Food for thought

Monica Heyl looks at preventing cross-border dangers to food

Our world of over seven billion individuals has inevitably become increasingly dangerous and more difficult to police, and for the first time in our history somebody with no formal education, but armed with a cause, can quickly find out online how to commit acts of terror or other nefarious deeds. So one of the major challenges of the 21st century will be to ensure that our borders and our ports of entry are protected from unscrupulous individuals or parties attempting to smuggle dual-use CBRNE materials into our commerce streams and cause grave harm or disruption. Public health and safety rely on national authorities developing systems of surveillance which ensure goods flow into countries unimpeded by individuals or state party agendas of harm.

Food as the vector

Food is one of the most vulnerable vehicles for intentional contamination. Grocery stores boast safe fresh produce from all over the world and we are highly dependent on foods, animal feeds and pharmaceuticals arriving within our border with clean bill of health. That is why we establish checkpoints and inspection stations along land and sea borders to ensure that our commodities are in compliance with the established regulations. There are many organisations worldwide that are responsible for monitoring and ensuring the safety of food commodities both manufactured in country and imported into other countries.

Recent food recalls with extremely virulent naturally occurring pathogens have sharply focused attention on monitoring agencies' ability to respond rapidly to international or isolated terrorist attacks that might use these regulated products as the vector. The susceptibility of our foods and commodities to tampering and to be used as instruments of terrorism is forcing us to be ever more diligent in finding better, faster and more cost-efficient ways to protect ourselves.

It is essential that we do not impede commodities from arriving safely at their intended destination. This is particularly relevant for perishable goods that are often frozen or require refrigeration. Typically in the US, sample collection to sample analysis and results are delayed one to three days from their point of entry until they are able to be cleared for entry. This delay is often unacceptable, so only a very small percentage of food is examined at our ports of entry. For this reason we are developing new approaches that provide improved screening, analysis and rapid response to the possibility of intentional contamination of our foods and drugs.

Predict, Prepare, Prevent

Preparation is the key to prevention. Preventing border crossing delays and potential large-scale disruption of food commodities into our distribution stream is essential, but the scale of global trade means the difficulties faced are daunting. As materials and goods are inspected at international borders or ports of entry, survey instruments, hand-held devices and well trained observers play the critical role in detecting potential pathogens or poisons. However, these capabilities come with their inherent limitations. They can only do so much; they are not a panacea, and how do we handle a suspect threat?

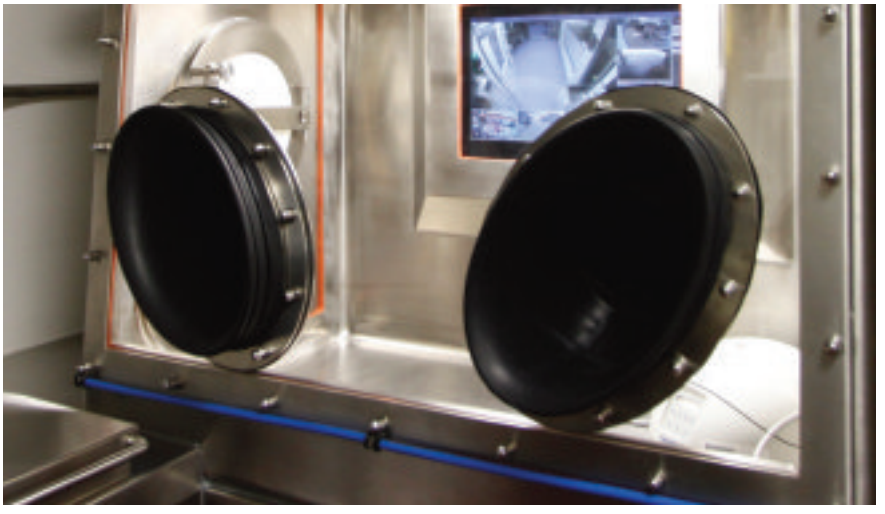
At the higher levels, strategic planning should include a prediction approach. A set of comprehensive risk reduction plans are based on each country's aims and capabilities. This begins with identifying the most vulnerable commodities, developing an understanding of those vulnerabilities and forging plans which best mitigate the threats. These plans need to be routinely practiced, and should go into effect after the initial screening has delivered a positive result.

A system of approaches including sample collection, examination, point-of-diagnosis-type screening tools and a well-thought-out analytical process performed at the site could easily be modularised and made available for use at particular borders. These pre-planned capacities may well help to prevent unnecessary delays in the delivery of goods and hence provide enormous savings in time and money, even casualties.

Recent developments in technology and inexpensive genetic sequencing are allowing us to establish technological advances by inserting new and established capabilities into areas of the world where they do not currently exist. The ability to bring the capability to the need is maturing every day. Global communications, digital technologies and information management mean lighter, smaller and faster capabilities. Additionally, they have also converged into turnkey systems that have integrated important factors such as lesser logistical burdens, minimised personnel requirements and advanced robotics.

Credible risk mitigation

Historically, on-site field science has provided a great deal of relevant information which far surpasses that of fixed-site, gold-standard,



(top) Patented 'Bleaching Station' allows for receipt and decontamination of packaged commodities so that they can be opened, examined and then safely analysed within engineering controls. Germfree Laboratories
(above left) The US Secure Freight Initiative builds on existing port security measures by scanning containers for nuclear and radiological materials. NNSA
(above right) Glovebox system with interior monitoring system for facilitating reach-back capabilities. Germfree Laboratories
(below) Many countries are now increasingly vigilant in order to ensure that imports are not being compromised. Germfree Laboratories

remote laboratories. Information can save lives, mitigate consequences and facilitate decisions, resulting in a reliable, measured response. However, this approach has often been viewed as suspect.

Strategies and innovative solutions for conducting highly reliable, forensically correct scientific studies are available. They integrate innovative mobile platforms, field-engineered instrumentation, engineering controls, trained technicians and scientists, and a mature reach-back approach for the analyses of CBRNE materials that can be performed in geographical areas of relevance.

New validated technologies such as fast polymerised chain reaction (PCR) allow for sample preparation to sample analysis in three minutes. Time of flight coupled with direct analysis in real time produce high resolution, accurate mass spectrometry with an orthogonal electrospray source, and high purity germanium detectors provide gamma ray analysis available in handheld detectors.

Using these technologies with pre-planned integrated solutions that address intelligent sampling, sample preparation, sample analysis, data development, interpretation and comprehensive data report generation allow for real-time and near real-time answers where they are needed.

Validation of definitive technologies (platforms), selection and validation of specific critical reagents and validation of methodologies that address the detection and analysis of threats (biological, chemical, mid-spectrum, and nuclear/radiological) will help to standardise our capability to respond to threats associated with food and drugs.

Standardised, integrated, 'intelligent' sample collection management: plans, tools and processes should be well thought out ahead of time. Monica Heyl & Associates

These validated technologies could then be transferred to mobile capabilities that could be positioned at border points. One country's capability could complement another country's capability and could diffuse potential areas of conflict if one country reported contamination in products received from the other.

Efficient analysis

Timely and accurate analysis at our borders is essential to maintaining commercial viability. Analytics in general are costly. To reduce this burden, designing systems for transportability, flexibility and integrated solutions are key to allowing us to effectively guard borders and commodities.

"The ability to bring the capability to the need is maturing every day..."

Developing this type of system requires integrated solutions that have been pre-planned and validated with over-arching objectives to mitigate catastrophic peril to one of our most vulnerable resources - food.

Ensuring that food commodities are protected from tampering facilitates trade. Enhancing CBRNE security helps to safeguard the activities of commerce, facilitating economic development, inspiring competition, establishing diplomacy, reducing poverty, improving living standards and creating jobs.

International cooperation, collaboration and partnerships are essential to our future. Alliances can only be achieved via a foundation of trust, not just among world leaders but among first responders, scientists and diplomats.

Pathogens do not know borders. Particulates, vapours, volatiles and disease do not have defined spaces. The responsible and trustworthy collaboration of scientists across the world is, therefore, essential.

Monica Heyl of Monica Heyl & Associates LLC is an on-site analysis expert.