

## Briefing Note on Polonium 210

Polonium-210 (Po-210):

- A naturally occurring radioactive isotope that was discovered by Marie Curie and her husband Pierre, who originally extracted it from uranium ores (pitchblende) and called it radium F before renaming it in honour of Poland, the country of Marie's birth.
- An alpha particle emitter (see below) that decays, to a non-radioactive isotope of lead (Pb-206), with a half-life of 138 days.
- Like other alpha particle emitters can be toxic if taken into the body (see below).
- Produces considerably more disintegrations per second, and hence radiation dose, per gram than other common alpha emitters and consequently even small, millionth of a gram (microgram), amounts can potentially produce lethal doses if taken into the body.
- Found in materials in the general environment, because it is a decay product of natural uranium, but only occurs at extremely low concentrations (at levels that are many orders of magnitude below which toxicity is a concern). Consequently, if it is required in high concentrations, it is more practical to produce it by neutron irradiation (activation) of Bismuth (Bi-210) in a nuclear reactor, than by processing the large quantities of uranium ores that would be required.
- Disappears rapidly once it is in an isolated form because of its short radioactive half-life, just 16% will remain after a year and only 2.5% after two years.
- Excreted from the body, following exposure, with a biological half-time of about 50 days (i.e. 50% will be eliminated from the body within 50 days). This effect, when combined with the reduction in activity due to radioactive decay (see above), means that activity in the body, and hence dose, falls off rapidly following cessation of exposure, halving approximately every 37 days.

Alpha particles:

- Being particulate in nature, unlike x-rays or gamma rays, and relatively massive (at an atomic level), are not very penetrating.
- Only travel about 2 cm in air (N.B. This does not mean that an aerosol containing their source will only travel 2 cm in air, as one recent news report suggested) and can be stopped by thin materials such as a sheet of paper or the outermost dead layer of skin that covers the human body. Consequently they present little or no hazard when their source, e.g. Po-210, is external to the body, even when in direct contact with the skin. However, when a source is taken into the body by inhalation, ingestion or injection (e.g. due to a puncture wound) and into contact with living cells, alpha particle emitters can be a considerable hazard.
- Deliver a relatively large amount of energy (as compared to other forms of radiation) in the short distance that they travel and hence are extremely lethal to any living cells that they do hit. Acute toxic effects are due to this direct killing of cells not damage to DNA.
- Easy to detect in the environment, even at very low levels, using simple hand held instruments.
- Because of their lack of penetration they are impossible to detect by direct measurements once their source is taken into the body. Hence, exposures need to be indirectly assessed, from concentrations found in biological samples, i.e. urine, and mathematical models that describe the absorption, distribution, metabolism and elimination of the source material.

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