, something we exercise several times a year. Although our exercises never imagined a situation like the Litvinenko poisoning, our established plans worked remarkably well, with very little modification.

Laboratories, power stations and production facilities, are our typical environments. Radioactive materials are often used within industrial processes or process control. We frequently monitor to demonstrate compliance with regulations and without time pressures for completing the work. The Litvinenko case was very different. Monitoring control and co-ordination is a high-pressure function in any radiation emergency, but especially so in the early stages of an incident, where there is significant pressure to provide measurement data, as it is key to directing the decision-making.

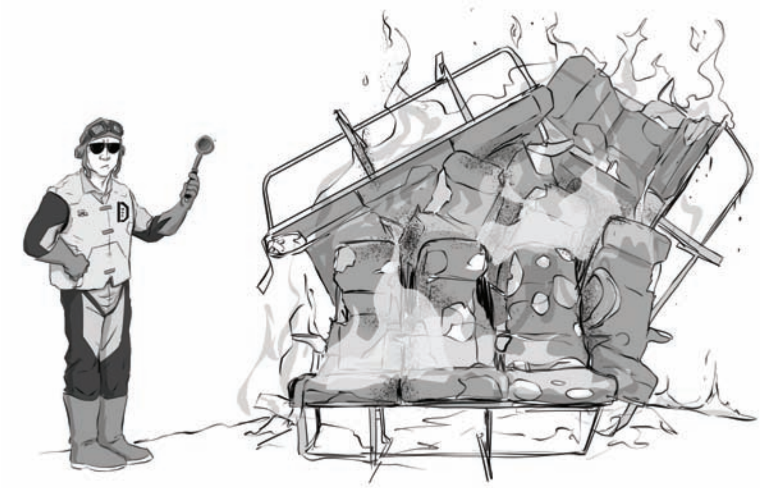
A monitoring team normally comprises two specialist scientists, plus admin support which often serves multiple teams. The monitoring operation worked 24/7, initially in two 12-hour shifts, and then three 8-hour shifts, as this proved more sustainable.

The monitoring was largely guided by information from the police, who first examined each site for forensic evidence. Once they had finished, the venue was handed over to HPA, and we conducted the necessary monitoring to establish if it could be returned to normal use, remediated, or closed to the public pending further decontamination. Monitoring was initially focussed on high traffic and high contact areas like door handles, chair backs, taps etc.

Fortunately the alpha signal is easily distinguished from background radiation, so building materials like granite, which has natural background, weren't a complicating factor. Monitoring surfaces contaminated with alpha radiation is highly specialised as there are several limiting factors, the principle one being the limited range of the particles - under 20mm in air.

This means that monitoring must be performed in close proximity to the object being examined, but not so close that the detector touches the surface, as that risks contaminating the detector, which must then be decontaminated. Also, alpha radiation is only weakly penetrating. The detector needs an extremely thin window and any contact with the window is likely to cause damage, rendering the detector useless until repaired.

Also remember that the instrument responds relatively slowly (taking a few seconds) so monitoring must be slow. Layers of dust, grime, water, etc, over the radioactive surface will attenuate the signal. What's more, if the layer of radioactive material is significantly deep, a degree of self-attenuation will occur, which again may corrupt any estimate of the activity present.



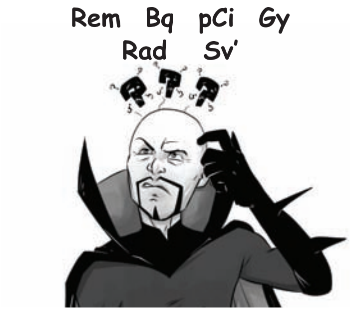
Simulating the extreme pressure experienced by monitoring co-ordination and control teams is virtually impossible in an exercise. The monitoring controller would often need to step outside the team ops room to deal with bigger picture issues. Another important lesson learnt was the need for a greater pool of individuals for the various roles. You can cope with one or two individuals for a short exercise, but when monitoring continues for weeks, you need many more. We experienced significant difficulties in trying to utilise people as monitoring controllers when they hadn't previously trained for the role during exercises. Interpreting the monitoring results to determine the level of activity present was another problem. Speed of agreement in developing a common conversion coefficient was vital.

We also had to clear aircraft, as there was extreme time pressure to get flying again and earning money! As we monitored several weeks after the event, information about where the individuals had sat was useless as the aircraft had undergone maintenance in the interim, and the seats hadn't necessarily been put back where they were before. This meant that every single seat and square inch of the aircraft had to be monitored."

There have been many crimes involving radioactive substances, however few cases involving the use of alpha emitters have been reported. The targeted assassination of Litvinenko in November of 2006 is the most widely studied but the murder of Roman Tsepov in 2004 is also considered to be a case involving an alpha emitter but it is yet to be officially unconfirmed.

In order to take observations from historical events and make them into a "lesson learned", plans and processes must be reevaluated and updated to address the contemporary knowledge.

Planning
The need to preplan in conjunction with your response partners cannot be emphasized enough. Prior coordination between law enforcement, fire, emergency medical services, public health, radiological SMEs and other relevant agencies is critical to the successful resolution of any event. Unfortunately, most exercises do not account for the fact that many crimes, including those with targeted assassinations via CBR materials, will have multiple crime scene that may be geographically dispersed. This can create a highly stressful environment with time pressures, intense political and media interest, and logistical burdens for access to limited equipment supplies. To accommodate the long time response periods that this type of incident can incur, it is imperative that all operational roles can be performed by many different personnel. Instead of deploying the entire HazMat/CBRN team to each site, consideration should be given to the use of Joint Hazard Assessment Teams (JHAT) that incorporate elements and expertise from each service to prioritize and accomplish the tasks. This allows for many smaller teams accomplishing the mission set in parallel. This approach does rely upon access to duplicate sets of equipment for the small team missions.



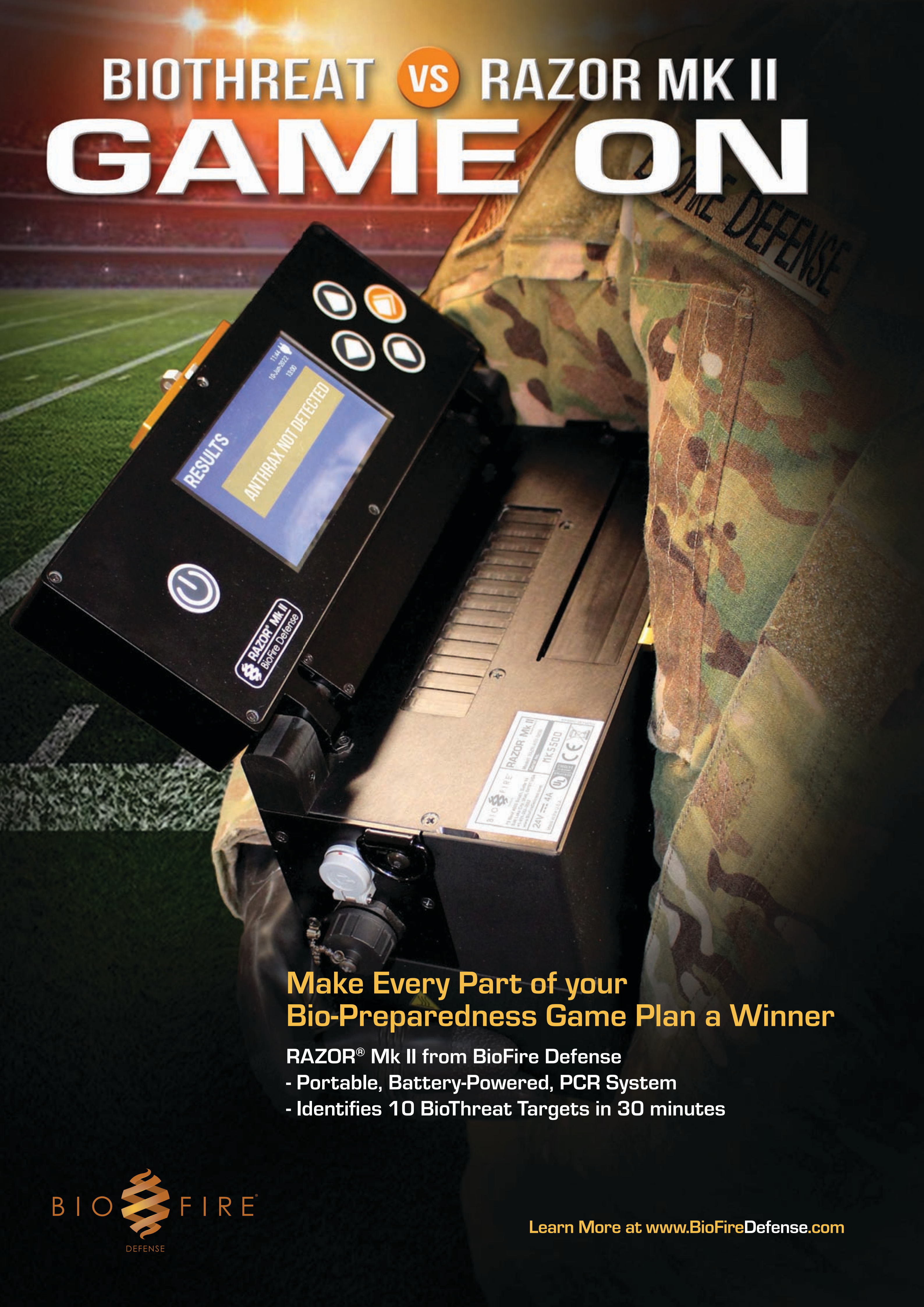
Detection
Due to the interagency nature of this type of response, the likelihood of disparate equipment types being used is high. Prior to field sampling and surveying, determinations must be made about how to survey the scenes, on how results will be interpreted, what units of measure will be used, and any conversion factors that will be applied. In addition, standardized levels for control zones at each incident site must be preplanned. Once these issues are decided upon, the mapping of the contamination spread can be performed using the interagency team approach also involving radiological SMEs.

Protection
Minimize opportunities for unexpected exposures by wearing appropriate respiratory and dermal protection. A P-100, or P-3, respirator should always be worn to minimize inhalation concerns. Consideration should also be given to wearing a protective outer garment to minimize the potential for secondary exposures and to reduce the cross-contamination concerns between sites.

Decontamination
Radiation detectors fitted with alpha probes must be used to measure levels of contamination before and after decontamination of personnel and the environment. It is imperative that agencies have predetermined end points to determine what is contamination, what is decontamination success and areas to be returned to normal use or requiring further remediation.

Remember – Preplan in conjunction with your response partners to identify suitable detectors, respiratory and skin protection approaches, and mitigation strategies that will protect the crime scene, as well as your decontamination and medical strategies. Most importantly, practice together!

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