

**PIM 4:
The murder/assassination of Alexander Litvinenko by ^{210}Po poisoning.**

The biological half-time is approximately 50 days. Radiation doses, including those from polonium-210, are assumed to give rise to an increase in lifetime cancer risk. The larger the dose, the larger the risk. Very high radiation doses can cause damage to body tissues and organs and in the extreme can be fatal.

Assuming that Mr. Litvinenko had been given a dose of $1\ \mu\text{g}$ of ^{210}Po on November 1, and he died on November 23, then the amount of ^{210}Po left can be calculated by using the following equations

$$T_{1/2} = 0.693/K$$

$$138.38 = 0.693/K$$

$$K = 0.693/138.38 = 5.0 \times 10^{-3}$$

The amount of ^{210}Po left after 23 days

$$\ln[A] = -Kt + \ln[A]_0$$

$$\ln[A] = -5.0 \times 10^{-3} \times 23 + \ln[1] = -0.115$$

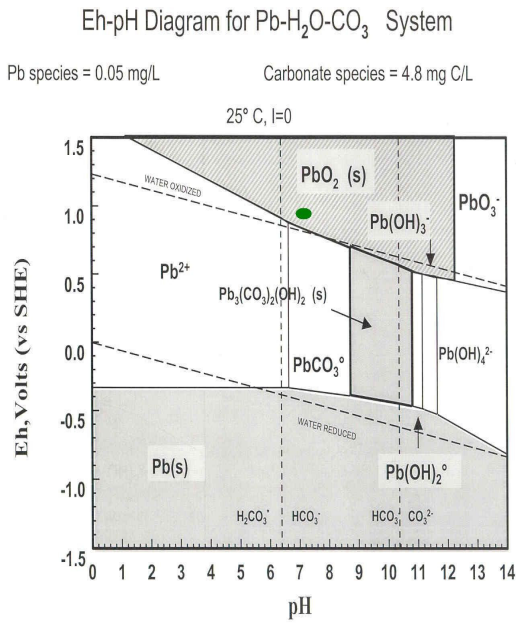
$$A = 0.891\ \mu\text{g}$$

PIM 3: Lead in Washington, DC drinking water

Drinking water in Washington DC became the main focus in the local news since Feb, 2004, when the local residence of DC started to be aware of the problem, Washington post published many articles, and provided the public with many data and regulations especially from the EPA not only about the lead limits in drinking water, but also about some proposal to solve the problem and lower the Lead contaminate level in DC drinking water.

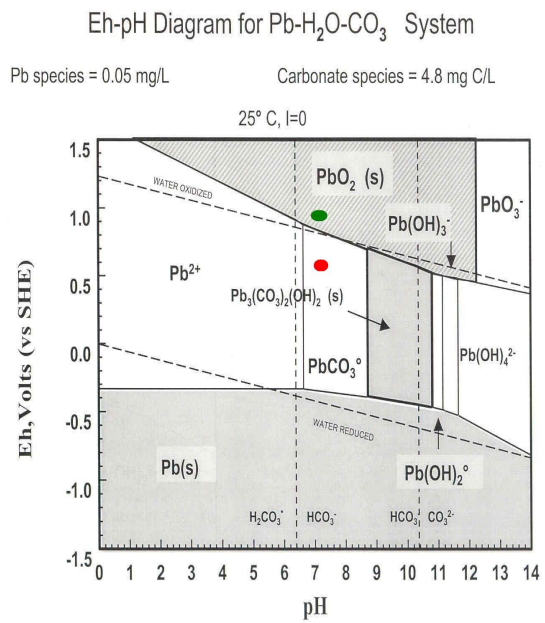
when Washington used large amounts of chlorine in the past, the highly oxidizing water fostered development of PbO_2 scales. As long as the drinking water remained highly oxidizing, those scales were stable and insoluble. With the shift to chloramines, the oxidizing potential of D.C.'s

water was lowered. Thus, Schock's research shows that after the change, D.C. water might well dissolve the PbO₂ scale, which would then raise the contaminant levels.(3)



The green dot represents the Eh of water in Washington when treated with HOCl

(A)



The red dot represents the Eh after disinfection with NH₂Cl began, in a soluble lead region.

(B)

A farther study to the above Eh-pH diagrams where diagram A shows the Eh-pH in DC water treated with HOCl, while diagram B shows Eh-pH when water treated with NH₂Cl. To form Pb oxide that Schok discovered if we want to keep the pH of drinking water at 7.0 then we need to push the Eh of this water to be between 1.1V and 1.5 V (green dot on diagram B), another way to shift this stability regions for the Pb oxides is to increase the pH of the water.