HEALTH PROTECTION AGENCY

METHOD FOR THE ASSESSMENT OF POLONIUM-210 IN URINE BEING USED BY HPA FOR THE UK PO-210 INCIDENT

Introduction

Different methods can be used for assessing Po-210 according to the objectives of the measurement. There are several different analytical techniques available, which are complementary, and fit for their respective purposes. Generally the greater the precision and sensitivity needed, the longer the process will take (a) because of the need for chemical processing to separate and concentrate the polonium, and (b) to allow time for a sufficient number of radioactive decays to take place.

The HPA measurements were designed for public health purposes: to confirm that exposures were low for members of the public and various employees who may have had contact with a contaminated person or location. A sensitive method was needed, which requires 2-3 days from receipt of a 24-hour sample.

The method used has been adapted from one that is in routine operational use for measurements on environmental samples, e.g. food. It is therefore capable of measuring natural levels of Po-210 in many types of sample, including urine. During validation of the procedure, measurements were made on urine samples from HPA staff. These have confirmed that it is able to measure natural Po-210 levels in both smokers and non-smokers.

This is a rapid method that has been developed for the incident by HPA-RPD. This is not the only method available and other labs in the UK are using different approaches. HPA staff have carried out validation checks with 4 other laboratories (who use different methods) and the results obtained have been consistent.

The notes below summarise the method that is being used by the Radiation Protection Division of the HPA to assess the level of polonium-210 in urine samples.

Summary of analytical procedure for Po-210 in Urine Samples

1. Measure 1litre of urine sample using a measuring cylinder into a 2litre beaker.

2. Add Po-209 or Po-208 yield tracer. (Typically about 0.2Bq)

3. Add 200ml of concentrated nitric acid. Heat on a hotplate set at 200^0C with occasional stirring. Sample should go straw coloured over time!

4. Evaporate sample to dryness (overnight –150^0C hotplate).

5. Cover the residue with a minimum quantity of concentrated hydrochloric acid (dissolve residue with warming) and take to dryness (hotplate 200^0C). Repeat this step.

6. Dissolve the residue with 6M hydrochloric acid and transfer to suitable beaker (250 – 600ml tall form beaker) using 6M hydrochloric acid. Make up to half beaker volume using 6M hydrochloric acid.

7. Add 1ml of 30% w/v hydroxyl ammonium chloride solution. Add magnetic stirrer and adjust the pH of the solution with stirring to 2 with .880 ammonia or hydrochloric acid.

8. Heat the solution with stirring to at least 85^0C. Plate on silver disc as per normal polonium method in use.

9. Count overnight on solid state alpha spectrometer (12h should be long enough to measure a minimum detectable activity of 20mBq for a 24h sample).

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