Committee for Risk Assessment (RAC)

Opinion related to the request by the Executive Director of ECHA under Art. 77(3)(c) of REACH to prepare a supplementary opinion on:

CEN technical report 17519 on risk management measures for artificial pitches and the ESTC study on their effectiveness and the proposed derogation for polymers without carbon atoms in their structure

ECHA/RAC/ A77-O-0000006949-54-01/F

RAC's opinion (adopted 19 March 2021)

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OPINION

Pursuant to Article 77(3)(c) of Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (the REACH Regulation), the Committee for Risk Assessment (RAC) has adopted its supplementary opinion on the proposed restriction on intentionally-added microplastics, taking into account new elements which emerged after RAC had adopted its final opinion in June 2020.

I. PROCESS FOR ADOPTION OF THE OPINION

On 5 February 2021[1], the Executive Director of ECHA requested RAC to prepare a supplementary opinion on the proposed restriction on intentionally-added microplastics, taking into account new elements which emerged after RAC had adopted its final opinion in June 2020.

Rapporteur, appointed by RAC: **PARIS Pietro**
Co-Rapporteur, appointed by RAC: **GEOFFROY Laure**

In accordance with the mandate from the Executive Director of ECHA to the Chair of the Committee, the rapporteurs developed the opinion, summarising the analysis and the justifications. In particular, RAC was requested to evaluate the following new elements received during the consultation on the SEAC draft opinion on the proposed restriction on intentionally-added microplastics:

A. The restriction options for infill material for artificial sport pitches, in view of submissions #686 and #811 to the consultation on the draft opinion of the Committee for Socio-Economic Analysis (SEAC)[2], including:

1. the recently published CEN technical report TR 17519 on risk management measures for infill material for artificial sport fields;

2. A recent (2020) study by Magnusson & Mácsik, commissioned by the EMEA Synthetic Turf Council (ESTC), assessing the effectiveness of the risk management measure proposed in CEN TR17519 to reduce infill releases < $7 g/m^2$;

B. The derogation for polymers without carbon atoms that was proposed by SEAC in its final

[1] https://echa.europa.eu/about-us/who-we-are/committee-for-risk-assessment/opinions-of-the-rac-adopted-under-specific-echa-s-executive-director-requests

[2] The consultation on the draft SEAC opinion was open from 01/07/2020 to 01/09/2020. https://www.echa.europa.eu/web/guest/registry-of-restriction-intentions/-/dislist/details/0b0236e18244cd73

opinion.

The RAC opinion is based on the new information submitted during the 60-day consultation on the SEAC draft opinion. The Committee was requested to prepare a supplementary opinion on the above basis

The RAC supplementary opinion was adopted **by consensus** on **19 March 2021**.

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II. THE OPINION OF RAC

RAC has formulated its opinion based on an evaluation of information related to the identified risk and to the identified options to reduce the risk documented in the consultation comments submitted on the SEAC draft opinion on intentionally-added microplastics.

III. OPINION JUSTIFICATION

1. Effectiveness of risk management measures for synthetic infill on artificial sport pitches

1.1. Background

Microplastics used as infill in synthetic turf sport pitches are the largest contributor at a European level in terms of both quantities of intentionally-added microplastics used and released to the environment, with a central estimate of 16 000 tonnes released to the environment per year. In line with other uses of microplastics that inevitably result in release to the environment, the Dossier Submitter concluded that the use of microplastics as infill on synthetic turf sports pitches poses a risk that is not adequately controlled.

The Dossier Submitter proposed two restriction options to address this risk:

- **Option A** – use of risk management measures to ensure that annual releases of microplastic do not exceed 7 g/m^2 (equivalent to 50 kg/full-size pitch/year[3]) after a transitional period of three years.

- **Option B** – a ban on placing on the market after a transitional period of six years.

As there is currently no list of standard risk management measures that could be specified in the conditions of the restriction, the Dossier Submitter considered that compliance with option A could be demonstrated, in due course, by implementing risk management measures that had been verified to achieve the required effectiveness of <7 g/m^2/year, ideally specified in a recognised international or European standard. In these circumstances, the minimum effectiveness of the risk management measures implemented would be set by the REACH restriction, but the precise type or combinations of different risk management measures used to achieve the stated minimum effectiveness could be established through standardisation. Different risk management measures could be established for different types of pitches (e.g. newly constructed pitches vs risk management measures retro-fitted to existing pitches) although the minimum standard of effectiveness would need to be the same.

The Dossier Submitter notes that over the longer term (i.e. >20 years after implementation) option A would be less effective than option B.

With respect to the risk management of microplastics used as infill on synthetic turf pitches, RAC concluded in its opinion that:

[3] For the purposes of this opinion a full size pitch means an average full-sized pitch with an area of 7 600 m^2

- From an effectiveness, practicality and enforceability perspective, a complete ban will be more effective to prevent releases of microplastics over the longer term than the use of risk management measures.
- RAC does not endorse the level of <7 g/m^2/year (equivalent to 50 kg/full-sized pitch/year) as an acceptable threshold, as this on its own still implies substantial releases to the environment on a continuing basis: amounting to 1 600 t/yr across the EU.
- RAC lacked evidence to conclude whether risk management measures capable of achieving the stated minimum effectiveness of <7 g/m^2/year exist.
- RAC has a clear preference, from an emissions reduction, practicality and enforceability perspective, for a ban on the use microplastics as infill material on synthetic turf sports pitches, which should be implemented as soon as possible. RAC concludes that the use of risk management measures over the longer term would be unlikely to result in an adequate control of risk.

In addition, RAC expressed concerns about the practicality and enforceability of risk management measures in the absence of appropriate international/European standards or guidance indicating which risk management measures should be used, and how, in order to prevent releases.

During the 60-day consultation on the SEAC draft opinion, ECHA received information (submissions #686 and #811) that:

- The European Standards Committee (CEN TC 217) responsible for sports surfacing developed had published (on 22nd July 2020) CEN Technical Report TR 17519 describing how infill material releases can be controlled and minimised through the application of risk management measures. In particular, the CEN report details design, construction, maintenance, operation and end-of-life disposal considerations for minimising the migration of infill from synthetic turf fields. Submission #811 by UEFA included a draft version of this technical report.
- A study by Magnusson & Mácsik (2020) concludes that combining certain risk management measures detailed in CEN TR 17519 effectively reduces infill releases into the environment to 2 g/m^2 (15 kg/full-sized pitch/year), i.e. below the limit of 7g/m^2 (50 kg/full-sized pitch/year) proposed by the Dossier Submitter for Option A. The main study conclusions, as well as the full study, are outlined in submission #686 by the ESTC.
- The RMMs recommended in TR 17519 were incorporated in specifications for new pitches by the FIFA Quality Programme, the World Rugby's and the Rugby Football League, the Gaelic Athletics Association, the International Hockey Federation and funding agencies such as the Football Foundation.

Therefore, RAC was requested to assess:

1. Whether an appropriate combination of RMM, as indicated by Magnusson & Mácsik (2020), can reduce infill releases into the environment to ≤7 g/m^2, potentially to 2 g/m^2 (15 kg/full-sized pitch/year[4])?

[4]

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2. Whether the publication of CEN TR 17519 addresses RAC's concerns regarding the practicality and enforceability of RMMs?

1.2. Justification for the opinion of RAC

1.2.1. RAC conclusion(s):

1. *Whether Magnusson & Mácsik (2020) indicates that an appropriate combination of RMM can reduce infill releases into the environment to ≤7 g/m^2, potentially to 2 g/m^2 (or 15 kg/full-sized pitch/year)?*

The Magnusson and Mácsik (2020) study is a meta-analysis of the best available information on infill migration from synthetic turf pitches from the literature, including an assessment of the relative magnitude of the losses that can occur through different processes (e.g., clothing, footwear, drainage etc.). The study combined information on the likely magnitude of infill loss via each of the processes during a discrete event (i.e. loss per player per use) with a 'worst-case' scenario considering high pitch utilisation (number of players per day) and a high frequency of wet days (where infill losses are assumed to be greatest[5]) to estimate baseline releases at a full-size pitch where there are no risk management measures. Using the available measured data on the effectiveness of individual risk management measures (e.g. brushing / drainage filters) the study then estimated the residual releases of infill, relative to baseline, after implementing different suites of risk management measures (termed scenarios).

The authors conclude that when certain technical and organisational risk management measures are combined, the cumulative average infill migration loss during service life can be reduced by 97% to 15 kg/year (2 g/m^2), i.e. below the 50 kg/year (7 g/m^2/year) level proposed as a compliance value by the Dossier Submitter in 'Option A' for the risk management of infill material. The Magnusson and Mácsik (2020) study included a sensitivity analysis that assumed lower effectiveness for organisational RMMs reliant on individual behaviour (i.e. cleaning of shoes/clothing). Under this scenario releases remained below 50 kg/year (7 g/m^2/year).

Whilst acknowledging that the available quantitative data on the loss of infill at synthetic pitches are from relatively few studies (focussed on experience in Northern Europe), RAC concludes that, on the basis of the results presented, infill dispersion to the environment from a synthetic sports surface during service life after fully implementing an appropriate combination of risk management measures from CEN TR 17519 (i.e. at a minimum consistent with the suite of risk management measures included in scenario 2d in Table 2 below) would be expected to be <7 g/m^2/year under normal conditions of use.

However, infill losses to the environment are unlikely to be as low as 2 g/m^2/year under normal conditions of use as the effectiveness of risk management measures reliant on individual behaviour (i.e. cleaning of shoes/clothing and maintenance equipment) is unlikely to be as high as reported unless users are supervised (e.g. by their coaches). RAC notes that the limit of 7 g/m^2/year relates to the service life of the pitch only i.e. infill dispersion that

[5] As wet infill is considered more likely to adhere to players' clothing and footwear than dry infill

occurs during either the installation of a pitch or during its end of life decommissioning and disposal are not included in this value.

Additional infill dispersion to the environment could occur during the installation of the pitch or during the end of life removal or disposal of the pitch. The extent and significance of infill dispersal as airborne dusts during service life remains unknown. RAC notes that drain filters have been reported as having an effectiveness of >99.9% (Regnell, 2019), but may not be effective in trapping very small particles, which are of greatest concern . **RAC reiterates that it has a clear preference, from an emissions reduction, practicality and enforceability perspective, for a ban on the use microplastics as infill material on synthetic turf sports pitches, which should be implemented as soon as possible.**

2. *Whether the publication of CEN TR 17519 addresses RAC's concerns regarding the practicality and enforceability of risk management measures?*

RAC concludes that the risk management measures detailed in CEN TR 17519 are practical and when **used in an appropriate combination** (i.e. at a minimum consistent with the suite of risk management measures included in Scenario 2d in Table 2 below) it would be expected that overall infill loss of <7 g/m^2/year could be achieved.

However, while all of the suggested risk management measures can be readily implemented at newly constructed artificial turf pitches CEN TR 17519 acknowledges that not **all of the best practice risk management measures identified can be implemented (retro-fitted) at existing pitches**, such as the use of a specific turf construction to stabilise infill or the use of a shock pad under the turf to reduce the volume of infill needed.

In the absence of an obligation that renders the implementation of an appropriate combination of the risk management measures detailed in CEN TR 17519 (i.e. at a minimum consistent with the suite of risk management measures included in Scenario 2d in Table 2 below), or to demonstrate compliance at existing pitches that cannot implement all of the risk management measures recommended for retro-fitting at existing pitches in CEN TR 17519, RAC considers that there will be a need for a standardised sampling and assessment methodology to be used to ensure that duty holders can demonstrate that releases are below the compliance threshold of 7 g/m^2/year. RAC further notes that although studies into the loss of infill have developed such methodologies (such as those reported by Magnusson & Mácsik, 2020) such a methodology is unlikely to be straightforward for duty holders to undertake themselves.

RAC considers that it will be of the upmost importance to clearly identify the specific combination of risk management measures that are required to be implemented before an overall effectiveness of <7 g/m^2/year can be achieved. Whilst this could be achieved by referring to CEN TR 17519 (and requiring at a minimum that the suite of risk management measures included in Scenario 2d in Table 2 below are followed), this could also be stated unambiguously by listing the minimum required risk management measures in the conditions of the restriction in Annex XVII of REACH or in an appendix to Annex XVII of REACH, which could be updated should the best practices in CEN TR 17519 be updated.

RAC notes that enforcement of risk management measures at pitches under the REACH regime is likely to pose significant challenges for Member States from an organisational perspective. With that in mind, enforcement could be simplified by requiring the use of a mandatory third-party audit and certification scheme that could allow duty holders to demonstrate compliance with the conditions of the restriction should they be required to by enforcement bodies.

1.2.2. Key elements underpinning the RAC conclusion:

1. *Whether Magnusson & Mácsik (2020) indicates that an appropriate combination of risk management measures can reduce infill releases into the environment to ≤7 g/m^2 (<50 kg/full-sized pitch/year), potentially to 2 g/m^2 (15 kg/full-sized pitch/year)?*

The study "*Determining the effectiveness of Risk Management Measures to minimize infill migration from synthetic turf sports fields",* published in August 2020, was commissioned by the European Synthetic Turf Council (ESTC). The aims of the study were to:

- Define what are the typical conditions for the use of synthetic turf fields
- Describe the ways in which the infill can be transported away from the artificial turf fields and the effectiveness of the containment measures in quantitative terms under normal conditions of use.

Literature was reviewed to describe typical use of synthetic turf fields in the EU and to describe infill function and its properties. In addition, data from field measurements of infill transported by maintenance equipment, run-off and players was gathered and used for quantifying the extent of infill transport due to common activities on turf fields.

Due to large differences in how synthetic turf pitches are used and maintained across the EU, it is difficult to quantify a mean infill loss from synthetic turf fields. Magnusson and Mácsik based their assessment of infill loss on what they considered to be a worst-case scenario.

- A scenario describing a synthetic turf field with high (full time) usage was developed. To estimate the number of occasions that a player would leave the pitch (potentially taking infill with them), the number of users (players) was set to 30 users/hour for 1 950 hours/year which gives 58 500 users/year. RAC notes that assuming 90 minute periods of use this is broadly equivalent to 8 hours use per day (by 160 players), every day of the year.
- Wet weather (rather than snow) was considered as the worst-case scenario for infill dispersal away from the field via shoes and maintenance equipment. The number of days with dry and wet weather in central and southern Europe was used in the calculations (rather than precipitation data for Northern Europe): a mean value of 120 wet days/year was considered (based on 140 days/year for central Europe and 100 days/year for south Europe). Users were assumed to play on the field even during rainy days.
- Maintenance brushing was conducted 2 times / week. Maintenance was assumed even under wet conditions.
- For the special case of snow removal, it was estimated that the field was snow cleared 5 times per winter.

RAC considers that this scenario is consistent with a reasonable worst-case for estimating infill loss per year.

Magnusson and Mácsik then calculated the average effectiveness of certain risk management measures and the cumulative effectiveness that these would bring to reducing infill losses when used in different combinations (Table 2 and 2, Figure 2).

The authors define three zones with respect to infill placement (see Figure 1):

Zone 1 - the synthetic turf field (playing area and run-offs) where the infill is meant to be;

Zone 2 - areas such as surrounding paving, storage compounds for maintenance equipment, shoe cleaning stations and storm water drains, where the infill can accumulate but is still controlled as it is contained;

Zone 3 - areas where any infill entering is uncontrolled and may contaminate the environment.

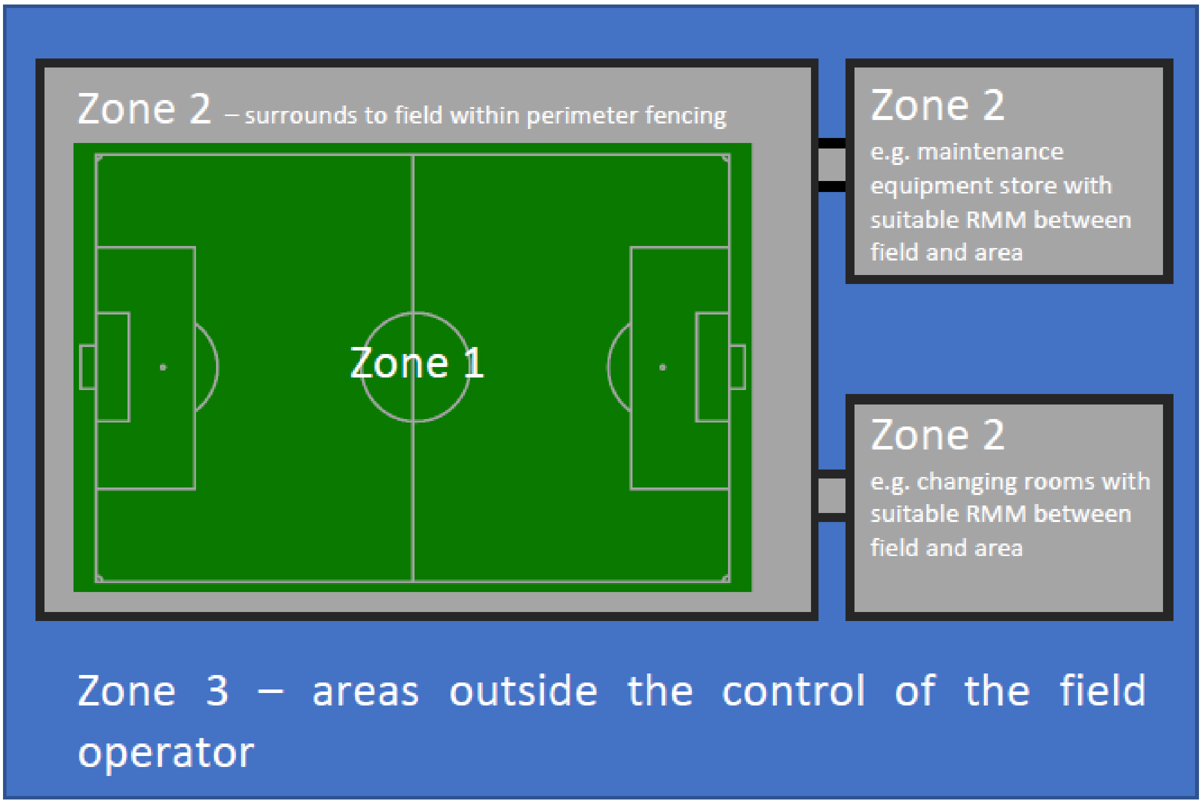

Figure 1 Containment zones around a synthetic turf pitch, after Magnusson and Mácsik (2020)

The report concludes that if **all the following** risk management measures are implemented (Scenario 2d) the cumulative result is migration to Zone 3 of only 15 kg/year or 2 g/m^2/year, on a full-size field:

- All snow removed from a field is stored either in Zones 1 or 2
- Perimeter barriers or accumulation areas define Zone 2
- One specific maintenance brush is used only for the synthetic turf field so that the brush never has to leave the Zone 2

- The maintenance tractor is brushed off before leaving site or is dedicated to the field and stays in Zone 2
- Clothes/shoes are brushed off before leaving Zone 2
- Filters fitted to drains to ensure any waterborne infill is captured and remains in Zone 2.

The scenarios assessed by Magnusson & Mácsik assume that containment barriers (scenario 1a) and accumulation zones (scenario 1b) are equally effective in preventing infill migration (estimated to prevent releases of 131 kg/year per average pitch). RAC considers that this is unlikely to be the case in practice unless maintenance activities at a site are very effective in redistributing the infill from the accumulation zones back to the pitch before it is further dispersed away from the site and considers that containment barriers should always be used in preference to accumulation zones. RAC notes that CEN TR 17519 already recommends that containment barriers are used **in combination** with field margin (accumulation zone) features (see below), which is a more stringent requirement than the assumption used by Magnusson & Mácsik.

In a sensitivity analysis assuming that the effectiveness of the cleaning of shoes/clothing was 75% (rather than 90% assumed in the main analysis) releases were estimated to be 40 kg/year per pitch (below 50 kg/year). This suggests that the 7 g/m^2/year limit value could still be achieved despite lower compliance with clothing and footwear cleaning by pitch users.

RAC notes that the available data on infill loss at synthetic pitches are from a relatively low number of studies that are focussed primarily on Northern Europe and that for certain activities the available data are limited (Table 1).

Nevertheless, when combined with the worst case assumptions on pitch utilisation and weather conditions outlined above, RAC concludes that infill dispersion to the environment from a synthetic sports surface during service life after implementing an appropriate combination of risk management measures from CEN TR 17519 (i.e. at a minimum consistent with the suite of risk management measures included in Scenario 2d in Table 2 below) would be expected to be <7 g/m^2/year. However, infill loss to the environment are unlikely to be consistently as low as 2 g/m^2/year under normal conditions of use as the effectiveness of risk management measures reliant on individual behaviour (i.e. cleaning of shoes/clothing) is unlikely to be as high as reported unless users are supervised (e.g. by their coaches or facility staff).

Additional infill dispersion to the environment could also occur during the installation of the pitch or during the end of life removal or disposal of the pitch. The extent and significance of infill dispersal as airborne dusts during service life remains unknown. RAC notes that drain filters have been reported as having an effectiveness of >99.9% (Regnell, 2019), but may not be effective in trapping very small particles, which are of greatest concern.

RAC notes that the effectiveness of additional best practices identified in CEN TR 17519, such as 'low splash' turf construction and use of a shock pad, were not accounted for in Magnusson & Mácsik (2020). In pitches where these measures are implemented alongside the risk management measures described in scenario 2d, infill losses could be expected to be lower than 7 g/m^2/year, but cannot currently be quantified.

Table 1 Estimates of infill dispersal used for the worst-case scenario

Activity	Quantity	Data quality	Reference
Migration via drains	15 kg/year	High quality, high number of references	Regnell (2019); Lundstrom (2019)
Migration via maintenance brush and tractor	232 kg/year *90% on brush* *10% on tractor* *3.4 kg/event wet* *1.8 kg/event dry*	Low quality, few measurements	Regnell (2019)
Migration via footwear and clothing	88 kg/year *2.7g/player wet* *0.91g/player dry*	High quality, high number of measurements	Regnell (2019 Forskningskampanjen (2017)
Migration via field boundaries	131 kg/year (12 – 250 kg/year)	Low quality, few measurements	NORCE (2017), (Hofstra et al 2017)
Migration via snow removal	433 kg/year	Low quality, few measurements	Sund (2020)

Table 2 Losses of infill in various potential scenarios, after Table 4 in Magnusson & Mácsik (2020)

SCENARIO	**RISK MANAGEMENT MEASURESIMPLEMENTED**	**POTENTIAL INFILL MIGRATION (loss from controlled zones – full size field)**
Worst case scenario	None	473 Kg/year (snow removal is NOT undertaken: total uncontrolled infill) 906 Kg/year (snow removal IS undertaken: if snow clearance is added and there are no maintenance routines for infill control or designated storage for snow)
Scenario 1a	There is a perimeter barrier for preventing infill that is migrating to the field sides	342 Kg/year
Scenario 1b	There are wide accumulation zones (but no containment boards) preventing infill that is migrating to the field sides	342 Kg/year
Scenario 2a	-Perimeter barriers or accumulation zones -One specific maintenance brush is used only for the synthetic turf field (the brush must never leave the containment zone)	127 Kg/year

SCENARIO	RISK MANAGEMENT MEASURESIMPLEMENTED	POTENTIAL INFILL MIGRATION (loss from controlled zones – full size field)
Scenario 2b	-Perimeter barriers or accumulation zones -One specific maintenance brush is used only for the synthetic turf field (the brush must never leave the containment zone) -The maintenance tractor is brushed off before leaving site (only 75% effectiveness of this measure assumed to account for mistakes/behaviour).	109 Kg/year
Scenario 2c	-Perimeter barriers or accumulation zones -One specific maintenance brush is used only for the synthetic turf field (the brush must never leave the containment zone) -The maintenance tractor is brushed off before leaving site (only 75% effectiveness of this measure assumed to account for mistakes/behaviour). -Clothes/shoes are brushed off before leaving site (only 90% effectiveness of this measure assumed to account for mistakes/behaviour).	30 Kg/year
Scenario 2d	-Perimeter barriers or accumulation zones -One specific maintenance brush is used only for the synthetic turf field (the brush must never leave the containment zone) -The maintenance tractor is brushed off before leaving site (only 75% effectiveness of this measure assumed to account for mistakes/behaviour). -Clothes/shoes are brushed off before leaving site (only 90% effectiveness of this measure assumed to account for mistakes/behaviour). -Filters/traps fitted to drains **RAC concludes that the implementation of the risk management measures included in this scenario (with the exception of accumulation zones) can limit infill dispersion to levels below 7 g/m^2/year.**	15 Kg/year

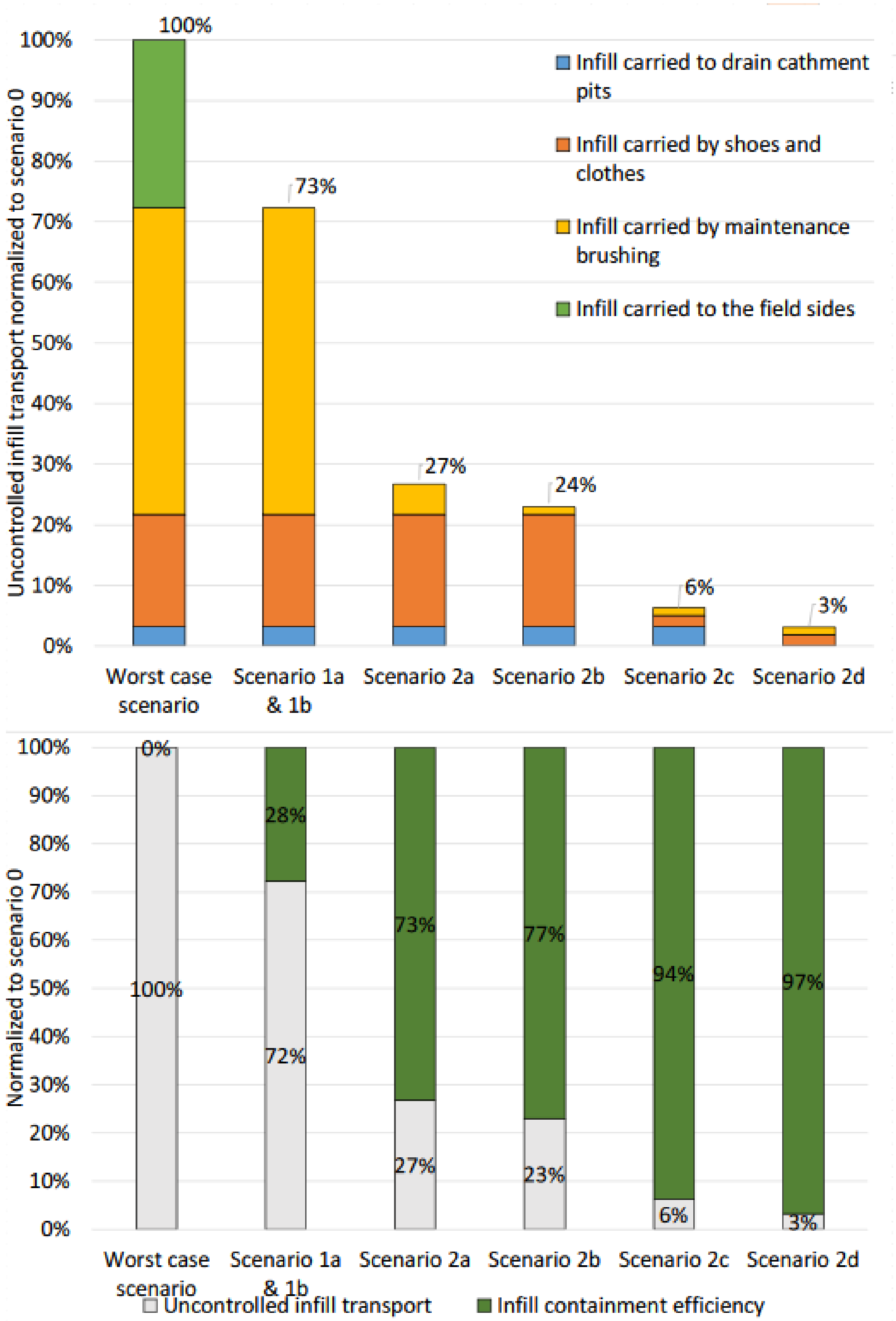

Figure 2 Uncontrolled infill loss under different risk management measure scenarios, after Figure 6 in Magnusson & Mácsik (2020)

2. *Whether the publication of CEN TR 17519 addresses RAC's concerns regarding the practicality and enforceability of risk management measures?*

CEN Technical Report TR 17519[6] was published in 2020 by the European Standards Committee through the joint efforts of professional sport associations such as FIFA, World Rugby and the International Hockey Federation (all members of CEN TC 217[7]). The report, which can be regarded as an official guideline to field designers, venue owners, installation companies or those maintaining synthetic turf sports fields, describes in detail the design, construction, maintenance, operation and end of life disposal procedures to minimise the infill dispersion from synthetic turf pitches. The document is intended to be practical and to have applicability for all forms of synthetic turf sports field, from community activities to professional and elite level athletes. The options described are based on examples of best practice identified by members of CEN /TC 217. However, it does not specify minimum performance standards or minimum combinations of risk management measures on synthetic turf sports pitches. Rather it lists various possible best practice measures that could be used either at a new pitch or retrofitted to an existing pitch.

The best practice risk management measures described in the report cover a number of aspects, including technical risk management measures implemented during the design/construction phase of a field as well as organisational risk management measures once the pitch is operational, such as appropriate snow clearing and maintenance practices to avoid infill loss, as follows:

- Use of a synthetic turf carpet having a specific design aimed at reducing the movement of the infill material, such as high tuft density (stitch rate), use of texturised/fibrillated/curled yarns or thatch zones[8]; resulting in 'low splash' surface ('Infill Splash Value' of <1.5 %')
- Use of a shockpad under the carpet will require significantly less infill to be added to the surface (removing the potential for it to migrate, by any means).
- Use of infill granules with an angular shape and low dust content.
- a slope not greater than 0.5%,
- appropriate field perimeter details, such as paved surrounds (providing a margin between the synthetic turf and the field perimeter) with an inward slope towards the field and/or solid perimeter containment barriers. Containment barriers are recommended to be 500 mm or higher (mounted to fencing system) unless the field margin between the edge of the synthetic surface and the field perimeter is at least 500 mm wide, whereupon lower solid containment barriers of at least 200 mm high are recommended).
- dedicated snow storage area within the perimeter fencing
- drainage silt traps (including a micro-filter for small particles) in the rainwater drainage system of the field, drains of the wet changing rooms, toilets and shower

[6] PD CEN TR 17519, 2020 Surfaces for sports areas — Synthetic turf sports facilities — Guidance on how to minimize infill dispersion into the environment

[7] https://standards.cen.eu/dyn/www/f?p=204:7:0::::FSP_ORG_ID:6198&cs=13DEC936FF01043C852FFF0F3ECB8E623

[8] Layer of curly tufts in a long pile synthetic turf carpet designed to stabilise infill and reduce movement of infill.

areas

- infill capture systems such as full width grates/scraper mats located at all the entrances to the field (at least 1.5 metres wide so that they cannot be stepped over), including multi-person boot cleaning stations with suitable signage positioned at the main points of egress from, or alternatively outside, the field
- Regular maintenance to avoid compaction (avoiding the need to add additional infill)
- thorough cleaning of maintenance equipment before it leaves a site
- Ensuring that boot cleaning stations are frequently cleaned and the brushes replaced as they wear.
- Regular maintenance of silt traps

The report notes that risk management measures can be expected to work best when used in combination and it should not be assumed that only incorporating one risk management measure will achieve the desired containment. In this regard RAC considers that minimum standards would be needed to achieve the desired minimisation.

CEN TR 17519 also addresses the end of life of a field. In particular, the removal of the old surface must be done by demonstrating the effectiveness of the chain of custody of the materials from the point where they leave the field to be recycled, reused or disposed of in accordance with all appropriate waste regulations.

Retrofitting existing fields

An important issue, with a significant impact on the effectiveness of a potential derogation from the restriction based on risk management measures, is related to the implementation of standardised and effective risk management measures on pre-existing fields. Some of the best practises detailed in the CEN TR 17519 are acknowledged to be difficult to implement retrospectively (i.e. use of a shock pad, high tuft-density carpets, pitch slope <1%, dedicated areas for snow storage, etc). Nevertheless, the report identifies that certain technical and operational measures can usually be implemented, as follows:

1. general good practices during maintenance operations (this shall be interpreted as including, as a minimum, the cleaning of all maintenance equipment prior to it leaving the site boundary; maintaining a single infill brush per pitch area (zone 2); retaining any cleared snow within the boundary of the pitch area (zone 2) as per Scenario 2d in Table 2);
2. the implementation of fine mesh plastic or canvas screening around the perimeter of the pitch;
3. the installation of containment boards to fence posts around the perimeter of the pitch (this shall be interpreted as requiring a minimum height of 500 mm unless the field margin between the edge of the synthetic surface and the field perimeter is at least 500 mm wide, whereupon lower solid containment barriers of at least 200 mm high are acceptable);
4. the installation of collection grates/mats at all field entrances;
5. the installation of boot cleaning stations at the entrance points to the field;
6. the installation of drain filters into existing stormwater drains.

These six measures in combination, where the specific maintenance and perimeter containment board requirements are met, are consistent with the suite of risk management measures included in scenario 2d assessed by Magnusson & Mácsik (2020) to result in releases <7 g/m^2/yr. However, RAC concludes that unless **all six of the measures** are implemented at an existing field (including the specific maintenance and perimeter board containment requirements) the overall effectiveness of risk management measures cannot be assumed to meet the threshold of <7 g/m^2/year and that compliance with the limit value would need to be demonstrated by alternative means.

2. The derogation for polymers without carbon atoms that was proposed by SEAC in its final opinion.

2.1. Background

In its final opinion, SEAC included a further derogation from the scope of the proposed restriction on intentionally-added microplastics (paragraph 3) for *'polymers without any carbon C in their chemical structure (i.e. polymer backbone or side-groups)'*.

Several relevant comments to the consultation on the SEAC draft opinion (Cefic #735; Clariant #784; VCI #785; Federchimica #793) raised the issue of ammonium polyphosphates, polymers used in flame retardants, which do not contain carbon. The comments also pointed out that polymers that do not contain carbon cannot contribute to the microplastic concern because they cannot be considered to be persistent according to Annex XIII of REACH[9]. Against this background, SEAC considered that, if the restriction is to be targeted to the identified risk, as required by REACH Annex XV (thereby minimising the potential for legal challenges), a derogation for inorganic polymers was warranted.

Independent from the legal considerations, RAC is requested to express their opinion on:

1. the risk assessment-related aspects of this new derogation; and
2. whether it is possible to assess the persistence of inorganic polymers (i.e. polymers without carbon), such as ammonium polyphosphates.

2.1. Justification for the opinion of RAC

2.1.1. RAC conclusion(s):

1. Risk assessment-related aspects of this new derogation

RAC concludes that the term 'persistence', and by analogy the vP criteria in Annex XIII referred to by the Dossier Submitter in their case-by-case risk assessment, is not currently appropriate to describe the properties of polymers without carbon, but notes that this does not diminish the fact that polymers that do not contain carbon have the potential to exist in particle form and for these particles to remain in the environment for an extended duration if they are not subject to degradation.

Equally, based on the absence of relevant ecotoxicity data, it is not currently possible to conclude that polymers without carbon in particulate form would not pose the same risks as microplastics.

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[9] Annex XIII of REACH states 'This Annex shall apply to all organic substances, including organo-metals.'

Nevertheless, if the derogation proposed by SEAC in its final opinion is not retained, RAC considers that paragraph three of the proposed restriction would need to include a further derogation for degradable polymers (e.g. via abiotic processes), complementary to the existing derogation for biodegradable polymers, to ensure that polymers without carbon that **would not reside** in the environment for an extended period could be derogated from the restriction (on the basis that they would not poses all the elements of the microplastic concern; the identified risk). The practicality of such a derogation is discussed in response to question two.

Whether it is possible to assess the persistence of inorganic polymers, such as ammonium polyphosphates.

In principle, polymers that do not contain carbon may be subject to degradation processes. However, the test methods used currently for assessing the biodegradability of substances are not appropriate for assessing the degradability of polymers that do not contain carbon. There is currently a lack of knowledge to identify appropriate standardised degradation test methods and criteria equivalent to those proposed for the assessment of polymer biodegradability within the scope of the proposed restriction (i.e. Appendix X).

2.1.2. Key elements underpinning the RAC conclusion:

1. *Risk assessment-related aspects of this new derogation*

The proposed restriction on microplastics is justified by the conclusions of a case-by-case risk assessment (referred to by the Dossier Submitter as the 'microplastics concern') underpinned by the persistence in the environment of particles containing solid polymer with defined properties and dimensions (microplastics) **in combination with** evidence from laboratory studies of adverse effects associated with the ingestion of these particles[10]. The microplastics concern is expressed in relation to persistence in the environment exceeding the 'very persistent' criteria in REACH Annex XIII. The Dossier Submitter considers that natural, biodegradable and soluble polymers are not microplastics, irrespective of their physical properties and dimensions. In addition to the microplastics concern, polymers may have other hazardous properties or pose different risks, but these are not addressed by the proposed restriction.

As highlighted in the Background Document, the REACH polymer definition does not differentiate between organic or 'inorganic polymers', thus all polymers are included in the regulatory definition of 'microplastics' if all other criteria (e.g. size and water solubility) are met.

The term 'inorganic polymer' is not clearly defined but can be used to refer to a range of polymers, such as polyphosphazenes, polysiloxanes, polysilanes, polygermanes or polystannanes. These polymers almost always contain carbon atoms as part of their structure (even if they do not have a carbon 'backbone') and fulfil the definition of polymer in REACH Article 3 (5). As such, they would almost always be within the scope of the microplastics

[10] Adverse effects can result from the polymers themselves, but also from the presence of additives or residuals/impurities from the manufacturing process (monomers, processing aids, etc etc). See RAC opinion on the proposed restriction on intentionally-added microplastics

restriction if they fulfil all of the other relevant criteria for physical properties, **irrespective of the new derogation proposed in the final SEAC opinion**. Some of them, and especially polysilanes, polygermanes and polystannanes, are used as superconductors. Other specific uses are known, such as for surface treatment with very specific properties, e.g. photochromic materials.

Geopolymers (sometimes termed as 'pure inorganic polymers') do not contain carbon in their structure and are formed by geopolymerisation, which is a different process to polymerisation. Geopolymers have very specific properties and thus specific uses, for example in ceramics, composite materials for the automotive, aeronautic and defence industries, fire-retardancy, thermosetting paints, medical devices (prosthetic bones) and fuel cell membranes. According to the new derogation proposed in the SEAC final opinion, these substances would be outside of the scope of the proposed restriction.

Further, the example of carbon black shows that substances which may sometimes be labelled as 'inorganic polymers' can be manufactured by a process other than polymerisation and in this case are not considered as polymers under REACH.

The Dossier Submitter noted that while 'inorganic polymers' were mentioned during the consultation on the Annex XV report, no specific information regarding uses, use quantities and potential releases were provided. Limited information on the uses of ammonium polyphosphates was provided in the consultation on the draft SEAC opinion, but this was limited to generic information on the types of articles where the substance is used as a flame retardant.

As polymers are not registered under REACH, it is not possible to obtain relevant information on substance properties from registration dossiers. However, RAC notes that some information on the hazards and risks of ammonium polyphosphates is available from a US-EPA screening study on alternatives to brominated flame retardants in polyurethane foams (US-EPA, 2015). The document provides a screening assessment, concluding, based on expert judgement, that ammonium polyphosphates have 'very high' persistence. The conclusion is based on a qualitative assessment of the estimated hydrolysis rate (ultimate degradation of the HMW[11] polymer >180 days) and on aerobic biodegradation estimate in water (recalcitrant based cut-off value for large HMW polymers). RAC notes that this substance would not be expected to biodegrade as it does not contain carbon, but may be subject to degradation processes, such as hydrolysis. Based on these data, it could be expected that particles of ammonium polyphosphate, if released to the environment, would remain in that form (for >180 days), and that whilst in this form they could be ingested, similar to carbon-containing polymeric particles. The new derogation in the SEAC opinion would exclude these polymers from the scope of the restriction.

The respondents to the consultation on the SEAC draft opinion argue that as Annex XIII applies to organic and organo-metals then polymers without carbon cannot be considered to be 'persistent' under REACH and that, therefore, the microplastics concern cannot apply.

RAC acknowledges that 'persistence', and by analogy the vP criteria in Annex XIII referred

[11] High-molecular weight

to by the Dossier Submitter in their case-by-case risk assessment, is not currently an appropriate term to describe the properties of these substances, but notes that this does not diminish the fact that polymers that do not contain carbon have the potential to exist in particle form and for these particles to remain in the environment for an extended duration. In this respect they could be considered to have similar properties to the persistent organic polymers in particle form targeted by the microplastics restriction.

RAC notes that the microplastic concern is not solely based on persistence, but also on evidence of adverse effects. Whilst the ecotoxicity of polymers containing carbon in microplastic form was demonstrated by the Dossier Submitter, RAC notes that the Dossier Submitter did not report any studies in the scientific literature on the ecotoxicity of polymers without carbon. RAC notes that US-EPA (2015) concludes that ammonium polyphosphates have low hazard for human health effects and aquatic toxicity, but it is unclear if this material was in particulate form when tested[12]. Therefore, based on the absence of relevant ecotoxicity data, it is not currently possible to conclude that polymers without carbon in particulate form would not pose the same risks as microplastics.

RAC notes that the proposed restriction includes a recommendation by the Dossier Submitter for a review after implementation, which RAC has supported. Should polymers without carbon be derogated from the restriction, their risks could be reviewed alongside other aspects of the restriction after implementation based on any new information[13],[14].

In addition, RAC notes that the substance scope of the proposed restriction is generic, but contains a series of equally generic derogations for a polymer to 'exit' the restriction where there is not considered to be a risk associated with the microplastics concern (these are detailed in paragraphs three and five of the proposed text). The derogations in paragraph three are for natural, biodegradable and soluble polymers. The criteria for biodegradable and soluble polymers are detailed in Appendix X and Y of the proposed restriction, respectively. These derogations are critical to ensuring the effectiveness of the proposed restriction according to Annex XV (i.e. that the restriction is targeted on the identified risk). Should a derogation for polymers without carbon not be included, RAC considers that paragraph three would need to include a derogation for degradable polymers (e.g. via abiotic processes), to ensure that polymers without carbon that **would not reside** in the environment for an extended period could be derogated from the restriction (on the basis that they would not poses all the element of the microplastic concern). The potential for such a derogation is discussed in relation to the Commission's second question below.

Finally, regarding the limited information provided during the consultations, it is difficult to anticipate the impact of the derogation proposed by SEAC on the risk reduction potential of the restriction. RAC recognises that one of the most important issue is to avoid undesirable (regrettable) substitution. Considering, the very specific physico-chemical properties of polymers that do not contain carbon, it is unlikely that these polymers could be used to

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[12] The assessment is based on the water column only as is based on 'no effects at saturation'. Limited data on the test material assessed is reported, but some studies are reported to have been on 'liquid ammonium polyphosphate', which could suggest that it is not in particulate form.

[13] An alternative option could be to exclude polymers without carbon from the ban on placing on the market, but to require the paragraph 7 (instructions for use and disposal) and paragraph 8 (reporting requirements). However, in the absence of information on adverse effects this is unlikely to be justified.

[14] Additional information could become available through the registration of polymers under REACH, should this be required in the future for polymers without carbon.

substitute polymers in the vast majority of the applications assessed under the restriction proposal.

2. *Whether it is possible to assess the persistence of inorganic polymers, such as ammonium polyphosphates.*

Conventional biodegradation tests, on which persistence assessment is typically based, require carbon in the molecular structure of a test material as they measure respiration (i.e. the formation of CO_2 or the consumption of O_2). Therefore, they are not applicable to polymers that do not contain carbon[15]. Data from degradability studies (e.g. hydrolysis, photodegradation, oxidation, reduction etc.….) do not measure mineralisation and cannot be used on their own within a persistence assessment, but may be used as part of a Weight-of-Evidence approach (ECHA, 2017).

If it could be demonstrated that transformation process (e.g. hydrolysis, photolysis, oxidation, reduction etc) would permanently lead to loss of microplastic properties (i.e. the polymer would no longer meet all the criteria of the microplastic definition), then it could be considered to have 'degraded' sufficiently for the purposes of the microplastics restriction (although in fact the substance may have simply changed its speciation or state). This is consistent with the rationale of several existing derogations in the proposed restriction i.e. for (i) polymers with solubility >2g/L stated in paragraphs 3(c) and (ii) the generic derogation in paragraph 5(b) for 'loss of microplastic form at end use'[16]). However, transformation to smaller and smaller particles or particles with different chemistry but still meeting the microplastics criteria should not be considered to have degraded.

There are a limited number of existing standardised OECD test guidelines for degradation e.g.:

- Test Guideline 111 on hydrolysis as a function of pH[17]
- Test Guideline 316 on phototransformation of chemicals in water[18]

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[15] Polymers that contain carbon (i.e. organic groups) in either their backbone or side-chains could be tested in biodegradation tests as these are typically normalised to the carbon content of the test substance.

[16] Paragraph 5(b): Derogation from paragraph 1 for substances or mixtures containing microplastic where the physical properties of the microplastic are permanently modified during end use, such that the polymers no longer fulfil the meaning of a microplastic given in paragraph 2(a).

[17] OECD Test Guideline 111 describes a laboratory test method to assess abiotic hydrolytic transformations of chemicals in aquatic systems at pH values normally found in the environment (pH 4 – 9). This Guideline is designed as a tiered approach; each tier is triggered by the results of the previous tier. Sterile aqueous buffer solutions of different pH values (pH 4, 7 and 9) are treated with the non-labelled or labelled test substance (only one concentration, which should not exceed 0.01 M or half of the saturation concentration). They are incubated in the dark under controlled laboratory conditions (at constant temperatures). After appropriate time intervals, buffer solutions are analysed for the test substance and for hydrolysis products. The preliminary test should be carried out for 5 days at 50 ± 0.5°C and pH 4.0, 7.0 and 9.0. The second tier consists of the hydrolysis of unstable substances, and the third tier is the identification of hydrolysis products. The higher Tier tests should be conducted until 90 % hydrolysis of the test substance is observed or for 30 days whichever comes first. Available online: https://www.oecd-ilibrary.org/environment/test-no-111-hydrolysis-as-a-function-of-ph_9789264069701-en

[18]

OECD Test Guideline 316 describes studies on phototransformation in water to determine the potential effects of solar irradiation on chemicals in surface water, considering direct photolysis only. It is designed as a tiered approach. The Tier 1 is based on a theoretical screen. The rate of decline of a test chemical in a direct photolysis study is

However, it is currently not possible to establish a comprehensive list of appropriate test methods, test conditions and pass/fail criteria (to predict transformation rate in the environment) to cover all possible transformation processes. The uncertainties in relation to the environmental relevance of standardised biodegradation test that are already highlighted in the RAC evaluation of the suite of biodegradation test methods proposed by the Dossier Submitter (Appendix X) would equally apply to any degradation test methods proposed for polymers without carbon i.e. the relevance of laboratory testing to field conditions. For example, particulate materials in the environment may not be exposed to the light if present in soils or in aquatic sediments.

In addition, RAC notes that the Dossier Submitter considered various requests made during the consultation on the Annex XV report to add degradation methods to the list of biodegradation test methods included in Appendix X and concluded that it would not be appropriate to do so.

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generally assumed to follow pseudo first-order kinetics. If the maximum possible losses is estimated to be superior or equal to 50% of the initial concentration over a 30-day period, an experimental study is proceeded in Tier 2. The direct photolysis rate constants for test chemicals in the laboratory is determined using preferably a filtered xenon arc lamp capable of simulating natural sunlight in the 290 to 800 nm, or sunlight irradiation, and extrapolated to natural water. If estimated losses are superior or equal to 20%, the transformation pathway and the identities, concentrations, and rate of formation and decline of major transformation products are identified. An optional task is the additional determination of the quantum yield for various types of water bodies, seasons, and latitudes of interest. The test chemical should be directly dissolved in the aqueous media saturated in air at a concentration which should not exceed half its solubility. For linear and non-linear regressions on the test chemical data in definitive or upper tier tests, the minimum number of samples collected should be 5 and 7 respectively. The exact number of samples and the timing of their collection is determined by a preliminary range-finding. Replicates (at least 2) of each experimental determination of kinetic parameters are recommended to determine variability and reduce uncertainty in their determination. Available online: https://www.oecd-ilibrary.org/environment/test-no-316-phototransformation-of-chemicals-in-water-direct-photolysis_9789264067585-en

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3. REFERENCES

References that are not cited in the Background Document:

ECHA (2017) Guidance on information requirements and chemical safety assessment. Chapter R.11: PBT/vPvB assessment. Version 3. European Chemicals Agency. Helsinki.

Magnusson S, Mascisk J. (2020). Determining the effectiveness of risk management measures to minimise infill migration from synthetic turf sports fields. Ecoloop, August 2020.

US-EPA (2015) Flame Retardants Used in Flexible Polyurethane Foam: An Alternatives Assessment Update, August 2015 EPA 744-R-15-002. Available online: Flame Retardants Used in Flexible Polyurethane Foam: An Alternatives Assessment Update (epa.gov). Accessed 12 February 2021