



## Control Sample CS-DVM-C1

### Cs-137 in Dry Vegetable Mixture

#### General Information

Intended use	Checking the performance of analytical laboratories engaged in the determination of Sr-90 in food and other biological samples
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#### Description of material

Parsnip, carrot and parsley roots were collected in central Poland. Roots were cleaned from soil, washed and skinned, and cut to small parts, which were then lyophilized according to a standard procedure used by food producers. Dry roots were milled in a centrifugal mill made of stainless steel and sieved by stainless sieves. Fraction of a particle diameter below 0.5 mm was collected. Mixture of 20% parsnip root, 40% carrot root and 40% parsley root was prepared and appropriate amount of standard solutions of Cs-137 was weighed and added together with nonradioactive carrier of Cs. The obtained material (ca. 5 kg) was further homogenized by mixing for 15 hrs. in a plastic drum rotated in three directions. The mixture of vegetables was then distributed into PE bags in portion of ca. 500 g and firmly covered. The material was next sterilized by electron beam radiation from linear accelerator with dose of 28 kGy. Homogeneity was examined by measuring of the activity concentration of Cs-137 in randomly selected bags. Assigning of reference values for activity concentration was carried out by the interlaboratory comparison in which 10 radiochemical laboratories took part.

#### Determination of moisture content

In order to express the concentration of elements on a dry-weight basis, moisture content should be determined by drying a subsample of dry vegetable powder of approx. 1 g for 23 hours at 70°C.

#### Assigning of reference values

Reference values were assigned on the basis of the results provided by several radiochemical laboratories. The radionuclide has to be determined by at least two methods in order to assign reference value. A reference value was calculated using the HISTO software delivered by the IAEA, an uncertainty was evaluated according to ISO 13528:2015 [1], ISO GUM [2] and IUPAC harmonized protocol [3].

## Reference values for activity concentration of Cs-137 in Dry Vegetable Mixture CS-DVM-C1

**Radionuclide**                      **reference value  $\pm$  expanded uncertainty (k=2)**  
 $X_{\text{ref}} \pm U^*$   
[Bq kg<sup>-1</sup> dry mass]

**Cs-137**                                      **8.620  $\pm$  0.352**

\* on 1 November, 2010 for Cs -137.

The traceability of this Control Material to the SI units is ensured by the use of certified standard solution used in the spike, traceable to the international standard of radioactivity through National Physical Laboratory (the UK's National Measurement Institute).

Long-time stability is monitored during storage. The shelf life of dry vegetable mixture has been established to be **31 December 2020**.

### References

1. ISO 13528:2015 Statistical methods for the use in proficiency testing by interlaboratory comparison. Geneva. 2015
  2. International Organization for Standardization (ISO). Guide to the Expression of Uncertainty in Measurement. ISO. Geneva. 1993 (corrected and reprinted 1995)
  3. M. Thompson. S.L.R. Ellison. R. Wood. The International Harmonized Protocol for the Proficiency Testing of Analytical Chemistry Laboratories (IUPAC Technical Report). Pure Appl. Chem. 78 (2006) 145
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