THE WALL STREET JOURNAL. ONLINE

December 1, 2006

COMMENTARY

# Polonium 210

**By PETER D. ZIMMERMAN**
*December 1, 2006; Page A12*



LONDON -- The gruesome death of former KGB Lt. Col. Alexander Litvinenko will make history. Litvinenko is undoubtedly the first person murdered by the administration of an alpha-particle emitting radioactive isotope; that makes him the first known fatality resulting from a radiological assassination. The isotope, polonium 210, is largely unknown to the public.

Litvinenko's death was as ghastly as it is possible to imagine. The radioactive material went to his gastrointestinal tract, where it rapidly killed the cells lining his gut. They sloughed off, causing nausea, severe internal bleeding and enormous pain. It was as if his internal organs received a severe sunburn, and peeled. If the dose was high enough, it was a death sentence, no matter what the doctors tried to do. At best they could have tried to make Litvinenko comfortable until the end.

David Gothard

Radiation poisoning was not detected immediately, even though the symptoms were at least consistent with that cause. At a moderately early stage, according to visitors to the bedside, radiation was suspected, and a simple monitor was passed over Litvinenko's body. It failed to register significant radiation. That is not surprising because of the perverse genius of the choice of poison.

Alpha rays, emitted from certain very heavy atomic nuclei, are nothing but the nuclei of helium atoms. They pack a lot of energy, but because they are heavy and slow moving, they do not penetrate the way that gamma rays -- the most common radioactive emission -- do. Alphas are stopped in no more than a sheet of paper or a piece of aluminum foil, while gammas of the same energy will go through inches of lead. The alphas from the polonium 210 coursing through Litvinenko's body were stopped by his flesh, his skin and his clothing. There was nothing to be detected from outside.

Polonium is 5,000 times as radioactive per gram as radium; it takes very little to kill when it is ingested. There isn't much data, given that only two people are known to have died from acute polonium poisoning, one of whom was Madame Curie's assistant almost 100 years ago.

The Health Physics Society suggests that only three millicuries of polonium will do the trick; a fellow physicist estimated seven millicuries; and using data from a tragic episode in Goiania, Brazil, where five people died after eating a different isotope, I calculated the lethal dose at five millicuries. A "curie" is the amount of radiation given off by one gram of radium in one second; a millicurie is that given off by one-thousandth of a gram of radium. Because polonium's radioactivity is so high, one millicurie of polonium would weigh only 0.2 millionths of a gram, or about seven billionths of an ounce. Given the paucity of the data, three, five and seven are all "the same number," and it might be best to say the lethal dose is "around 10 millicuries." That is probably no bigger than a few grains of salt.

As this newspaper goes to press, the British authorities are investigating polonium contamination in at least a dozen locations in the West End of London, and British Airways has taken three Boeing 767 aircraft out of service for forensic examination. Many people who have been at or even near those locations fear for their own safely -- not surprising given the way Litvinenko died. In all likelihood there is no cause for any worry: The contamination must be at a very low level, particularly if it came from Litvinenko's body. The British government is partly to blame for the panic. It has announced "contamination," but has not indicated the amounts. It has sent a few people for follow-up screening, but has not explained that they are unlikely to be in any danger, and that the screening is probably only to gather forensic evidence.

Po-210 is a strange beast of a metal. The energy of each radioactive disintegration is so great that small chunks, perhaps a few hundred atoms in size, are blasted out of the surface and then drift around the room. Like dust they settle, but unlike dust they are radioactive themselves. And so, if one looks for alpha radiation with a sensitive detector, the micro-specks will announce themselves. But if such specks are all the contamination that exists, they are far too small to be dangerous.

When the use of polonium to kill Litvinenko was revealed, most scientists said that preparing the poison required the resources of a government, or at least the use of a nuclear research reactor. The only economical way to make the material is in a reactor where a target is bombarded with neutrons; the resulting tiny amounts of polonium are then carefully separated in a radiochemistry laboratory. The basic techniques date back to Pierre and Marie Curie's 1898 discoveries.

But it turns out that polonium 210 is a fairly common industrial isotope, one for which there are few substitutes. The radiation from a Po-210 source is used to ionize air, so that static electricity can be dissipated from textiles being pulled along rollers, from rapidly moving bands of paper, such as newsprint, and from photographic film. Alpha radiation makes it possible to brush off dust from film without having it immediately yanked back by a static charge.

Indeed, the U.S. Nuclear Regulatory Commission does not even require much in the way of licensing or paperwork to buy polonium sources smaller than two curies. Antistatic brushes, when fresh, can contain up to 10% of a lethal dose of Po-210; air ionizers for use in industry can contain up to the limit without coming under serious regulation, but larger and more useful sources are controlled. Such brushes, and somewhat larger ones, remain on the market.

As the threat of "dirty bombs," or radiological dispersion devices (RDDs), became well known a few years ago, thought was given to controlling alpha sources almost as tightly as gamma sources. However, it was recognized that alpha-emitters were not useful in RDDs because the radioactive material was only dangerous if you could persuade the victim to eat, drink or inhale it, something which seemed improbable. The allowed sealed radioactive sources are extremely hard to open, and extracting the microscopic speck of polonium is even more difficult.

Does the Litvinenko murder change things drastically? Not immediately, in my opinion. Polonium sources are still valuable in industry, and substituting small x-ray devices would be expensive and would take years to accomplish. The lesson from the Litvinenko murder is not that radioactive sources should be banned, not even alpha sources. It is that radiological weapons have the power to frighten us and to disrupt our lives, even when they cannot be used to cause widespread death and injury, and that an inarticulate government can make things much worse.

***Mr. Zimmerman, a physicist, is professor of science and security at King's College London, and previously was chief scientist at the Senate Foreign Relations Committee and science adviser at the State Department during the Clinton administration.***

**URL for this article:**
http://online.wsj.com/article/SB116493485128037515.html