Chemical requirements for artificial turf and rubber safety surfacing in Stockholm

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Contents

Summary

Artificial turf and rubber safety surfacing contain several substances that may pose risks to both human health and the environment. The City of Stockholm has a stated goal of phasing out particularly hazardous substances and has a special focus on the so-called phase-out substances, PFAS, phthalates and bisphenols. This report analyses how current requirements need to be developed to better support the goal of a toxic-free Stockholm.

The analysis shows that current requirements, including the criteria set out by Byggvarubedömningen (BVB), do not fully cover the risks identified in artificial turf and rubber safety surfacing, particularly with regard to PFAS.

To ensure that procurement contributes to a greater extent to reducing the presence of harmful substances, the report proposes a number of stricter chemical requirements. Materials used in artificial turf and rubber safety surfacing should meet the *Recommended* level in the BVB system, while the products as a whole should at least meet the *Accepted* level. PFAS requirements are also proposed, as are quality requirements.

In addition, a few minor changes are proposed, such as incorporating the Swedish Environmental Protection Agency's updated guideline values for contaminated soil from 2025. The requirement for PAHs is proposed to remain unchanged. No further requirements regarding phthalates, bisphenols or phase-out substances are deemed necessary, as these substances are already regulated in BVB's *Recommended* level.

Overall, the proposed requirements represent a slight change to the City's chemical requirements. The main changes concern the introduction of PFAS requirements, the *Recommended* level in BVB, and quality requirements.

Glossary

BBP	Benzyl butyl phthalate
BVB	Byggvarubedömningen
CMR	Carcinogenic, mutagenic and reprotoxic
DBP	Dibutyl phthalate
DCHP	Dicyclohexyl phthalate
DEHP	Bis(2-ethylhexyl) phthalate
DEP	Diethyl phthalate
DIBP	Diisobutyl phthalate
EPDM	Ethylene propylene rubber
PE	Polyethylene
PP	Polypropylene
PU	Polyurethane
PBT	Persistent, bioaccumulative and toxic
PAHs	Polycyclic aromatic hydrocarbons
PFAS	Perfluorinated organic substances
PRIO	Prioritisation guide
SBR	Styrene butadiene rubber
SVHC	Substances of very high concern
TPEs	Thermoplastic elastomers
TPO	Thermoplastic olefin
VOCs	Volatile organic compounds

1 Introduction

Artificial turf and rubber safety surfacing are widely used in public spaces in cities, such as playgrounds, multi-sport pitches and sports arenas. However, these materials may contain a number of chemicals that are potentially harmful to both health and the environment and which are released into the surrounding environment in the form of microplastics, among other things. Against this background, Goodpoint has conducted a study on behalf of the Chemicals Centre to map and evaluate the City's recommendations for artificial turf and cast-in-situ rubber.

The purpose of the report is to identify the requirements and assessment levels that should be set for artificial turf and safety surfacing materials in order to reduce the presence of hazardous substances in the city's outdoor environments.

2 Background

Contents of artificial turf & rubber safety surfacing, an overview

Artificial turf

Artificial turf consists mainly of two components: **the top layer** (the artificial turf itself) and **the backing**. The top layer is usually made of **polyethylene (PE)**, **polypropylene (PP)** and **polyester**, while the backing often consists of **styrene-butadiene rubber (SBR) from recycled car tyres**, **PP** and **polyurethane (PU)**.

In order to achieve the desired properties such as **shock absorption**, **ball rebound** and **stability**, artificial turf may need **infill material**. This infill material can consist of **rubber granules** or **organic materials** such as cork, coconut fibre or olive pits. **Sand** is also often used as infill material. Some types of artificial turf do not require infill material, as they are designed with a **heavier and denser fibre structure**.

Rubber granules used as infill material in artificial turf pitches may contain particularly hazardous substances, such as heavy metals, volatile organic compounds (VOCs), phthalates, per- and polyfluoroalkyl substances (PFAS) and polycyclic aromatic hydrocarbons (PAHs) (KEMI, 2025a; RISE, 2022). Rubber granules are classified as microplastics, which means that their sale will be prohibited in 2031.

Artificial turf may also contain **zinc oxide**, which acts as an antibacterial additive, and **pigments** to give it its characteristic green colour.

Rubber safety surfacing consists mainly of two components: **rubber** and **filler**. The rubber is usually **ethylene propylene rubber (EPDM)** or **SBR**, while the filler often consists of **calcium carbonate** or **aluminium hydroxide**. In addition, **plasticisers** in the form of mineral oil or petroleum distillate and **pigments** may be added. Safety surfacing usually consists of a base layer, a top layer and a binder. The binder may contain chemicals with harmful properties, such as hardeners.

Overview of the City of Stockholm's requirements

The City of Stockholm's Environment programme 2030 sets out a number of goals that the City will work to achieve. One of these is "A non-toxic Stockholm", which is in line with one of Sweden's overall environmental quality objectives, "A non-toxic Environment". To concretise the strategy and the work to achieve this goal, the City of Stockholm has had a Chemicals Action Plan since 2014. This plan is now in its third edition (Stockholms stads kemikalieplan 2025-2031).

The City's environment programme explicitly states that PFAS, bisphenols and phthalates should be phased out and that cast-in-situ rubber should be phased out gradually. The City shall " *tighten its requirements and stop purchasing goods and products in which the content of PFAS, phthalates, bisphenols and persistent organic pollutants is known, and gradually phase out these products*". With regard to cast-in-situ rubber, the plan states that this will be phased out gradually and replaced by environmentally friendly and biodegradable materials.

The Chemicals Action Plan focuses broadly on property criteria rather than on a list of substances to be prioritised for phase-out. The plan uses the Swedish Chemicals Agency's classification of substances (according to PRIO, the priority guide) – phase-out substances and priority risk-reduction substances. It is stated in the plan that phase-out substances should be phased out and that risk-reduction substances should only be used if their use can be considered safe. With regard to phase-out substances, the City also uses the SIN List to identify endocrine-disrupting chemicals, as these have not yet been fully implemented in REACH.

The Chemicals Action Plan also addresses microplastics, stating that materials and goods that release microplastics should be avoided as far as possible.

For construction and civil engineering materials, the City of Stockholm uses Byggvarubedömningen (BVB). The construction and civil engineering materials used must primarily achieve the level *Recommended* or *Accepted* in the system. However, the requirements are higher or more specific in the following cases:

- If there is a risk that small children will be exposed to the material.
- Copper and zinc in contact with water.
- Materials that cause the spread of microplastics.
- Addition of nanomaterials.

- Drinking water distribution.

With regard to artificial turf and rubber safety surfacing, the City of Stockholm has had a recommendation on artificial turf and cast-in-situ rubber since 2019. The recommendation includes an appendix with proposed chemical and environmental requirements to be used in the procurement and purchase of facilities for football pitches, multi-sport areas, sports arenas and playgrounds that contain synthetic ground materials. This work aims to update the chemical requirements in this appendix.

3 Basis for updating current requirements

Assessment of artificial turf and rubber safety surfacing in Byggvarubedömningen

The table below shows how products relevant to artificial turf and rubber safety surfacing are assessed according to BVB, based on the City of Stockholm's general chemical requirements. For more information on the BVB reporting requirements, see Appendix 1.

	Accepted BVB	Recommended BVB
Phase-out substances	See Appendix 1 (marked with U) Phase-out substances must not exceed the specified concentrations. These concentrations depend on the classification of the substance.	See Appendix 1 (marked with U) Phase-out substances must not be included above the specified levels. These levels depend on the classification of the substance.
Risk reduction substances	See Appendix 1 (marked with R) Risk reduction substances must not exceed the specified levels. These levels depend on the classification of the substance.	See Appendix 1 (marked with R) Risk reduction substances must not be included above the specified levels. These levels depend on the classification of the substance.
Candidate List	Reporting requirements apply to concentrations above 0.1% at the total or component level. The assessment is based on the classification of the substance.	Reporting requirements apply to concentrations above 0.1% at the total level or component level. The assessment is based on the classification of the substance.
Leaching	For products that are expected to come into contact with water, there are special requirements that focus on substances classified as environmentally hazardous and endocrine disruptors.	For products that are expected to come into contact with water, there are special requirements that focus on substances classified as environmentally hazardous and endocrine disruptors. Safety surfacing rubber and artificial turf made of EPDM/SBR cannot be recommended due to the presence of zinc oxide.
Recycling potential	Reuse is not possible, and energy recovery is the current method of disposal. This is usually assessed for plastic, rubber and natural-based materials.	Only one supplier of artificial turf (ONE-DNA) without granules meets the requirements for *Recommended*.
PFAS	<0.1	0
Phthalates	0.1 See Appendix 1 (Endocrine disruptors according to the SIN List or candidate list.)	0.01 See Appendix 1 (Endocrine disruptors according to the SIN List or candidate list.)
PAHs	The content must be below 1 mg/kg for the eight PAHs covered by legal requirements. If the product is intended for children, a limit of below 0.5 mg/kg applies.	The content must be below 1 mg/kg for the eight PAHs covered by legal requirements. If the product is intended for children, a limit of below 0.5 mg/kg applies.
Microplastics	No requirement, but may change with the EU directive on microplastics.	No requirement, but may change with the EU directive on microplastics.

The table below shows the chemical requirements set out in the City of Stockholm's requirements for artificial turf in accordance with Appendix 1, Adda (level medium and high) and relevant REACH legislation, in relation to BVB's requirements. The colour markings red, yellow and green indicate whether the respective requirements are not met, partially met or met by BVB's requirements. Empty cells mean that there are no requirements.

		The City of Stockholm's current requirements (chemical and environmental requirements for the construction of football pitches, multi-sport surfaces, sports arenas and playgrounds containing synthetic materials)	Adda Medium	Adda High	REACH (Candidate List + PAHs + microplastics)
General chemical requirements (construction and installation requirements)	Substance reporting	Complete content report.			
	Additives	Additives are reported with CAS/EC numbers			
	Candidate List	<0.1	< 0.1% per substance in top layer (straw, granules, backing)	< 0.1% per substance in constituent components (granules, backing)	Information requirements for concentrations > 0.1%
Specific to artificial turf/safety surfacing	Leaching	Swedish Environmental Protection Agency sensitive land use (tables 4 + 5)	Zinc <10,000 mg/kg (granules)	Zinc < 250, mg/kg e (backing + granules)	

	PAH (surface layer)	≤0.5 mg/kg			Granules <20 mg/kg of the 8 listed PAHs. For plastics in contact with skin: <1 mg/kg for the 8 PAHs covered by legal requirements. (<0.5 mg/kg if children are the intended users)
	Recyclability		Documentation must show how the components of the artificial turf system can be recycled, and distinguish between material and energy recovery.	The system components shall be made of materials that are 100% mechanically or chemically recyclable. The contractor shall have documentation verifying this.	
	Microplastics	Avoid if possible	The tuft lock must withstand a tensile force of at least 40 N, and the joint lock at least 75 N. The system must not contain binding wire (wrapping wire).	The tuft lock must withstand at least 50 N and the joint lock at least 75 N in torque.	Ban on microplastics 17 October 2031

As can be seen from the table above, BVB's requirements do not cover the requirements imposed by the City of Stockholm on artificial turf and safety surfacing, which is why additional requirements are necessary, as proposed in this report.

Problematic substances in plastic

Plastic never consists of a polymer alone; additives such as plasticisers, pigments and stabilisers are always present. These additives can have negative effects on human health and the environment and can also hinder recycling. In 2023, the Swedish Chemicals Agency investigated problematic substances in plastics that hinder recycling (KEMI, 2023). Two groups of chemicals were identified as particularly problematic: plasticisers (phthalates) and flame retardants. However, information on the potential presence of flame retardants in artificial turf is currently very limited, based on scientific literature and grey literature. Other substances such as residual monomers and additives have also been reported to be present in artificial turf, but the main problem is the lack of information on additives in plastics.

A review study shows that benzotriazoles, additives used as light stabilisers, and new brominated flame retardants can leach from polyethylene and polypropylene used in artificial turf and act as endocrine disruptors on aquatic organisms (Galkina, 2023).

PFAS

The presence of PFAS in artificial turf and their potential effects on human health and the environment have been investigated in recent years (Goulding, 2025; Ryan-Ndegwa et al., 2024). Based on the reviewed literature, there is no clear conclusion as to why PFAS are used in the manufacture of artificial turf or granules. However, two main sources of PFAS presence may be the use of recycled materials containing PFAS and the use of PFAS as production aids during extrusion (Lauria et al., 2022). PFAS therefore does not appear to be used directly to give the end product specific properties.

The presence of PFAS in artificial turf in the Stockholm area has been investigated in a thesis (Naim, 2020). Samples were taken from 18 different pitches and separated according to artificial turf components (backing, infill material, artificial turf blades), types of infill material (including EPDM, TPE, TPO SBR and coconut/cork) and "old" and "new" pitches. A total of 54 samples were analysed for PFAS content and total fluorine content.

Most of the backing samples (76%) contained PFAS at levels up to 0.9 ng/g, while 18% of the filling material samples and only one straw sample (6%) contained PFAS at detectable levels (up to 0.2 ng/g and 0.01 ng/g, respectively). The total fluorine content was found to be much higher in fillings made of EPDM, TPE and TPO (average levels of 183; 120 and 219 µg total fluorine content/g, respectively) compared to fillings made of SBR or coconut/cork. In addition, the study by installation year ("old" versus "new" pitches) shows that weather conditions do not appear to affect PFAS levels in the backing, suggesting limited release of PFAS into the environment. In

EPDM infill material, however, the result was the opposite: no PFAS was detected in "old" EPDM infill material, suggesting that PFAS may have leaked from the infill material into the environment.

The authors estimated the contribution of artificial turf to PFAS and total fluorine emissions into the environment in Stockholm, assuming that the infill is replaced annually, that a pitch has a lifespan of 10 years, and that there are 103 pitches in Stockholm. They calculated that all pitches would contribute a total of 7 mg of PFAS and 30 kg of total fluorine over 10 years. Finally, the authors point out the large differences between total PFAS concentrations and total fluorine levels, which shows that a large amount of fluorine present in artificial turf is not identified in this study.

This work has been supplemented by a study aimed at characterising the total fluorine detected in artificial turf in Stockholm (Lauria et al., 2022). The results of this study show the same results as the previous study, where total fluorine was detected in all analysed samples, while PFAS and extractable organic fluorine were detected in <42% of the samples. The study results show that fluorine that is not PFAS could be other types of polymeric organofluorine compounds, such as fluoroelastomers, polytetrafluoroethylene and polyvinylidene fluoride. However, a complete characterisation of total fluorine could not be carried out, and the authors point out that the presence of inorganic fluorine compounds cannot be ruled out. The authors also write that fluorine in artificial turf does not pose an immediate risk to users, based on the properties of the substances (low extractability and oxidation potential), but that there are still concerns about the production and end of the life cycle of artificial turf.

Overall, the results indicate that although PFAS only accounts for a small proportion of the total fluorine content, quantification of PFAS in artificial turf appears to be the most reliable indicator of potential risks. Unlike other fluorinated substances, PFAS allows for unambiguous characterisation, and its well-known risks provide a solid basis for risk assessment and recommendations.

There are a number of Swedish and EU-based limit and guideline values for PFAS (see summary below). The authorities use different groupings for these limit and guideline values (PFAS4, PFAS11, PFAS21, etc.).

In addition, a broad PFAS restriction is currently being evaluated within the EU, with plans for ECHA to present a proposal for a ban to the Commission in 2026.

Below are some examples of limit and guideline values for PFAS that currently exist in Sweden and the EU:

Food

- Legally binding limit values for PFOS, PFOA, PFNA and PFHxS in various foods.

Drinking water (binding from 2026)

- PFAS4: 4 ng/l
- PFAS21: 100 ng/l

Groundwater

- Guideline value: Total of 11 PFAS (PFBS, PFHxS, PFOS, Fluorotelomer sulfonate (6:2 FTS), PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFNA and PFDA): 90 ng/l
- Guideline value for PFOS 45 ng/l
- General threshold value: Weighted sum of 24 PFAS: 4.4 ng PFOA equivalents/l. There are also annual average values and maximum values for PFOS in different types of water.

Land use

- Guideline value for PFOS: Sensitive soil: 3µg PFOS/kg TS. Less sensitive soil: 20µg PFOS/kg TS

Biota (fish)

- Limit value for PFOS: 9.1 µg/kg

Waste (Legally binding limit values for hazardous waste)

- PFOS: 50 mg/kg
- PFOA and its salts: 1 mg/kg
- PFOA-related compounds 40 mg/kg
- PFHxS and its salts 1 mg/kg
- PFHxS-related compounds 40 mg/kg

Products

- The POPs Regulation imposes legally binding requirements on:
    - PFOA, PFOA salts and PFOA-related compounds: 25 ppb (25 µg/kg) for each of PFOA and its salts. 1,000 ppb (1,000 µg/kg) for individual PFOA-related compounds or combinations of PFOA-related compounds.
    - PFOS and its derivatives: 10 mg/kg (0.001% by weight) when present in substances and preparations. 0.1% by weight in products or articles or parts thereof.
- REACH has the following restrictions:

- C9-C14 PFCAs, their salts or a combination thereof: 25 ppb for the sum of C9-C14 PFCAs and their salts or 260 ppb for the sum of C9-C14 PFCA-related substances.
- PFHxS, PFHxS salts and PFHxS-related compounds: 0.025 mg/kg (0.0000025% by weight) for PFHxS or any of its salts. 1 mg/kg (0.0001% by weight) for the sum of the concentrations of all PFHxS-related compounds at a maximum of 0.1 mg/kg (0.00001% by weight) when present in concentrated fire-fighting foam mixtures for concentrations of PFHxS, PFHxS salts and PFHxS-related compounds

The proposal for the universal restriction on PFAS currently being discussed by ECHA's scientific committees suggests a limit of 50 ppm for total PFAS content (including polymers such as PTFE). A decision on the PFAS restriction is expected to be taken by the European Commission in 2026. However, implementation of the ban will take a few years.

In BVB level *Recommended*, it is required that no PFAS be present in the product. However, no verification of this requirement is required, either in the form of a supplier certificate or a test report. A product containing up to 0.1% PFAS may receive the assessment *Accepted*.

One of the suppliers contacted has conducted PFAS tests on an artificial turf they sell (the test covered the entire turf, i.e. the primary backing, secondary backing (the adhesive used to hold the fibres in place on the fabric) and the fibres). They found PFAS in very low concentrations (0.64 ng/litre for PFAS 4). In this case, the manufacturer had also certified that PFAS had not been intentionally added to the product.

There are currently a number of standard tests for different PFAS groups, such as PFAS4, PFAS11 and PFAS21. However, to ensure that no PFAS are included in the product, tests must be carried out for all types of PFAS. Such tests are significantly more expensive than the standard tests mentioned above.

Proposed requirements for PFAS

The City of Stockholm aims to phase out all use of PFAS. Therefore, the following requirements are proposed, which are in line with the proposed restrictions on PFAS currently being developed in the EU:

The total PFAS content in the product must be less than 50 ppm. Verified by test protocols showing that the total PFAS content is below 50 ppm.

Phthalates in artificial turf

Phthalates are one of the priority groups for phase-out in the City of Stockholm's environment programme. Phthalates are used as plasticisers to increase the malleability of rubber or plastic materials (Massey et al., 2020). Some phthalates pose a problem to human health because they are toxic to reproduction and/or endocrine disruptors.

In 2008, the Danish equivalent of the Swedish Environmental Protection Agency (Miljøstyrelsen) published a report on the mapping, emissions and assessment of chemical substances in artificial turf (Danish Environmental Protection Agency, 2008). Six phthalates were detected in significant e concentrations in leachate from artificial turf pitches and were linked to possible health and environmental effects. These are diethyl phthalate (DEP), dibutyl phthalate (DBP), benzyl butyl phthalate (BBP), diisobutyl phthalate (DIBP), dicyclohexyl phthalate (DCHP) and diethylhexyl phthalate (DEHP).

In a study conducted on artificial turf, the authors quantify the presence of 1529 semi-volatile contaminants (Donald et al., 2019). Only two phthalates are detected in significant levels (DEHP and DBP), but the authors do not draw any conclusions about potential health effects in the report.

A recent systematic review addresses chemical analyses of artificial turf in relation to bioavailability analyses (i.e. how accessible the chemicals are to humans) and human health risk assessment (Ryan-Ndegwa et al., 2024). The study concludes that key phthalates (DIBP, BBP and DBP) are not available or have very limited bioavailability properties, which means limited risks to human health .

Proposed requirements for phthalates

All of the above-mentioned phthalates are classified as endocrine disruptors according to either the Candidate List or the SIN List. In order for the product to receive the *Recommended* rating with regard to content, reporting of endocrine disruptors, according to the SIN List or the Candidate List, down to 0.01% is required. Against this background, no further requirements are proposed beyond the *Recommended* rating in BVB regarding content.

PAHs

Polycyclic aromatic hydrocarbons (PAHs) are hydrocarbon compounds consisting of at least two benzene rings and have carcinogenic and mutagenic effects. They occur in plastic and rubber materials based on crude oil and can be found in both artificial turf and rubber safety surfacing. Due to their serious

health effects, polycyclic aromatic hydrocarbons (PAHs) are regulated in the REACH Regulation (Annex XVII). Eight specific PAH substances are subject to limit values that must not be exceeded in certain designated product groups to ensure safe use. For rubber granules used as infill material in artificial turf pitches, a limit of 20 mg/kg applies. For plastic or rubber materials in toys and childcare articles that may come into direct and prolonged or repeated contact with children's skin or oral cavity, however, a significantly stricter content limit of 0.5 mg/kg applies. It is this lower limit that BVB applies when assessing artificial turf and safety surfacing rubber.

Proposed requirements for PAHs

In order for artificial turf or safety surfacing to meet the current requirements, an analysis report certifying that the statutory requirement for a maximum PAH content of 0.5 mg/kg is met is required. We propose no changes to the PAH requirement for artificial turf or safety surfacing. The current maximum content of 0.5 mg/kg (0.00005%) for the eight legally regulated PAH substances is considered sufficient. The reason why stricter requirements are not proposed is that many plastic and rubber-based materials contain PAHs, albeit in very low concentrations. A total ban or stricter requirements would not be feasible for plastic or rubber-based materials. Furthermore, the limit of 0.5 mg/kg is the strictest requirement currently stipulated by law. The suppliers we have been in contact with have not expressed any difficulty in meeting this requirement for their products, which is why a lower requirement is not justified.

Phasing-out substances relevant to artificial turf and safety surfacing

The table below shows a summary of PRIO phase-out substances included in EPD-EPDM, TPE and SBR. All phase-out substances are restricted in BVB based on the classification of the substance. The concentration limits for the various classifications to achieve *Accepted* and *Recommended* are shown in Appendix 1 (marked with U). To achieve *Recommended* in BVB, lower concentrations of the substances in question are required than for the *Accepted* level.

Substance name	CAS	Material
Diaminodiisocyanatozinc	122012-52	SBR, EPM-EPDM
Dibenz[a,h]anthracene	53-70	SBR
Krysen	218-01	SBR, EPM-EPDM
4,4'-Isopropylidenediphenol	80-05	SBR
Benz[e]acephenanthrylene	205-99	SBR
Benzo[k]fluoranthene	207-08-9	SBR

Nonylphenol	25154-52-3	SBR, EPM-EPDM
Bis(2-ethylhexyl) phthalate	117-81	SBR, EPM-EPDM
2,2'-[(3,3'-Dimethoxy[1,1'-biphenyl]-4,4'-diyl)bis(azo)]bis[3-oxo-N-phenylbutyramide]	6505-28	SBR, EPM-EPDM
Benzo[a]pyrene	50	SBR, EPM-EPDM
Benz[a]anthracene	56-55	SBR, EPM-EPDM
Bis(pentabromophenyl) ether	1163-19	SBR, EPM-EPDM, TPE
Anthracene	120-12-7	SBR, EPM-EPDM
4-tert-Octylphenol	140-66-9	SBR, EPM-EPDM
Chlorinated paraffins, C14-17	85535-85-9	SBR
Benzyl butyl phthalate	85-68	SBR
Benzo[ghi]perylene	191-24	SBR, EPM-EPDM
N-Methyl-2-pyrrolidone	872-50	SBR
Fluoranthene	206-44	SBR, EPM-EPDM
Pyrene	129-00	SBR
Fenanthrene	85-01	SBR, EPM-EPDM
1,4-Benzenediamine, N,N'-mixed phenyl and tolyl derivatives	68953	SBR
2,4-Di-tert-butyl-6-(5-chlorobenzotriazol-2-yl)phenol	3864-99	EPM-EPDM
4,4'-Methylenediphenyl diisocyanate	101-68	TPE
m-Tolylidene diisocyanate	26471-62	TPE
2-(2H-Benzotriazol-2-yl)-4,6-bis(2-methylbutan-2-yl)phenol	25973-55	TPE
Bis(2-ethylhexyl)tetrabromophthalate	26040-51	TPE

Proposed requirements for phase-out substances for artificial turf and safety surfacing

A requirement that artificial turf and rubber safety surfacing should contain lower levels than the assessment level for *Recommended* is not feasible, as they can be found in plastic and rubber-based materials, albeit in very small quantities. We therefore propose that all products should achieve the *Recommended* assessment in BVB, which includes all phase-out substances.

Leaching criteria

The City of Stockholm's current proposal on chemical requirements for artificial turf and safety surfacing with regard to sensitive and less sensitive land use cannot be fully met with BVB's requirements for the *Recommended*

level. Only mercury (MKM) is covered with certainty by the requirements (see Appendix 1).

The Swedish Environmental Protection Agency's guidelines for KM (sensitive land use) / MKM (less sensitive land use) specify general guidelines that indicate levels of soil contamination below which risks to human health and the environment are normally low and acceptable. These guideline values are currently used in the chemical requirements that the City of Stockholm has for artificial turf and rubber safety surfacing. The Swedish Environmental Protection Agency's guideline values were updated in August 2025. The table below shows the values that have changed from the previous version in yellow. Lead, cadmium and chromium (VI) have been given new lower values in the updated version for MKM, while only cadmium has been given updated values for KM.

	Sensitive land use (KM)	Less sensitive land use (MKM)
Substance	Guideline value, maximum content mg/kg Previous value/updated value	Guideline value, maximum content mg/kg Previous value/updated value
Antimony	12	30
Arsenic	10	25
Barium	20	30
Lead	50	400/180
Cadmium	0.8	12
Cobalt	15	35
Copper	80	20
Chromium (total)	80	15
Chromium (VI)	2	10/8
Mercury	0.25	2.5
Molybdenum	40	10
Nickel	40	120
Vanadium	10	20
Zinc	*	*
PAH-L	3	15
PAH-M	3.5	2
PAH-H	1	10
Benzene	0.012	0.04
Toluene	10	40
Ethylbenzene	10	5
Aliphatic >C5-C16	10	50
Aliphatic >C16-C35	**	100
Aromatic >C8-C10	10	5
Aromatic >C10-C16	3	15
Aromatic >C16-C35	10	3

*) For zinc, the KM requirement is waived; instead, the supplier must report the zinc content, which constitutes an award criterion in the tender evaluation.

**) For aliphatic >C16-C35, the KM requirement is waived; instead, the supplier must report the content of aliphatic >C16-C35.

Other limit values that may be taken into account are DNEL (Derived No Effect Level). These are used in the EU's chemical safety assessments to determine safe exposure levels for workers and consumers. Thus, DNEL focuses on human health, while KM/MKM focuses on the environment. Although a complete risk assessment is not possible based on DNEL, it is possible to estimate the concentration of a substance in a product required to reach DNEL. If the substance is likely to be present in this concentration in the product, a risk to human health cannot be ruled out. Otherwise, the risk can be assessed as negligible. The concentration of a substance in synthetic materials that would lead to DNEL can be calculated based on the following assumptions:

- 0.1 g of filler material is ingested per day (ECHA, 2021)
- An average user weighs 25 kg (conservative n assumption of a "sensitive" user: child - 10 years old)
- Exposure occurs via ingestion. This assumption is limited but relates to the only available estimate of exposure (0.1 g of filling material ingested per day).

The theoretical substance content can then be compared with the Swedish Environmental Protection Agency's guideline values.

Example – arsenic: The DNEL for arsenic is achieved for a 25 kg child who ingests 0.1 g of infill per day if the arsenic concentration in the artificial turf is 425 mg/kg. This is higher than the MKM limit (25 mg/kg), which shows that the Swedish Environmental Protection Agency's MKM guideline values are stricter than the limit value based on DNEL.

This method shows that for all available DNEL values, the theoretical limit values calculated are many times higher than the recommendation based on KM guideline values.

However, for a complete risk assessment, all routes of exposure for humans must be taken into account. The theoretical limit values presented should therefore not be regarded or used as "safe values", but only as a comparison tool.

Substance	KM Guideline value, maximum content mg/kg	MKM Guideline value, maximum content mg/kg	Comment	Comment 2: Theoretical content limit in infill to achieve DNEL (oral)
Antimony	12	30	(DNEL) 28 mg/kg bw/day	cannot be reached*
Arsenic	10	25	(DNEL) 1.7 µg/kg bw/day	425 mg/kg
Barium	200	300	(DNEL) 3.7 mg/kg bw/day - oral	925 g/kg
Lead	50	180	The guideline value for KM is set after consideration of more factors than just risk. See supporting documentation for more information.	-
Cadmium	0.7	2.5	See supporting documentation for more information. (DNEL) 1 µg/kg bw/day	250 mg/kg
Cobalt	15	35	268 mg/kg infill is considered low risk by ECHA	
Copper	80	20	(DNEL) 41 µg/kg bw/day	10 g/kg
Chromium (total)	80	15	If the proportion of chromium (VI) is greater than 1% of the total chromium content, chromium (VI) should also be risk assessed. Only for inhalation: DNEL = 27 µg/m³	-
Chromium (VI)	2	8	Note	-
Mercury	0.25	2.5	(DNEL) 7.39 µg/kg bw/day	1.8 g/kg
Molybdenum	40	10		580 g/kg
Nickel	40	120		-
Vanadium	100	200	No hazard identified (ECHA)	-
Zinc	250	50	21g/kg infill is considered low risk by ECHA	
PAH-L	3	15	PAH with low molecular weight	-
PAH-M	3.5	20	PAH with medium molecular weight	-
PAH-H	1	10	PAH with high molecular weight	-
Benzene	0.012	0.04	Notes 1, 2. Hazardous if inhaled	-
Toluene	1	40	Note 1, 2. (DNEL) 8.13 mg/kg bw/day	cannot be reached*
Ethylbenzene	10	50	Note 1, 2. (DNEL) 1.6 mg/kg bw/day	cannot be reached*
Aliphatic >C5-C16	10	50		-
Aliphatic >C16-C35	**	100		-
Aromatic >C8-C10	10	5		-
Aromatic >C10-C16	3	15		-
Aromatic >C16-C35	10	30		-

***cannot be reached:** Based on the estimated average exposure through ingestion of infill, the DNEL value would not be reached, even in the theoretical scenario where the substance constitutes 100% of the infill mass

Note 1: Substances that may occur to a large extent in pore air. Supplementary analyses of soil air and indoor air are recommended. **Note 2:** Substances that may occur to a large extent in groundwater. Supplementary analyses of groundwater are recommended.

Proposed requirements linked to the Swedish Environmental Protection Agency's guideline values

We recommend continuing to use the updated guidelines from the Swedish Environmental Protection Agency for sensitive and less sensitive land use as requirements, as these requirements are more ambitious than BVB's criteria and are also relevant for soil. No other relevant guidelines to refer to for additional requirements have been identified, and therefore no new requirements are proposed.

To ensure compliance with the requirements, it is proposed that suppliers submit analysis reports for the products to ensure that the requirements are met. Currently, a list of ingredients is required, but as the guideline values are lower than what suppliers usually specify in lists of ingredients, analysis reports provide greater accuracy. However, this represents an increased cost for suppliers, which needs to be taken into account in the decision on whether test reports should be required as verification or not.

4 Supplier dialogues

During the course of the work, the following suppliers were interviewed: A selection of Stockholm City's current suppliers of this type of product

- Nordic Surface: Sells artificial turf for playgrounds and landscaping, as well as safety surfacing (not artificial turf for sports)
- Saltex: Sells artificial turf for sports, playgrounds and landscaping, as well as safety surfacing
- Nordic Service Arena: Sells artificial turf for sports surfaces
- Spentab: Sells artificial turf for sports, playgrounds and landscaping, as well as safety surfacing

Below is the information provided by the various suppliers during interviews conducted with them. The information provided by the suppliers has not been verified by Goodpoint.

Safety surfacing:

Most suppliers use cast-in-situ rubber in their products. One of the suppliers advocated cork, which is a moulded material consisting of a bottom layer and a top layer that are glued together during installation. Glue is assessed as *To*

be Avoided in BVB because it is a product with a hardener. There are bio-based glues, but these are not currently used on a large scale.

Cork is 50–70% more expensive than cast rubber. One supplier claimed that cork products are of poor quality, crack and break easily, and that a lot of binding agents are used in the product itself, which should not be considered good from an environmental point of view. Safety surfacing tiles made of cork are also difficult to reuse, difficult to recycle and difficult to repair, according to one manufacturer.

Bio-based safety surfacing products (such as those from Baremark, Woodworks, Rampline) are currently being developed in many places. However, there are few bio-based alternatives to rubber-based safety surfacing products that are sold on a large scale and have therefore been properly tested in "real life" to currently require their use.

EPP or EPDM is usually used as the top layer on safety surfacing rubber tiles. Sometimes SPE rubber is used under the top layer (the thickness depends on the shock-absorbing effect required). In Gothenburg, artificial turf is often used on top of safety surfacing slabs because it is less expensive and means that less material needs to be replaced when it wears out.

Artificial turf for playgrounds/landscaping

Many suppliers raised the importance of introducing quality requirements for artificial turf for playgrounds, as many cheaper, lower-quality artificial turf products are often used in playgrounds today. Due to their poor quality, these need to be replaced more often, which is costly and resource-intensive.

Sand works well as a filling material for artificial turf used in playgrounds or landscaping projects. Currently, only one supplier has a *Recommended* rating in BVB for its artificial turf for playgrounds/landscaping. Some suppliers stated that they had not evaluated whether their products would meet the *Recommended* standard in BVB and were therefore unable to answer the question of whether they would be able to supply artificial turf for playgrounds/landscaping if such a requirement were to be imposed.

According to the supplier, there is no price difference between artificial turf for playgrounds/landscaping that is rated as *Recommended* in BVB and other artificial turf.

Artificial turf for football pitches/sports arenas

The backing on artificial turf pitches is usually made of PP dipped in PU/latex (which contains styrene butadiene), and therefore these pitches can only be

rated *Accepted* in BVB. One of the suppliers said that they are developing a new backing made of PE that is fully recyclable. The supplier hopes to launch these products before the end of 2025. According to the supplier, there is only one other supplier that can offer sports pitches with PE backing, but all suppliers (8 in total) are working on finding a solution to switch to PE.

The supplier's goal is for the PE backing plan to be *Recommended* by BVB, and they expect this to be completed within 2-3 years (as BVB will likely need to adapt their criteria).

Football pitches/sports arenas without infill material

Artificial turf without infill material is manufactured with denser grass and often with a different grass structure (e.g. crimped fibres). Crimped fibres have been used for a long time and are a very durable product. The result is a different feel, somewhat like the difference between natural grass and artificial turf.

The downside of sports pitches without infill is that much more plastic is required in the manufacturing process, up to 4 kg/m² compared to 1.3 kg/m² for infill grass. However, pitches without infill do not require 7-10 kg of infill material/m² during installation and do not require the continuous addition of further infill material. Several suppliers said that the grass on pitches wears more quickly if there is no infill material, as only the grass is in contact with the wear. However, one supplier said that this is not the case. The same supplier said that sports pitches without infill material are growing very strongly now and are becoming more and more common. They said that the market for sports pitches without infill material is now "exploding".

Football pitches/sports arenas with infill material

Organic infill material and sand are not suitable during the cold season in Sweden, as pitches with this infill material retain a lot of water and become very hard and difficult to use at sub-zero temperatures. Cork, for example, also has a tendency to scatter easily. This problem can be counteracted by using crimped fibre in combination with infill.

TPE plastic, which is one of the infill materials currently permitted by the City of Stockholm, is much more expensive than other types of rubber and twice as expensive as cork. However, TPE works well even in winter.

One supplier has developed a cellulose coating for sand, which means that the grass wears less than with ordinary sand (which is more angular and sharp and therefore wears more). The cellulose layer is biodegradable and is not

considered microplastic. According to the supplier, it also works well in cold weather.

Using crimped fibres as infill material can help to keep the infill in place. This can be useful when using cork, for example, which otherwise spreads easily. Using infill in substrates with crimped fibres means that the fibres wear less than without infill.

Other

Some of the suppliers we have been in contact with do not conduct any chemical tests on their products themselves. Some had test reports from the manufacturer that they could provide. One said that they conduct tests where required, but not on all products. Some manufacturers consider Sweden to be too small a market to conduct tests. Most suppliers think that requiring chemical testing is a reasonable demand, but they would like greater clarity on what should be tested (which standard is required) and which levels are acceptable or not.

Some suppliers have conducted PFAS tests and some find PFAS in very low concentrations (0.64 ng/litre for PFAS 4, for example). What BVB requires is information about whether PFAS has been intentionally added to the product; BVB does not set any concentration limits. Some suppliers have received responses from manufacturers stating that PFAS is not added during production, but they find PFAS when they conduct their own tests, which has created confusion about what BVB actually requires and whether PFAS can come from sources other than production itself. Suppliers wanted clarity on how to check the PFAS requirement.

Many suppliers and manufacturers have worked extensively on climate and recycling issues. Some use recycled plastic (20% mentioned a manufacturer) and bio-based plastic. Some have their own recycling facilities. At present, it is not possible to use worn-out artificial turf for new artificial turf; instead, it is used for other products. Several suppliers expressed that the City of Stockholm should focus more on quality and reuse of both its products and, for example, sand, which is currently sent away when a mat is removed or replaced instead of being reused on site.

Proposed quality requirements

Proposal that the City of Stockholm impose requirements on the quality and lifespan of all products in this area, as many suppliers have stated that the City currently purchases lower quality products because they are often cheaper.

No proposal has been made on how these requirements should be formulated, as this is outside the scope of this report.

Summary of proposed revised requirements

Proposals for revised requirements are presented in detail in Appendix 2. In brief, the following new requirements are proposed:

- Requirement for *Recommended* in BVB for the content (exception for adhesives in safety surfacing).
- Requirement for *Accepted* in BVB as an overall assessment.
- Requirement that the product does not contain PFAS in concentrations higher than 50 ppm.
- Update of current requirements for constituent levels in accordance with the Swedish Environmental Protection Agency's updated guidelines for contaminated soil. Possibly also a requirement for a test report for these substances as verification.
- The PAHs requirement is proposed to be retained as before.
- No new requirement is proposed for phthalates, as these are covered by the level *Recommended* in BVB
- Proposed quality requirements for all products

Contact has been made with a number of municipalities and the artificial turf network, but these contacts have not revealed any additional requirements beyond those imposed by the City of Stockholm.

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Appendix 1: Byggvarubedömningen's assessment requirements

U: Phase-out substance; R: Risk reduction substance

Classification/listing	Accepted	Recommended
Unclassified substances and materials and other classifications not listed below	2%	2%
Carcinogenic, category 1A or 1B (H350) U	0.1%	0.01%
Carcinogenic, category 2 (H351) R	1%	0.1%
Mutagenic, category 1A or 1B (H340) U	0.1%	0.01%
Mutagenic, category 2 (H341) R	1%	0.1%
Reproductive toxicity, category 1A or 1B (H360) U	0.3%	0.03%
Reproductive toxicity, category 2 (H361) R	2%	0.3%
Reproductive toxicity, effects on or via lactation (H362) R	0.3%	0.03%
Endocrine disruptors according to the SIN list or Candidate List U	0.1%	0.01%
Endocrine disruptors for human health, category 1 (EUH380) U	0.1%	0.01%
Endocrine disruptors for human health, category 2 (EUH381) R	1%	0.1%
Endocrine disruptors for the environment, category 1 (EH430) U	0.1%	0.01%
Endocrine disruptors for the environment, category 2 (EUH431) R	1%	0.1%
PBT substances (EUH440) U	0.1%	0.01%
vPvB substances (EUH441) U	0.1%	0.01%
PBT and/or vPvB substances U	0.1%	0.01%
Potential vPvB and PBT substances R	1%	0.1%
PMT substances (EUH450) U	0.1%	0.01%

vPvM substances (EUH451) U	0.1%	0.01%
PMT and/or vPvM substances U	0.1%	0.01%
PFAS substances U	>0%	>0%
Ozone-depleting substances (EUH 059, H420) U	0.1%	0.01%
Sensitisation, respiratory category 1A (H334) U	0.1%	0.01%
Sensitisation, respiratory category 1 or 1B (H334 solid/liquid) U	1%	0.1%
Sensitisation, respiratory category 1 or 1B (H334 gas) U	0.2%	0.02%
Sensitisation, skin category 1A (H317) U	0.1%	0.01%
Sensitisation, skin category 1 or 1B (H317) R	1%	0.1%
Acute toxicity, category 1 (H300, H310, H330, H301, H311 and/or H331) H330 is R	0.1%	0%
Acute toxicity, category 2 (H300, H310, H330, H301, H311 and/or H331) H330 is R	1%	0.1%
Acute toxicity, category 3 (H300, H310, H330, H301, H311 and/or H331) H330 is R	2%	1%
Specific target organ toxicity – single exposure (STOT-SE), category 1 (H370) R	1%	0%
Specific target organ toxicity – single exposure (STOT-SE), category 2 (H371)	2%	1%
Specific target organ toxicity – repeated exposure (STOT-RE), category 1 (H372) R	1%	0%
Specific target organ toxicity – repeated exposure (STOT-RE), category 2 (H373)	2%	1%
Hazardous to the aquatic environment, category acute 1 (H400)	2%	2%
Hazardous to the aquatic environment, category chronic 1 (H410) R	2%	0.25%
Hazardous to the aquatic environment, category chronic 2, 3, 4 (H411, H412, H413) H413 is R	2%	2%
Fluorinated greenhouse gases U	0.1%	0.01%
Pure substances or compounds of lead (Pb) U	0.1%	0.01%
Pure substances or compounds of mercury (Hg) U	Contamination ≥ 2.5 mg/kg	Actively added always reported

Pure substances or compounds of cadmium (Cd) U	0.01%	0.001%
Candidate list, to be reported at component level	>0.1% (component level)	>0.01% (component level)

Appendix 2: Updated version of current chemical requirements for artificial turf and rubber safety surfacing

Below are the updated chemical requirements for artificial turf and rubber safety surfacing in the same format as the previous requirements.

Chemical requirements

General chemical requirements for all building and construction materials[1]

Prescribed and used chemical products and solid construction and civil engineering goods[2] must be environmentally assessed and documented in a digital logbook in Byggvarubedömningen (BVB), or using an equivalent system[3]. The overall assessment (content and life cycle criteria) must be rated as *Recommended* or *Accepted*. *Recommended* goods shall be chosen over *Accepted* goods. Construction and civil engineering products that have not been assessed or that have an overall assessment (content and life cycle criteria) of *To be Avoided* shall be treated as deviations. The digital logbook shall contain documentation verifying the content. The logbook shall contain information about the type of product, product name, content declaration (construction product declaration, CPR[4]), and manufacturer. Materials handled as deviations shall be documented with information about their location in the building/facility. The digital logbook forms the basis for follow-up. Products that do not meet the above requirement shall be handled as an internal deviation with the written approval of the building contractor.

It must also be clearly stated whether the product, or any of its components, contains equal to or more than 0.1% by weight of a substance on the Candidate List.

1 http://foretag.stockholm.se/hallbarhetskraven

[2] The product groups that are to be environmentally assessed are listed at www.stockholm.se/hallbarhetskraven

[3] Equivalent systematics means a system for material assessment and logbook management that meets the chemical requirements of the city's chemical plan and environmental programme. Equivalent also means that the assessments must be third-party reviewed and that criteria must be met in accordance with BVB's assessment criteria for content version 4.0, which is equivalent to assessment A, B, or C+ in SundaHus, or that the product is registered in the BASTA register. In addition, pollutants with a risk of leaching into water must be avoided, such as copper and zinc ions that can leach from roof or facade materials.

[4] In addition to the reporting requirements according to the assessment systems (eBVD2015, safety data sheets, etc.), the documentation must also contain information about whether the product is or contains nanomaterials.

Table 1. General chemical requirements for construction and facility requirements in the City of Stockholm.

No	Requirement text	Verification
1	The product must be assessed and documented in a digital logbook in Byggvarubedömningen (rating level Recommended for constituent materials and rating level *Accepted* or *Recommended* at the overall level). Individual components must meet the requirements separately.[5] A complete declaration of contents must be provided. Additives added to the product must be reported with CAS/EC numbers in accordance with Byggvarubedömningen's requirements.	Shall requirement Verified with current assessment results.
2	The content of substances (>= 0.1%) on the Candidate List in the entire product and in its constituent components must be reported. For chemical products, the content must be reported in accordance with section 3 of the safety data sheet.	Shall requirement Verified with a list of contents or analysis report.

References to requirements, Table 1

Requirement 1. This requirement is the City's requirement for building and construction materials, according to the Chemicals Action Plan and Environment Programme. In line with sustainability requirements, the requirements for the use of BVB or equivalent system also apply when external actors build on city land.

Requirement 2. This requirement refers to the obligation to provide information on the content of substances on the candidate list equal to or above 0.1 per cent by weight. For chemical products, the content of substances on the candidate list must be stated if the content exceeds 0.1% by weight. The requirement is based on the principle of "once a substance, always a substance". This means that all components in a system are covered separately by the requirement. This obligation is laid down in Article 33 of the REACH Regulation 2006/1907/EC.

[5]Exceptions may be made for the binder/adhesive if the supplier can demonstrate that the product does not pose a risk to health and the environment in its cured state.

Specific chemical requirements for rubber-based materials for ground coverings

All newly produced rubber-based granulate material to be used for surface layers must meet the chemical requirements in Table 2. Verification of chemical content must be provided through a declaration of contents and, upon request, through chemical analysis.

Recycled material may not be used as a surface layer.

All material to be used for base layers must meet the chemical requirements in Table 3. Verification of chemical content must be provided through a declaration of contents and, upon request, through chemical analysis. The chemical requirements are attached to the request for quotation.

Follow-up

Compliance with the requirements will be monitored through random sampling in the form of chemical analyses in connection with the installation of rubber asphalt/safety surfacing/artificial turf surfaces in the city's operations.

Table 2. Chemical requirements for materials for newly produced rubber-based granulate material to be used for surface layers.

No	Requirement text	Verification
1	The product must not contain substances on the candidate list in concentrations equal to or exceeding 0.1% at the total level or component level.	Shall requirement Verified with a list of contents or analysis report.
	The product must not contain polycyclic aromatic hydrocarbons (PAHs) in concentrations exceeding 0.5 mg/kg (0.00005%).	Shall requirement Verified with *Recommended* in BVB or with analysis report.
3	Substances in the product must be below the levels for sensitive land use, according to the Swedish Environmental Protection Agency's guidelines for contaminated land for PAHs, hydrocarbons and metals (zinc and aliphatic hydrocarbons >C16-C35 excluded*). See Table 4.	Shall requirement Verified with analysis report.
4	The product must not contain PFAS in levels above 50 ppm.	Shall requirement

		Verified with chemical analysis report.

*For zinc and aliphatic hydrocarbons >C16-C35, the requirement is waived; instead, the supplier must report the levels for each substance/substance group. The zinc content is an award criterion in the tender evaluation (the lowest zinc content gives the highest score).

Table 3. Chemical requirements for base layer materials.

No	Requirement text	Verification
5	The product must not contain substances on the candidate list in concentrations equal to or exceeding 0.1% at the total level or component level.	Shall requirement Verified with a list of contents or analysis report.
6	Substances in the product must be below the levels for less sensitive land use, according to the Swedish Environmental Protection Agency's guidelines for contaminated land for PAHs, hydrocarbons and metals (zinc excluded*). See Table 5.	Shall requirement Verified with analysis report.
7	The product must not contain PFAS in levels above 50 ppm.	Shall requirement Verified with chemical analysis report.

* For zinc, the requirement is waived; instead, the supplier must report the zinc content, which is an award criterion in the tender evaluation (the lowest zinc content gives the highest score).

References to requirements in Tables 2 and 3

Requirements 1 and 5 This requirement refers to the obligation to provide information on the content of substances on the candidate list equal to or above 0.1% in goods. The requirement is based on the principle of "once a substance, always a substance". This means that all components in a system are covered separately by the requirement. This obligation is laid down in Article 33 of the REACH Regulation 2006/1907/EC.

Requirement 2. Restriction Annex: Annex XVII to the REACH Regulation 2006/1907/EC and Commission Regulation (EU) No 1272/2013[6] .

[6] https://eur-lex.europa.eu/legal-content/SV/TXT/HTML/?uri=CELEX:32013R1272&from=SV. The PAHs referred to are a) Benz[a]pyrene CAS No. 50–32–8 b) Benz[e]pyrene CAS No. 192–97–2 c) Benz[a]anthracene CAS No. 56–55–3 d) Chrysene CAS No. 218–01–9 e) Benz[b]fluoranthene CAS No. 205–99–2 f) Benz[j]fluoranthene CAS No. 205–82–3

Requirements 3 and 6 This requirement refers to the guideline values developed by the Swedish Environmental Protection Agency for contaminated soil[7] . Risk assessments and proposed measures for contaminated areas specify different classifications. The concentration level that is most applicable in this context is that which applies to sensitive land use (KM) for surface layers and less sensitive land use (MKM) for base layers. Zinc regularly occurs in concentrations that exceed the concentration limits and is exempt from the requirement. As the concentrations of the substances in Tables 4 and 5 are low, there is a risk that they will not be included in a list of contents, which means that an analysis report is a more reliable verification method.

Requirements 4 and 7 This requirement refers to the City of Stockholm's zero tolerance for added PFAS in building and construction materials. As a supplier's certificate does not always provide complete information, an analysis report is also required to ensure that the requirement is met.

[7,] Swedish Environmental Protection Agency (2009). Guideline values for contaminated soil – model description and guidance. Report 5976.

Table 4 – Levels for sensitive land use (KM) applicable to synthetic materials (excluding recycled SBR)

Materials used in synthetic surfacing (excluding SBR) must not contain substances that exceed the specified guideline values for sensitive land use (KM) according to the Swedish Environmental Protection Agency's guidelines for contaminated land. The following requirements for substances and guideline values must be met:	
Substance	**Guideline value, maximum content mg/kg**
Antimony	12
Arsenic	10
Barium	20
Lead	50
Cadmium	0
Cobalt	15
Copper	80
Chromium (total)	80
Chromium (VI)	2
Mercury	0
Molybdenum	40
Nickel	40
Vanadium	10
Zinc	25
PAH-L	3
PAH-M	3
PAH-H	1
Benzene	0.012
Toluene	1
Ethylbenzene	10
Aliphatic >C5-C16	10
Aliphatic >C16-C35	**
Aromatic >C8-C10	10
Aromatic >C10-C16	3
Aromatic >C16-C35	10

Acceptable verification: Analysis report.

*) For zinc, the KM requirement is waived; instead, the supplier must report the zinc content, which is an award criterion in the tender evaluation.

**) For aliphatic >C16-C35, the KM requirement is waived; instead, the supplier must report the content of aliphatic >C16-C35.

Table 5 - Levels for less sensitive land use (MKM) for recycled SBR rubber.

SBR rubber is permitted in base layers if it does not contain substances that exceed the specified guideline values for less sensitive land use (MKM) according to the Swedish Environmental Protection Agency's guidelines for contaminated soil. The following requirements for substances and guideline values must be met:	
Substance	**Guideline value, maximum content mg/kg**
Antimony	30
Arsenic	25
Barium	30
Lead	18
Cadmium	2.5
Cobalt	35
Copper	20
Chromium (total)	15
Chromium (VI)	8
Mercury	2.5
Molybdenum	10
Nickel	12
Vanadium	20
Zinc	50
PAH-L	15
PAH-M	20
PAH-H	10
Benzene	0.04
Toluene	40
Ethylbenzene	5
Aliphatic >C5-C16	50
Aliphatic >C16-C35	10
Aromatic >C8-C10	5
Aromatic >C10-C16	15
Aromatic >C16-C35	30

Acceptable verification: Analysis report.

*) For zinc, the MKM requirement is waived; instead, the supplier must report the zinc content, which is an award criterion in the tender evaluation. (The lowest zinc content gives the highest score.)