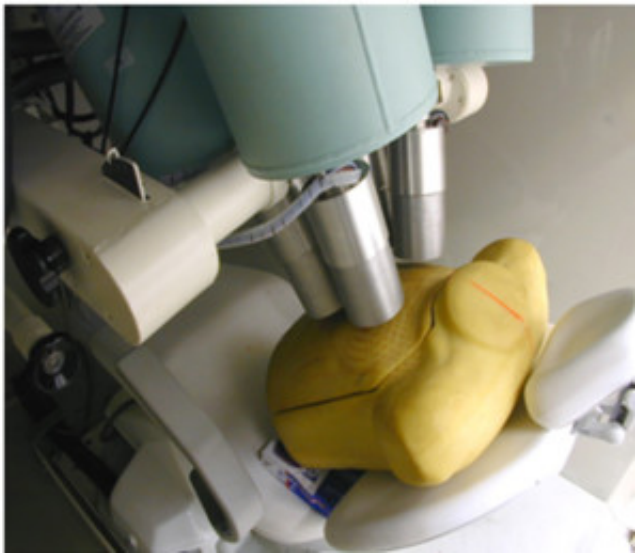
Enhanced radioactive content of "balance" bracelets

Individual monitoring of internal dose at the Nuclear Research Center Negev (NRCN) includes routine Whole Body Counting (WBC) check (Fig. 1.). In one of these checks, an abnormal high activity of ^{232}Th (Thorium-232) and natural uranium was found. An investigation was set up and it was found out that the worker did not take off his rubber bracelet before entering the WBC chamber (although it was required according to the WBC procedure) claiming that it was “made of rubber and had no chance of containing any radioactivity”. According to the bracelet producers, it was used as a “holographic and negative ion technologies” to “improve body balances”.



The bracelet was counted directly by a gamma spectrometry system, supporting beyond any doubt the fact that it was the source of the detected enhanced ^{232}Th and uranium activity. This was supported by an additional WBC counting of the worker, without the bracelet, which gave results under the detection levels for thorium and natural uranium.

The bracelet was counted directly by an HPGe gamma spectrometry system and the specific activities determined were 10.80±1.37 Bq/g for ^{232}Th and 5.68±0.88 Bq/g for natural uranium. These values are high compared to NORM average values. The dose rate to the wrist surface was estimated to be about 3.9 ?Gy/h and about 34 mGy for a whole year. The dose rate at the center of the wrist was estimated to be about 2.4 ?Gy/h and about 21 mGy for a whole year.

The source of the abnormally high radioactive content in the bracelets is not clear. The bracelets are made of rubber silicone, which may contain natural components. Natural materials as sands enriched in ^{232}Th and uranium were found in several locations. This finding is mainly explained by variations in heavy minerals concentration (especially zircon) and the grain size effect, the finest fraction being enriched by about three orders of magnitude.

Another source of enhanced natural radioactivity could be fly ash, used as filler in the production process of synthetic rubber. The average specific activity in coal is generally around 20 Bq kg^{-1} for both ^{238}U and ^{232}Th, but there are significant variations at different geographical locations.

The present findings pose a more general issue. Synthetic rubber and silicone products are common and widely used, but their radioactivity content is mostly uncontrolled. Other products containing enhanced radioactivity may be in the market causing unjustified exposure due to radioactivity. Better control procedures are needed to avoid this source of radiation exposure of the public.

Publication

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