CLAIMS

1. A method of generating radioisotope ^{212}Pb, the method comprising:

exposing an interior surface of a container to a ^{212}Pb precursor isotope source by sliding a rod from a closed position in which the ^{212}Pb precursor isotope source is sealed off from the interior surface of the container to an open position in which the ^{212}Pb precursor isotope source is exposed to the interior surface of the container, wherein the ^{212}Pb precursor isotope source is disposed on the rod;

allowing sufficient time for the precursor isotope source to decay into one or more progeny isotopes and to emanate the one or more progeny isotopes into the container, wherein the one or more progeny isotopes comprise ^{220}Rn, ^{216}Po, and/or ^{212}Pb; and

isolating the ^{212}Pb precursor isotope source from the container by sliding the rod from the open position to the closed position.

2. The method according to claim 1, wherein the ^{212}Pb precursor isotope source comprises a thorium 228 isotope (^{228}Th) and/or a radium 224 isotope (^{224}Ra), the method further comprising allowing the ^{228}Th to decay into at least one of a radon 220 isotope (^{220}Rn) and a lead 212 isotope (^{212}Pb).

3. The method according to either claim 1 or claim 2, the method further comprising allowing the ^{212}Pb to deposit on the interior surface of the container.

4. The method according to any one of the preceding claims, wherein isolating the ^{212}Pb precursor isotope source from the container further comprises withdrawing the ^{212}Pb precursor isotope source.

5. The method according to any one of the preceding claims, the method further comprising turning the container before exposing the interior surface to the ^{212}Pb precursor isotope source.

6. The method according to any one of the preceding claims, wherein exposing the interior surface of the container to the ^{212}Pb precursor isotope source exposes the interior surface of the container to the ^{212}Pb precursor isotope source without having the ^{212}Pb precursor isotope source touch the interior surface.

7. The method according to any one of the preceding claims, wherein allowing sufficient time for the at least one progeny isotopes to emanate into the container comprises allowing the at least one

progeny isotopes to emanate into the container from the ^{212}Pb precursor isotope source through a gas permeable barrier.

8. The method according to any one of the preceding claims, wherein allowing sufficient time for the at least one progeny isotopes to emanate into the container from the ^{212}Pb precursor isotope source comprises allowing sufficient time for the at least one progeny isotopes to emanate into the container from the ^{212}Pb precursor isotope source disposed in a sponge, a wool, a strip, or a sphere comprising at least one selected from the group consisting of: quartz, glass, mineral, paper, plastic, metal, ceramic, natural fibers, and synthetic fibers.

9. A system for generating radioisotope ^{212}Pb, the system comprising:

a ^{212}Pb precursor isotope source disposed on a rod, the rod configured to slide between an open position in which the ^{212}Pb precursor isotope is exposed to an interior surface of a container to allow the ^{212}Pb precursor isotope source to decay into one or more progeny isotopes emanated into the container, and a closed position in which the ^{212}Pb precursor isotope source is sealed off from the container to isolate the ^{212}Pb precursor isotope source from the interior surface,

wherein the one or more progeny isotopes comprise ^{220}Rn, ^{216}Po, and/or ^{212}Pb.

10. The system according to claim 9, wherein the ^{212}Pb precursor isotope source comprises a thorium 228 isotope (^{228}Th) and/or a radium 224 isotope (^{224}Ra), and the one or more progeny isotopes comprises at least one of a radon 220 isotope (^{220}Rn) and a lead 212 isotope (^{212}Pb).

11. The system according to either claim 9 or claim 10, wherein, in the closed position, the rod forms a gas tight seal with a tube in which the rod slides to isolate the ^{212}Pb precursor isotope source from the interior surface.

12. The system according to any one of claims 9-11, wherein the rod holds the ^{212}Pb precursor isotope source without having the precursor isotope source touch the interior surface.

13. The system according to any one of claims 9-12, wherein the ^{212}Pb precursor isotope source is encapsulated in a gas permeable barrier.

14. The system according to any one of claims 9-13, wherein the ^{212}Pb precursor isotope source is disposed on a sponge, a wool, a strip, or a sphere comprising at least one material selected from the list consisting of: quartz, glass, mineral, paper, plastic, metal, ceramic, natural fibers, and synthetic fibers.

15. The system or the method according to any one of the preceding claims, wherein the interior surface of the container is configured to allow the ^{212}Pb to deposit on the interior surface, or wherein the rod includes at least one O-ring to form the gas tight seal with the tube in the closed position, or wherein the precursor isotope source is configured to decay and emanate the one or more progeny isotopes into the container for 5 hours, 10 hours, 20 hours, 24 hours, 48 hours, 72 hours, or 96 hours.