By Bob Ferguson

Spies in the Sewer

Visualizing an unexpected application of sewage analysis

In the May 7 issue of *Time* magazine, there was an article about the capture and killing of Osama bin Laden. The article, "How It Went Down," described not only the actual mission by the Navy Seals to raid the compound in Abbottabad, Pakistan, but also the intelligence operations leading up to the raid.

The article, by Harvard Professor Graham Allison, offered a behind-the-scenes look at the processes and decision-making that went into the intelligence operation and the search for bin Laden.

But for those of us in the water and wastewater industry, there was one line in the article that should have stood out. In the description of the options available for the surveillance and intelligence gathering that occurred prior to the mission, it was mentioned that one of the techniques available to determine if bin Laden was in the compound was "analyzing local sewage for genetic markers."

Wow. Spies in the sewer!

The actual surveillance options used are secret and the article did not go into any further detail about the techniques actually used. But with experience in water and wastewater and some background in molecular detection technology, I can speculate.

The analytical technique that would have been used is called polymerase chain reaction analysis (PCR). Most of you are probably already familiar with PCR, but in case you are not: It is an analytical technique that works by detecting and amplifying a piece of DNA in a sample and generating thousands or even millions of copies of a particular target DNA sequence. This technique is commonly called "DNA testing" and typically is used in criminal cases and paternity testing. The test also is used by environmental researchers to trace sewage contamination of water sources. By analyzing water sources for specific genetic sequences of bacteria known to inhabit only the human gut, the source of water contamination can be definitively traced back to sewage sources and not from animal or other sources.

Somatic cells from such sources as epithelial cells that line the intestines or old cells that are routinely being replaced throughout the body also wind up in urine or feces and ultimately in the sewer. All of these cells contain the unique genetic sequences that can be used to identify whom they came from.

Making Connections

To identify the source of DNA in a sample, DNA—sometimes from the individual but, in the case of an investigation like the one involving bin Laden, usually from a close family member—is compared with that found in the sample to make an identification with a high degree of confidence. But to do this, the scientists—spies, in this case—would need to have access to DNA samples from a close bin Laden family relative.

It turns out that they did. Before bin Laden was buried at sea, DNA sampling was conducted to positively identify that the body was indeed his. It has been reported that samples from the body were compared to samples from bin Laden's sister, who died at Massachusetts General Hospital in 2010. But this would also mean that the genetic markers needed to identify bin Laden were available prior to the raid on the compound.

The *Time* article also reported that, after the raid, Pakistani intelligence arrested a doctor who, in the months leading up to the raid, had been vaccinating children in the area in hopes of extracting bin Laden DNA in the process. Knowing that the markers were available and that there were other efforts to obtain DNA samples, makes it even more possible that sewage testing could have been part of the surveillance.

It also would be useful to know about the structure of the sewer treatment system serving the compound. The fewer the houses discharging into the sewer system, or the closer the sampling point could be to the house, the fewer sources of DNA the analysts would have to sort through. It would be difficult, if not impossible, to use this technique to determine if, for example, a particular person was in a large apartment building with a diverse population, but far easier in a situation where there are few sources of discharge. Bin Laden reportedly lived in the compound with several of his children and grandchildren, so the sought-after genetic markers would have been prevalent in the samples, further facilitating the possibility that this type of testing could be effectively used.

It is tempting to speculate that the compound was completely disconnected and served by a septic system. But I would also guess that trying to obtain samples from a septic system would carry such a huge risk of discovery that it would have been ruled out early in the planning process, such that it would not have remained a topic worthy of mention in the article. My speculation is that there was indeed a sampling point that could be isolated and accessed without undue risk of raising suspicion.

It certainly is not often that wastewater analysis plays a role in espionage and international intrigue. But in this case it seems that it very well may have. WWD

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