

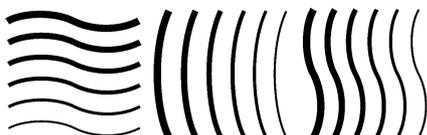
# **Determining lead equivalence in composite shielding aprons**

## **Addendum to Code of practice for personal dosimetry of professionals wearing protective clothing during radiological procedures**

**NEDERLANDSE COMMISSIE VOOR STRALINGSDOSIMETRIE**

**Report 19, addendum**

**October 2019**



**Netherlands Commission on Radiation Dosimetry**

October 2019 DOI: [10.25030/ncs-019](https://doi.org/10.25030/ncs-019)

## **Disclaimer regarding NCS reports**

The NCS frequently publishes reports for fellow professionals in which recommendations are given for various quality control procedures or otherwise. The members of the NCS board and the members of the concerning subcommittee do not claim any authority exceeding that of their professional expertise. Responsibility on how the NCS recommendations are implemented lies with the user, taking into account the practice in his/her institution.

### **Authors:**

Dirk Zweers (department of radiology LUMC, Leiden)  
Tom Grimbergen (Mirion Dosimetry Services, Arnhem)

## **1 Introduction**

The Netherlands Committee on Radiation Dosimetry (in Dutch: Nederlandse Commissie voor Stralingsdosimetrie NCS; <https://radiationdosimetry.org/>) has formulated conversion factors in NCS report 19 [1]. These conversion factors are intended for radiation protection officers (RPOs) and radiation protection experts (RPEs), for approved personal dosimetry services and for the administrator of the Dutch dose registration and information system (in Dutch: Nationaal Dosisregistratie- en Informatie Systeem, NDRIS; <http://www.ndris.nl>). These conversion factors can be used to provide a best estimate of the effective dose for an exposed worker, based on the reading of a personal dosimeter that is worn outside the protective clothing.

## **2 Problem description**

In report 19, the NCS explicitly stated that the protocol only applies to protective clothing containing lead as shielding material. Ergo, the protocol may not be used for protective clothing using, exclusively or in addition, other materials for shielding than lead. Due to improved comfort and reduced weight, an increasing number of suppliers provide protective clothing consisting of composite materials that also use other constituents for shielding. Since the NCS protocol as laid down in report 19 does not apply to such clothing, the usefulness of the report is rendered limited, increasingly posing problems for every day radiation protection practice in the Netherlands.

## **3 Determining of attenuation equivalent (mm Pb)**

To be able to use the NCS protocol, the attenuation equivalent, expressed in millimetres lead (mm Pb), of the protective clothing needs to be determined. For this, several methods have been devised, strongly varying in both methodology and complexity. The first procedure to assess attenuation equivalent has been described in DIN 6857-1 [2] but this protocol is rather elaborate. Mid 2014, a revised version of the international standard IEC 61331-1 on assessing attenuation equivalent has been published [3]. This standard is easy to use and can be executed using standard equipment, present in most departments of radiology. The authors of this addendum have tested the standard using various types of shielding aprons [4,5]. The use of the new IEC 61331-1 has proven to be straightforward and correct regarding determining the attenuation equivalent [4,5].

## 4 Relation to NCS Code of Practice, report 19

The attenuation equivalent of composite materials can be determined using an internationally accepted standard. Therefore, the NCS advises to use the Code of Practice as outlined in report 19 for composite clothing, using the attenuation equivalent as determined using IEC 61331-1. Since deviations from the attenuation equivalent provided by the manufacturer have been encountered [4,5], it is highly recommended to perform an independent measurement, either by the user, the hospital or an appropriately qualified third party.

## 5 In summary

The NCS 'Code of practice for personal dosimetry of professionals wearing protective clothing during radiological procedures' [1] can be used for protective clothing in which non-lead materials are used as protective material, provided that the attenuation equivalent has been assessed conform the international standard IEC 61331-1 by an appropriately qualified party. It is highly recommended that this test is performed independently from the manufacturer.

## References

- [1] Van Dijk JWE, Ebben L, Franken Y, Grimbergen TWM, Hummel WA, Kicken PJH, et al. NCS Report 19: Code of practice for personal dosimetry of professionals wearing protective clothing during radiological procedures. Delft: 2008. doi:10.25030/ncs-019.
- [2] Radiology Standard Committee within the DIN institute. DIN 6857-1: Radiation Protection Accessories for Medical Use of X-rays— Part 1: Determination of Shielding Properties of Unleaded or Lead Reduced Protective Clothing. 2007.
- [3] IEC 61331-1. Protective devices against diagnostic medical X-radiation - Part 1: Determination of attenuation properties of materials. 2014.
- [4] Peters SMB, Zweers D, de Lange F, Mourik JEM. LEAD COMPOSITE VS. NONLEAD PROTECTIVE GARMENTS: WHICH ARE BETTER? A MULTIVENDOR COMPARISON. Radiat Prot Dosimetry 2017. doi:10.1093/rpd/ncw373.
- [5] Peters SMB, Zweers D, Van de Kamer JB, de Lange F, Mourik J. Beschermende schorten: wat absorbeert beter en wat betekent dit voor de Nederlandse praktijk? Ned Tijdschr Voor Stralingsbescherming 2017:40–4.