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Asbestos in play sand

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Summary TNO Public

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Introduction

The Netherlands Food and Consumer Product Safety Authority (NVWA) is conducting research into the presence of asbestos in play sand. For this purpose, samples have been collected and analyzed by an external laboratory. To ensure proper interpretation of these analytical results, the NVWA has requested TNO to provide an expert judgement regarding the following questions and issues raised by the NVWA:

1. A statement regarding the determination of asbestos content according to NEN 5896 and VDI 3866-5: can we assume that, when following the standard, the VDI determination represents the most accurate value of the weight percentage of asbestos in a sample?
2. A review and interpretation of the available measurement results from the analyses of the samples taken by the NVWA. To this end, NVWA will submit the raw analysis results from the external laboratory to TNO, together with information on sample preparation and sampling, insofar as this is not clear from the analysis certificates and standards.
3. A general description of the framework of standards used for determining the content of asbestos (NEN 5896, NEN 5898, VDI 3866 (part 5 in particular), NEN-ISO 22262-2, NEN-ISO 16000-27 and possible other standards), including:
   a. an indication of the suitability of these standards for specific purposes;
   b. a description of the similarities and differences between the analyses described in the standard;
   c. a description of the possible (significant) differences in the results of these methods (i.e. asbestos weight percentage);
   d. a description of any shortcomings of the analyses and the value of the various standards in determining exceedance of the limit value of 0.1 weight percent asbestos.
4. The best available analysis for the quantitative determination of asbestos content in a sand sample, across the entire range of available quantities of packaged play sand (in practice from 200 grams to 25 kilograms).
5. Specific question regarding batch size, sampling and analysis: How does TNO view the theoretical possibility that, even within the same batch code, there may be variations in asbestos content between individual 200 g packs? In other words: is a single package of 200 g representative of an entire batch (code) of play sand, or would it better test five combined packages from the same batch? How does TNO view these same questions when it comes to larger packages, for example 25 kg?
6. A review of the methods that manufacturers/importers can use to obtain an asbestos-free declaration.

This note addresses the questions posed by NVWA in a structured way. The note is organized as follows: First the applied analytical methods NEN 5896 and VDI 3866-5 are discussed, including their suitability for determining asbestos content in play sand. Subsequently, the outcomes of the analyses of the external laboratory and identified issues are reviewed. Then, the framework of standards and regulations are explained, including a comparison of most relevant methods and their areas of application. The shortcomings of existing analytical techniques and the value of various standards in establishing regulatory exceedance are also considered. Finally, the best available analytical technique, sampling strategy, and options for an asbestos-free declaration are outlined.

1 Applied methods NEN 5896 and VDI 3866-5

For toys such as play sand, EU legislation is decisive: toy safety is harmonised at European level and assessed primarily under the EU Toy Safety framework and REACH, which together make the presence of asbestos in toys incompatible with the required level of child safety, leaving no primary role for national rules such as the *Productenbesluit asbest*. European toy safety legislation and REACH do not specify or mandate a particular analytical method for determining asbestos in toys, but define safety objectives and restrictions while leaving the choice of testing method to Member States and enforcement authorities.

The method designated by the legislator in the *Productenregeling asbest* is NEN 5896, version May 2003. However, this method is suitable and intended for the identification and estimation of products with a macro quantity of asbestos present, such as construction and insulation materials, to which asbestos is intentionally added during the manufacturing process (NEN 5896:2003). As noted, toys and play sand are outside the scope of the Productenbesluit Asbest; however, the designated analytical method may nevertheless be applicable.

The method involves light microscopy and is applicable for a concentration range between 0.1 and 100 weight percent (w/w %) asbestos. The detection limit of 0.1 weight percent (1000 mg/kg) makes it unsuitable for materials with low concentrations of asbestos. With sample pre-treatment techniques combined with scanning electron microscopy (SEM), a lower detection limit of about 0.01 weight percent can be achieved. However, quantification in the NEN 5896 is based on a visual estimation of the weight percentage of asbestos and cannot be considered as accurate.

Because the detection limit of the NEN 5896 method is 0.1%, any detected asbestos present below this level is reported within the 0.1–2 w/w % category, even if the actual concentration is lower. The asbestos is observed, and thus the concentration is above the detection limit. It is not (easily) possible to distinguish between products with low asbestos concentrations in the range just below and above 0.1%.

Conversely, low concentrations below 0.1% are not always detected using this method. For certain products, such as play sand, it is therefore relevant to assess whether asbestos is present at concentrations below 0.1%, so as to exclude the possibility of children being exposed to asbestos when playing with the product. NEN 5896 is therefore not suitable for the analysis of play sand with low concentrations of asbestos because the method is based on estimation with a high detection limit. NEN 5896 is currently being revised and supplemented with a method to quantitatively determine the asbestos content, so that it better aligns with regulatory requirements. [1]

In Annex B of VDI 3866-5 a method for semi-quantitative determination of asbestos content in low concentrations is described. After sample pre-treatment, in which interfering materials are removed with an acid treatment and the material is suspended in a liquid, a known portion is filtered over a gold-coated Nuclepore filter and examined with SEM. Detected asbestos fibres and fibre structures are measured at different magnifications and converted to a mass, from

[1] https://www.nen.nl/nieuws/herziening-norm-analyseren-asbest-middels-polarisatiemicroscopie-en-sem-rma/

which the concentration is calculated. The method is currently the most suitable method to supplement NEN 5896 to achieve a semi-quantitative result, enabling assessment against the applicable regulations (Toy Safety Directive, General Product Safety Regulation. REACH/CLP). For this, it is necessary to apply the prescribed conversion factor (K-factor, which is related to the density, specific mass of the type of asbestos indentified) and calculate the dilution factor to arrive at a weighted concentration.

2 Review results analyses of samples taken by the NVWA

The VDI 3866-5 standard has been evaluated and the analysis results from the external laboratory that were provided by NVWA, have been reviewed and recalculated. The results as shared with TNO consisted of NEN 5896 and VDI3866-5 analysis certificates, VDI3866-5 registration forms, raw counting results (SEM photos and EDX tables), one counting form (sample 966016), and a summary report (Excel spreadsheet) with the calculated weight percentages. During the review several inconsistencies were observed, causing the values as reported by the external laboratory not to correspond with the values as calculated by TNO based on the VDI 3866-5 registration forms. After the external laboratory was informed of these inconsistencies, a correction factor was proposed by the external laboratory, with which the analysis results were recalculated.

Below the findings of TNO are described.

- *Interpretation of the Standard*
  The external laboratory, in an initial response to the suspicion of a calculation error, stated that there is an error in VDI 3866-5. We cannot endorse this claim. In our assessment, it concerns an incorrect interpretation of the standard text. In Annex B, the first step is to determine the weight of the detected fibres on the filter (Ma), using formulas B1 and B2. The mass percentage is then calculated with formula B3, in which Ma is divided by the total mass on the filter sample (Me). The external laboratory interpreted this total mass (Me) as the entire mass of the suspension processed. However, the standard text (p. 31) shows that Me refers to the mass per filter area (“mass after high-temperature ashing, per filter area”).

- *Correction factor for dilution and K-factor*
  We agree with the correction factor for dilution and the K-factor proposed by the external laboratory. The latter also depends on the density of the different asbestos types. Since the density varies per type, the K-factor can be adjusted based on the actual fibre types found.

- *Discrepancy in weighed sample material*
  We observed a discrepancy in the weight of the samples processed between the VDI3866-5 analysis certificates (50 mg) and the registration forms (appr. 500 mg). After discussions with the external laboratory, it was concluded that the weight on the certificates were not reported correctly, and calculations were performed with the right amount of sample (appr. 500 mg). .

- *Deviations between count registration forms and summary report*
  For sample M16 (966016), we received both the IL&T registration form and the count form with raw data. This allowed us to check the calculations. The calculations on the count form were performed correctly, but do not match the values on the registration form.
  This is because a default value was entered for the analyzed image area in the registration form, which was not adjusted to the actual number of counted image fields. This deviation in the number of image areas was observed for several samples. Also the calculated fibre

masses on the registration forms were a factor 10 lower than reported in the summary report (Excel spreadsheet).

The findings have been shared with NVWA and the external laboratory, after which a new summary report (Excel-spreadsheet) with the corrected results has been produced by the external laboratory.

3 Framework of standards for determining the content of asbestos

For toys, European legislation applies (the Toy Safety Directive (2009/48/EC) or GPSR (EU 2023/988), in conjunction with REACH (Annex XVII, Entry 6) and CLP (Annex VI), but no specific methods are prescribed for determining the presence of asbestos.

The prohibition on manufacturing, importing, applying, or processing asbestos or asbestos-containing products applies if asbestos has been added to the material or product. If asbestos has not been added, for example, if it is 'naturally' present in a product or raw material, the threshold of 100 mg/kg (weighted concentration) asbestos per kilogram of product applies. The *Productenregeling asbest* lists which method must be used to determine this (see Table 1).

Table 1: *Methods in the Productenregeling asbest*

Material / Product	Applicable NEN Standard	Description of Standard
Rubble and granulate	NEN 5897: 2015 + corr. 2016/17	Inspection and sampling of asbestos in construction and demolition waste and recycled granulate.
Soil	NEN 5707: 2015 + corr. 2016/17	Inspection and sampling of asbestos in soil and soil batches.
Dredge and sludge	NEN 5720: 2017	Strategy for conducting environmental research (water bottom).
Other products	NEN 5896: 2003	Qualitative analysis of asbestos in materials using polarisation microscopy.

- *NEN 5896:2003.*
  The aforementioned NEN 5896 is described above. As mentioned, this method is qualitative and therefore not suitable for assessment against the regulatory requirements.

- *NEN 5898:2016.*
  This method describes a procedure for determining the asbestos content in soil, water bottom, construction and demolition waste, and granulate in the context of research according to NEN 5897, NEN 5707, and NTA 5727 (now NEN 5720), as mentioned above in the *Productenregeling asbest*. The three research methods as described included fieldwork, inspection, and sampling strategy. It describes how a material such as soil should be examined for asbestos-containing materials, after which soil samples are analyzed according to NEN 5896. By sieving the material into different fractions, the detectability of asbestos-containing materials is significantly increased. Sieving is therefore a good step to add to the NEN 5896 analysis method to increase the detectability of asbestos-containing materials in, for example, sand. The limitations of NEN 5896, particularly the asbestos weight estimation, remain.

NEN 5898 also describes an electron microscopic method to determine the fraction of respirable (inhalable) asbestos fibres in addition to the light microscopic analysis of the sieve fractions. Very fine fibres, including respirable asbestos fibres, in the sieve fraction smaller than 0.5 mm cannot be detected with light microscopy. If these fibres are present but not observed, a false negative result would be determined. The Standard describes that a small part of the sieve fraction (after ashing) is suspended in liquid and then filtered over a gold-coated Nuclepore filter, after which fibre counting is performed with electron microscopy (according to ISO 14966). The mass of asbestos fibres is determined based on the fibre dimensions and fibre density. In many respects, this method is very similar to the aforementioned VDI 3866-5 and, with some adjustments, can be made suitable for the analysis of play sand.

- *NEN-ISO 22262-2:2026*
  This standard describes the quantitative determination of asbestos in bulk materials using gravimetric and microscopic methods and replaced the 2014 version. The 2026 version includes additions in areas such as the analysis of talc and other mineral powders, low asbestos concentrations, quantification, and refinement of pre-treatment steps. The standard describes several sample pre-treatment methods such as ashing, acidifying, and sedimentation to selectively remove matrix material, making asbestos (fibres) more detectable and lowering the detection limit. The standard describes a method by which the asbestos content can be quantitatively determined using a point count method with electron microscopy. This is a standardized statistical approach to quantifying the presence of asbestos in the 2D microscope image, which is different from the method described in VDI 3866-5. Also the applied magnification (100x) deviates from the procedure in the VDI 3866-5 (magnifications of 50x, 200x, 1000x and 2000x) as a result of which thin and/or short fibres cannot be observed.

  However the NEN-ISO 22262-2 does describe a method for the determination of asbestos fibres in talc and other mineral powders, which uses the same strategy as the VDI 3866-5 and NEN 5898: sample pre-treatment, suspension in liquid, filtering and fibre counting with electron microscopy. In the NEN-ISO 22262-2 the preferred electron microscopic technique is transmission electron microscopy (TEM) and fibre counting is performed in accordance with ISO 13794:2019. The preference for TEM is the higher resolution and the application of the electron diffraction detector (SAED) to be able to distinguish between asbestiform from non-asbestiform fibres in talc. Nevertheless, the standard states that also SEM with energy dispersive X-ray analysis (SEM-EDX) can be used for fibre counting in mineral powders. Commissioned by the NVWA, in 2018 TNO performed an assessment of analytical methods for the determination of low concentrations of asbestos in talc-containing products (Tromp, 2018). In this report TNO stated that SEM offers more advantages over TEM in the determination of asbestiform fibres in talc-containing products, due to the lower detection limits and the ability to determine morphological characteristics. It was concluded that the most suitable method for determination of asbestos in talc was a combination of NEN-ISO 22262-2 (sample pre-treatment) and NEN-ISO 14966 (fibre counting).

- *NEN-ISO 16000-27:2014*
  In this standard a method is described by which the numerical concentration of, among others, asbestos fibres and structures in settled dust can be determined using electron microscopy. This concerns the number of asbestos fibres per sampled surface (on which the dust has settled) and thus not a determination of the asbestos content in a material or product and is therefore not applicable for play sand.

3.1 Suitability of standards, and similarities and differences between the analysis described in these standards

The table below provides an overview of the suitability, differences and similarities of most relevant (inter)national standard protocols for the determination of low concentrations of asbestos in bulk materials.

Table 2: *Overview of most relevant (inter)national standards for the determination of low-concentrations of asbestos in bulk materials*

Standards	Techniques	Detection limit	Application
NEN 5896	LM, PLM, optionally SEM-EDX	0.1% (≈0.01% with SEM/RMA)	Identification
ISO 22262-2	PLM, SEM-EDX, TEM-EDX	<0.01%, <0.0001% with fibre counting	Quantification
VDI 3866-5	LM, PLM, optionally SEM-EDX	<1%, <0.0001% with fibre counting	Quantification

LM: Stereomicroscopy, PLM: polarised light microscopy, SEM: scanning electron microscopy, EDX: energy dispersive X-ray analysis, TEM: transmission electron microscopy

Analytical techniques
Stereomicroscopy (LM) provides a qualitative assessment of visible fibres, while polarised light microscopy (PLM) enables basic fibre identification. After sample pre-treatment steps, such as ashing, sieving, sedimentation and/or acid treatment, electron microscopy (SEM or TEM) may be used. Fibre identification is supported by energy dispersive X-ray analysis (EDX) and, where needed, electron diffraction (SAED) to characterize crystal structures. Each method has its own detection limit , indicating the lowest asbestos concentration that can be reliably detected.

Standard methods and their applicability
Most established analytical standards, including NEN 5896, VDI 3866-1/5 and ISO 22262-1/2/3, were designed for bulk materials containing relatively high functional asbestos concentrations (>0.1%). These levels are easily observed by light microscopy. When concentrations fall below this range, additional pre-treatment steps are required to enhance detectability. Also electron microscopy is particularly valuable in these cases, as it allows observation of thin, short fibres at low concentrations.

Limitations for low-concentration samples
Products containing less than 0.1% asbestos, including materials where asbestos has not been intentionally added such as play sand, pose challenges because the detection limits of existing methods lead to automatic classification as “asbestos-containing” when any asbestos fibre is observed.

This results in overestimation of concentration classes. VDI 3866-5 Annex B provides a semi-quantitative approach for improved accuracy, while ISO 22262-2 includes broader guidance on sample pre-treatment (matrix reduction) and visibility-enhancing techniques, including a detailed description of the determination of asbestos in vermiculite, talc and other mineral powders. NEN 5898 has many similarities with VDI 3866-5 but is more detailed on a number of points and is also consistent with the methods prescribed by the regulator. However, NEN 5896 is not sufficiently accurate and therefore not applicable for low-concentration samples below 0.1%.

Differences between methods
VDI 3866-5 examines bulk materials, with sample pre-treatment at multiple magnifications (50x to 1000x), allowing identification of both thick and thin fibres. Fibre dimension measurements, combined with assumed density, enable mass estimation. Although the method accounts for thin fibres, it is influenced by the large mass contribution of thicker fibres. By contrast, the point-counting method in the ISO 22262-2 uses a single low magnification (100x). These methodological differences can yield different concentration estimates. NEN 5898 separates asbestos-containing components through sieving and weighs these components before assigning the asbestos mass to the respective sieve fraction, resulting in a more accurate quantification for granular samples than methods assigning mass across the entire sample. The standard also includes a procedure for isolating the respirable fibre fraction, which can be relevant for assessing exposure risks. For regulatory assessment, however, total asbestos mass remains the required metric.

Evolving requirements and regulatory alignment
Within the NEN Standards committee, it has been acknowledged that NEN 5896:2003 does not align with regulatory needs for products with low concentrations of asbestos and products in which asbestos has not been intentionally added (Ontw. NEN 5896: 2024). As such, attention is shifting from total asbestos mass to the number of respirable fibres that may be released during use. Converting the threshold value (100 mg/kg) to a numerical fibre concentration enables assessment according to ISO 14966. Exceeding the numerical fibre threshold value results in classification as “asbestos-containing”. This provides a more health-relevant (exposure-risk based) approach compatible with existing laboratory infrastructure.

3.2 Shortcomings of the analyses and value of various standards in determining exceedance of the limit value of 0.1 weight per-cent asbestos

NEN 5896 is the method designated in the Productenregeling asbest and within the certification scheme for the analysis of materials sampled during building asbestos surveys. The method is intended for the analysis of bulk materials, such as construction materials, which typically contain asbestos at concentrations above 0.1% w/w. The main shortcoming of this method is the low accuracy and sensitivity (detection limit of 0.1%). Even with the use of concentration pre-treatment techniques, the required sensitivity is not achieved. In addition, the determination of the concentration is based on visual estimation or comparison with reference materials and is not exact.

The limit value 0.1 weight percent should be interpreted as zero (0), as it is the detection limit of the method. When asbestos is detected by light microscopy in accordance with NEN 5896, the method assumes that the detection limit has been exceeded, and based on an estimate the product is classified into a category (e.g. 0.1-2 weight procent), without performing the necessary steps to obtain a quantitative comparison with the threshold value.

Methods or components of methods such as NEN 5898, ISO 22262-2 and Annex B of VDI 3866-5 can be used as supplementary techniques to analyze and quantify low-concentration materials without added asbestos, especially in the range below 0.1 %.

4 Best analysis technique for quantitative determination of asbestos content in play sand

The best analysis technique for a quantitative determination of asbestos content in play sand is a fibre counting method with SEM-EDX in agreement with VDI 3866-5 - Annex B “Analysis of samples with low asbestos contents (< 1 %)”. Fibre counting should be performed at four different magnifications, 50x, 200x, 1000x and 2000x, to ensure the detection of both large asbestos structures and thin, respirable fibres. Sample pre-treatment techniques in accordance with the NEN 5898 or NEN-ISO 22262-2 can be used for matrix reduction, to increase visibility of the asbestos fibres. If these steps are performed quantitatively, this will not result in an overestimation. The pre-treatment depends on the nature of the material:

- If the product (partly) consists of calcium carbonate (limestone or marble), the matrix can be removed with an acid treatment (in accordance with NEN-ISO 22262-2 and VDI 3866-5). Play sand doesn’t contain calcium carbonate and consists mostly of quartz with minor feldspar and accessory minerals, therefore acid treatment is not necessary.
- If the product consists of different grain sizes, sieving is the most appropriate pre-treatment technique to improve the visibility of asbestos (in accordance with NEN 5898). Play sand has already been processes by sieving (normally the fraction between 0.063 – 2mm), therefore extra sieving is not necessary.
- If the product is magic sand or kinetic sand, the base material has been treated with a silicone oil (polydimethylsiloxane, etc.). Removal of the oil reduces the adhesion between the sand grains and asbestos fibres, thereby increasing the detectability of the asbestos fibres. The oil can be removed by ashing the material at a maximum of 450 °C, in accordance with NEN 5896.

5 Heterogeneity of asbestos in play sand and best sampling strategy

When interpreting analytical results for asbestos in play sand, the question arises whether asbestos is homogeneously distributed within the product. If this is not the case, individual consumer packages may contain different asbestos concentrations. The homogeneity of asbestos in play sand has not been investigated by TNO. No specific data are available on the distribution of asbestos within individual consumer packages or production batches. The following considerations are therefore based on general knowledge of the origin of the raw material, production processes and the applicable normative framework.

It is considered plausible that any asbestos present in play sand has not been deliberately added, but originates from natural mineral impurities or from an external contamination. Most play sand comes from sand extraction from rivers, the sea or special sand pits. Crusher sand (from crushed rock) is normally not used, because the grains are angular and sharp and not save for children. Sand remains a natural raw material where so-called geological contamination with asbestos is possible. In certain areas of China there are veins of asbestos-containing rock (i.e. Harper, 2008). Sand excavations in these areas can cause sand to become mixed with asbestos. In the Netherlands, strict regulations apply to sand extraction, whereby sand extraction sources are extensively checked in advance for contamination (*Omgevingswet, Besluit activiteiten leefomgeving*). In China, environmental regulations and control of these "sources" are less strict, for instance there are no geological “at-source” checks (EC 2022). Cross-contamination during transport and storage and the use of asbestos containing equipment can also be the origin of contamination. Sand can be transported in bulk carriers, trucks and conveyor belts, processed in sieving installations or stored in silos that contain asbestos or are previously used for asbestos-containing materials.

The asbestos is most likely heterogeneously distributed in the sand. During excavation in a quarry, the sand often comes from different layers. If one specific layer contains an asbestos vein, that asbestos ends up in "clusters" or "pockets" in the entire batch. Additional sieving of the sand will result in some degree of mixing, but the asbestos will remain heterogeneously distributed. During transport, segregation will occur due to the difference in shape and size of the sand grains and asbestos fibers. All this can lead to a variability in contamination at the level of individual product units.

Currently, there is no comprehensive standard describing a sampling strategy for consumer products contaminated with asbestos. However, Appendix B “determination of the minimum increment and sample size” from NEN 5707 can be used. For normal play sand with a maximum grainsize of 2mm, the minimal increment size is about 1 gram. The sample size is dependent upon the fraction of asbestos containing particles ‘p’ in the product and the accepted coefficient of variation ‘vc’. The fraction ‘p’ is not known, but considering the amount of asbestos fibres in the samples analyzed by the external laboratory this is assumed to be in the range of 10% (1/10). With a coefficient of variation of 10% the sample size would be around 100 grams.

However, these sampling statistics do not take into account the variation between individual products. To account for this variability, it is recommended to sample multiple (3 – 5) packages per batch/product, preferably from different retailers. From all these single packages separate subsamples should be taken in accordance with the sampling statistics of the NEN 5707: this means that from each package approximately 100 random increments of minimal 1 gram are taken to end up with a subsample of 100 grams per package. All subsamples should be analyzed separately in accordance with the NEN 5896. If no asbestos is observed in all the subsamples of the selected individual packages, one mixed sample of all individual packages should be taken and analyzed in accordance with VDI 3866-5. If in one or more subsamples asbestos is observed than the subsample with the highest estimated weight percentage should be analyzed in accordance with VDI 3866-5.

6 Methods to obtain asbestos-free declaration

EU toy legislation aims to fully protect children from health risks; because asbestos is a known carcinogen without a safe threshold, its presence in toys is regarded as incompatible with the required level of safety. It is therefore recommended to apply a threshold value of zero for analysis with LM in combination with a SEM-EDX based method with a maximum detection limit of 0.001 % (10 mg/kg).

Thus, the NEN 5896 can be used for a first visual inspection combined with the fibre counting method with SEM-EDX in agreement with VDI 3866-5. When one asbestos fibre or asbestos-containing structure is observed in the sample, subsample or composite, the product exceeds the threshold value, and the analysis can be terminated. In the Netherlands, where SEM-EDX is the golden standard, fibre counting should be performed in accordance with NEN-ISO 14966, applying a final magnification of 2000x, to be able to detect thin, respirable fibres.

These criteria are also part of the ProRail product specification SPC00353 concerning additives for quartz-free railway ballast - ballast free of crystalline silica and asbestos. In this product specification asbestos analysis needs to be carried out according to IFA-AM 7484 or NEN-ISO 22262-2. The supplier or quarry needs to prove that their product is “asbestos-free” using SEM-EDX fibre counting with a detection limit smaller than 0.001 % (10 mg/kg).

Summary of conclusions

This note addresses the questions posed by NVWA regarding the analysis of asbestos in play sand. The principal findings are described below.

Can the combination of NEN 5896 and VDI 3866-5 provide an accurate value for the asbestos weight percentage in play sand?
The combination of NEN 5896 and VDI 3866-5 currently represents the most suitable approach to obtain a semi-quantitative indication of the asbestos content in play sand. Although this approach cannot establish a legally defined acceptance limit for toys, it provides a technically meaningful basis to assess the presence of asbestos at low concentrations and to support enforcement decisions aimed at excluding potential exposure of children.

How were the analytical outcomes evaluated?
The results from the external laboratory were recalculated, and inconsistencies were identified, including misinterpretations of the standard and deviations in certificates and registration forms.

Which standards are relevant and what is their suitability?
NEN 5896, NEN 5898, VDI 3866-5, NEN-ISO 22262-2, and NEN-ISO 16000-27 were reviewed. NEN 5896 is qualitative and not suitable for regulatory assessment of products with low asbestos content (<0.1%); NEN 5898, VDI 3866-5 and NEN-ISO 22262-2 are more appropriate for quantitative analysis of low asbestos concentrations.

What are the similarities and differences between the methods and their results?
In general, the methods are very similar; all methods are based on fibre counting with (electron) microscopic techniques and translating fibre dimensions into asbestos mass concentrations. However methods differ in sample pre-treatment steps and microscopic settings (magnifications), which can eventually result in different concentration outcomes.

What shortcomings exist in the analyses and standards?
The main limitation is that NEN 5896 lacks sufficient sensitivity for products containing asbestos at concentrations below 0.1 % w/w. Supplementary analytical techniques are therefore required to reliably analyze such materials.

What is the best available analytical technique?
NEN 5896 may be applied for an initial visual screening of the material, followed by the fibre counting method using SEM-EDX in agreement with VDI 3866-5. This approach allows for the detection of asbestos at low concentrations.

How should sampling be conducted?
To account for the variability between individual packages, it is recommended to sample multiple (3 – 5) packages per batch/product, preferably from different retailers. From each package approximately 100 randomly taken increments of minimal 1 gram must be taken to end up with a subsample of 100 grams per package (in agreement with Annex B of NEN 5707).

How can an asbestos-free declaration be obtained?
It's recommended to apply a threshold value of zero in combination with a SEM-EDX based method with a maximum detection limit of 0.001 % (10 mg/kg). The NEN 5896 can be used for a first visual inspection followed by an electron microscopic fibre counting technique in agreement with VDI 3866-5, NEN 5898 and/or NEN-ISO 22262-2 depending on the type of sample.

Signature

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