Bundesamt für
Verbraucherschutz und
Lebensmittelsicherheit

Abstract Report on the National Monitoring 2019

Joint report by the Federal Government and Federal States

Table of content

Abstract Report on the National Monitoring 2019

This Abstract Report presents a short overview about the findings of the analyses of foods, cosmetic products and commodities carried out in 2019. A full version of the Report on the National Monitoring 2019 is available in German from http://www.bvl.bund.de/monitoring. Abstract Reports on the National Monitoring from previous years can be downloaded from www.bvl.bund.de/monitoring_abstracts.

1 Summary

The Monitoring Scheme is a system of repeated representative measurements and evaluations of levels of substances that are undesirable from a health point of view, such as residues of plant protection products and pesticides, heavy metals, mycotoxins and other contaminants in and on foodstuffs, commodities and cosmetic products. Further details about the monitoring programme are available from http://www.bvl.bund.de/monitoring_EN.

In line with the General Administrative Provision (AVV) for the Monitoring Programme, the following foodstuffs, commodities and cosmetic products from the population's representative market basket were examined in 2019 (market basket monitoring):

1.1 Food of Animal Origin

- Curd cheese/Farmer's cheese/ Cream cheese without spices/herbs
- Gouda cheese
- UHT milk
- Pork, meat
- Pork, fat/flare fat
- Pork, kidney
- Pork, liver
- Plaice (*Pleuronectes platessa/ Lepidopsetta bilineata*)
- Redfish (Sebastes sp.)
- Shark catfish (*Pangasius* spp.)
- Crab meat
- Veal, meat
- Veal, liver

1.2 Food of Plant Origin

- Apple
- Apple juice
- Avocado
- Basil (fresh/dried)
- Beans, white/brown/red/black
- Barley grains
- Durum wheat pasta products
- Flower honey
- Foods intended for infants and young children
- Oat grains/flour
- Oat flakes
- Pineapple
- Pear juice
- Raspberry
- Chickpea
- Lettuce
- Lentils brown, unpeeled
- Lentils red, peeled
- Maize germ oil
- Almonds (sweet)
- Mixed mushrooms, dried
- Peach
- Nectarine
- Plum
- Pistachio
- Leek
- Rapeseed oil (cold-pressed)
- Brussels sprout
- Soybeans, -flour, -grits, -flakes
- Soy sauce
- Sunflower oil (cold-pressed)
- Spinach
- Savoy cabbage
- Strawberry (fresh/deep-frozen)
- Tomato
- Walnut
- Wine red/white
- White cabbage, pointed cabbage
- Zucchini

1.3 Other Food

- Natural mineral water

1.4 Cosmetic Products

- Antiperspirants
- Lip cosmetics with and without glitter
- Sunscreen products

1.4 Commodities

- Food contact items of paper/carton/cardboard and used for cooking, frying, baking and grilling
- Food packaging materials of paper/carton/cardboard or textile fibres, and dry foodstuffs wrapped therein
- Toys of paper or cardboard for children under 36 months of age (picture book and puzzle with large pieces)
- Toys and joke articles (modelling clay, wobbling mass, wooden building bricks, chalk)

Depending on what undesirable substances were expected, the foods were analysed for residues of plant protection products and pesticides as well as for contaminants (for instance, dioxins and polychlorinated biphenyls (PCB), per- and polyfluorinated alkyl substances (PFAS), polycyclic aromatic hydrocarbons (PAH), elements, mycotoxins, and nitrate).

As regards the cosmetics, antiperspirants, lip cosmetics with and without glitter, and sunscreen products were examined for elements.

As regards the consumer items, mineral oil portions were analysed in food contact items and packaging made of paper, carton, and cardboard, in textile food packaging, and in dry foodstuffs (or food simulant) contained in such packaging, as well as in paper and cardboard toys intended for children under 36 months of age.
Furthermore, toys and joke articles (modelling clay, wobbling mass, toy building bricks, and chalk) were analysed for release of elements.

In addition to the market basket monitoring, the six following specific subjects were treated in the framework of the “project monitoring” part of the programme:

- Tropane alkaloids in tea and herbal infusions
- Pesticide residues in canned fruit and vegetables
- *Alternaria* toxins in tomato products
- Total delta-9-tetrahydrocannabinol in hemp oil
- Residues of quaternary ammonium compounds and chlorate in fish products
- Determination of lead in liqueur wines

As far as comparison with results from earlier monitoring studies was possible, this was considered in the interpretation of findings. Yet, all statements and assessments in this report concerning the presence of substances that are undesirable from a health point of view, solely refer to the products, substances and substance groups examined in 2019. At the same time, it is not possible to estimate the entire exposure to certain substances because only part of the market basket can be examined per year, while the substances considered also occur in other products.
Altogether, the findings of the 2019 Monitoring Programme again support the recommendation of a varied and balanced diet, as this is the most practicable way to minimise the dietary intake of undesirable substances, which itself is, to a certain degree, unavoidable.

A total of 10,177 samples of products of domestic and foreign origin were analysed in the framework of market basket and project monitoring in 2019, including 9,234 samples of foodstuffs, 558 samples of cosmetic products, and 385 samples of consumer items (such intended for food contact or body contact). The findings are presented in the following chapters.

2 Foodstuffs

2.1 Residues of Plant Protection Products and Pesticides

2.1.1 Food of Animal Origin

Residues of plant protection products and pesticides were quantified in 53.2% of redfish samples, 50.7% of pork liver samples, 50.0% of pork kidney samples, 46.3% of plaice samples, 28.7% of veal samples, 20.0% of full milk samples, 19.0% of calf liver samples, and in 2.8% of the samples of pork fat/flare fat.
All levels were lower than the maximum residue level (MRLs) fixed in Regulation (EC) No. 396/2005 and the German national regulations on maximum residue levels (*RHmV*).
As in the years before, residues found in foodstuffs of animal origin were almost exclusively such of ubiquitous persistent organo-chlorine compounds. Apart from that, pendimethalin was determined in more than 10% of the samples of calf and pig liver and plaice.
The residues did not mean a health risk to consumers.

2.1.2 Food of Plant Origin

Most samples with quantifiable residues were found in white wine (89.4%), pineapple (88.6%), and strawberries (88.0%). Apart from infant food (with 10.4% samples with quantifiable residues), soy product samples had by far the fewest residue findings (19.0%).
Eight of the 24 vegetal foodstuffs examined did not have any findings exceeding maximum residue levels. These were apple and pear juice, honey, oats, peaches, red wine, cabbage, and zucchini. The highest percentages of findings non-compliant with MRLs occurred in infant food fruit and vegetable preparations (9.0%), followed by soy products (4.8%), spinach (4.1%), and avocados (3.7%).
1.1% of the vegetal food samples originating from Germany showed residues of active substances which were actually not authorised for use in the respective crop in Germany in 2019. In 2018, this percentage was 2.3%.
The risk assessment resulted in the opinion that acute health impairment of children was possible with one residue of acetamiprid in spinach and one residue of fluazinam in leek.
Acute health impairment of children and adults was considered possible, based on the current state of knowledge, with residues of dimethoate in one tomato sample, omethoate in one spinach sample, dimethoate/omethoate in a strawberry sample, chlorpyrifos in a pineapple sample, dithiocarbamate and acetamiprid each in one lettuce sample, and flonicamide in one savoy cabbage sample.

Project 02: Pesticide residues in canned vegetables and fruits
In addition to the above, a special monitoring project analysed pesticide residues in a total of 151 samples of jarred cherries and 155 samples of canned tomatoes.
The results showed that canned cherries and tomatoes, overall, contain low levels of residues, compared with the fresh product. Yet there were wide differences with regard to the residue levels between the two exemplarily chosen, canned foodstuffs. In spite of the preserving process, cherry jars had a very high portion of 85% of samples with quantifiable residues. The cherry jar example illustrates that relevant residue levels were found in the jars, and that some substances were found more often or only in the jarred product, while the same substances played no, or only a subordinate role in the fresh or deep-frozen product.
Dimethoate residue findings in one sample of jarred sweet cherries could not be compared with an Acute Reference Dose (ARfD), because no toxicological reference values could be derived. Because of that active substance’s genotoxic potential, acute health impairment of children and

adults is possible. Canned fruit and vegetables should continue to be monitored in the framework of the Monitoring Programme.

2.2 Quaternary Ammonium Compounds (QAC)

Redfish was the only foodstuff found to contain the quaternary ammonium compounds benzalkonium chloride (BAC) and didecyl dimethyl ammonium chloride (DDAC) at levels higher than 0.1 mg/kg. In the other foodstuffs examined, levels ranged between 0.01 and 0.09 mg/kg. The residues found do not provide reason for assuming any health risk for consumers. As maximum residue levels pursuant to Regulation (EU) No 1119/2014 are currently only preliminary, BAC and DDAC will continue to be subject of intensified monitoring in the EU, and consequently, also subject to this Monitoring Programme.

2.3 Chlorate

The percentages of samples with quantifiable chlorate residues were highest in basil (48.0%), plaice (43.8%), and zucchini (42.3%). The maximum value found in the analyses was 2.2 mg/kg in one sample of basil.
Overall, the maximum values measured in zucchini (1.11 mg/kg) and in white wine (2.18 mg/kg) signalled a possible acute health risk to consumers. In order to complete the data basis for a well-founded risk assessment, which in turn will be the basis for defining specific maximum residue levels, monitoring programmes will continue to look at residues of chlorate in a variety of foodstuffs in the years to come.

Project 05: Residues of quaternary ammonium compounds and chlorate in fish products
Another monitoring project examined 80 samples of shark catfish (*Pangasius* spp.) and 97 samples of smoked salmon for the quaternary ammonium compounds BAC and DDAC, as well as for chlorate.
As regards residue findings of chlorate (3 shark catfish samples) and BAC (5 shark catfish samples), an acute health impairment of children and adults seems possible, proceeding from the current state of knowledge on the basis of the EFSA *RPC* (*Technical report on the raw primary commodity*) model. The dietary intakes of residues calculated for the respective German population groups exceed the acute reference doses (ARfD).
The results of this monitoring projects make clear that manufacturers and distributors of fish products must make considerable efforts in order to protect consumers from contaminated foodstuffs.

2.4 Perchlorate

Both vegetable and animal-origin foodstuffs tested contained low perchlorate levels, in the majority. Perchlorate reference values valid in 2019 were exceeded only in single cases. Just basil and spinach had some more findings higher than the reference values.
The same as in 2016, perchlorate was not quantifiable in any sample of fruit or vegetable preparations for infants. This shows that the situation of perchlorate contamination of foodstuffs for infants is well under control, and that the parties responsible in the trade with these products make all efforts to protect this particularly susceptible consumer group.

2.5 Dioxins and Polychlorinated Biphenyls (PCB)

Only low levels of dioxins and dioxin-like PCBs were found in veal, pork, and plaice, and in sunflower oil. As expected, dioxin levels in pig liver were enhanced in comparison to muscle meat, which was also tested. The level found in one sample of pig liver exceeded the WHO-PCDD/F TEQ (2005).
Levels found in dried basil leaf spice exceeded, after conversion to the fresh weight, the trigger value for dioxins in 10 cases. Half of these samples originated from Germany. Enhanced dioxin levels may be attributable to improper drying or to environmental factors. It is recommended to

highlight this complex of problems, for instance by further investigations. As it is, there are no established maximum levels for dioxins and PCBs in herbs and spices.
Based on an exposure assessment made by the Federal Institute of Risk Assessment (BfR), consumption of basil containing levels of dioxins and dioxin-like PCBs as measured in this monitoring could mean that a person might use up to 50% of his or her tolerable weekly intake (TWI) of 2 pg WHO_{2005}-PCDD/F-dl-PCB-TEQ (EFSA 2018). So, considering basil consumption alone, a health risk is unlikely. On the other hand, the TWI should not be used up to that extent by one single foodstuff, which accounts only for a tiny portion of consumption.
Examination of the selected foods for the sum of the six non-dioxin-like PCBs has not produced any conspicuous findings.

2.6 Perfluorinated and polyfluorinated Alkyl Substances (PFAS)

In full-cream milk, natural mineral water, and fruit and vegetable preparations for infants, all single PFAS substances were at levels below the analytic limit of determination. Shark catfish and plaice displayed very low to low PFAS levels. Pork meat and liver also had very low PFAS levels.
Full-cream milk and pig's liver had been tested for PFAS also in the years before. Full-cream milk showed a further decline in PFAS levels, compared with the findings in the 2013 monitoring. Pig's liver currently does not show a change in PFAS levels, compared with the results of examination in 2016.
In view of the fact that EFSA has noticeably reduced health-related guidance values for PFAS, it is explicitly recommended to widen PFAS analytics in the field of food control, and to develop more sensitive analytic methods.

2.7 Polycyclic Aromatic Hydrocarbons (PAH)

Both benzo(a)pyrene and sum levels of PAH-4 were low in rapeseed and sunflower oils. In all samples, levels were lower than the maximum levels fixed for benzo(a)pyrene and the major PAH-4 substances.

2.8 Mycotoxins

2.8.1 Aflatoxins B1, B2, G1, G2

Aflatoxins were not quantifiable in any sample of beans, chickpeas, or lentils, nor in walnuts or cold-pressed rapeseed oil. Direct comparison of ground and whole almonds shows clearly higher aflatoxin levels in the ground product. This finding might indicate that almonds used for manufacturing ground product could be of less high quality.
Though aflatoxin levels in oat flakes and pistachios were very low, they were slightly higher than in previous years' examinations. This is probably attributable to climatic fluctuations. Levels in 3 samples of pistachios and 2 samples of ground almonds exceeded the established maximum level.

In its current scientific opinion, EFSA recommends to continue to monitor potentially rising aflatoxin contaminations – possibly attributable to the climate change – in future programmes.

2.8.2 Ochratoxin A (OTA)

Pistachios displayed by far the highest levels of ochratoxin A (OTA), followed, at a distance, by beans and soy beans, and products of soy beans. These three food groups showed some peak levels which could be cut off in future, for instance by regulating maximum levels. Pig's liver and ground almonds displayed very low OTA levels. Chickpeas, rapeseed oil, lentils, walnuts and whole almonds had only some single samples with levels just above the analytic determination limit. It is recommended to continue to monitor pistachios, beans, ground almonds, and soy products for OTA in the framework of official programmes.

2.8.3 T-2-Toxin and HT-2-Toxin

T-2 and HT-2 was not quantifiable in soy beans and soy bean products. This was the same result as when the toxins were last examined in the monitoring in 2011.
Oat flakes and whole meal oat flakes were examined for T-2-/HT-2 toxin for the first time in this monitoring and had higher medians of trichothecene levels than barley grains, as it was expected. Levels in three barley grain samples exceeded the guidance value.
Fusarium toxin levels in cereals vary strongly over the years, which is primarily owing to weather influences and could be minimised by appropriate selection of varieties in crop growing.

2.8.4 Deoxynivalenol (DON)

Barley grains were analysed for the mycotoxin DON for the first time in 2019. On average, barley grains had very low DON levels. The permitted maximum level was not exceeded.

2.8.5 Zearalenone

Zearalenone (ZEN) was not quantifiable in any sample of barley grains. Only one sample of soy meal was found to contain ZEN, and this at a low level. Compared with the findings of last year's monitoring programme, this is a significant decline in ZEN levels.
Maize germ oil, in contrast, showed slightly enhanced values in all statistical parameters. The valid maximum level was by far not reached, however.

2.9 Vegetal toxins

Project 01: Tropane alkaloids in tea and herbal infusions
Examination of tea and herbal infusions for tropane alkaloids (TA) showed that these alkaloids were not quantifiable in more than half of the samples. The highest levels were measures in fennel herb/infusion, followed by peppermint leaves/infusion. The black tea subject to this examination was noted for its very low TA contents.
The toxicological assessment by the BfR came to the conclusion that consumers of black tea or peppermint leaf infusion would use up only a very small portion of the TA acute reference dose (ARfD), even if teas contained the maximum levels found in samples. This holds both for adults and children. The picture is slightly different with fennel tea. Heavy consumers of fennel tea with an assumed TA content equal to the highest contamination level found in the analyses, would exceed the ARfD by about factor 1.6 (adults) or factor 3.7 (children). The same consumption of fennel tea with a TA content as determined for the 90th percentile of samples, however, would just about meet the ARfD for children, and clearly fall below the ARfD for adults. Yet, the tropane alkaloids' acute toxicity makes a health risk still possible in these rare cases, also with short-term exposure.
Compared with risk-based examinations of previous years, the current findings indicate that manufacturers' minimisation strategies begin to show first effects. Still, TA levels in herbal teas should be further reduced, in order to be able to better protect susceptible consumer groups. To monitor the trend, it is necessary to survey more data.
It is therefore recommended to include breastfeeding teas, teas for children and infants, and instant teas into future monitoring projects.

Project 03: *Alternaria* toxins in tomato products
Though *Alternaria* toxins are quite widely present in foodstuffs, they have been less in the focus of public attention. In 2019, their presence in foodstuffs was for the first time subject to the monitoring programme. The project covered the five most important single substances: alternariol, alternariol monomethyl ether, altenuene, tenuazonic acid, and tentoxin. Foodstuffs examined were tomato juice, tomato ketchup, and canned tomatoes, because there are reliable analytic methods for these matrices.
The highest sum levels of *Alternaria* toxins were detected in tomato ketchup, followed by canned tomato purée, canned tomato pieces, and tomato juice. In all products, tenuazonic acid

accounted for nearly 100% of the sum levels of *Alternaria* toxins. Altenuene was not quantifiable in any product.
It must be left to further examinations to find out in how far processing conditions and possible accumulation, for instance, in tomato ketchup, affect the formation of *Alternaria* toxins in foodstuffs. The present data also give rise to the assumption that the production and manufacture of foodstuffs actually have a potential for minimising formation of these mycotoxins.
With a view to preventive consumer protection, we should soon establish the conditions for routine *Alternaria* toxin analytics in more matrices, namely, cereals, fruit, vegetables, meat products, and others.
Reliable analytic methods should be developed for more food groups to be examined in future market basket monitoring.

Project 04: Total delta-9-tetrahydrocannabinol (THC) in hemp oil
Partly, levels detected were very high. With an average total THC content of 5.49 mg/kg in the samples analysed, an adult person of 70 kg body weight would already use up his or her acute reference dose (ARfD) by consuming 12.7 g oil (about two tablespoonful). Monitoring tests should therefore be repeated at regular intervals for the purpose of health protection of consumers.

2.10 Elements

In the majority, the analyses produced low element level findings. Regarding lead, there was no finding higher than the maximum levels established in Regulation (EC) No. 1881/2006. Copper findings were only in single cases higher than respective maximum levels. The percentage of non-compliant findings of cadmium in avocado was relatively high, with 7.9%.
Compared to the findings in previous years' monitoring programmes, the levels of lead, cadmium, arsenic, nickel, and mercury found in the foodstuffs examined were comparable or lower.
Higher levels of cadmium, aluminium, and nickel were measured only in single cases. Pig kidneys, for instance, contained higher levels of cadmium because of the characteristic cadmium accumulation in kidneys. However, all findings were lower than the maximum level established for cadmium in kidney. Higher aluminium levels were measured in pulses, spinach, and lettuce. Pulses (chickpeas and lentils) in addition displayed higher nickel levels.
Dried mixed mushrooms had by far the highest element levels. This holds for lead, cadmium, mercury, arsenic, and in particular for aluminium, too. The median level of aluminium in dried mushrooms was as high as 300 mg/kg. Levels of heavy metals and other elements may be higher in mushrooms than in other vegetal foodstuffs, as mushrooms tend to accumulate these substances from the environment. They are then further concentrated in the drying process.

Project 06: Analysis of lead in liqueur wines
The liqueur wines analysed in this project contained very low or low levels of lead. In all samples, even the maximum values measured (0.015 mg/kg to 0.10 mg/kg) were clearly below the maximum level of 0.15 mg/kg established by the *Codex Alimentarius* for lead in liqueur wines. The data collected in this project can serve as an important basis for decision in further discussions for introducing a legal maximum level for lead in liquor wines in Regulation (EC) No. 1881/2006.

2.11 Nitrate

Nitrate levels in lettuce have declined compared to earlier monitoring analyses. Still, lettuce continued to have high levels of nitrate, the same as spinach. Suitable measures to reduce nitrate in these foodstuffs should therefore be kept up. Savoy cabbage was also found with enhanced nitrate levels in single cases. The nitrate median level in savoy was low, in contrast. Anyhow, consumers should in no way reduce consumption, but just take care to vary their

choice of vegetables, according to the BfR's FAQ compilation about nitrate and nitrite in foodstuffs.

3 Cosmetic Products

3.1 Elements in lip cosmetics with and without glitter/gloss

A total of 290 samples of lip cosmetics were analysed for element content. At least 98% of samples without glitter and 92% of samples with glitter had levels below the orientation values for technically avoidable levels of arsenic, antimony, lead, cadmium, and mercury, as published in the *Journal of Consumer Protection and Food Safety* (JCF) in 2016. Compared with the results of examinations of lip cosmetics in the 2011 monitoring programme, statistical indices were lower, with the exception of the maximum finding in mercury and the median in antimony. As these substances are banned from use in cosmetics, heavy metal levels should be further reduced through careful choice of raw materials and good manufacturing practice, and should remain subject to official monitoring from time to time.
In 2018, various product groups were examined in order to derive orientation values for technically avoidable nickel levels. It showed that the 90th percentiles differed noticeably between the various product groups. In 2019, nickel levels in lip cosmetics were comparably low. 90% of all samples contained less than 1.5 mg/kg.
Similar were the findings of analyses of total chromium. 90% of samples contained less than 2 mg/kg.

3.2 Elements in sunscreen products

Using the lower bound procedure (represented only in the tables volume) – as it was also used in determining orientation values for technical avoidability of heavy metals in the 2016 publication cited above (JCF) – the levels found in at least 90% of samples (i.e. the 90th percentile levels) were lower than 0.03 mg/kg arsenic, 0.31 mg/kg lead, 0.07 mg/kg cadmium, 0.53 mg/kg nickel, and 0.01 mg/kg mercury. Antimony was not quantifiable in any sample, and the 90th percentile level of aluminium was 4,360 mg/kg. All samples complied with the technical avoidance orientation levels of antimony, arsenic, lead and mercury (which were generated while not specifically analysing sunscreen products with very high portions of mineral UV filters). However, 7.2% of the samples exceeded the cadmium avoidance orientation level – in the maximum by up to eight times. 92% of the sun screen products analysed complied with the Cadmium avoidance orientation level.
In its exposure assessment, the BfR came to the conclusion that there is no acute health risk to consumers. Yet, heavy metals are subject to the ALARA principle.

3.3 Aluminium in antiperspirants

Aluminium was quantifiable in nearly all (97.3%) of the 186 antiperspirant samples subject to analysis. 50% of the samples had aluminium levels of more than 2.67%**,** the maximum level found was 5.85 %. This means that the samples examined in 2019 can be classified as safe with regard to the aluminium concentrations, which is in line with the SCCS's (Scientific Committee on Consumer Safety) opinion of March 2020.

4 Commodities/Daily Use Articles

4.1 Mineral oil portions in food packaging material of paper/carton/cardboard and textile packaging materials, and migration to dry food packed therein. Mineral oil portions in articles for cooking/roasting/baking/grilling, made of paper/board/cardboard

Because of the possible carcinogenic potential of mineral oil aromatic hydrocarbons, both the Federal Institute of Risk Assessment (BfR) and the European Food Safety Authority (EFSA) hold the opinion that human exposure to MOAH should be minimised. As regards consumer items intended for food contact, minimisation can be achieved by using, for instance, fresh-fibre cartons, mineral oil-free printing inks, or by integrating functional barriers in the structure of food packaging. Measurements in this monitoring showed that the large majority of samples (96.2%) complied with the limit values recommended by the BfR and with the detection limit defined in the draft of the 22nd Regulation amending the *Regulation on Food Contact Items* (in German, "*Mineralölverordnung*").
Overall, 2 out of 53 samples (3.8%) of packed foodstuffs were detected with MOSH or MOAH at levels higher than the – so far not binding – limit values for migration of MOSH/MOAH from food contact items made of paper, carton, or cardboard, or from recycling paper. A comparison of MOSH/MOAH distribution patterns in these two foodstuff samples however, showed that the entry of mineral oil was less attributable to the packaging materials, but rather to other causes. In these cases, the recommended limit values or detection limit as referenced above cannot serve as a basis of evaluation. Apart from that, the percentage of non-compliance with the recommended limit values or the detection limit has decreased, compared to the findings in the year before (then, 6.8% 'non-compliant' samples).
Further investigations into MOSH/MOAH in foodstuffs are scheduled in the monitoring programme of 2020.

4.2 Mineral oil portions in toys of paper or cardboard intended for children aged under 36 months (picture books and large-piece puzzles)

The findings show that the majority of picture books and puzzles with large pieces suitable for children aged under 36 months contain high levels of MOSH/MOAH. MOAH were quantified in 87% of the picture books and in 100% of the puzzle toys. Oral exposure of children to mineral oil hydrocarbons through what is called "mouthing" or nibbling is foreseeable, and comes in addition to potential exposure through consumption of food.
What nibbling and swallowing of toy particles contribute to young children's exposure to MOAH is less than what is ingested with foodstuffs, pursuant to a current exposure assessment made by EFSA. Potential ingestion of the MOSH fractions C≥10–C≤16 and C>16–C≤20 by swallowing toy particles is clearly less than the ingestion amounts to be expected as a result of MOSH/MOAH migration from paper or cardboard food contact material to a food, proceeding from the guidance migration levels recommended by the BfR. The present data do not allow to assess to what extent migration of mineral oil components to saliva as a result of "mouthing" contributes to the general exposure. It is therefore not possible to make a final toxicological evaluation of the exposure resulting from the MOSH/MOAH contents measured in the toys.
The BfR and EFSA hold the opinion that human exposure to MOAH should be minimised, because of their possible carcinogenic potential. As regards cardboard toys, minimisation can be achieved by using, for instance, fresh-fibre cartons, mineral oil-free printing inks, or by applying a film-coat.

4.3 Release of elements from toys and joke articles (modelling clay, wobbling mass, wood bricks, chalk)

Apart from a few exceptions, migration limit values pursuant to industrial standard DIN EN 71-3 or Directive 2009/48/EC were by far not reached. This shows that notably lower migration levels are technologically feasible with good manufacturing practices.